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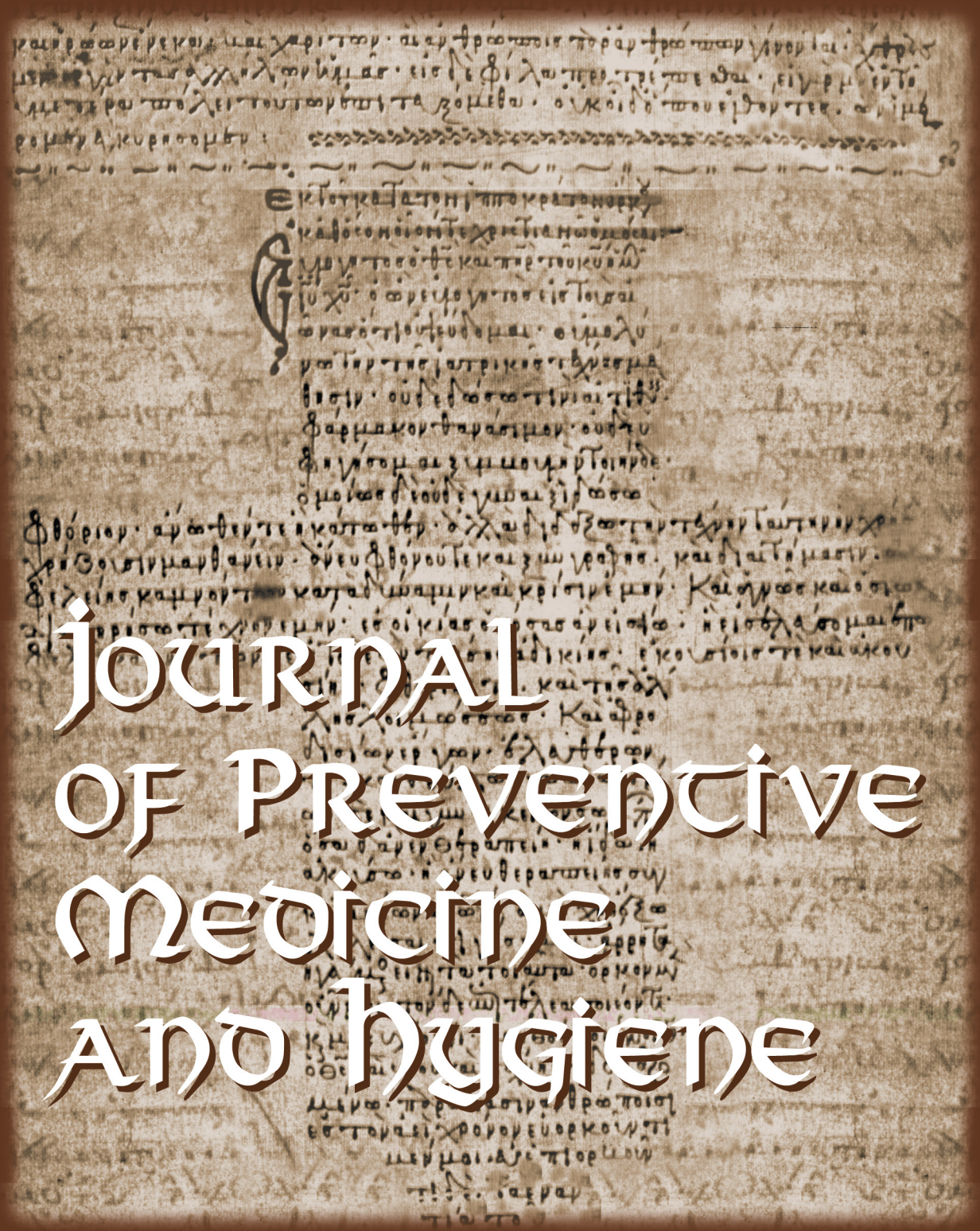

The original document of Hippocrates' oath

# Journal of Preventive Medicine and Hygiene

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Infectious disease

# Direct long-acting antibodies: updating the language of RSV prevention to reflect the evolution of mAbs

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Keywords

RSV • mAb • Prevention • Vaccination • Immunisation

Summary

**Introduction**. *The language of medicine is constantly evolving, typically to better describe a new understanding of disease, adjust to changing social sensibilities, or simply to reflect a new drug class or category. We address the need for an updated language around monoclonal antibodies, or "mAbs" – a widely used medical term, but one which is now too general to accurately reflect the range of mAb pharmaceuticals, their effects, and the intended patients.*

**Methods**. *The question of "what should we call a monoclonal antibody immunisation against respiratory syncytial virus (RSV) to ensure accurate understanding of the product?" was the basis for a virtual advisory panel in May 2022. The panel was convened by Sanofi with the intention of reviewing appropriate language in terminology in the context of mAb-based prophylaxis for RSV. The panel comprised several global experts on RSV and vaccination, a trained linguist specialising in doctor-patient interactions and medical language, and several experts in marketing and communications.*

**Results**. *We suggest the term "Direct Long-acting Antibody" (DLA) for a specific sub-class of mAbs for use in prevention of RSV disease in infants. This terminology should differentiate from other mAbs, which are generally not used as therapies in infants.*

**Discussion and Conclusions**. *This change will more accurately convey the specific mode of action of a mAb in infants, and how it could impact the prevention of communicable diseases: this class of mAbs is not an active treatment, but rather will offer direct and rapid protection lasting at least 5 months.*

## Introduction

The language of medicine, and of science in general, is constantly evolving. This is necessary to reflect the ongoing "march of science" where our knowledge and understanding of biology and pharmacologic interventions increases every year [1], and changes in the social fabric within which medicine is practised [2, 3]. For the former, we have examples like "bipolar disorder", which replaced "manic depression" to more accurately convey the nature of the condition (bipolar patients tend towards primary mania or depression, not both). In the latter case, we can look to the recent change of "non-alcoholic fatty liver disease" to "metabolic fatty liver disease" to remove possible stigma and judgement, as well as to clarify the role alcohol may (or may not) play in this disease [4]. While these changes may seem trivial, we often rethink the language we use if we find that the current linguistic forms are simply no longer accurate to a precise degree. It is worth remembering that if we didn't change the language we use, we would still be referring to heart failure as "dropsy", and people with cerebral palsy as "spastics".

In addition, language which creates unwanted impressions or is off-putting to an intended audience may need to be revised, as this type of language can create real barriers to appropriate medical care [5]. For example, the language around addiction has been focused on "dependence" for some time, as it is easier to self-identify as "dependent" rather than "addicted" with all the social baggage the latter produces. As an almost ubiquitous and current example, the recent highly charged discussions around the meaning and proper reference for the words "women", "men", "female", and "male" combine both the medical and social aspects of language change.

Also relevant in this case is the classification of a drug within a category, and how this may influence how that drug is perceived. Aspirin (acetylsalicylic acid) was first observed to have analgesic and antipyretic qualities, and was subsequently classed as a non-steroidal anti-inflammatory (NSAID) [6]. However, numerous potential applications of Aspirin have been identified when prescribed at different doses – from anticoagulation and preventing cardiovascular events, to the treatment of cancers and dementias, as well as in the field of ophthalmology [6-8] – suggesting its benefits may reach far beyond those its classification as a simple

NSAID would initially suggest. Evidently, language has a clear and defining effect on perceived benefits and other aspects of drugs or diseases; how we describe and talk about such interventions could be of paramount importance from their inception.

In this paper we will discuss just such a proposed language change for a term which has both medical (pharmacological) and, to some extent, social foundations. This language change was discussed by a panel of experts brought together by Sanofi and reviewed in the context of a monoclonal antibody-based prophylactic immunisation against respiratory syncytial virus (RSV) disease for infants under 1 year of age. The ideas discussed by the panel and identified in this paper are intended to stimulate discussion within the scientific community around the potential limitations of currently used language used to discuss mAb-based propylaxis in RSV.

RSV is the most common respiratory pathogen in infants worldwide [9], infecting around 90% of infants by their second birthday [10]. The virus emerges, peaks, and recedes in a seasonal pattern – typically lasting 5 months from the autumn to spring in temperate climates [11, 12]. Each year, RSV disease places a substantial burden on healthcare systems globally and represents a leading cause of hospital admission among infants. It requires substantial healthcare investment and seasonal planning to ensure adequate resources are in place [13].

The immunisation being discussed in this paper is currently classified as a "monoclonal antibody" (mAb) which, although scientifically accurate, could create several unnecessary forms of potential confusion among parents, caregivers and even healthcare professionals, with a likely impact on usage and uptake. Both the history of mAbs and the current social environment surrounding vaccination as a topic for discussion (and misinformed debate) argue that we should, in fact, increase our specificity of language in this case. Furthermore, the very term 'mAb' is itself now dated: in 2021, the International Nonproprietary Names (INN) Programme of the World Health Organization (WHO) decided to discontinue the use of the term for new substances, owing to the high number of drug names already ending in '-mab' [14]. They have instead proposed and adopted a radically different naming system for future pharmaceutical substances [14].

The four areas of "communicative precision" that can be achieved through the use of new linguistic forms that will more accurately convey the core features of this particular mAb are:

1. to differentiate this monoclonal antibody from current class perceptions, which often involve treatment of severe chronic or acute disease, rather than prevention of infection in infants;
2. to create a clear understanding of the mechanism of RSV protection provided by this mAb (specifically regarding its role as a prophylaxis, not an active treatment – a departure from most currently approved mAbs in other disease areas);
3. to specify the duration of effect of the prophylaxis provided (a necessary element for this mAb as it is used as an immunisation in the context of RSV being a seasonal virus);
4. to clarify how this immunisation provides direct protection from the point of administration, and why this differs to active immunisation.

It is our hope and intention that this new language will provide an easily introduced, easily understood, and easily applied upgrade to the existing language surrounding mAbs, and to clarify the nature of this immunisation. The remainder of this article will outline the key discussion points from the panel regarding this new terminology. In an era of heightened vaccine scrutiny, misinformation, and hesitation, it is important to find the correct language to facilitate understanding and uptake of this important new entrant to the field of RSV prevention.

## Methods

Despite the clear impact RSV disease has across healthcare systems, limited prophylactic options are currently available [15]. Several approaches to tackle this unmet need are under development, including immunisations for pregnant women in their third trimester, paediatric vaccines, and passive immunisation with monoclonal antibodies with extended half-lives – among the monoclonal antibody category, a new solution called nirsevimab (registered name Beyfortus®; AstraZeneca Pharmaceuticals LP Frederick Manufacturing Center, Maryland, US) is included [15], which was approved in the European Union and UK in November 2022 [16], and in the USA in July 2023 [17].

The question of "what should we call a monoclonal antibody immunisation against RSV to ensure accurate understanding of the product?" was the basis for a virtual advisory panel, assembled in May 2022 by Sanofi to discuss the specific issue of language and communication of mAbs in the context of RSV disease.

The panel was comprised of several global experts on RSV and vaccination (Prof. Pier Luigi Lopalco, Prof. Susanna Esposito, Prof. Federico Martinón-Torres, and Dr. Todd Wolynn), a trained linguist specialising in doctor-patient interactions and medical language overall (Dr. Brad Davidson), and several experts in marketing and communications (including Ms Jacqui Thornton, Health Journalist). Each of these participants played a significant role in the discussion, providing a broad and complementary view of both clinical and communication practices. No patients or members of the public were involved in the discussion or outputs of this advisory panel. As this was a language-focused meeting, the need for a new method for preventing RSV was beyond the scope of discussion and will therefore not be further discussed.

Given the product's status as a monoclonal antibody (a "mAb") and the fraught public discourse around immunisations and vaccinations [18, 19], it was identified that the language used to describe the mAb needed to be vetted to avoid unnecessary confusion,

concern, or outright dismissal. The concerns centred around two areas, both of which were discussed in the meeting:

1. the impression of mAbs as "serious treatment" of illness (usually in adults), not appropriate for the prevention of illness in infants;
2. the overall challenge of introducing and discussing a new "infant vaccination" or "vaccine-like" intervention, during a period of heightened vaccine resistance, discussion, and sensitivity.

For the first area of discussion (the issue of mAbs as a perceived "strong medicine"), the discussion centred on the historical and current usages of mAbs, many of which focus on treating cancers or serious, highly symptomatic rheumatologic conditions like rheumatoid arthritis and plaque psoriasis. The concern in this case is that the term "monoclonal antibody", while entirely accurate, is no longer precise enough to cover all of the different types of mAbs equally well. As Dr. Brad Davidson, the linguist, phrased it: "mAb has become a class name for a very large class, like mammal. Mammal is a useful term, but it describes both tigers and mice. Calling something a mammal doesn't tell you how big, fast, or potentially dangerous it is". The clinicians in the room agreed that the term mAb/monoclonal antibody brought forward associations with strong treatments, and strong adverse event potential – neither of which are appropriate for prophylaxis of disease in infants under 1 year of age. In a unanimous agreement, the participants of the meeting concluded that mAb as a descriptor was not sufficiently precise in today's crowded mAb category to convey the true nature of the product, despite being medically accurate.

The second area of discussion (that of the rising tone and volume of public vaccine discourse) was also considered at length. It was agreed that nirsevimab is, indeed, a form of immunisation, and it could be argued that it is not an active vaccination as it does not stimulate the recipient's immune system. Unlike an active immunisation, nirsevimab's directly-administered monoclonal antibodies do not rely on a host immune response to offer rapid protection after administration, instead, offering rapid passive protection against RSV lower respiratory tract disease via administration of direct-acting antibodies [15]. In contrast, an active immunisation may require time for the host to generate an immune response, and may require repeated vaccine administrations to achieve maximal protection [20]. While this distinction may be meaningful within a research environment, it was also acknowledged that in common usage the terms vaccination and immunisation are employed interchangeably. This confusing, and confused, system of nomenclature is compounded by the truly enormous number of false statements about vaccines and immunisations that have proliferated throughout the COVID-19 pandemic, which have had demonstrable effects on vaccine uptake [21, 22]. The participants agreed that while nirsevimab is indeed "vaccine-like" when evaluated by the broad standards of the term, it is not "active" in its mechanism of protection but "passive". Clarifying exactly how nirsevimab works in infants (whose immune systems are too immature to provoke a robust response to an active vaccine after one single administration) would be important to integrate into the language surrounding nirsevimab.

## Results

Providing a solution to the linguistic puzzle was the primary focus of the discussion and subsequent communications. The solution that was developed and agreed upon was that nirsevimab should be referred to as a "Direct Long-acting Antibody" (DLA), for the reasons described below:

1. *Direct:* this is a specific reference to the fact that nirsevimab does not "provoke a response" from infant immune systems so that they will produce antibodies; rather, it is the antibodies which are directly introduced into the infant's body at a time when infants are most vulnerable to the effects of RSV infection [15], to provide rapid protection against RSV lower respiratory tract disease. Much like exogenous insulin, the body is not required to react to the intervention, nor will it in an immunologic sense. In essence, what infants lack (*i.e.*, antibodies which target RSV) is being directly supplied to them. This also provides contrast to other interventions either currently used in the RSV category or expected in the future, for example immunisation for pregnant women where protective antibodies reach the infant indirectly, via the mother [23]; and paediatric vaccines which will require the infant's immune system to develop its own immune response (including antibodies) after administration [15]. Prophylactic solutions that provide direct and rapid protection against RSV disease allow for administration to coincide with the period of highest risk – an infant's first RSV season – which is an important benefit considering that the virus is seasonal.
2. *Long-acting*: the importance of duration of protection is very specific in this category – protection against RSV disease needs to last throughout a season, while the infant's lung and immune physiology continue to develop and eventually become mature enough to cope with an RSV infection. This period of heightened vulnerability when an infant faces their first RSV season during their first year of life is often referred to as their "first season" or "seasonal" risk. The protection afforded by nirsevimab is at least 5 months [15] – long enough to cover a typical RSV season in a temperate climate [11, 12], during an infant's period of heightened vulnerability in their first year of life [15]. In this context, "long-acting" is a reference to the duration of protection nirsevimab provides, which could cover the period of heightened vulnerability as infants enter their second year of life and their immune system gradually becomes robust enough to either combat the disease or mount an

immune response to any potential future paediatric RSV immunisations. In addition, "long-acting" serves to highlight the difference between existing short-acting mAb prophylaxis in RSV disease, which requires monthly injections throughout the season.

3. *Antibody:* the primary result of most vaccinations is the creation of antibodies that are specific to the disease against which the person is being vaccinated [20]. The result following an administration of nirsevimab is no different in this regard, although the process is more direct; as discussed earlier, immunisation with nirsevimab offers rapid protection against RSV lower respiratory tract disease via administration of direct-acting antibodies [15]. This particular element from the full term "monoclonal antibody" seemed most important to call out: it is the presence of the antibodies which supports nirsevimab's mechanism of action in providing protection against RSV, and the monoclonal element could lead to confusion with treatment for chronic disease. In other words, the focus here is on "what" nirsevimab is (an antibody), and not how it was manufactured as this does not serve any clinically meaningful purpose in this instance and has the potential to cause confusion.

Based on this information, the advisory panel concluded that nirsevimab is most accurately defined as a Direct Long-acting Antibody (DLA) and is a part of the larger class of mAbs.

## Discussion and conclusions

We believe this type of process, where the true nature of a drug is discussed, is more important today than ever before. We live in an era of tremendous medical advances, with new pharmaceuticals being developed and launched at an astounding rate. With new mechanisms of action there comes a new need for precise language. In this case, a mAb is not just a mAb – in the same way that not all "small molecules" or "large molecules" are the same. Nirsevimab shares characteristics with, and is properly classified as, a monoclonal antibody-based passive immunisation. However, this term does not tell the whole story, and indeed in current context could be misleading or misunderstood. Our objective is clarity in communication, and we believe this terminology achieves that aim.

Our study had several strengths, including the involvement of leading individuals in the RSV, paediatrics, infectious disease, and linguistics space; and the versatility of the approach taken in exploring medical science linguistics to fill a language gap left where technology has advanced. Limitations of this study include a limited number of panellists submitting their expertise, and limited means of testing our output at the time of writing.

This challenge of proper naming, and using linguistic precision to facilitate proper understanding between provider and patient, can have substantial implications in preclinical and clinical settings. As such, we call on stakeholders in health and clinical practice, guideline and recommending bodies, and those engaged in the development of new and novel therapies to seriously consider this linguistic approach to nirsevimab – one which accurately describes its role as a preventative option against RSV disease, but emphasises the distinct characteristics which differentiate it from other prophylactic offerings such as active vaccination. We hope the themes discussed in this paper will stimulate further discussion on the appropriate definition of individual mAbs from the scientific community.

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## Conflict of interest statement

Pier Luigi Lopalco: Advisory Board Participation & Honoraria for Lectures and other Training activities from GSK, Moderna, MSD, Pfizer, Sanofi, Seqirus.
Susanna Esposito: Advisory Board Participation & Honoraria for Lectures. GSK, Janssen, Pfizer, Moderna, MSD, Qiagen, Sanofi, Genzyme, Janssen.
Federico Martinón-Torres Received honoraria from GSK group of companies, Pfizer Inc, Sanofi Pasteur, MSD, Seqirus, Biofabri and Janssen for taking part in advisory boards and expert meetings and for acting as a speaker in congresses outside the scope of the submitted work. FM-T has also acted as principal investigator in randomised controlled trials of the above-mentioned companies as well as Ablynx, Gilead, Regeneron, Roche, Abbott, Novavax, and MedImmune, with honoraria paid to his institution.
Jacqui Thornton Communications Ltd. Received honoraria from Sanofi, Ipsen, Angelini Pharma, PTC Therapeutics, AbbVie and Indivior for moderating events and training work.
Todd Wolynn Received honoraria from Merck, Sanofi Pasteur, Mordera, Novavax, Seqirus, Pfizer for speaker events and in a consultant capacity.
Giovanni Checcucci Lisi and Kocfa Chung-Delgado are employed by Sanofi and may hold shares and/or stock options in the company, a company that may be affected by the research reported in the enclosed paper.
Stephanie Evans, Amit Patel, Claire Fellingham, Ben Pounds, Charlotte Harris and Tapas Mukherjee are employees of Havas Lynx Group, which was paid by Sanofi to facilitate the working group session described herein, and contribute to this manuscript.
Brad Davidson is an employee of Havas Health & You, and was a paid consultant to Sanofi in connection with developing new language of mAbs and with the development of this manuscript.

## Authors' contributions

SE, AP, BD, TM, CH and GL designed and facilitated the round table meeting. PL, SE, FMT, JT and TW

attended the round table to provide insights and direction on RSV communication strategies. The first draft of the manuscript was written by SE, BD, TM, BP and CF. BP and KCD provided critical review. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

## References


[1] Allen LN, Feigl AB. What's in a name? A call to reframe noncommunicable diseases. Lancet Glob Health 2017;5:e129-30. https://doi.org/10.1016/S2214-109X(17)30001-3

[2] Cox C, Fritz Z. Presenting complaint: use of language that disempowers patients. BMJ 2022;377:e066720. https://doi.org/10.1136/bmj-2021-066720

[3] Maruta T, Matsumoto C. Renaming schizophrenia. Epidemiol Psychiatr Sci 2019;28:262-4. https://doi.org/10.1017/S2045796018000598

[4] Fouad Y, Waked I, Bollipo S, Gomaa A, Ajlouni Y, Attia D. What's in a name? Renaming 'NAFLD' to 'MAFLD'. Liver Int 2020;40:1254-61. https://doi.org/10.1111/liv.14478

[5] Ellison N, Mason O, Scior K. Renaming schizophrenia to reduce stigma: comparison with the case of bipolar disorder. Br J Psychiatry 2015;206:341-2. https://doi.org/10.1192/bjp.bp.114.146217

[6] Desborough MJR, Keeling DM. The aspirin story–from willow to wonder drug. Br J Haematol 2017;177:674-83. https://doi.org/10.1111/bjh.14520

[7] Caccavale A, Romanazzi F, Imparato M, Negri A, Morano A, Ferentini F. Low-dose aspirin as treatment for central serous chorioretinopathy. Clin Ophthalmol 2010;4:899-903. https://doi.org/10.2147/opth.s12583

[8] Nilsson SE, Johansson B, Takkinen S, Berg S, Zarit S, McClearn G, Melander A. Does aspirin protect against Alzheimer's dementia? A study in a Swedish population-based sample aged ≥80 years. Eur J Clin Pharmacol 2003;59:313-9. https://doi.org/10.1007/s00228-003-0618-y

[9] Piedimonte G, Perez MK. Respiratory syncytial virus infection and bronchiolitis. Pediatr Rev 2014;35:519-30. https://doi.org/10.1542/pir.35-12-519

[10] Simoes EA. Respiratory syncytial virus infection. Lancet 1999;354:847-52. https://doi.org/10.1016/S0140-6736(99)80040-3

[11] Demont C, Petrica N, Bardoulat I, Duret S, Watier L, Chosidow A, Lorrot M, Kieffer A, Lemaitre M. Economic and disease burden of RSV-associated hospitalizations in young children in France, from 2010 through 2018 BMC Infect Dis 2021;21:730. https://doi.org/10.1186/s12879-023-08049-7

[12] Reeves RM, Hardelid P, Panagiotopoulos N, Minaji M, Warburton F, Pebody R. Burden of hospital admissions caused by respiratory syncytial virus (RSV) in infants in England: a data linkage modelling study. J Infect 2019;78:468-75. https://doi.org/10.1016/j.jinf.2019.02.012

[13] Shi T, McAllister DA, O'Brien KL, et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in young children in 2015: a systematic review and modelling study. Lancet 2017;390:946-58. https://doi.org/10.1016/S0140-6736(17)30938-8

[14] Guimaraes Koch SS, Thorpe R, Kawasaki N, Lefranc M-P, Malan S, Martin ACR, Mignot G, Plückthun A, Rizzi M, Shubat S, Weisser K, Balocco R. International nonproprietary names for monoclonal antibodies: an evolving nomenclature system. MAbs 2022;14:2075078. https://doi.org/10.1080/19420862.2022.2075078

[15] Esposito E, Raya BA, Baraldi E, Flanagan K, Martinon Torres F, Tsolia M, Zielen S. RSV Prevention in all infants: which is the most preferable strategy? Front Immunol 2022;13:880368. https://doi.org/10.3389/fimmu.2022.880368

[16] Sanofi. European Commission grants first approval worldwide of Beyfortus® (nirsevimab) for prevention of RSV disease in infants. Available at: https://www.sanofi.com/en/media-room/press-releases/2022/2022-11-04-07-00-00-2548492 (Accessed on: 25/01/2024).

[17] FDA (US Food & Drug Administration). FDA Approves New Drug to Prevent RSV in Babies and Toddlers. Available at: https://www.fda.gov/news-events/press-announcements/fda-approves-new-drug-prevent-rsv-babies-and-toddlers (Accessed on: 25/01/2024).

[18] Dubé È, Ward JK, Verger P, MacDonald NE. Vaccine Hesitancy, acceptance, and anti-vaccination: trends and future prospects for Public Health. Annu Rev Public Health 2021;42:175-91. https://doi.org/10.1146/annurev-publhealth-090419-102240

[19] Majid U, Ahmad M, Zain S, Akande A, Ikhlaq F. COVID-19 vaccine hesitancy and acceptance: a comprehensive scoping review of global literature. Health Promot Int 2022;37:daac078. https://doi.org/10.1093/heapro/daac078

[20] Pollard AJ, Bijker EM. A guide to vaccinology: from basic principles to new developments. Nat Rev Immunol 2021;21:83-100. https://doi.org/10.1038/s41577-020-00479-7

[21] Lin F, Chen X, Cheng EW. Contextualized impacts of an infodemic on vaccine hesitancy: the moderating role of socioeconomic and cultural factors. Inf Process Manag 2022;59:103013. https://doi.org/10.1016/j.ipm.2022.103013

[22] Puri N, Coomes EA, Haghbayan H, Gunaratne K. Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases. Hum Vaccin Immunother 2020;16:2586-93. https://doi.org/10.1080/21645515.2020.1780846

[23] Pfizer. European Commission Approves Pfizer's ABRYSVO™ to Help Protect Infants through Maternal Immunization and Older Adults from RSV. Available at: https://www.pfizer.com/news/press-release/press-release-detail/european-commission-approves-pfizers-abrysvotm-help-protect (Accessed on: 25/01/2024).


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Infectious disease

# Risk factors of HIV/AIDS among men who have sex with men in Akwa Ibom State, Nigeria

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Keywords

Risk factors • HIV/AIDS • Sexual and Gender Minorities • Akwa-Ibom State • Nigeria

Summary

**Introduction**. *Men who have sex with men (MSM) belong to the key population group which contributes to the high burden of human immunodeficiency viruses (HIV)/acquired immunodeficiency syndrome (AIDS) despite the ongoing HIV prevention programs in Nigeria. The current study assessed the risk factors of HIV/AIDS among men who have sex with men in Akwa-Ibom State, Nigeria.*
**Methods**. *This study was a cross-sectional study of 400 men who have sex with men selected from three senatorial zones in Akwa Ibom. A statistical package for service solution version 23 was used to analyze the data. Descriptive statistics, Relative risk and Binary logistic regression were used to compare proportions between risk factors and HIV/AIDS among the MSM.*
**Results**. *More than half (50.5%) of the respondents were between the ages of 20-29 years. Above 66% of the respondents made their debut into MSM at the age bracket of 13-19 years. 50% of the respondents preferred unprotected sex with fellow men. About 99% of the respondents have multiple sexual partners. More than 72% of the respondents had engaged in group sex. About 64% of the respondents use tramadol before sex. Greater than half (54%) of the respondents have shared injection needles. Averagely, 97% of the respondent engaged in transactional sex in the past 3 months. 11.8% of the 400 respondents tested positive for HIV. There was a significant association between risk factors and HIV among the MSM studied.*
**Conclusions**. *MSM in Akwa Ibom State engage in high-risk behaviors, therefore, a risk reduction program targeted at each specific identified risk is highly recommended.*

## Introduction

Nigeria has one of the largest HIV epidemics in the world [17]. Despite this, only over 1% of adults are living with HIV. However, the size of Nigeria's population means that close to 2 million people were living with HIV by 2019. Six of Nigeria's states account for 41% of people living with HIV, including Kaduna, Akwa Ibom, Benue, Lagos, Oyo, and Kano. HIV prevalence is higher in southern Nigeria – particularly Akwa Ibom – where an estimated 5.5% of the population is living with HIV [12]. It is lowest in the southeast where only 1.8% are living with HIV [25].
UNAIDS estimates that two-thirds of the new HIV infections in Nigeria this year came from heterosexual people and half of the new HIV cases in sub-Saharan Africa [24]. In Nigeria's mixed epidemic, 3.4% of the population – men who have sex with men, sex workers, and people who inject drugs – are only responsible for 32% of new HIV infections [21].
MSM are people who have sexual contact with males, including heterosexuals. MSM make up less than 1% of Nigeria's population and about 0.07% of the Akwa Ibom population [21]. The term MSM was created in the 1990s by epidemiologists to study the spread of disease among men who have sex with men, regardless of identity [23]. Compared with non-MSM males, studies show that MSM typically have multiple sexual partners and a higher proportion of unprotected sex behaviour suggests that they are also a high-risk group for HIV transmission.
Sex between men occurs in every culture and society. However, the extent and public acknowledgement vary from place to place [25]. This can depend on how tolerant the society or culture is towards homosexuality. For example, in Nigeria Global AIDS Response Progress Reporting (GARPR) 2015 reports from National Agency for Control of AIDS (NACA) state that 'no provision of this law will deny anybody in Nigeria access to HIV treatment and other medical services.
However, the World Health Organization International Classification of Diseases states that according to Nigeria GARPR 2015 report, the Nigerian government had in 2014 increased the punishment for homosexuality to 14 years in jail [23].
Sex between men is significant in the context of HIV because when unprotected, anal sex carries a very high risk [5].
A risk factor is any attribute, characteristic or exposure of an individual that increases their likelihood of developing a disease or injury. The risk of acquiring HIV among men who have sex with men is 22 times higher than in the general population. It's also increased by factors such as injection drug use and sex work. This is because condom use is low among these groups [23].
Available data from previous studies suggest that the


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HIV epidemic among gay, bisexual and other male-to-male sex has intensified and continues to spread globally. Globally, MSM is disproportionately affected by HIV more than those in the general population [4]. In spite of huge investments bringing resources for global HIV programming and expanded antiretroviral treatment programs that have resulted in significant declines for other populations including the general population, female sex workers and injection drug users, HIV among MSM has remained on a sustained increase globally [5].

### Justification of the study

The relative increase in HIV incidence among MSM in the era of expanded Antiretroviral Therapy (ART) Program and in which there's been HIV decline among other groups has been termed "resurgent epidemic in MSM and future studies among this group may benefit from this study to estimate the HIV incidence rate among MSM in Akwa Ibom [21].

The quality of knowledge of HIV risk factors among MSM is concerning and how this knowledge translates into practice appears to be substantially lacking in Akwa Ibom State. In this study, more findings about the major drivers of spread of HIV/AIDS among the MSM will be useful in planning for strategic intervention towards the HIV epidemic control in Akwa Ibom State [12].

This study tends to provide an insight on their behavioral pattern that exposes them to HIV infection in Akwa Ibom State, Nigeria.

## Materials and methods

### Ethical considerations

Ethical approval to undertake the study was obtained from the State ministry of health. The participants were briefed on the objectives of the study, and their written consent was also obtained before proceeding with the research. This is a cross-sectional study carried out on MSM residents in Akwa Ibom State. At the onset of this study, an entry visit was paid to the gatekeepers and heads of the MSM community in Akwa-Ibom State to explain the essence of the study and further seek their buy-in and support to carry out the survey.

**Population of the Study:** the study included men who have sex with men in Akwa Ibom State, Nigeria. Eligibility criteria for the participants included being biologically male, 18 years and above, identified as having had sex with another man in the preceding year, and currently living in Akwa Ibom State.

**Study Area:** the study was carried out in Akwa Ibom State. It is in the South-South geopolitical zone, lying between Latitudes 4o 32N and 5o 33North and Longitudes 7o25E and 8o 25 East. The State capital is Uyo, with over 500,000 inhabitants. Akwa Ibom has an airport and two major seaports. The State covers a total land area of 7,081 kilometers square. It is currently the highest oil and gas-producing State in the country. Akwa Ibom has an airport and two major seaports. Akwa-Ibom State consists of thirty-one local government areas and 13 major cities. The main spoken languages are English, Ibibio, Annang, Eket and Oron. The people of Akwa Ibom thrive in fishing, Oil and Gas business, crafts, sales of goods and services, palm oil production and fishing farming.

### Sample size calculation

The sample size was determined using the formula for calculating sample size for an unknown population.

$$\text{Sample size (n)} = \frac{Z^2 \times Pq}{d^2}$$

n = sample size

$Z^2$ = confidence interval (95%) = 1.96

P = proportion of the population having the characteristics (unknown use 0.5)

d = degree of accuracy desired (5%) = 0.05

q = estimate of the true proportion of factor of interest in the population (1-P)

$$n = \frac{1.96^2 \times 0.5 \times (1 - 0.5)}{0.052}$$

$$n = \frac{3.8416 \times 0.25}{0.0025} = \frac{0.9604}{0.0025} = 384.16$$

$$n = 384.16 \sim 400$$

The sample size was rounded up to 400 men to make room for dropouts.

### Sampling procedure

To select respondents for this study, a snowball sampling technique was used. The study was done in three senatorial zones of Akwa Ibom State (*i.e.*, Ikot Ekpene, Uyo and Eket Senatorial Zones) with participants across 26 out of 31 LGAs of the State. A total of 400 MSM residents from the 3 senatorial zones were recruited for the study; 150 living in Uyo, 125 living in Ikot Ekpene and 125 living in Eket. For working with the MSM community lead/gatekeepers, HALG – a non-governmental organization whose mission is to prevent HIV/AIDS among key populations including people who have sex with men – nominated three lead gatekeepers per zone. These gatekeepers were trained on how to work with the research assistants and provided financial compensation for their work (N 40,000.00 each per zone). With a snowball sampling approach, first, the initial seed person added one more to whom he had contact and so on. The referral continued until the required sample size was attained. At each identified location where there were MSM groups or "hotspots", they were approached at their convenience times and convenient locations (including restaurants, bars, cafes, lessons centres church football).

### Data collection

The respondents were contacted for the study and were sent questionnaires about their medical and HIV testing history, as well as socio-economic status and demographic information. The research assistants administered the validated questionnaires to the participants themselves. These were checked

for accuracy, and any mistakes were noted. The frequency of risky behaviour was collected using self-administered questionnaires with informed consent from all participants. A pre-counselling session was conducted by HIV counsellor tester among the research assistants and HIV test was done on site.

### Screening for HIV

Each participant underwent a pre-counseling and HIV test following the national testing algorithm. Those reactive on the 'Determine' testing kits were confirmed using the Unigold kits and the clients who were positive were given post-test counseling. They were then referred to further follow-up and ART initiation by HALG.

### Data analysis

The data were analyzed using IBM SPSS Version 20. The distributions of the variables were shown in the frequency table, and the comparison of the frequency proportions was done using chi-square and Fisher exact tests where appropriate. P-values less than 0.05 were considered a statistically significant difference and there was a statistically significant association between the dependent variable and independent variable.
To adjust for multiple covariates, the Logistics regression model was conducted with HIV status as the dependent variable and several covariates that were significant in bivariate analysis were included. The output was expressed in odds ratio (OR) with a 95% confidence interval (95%). The model adjusted for covariates was statistically significant $\chi^2(37) = 129.23$, $p < 0.001$. The model explained 53.6% (Nagel Kerke R2) of variance in HIV positivity in the study population.

## Results

Results in Table I showed that more than half (50.5%) were between the ages of 20-29 years and (29.8%) were ≤ 19 years. About (49.5%) of the respondents had tertiary education, (45.3%) completed secondary education and (5.5%) completed primary education. Some (30%) of the respondents were students, (13.3%) were artisans, (6.5%) were farmers, 19.3% were traders and 26.8% were unemployed. However, about (4.3%) of the respondents were in other occupations. The vast majority (81.8%) of the respondents were single, 8.0% were married, 6.3% were separated and 4% were once married and now divorced. The majority (41.8%) of the respondent leave alone, (34.8%) leave with family, (18.8%) leave with a male friend and about (4.5%) leave with a female friend. More than half (52%) of the respondents stay in a public yard, (33.5%) stay in a detached house and about (14.3%) stay in a hostel. About (69%) of the respondents are independent of their monthly income while (29.2%) are dependent. However, (1.8%) of the respondents are not dependent or independent of their monthly income.
Results on Table II showed that majority (94.8%) of the respondents are members of MSM community while few (5.3%) are not members. About (39.8%) of the respondents describe themselves as MSM, (36.5%) bisexual and (23.5%) gay. Vast majority (66.3%) of the respondents were between 15-20 years of age when they had first sex with male partner, some (18.5%) were between 21-25 years, few (9%) were between 9-14 years while very few (5.5%) were between 26-30 years. Some (26.5%) of the respondents joined the MSM community voluntary, (26%) joined due to peer pressure, (20.5%) joined the MSM community because of financial need, few (7.8%) were forced to join, (5.3%) joined because of career pursuit (Tab. II).
About (45.5%) of the respondents are versatile, (29.3%) preferred the role of being on top while (25.3%) preferred the bottom role. Some (44%) prefer men in higher authority as male sex partner, (34.5%) prefer the same age bracket while (21.5%) prefer adolescents. More than half (74.3%) of the respondents had sex with a male partner

Tab. I. Socio-demographic characteristics of the respondents.

| Variable | Frequency (F) | Percentage (%) |
|---|---|---|
| **Age group** | | |
| ≤ 19 years | 119 | 29.8 |
| 20-29 years | 202 | 50.5 |
| 30-39 years | 59 | 14.8 |
| ≥ 40 years | 20 | 5 |
| **Educational status** | | |
| Primary | 22 | 5.5 |
| Secondary | 181 | 45.3 |
| University | 197 | 49.3 |
| **Occupation** | | |
| Student | 120 | 30 |
| Artisan | 53 | 13.3 |
| Farmer | 26 | 6.5 |
| Trading | 77 | 19.3 |
| Unemployed | 107 | 26.8 |
| Other | 17 | 4.3 |
| **Marital status** | | |
| Single | 327 | 81.8 |
| Married | 32 | 8 |
| Separated/Divorced | 25 | 6.3 |
| Widowed | 16 | 4 |
| Others | - | - |
| **Leaving with** | | |
| Alone | 167 | 41.8 |
| With family | 139 | 34.8 |
| With male friend | 75 | 18.8 |
| With female friend | 18 | 4.5 |
| Others | 1 | 0.3 |
| **Resident** | | |
| Public yard | 208 | 52 |
| Detached | 134 | 33.5 |
| Hostel | 57 | 14.3 |
| Others | 1 | 0.3 |
| **Income Status** | | |
| Dependent on monthly income | 117 | 29.3 |
| Independent of monthly income | 276 | 69 |
| Others | 7 | 1.8 |

Tab. II. Sexual orientation among the respondents.

| Variable | Frequency (F) | Percentage (%) |
|---|---|---|
| **Member of MSM community** | | |
| Yes | 379 | 94.8 |
| No | 21 | 5.3 |
| **Typology** | | |
| Gay | 94 | 23.5 |
| Bisexual | 146 | 36.5 |
| MSM | 159 | 39.8 |
| Others | 1 | 0.3 |
| **Age you had first sex with male partner** | | |
| ≤ 12 years | 36 | 9 |
| 13-19 years | 265 | 66.3 |
| 20-29 | 74 | 18.5 |
| ≥ 30 | 25 | 6.3 |
| **Why I joined MSM community** | | |
| Forced | 31 | 7.8 |
| Hormonal/involuntary | 28 | 7.0 |
| Voluntary | 106 | 26.5 |
| Peer pressure | 104 | 26.0 |
| Financial need | 82 | 20.5 |
| Career pursuit | 21 | 5.3 |
| Respect of authority | 28 | 7.0 |

Tab. III. Sexual lifestyle among the respondents.

| Variable | Frequency (F) | Percentage (%) |
|---|---|---|
| **Preferred role during sex** | | |
| Top | 117 | 29.3 |
| Bottom | 101 | 25.3 |
| Versatile | 182 | 45.5 |
| Others | - | - |
| **Preferred choice of male partner** | | |
| Men in higher authority | 138 | 34.5 |
| Same age bracket | 176 | 44 |
| Adolescents | 86 | 21.5 |
| Others | - | - |
| **Sex with male partner within last 3 month** | | |
| Yes | 297 | 74.3 |
| No | 100 | 25 |
| Others | 3 | 0.8 |
| **Sex you preferred not to use condom with** | | |
| Same sex | 200 | 50 |
| Opposite sex | 58 | 14.5 |
| Both sexes | 135 | 33.8 |
| Others | 7 | 1.8 |

within the last 3 months, (25%) indicated 'no' as not having sex with a male partner within the last 3 months. Some (33.8%) prefer not to use condom with both sexes, (50%) with same sex and (14.5%) with opposite sex. However, few (1.8%) uses condom (Tab. III).

In the last 3 months, slightly less than half (47.5%) of the respondents sometimes do not use condom during sex, (30.5%) almost every time do not use condom while (21.8%) do not use condom every time they have sex. About (42.5%) of the respondents sometimes had multiple sex partner, (35.3%) almost every time while (21.5%) every time. However, (0.8%) had no multiple sex partner. Slightly less than half (45.8%) sometimes had group sex, (14.8%) almost every time had group sex while (12.8%) had group sex every time. However, about (26.8%) of the respondent did not have group sex. Some (36.8%) of the respondents sometimes use psychoactive drugs, (15%) every time, (12%) almost every time while (36.3%) did not use psychoactive drugs.

Slightly more than half (54.3%) did not share injection syringes/needle, about (30.5%) sometimes share injection syringes/needle, (6%) share injection syringes/needle almost every time while (9.3%) share injection syringes/needle every time.

Slightly less than half (48.3%) of the respondents sometimes do not use lubrication during sex, (26.8%) almost every time do not use lubrication, (14.8%) do not use lubrication every time during sex while few (10.3%) uses lubrication during sex. Majority (62.5%) sometimes

Tab. IV. Behavioral lifestyle of the respondents.

| Variable | Frequency (F) | Percentage (%) |
|---|---|---|
| **Non-use of condom during sex** | | |
| Every time | 87 | 21.8 |
| Almost every time | 122 | 30.5 |
| Sometimes | 190 | 47.5 |
| Others | 1 | 0.3 |
| **Multiple sex partner** | | |
| Every time | 86 | 21.5 |
| Almost every time | 141 | 35.3 |
| Sometimes | 170 | 42.5 |
| Others | 3 | 0.8 |
| **Group sex** | | |
| Every time | 51 | 12.8 |
| Almost every time | 59 | 14.8 |
| Sometimes | 183 | 45.8 |
| Others | 107 | 26.8 |
| **Use of psychoactive drugs** | | |
| Every time | 60 | 15 |
| Almost every time | 48 | 12 |
| Sometimes | 147 | 36.8 |
| Others | 145 | 36.3 |
| **Sharing of injection syringes/needle** | | |
| Every time | 37 | 9.3 |
| Almost every time | 24 | 6.0 |
| Sometimes | 122 | 30.5 |
| Others | 217 | 54.3 |
| **Non-use of lubrication during sex** | | |
| Every time | 59 | 14.8 |
| Almost every time | 107 | 26.8 |
| Sometimes | 193 | 48.3 |
| Others | 41 | 10.3 |
| **Transactional sex** | | |
| Every time | 65 | 16.3 |
| Almost every time | 74 | 18.5 |
| Sometimes | 250 | 62.5 |
| Others | 11 | 2.8 |

had transactional sex, (18.5%) almost every time, (16.3%) every time while (2.8%) of the respondents did not have any transactional sex. MSM who sell sex may also be those who are in lower socioeconomic status or use drugs, putting them at higher risk of HIV infection (Tab. IV).
About (30.5%) of the respondents indicated that unprotected sex with both sexes exposes one more to getting infected with HIV, (28.8%) indicated unprotected sex with opposite sex, (24.8%) indicated unprotected sex with same sex while (16%) indicated that none of the above can expose one more to getting infected with HIV. Majority (72.3%) of the respondents do not know their casual male sex partner HIV status, (27%) indicated negative while few (0.8%) indicated positive. About (62.3%) HIV status of the main male sex partner were unknown, (30%) were negative while (7.8%) of the main male sex partner are positive. Majority (75.5%) of the respondents' female sex partner HIV status was unknown, about (23.5%) were HIV negative while (1%) were HIV positive. The average number of the self-reported sex partners was 7.3% in the past 6 months, with more than one-third of them (36.9%) reporting having more than 11 male partners in those six months. These sex partners were either regular partners (76.1%, n = 305), casual partners (18.0%), or paying partners (5.9%). About 38.2% of the participants reported that they were not aware of their sex partners' HIV status.

**Tab. V.** Perception of HIV risk factors and willingness to use HIV preventive measures.

| Variable | Frequency (F) | Percentage (%) |
|---|---|---|
| **Which exposes one more to HIV infection** | | |
| Unprotected sex with same sex | 99 | 24.8 |
| Unprotected sex with opposite sex | 115 | 28.8 |
| None of the above | 64 | 16 |
| Unprotected sex with both sexes | 122 | 30.5 |
| **HIV status of casual male partner** | | |
| Positive | 3 | 0.8 |
| Negative | 108 | 27 |
| Unknown | 289 | 72.3 |
| **HIV status of main male partner** | | |
| Positive | 31 | 7.8 |
| Negative | 120 | 30 |
| Unknown | 249 | 62.3 |
| **HIV status of female partner** | | |
| Positive | 4 | 1.0 |
| Negative | 94 | 23.5 |
| Unknown | 302 | 75.5 |
| **Use of pre-exposure prophylaxis** | | |
| Yes | 137 | 34.3 |
| No | 124 | 31 |
| Not aware | 139 | 34.8 |
| **Awareness of HIV preventives services** | | |
| Very much aware | 315 | 78.8 |
| Not aware | 51 | 12.8 |
| Never aware | 34 | 8.5 |

**Tab. VI.** Prevalence of HIV infection among the respondents.

| Variable | Frequency (F) | Percentage (%) |
|---|---|---|
| Positive | 47 | 11.8 |
| Negative | 353 | 88.3 |
| Total | 400 | 100 |

About (34.8%) indicated not aware of using Pre-exposure prophylaxis in the past three months, (34.3%) used pre-exposure prophylaxis while (31%) indicated no. Majority (78.8%) of the respondents were very much aware of HIV preventive services for the members of MSM community, (12.8%) were not aware while about (8.5%) were never aware (Tab. V).
The result in Table VI below revealed that vast majority (88.3%) of the respondents were HIV negative while few (11.8%) were HIV positive.
Table VII shows the relationship between the variables and HIV/AIDS among the respondents. About 13.0% of the respondent within 20-29 years age group tested positive for HIV, while 12.1% of those within 30-39years age group tested positive for HIV and only 6.7% of the respondents ≥ 40 years, tested positive for HIV. The risk analysis showed non-statistical significance association of the Age group with HIV positive status with p-value of 0.41.
About 17.7% of the respondents who attended at most secondary school, tested positive for HIV, while 9.1% of those respondents with primary school education, tested positive for HIV and about 6.6% of those with university education, tested positive for HIV. The risk analysis showed statistical significance association between educational status and HIV status, with a p-value of 0.003 [Odd ratio = 2.49 (95% CI = 0.32-19.75)]. About 36.3% of those respondents who are unemployed, tested positive for HIV, 11.7% of the respondents that are traders, tested positive for HIV, 9.4 of the respondents that are artisans, tested positive to HIV, 7.5% of the respondents who are students, tested positive while 3.8% of those respondents that are farmers tested positive for HIV. The risk analysis showed non-statistical significance with p-value of 0.1. A total of 13.1% of the respondents who were single, tested positive for HIV, while about 12.5% of the married respondents, tested positive for HIV. The risk analysis shows that there is a statistical significance association between marital status and HIV positive outcome, with a p-value of 0.01 [Odd ratio = 2.64 (95% CI = 0.49-14.2)]. The respondents who said they were living with their family had about 18.7% of them who were tested positive for HIV, while about 9.6% of those respondents living alone, tested positive and the respondents who were living with their male friend had about 5.3% of them tested positive for HIV. About 15.4% of the respondents who are residing in a public yard, tested positive for HIV, while 8.2% of those respondents who are resident in a detached house, tested HIV positive and 5.3% of the respondents residing in a hostel, tested positive for HIV. The risk analysis showed a statistical significance with p-value

Tab. VII. Relationship between sociodemographic variables and HIV /AIDS.

| | | HIV Status | | | |
|---|---|---|---|---|---|
| Variable | Category | Positive (%) | Negative (%) | $\chi^2$ | p-value |
| Age group | ≤ 19 | 0 (0) | 17 (100) | 2.79 | 0.41 |
| | 20-29 | 33 (13.0) | 221 (87.1) | | |
| | 30-39 | 12 (12.1) | 87 (87.9) | | |
| | ≥ 40 | 2 (6.7) | 28 (93.3) | | |
| Educational status | Primary | 2 (9.1) | 20 (90.0) | 11.47 | 0.003 |
| | Secondary | 32 (17.7) | 149 (82.3) | | |
| | University | 13 (6.6) | 184 (93.4) | | |
| Occupation | Student | 9 (7.5) | 111 (92.5) | 8.91 | 0.1 |
| | Artisan | 5 (9.4) | 48 (90.6) | | |
| | Farmer | 1 (3.8) | 25 (96.2) | | |
| | Trading | 9 (11.7) | 68 (88.3) | | |
| | Unemployed | 20 (18.7) | 87 (81.3) | | |
| | Other | 3 (17.6) | 14 (82.4) | | |
| Marital status | Single | 43 (13.1) | 284 (86.9) | 5.92 | 0.01 |
| | Married | 4 (12.5) | 28 (87.5) | | |
| | Separated | 0 (0) | 25 (100) | | |
| | Divorced | 0 (0) | 16 (100) | | |
| Living with | Alone | 16 (9.6) | 151 (90.4) | 10.6 | 0.03 |
| | With family | 26 (18.7) | 113 (81.3) | | |
| | With male friend | 4 (5.3) | 71 (94.4) | | |
| | With female friend | 1 (5.6) | 17 (94.4) | | |
| | Others | 0 (0) | 1 (100) | | |
| Resident | Public yard | 32 (15.4) | 176 (84.6) | 11.03 | 0.009 |
| | Detached | 11 (8.2) | 123 (91.8) | | |
| | Hostel | 3 (5.3) | 54 (94.7) | | |
| | Others | 1 (100) | 0 (0) | | |
| Monthly income | Dependent | 15 (12.8) | 102 (87.2) | 2.57 | 0.25 |
| | Independent | 30 (10.9) | 246 (89.1) | | |
| | Others | 2 (28.6) | 5 (71.4) | | |

of 0.009 [Odd ratio = 0.93 (95% CI = 0.32-2.78)]. About 28.6% of the respondents who chose not to disclose their monthly income status, tested positive for HIV, 12.8% of the respondents who said they are dependent on monthly income source, tested positive for HIV, while 10.9% of those who said they are independent on monthly income source, tested positive for HIV. The risk analysis showed a non-statistical significance relation of the income dependability with HIV with a p-value of 0.25 (Tab. VII). Table VIII showed the relationship between the sexual orientation of the respondents and their HIV status. About 12.1% of those respondents who belonged to the MSM community social group, tested HIV positive, while 4.8% of those respondents who did not belong to any MSM community social group, tested positive for HIV. The risk analysis showed no statistical significance with a p-value of 0.5. The respondents who self-identified as gay, had about 18.1% of them tested positive for HIV, while 16.4% of the respondents who identified as bisexual, tested positive for HIV and only 3.8% of those respondents who chose to be identified as MSM, tested positive for HIV. The risk analysis showed a statistically significant association between bisexual and HIV positivity with a p-value of < 0.001 [Odd ratio = 1.51 (95% CI = 0.56-4.05)]. About 12.8% of those respondents who made their debut into MSM at the age bracket of 20-29 years, tested positive for HIV, while 11.7% of the respondents who had their first sex with men at the age range of 13-19 years, tested positive for HIV. The risk analysis showed no statistically significant association between age of debut into MSM and HIV positivity as seen with a p-value of 0.8. About 23.8% of the respondents who joined MSM in search of career pursuit, tested positive for HIV, 15.1% of those that voluntarily joined MSM, tested positive, 13.4% of those respondent who joined MSM due to financial need, tested positive, about 9.6% of those who joined MSM due to peer pressure, tested positive, while 6.5% of those who were forced into MSM, tested positive and only about 3.6% of those joined MSM due to respect for higher authority, tested positive for HIV. The risk analysis showed a non-significant relationship between mode of debut into MSM and HIV positive outcome, with a p-value of 0.29 (Tab. VIII).

Table IX shows relationship between sexual lifestyle of the respondents and HIV status.

About 15.8% of those respondents who chose to play the role of bottom during sexual intercourse with fellow

**Tab. VIII.** Relationship between Sexual Orientation of the Respondents and HIV Status.

| | | HIV Status | | | |
|---|---|---|---|---|---|
| Variable | Category | Positive | Negative | $X^2$ | p-value |
| MSM community member | Yes | 46 (12.1) | 333 (87.9) | 0.45 | 0.5 |
| | No | 1 (4.8) | 20 (95.2) | | |
| Typology | Gay | 17 (18.1) | 77 (81.9) | 19.14 | < 0.001 |
| | Bisexual | 24 (16.4) | 122 (83.6) | | |
| | MSM | 6 (3.8) | 153 (96.2) | | |
| | Others | 0 (0) | 1 (100 | | |
| Age at First sex | ≤ 12 | 0 (0) | 10 (100) | 0.92 | 0.8 |
| | 13-19 | 27 (11.7) | 203 (88.3) | | |
| | 20-29 | 20 (12.8) | 136 (87.2) | | |
| | ≥ 30 | 0 (0) | 4 (100) | | |
| Why MSM | Forced | 2 (6.5) | 29 (93.5) | 0.72 | 0.29 |
| | Hormonal/involuntary | 2 (7.1) | 26 (92.9) | | |
| | Voluntary | 16 (15.1) | 90 (84.9) | | |
| | Peer pressure | 10 (9.6) | 94 (90.4) | | |
| | Financial need | 11 (13.4) | 71 (86.6) | | |
| | Career pursuit | 5 (23.8) | 16 (76.2) | | |
| | Respect of authority | 1 (3.6) | 27 (96.4) | | |

**Tab. IX.** Relationship between sexual lifestyle of the respondents and HIV status.

| | | HIV Status | | | |
|---|---|---|---|---|---|
| Variable | Category | Positive | Negative | $X^2$ | p-value |
| Role in Sex | Top | 11 (9.4) | 106 (90.6) | 2.28 | 0.31 |
| | Bottom | 16 (15.8) | 85 (84.2) | | |
| | Versatile | 20 (11.0) | 162 (89.0) | | |
| | Others | | | | |
| Choice of male partner | Men in authority | 10 (7.2) | 128 (92.8) | 4.48 | 0.11 |
| | Same age bracket | 26 (14.8) | 150 (85.2) | | |
| | Adolescents | 11 (12.8) | 75 (87.2) | | |
| MSM sex in last 3 month | Yes | 30 (10.1) | 267 (89.9) | 4.46 | 0.11 |
| | No | 16 (16.0) | 84 (84.0) | | |
| | Others | 1 (33.3) | 2 (66.7) | | |
| Use Condom Preferred sex | Same sex | 12 (6.0) | 188 (94.0) | 17.2 | < 0.001 |
| | Opposite sex | 6 (10.3) | 52 (89.7) | | |
| | Both sexes | 27 (20.0) | 108 (80.0) | | |
| | Others | 2 (28.6) | 5 (71.4) | | |

men, tested positive for HIV, while 11.0% of those respondents who are versatile, tested positive and 9.4% of those respondents that ply the Top role during sex with men, tested positive for HIV. The risk analysis showed a non-significant relationship between the role and HIV positive outcome with a p-value of 0.31. More than 14% of those respondents who preferred having sex with men of same age bracket, tested positive for HIV, while 12.8% of the respondents that preferred sex with adolescent men, tested HIV positive and 7.2% of those MSM who chose to have sex with men in higher authority, tested positive to HIV. The risk analysis showed a non-significance relationship between the choice of male sex partner and HIV positive outcome with a p-value of 0.11. The respondents who were neutral about their sexual activeness in the past 3 months, had about 33.3% of them tested positive for HIV, while 16% of those who said they never had sex within the last 3 months, tested HIV positive and about 10.1% of those respondents who had sex with men within the last 3 months, tested positive for HIV. The risk analysis showed a non-significant relationship between sexual activeness and HIV positive outcome with a p-value of 0.11. About 28.6% of the respondents who do not use condom during sex, tested positive for HIV, 20% of the respondents who use condom while having sex with both male and female, tested positive to HIV, while 10.3% of the respondent who uses condom during sex with opposite partners only, tested positive for HIV and 6.0% of those that use condom only with same sex, tested positive for HIV. The risk analysis showed a statistically significant association between unprotected sex and HIV positivity, with a p-value of < 0.001 [Odd ratio = 4.13 (95% CI = 0.38-44.52)] (Tab. IX).

Table X shows relationship between risk behaviors of the respondents and HIV status.

About 14.9% of the respondents who do not use condom every time they have sex, tested positive, 14.2% of those who sometimes do not use condom during sex, tested positive for HIV, while 5.7% of the respondents who almost every time do not use condom, tested positive for HIV. The risk analysis showed a non-significance relationship between the rate of non-condom use during sex and HIV positive outcome with a p-value of 0.06. About 23.3% of the respondents who engage every time with multiple sex partners, tested positive for HIV, while about 10.0% of the respondents who sometimes engage with multiple sex partners, tested HIV positive. The risk analysis showed a statistical significance association between multiple sex partner engagement and HIV positive outcome with a p-value of 0.004 [Odd ratio = 0.30 (95% CI = 0.09-1.03)]. More than 25% of the respondents who engage in a group sex with men every time, tested positive for HIV, about 14.8% of the respondents who sometimes engage in a group sex with fellow men, tested positive for HIV, while 6.8% of those that almost every time engage in group sex, tested HIV positive. The risk analysis showed a statistically significant relationship between group sex engagement and HIV positive outcome with a p-value of < 0.001 [Odd ratio = 0.47 (95% CI = 0.14-1.59)]. About 25% of the respondents who use psychoactive substances every time they want to have sex, tested positive for HIV, while about 17.7% of the respondents who sometimes use psychoactive substances during sex, tested HIV positive, above 10% of the respondents who almost every time use psychoactive substances during sex, tested HIV positive and less than 1% of the respondents who do not consume psychoactive substances, tested positive for HIV. The risk analysis showed a statistical significance relationship between intake of psychoactive substances by the respondents and HIV positive outcome with a p-value of < 0.001 [Odd ratio = 0.37 (95% CI = 0.08-1.87)]. Greater than 13% of the respondents who sometimes share injection syringes/needles, tested positive to HIV, while about 11.5% of the respondents who do not share syringes/needles, tested positive for HIV, and greater than 8% of the respondents who share needles almost every time, tested positive for HIV. The risk analysis showed a non-significance relationship between the sharing of syringes/needles among the respondents and HIV positive outcome with a p-value of 0.82. About 15.3% of the respondents who do not use lubricant every time during sex, tested HIV positive, while about 14.6% of those who use lubricant during sex, tested HIV positive and 14.5% of those who sometimes do not use lubricant during sex, tested HIV positive. The risk analysis showed a statistical

**Tab. X.** Relationship between risk behaviors of the respondents and HIV status.

| | | HIV Status | | | |
|---|---|---|---|---|---|
| Variable | Category | Positive | Negative | $X^2$ | p-value |
| Non-use of Condom | Every time | 13 (14.9) | 74 (85.1) | 7.4 | 0.06 |
| | Almost every time | 7 (5.7) | 115 (94.3) | | |
| | Sometimes | 27 (14.2) | 163 (85.3) | | |
| | Others | 0 (0) | 1 (100) | | |
| Multiple sex partner | Every time | 20 (23.3) | 66 (76.6) | 12.83 | 0.004 |
| | Almost every time | 10 (7.1) | 131 (92.9) | | |
| | Sometimes | 17 (10.0) | 153 (90.0) | | |
| | Others | 0 (0) | 3 (100) | | |
| Group sex | Every time | 13 (25.5) | 38 (74.5) | 20.96 | < 0.001 |
| | Almost every time | 4 (6.8) | 55 (93.2) | | |
| | Sometimes | 27 (14.8) | 156 (85.2) | | |
| | Others | 3 (2.8) | 104 (97.2) | | |
| Use of Psychoactive drugs | Every time | 15 (25.0) | 45 (75.0) | 39.16 | < 0.001 |
| | Almost every time | 5 (10.4) | 43 (89.6) | | |
| | Sometimes | 26 (17.7) | 121 (82.3) | | |
| | Others | 1 (0.7) | 144 (99.3) | | |
| Sharing of syringes/needle | Every time | 3 (8.1) | 34 (91.9) | 1.01 | 0.82 |
| | Almost every time | 2 (8.3) | 22 (91.7) | | |
| | Sometimes | 17 (13.9) | 105 (86.1) | | |
| | Others | 25 (11.5) | 192 (88.5) | | |
| Non-use of lubricant | Every time | 9 (15.3) | 50 (84.7) | 10.6 | 0.01 |
| | Almost every time | 4 (3.7) | 103 (96.3) | | |
| | Sometimes | 28 (14.5) | 165 (85.5) | | |
| | Others | 6 (14.6) | 35 (85.4) | | |
| Transactional sex | Every time | 13 (20.0) | 52 (80.0) | 19.7 | < 0.001 |
| | Almost every time | 7 (9.5) | 67 (90.5) | | |
| | Sometimes | 21 (8.4) | 229 (91.6) | | |
| | Others | 6 (54.5) | 5 (45.5) | | |

significance relationship between non-use of lubricant during sex and HIV positivity outcome with a p-value of < 0.01 [Odd ratio = 1.43 (95% CI = 0.44-6.23)]. About 54% of the respondents who do not transact sex, tested HIV positive, while 20% of the respondents who transact sex every time, tested positive for HIV, above 9% of the respondents who transact sex almost every time, tested HIV positive and about 8.4% of those that transact sex sometimes, tested HIV positive. The risk analysis showed a statistical significance relationship transactional sex and HIV positive outcome with a p-value of < 0.001 [Odd ratio = 2.96 (95% CI = 0.41-21.4)] (Tab. X).

Table XI shows relationship between perception of HIV risk factor and HIV status.

Greater than 17% of those who believed that unprotected sex with both male & female partners poses a higher risk, tested HIV positive, while 12% of the respondents who do not believe that unprotected sex with neither male nor female sexual partner exposes them more to contracting HIV, tested positive for HIV, while about 10.1% of those who believed it is only unprotected sex with male partner posed a higher risk of HIV contraction, tested positive for HIV, and about 7.0% of those who believed only unprotected sex with female partner that poses a high risk exposure, tested HIV positive. The risk analysis showed a non-significant relationship between this variable and HIV positive outcome with a p-value of 0.1. About 33.3% of the respondents whose casual male partner were HIV Positive, tested positive for HIV; Above 13% of those respondents who did not know the HIV status of their casual male partners, tested positive for HIV, and about 6.5% of those respondents whose male casual partner was HIV negative, tested positive for HIV. The risk analysis showed a non-significance relationship between this variable and HIV positive outcome with a p-value of 0.07. More than 35.5% of the respondents who has HIV positive main male partners, tested positive for HIV, while 10.8% of those who do not know the HIV status of their main male partner, tested HIV positive and 7.5% of those whose HIV status of their main male partner is Negative, tested positive for HIV. The risk analysis showed a statistical significance relationship between awareness of the main male partners' HIV status and HIV positive outcome with a p-value of < 0.001 [Odd ratio = 0.14 (95% CI = 0.04-0.52)]. Exactly 25.0% of the respondents who are aware of their female partners, HIV positive status, tested HIV positive, while 11.9% of those who are not aware of their female partners' HIV status, tested HIV positive and about 10.6 of the respondents who are aware of their female partner's HIV negative status, tested HIV positive. The risk analysis showed a non-significance relationship between this variable and HIV positive outcome with a p-value of 0.47.

More than 23% of the respondents who do not use Pre-Exposure Prophylaxis (PrEP), tested HIV positive, while about 6.6% of those who take PrEP, tested HIV positive and slightly less than 6.6% of those who are not aware of PrEP, tested positive for HIV. The risk analysis showed a statistical significance relationship between awareness/uptake of PrEP and HIV positive outcome with a p-value of < 0.001 [Odd ratio = 5.10 (95% CI = 0.04-0.52)]. Close to 13.8% of those who were not much aware of HIV preventive services going on in the State, tested positive, while about 12.4% of those who are aware of the ongoing HIV preventive services in the State, tested positive and less than 3% of those were never aware of any ongoing HIV preventive program in the State, tested positive. The risk analysis showed a non-significant relationship between this variable and HIV positive outcome with a p-value of 0.47 (Tab. XI).

**Tab. XI.** Relationship between perception of HIV risk factor and HIV status.

| | | HIV Status | | | |
|---|---|---|---|---|---|
| Variable | Category | Positive | Negative | $X^2$ | p-value |
| What causes more Exposure | Unprotected same sex | 10 (10.1) | 89 (89.9) | 6.2 | 0.1 |
| | Unprotected opposite sex | 8 (7.0) | 107 (93.0) | | |
| | None of the above | 8 (12.5) | 56 (87.5) | | |
| | Unprotected sex with both | 21 (17.2) | 101 (82.8) | | |
| Casual male partner HIV status | Positive | 1 (33.3) | 2 (66.7) | 5.72 | 0.07 |
| | Negative | 7 (6.5) | 101 (93.5) | | |
| | Unknown | 39 (13.5) | 250 (86.5) | | |
| Main male partner HIV status | Positive | 11 (35.5) | 20 (64.5) | 14.7 | < 0.001 |
| | Negative | 9 (7.5) | 111 (92.5) | | |
| | Unknown | 27 (10.8) | 222 (89.2) | | |
| Female partner HIV status | Positive | 1 (25.0) | 3 (75.0) | 1.37 | 0.47 |
| | Negative | 10 (10.6) | 84 (89.4) | | |
| | Unknown | 36 (11.9) | 265 (88.1) | | |
| Use of PEP | Yes | 9 (6.6) | 128 (93.4) | 21.09 | < 0.001 |
| | No | 29 (23.4) | 95 (76.6) | | |
| | Not aware | 9 (6.5) | 130 (93.5) | | |
| Preventive services awareness | Very much aware | 39 (12.4) | 276 (87.6) | 2.89 | 0.22 |
| | Not aware | 7 (13.7) | 44 (86.3) | | |
| | Never aware | 1 (2.9) | 33 (97.1) | | |

Tab. XII. Multivariate analysis.

| Variable | Categories | Odd Ratio (95% CI) |
|---|---|---|
| Education | Primary‡ | 1 |
| | Secondary | 2.49 (0.32-19.75) |
| | Tertiary | 0.81 (0.10-6.39) |
| Marital Status | Single‡ | 1 |
| | Married | 2.64 (0.49-14.2) |
| | Separate | 0 |
| | Divorced | 0 |
| Living | Alone‡ | 1 |
| | With family | 1.97 (0.7-5.52) |
| | With male friend | 1.14 (0.2-4.97) |
| | With female friend | 1.31 (0.11 -1.31) |
| | Other | 0 |
| | Public yard‡ | 1 |
| Resident | Detached | 0.93 (0.32-2.78) |
| | Hostel | 0.34 (0.10-1.76) |
| | Others | |
| Typology | Gay‡ | 1 |
| | Bisexual | 1.51 (0.56-4.05) |
| | MSM | 0.48 (1.20-1.92) |
| | Others | |
| Use of condom | Same sex‡ | 1 |
| | Opposite sex | 0.91 (0.21-32.95) |
| | Both sexes | 1.84 (0.637-5.32) |
| | Others | 4.13 (0.38-44.52) |
| Multiple Sex | Every time‡ | 1 |
| | Almost every time | 0.19 (0.05-0.69)* |
| | Sometimes | 0.30 (0.09-1.03) |
| | Others | |
| Group Sex | Every time‡ | 1 |
| | Almost every time | 0.04 (0.006-0.30)* |
| | Sometimes | 0.47 (0.14-1.59) |
| | Others | 0.45 (0.05 -3.58) |
| Use of Psychoactive substances | Every time‡ | 1 |
| | Almost every time | 0.37 (0.08-1.87) |
| | Sometimes | 0.35 (0.11-1.07 |
| | Others | 0.014 (0.001-0.17)* |
| Non-use of Lubricant | Every time‡ | 1 |
| | Almost every time | 0.54 (0.12-2.58) |
| | Sometimes | 1.48 (0.43-5.12) |
| | Others | 1.02 (0.17-6.15)* |
| Transact Sex | Every time‡ | 1 |
| | Almost every time | 0.98 (0.2-4.47) |
| | Sometimes | 1.43 (0.44-6.23) |
| | Others | 2.96 (0.41-21.4) |
| HIV Status of Main male partner | Positive‡ | 1 |
| | Negative | 0.13 (0.03-0.57)* |
| | Unknown | 0.14 (0.04-052)* |
| Use of PrEP | Yes‡ | 1 |
| | No | 5.10 (1.59-16.4)* |
| | Not aware | 2.70 (0.68-10.67) |

‡ Reference variable. * Independent covariate statistically significantly associated ($p < 0.05$) with HIV positivity. p-value < 0.05 = Significant.

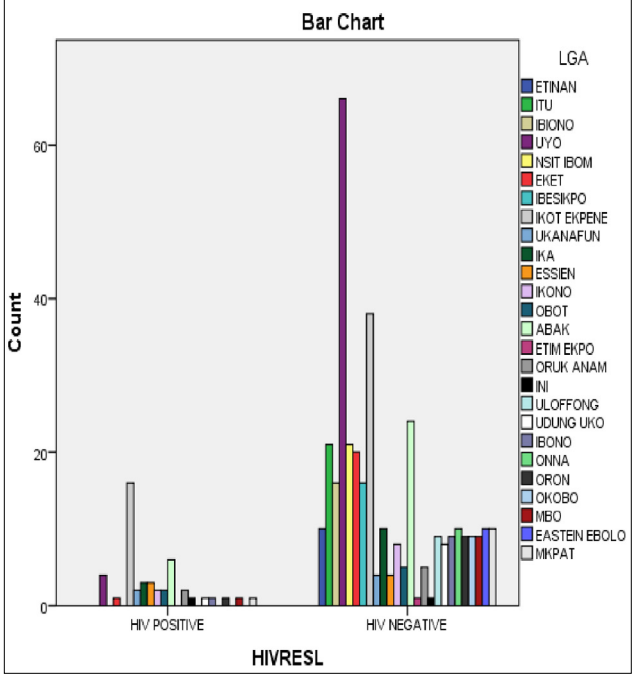
Table XII shows the multivariate analysis. To adjust for multiple covariates, Logistics regression model was performed with HIV status as dependent variable and several covariates that were significant in bivariate analysis were entered. The output was expressed in odd ratio (OR) with 95% confidence interval (95% CI). The logistic regression model was statistically significant, $\chi^2(37) = 129.23$, $p < 0.001$. The model explained 53.6% (Nagel kerke R2) of the variance in HIV positivity in the study population. With other variables held constant education, marital status, typology, unprotected sex with both male/female partner (non-use of condom), multiple sex partner (almost every time), group sex (almost every time), Psychoactive drug (Others), Lubricant sex (others), HIV status of main male partner, Use of PrEP (No) were significantly associated ($p < 0.05$) with HIV positivity. The respondents who had at most secondary and tertiary education are 2.49 times more and 0.81 less likely to be HIV positive than those with only primary school education; with other variable held constant. The respondents who self-identified as bisexual are 1.51 more likely to be HIV positive when compared to those who strictly identified as Gay; with other variable held constant. The odd of being HIV positive is 4.13 times higher in those who engage in unprotected sex than those who use condom during sex; with other variable held constant.

The respondent who had multiple sex partners (almost every time) had 0.19 times lesser odd of HIV positivity to those who had multiple sex partners every time with other variable held constant. With all other variables held constant, the respondents who engage in group sex almost every time is 0.45 times lesser than those who engage in group sex every time. The respondents who do not use psychoactive substances during sex is 0.014 times less likely to become HIV positive when compared to those with regular (every time) intake of psychoactive substances; with other variable held constant. The respondents who do not use lubricant during sex (every time, stands 1.02 times chances higher of being HIV positive than those who use lubricant during sex; with other variable held constant. The respondents who do not engage and those who sometimes engage in transactional sex are 2.96 times and 1.43 times more likely to be HIV positive than those who transact sex every time; with other variable held constant. The respondent whose main male partner's HIV status is negative, is 0.13 times less likely to be HIV positive than those with HIV positive main male partner; with other variable held constant. The respondents who did not take PrEP (NO) and (unaware) are 5.10 and 2.70 times more likely to be HIV positive than those who used PrEP (yes); with other variable held constant (Tab. XII).

Distribution of HIV incidence among MSM across 26 LGAs covered in Akwa Ibom Ikot Ekpene LGA had 16 (34% positivity rate) while, Abak LGA had 6 (13% positivity rate) then followed by Uyo with 4 positives (9% positivity rate). The above results correspond with the NAIIS and AKAIS survey report with Ikot Ekpene LGA having saturation in terms of meeting the 1st 95 of the UNAIDS 95-95-95 target, while Uyo has a good number of unmet targets in HIV status identification among the general population.

Figure 1 shows the distribution of HIV positivity among the MSM in the 26 LGAs covered.

Fig. 1. Bar chart showing the distribution of HIV positivity among the MSM in the 26 LGAs covered.




## Discussion

This study on the risk factors of HIV among men who have sex with men in Akwa Ibom marked the first among other studies on key populations in the State in focusing specifically on identifying the extent of engagement of the MSM in the established risk behaviors that exposes them more to HIV infection. The findings of this study reveal the statistical rate of participation in high HIV risk behavior among the MSM in Akwa Ibom beyond the usual estimated figures from the related research on the key populations.

The quality field data from the findings, has further given clue on the major drivers of HIV epidemic in the State and identified other risk factors on which actions can be taken to change the HIV epidemic rising among the MSM populations.

In this study, more than 50% of the total respondent are within the age group of 20-29 years and about 49.5% of the study group has attended up to university level while 45% stopped at Secondary school in terms of educational status. Almost 95% of the study group responded to have belonged to the MSM community social group, which they claim gives them the coverage, protection and easy access to other MSM in their cohort/cluster. Enquiry on the 5% of the study population not belonging to the MSM community social group revealed that most of them were self-identified as bi-sexual and are even scared of being stigmatized when noticed they are mingling with other fully known persons in the gay community. They rather prefer to communicate and reach out to their partners privately.

Further dip into the occupational status of the study population revealed that about 30% were students, 26.8% were unemployed while the remaining population were either artisan (13.3%), trader (19.3%) or farmers (6.5%). Sociodemographic/behavioral characteristics of the study population showed that about 81.8% were single, only 8% married while 10.3% were separated/divorced. This is in contrast with Chen et al. which proposed that to conceal their sexual orientation from friends/families, MSM often feel pressured to marry women [7]. However, high percent of the single MSM in the study population may be related to the greater percentage of them being student and unemployed.

More than half (52%) of the respondents were resident in a public yard to avoid people suspecting their sexual lifestyle while about 34% preferred detached apartment to enable their confidentiality. About 14% of the student MSM were resident in a hostel while the rest prefer to co-habit with their sexual partner in a detached apartment.

Only about 29% of the respondents were reported to be financial dependent and 69% of the participants responded that they were financially independent while the rest chose to be neutral about their monthly income status.

In line with Baral et al. who reported that male-male sex is often initiated during adolescent years and is very common in the repertoire of adolescent sexual experimentation, thus making them more vulnerable to risky sexual behaviours and perpetrators are seen as key vectors for HIV transmission, about 66% of this study respondents said they made their sexual debut into MSM at the age of 13 -19 years, while 19% responded to have had their first sex with fellow men by age of 20-29 years [3]. This agrees with Outlaw et al. which reported the average age of sexual debut into MSM for youth in the United States as 14.4 years, with approximately 7% reporting their sexual debut prior to age 13 [20]. This further agreed with our study where only about 9% reported to have made their debut at age bracket of 9 -13 years.

Enquiry into the possible mode of debut into MSM revealed that most of the respondents joined MSM voluntarily (27%), 26% joined via peer pressure, 21% joined as result of financial need, 8% reported to have been forced into MSM while about 7% reported to have joined because they biologically were wired as a female while the rest 7% joined because of respect to the higher authority within their environment. Our study revealed that greater percent of our respondents preferred to be classified/typed as versatile (46%), top (29%) and bottom (25%) regarding their preferred role during sex with fellow men while majority also preferred to have sex with men of same age bracket (44%), while 35% preferred sex with men in higher authority and only about 22% of them preferred sex with adolescents. This finding tends to disagree with Twahirwa et al. which found out that there were no differences found in age preferences for specific sex roles, except for somewhat lower minimum age preferred by tops [22]. With regards to relationship type preferences, versatile sought somewhat more sexual encounters. These findings imply

that men who have sex with men, may have a wider spectrum of traits preferred in a partner, like age, but not necessarily so for other traits. Additional studies could explore these preferences with regards to different sex roles among male homosexuals. The study revealed that sexual activeness and preferences for condomless sex among the study population ranges in the following order. About 75% of the respondents said to have had sex with male partners within the last 3 months while only 25% of them answered 'no' to sexual intercourse within the past 3 months. In same vein, 50% said they preferred unprotected sex with fellow men, 34% preferred condomless sex with both male and female partner, 14% preferred to have unprotected sex only with opposite partner while 2% of the respondents do not engage in unprotected sex with either male or female partner. This contradicts the findings by Yi et al. and Eluwa et al. on the decline of condomless sex preference among MSM [26, 11]. This might also be supporting the persistent rise in HIV incidence among MSM group despite the increasing HIV prevention/control program going on in the State. The greater percent that prefer unprotected sex also reiterated during further conversation that they drive more pleasure without condom and feel safer since they are having sex with their fellow men. On the other hand, more of the respondent, during Focused Discussion Interview (FDI) accepts that they were addicted to viewing Sexually Explicit Media (SEM); (*i.e.*, pornography) which correlates findings by Nelson et al. which suggests that viewing sexually explicit media (SEM); may be related to the sexual behaviors of men who have sex with men (MSM) [18]. Men who self-identified as bisexual, engaged in transactional sex, and reported greater agreement with sexual risk cognitions (*i.e.*, heat-of-the-moment thoughts about condom use) had significantly greater odds of reporting a preference for condomless sex in SEM [18].

This study findings gives room for future research on the estimating the role of SEM in the sexual health of MSM in Nigeria and the extent to which exposure to SEM among MSM alters their sexual behavior and preferences for condomless sex and how this might be addressed in HIV prevention programs. Almost all the respondents (about 99%) reported to have both concurrent and non-concurrent multiple sexual partners with only 1% reported to have only one sexual partner. This correlates with many other studies in the literature showcasing the engagement of MSM in high-risk behavior of having multiple sex partners among others [13, 11].

More than 72% of the respondents said they had engaged in group sex especially during their birthday parties, school graduation and other occasions such as burial wake keep. Recent studies have shown that private sex parties are an emerging risk environment for HIV among men who have sex with men (MSM) which agrees with the explanation by the respondents during FDI, that group sex occurs mostly on such occasions, as they get to meet with old friends and the new ones who are invited by their peer groups and on such parties, that access to alcohol and psychoactive drugs is usually common [16]. This finding agrees with Mimiaga et al. which found out that nearly one-third (32%) of their study population have engaged in one or more serodiscordant unprotected anal sex (SDUAS) acts at the most recent sex party attended [16]. This correlate with further findings on the individual response on involvement in the use of psychoactive substances during sex. The observation on the group sex participation of the respondents further correlates study by Chen et al. which found that specific countries indicated group sex was common among men who have sex with men (MSM), and men who reported group sex participation were at increased risk of human immunodeficiency virus (HIV)/sexually transmitted infections (STIs) [7].

64% of the respondents reported that they use psychoactive substances (such as tramadol) during and after sexual intercourse. This result is in line with findings by Hunter et al. who reported that substance use among men who have sex with men (MSM) is higher than in comparable non-MSM samples [15].

During focused discussion interview, majority of the respondent who use psychoactive substances claimed that it enhances their libido while others felt they will not feel shy when they are on drugs especially while meeting their new partner for the first time. Their claims tend to agree with Deimel and Graf who explained in their studies that main reported motives for chemsex are not only enhanced sexual performance and increased sexual pleasure but also the feeling of belonging and De-stigmatization while methamphetamine as a psychostimulant especially intensifies sensitivity, can maximize sexual pleasure, and enhances the feeling of intimacy [9, 14]. It might, therefore, help to establish relationships and facilitates sexual intercourse with more partners over a longer period [14].

The high prevalence of needle reuse and sharing practices highlights significant risks for onward transmission and acquisition of HIV and viral hepatitis [22]. However, this was not the same case from this study as greater percent (54%) of the study population responded to have never shared injection needles before, compared to Twahirwa et al. who had 91% of their participants reported ever sharing needles in their lifetime [22]. The findings on lubricant use by the respondents of this study which showed that about 90% do not use lubricant in their most recent sex, did not align with some other previous studies like Eluwa et al. which reported increasing use of lubricant among the MSM accessed during IBBS survey in Akwa Ibom, likewise the works of Oluyemisi which reported that 85.6% used lubricants mostly with condom, products used were KY jelly, body cream, saliva and Vaseline [11, 19]. In contrast, some, however, agreed to have only used saliva as lubricant during sex in the last 3 months. This call for attention towards increasing access to lubricant among the MSM community in Akwa Ibom. This result further disagreed with the findings by Crowell et al. which reported that From March 2013-November 2017, 2090 MSM and TGW enrolled in the TRUST/RV368 cohort, Consistent use of condoms with water-based CCLs during receptive anal sex was reported by

238 of 386 (61.7%) participants after nine months and 212 of 316 (67.1%) after 15 months in the study [8].

In this study, almost 97% of the respondent reported to have engaged in transactional sex in the past 3 months. This result correlates that of Crowell et al. who reported that almost half of their study population (50.9%) had received payment for sex while 45.4% had paid for sex in the past [8]. Transactional sex (TS) is generally defined as the trading (buying or selling) of sex for material benefit (*i.e.*, exchanging money, drugs, food, shelter, or other items for sex), Various studies have reported increased prevalence of TS among men who have sex with other men (MSM) [2]. Engagement in TS occurs along a spectrum of participation ranging from casual, infrequent encounters to continual professional exchange.

Transactional sex between men frequently involves anal intercourse which, if unprotected, carries a high risk of transmission of sexually transmitted infections for the receptive partner, and a significant risk for the insertive partner.

HIV risk perception among MSM in Akwa Ibom is among the very vital variables explored in this study. Perception of health risk is a key dimension of most health behavior models used to construct health promotion campaigns particularly those targeting HIV related risk behaviors.

In this study, the respondents' perception of risk of HIV was assessed and the findings were as follows; almost 31% (122) of the respondent agreed that unprotected sex with both male and female partners exposes one more to risk of contracting HIV, 29% believed that unprotected sex with only opposite partner poses a high risk, 25% said only unprotected sex with same sex poses a high risk of HIV while about 16% of the respondent still did not believe that unprotected sex with either same or opposite sex poses a high risk of contracting HIV. On the knowledge of HIV status of the respondents' sexual partner, about 28% of the respondents knew their sexual partners HIV status of which less than 1% said their male sexual partner were HIV positive while 27% reported their sexual partners' HIV status as negative. However, greater than 72% of the participants reportedly do not know the HIV status of their sexual partners. In this study, there was no significant difference among the group of respondents who agreed to be aware and use Pre-Exposure Prophylaxis (PrEP) (34.2%), those that are aware but do not use PrEP (31%) and those that were not even aware of PrEP prior to the time of this stud (34.8%). Greater than 78% of the respondents in this study said they are aware of HIV preventive services going on in Akwa Ibom while 12.8% not aware and 8.5% reported never aware of any HIV preventive program in the State. The findings of this study on HIV risk perception correlate that of which stated that HIV risk perception and comprehensive HIV knowledge are very low among MSM in Nigeria [11]. Majority of the respondent in this study, agreed to have been tested for HIV though more than 3 months prior to the time of the study. However, a fresh HIV test was conducted for all the 400 participants selected for this study. About 11.8% of the study population tested positive for HIV. This result correlate with the findings by Amobi et al. who reported, in their study on HIV prevalence among MSM and people who inject drugs (PWID) that Among MSM in all states, the median HIV prevalence in the FCT was the highest (20.0%, 95% CI 3.4-25.9), followed by Lagos (13.5%, 95% CI 10.6-18.2) and Akwa Ibom state (12.0%, 95% CI 10.2-16.9) [1]. The risk analysis showed non-statistical significance association of the Age group with HIV positive status with p-value of 0.41. However, it disagrees with the CDC HIV Basic statistics which suggests that HIV affects mostly younger persons. This contradicts the finding by Chen et al. that age, residence, and wealth status may be important factors associated with HIV seropositivity and Eluwa et al. who reported that MSM aged ≥ 25 years, were more likely to be HIV positive, when compared to those aged 16-19 years and 20-24 years [7, 11]. The risk analysis showed statistical significance relationship between educational status and HIV status, with a p-value of 0.003 [Odd ratio = 2.49 (95% CI = 0.32-19.75)]. This contradicts the finding by Chapotera et al. who reported that education was not found to be associated with being HIV-positive. The risk analysis shows that there is a statistical significance association between marital status and HIV positive outcome, with a p-value of 0.01 [Odd ratio = 2.64 (95% CI = 0.49-14.2)]. This agrees with the finding by Chapotera et al. who reported that lifetime number of sexual partners, may be important factors associated with HIV seropositivity [6]. The risk analysis shows that there is a statistical significance association between the resident and the HIV positivity outcome with a p-value of 0.03 [Odd ratio = 1.97 (95% CI = 0.7-5.52)]. This agrees with the finding by Chapotera et al. who reported that residence, and wealth status may be important factors associated with HIV seropositivity [6]. The finding on the significant association between bisexual role of MSM and HIV positivity rate with a p-value < 0.001 [Odd ratio = 1.51 (95% CI = 0.56-4.05)] agrees with Eluwa et al. which reported that HIV prevalence among the bisexual is high and serves as a bridge between the key population and general population [11]. The risk analysis showed no statistically significant association between age of debut into MSM and HIV positivity as seen with a p-value of 0.8. This agrees with the study by Nelson et al. who stated that there was no difference in the HIV seroconversion among those MSM who had first sex with male partner earlier or later in life [18]. The risk analysis showed a non-significance relationship between the role and HIV positive outcome with a p-value of 0.31 This disagrees with Eluwa et al. who reported that those who engage only in Insertive Anal sex (Top) are more likely to have HIV positive than the bottom and versatile [11]. The risk analysis showed a statistically significant association between unprotected sex and HIV positivity, with a p-value of < 0.001 [Odd ratio = 4.13 (95% CI = 0.38-44.52)]. The risk analysis showed a non-significance relationship between the rate of non-condom use during sex and HIV positive outcome with a p-value of 0.06. This contradicts Eluwa

et al. which reported that the increase in consistent condom use observed during transactional sex may explain the low perceived risk of HIV among MSM. The risk analysis showed a statistical significance association between multiple sex partner engagement and HIV positive outcome with a p-value of 0.004 [Odd ratio = 0.30 (95% CI = 0.09-1.03)] [11]. This agrees with García et al, 2016 who reported that A large proportion of the MSM who were surveyed reported engaging in multiple and/or concurrent sexual partnerships, rendering them especially vulnerable not only to becoming HIV infected, but to infecting their sex partners as well [13]. The risk analysis showed a statistically significant relationship between group sex engagement and HIV positive outcome with a p-value of < 0.001 [Odd ratio = 0.47 (95% CI = 0.14-1.59). The risk analysis showed a statistical significance relationship between intake of psychoactive substances by the respondents and HIV positive outcome with a p-value of < 0.001 [Odd ratio = 0.37 (95% CI = 0.08-1.87)]. This corroborates with Beyrer et al. which reported that drug use especially use of methamphetamine has been associated with HIV among MSM [4]. The risk analysis showed a non-significance relationship between the sharing of syringes/needles among the respondents and HIV positive outcome with a p-value of 0.82. The risk analysis showed a statistical significance relationship between non-use of lubricant during sex and HIV positivity outcome with a p-value of < 0.01 [Odd ratio = 1.43 (95% CI = 0.44-6.23). The risk analysis showed a statistical significance relationship transactional sex and HIV positive outcome with a p-value of < 0.001 [Odd ratio = 2.96 (95% CI = 0.41-21.4). The risk analysis showed a statistical significance relationship between awareness of the main male partners' HIV status and HIV positive outcome with a p-value of < 0.001 [Odd ratio = 0.14 (95% CI = 0.04-0.52). The risk analysis showed a statistical significance relationship between awareness/uptake of PrEP and HIV positive outcome with a p-value of < 0.001 [Odd ratio = 5.10 (95% CI = 0.04-0.52)]. This supports the study by Elion et al., (2019) which found that PrEP use by young Black MSM was the most efficient strategy in preventing HIV infection, with ten young Black MSM needing to be treated with PrEP to prevent one new HIV infection. The respondents in this study cut across the 3 senatorial zones and span throughout the 31 LGAs of Akwa Ibom State which makes generalization of the data very significant.

It is possible that the ever-rising HIV epidemic among MSM and other key population can be mitigated by clear understanding of the rate/extent of exposure to the high HIV risk -related behaviors among the MSM community and allocate appropriate resources, policy and other comprehensive intervention plan. This is in line why recent scientific reviews of HIV among MSM in Africa have called for improvements in HIV surveillance systems and the reporting of key HIV indicators [4]. This study is very vital in the broader initiative to inform HIV programming for key populations in Nigeria and Akwa Ibom through the Enhancing Nigeria's Response to HIV/AIDS. Through this study, we have been able to provide the level of exposure to high HIV risk behaviors among the MSM community in Akwa Ibom. Though the HIV screening only revealed 11.7% of the population tested as positive, continuous exposure to high-risk behavior will likely increase the HIV incidence rate in Akwa Ibom, if not urgently followed up.

More MSM hotspots were discovered in addition to the earlier ones identified by Lo et al. 2021 [27] in their study –mapping key population hotspots in Nigeria for targeted HIV program planning earlier mapped hotspots. Lesson centres as well as shopping malls in the city were among the new hotspots identified in addition to the existing ones.

## Conclusions

MSM in Akwa Ibom State are at high risk of acquiring and transmitting HIV because of the high-risk behaviors they engage in with both men and women. In addition, the HIV testing done among the participants shows significantly high prevalence rate of 11.8% (47 positives of 400 tested) among the MSM in Akwa Ibom, however, there may be increase in the HIV burden if the risk factor making the MSM prone to HIV infection is not urgently addressed. Greater percentage of the MSM engage in unprotected sex, multiple sex partners, group and transactional sex and do not know the HIV status of their partners. On the other hand, the bisexual nature of most MSM serves as a linkage to the general population. With the age group of 20-29 years recording highest among the MSM community and having their first debut into having sex with fellow men at 13-19 years speaks volume at the most exposed age bracket and probably calls for adolescent targeted HIV program intervention. Despite the condom availability at the health facilities, the MSM community in Akwa Ibom still prefers having an unprotected anal and vaginal sexual intercourse. This calls for total behavioral re-orientation and other biomedical interventions. There is need for targeted interventions for MSM who bisexual, married, and male sex workers are. In response to the multifaceted risks and vulnerabilities that put Nigerian MSM at a greater risk of HIV infection, future interventions targeting MSM should focus on a comprehensive intervention approach that includes behavioral, biomedical, and structural interventions (combination prevention approach) [3].

### Suggestion for Future Research

Considering the higher number of respondents in this study who self-identified as bisexual with high-risk behaviors capable of exposing them to HIV infection, it would be appropriate if another research is carried out on identifying the risk of HIV/AIDS among the MSM bisexuals and their male/female partners.

Study on the prevalence of HIV/AIDS among the bisexual and their partners in Akwa Ibom is highly recommended.

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## Conflict of interest statement

We declare no conflict of interest.

## Authors' contributions

NA: concept. CE: methodology. EG: proof reading. UW: formatting.

### References

[1] Onovo A, Kalaiwo A, Katbi M, Ogorry O, Jaquet A, Keiser O. Geographical disparities in HIV prevalence among men who have sex with men and people who inject drugs in Nigeria. Medrxiv 2020.01.09.20017103. https://doi.org/10.1101/2020.01.09.20017103

[2] Bamgboye EA, Badru T, Bamgboye A. Transactional sex between men and its implications on hiv and sexually transmitted infections in Nigeria. J Sex Transm Dis 2017;2017:1810346. https://doi.org/10.1155/2017/1810346

[3] Baral S, Holland CE, Shannon K, Logie C, Semugoma P, Sithole B, Papworth E, Drame F, Beyrer C. Enhancing benefits or increasing harms: community responses for HIV among men who have sex with men, transgender women, female sex workers, and people who inject drugs. J Acquir Immune Defic Syndr 2014;66(Suppl 3):S319-28. https://doi.org/10.1097/QAI.0000000000000233

[4] Beyrer C, Baral SD, van Griensven F, Goodreau SM, Chariyalertsak S, Wirtz AL, Brookmeyer R. Global epidemiology of HIV infection in men who have sex with men. Lancet 2012;380:367-77. https://doi.org/10.1016/S0140-6736(12)60821-6

[5] CDC (2018). HIV among gay and bisexual men. https://www.cdc.gov/nchhstp/newsroom/fact-sheets/hiv/HIV-gay-bisexual-men.html (Accessed on: 13/02/2020).

[6] Chapotera G, Jayachandran V, Phukha J. Factors associated with HIV infection among educated Malawians: analysis of the 2010 demographic and health survey. DHS Working Papers No. 127. Rockville, Maryland, USA ICF International 2016.

[7] Chen JP, Han MM, Liao ZJ, Dai ZZ, Liu L, Chen H, Wen XY, Hu S, Que P, Wen W, Peng B. HIV-related behaviors, social support and health-related quality of life among men who have sex with men and women (MSMW): a cross-sectional study in Chongqing, China. PLoS One 2015;10:e0118651. https://doi.org/10.1371/journal.pone.0118651

[8] Crowell TA, Baral SD, Schwartz S, Nowak RG, Kokogho A, Adebajo S, Keshinro B, Makanjuola O, Michael NL, Robb ML, Charurat ME, Ake JA; Trust/rv368 study group. Time to change the paradigm: limited condom and lubricant use among Nigerian men who have sex with men and transgender women despite availability and counseling. Ann Epidemiol 2019;31:11-19.e3. https://doi.org/10.1016/j.annepidem.2018.12.004

[9] Deimel D, Stöver H, Hößelbarth S. Drug use and health behaviour among German men who have sex with men: results of a qualitative, multi-centre study. Harm Reduct J 2016;13:36. https://doi.org/10.1186/s12954-016-0125-y

[10] Elion RA, Kabiri M, Mayer KH, Wohl DA, Cohen J, Beaubrun AC, Altice FL. Estimated impact of targeted pre-exposure prophylaxis: strategies for men who have sex with men in the United States. Int J Environ Res Public Health 2019;16:1592. https://doi.org/10.3390/ijerph16091592

[11] Eluwa GI, Adebajo SB, Eluwa T. Rising HIV prevalence among men who have sex with men in Nigeria: a trend analysis. BMC Public Health 2019;19:1201. https://doi.org/10.1186/s12889-019-7540-4

[12] Federal Ministry of Health, Nigeria. Nigeria HIV/AIDS Indicator and Impact Survey (NAIIS) 2018: Technical Report. Abuja, Nigeria. October 2019.

[13] García MC, Duong QL, Meyer SB, Ward PR. Multiple and concurrent sexual partnerships among men who have sex with men in Viet Nam: results from a National Internet-based Cross-sectional Survey. Health Promot Int 2016;31:133-43. https://doi.org/10.1093/heapro/dau097

[14] Graf N, Dichtl A, Deimel D, Sander D, Stöver H. Chemsex among men who have sex with men in Germany: motives, consequences and the response of the support system. Sexual Health 2018;15:151-6. https://doi.org/10.1071/SH17142

[15] Hunter LJ, Dargan PI, Benzie A, White JA, Wood DM. Recreational drug use in men who have sex with men (MSM) attending UK sexual health services is significantly higher than in non-MSM. Postgrad Med J 2014;90:133-38. https://doi.org/10.1136/postgradmedj-2012-131428

[16] Mimiaga MJ, Reisner SL, Bland SE, Driscoll MA, Cranston K, Isenberg D, VanDerwarker R, Mayer KH. Sex parties among urban MSM: an emerging culture and HIV risk environment. AIDS Behav 2011;15:305-18. https://doi.org/10.1007/s10461-010-9809-6.

[17] National Agency for the Control of AIDS (NACA). National HIV and AIDS Strategic Framework 2017-2021. NACA 2017. https://www.childrenandaids.org/sites/default/files/2017-11/NATIONAL-HIV-AND-AIDS-STRATEGIC-FRAMEWORK.pdf (Accessed on: 21/02/2021).

[18] Nelson KM, Eaton LA, Gamarel KE. Preferences for condomless sex in sexually explicit media among Black/African American men who have sex with men: implications for hiv prevention. Arch Sex Behav 2017;46:977-85. https://doi.org/10.1007/s10508-016-0878-0

[19] Ayoola OO, Sekoni AO, Odeyemi KA. Transactional sex, condom and lubricant use among men who have sex with men in Lagos State, Nigeria. Afr J Reprod Health 2013;17(4 Spec No):90-8.

[20] Outlaw AY, Phillips G 2nd, Hightow-Weidman LB, Fields SD, Hidalgo J, Halpern-Felsher B, Green-Jones M; Young MSM of Color SPNS Initiative Study Group. Age of MSM sexual debut and risk factors: results from a multisite study of racial/ethnic minority YMSM living with HIV. AIDS Patient Care STDS 2011;25(Suppl 1):S23-9. https://doi.org/10.1089/apc.2011.9879

[21] Society for Family Health, 2017 Report. Mapping and characterization of most-at-risk populations in Nigeria, 2015.

[22] Twahirwa Rwema JO, Nizeyimana V, Prata NM. Injection drug use practices and hiv infection among people who inject drugs in Kigali, Rwanda: a cross-sectional study. Harm Reduct J 2021;18:130. https://doi.org/10.1186/s12954-021-00579-0

[23] Joint United Nations Programme on HIV/AIDS (UNAIDS). The Gap Report 2014: Gay men and other men who have sex with men. UNAIDS 2014, p. 9. https://www.unaids.org/sites/default/files/media_asset/07_Gaymenandothermenwhohavesexwithmen.pdf (Accessed on: 21/04/2021).

[24] Joint United Nations Programme on HIV/AIDS (UNAIDS). Blind spot. Reaching out to men and boys. Addressing a blind spot in the response to HIV. UNAIDS 2017, p. 15. https://www.unaids.org/sites/default/files/media_asset/blind_spot_en.pdf (Accessed on: 26/05/2021).

[25] World Health Organization. HIV and young men who have sex with men. Technical brief. WHO 2015. https://www.who.int/publications/i/item/WHO-HIV-2015.8 (Accessed on: 21/01/2022).

[26] Yi S, Tuot S, Chhoun P, Pal K, Tith K. Factors associated with inconsistent condom use among men who have sex with men in Cambodia. Plos One 2015;10:e0136114. https://doi.org/10.1371/journal.pone.0136114

[27] Lo J, Nwafor SU, Schwitters AM, Mitchell A, Sebastian V, Stafford KA, Ezirim I, Charurat M, McIntyre AF. Key population hotspots in Nigeria for targeted HIV Program Planning: mapping, validation, and reconciliation. JMIR Public Health Surveill 2021;7:e25623. https://doi.org/10.2196/25623

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Infectious disease

# Mpox: "the stigma is as dangerous as the virus". Historical, social, ethical issues and future forthcoming

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Keywords

Mpox • LGBTQ • Epidemiology • Public health • History of hygiene • Ethical issues

Summary

**Objectives**. *The authors aim to show the possibility of stigma that hits affected Mpox patients because of the statements of society involving their sexual sphere.*
**Introduction**. *23 July 2022, the Director-General of the WHO, Thedos Ghebreyesus, issued an international public health alert regarding cases of Mpox (formerly known as Monkeypox). Although Mpox has been present in an endemic form for years in some Central African countries, the spread of the disease outside Africa has aroused considerable alarm in populations already sorely afflicted by the COVID-19 pandemic. Aside from the data, what is striking is that Mpox, like other infectious diseases, seems to have become a problem only when it began to cross the borders of Africa. Some may justify this attitude simply by ascribing it to the fear of an epidemic outside the areas where the virus is endemic. However, in such cases, and especially after the COVID-19 experience, other factors are also involved: lack of information and, even more so, the human capacity to utilise diseases to reinforce arguments against the tendencies, inclinations, orientations and behaviours of some social groups. Such information, albeit basically correct, is nevertheless incomplete. Moreover, it tends to prompt a view of this disease that may give rise to highly dangerous and embarrassing situations, engendering the risk of repeating the error that was made about AIDS. Mpox is the latest in a series of epidemics that have struck humanity in the space of very few years.*
**Material and methods**. *Setting and partecipants: people and social groups who, due to sexual orientations and behaviours, are considered to be at risk of being infected with Mpox. Main outcomes measures: - outcomes directly related to mental health of Mpox patients: anxiety, fear and depression, emotional difficulties, feelings of loneliness and isolation; - well-being outcomes of people with Mpox; - risk of not being able to reduce the epidemic among those groups don't feel as though they belong to LGBTQ and therefore do not implement any kind of prevention.*
**Results**. *Limit the contagion from Mpox through specific health and communication campaigns. Remove any stigma related to Mpox disease.*
**Conclusions**. *In the face of this disease, it is absolutely essential that we do not needlessly isolate groups of people by feeding stigma, prejudice and discrimination, which can have devastating effects not only on individuals but also on society as a whole. As the full inclusion of persons of LGBTQ community is probably still a long way off, we must surely wonder when we will be ready enough to achieve the important objective of equality for all.*

## Introduction

On 23 July 2022, the Director-General of the WHO, Thedos Adhanom Ghebreyesus, issued an international public health alert regarding cases of Mpox (MPX) [1]. He "declared that the multi-country outbreak of Mpox is a public health emergency of international concern (PHEIC)" [1].
According to the international health regulation, this declaration establishes the highest level of global alert for public health: in this way it ensures that there is better coordination of actions to be applied, greater cooperation and global solidarity.
In the majority of cases, the symptoms of Mpox, as skin infections, pneumonia, confusion and eye infections, disappear within a few weeks. However, in 3% to 6% of cases reported in countries where the disease is endemic, severe complications may ensue, leading even to death in immunodeficient subjects [2].
These data show that Mpox is in any case a serious disease that requires particular attention from the scientific community, governments and all citizens.

## Background

Mpox is caused by a virus of the variola family that causes smallpox, now eradicated from World. Mpox is a zoonosis that, can also spread from animals to humans, and therefore from humans to other humans.
This disease has symptoms similar to those of human smallpox but milder and has an absolutely lower death rate. It has been clarified that Mpox is not related to chickenpox [3].
The most common symptomatology, recorded among those affected, is given by fever, headache, muscle aches, back pain, low energy and swollen Lymph nodes. These symptoms can be accompanied or followed by a characteristic rash that affects the face, palms, soles of the feet, groin, genital and/or anal


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regions. It may also be found in the mouth, throat, or on the eyes.
The number of such sores is extremely varied and changes from person to person. Sores on the skin begin flat, then fill with liquid before they crust over, dry up and fall off, with a new layer of skin forming below [4].
Usually, Mpox resolves positively and the symptoms just listed, including fever, disappear within a few weeks. However, in some individuals Mpox can have a much more severe course and in some cases can lead to death. The period of infectiousness remains until all the sores have become encrusted, the crusts have fallen and a new layer of skin has formed below.

## Origin and history of Mpox

The discovery of the virus that causes Mpox is rather young: it was recognized in 1958 when two outbreaks of a smallpox-like disease occurred in monkey colonies kept for research [5]. Hence the name "monkey smallpox", although the source of the disease remains unknown. It is known that African rodents and non-human primates (such as monkeys) could host the virus and infect people.
The first known human case of monkey smallpox was recorded in 1970 in Zaire (now Democratic Republic of the Congo, DRC): it was a case of transmission of zoonotic MPV from animal to man in a 9-month-old child [6-9].
Prior to the Mpox outbreak detected in 2022, the disease rarely occurred outside the African continent, where over the years some cases have been reported in 11 African countries: Benin, Cameroon, Central African Republic, Democratic Republic of the Congo, Gabon, Ivory Coast, Liberia, Nigeria, Republic of the Congo, Sierra Leone and South Sudan [10].
When this happened, in most of the time it was linked to international trips to countries where the disease is endemic, such as Nigeria, where Mpox has re-emerged in the last decade after a 40-year break.
In other cases, the transmission is linked to the import of animals from Africa: a major outbreak – with 47 confirmed or probable cases – occurred in 2003 in the US following introduction to infected pet prairie dogs, which had got Mpox virus from infected exotic animals imported from Ghana [11-13].
During recent years, there have been various travel-associated cases of Mpox, all following exposures in Nigeria. There was one case in Israel in 2018, three in the UK (two in 2018, one in 2019, and one in Singapore in 2019 [14, 15]. There was also another case in 2018, in the UK, nevertheless it was the result of nosocomial transmission to a healthcare worker (Fig. 1) [16].
The WHO Bulletin reported over 6,200 and 9,400 confirmed and suspected cases in 2020 and 2021, respectively (probably underestimating data due to the lack of surveillance system in endemic regions) [17, 18].
Although Mpox has been present in an endemic form for years in some Central African countries, the spread of the disease outside Africa has aroused considerable alarm in populations already sorely afflicted by the COVID-19 pandemic.
With 92,167 total cases (data issued by the Centers for Disease Control and Prevention on December 1, 2023), 90195 of which in countries where Mpox had never been reported, the virus has now reached 117 nations, 110 of which for the first time. The dead due to the Mpox are 170: 149 in locations that have not historically reported Mpox, 21 in locations that have historically reported Mpox [19].
In recent times, the case fatality ratio has been around 3-6%, with a rate of 1 percent around the West African clade, found in cases in Europe and America [10].
One of the main and possible causes of the increasing number of cases of Mpox is the interruption of vaccinations against smallpox in the population following the eradication of smallpox in 1980 [20-22].

**Fig. 1.** Number of confirmed, probable, and/or possible Mpox cases between 1970-2019 [11].

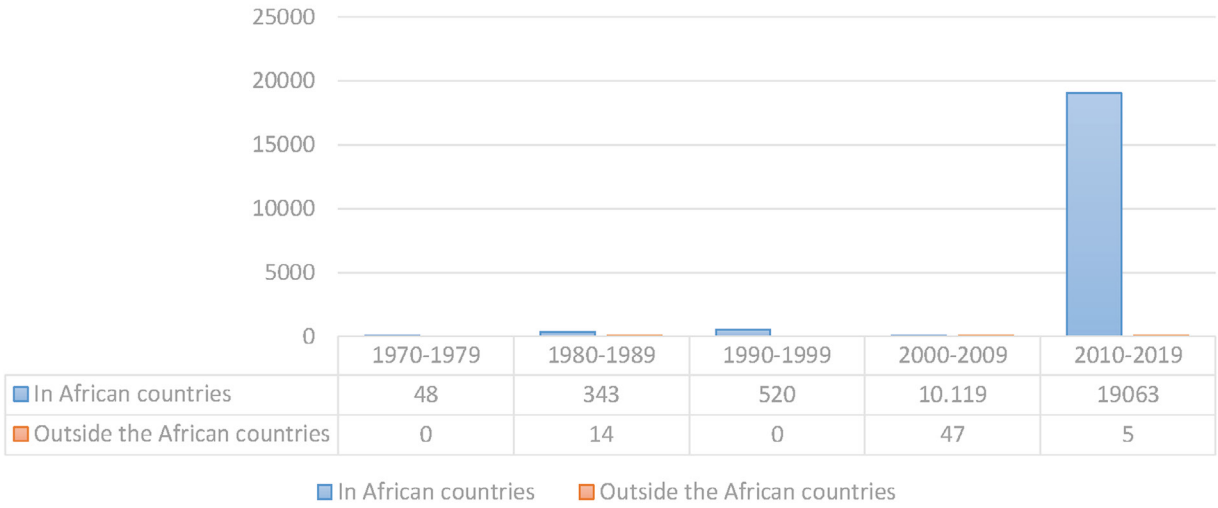
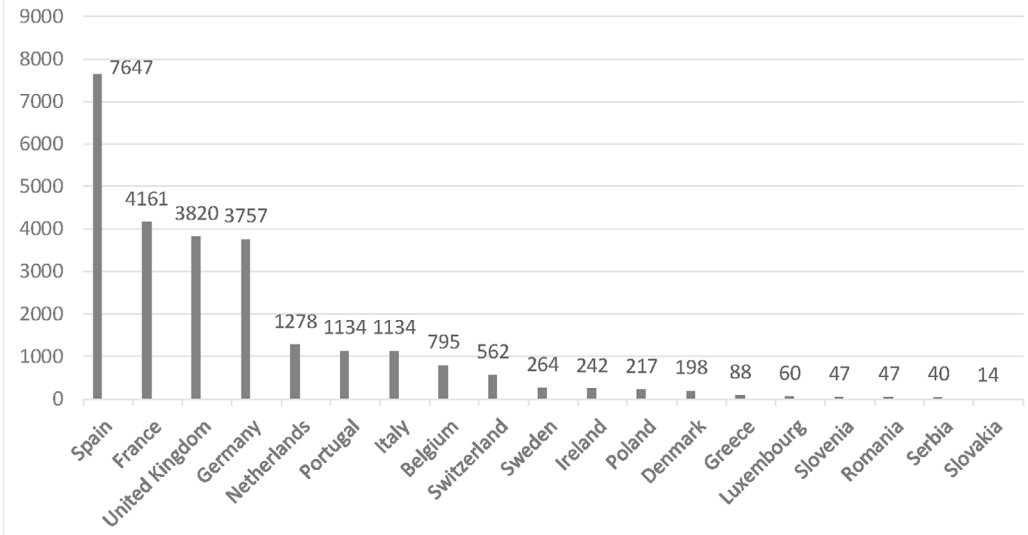


Fig. 2. Mpox Outbreak: cases reported in European countries as of December 1, 2023 [25].




According to some scholars, including Zhilong Yang, the current epidemic of Mpox "is still very unusual, mainly for two reasons", as most infected individuals have never traveled to areas where Mpox is endemic, and the epidemic is developing at the same time in different countries [23]. The latter suggests that there are multiple sources of introduction.

In Europe, noticeable data can be recorded, especially in countries such as Spain, France, United Kingdom and Germany (Fig. 2). There are 31,277 cases registered in USA (December 1, 2023), 1,496 in Canada and 4,071 in Mexico. On the same date, in South America, we report and highlight 10,967 cases in Brazil, 4,090 in Colombia, 3,812 in Peru, 1,531 in China. Only two cases in Russia [19].

## Discussion

Current data suggests that Mpox may represent a long-term global threat. However, no particular attention we paid to this disease until July 2022 with the Public Health Emergency of international Concern (PHEIC).

We also add the public health conditions of African countries where the virus is endemic; they are developing countries, with little tools to monitor and report cases of Mpox and the clinical signs also have similarities with some other diseases that are widespread in the same countries, such as syphilis and chicken pox. This lack of rigorous and careful health surveillance can strengthen the spread of the epidemic.

Aside from the data, what is striking is that Mpox, like other infectious diseases, seems to have become a problem only when it began to cross the borders of Africa.

Some may justify this attitude simply by ascribing it to the fear of an epidemic outside the areas where the virus is endemic.

However, in such cases, and especially after the COVID-19 experience, other factors are also involved: lack of information and, even more so, the human capacity to utilise diseases to reinforce arguments against the tendencies, inclinations, orientations and habits of some social groups.

While outbreaks of Mpox in African countries have been limited to populations who eat the meat of wild animals – so-called "bushmeat" –, which enables the virus to spread, cases that by May 2022 have been identified and reported through sexual health or other health services in primary or secondary health-care facilities in countries other than African ones are instead caused by sexual transmission. They have been detected in men who have sex with other men [24]. As a result, the disease was immediately accompanied by a stigma.

And this, even though in the meantime it has been shown that the virus can also be transmitted through direct contact with infected sores, scabs or bodily fluids, or by sharing underwear or clothing [25-27].

A body of evidence shows that from February 2023 some individuals may spread the disease one to four days before the onset of symptoms [28]. This is a possibility that has important and serious repercussions during the epidemic.

It is essential to keep the focus on the transmission of the Mpox virus alive. We believe that the constant attention and international support are essential for greater surveillance and that the detection of cases of smallpox monkeys are necessary tools for the continuous understanding and to change the epidemiology of this emerging disease.

## Ethical and social issues

Such information, albeit basically correct, is nevertheless incomplete. Moreover, it tends to prompt a view of this disease that may give rise to highly dangerous and embarrassing situations, engendering the risk of

repeating the error that was made with regard to AIDS.
The current outbreak seems to be spreading mainly among men who have sex with other men a trend that has drawn parallels with the HIV/AIDS epidemic, which overly affected the LGBTQ community at its peak in the late 1980s and early '90s. Scientists are not completely sure why the disease is spreading this way, but early outcomes suggest and record a wide spread within the LGBTQ community, where it can spread more than the general population.
On this point, blaming a particular social group for the spread of Mpox has two deleterious consequences; not only does it stigmatise the gay community, it also underestimates the risk to the rest of the population.
"It must be clear to people that everyone can acquire Mpox, regardless of gender identity or sexual orientation, or age" [29].
In this regard, the WHO recommendation that "men who have sex with men should consider limiting their sexual partners to lower their risk of infection and reduce the spread", though based on good intentions, risks exacerbating the danger of stigma. And "The stigma and discrimination – as WHO chief Tedros Adhanom Ghebreyesus said – can be as dangerous as any virus and can fuel the outbreak" [30, 31].
In 1963, sociologist Erving Goffman, in his book Stigma. Notes on the Management of Spoiled Identity defined stigma as a social attribute that discredits an individual or group [32]. According to Goffman's conceptualization, the term stigma refers to a series of signs - physical, such as certain malformations of the body, or character, such as dishonesty, an attitude to violence, inordinate passions, or cultural, tribal or religious affiliation - which, within a society, refer to a difference perceived as deviance from a norm [33].
Expanding on Goffman's social interactionist definition of stigma, Link and Phelan [34] "conceptualize stigma as the co-occurrence of labelling, stereotyping, separating, status loss and discrimination. Their definition, with its focus on structural contexts in addition to relational contexts, has fostered stigma research in two additional areas: (a) the translation of stigmas into broader socio-cultural traditions and institutions, including social welfare policies and (b) the interaction of stigmas with other determinants of health advantage or disadvantage" [35-37].
People have always tended to blame outbreaks of disease on individuals who do not belong to their own social circle ("othering"), who are seen as intruders in their "walled garden".
Because of fear, prejudice and discrimination against Mpox sufferers is growing, "prescribing an "otherness" to disease to feel protected and ascribing blame to justify prejudicial rhetoric. This stigma has recurred throughout history: Jewish persecution during the Black Death, LGBTQ communities during the rise of HIV, and people of west African descent during the Ebola outbreak" [38].
Thus, while we may regard "othering" as a defence strategy, we can in no way endorse it.
Indeed, history clearly demonstrates that blaming diseases or catastrophes on those who are different from us gives rise only to suffering and does not protect society against the incumbent evil [39].
For this reason, on September 27th CDC published "Reducing Stigma in Mpox Communication and Community Engagement" (updated October 18, 2022), with a series of recommendations to avoid stigma and give correct information, starting with the one according to which "Describe Mpox as a legitimate public health issue that is relevant to all people" [40].
On March 2, 2023, CDC reconsidered the issue of stigma in Mpox by publishing Mpox Equity and Anti-Stigma Toolkit. The document opens with this declaration of intents: "CDC is committed to health equity, which means everyone has fair and just opportunity to their highest level of health. For Mpox, this includes reliable access to accurate information and prevention education, as well as vaccine access" [41].
The ability to be properly informed and to have access to treatments and vaccines means that people can have all the necessary information and tools to prevent or treat the disease quickly, in their own and the community's interests.
Extreme attention must therefore be paid to the implementation and dissemination of information messages, which must be transmitted by trusted messengers recognized by the community to which they are addressed. These messages must be realized through communicative codes recognizable and shared by the community itself. Only in this way will they be able to reach and be effective "on the populations at greater risk of Mpox through racial, ethnic, sexual, socio-economic and geographical backgrounds" [41].
For this reason, the WHO changed the name of the disease from Mpox to Mpox, as the term Mpox may appear discriminatory, stigmatizing and misleading. In fact, this occurred in the early months of the monkey smallpox epidemic, due to the particular naming but especially the mode of sexual transmission in gay individuals. This led the WHO to the determination to change the name of the disease to Mpox. Both names will be used simultaneously for one year while Mpox is gradually phased out [42].

## Future forthcoming

The World Health Organization (WHO) declares that "It is fortunate that smallpox vaccines also provide solid protection against monkey smallpox, and the smallpox drug, TPOXX, is promising and probably effective for treating monkey smallpox" [24].
At least two vaccines approved by the US FDA can prevent Mpox. Similarly, it appears that other smallpox vaccines used in the era of smallpox should also be able to provide protection.
However, as monkey smallpox is spreading to many countries and affecting a significant number of people, further epidemiological studies are needed, "with particular reference to zoonotic hosts, transmission

potential and severity of human cases", and the study and development of a new generation of vaccines [21].
From a social point of view, we need to focus on our attention on a fundamental point: Mpox is the latest in a series of epidemics that have struck humanity in the space of very few years, with recrudescence also of important diseases that were considered to be in the process of being eradicated or under control, such as poliomyelitis [43, 44], measles [45] or cholera [46].
In the face of Mpox, it is essential that we do not needlessly isolate groups of people by feeding stigma, prejudice and discrimination, which can have devastating effects not only on individuals but also on society as a whole [47, 48].
As has happened with other diseases in the past, Mpox patients have also suffered stigma and discrimination, and this is not only unfair from an ethical point of view but can cause significant harm, delaying access to treatment in most cases.
Faced with such incidents, the response of the community must be unambiguous and respectful of human rights, with particular attention to the inclusion and dignity of all individuals, without exception [49].
However, the full inclusion of persons who are lesbian, gay, bisexual or transgender (LGBTQ) is probably still a long way off, we must surely wonder when we will be mature enough to achieve the important objective of equality for all [50].
For these reasons we therefore need to be extremely careful when we refer to Mpox disease and people affected by it.
The CDC suggestions covered in the Mpox messaging framework can be extremely valuable [40].
It is enough to use an inclusive language, such as 'us' and 'we' pronouns. At the same time, the media should avoid using sensational language and images: they do not serve and can hurt [51].
Instead, you should use simple language that is easy to understand [52, 53].
Finally, even considering that people are very afraid after the COVID-19 pandemic, it is useful to use a communication aimed at emphasizing the possibilities of prevention, the quick recognition of symptoms and especially the treatable condition of Mpox.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Authors' contributions

DO and MM: designed the study, conceived and drafted the manuscript; MLC and AMS: revised the manuscript; DO, MM and MS: performed a search of the literature; MLC, AMS: critically revised the manuscript; DO and MM: conceptualization, and methodology; MM, DO, MLC, AMS, MS: investigation and data curation; DO and MM: original draft preparation; MLC, AMS, MS, DO, MM: review; DO, MM, MLC: editing. All authors have read and approved the latest version of the paper for publication.

### References

[1] World Health Organization (WHO). WHO Director-General declares the ongoing monkeypox outbreak a Public Health Emergency of International Concern. Available at: https://www.who.int/europe/news/item/23-07-2022-who-director-general-declares-the-ongoing-monkeypox-outbreak-a-public-health-event-of-international-concern (Accessed on: 10/12/2023).

[2] UN News Global Perspective Human stories. Monkeypox: how it spreads, who's at risk - here's what you need to know. Available at: https://news.un.org/en/story/2022/07/1123212 (Accessed on: 10/12/2023).

[3] Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Division of High-Consequence Pathogens and Pathology (DHCPP). Available at: https://www.cdc.gov/poxvirus/monkeypox/about/index.html (Accessed on: 10/12/2023).

[4] World Health Organization (WHO). Monkeypox. Available at: https://www.who.int/news-room/questions-and-answers/item/monkeypox (Accessed on: 11/12/2023).

[5] von Magnus P, Andersen EA, Petersen KB, Birch-Andersen A. A pox-like disease in cynomolgus monkeys. Acta Path Microbiol Scand 1959;46:159. https://doi.org/10.1111/j.1699-0463.1959.tb00328.x

[6] Cho CT, Wenner HA. Monkeypox virus. Bacteriol Rev 1973;37:1-18. https://doi.org/10.1128/br.37.1.1-18.1973

[7] Breman JG, Kalisa R, Steniowski MV, Zanotto E, Gromyko AI, Arita I. Human monkeypox, 1970-79. Bull World Health Organ 1980;58:165-82.

[8] Marennikova SS, Seluhina EM, Mal'ceva NN, Cimiskjan KL, Macevic GR. Isolation and properties of the causal agent of a new variola-like disease (monkeypox) in man. Bull World Health Organ 1972;46:599-611.

[9] Jezek Z, Fenner F. Human monkeypox. In: Melnick JL, ed. Monographs in Virology, vol. 17. Basel, Switzerland: Karger 1988.

[10] World Health Organization (WHO). Monkeypox. Available at: https://www.who.int/news-room/fact-sheets/detail/monkeypox (Accessed on: 11/12/2023).

[11] Bunge EM, Hoet B, Chen L, Lienert F, Weidenthaler H, Baer LR, Steffen R. The changing epidemiology of human monkeypox-A potential threat? A systematic review. PLoS Negl Trop Dis 2022;16:e0010141. https://doi.org/10.1371/journal.pntd.0010141

[12] Huhn GD, Bauer AM, Yorita K, Graham MB, Sejvar J, Likos A, Damon IK, Reynolds MG, Kuehnert MJ. Clinical characteristics of human monkeypox, and risk factors for severe disease. Clin Infect Dis 2005;41:1742-51. https://doi.org/10.1086/498115

[13] Gross E. Update on emerging infections: news from the Centers for Disease Control and Prevention. Update: Multistate outbreak of monkeypox--Illinois, Indiana, Kansas, Missouri, Ohio, and Wisconsin, 2003. Ann Emerg Med 2003;42:660-2; discussion 662-4. https://doi.org/10.1016/s0196064403008199

[14] Erez N, Achdout H, Milrot E, Schwartz Y, Wiener-Well Y, Paran N, Politi B, Tamir H, Israely T, Weiss S, Beth-Din A, Shifman O, Israeli O, Yitzhaki S, Shapira SC, Melamed S, Schwartz E. Diagnosis of Imported Monkeypox, Israel, 2018. Emerg Infect Dis 2019;25:980-3. https://doi.org/10.3201/eid2505.190076

[15] Yong SEF, Ng OT, Ho ZJM, Mak TM, Marimuthu K, Vasoo S, Yeo TW, Ng YK, Cui L, Ferdous Z, Chia PY, Aw BJW, Manauis CM, Low CKK, Chan G, Peh X, Lim PL, Chow LPA, Chan M, Lee VJM, Lin RTP, Heng MKD, Leo YS. Imported Monkeypox, Singapore. Emerg Infect Dis 2020;26:1826-30. https://doi.org/10.3201/eid2608.191387

[16] Vaughan A, Aarons E, Astbury J, Brooks T, Chand M, Flegg P, Hardman A, Harper N, Jarvis R, Mawdsley S, McGivern M, Morgan D, Morris G, Nixon G, O'Connor C, Palmer R, Phin N, Price DA, Russell K, Said B, Schmid ML, Vivancos R, Walsh A, Welfare W, Wilburn J, Dunning J. Human-to-Human Transmission of Monkeypox Virus, United Kingdom, October 2018. Emerg Infect Dis 2020;26:782-5. https://doi.org/10.3201/eid2604.191164

[17] World Health Organization. Regional Office for Africa. Weekly bulletin on outbreak and other emergencies: Week 4: 18-24 January. World Health Organization, Regional Office for Africa. Available online: https://apps.who.int/iris/handle/10665/338891 (Accessed on: 10/12/2023).

[18] World Health Organization. Regional Office for Africa. Weekly bulletin on outbreak and other emergencies: Week 4: 17-23 January. World Health Organization, Regional Office for Africa. Available at: https://apps.who.int/iris/handle/10665/351164 (Accessed on: 10/12/2023).

[19] Centers for Disease Control and Prevention CDC. 2022 Monkeypox Outbreak Global Map. Available at: https://www.cdc.gov/poxvirus/monkeypox/response/2022/world-map.html (Accessed on: 11/12/2023).

[20] Simpson K, Heymann D, Brown CS, Edmunds WJ, Elsgaard J, Fine P, Hochrein H, Hoff NA, Green A, Ihekweazu C, Jones TC, Lule S, Maclennan J, McCollum A, Mühlemann B, Nightingale E, Ogoina D, Ogunleye A, Petersen B, Powell J, Quantick O, Rimoin AW, Ulaeato D, Wapling A. Human monkeypox - After 40 years, an unintended consequence of smallpox eradication. Vaccine 2020;38:5077-81. https://doi.org/10.1016/j.vaccine.2020.04.06

[21] Martini M, Bifulco M, Orsini D. Smallpox vaccination and vaccine hesitancy in the Kingdom of the Two Sicilies (1801) and the great modernity of Ferdinand IV of Bourbon: a glimpse of the past in the era of the SARS-COV-2 (COVID-19) pandemic. Public Health 2022;213:47-51. https://doi.org/10.1016/j.puhe.2022.09.012

[22] Bifulco M, Di Zazzo E, Pisanti S, Martini M, Orsini D. The nineteenth-century experience of the kingdom of the two Sicilies on mandatory vaccination: an Italian phenomenon? Vaccine 2022;40:3452-4. https://doi.org/10.1016/j.vaccine.2022.04.052

[23] Yang Z. Monkeypox: a potential global threat? J Med Virol 2022;94:4034-6. https://doi.org/10.1002/jmv.27884

[24] World Health Organization (WHO). Monkeypox outbreak 2022. Available at: https://www.who.int/emergencies/situations/monkeypox-oubreak-2022 (Accessed on: 10/12/2023).

[25] Centers for Disease Control and Prevention CDC. CDC and health partners responding to Monkeypox Case in the US. Available at: https://www.cdc.gov/media/releases/2022/s0518-monkeypox-case.html (Accessed on: 10/12/2023).

[26] Rizk JG, Lippi G, Henry BM, Forthal DN, Rizk Y. Prevention and Treatment of Monkeypox. Drugs 2022;82:957-63. https://doi.org/10.1007/s40265-022-01742-y

[27] Kumar N, Acharya A, Gendelman HE, Byrareddy SN. The 2022 outbreak and the pathobiology of the monkeypox virus. J Autoimmun 2022;131:102855. https://doi.org/10.1016/j.jaut.2022.102855

[28] Centers for Disease Control and Prevention. Science brief: detection and transmission of Mpox (formerly monkeypox) virus during the 2022 clade IIb outbreak. Available at: https://www.cdc.gov/poxvirus/Mpox/about/science-behind-transmission.html (Accessed on: 10/12/2023).

[29] Sah R, Mohanty A, Reda A, Kumar Padhi B, Rodriguez-Morales AJ. Stigma during monkeypox outbreak. Front Public Health 2022;10. https://doi.org/10.3389/fpubh.2022.1023519

[30] World Health Organization (WHO). WHO Director-General's opening remarks at the COVID-19 media briefing-27 July 2022. Available at: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-COVID-19-media-briefing--27-july-2022 (Accessed on: 10/12/2023).

[31] Kimball S. WHO recommends gay and bisexual men limit sexual partners to reduce the spread of monkeypox. Available online: https://www.cnbc.com/2022/07/27/monkeypox-who-recommends-gay-bisexual-men-limit-sexual-partners-to-reduce-spread.html (Accessed on: 10/12/2023).

[32] Goffman E. Stigma. Notes on the management of spoiled identity. London: Penguin Books 1963.

[33] Andersen MM, Varga S, Folker AP. On the definition of stigma. J Eval Clin Pract 2022;28:847-53. https://doi.org/10.1111/jep.13684

[34] Link BG, Phelan JC. Conceptualizing stigma. Annu Rev Sociol 2001;27:363-85. https://doi.org/10.1146/annurev.soc.27.1.363

[35] Phillips R, Benoit C. Exploring stigma by association among front-line care providers serving sex workers. Healthc Policy 2013;9(SP):139-51.

[36] Link BG, Phelan JC. Stigma and its public health implications. Lancet 2006;367:528-9. https://doi.org/10.1016/S0140-6736(06)68184-1

[37] Stuber J, Meyer I, Link B. Stigma, prejudice, discrimination and health. Soc Sci Med 2008;67:351-7. https://doi.org/10.1016/j.socscimed.2008.03.023

[38] Coates M. COVID-19 and the rise of racism. BMJ 2020;369. https://doi.org/https://doi.org/10.1136/bmj.m1384

[39] Martini M, Besozzi G, Barberis I. The never-ending story of the fight against tuberculosis: from Koch's bacillus to global control programs. J Prev Med Hyg 2018;59:E241-7. https://doi.org/10.15167/2421-4248/jpmh2018.59.3.1051

[40] CDC Center for Disease Control and Prevention. Reducing Stigma in Monkeypox Communication and Community Engagement. Available at: https://www.occhd.org/application/files/6616/6094/0398/Monkeypox_Stigma_508.pdf (Accessed on: 10/12/2023).

[41] Centers for Disease Control and Prevention. Mpox Equity and Anti-Stigma Toolkit. Available at: https://archive.cdc.gov/www_cdc_gov/poxvirus/mpox/resources/toolkits/equity.html (Accessed on: 10/12/2023).

[42] World Health Organization (WHO). WHO recommends new name for monkeypox disease. Available online: https://www.who.int/news/item/28-11-2022-who-recommends-new-name-for-monkeypox-disease (Accessed on: 10/12/2023).

[43] Martini M, Orsini D. Armed conflict in the world threatens the eradication of Poliomyelitis: risks of humanitarian crises. Pathog Glob Health 2022;116:267-8. https://doi.org/10.1080/20477724.2022.2081785

[44] Martini M, Orsini D. The fight against poliomyelitis through the history: past, present and hopes for the future. Albert Sabin's

missing Nobel and his "gift to all the world's children". Vaccine 2022;40:6802-5. https://doi.org/10.1016/j.vaccine.2022.09.088

[45] Orsini D, Martini M. Measles: a new danger for Ukraine's children! The need for an effective and timely vaccination prevention campaign for an insidious disease that comes from afar. J Prev Med Hyg 2023;64:E204-8. https://doi.org/10.15167/2421-4248/jpmh2023.64.2.2996

[46] Davide O, Martini M. The insidious return of cholera in the Eastern Mediterranean Region, Lebanon and Syria: a worrying signal! Past, present, and future forthcoming. J Prev Med Hyg 2023;64:E27-E33. https://doi.org/10.15167/2421-4248/jpmh2023.64.1.2910

[47] Canetti D, Riccardi N, Martini M, Villa S, Di Biagio A, Codecasa L, Castagna A, Barberis I, Gazzaniga V, Besozzi G. HIV and tuberculosis: the paradox of dual illnesses and the challenges of their fighting in the history. Tuberculosis (Edinb) 2020;122:101921. https://doi.org/10.1016/j.tube.2020.101921

[48] Martini M, Gazzaniga V, Behzadifar M, Bragazzi NL, Barberis I. The history of tuberculosis: the social role of sanatoria for the treatment of tuberculosis in Italy between the end of the 19th century and the middle of the 20th. J Prev Med Hyg. 2018;59:E323-7. https://doi.org/10.15167/2421-4248/jpmh2018.59.4.1103

[49] Irshad U. Overcoming stigma-contracting mpox as a minoritised trainee. Lancet Infect Dis 2023;23:400. https://doi.org/10.1016/S1473-3099(23)00064-6.

[50] Organisation for Economic Co-operation and Development (OECD). Society at a Glance 2019. Available online: https://www.oecd.org/social/society-at-a-glance-19991290.htm (Accessed on: 10/12/2023).

[51] Rosselli R, Martini M, Fluad Effect Working Group, Bragazzi NL, Watad A. The public health impact of the so-called "Fluad effect" on the 2014/2015 influenza vaccination campaign in Italy: ethical implications for health-care workers and health communication practitioners. Adv Exp Med Biol 2017;973:125-34. https://doi.org/10.1007/5584_2017_39

[52] Orsini D, Bianucci R, Galassi FM, Lippi D, Martini M. Vaccine hesitancy, misinformation in the era of COVID-19: Lessons from the past. Ethics Med Public Health 2022;24:100812. https://doi.org/10.1016/j.jemep.2022.100812

[53] Mahroum N, Watad A, Rosselli R, Brigo F, Chiesa V, Siri A, Ben-Ami Shor D, Martini M, Bragazzi NL, Adawi M. An infodemiological investigation of the so-called "Fluad effect" during the 2014/2015 influenza vaccination campaign in Italy: ethical and historical implications. Hum Vaccin Immunother 2018;14:712-8. https://doi.org/10.1080/21645515.2017.1420448

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Infectious disease

# Risk factors for carbapenem-resistant *Klebsiella pneumoniae* infections in Intensive Care Units: a multicentre case-control study with a competing-risks analysis

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## Keywords

Klebsiella pneumoniae • Carbapenem-resistant *Klebsiella pneumoniae* (CRKP) infections • Intensive Care Units • Risk factors

## Summary

**Aim**. *This study investigated the risk factors for the development of carbapenem-resistant Klebsiella pneumoniae (CRKP) infections in adult patients in Intensive Care Units (ICUs).*
**Methods**. *A multicentre case-control study was conducted in ICUs in three tertiary hospitals in Turkey. The cases were patients culture-confirmed CRKP and a condition associated with healthcare-associated infections. Two controls were randomly selected for each case from among all other patients with an ICU stay at least as long as that of the corresponding case-patient. A proportional semiparametric subdistribution hazards regression model was used to assess risk factors for CRKP infection. ICU discharge and non-CRKP-related deaths were treated as competing risks.*
**Results**. *A total of 120 patients, 44 cases and 76 controls were included in the analysis. Of the controls, 32 were discharged from the ICU and 44 died without acquiring CRKP infection. Endotracheal intubation (hazard ratio [HR]: 1.96, 95% confidence interval [CI]: 1.00-3.868) and type 2 diabetes mellitus (HR: 1.57, 95% CI: 0.888-2.806) were associated with an increased risk of CRKP infection, whereas carbapenem exposure (HR: 0.47, 95% CI: 0.190-1.1175) and the presence of a nasogastric tube (HR: 0.49, 95% CI: 0.277-0.884) were associated with a decreased risk of CRKP infection.*
**Conclusions**. *Enteral nutrition support via a nasogastric tube may be associated with a reduced risk of CRKP-resistant infections in ICU patients. This hypothesis should be tested with a well-designed study.*

## Introduction

*Klebsiella pneumoniae* causes lung, urinary tract, and bloodstream infections, especially in the older and immunosuppressed patients [1]. Urinary, endotracheal, venous (especially femoral vein), nasogastric, and other feeding catheters are risk factors that may cause infection by mucosal colonisation [2, 3]. *K. pneumoniae* has transcriptomic activity that is associated with enhanced colonisation, virulence, and antibiotic resistance through genomic loci located on chromosomes and plasmids [4]. These genetic activities are thought to be expressed in the presence of inducing factors, especially antibiotics [5].
Intensive Care Units (ICUs) are a high-risk setting for carbapenem-resistant *K. pneumoniae* (CRKP) infections because of the presence of vulnerable hosts, an abundance of invasive procedures, and polypharmacy. CRKP infections have high morbidity and mortality rates [6]. The limited availability of the new beta-lactam and beta-lactamase inhibitor combinations (such as ceftazidime-avibactam) makes treatment of infection challenging, particularly in limited-resource settings.
Determining individual risk factors for CRKP infections is important for early diagnosis and treatment [7]. Screening for carbapenem-resistant *Enterobacterales* (CRE), vancomycin-resistant enterococcus (VRE) and methicillin-resistant *Staphylococcus aureus* (MRSA) is a standard ICU admission procedure in tertiary hospitals in Turkey.
Studies to determine risk factors are generally carried out with a case-control design. Previous case-control studies of risk factors for CRKP infection have had several limitations in terms of study design and statistical methods [8, 9]. In this study, we aimed to determine the risk factors for the development of CRKP infections in adult ICU patients using a proportional semiparametric subdistribution hazards regression model to overcome the biases of previous studies.

## Methods

### Study design, settings, and patient selection

We conducted this case-control study at three tertiary hospitals in Turkey. A Microsoft Access database was created and distributed it to the participating centres. To ensure data validity, data input was restricted by dropdown lists to the names of drugs (supplied by the World Health Organization), names of microorganisms, and underlying diseases. Subjects were selected patients who admitted to ICU units between January 2017 and December 2019.This study was approved by the Ethical Committee of Istanbul Medeniyet University. The requirement for informed consent was waived because of its retrospective design.

The inclusion criteria for the study were defined as follows: patients aged 18 and older, who stayed in the intensive care unit for at least three days, and had CRKP growth in at least one culture during their intensive care admission. Pregnant individuals and patients under the age of 18 were not included in the study. Patients who had CRKP colonisation or CRKP infection diagnosed before the third day of ICU admission were excluded from the study because it was not possible to rule out pre-ICU factors as the source of the CRKP infection.

### Antimicrobial susceptibility test

Bacteraemia was defined as the isolation of *K. pneumoniae* in a blood culture. Bacterial identification and routine antimicrobial susceptibility testing were performed. We processed all cultures with ready-to-use media, identified bacteria using matrix-assisted laser desorption/ionization time-of-flight mass spectrometry MALDI-TOF MS (VITEK MS, bioMérieux, France), and performed antimicrobial susceptibility tests usingVITEK-2 (bioMérieux) according to Clinical and Laboratory Standards Institute recommendations. CRKP was defined according to the European Committee on Antimicrobial Susceptibility Testing definition as an isolate with an ertapenem minimal inhibitory concentration (MIC) ≥ 2 μg/mL), or imipenem and/or meropenem MIC ≥ 4 μg/mL. The *K. pneumoniae* isolates susceptible to ertapenem, imipenem, and meropenem were considered as CSKP. We performed antimicrobial susceptibility tests for *K. pneumoniae* isolates using VITEK-2 and confirmed carbapenem resistance of isolates using ertapenem E-test (bioMérieux). We determined the MICs of ceftazidime, ceftazidime-avibactam, meropenem, meropenem-sulbactam, and colistin using microdilution tests.

### Definitions

Cases were patients who had a positive microbiological culture for CRKP and a condition associated with healthcare-related infections. The consulting infectious disease physician notes were extracted and recorded to ensure that this condition was met. For each patient case, two control patients were randomly chosen from all other ICU patients who had spent at least the same "time at risk" as the corresponding case-patient. In this context, "time at risk" refers to the duration between ICU admission and either the occurrence of an event or the time of censoring. For cases, event time was the time when the first CRKP infection was detected. For patients who died or were discharged without being diagnosed with CRKP infection, time at risk was defined as the time between admission and death or discharge, respectively. Prior exposure to a drug was defined as a drug being used for more than one day and started at least three days prior to the event time. For controls, prior exposure to the drug was present if the drug was used for at least three days before discharge or death, as applicable.

A total of 12 variables were found suitable for potentially predictive and were considered in the variable selection procedure: centre; age; sex; carbapenem (mostly meropenem, imipenem and ertapenem) use; $3^{rd}$-/$4^{th}$-generation cephalosporin (ceftriaxone,ceftazidime, cefepime) use; and piperacillin/tazobactam (only) use; central venous catheter; haemodialysis catheter; intubation tube; thorax tube (for chest drain); tracheostomy tube; and nasogastric tube insertions. All patients had urinary catheters. Type 2 diabetes mellitus (T2DM) was included as an underlying disease.

### Statistical analysis

Descriptive values were computed as means, standard deviations, medians and count/percent frequencies, depending on the variable type. The data did not include missing observations and had a right-censored (discharge from ICU) competing risk design with two failure events. ICU-acquired CRKP infection was the failure event of interest. A number of patients died (competing risk) before acquiring CRKP. Therefore, death was the second failure event that prevented the occurrence of the primary event. To estimate the effects of covariates on the failure event (CRE infection) in competing risk data, the proportional semiparametric subdistribution hazards model, which is a slight modification of the Fine and Gray approach to account for between-centre heterogeneity in multicentre studies, was used [10]. This model directly compares the cumulative incidence function by modelling the so-called hazard of the subdistribution. The cumulative incidence is the probability of failure for a particular cause in the presence of other causes. In the first stage of modelling, the full model was established.

With the backward variable selection and purposeful variable selection methods, variables included in the full model which have a statistically significant ($p \leq 0.05$) effect on infection risk, and variables considered to be clinically important or significant (that is, $0.05 < p < 0.15$) were included in the model, and the final model was obtained. Because the differences between centres were not statistically significant, centre was excluded from the model. Stata version 14 (StataCorp LP, College Station, TX, USA) was used for data analysis.

**Tab. I.** Demographics, baseline and outcome characteristics of the study population.

| | CRKP infection | | |
|---|---|---|---|
| Variables | No[1] N = 76 | Yes N = 44 | p |
| Gender[£] | | | 0.666 |
| Male | 37 (49%) | 24 (54,5%) | |
| Female | 39 (51%) | 20 (55,5%) | |
| Age[¥] | 68.2 ± 19.0 | 71.4 ± 15.9 | 0.354 |
| Time under the risk[§] | 17 [9-24] | 17 [10-27] | 0.434 |
| APACHE II score | 21 [17-28] | 21 [15-28] | 0.852 |
| SOFA score | 6 [4-9] | 7 [4-9] | 0.366 |
| VAP | - | 14 (30%) | |
| Bacteremia | - | 27 (49%) | |
| Urinary tract infection | - | 1 (2%) | |
| Soft tissue infection | - | 2 (4, 5%) | |
| Diabetes mellitus | 15 (19.7%) | 16 (36.4%) | **0.045** |
| Outcome | | | 0.670 |
| Discharged | 44 (58%) | 16 (36%) | |
| Died | 32 (42%) | 28 (64%) | |

[¥] Mean ± SD for normal distributed variables. [§] Median [25$^{th}$-75$^{th}$ ] for other distributed variables. [£] n (%). [1] Discharged or died before CRKP occurred. Competing = 44, Cencoring = 32.

## Results

ICU records of a total of 285 patients were obtained. Of these patients, 54 had CRKP growth on culture. Nine cases were excluded from the study because CRKP growth on a sample collected on the first day of hospitalisation. One 5-year-old boy was excluded because the study was restricted to patients aged ≥18 years. Eight patients could not be included in the control group because their hospital records were incomplete. Therefore, data from 44 cases and 76 controls (a total of 120 patients) were used in the analysis. Of the controls, 32 were discharged from the ICU and 44 died without CRKP infection. Patient demographics, baseline characteristics, and outcomes are presented in Table I.

The full model results in which all risk factors are included in the model are given in Table II. The final model selected after using the combined backward variable elimination and purposeful variable selection method is given in Table III.

The final model revealed that endotracheal intubation and the presence of T2DM were associated with an increased CRKP infection risk, whereas carbapenem exposure and a nasogastric tube insertion were associated with a decreased risk of CRKP infection. The cumulative incidence according to each of the four significant risk factors is given in Figures 1-4.

## Discussion

Patients with a nasogastric tube had a significantly lower risk of CRKP infection. This suggests that continuity of enteral nutrition may be an important factor in preventing CRKP infections in ICU patients. Contrary to

**Tab. II.** Results of full proportional semiparametric subdistribution hazards model.

| | sHR[(i)] | 95% CIs | | |
|---|---|---|---|---|
| | | ll[(ii)] | ul | p-value |
| Centers | | | | |
| 2 | **1.24** | 0.275 | 5.60 | 0.777 |
| 3 | 0.723 | 0.160 | 3.26 | 0.673 |
| Gender | 1.183 | 0.648 | 2.15 | 0.583 |
| TZP exposure | 0.708 | 0.234 | **2.14** | 0.542 |
| Cephalosporin exposure | 1.014 | 0.98 | 1.03 | 0.63 |
| Carbapenem exposure | 0.387 | 0.116 | 1.28 | 0.120 |
| Haemodialysis catheter | 1.045 | 0.495 | 2.18 | 0.915 |
| Nasogastric_tube | 0.380 | 0.188 | 0.768 | **0.007** |
| Endotracheal_intubation | 3.355 | 1.315 | 8.561 | **0.011** |
| Thorax tube | 0.752 | 0.370 | 1.529 | 0.432 |
| Tracheostomy | 1.525 | 0.796 | 2.932 | 0.202 |
| Diabetes mellitus | 0.995 | 0.978 | 1.013 | 0.652 |

[(i)] sHR, subdistribution Hazard Ratio for CRKP infection. [(ii)] ll & ul, lower and upper limits of confidence interval.

**Tab. III.** Results of final proportionalsemiparametric subdistribution hazards model.

| | sHR[(iii)] | 95% CIs | | |
|---|---|---|---|---|
| | | ll[(iii)] | ul | p-value |
| Carbapenem exposure | 0.47 | 0.190 | 1.175 | 0.107 |
| Nasogastric tube | 0.49 | 0.277 | 0.884 | 0.018 |
| Endotracheal intubation | 1.96 | 1.00 | 3.868 | 0.050 |
| Diabetes mellitus | 1.57 | 0.888 | 2.806 | 0.120 |

[(iii)] sHR, subdistribution Hazard Ratio for CRKP infections. [(iii)] ll & ul, lower and upper limits of confidence interval.

**Fig. 1.** Cumulative incidence by exposure to carbapenem.

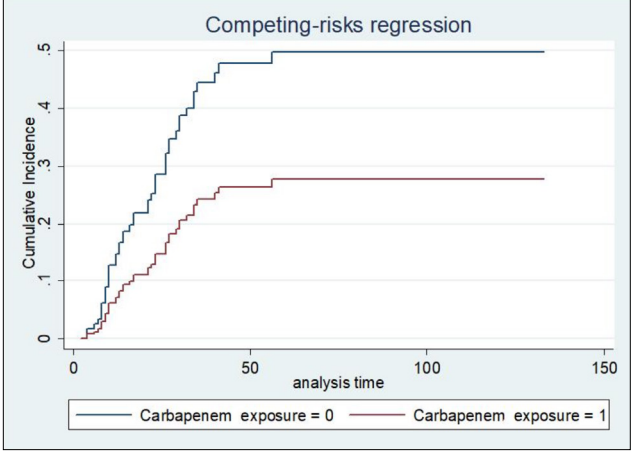



**Fig. 2.** Cumulative incidence in nasogastric tube use.

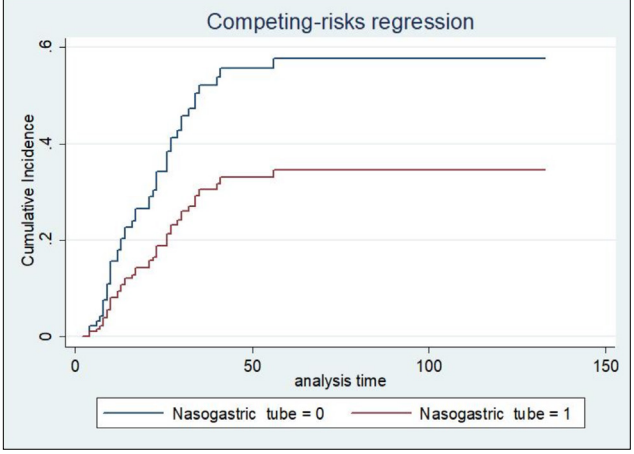



**Fig. 3.** Cumulative incidence in endotracheal intubation.

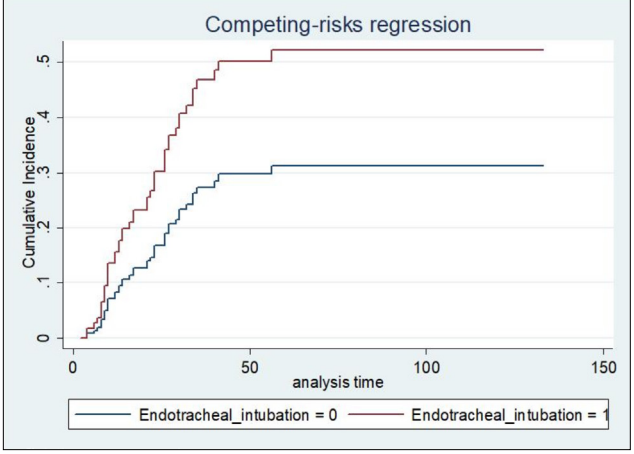
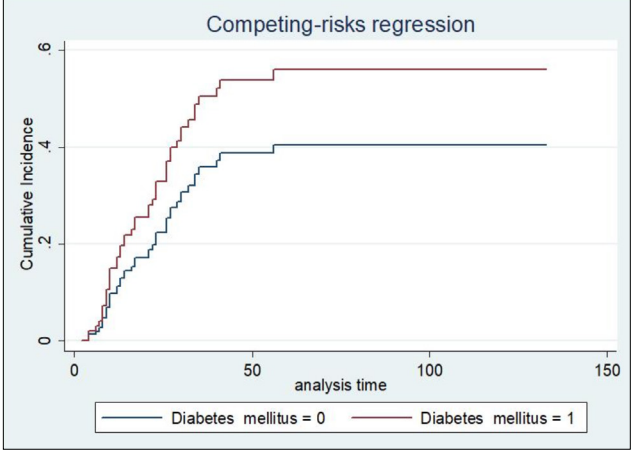



**Fig. 4.** Cumulative incidence in the presence of diabetes mellitus.




previous studies, carbapenem exposure was associated with a decreased risk, rather than an increased risk, of CRKP infection [11, 12]. We found that T2DM and endotracheal intubation were underlying risk factors for CRKP infection in ICU patients.

The use of broad-spectrum antibiotics results in increased colonisation by drug-resistant pathogens. In a large prospective intensive care surveillance study, CRKP colonisation did not increase during the hospitalisation period in individuals with prior carbapenem exposure, but increased significantly in cultures taken one month after hospitalisation [13]. This illustrates that not every colonisation turns into infection. Our study evaluated factors that facilitate the transition from colonisation to infection, and the time taken for this process to occur. Our study differs from other studies due to the parametric analysis of the use of catheters that bypass natural immunity and the use of a cumulative hazard time-to-infection approach. Many previous studies have revealed a linear relationship between antibiotic pressure and antibiotic resistance. Our study and other studies obtained different results that may be related to the cause of diversity of resistance mechanisms.

In ICUs, nasogastric tube-mediated nutrition keeps the intestinal tract relatively functional and provides the continuity of the commensal relationship between mucosal immunity and intestinal flora [14]. The results of one of our previous studies on risk factors for invasive candidaemia in ICU patients emphasised the importance of gut functionality and integrity with regard to infection prevention [15]. In this study, we have found prior exposure to N-acetylcysteine that might have an independent role in the health of enterocytes.

High quality enteral nutrition in ICU patients can reduce the risk of developing serious infections and the risk of death [16]. A prospective observational study showed that greater amounts of energy and protein intake were associated with lower infection rate, especially when given more than 96 h after admission [17].

On contrary, when parenteral nutrition is added to support standard enteral nutrition, the risk of intra-abdominal and catheter-related infections increases [18]. There is, however, a lack of consensus on the risks and benefits of parenteral versus standard enteral nutrition in ICU patients, and a meta-analysis on this subject was

inconclusive because of the heterogeneity of the studies and various biases in the included studies [19].
Our study has some limitations. Its main weaknesses are its retrospective nature and the limited sample size. Other underlying diseases that may increase the risk of infection in intensive care patients (cirrhosis, haematologic or solid organ tumours, transplantation) were not included in the analysis because of the limited sample size and their even distribution in the case and control groups.

## Conclusions

To our knowledge, this study is the first case-control study with a competing risks analysis of risk factors for CRKP infection in ICU patients. The routine performance of blood culture of patients on admission to the ICU patients with CRKP colonisation to be excluded from the case group.
In conclusion, provision of enteral nutrition support may help to reduce the incidence of CRKP infection in ICU patients. This hypothesis should be tested with well-designed studies.

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## Conflict of interest statement

The authors declare that they have no competing interests.

## Authors' contributions

FA and HV made concept, designed and wrote the study. HA did statistical analysis and interpreted the results. Selection of patients and control group and acquisition of data were proved by EA, SS, HCD, AÖ, SA, HOE, AM. All authors read and approved the final manuscript.

### References

[1] Frontiers | Colonization, Infection, and the Accessory Genome of Klebsiella pneumoniae | Cellular and Infection Microbiology. https://www.frontiersin.org/articles/10.3389/fcimb.2018.00004/full (Accessed on: 9/1/2021).

[2] Zheng X, Wang J, Xu W, Xu J, Hu J. Clinical and molecular characteristics, risk factors and outcomes of Carbapenem-resistant Klebsiella pneumoniae bloodstream infections in the intensive care unit. Antimicrob Resist Infect Control 2017;6:102. https://doi.org/10.1186/s13756-017-0256-2

[3] Humphries RM, Yang S, Kim S, Muthusamy VR, Russell D, Trout AM, Zaroda T, Cheng QJ, Aldrovandi G, Uslan DZ, Hemarajata P, Rubin ZA. Duodenoscope-Related Outbreak of a Carbapenem-Resistant Klebsiella pneumoniae Identified Using Advanced Molecular Diagnostics. Clin Infect Dis 2017;65:1159-66. https://doi.org/10.1093/cid/cix527

[4] Holt KE, Wertheim H, Zadoks RN, Baker S, Whitehouse CA, Dance D, Jenney A, Connor TR, Hsu LY, Severin J, Brisse S, Cao H, Wilksch J, Gorrie C, Schultz MB, Edwards DJ, Nguyen KV, Nguyen TV, Dao TT, Mensink M, Minh VL, Nhu NTK, Schultsz C, Kuntaman K, Newton PN, Moore CE, Strugnell RA, Thomson NR. Genomic analysis of diversity, population structure, virulence, and antimicrobial resistance in Klebsiella pneumoniae, an urgent threat to public health. Proc Natl Acad Sci 2015;112:E3574-81. https://doi.org/10.1073/pnas.1501049112

[5] Paczosa MK, Mecsas J. Klebsiella pneumoniae: going on the offense with a strong defense. Microbiol Mol Biol Rev 2016;80:629-61. https://doi.org/10.1128/MMBR.00078-15

[6] Xu L, Sun X, Ma X. Systematic review and meta-analysis of mortality of patients infected with carbapenem-resistant Klebsiella pneumoniae. Ann Clin Microbiol Antimicrob 2017;16:18. https://doi.org/10.1186/s12941-017-0191-3

[7] Shields RK, Nguyen MH, Chen L, Press EG, Potoski BA, Marini RV, Doi Y, Kreiswirth BN, Clancy CJ. Ceftazidime-Avibactam Is Superior to Other Treatment Regimens against Carbapenem-Resistant Klebsiella pneumoniae Bacteremia. Antimicrob Agents Chemother 2017;61:e00883-17. https://doi.org/10.1128/AAC.00883-17

[8] Evans SR, Harris AD. Methods and issues in studies of CRE. Virulence 2017;8:453-9. https://doi.org/10.1080/21505594.2016.1213473

[9] Tsioutis C, Eichel VM, Mutters NT. Transmission of Klebsiella pneumoniae carbapenemase (KPC)-producing Klebsiella pneumoniae: the role of infection control. J Antimicrob Chemother 2021;76:i4-i11. https://doi.org/10.1093/jac/dkaa492

[10] Zhou B, Latouche A, Rocha V, Fine J. Competing risks regression for stratified data. Biometrics 2011;67:661-70. https://doi.org/10.1111/j.1541-0420.2010.01493.x

[11] Marimuthu K, Ng OT, Cherng BPZ, Fong RKC, Pada SK, De PP, Ooi ST, Smitasin N, Thoon KC, Krishnan PU, Ang MLT, Chan DSG, Kwa ALH, Deepak RN, Chan YK, Chan YFZ, Huan X, Zaw Linn K, Tee NWS, Tan TY, Koh TH, Lin RTP, Hsu LY, Sengupta S, Paterson DL, Perencevich E, Harbarth S, Teo J, Venkatachalam I, CaPES Study Group. Antecedent Carbapenem Exposure as a Risk Factor for Non-Carbapenemase-Producing Carbapenem-Resistant Enterobacteriaceae and Carbapenemase-Producing Enterobacteriaceae. Antimicrob Agents Chemother 2019;63:e00845-19. https://doi.org/10.1128/AAC.00845-19

[12] Liu P, Li X, Luo M, Xu X, Su K, Chen S, Qing Y, Li Y, Qiu J. Risk factors for carbapenem-resistant Klebsiella pneumoniae infection: a meta-analysis. Microb Drug Resist Larchmt N 2018;24:190-8. https://doi.org/10.1089/mdr.2017.0061

[13] Ruiz J, Gordon M, Villarreal E, Frasquet J, Sánchez MÁ, Martín M, Castellanos Á, Ramirez P. Influence of antibiotic pressure on multi-drug resistant Klebsiella pneumoniae colonisation in critically ill patients. Antimicrob Resist Infect Control 2019;8:38. https://doi.org/10.1186/s13756-019-0484-8

[14] Kreymann KG, Berger MM, Deutz NEP, Hiesmayr M, Jolliet P, Kazandjiev G, Nitenberg G, van den Berghe G, Wernerman J, Ebner C, Hartl W, Heymann C, Spies C. ESPEN guidelines on enteral nutrition: intensive care. Clin Nutr 2006;25:210-23. https://doi.org/10.1016/j.clnu.2006.01.021

[15] Arslan F, Caskurlu H, Sarı S, Dal HC, Turan S, Sengel BE, Gul F, Yesilbag Z, Eren G, Temel S, Alp E, Gol Serin B, Kose S, Calık S, Tuncel ZT, Senbayrak S, Sarı A, Karagoz G, Tomruk SG, Sen

B, Hizarci B, Vahaboglu H. Risk factors for noncatheter-related Candida bloodstream infections in Intensive Care Units: a multicenter case-control study. Med Mycol 2019;57:668-74. https://doi.org/10.1093/mmy/myy127

[16] Immune enhancing enteral nutrition reduced mortality and acquired infections in intensive care unit patients with sepsis. Evid Based Nurs 2000;3:120. https://doi.org/10.1136/ebn.3.4.120

[17] Heyland DK, Stephens KE, Day AG, McClave SA. The success of enteral nutrition and ICU-acquired infections: a multicenter observational study. Clin Nutr Edinb Scotl 2011;30:148-55. https://doi.org/10.1016/j.clnu.2010.09.011

[18] Wischmeyer PE, Hasselmann M, Kummerlen C, Kozar R, Kutsogiannis DJ, Karvellas CJ, Besecker B, Evans DK, Preiser J-C, Gramlich L, Jeejeebhoy K, Dhaliwal R, Jiang X, Day AG, Heyland DK. A randomized trial of supplemental parenteral nutrition in underweight and overweight critically ill patients: the TOP-UP pilot trial. Crit Care Lond Engl 2017;21:142. https://doi.org/10.1186/s13054-017-1736-8

[19] Lewis SR, Schofield-Robinson OJ, Alderson P, Smith AF. Enteral versus parenteral nutrition and enteral versus a combination of enteral and parenteral nutrition for adults in the intensive care unit. Cochrane Database Syst Rev 2018;6:CD012276. https://doi.org/10.1002/14651858.CD012276.pub2

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HEALTH PROMOTION

# Adults' perceived health promotion needs in the prediabetes stage: a meta-synthesis study

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## Keywords

Prediabetes • Needs Assessment • Health Promotion • Meta-Synthesis • Systematic review • Iran

## Summary

**Introduction**. *One of the methods to promote pre-diabetic patients' adherence to preventive behaviors and improving their lifestyle is to pay attention to their needs in the designed educational programs. Therefore, this study was conducted with the aim of identifying the needs of individuals with prediabetes.*

**Methodology**. *Three databases, including ISI/Web of Sciences, PubMed, Scopus were searched without time limitation until August 2022. The quality of the included studies was assessed using the Critical Appraisal Skills Programme tool. This study was reported according to the Enhancing Transparency in Reporting the Synthesis of Qualitative Research guidelines and to achieve the research goal, Sandelowski and Barroso's seven-step meta-synthesis method (2007) was used. Thematic synthesis was used to analyses the data.*

**Results**. *Out of the 1934 studies obtained, 34 studies were finally examined and 805 codes were recorded based on the extracted data. Through synthesizing and analyzing the primary studies, 8 main themes were extracted regarding individuals' needs in the prediabetes stage: Information needs, Cultural needs, psychological needs, Social support needs, Education needs, Financial needs, Service needs and Skill needs.*

**Discussion and conclusions**. *The perceived needs and their types in each of the dimensions in detail can be a proper guide for designing educational programs and various interventions to control the prediabetes condition, leading to a reduction in the prevalence of type 2 diabetes in the society.*

## Introduction

Diabetes is one of the most common non-communicable diseases affecting people all over the world, whose prevalence is increasing in all the countries of the world, especially in the developing countries. Individuals with prediabetes are among the individuals at the highest risk of diabetes [1]. The International Diabetes Federation has reported that about 374 million people around the world are at the prediabetes stage [2, 3].

Preventing the development of prediabetes and slowing down the progress of diabetes is an important challenge and one of the urgent measures taken by the World Health Organization. The reason is that prediabetes has been associated with an increased risk of coronary heart diseases, kidney diseases, brain strokes, and death in all societies [4]. Studies show that without self-care, preventive, and health-promoting behaviors, more than 70% of individuals with prediabetes will develop type 2 diabetes. The United States Diabetes Prevention Program, as one of the largest studies conducted in the field of diabetes prevention, shows that engaging individuals in self-care behaviors can reduce the risk of diabetes by 58% in individuals with prediabetes [5].

Diabetes prevention programs have been widely implemented and found effective in helping individuals lose weight and improve health behaviors such as participating in physical activities and having a balanced diet. However, in a systematic review study by Barry et al. (2017), it has been reported that only 27% of the population at risk of diabetes were able to participate in diabetes prevention programs and follow them until the end of the intervention [6].

Different studies have mentioned various factors preventing patients from participating in diabetes prevention programs, such as the lack of time, financial problems, the lack of access to clinics and clinical institutions, the lack of motivation, insufficient knowledge, the lack of awareness of one's condition, poor social support, incorrect perception of the upcoming situation [7, 9]. In addition, in their prediabetes stage, adults have stated that much of the information received from diabetes prevention education programs is old, sporadic, inconsistent, and not fitting their perceived needs [10, 11].

Therefore, considering the existing studies on the perception and the preferences of the individuals in the prediabetes stage, as well as the barriers, challenges, facilitators, and motivational factors impacting individuals' participation in the offered programs and

interventions, the present study has been conducted with the approach of reviewing studies and the aim of recognizing the needs of the individuals in prediabetes stage.

## Methods

Meta-synthesis, or combining qualitative evidence, is a combination of primary research studies related to a specific topic in order to gain a new or increased perception of a specific phenomenon under investigation [12]. In this study to achieve the research goal, Sandelowski and Barroso's seven-step meta-synthesis method (2007) was used, including the development of the research question, systematic literature review, searching for and selecting suitable articles, extracting data from articles, analyzing and combining qualitative findings, controlling the quality of articles, and presenting findings [13]. Also, this study has been reported according to the Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ) guidelines [14] (reported in Additional file 1).

**Developing the research question:** the present meta-synthesis study aims to investigate adults' comprehensive needs in the prediabetes stage based on the published articles on the needs, obstacles, challenges, facilitators, and the perceptions of prediabetes of their own situation, as well as the offered plans and interventions.

### The Strategy for Searching and Selecting Studies

*Study search strategy*

Due to the lack of access to other scientific databases, the articles used in this study are the result of searching in PubMed, Scopus and Web of Sciences databases, without time limitation until August 2022, performed by two independent researchers (MJ, MZ). The first keyword search was done in MeSH. Then, using the titles and the abstracts of the related articles, more keywords were created. Finally, the list of keywords was completed based on the opinions of the experts in this field. English keywords such as Needs, Perception, Facilitators, Barriers, Challenges, Motivators, Prediabetes, and their combinations were used to search for articles, with the help of the operators related to the searched database, such as not, or, and. The strategies for searching in PubMed (N: 372), Scopus (N: 623) and Web of Sciences (N: 939) databases are listed separately (Tab. I).

*Study Selection Strategy*

The articles obtained from the systematic search in Thomson, Reuters, EndNote.20.2.1, Build, Toronto, ON, and Canada were entered into EndNote, and duplicate articles were removed. The initial screening was performed through reading the titles and the abstracts by two independent researchers, and the potentially relevant studies were selected. In the next step, the full texts of the articles were studied. The final articles were selected based on the inclusion and exclusion criteria. All these steps were taken by two independent researchers (MJ, MZ), and any disagreements were resolved through discussion, investigation, and a third researcher (AE).

Review questions and formulation of the search strategy were conducted according to the Sample, Phenomenon of Interest, Design, Evaluation, Research type (SPIDER) mnemonic, which represents an efficient tool for organizing a search strategy of qualitative investigations [15]. Table II shows the SPIDER elements adopted in the present study. The following data were extracted from the articles using a predefined form including the author's name, the year of publication, country, study objectives, the inclusion criteria, and the total number of the participants. The data is also categorized based on gender, age range, and intervention experience. The specifications of the reviewed articles are given in Table III.

*Inclusion and Exclusion Criteria*

The inclusion criteria consisted of all qualitative and mixed-method articles, or any questionnaire study with open questions. Oral or written interviews were conducted from the beginning to the end of July 2022 regarding the perceptions, needs, obstacles, challenges, facilitators, and individuals' motivations in the prediabetes stage.

**Tab. I.** July 2022

| | Search Term 1 |
|---|---|
| 1 | PubMed<br>("Prediabetic State"[mh] OR Prediabetic State[tiab] OR Prediabetic States[tiab] OR Prediabetes[tiab]) AND ("Needs Assessment"[mh] OR Needs Assessment[tiab] OR Educational Needs Assessment[tiab] OR Determination of Healthcare Needs[tiab] OR Assessment of Healthcare Needs[tiab] OR Preferences[tiab] OR Needs[tiab] OR need[tiab] OR Health education needs[tiab] OR Self Care needs[tiab] perception[tiab] OR "perception"[mh] OR healthy needs[tiab] OR health needs[tiab])<br><br>PubMed<br>("Prediabetic State"[mh] OR Prediabetic State[tiab] OR Prediabetic States[tiab] OR Prediabetes[tiab]) AND (Facilitators[tiab] OR Barriers[tiab] OR challenges[tiab] OR motivators[tiab]) |

**Tab. II.** Elements of Sample, Phenomenon of Interest, Design, Evaluation, Research type (SPIDER) mnemonic adopted in this review for strategy search

| Elements of SPIDER | Elements of SPIDER as applied to current study |
|---|---|
| S – Sample | Prediabetes |
| PI – Phenomenon of interest | Needs of prediabetes |
| D – Design | Qualitative studies, mixed-method studies and survey with open question studies |
| E – Evaluation | Perceptions, views, opinions, experiences |
| R – Research type | Interviews (personal interview, semi-structured, in-depth, open questions survey and focus groups) |

**Tab III.** The articles' specifications.

| Themes | Method | Samples: total number, female and male, the age range | Purpose of study | Author, year Country |
|---|---|---|---|---|
| Positive interaction/attributes of the health and wellness coach, sense of personal accountability, specific exercise or diet strategies, goal setting/motivation/ self awareness | A survey study closed questions (Likert scale) and open questions | N: 62<br>Female: 34<br>Male: 28<br>Age range: not mentioned | This project assessed patients' experience and obtained their perceptions on barriers and facilitators to participation in a primary care-based wellness coaching program | Ramona S DeJesus, 2018 USA |
| Adopting system, problem, intervention health system characteristics, context | A qualitative study | N: 37<br>Female: 32<br>Male: 5<br>Age range: not mentioned | The aim of this qualitative study was to assess the perceived demand for the DPP from the perspectives of potential program recipients and potential program providers What factors constrain or support diabetes prevention intervention adoption in North Carolina? | Tainayah Thomas, 2018 USA |
| Understanding of prediabetes participants, preferences and experiences with clinicians, emotions and attitudes about prediabetesc. Barriers to prevention, access to and preferred forms of health information and assistance, attitudes toward N-DPP | Mixed-methods study data from clinician surveys | N: 15<br>Female: 7<br>Male: 6 | The purpose of the study was to assess patient and clinician perceptions of prediabetes in an academic family medicine practice (FMP) | Karen L Roper, 2019 USA |
| No awareness of diagnosis of prediabetes, emotions associated with a prediabetes diagnosis, understanding prediabetes, back in the Islands' of Tonga | A qualitative study | N: 12<br>Female: 9<br>Male: 3 | To develop an understanding of how being 'at risk' of developing type 2 diabetes is perceived by Tongan people with prediabetes living in Auckland, New Zealand | Julienne Faletau, 2020 New Zealand |
| Practicality, feasibility, acceptability, social support | And a mixed-method approach | N: 49<br>Female:22<br>Male: 27 | This study aimed to evaluate a prediabetes intervention program designed for rural adults in southwestern Ontario based on the feedback of participants | Jayson Azzi, 2020 Canada |
| Perception of food components, factors perceived to influence the healthfulness of foods, perceptions of dietary information, challenges to forming accurate perceptions | A qualitative study | N: 12<br>Female: 7<br>Age range: not mentioned | To investigate dietary perceptions of adults with prediabetes and type 2 diabetes | Hannah Lawrence, 2016 New Zealand |
| Knowledge gaps are pervasive, evidence about prediabetes and diabetes prevention is motivating, ILIs and metformin are acceptable treatment options | A qualitative approach | N: 35<br>Female<br>Age range: were age 20 to 59 | The purpose of this study was to explore how adults with prediabetes perceive their risk of developing diabetes and examine their preferences for evidence-based treatment options to prevent diabetes | Matthew J., 2016 USA |
| Cultural influences, barriers to healthier lifestyles, recommendations for interventions | Qualitative research | N: 27<br>Female:21<br>Male:6<br>Age range: 43-77 | The purpose of the study was to conduct focus groups with Mexican Americans in an impoverished rural community on the Texas-Mexico border to identify current barriers to adopting healthier lifestyles and to obtain recommendations for diabetes prevention | Sharon A. Brown, 2018 America |
| Gender-tailoring, modality choice importance of choice-satisfaction with modality choice, modality-specific recommendations | This mixed-methods study | N: 22<br>All women | Assessed the impact of gender-tailoring and modality choice on women Veterans' perceptions of and engagement in tailored DPP | Karen E. Dyer, 2020 USA |
| T2D risk is not urgent enough to act upon, adaptations in everyday life as a part of aging, diagnosis as a motive for change, diagnosis as a motive for change | Qualitative study | N: 15<br>Female: 7<br>Male: 8<br>Age range: 58-73 | The aim of this study was to improve the understanding of how older persons with a high risk of developing Type 2 diabetes manage and relate to information about diabetes risk over a ten-year period | Linda Timm, 2019 Sweden |
| Perceptual factors. Perceived barriers/not giving priority. Self-efficacy, physical health, mental health, prevention of complications, lack of need to consume medicine | Qualitative study | N: 41<br>Women | The aim of the present study was explaining women's perception of regular physical activity based on PEN-3 model | Seyed Saeed Mazloomy Mahmoodabad, 2019 Iran |

▶

**Tab III** (*follows*). The articles' specifications.

| Themes | Method | Samples: total number, female and male, the age range | Purpose of study | Author, year Country |
|---|---|---|---|---|
| Reasons for not receiving prediabetes education, several, preferred health communication message contents, preferred subcomponents of healthy eating education, both groups of participants, preferred subcomponents of physical activity education, preferred communication channels, preferred setting for the education programme | Mixed methods study | N: 48<br>Female: 24<br>21-79 years | To assess factors associated with ever receiving prediabetes education, and to explorethe health education and communication needs among primary care patients with predia-betes in Singapor | Raymond Boon Tar Lima, 2019 Singapore |
| Self-management, physical activity, eating habits, diabetes medication, psychosocial wellbeing, SLEEP | Mixed methods study | N: 32 | Therefore, the objective of this article is to describe the development of a patient education program for Brazilians with diabetes and prediabetes. We hypothesize that following the steps presented here we will be able to develop a culturally adapted and effective intervention for the assigned population | Gabriela Lima de Melo Ghisi, 2021<br>Brazile |
| Insufficient education about physical activity. Health concerns about physical activity, work-related barriers to physical activity. Types of physical activity, intensity and duration, information resources, barriers | Concurrent mixed-methods design | N: 55 | Learn more about this population's knowledge of physical activity, the types and intensity levels performed, and the barriers to such activity<br>Among Chinese<br>American Immigrants with prediabetes or Type 2 diabetes | Sophia H. Hu, 2018<br>Chinese |
| Interacting with healthcare clinicians, seeking information online, taking a nutrition/diabetes management class<br>Taking a nutrition/diabetes management class, lack of consistent/routine care<br>BARRIER, lack of access to resources<br>BARIEER | Qualitative study | N: 33<br>Female: 17<br>Male: 16<br>Range: 25-65 | To identify communication cycles patients use to make sense of a diabetes diagnosis and barriers patients encounter in their sensemaking process | Christy J.W. Ledford, 2020<br>USA |
| Gaining knowledge, making lifestyle changes, encountering a life-changing event<br>Transition, receiving social support, interacting with clinicians | A mixed-methods study on | N: 33<br>Female: 17<br>Male: 16<br>Age range: 25-65 | The goal of this study is to identify "turning points" that have significance to diabetes-related health | Christy J.W. Ledford, 2020<br>USA |
| DPP Convenience. Employment and life flexibility, supplemental resources, social support (DPP/ lifestyle change, and/or metformin). Pharmacists then provided participants with information on how to enroll in the DPP and/or prescribed metformin, based on participant choice | Qualitative study | N: 24<br>Female: 11<br>Male: 13<br>Age range: 40-73 | To explore perspectives about weight loss from PRIDE participants of different racial and ethnic groups | Rintu Saju, 2022<br>USA |
| Intervention satisfaction Based, Changes of psychological, behavioral and physical health outcomes after intervention | Mixed method study | N: 11 | To investigate the feasibility of delivering a low-dose mindfulness-based stress reduction (MBSR) intervention among prediabetes/ diabetes patients in a clinical setting (participants' satisfaction, motivation, and barriers to engage in this low-dose MBSR intervention were evaluated through a post-intervention qualitative, semi-structured telephone interview. All s) | Tong Xia, 2022<br>USA |

**Tab III** (*follows*). The articles' specifications.

| Themes | Method | Samples: total number, female and male, the age range | Purpose of study | Author, year Country |
|---|---|---|---|---|
| Barriers to behavioral change internal, feedback on curriculum contents and suggestions, web-based intervention acceptability, web-based intervention feasibility, web-based intervention implementation and modifications | A qualitative study | N: 24 | The purpose of this study was to explore the cultural and linguistic acceptability of the Centers for Disease Control and Prevention's Prevent T2 curriculum in an online format in the Chinese American community in New York City (NYC | Ming-Chin Yeh, 2022 USA |
| Barriers to enrollment and retention in the National DPP, facilitators to enrollment and retention in the National DPP, and opportunities for improvement | A qualitative study | N: 23 | Aims to understand barriers and facilitators to enrolling and completing the National DPP among women, and to provide recommendations for improvement | Katherine Jane Williams, 2021 USA |
| Overall program utility, participant feedback regarding health coach element, online peer support and goal tracking, barriers and recommendations | A randomized controlled trial (mixed method evaluatio) | N: 18 Age range: 35-75 | This process evaluation aimed to examine the utilization patterns of BetaMe/Melon, identify which components participants found most (and least) useful, and identify areas of future improvement | Virginia Signal, 2020 New Zealand |
| Healthcare context, route to testing, normalisation of diabetes, relationships, roles, and responsibilities, resource constraints | Qualitative study | N: 23 Female: 13 Male: 10 | : To explore the experience of diagnosis of pre-diabetes, and understand the barriers and facilitators to uptake of the NHS DPP for people living in socioeconomically deprived areas. | Helen Twohig, 2019 UK |
| Support from social network. Use of external supports, high motivation, competing demands, low motivation, lack of resources to support healthy choices | Mixed methods study | N: 40 | Examined the frequency of, facilitators of, and barriers to engagement in recommended behaviors among employees found to have prediabetes during a workplace screening | Jeffrey T Kullgren, 2016 USA |
| A serious condition and situation, not that bad, doesn't concern me personally today opened my eyes today opened my eyes, GP negligence | A qualitative study | N: 28 Female: 19 Male: 9 | To explore how participating in a randomised controlled trial affected motivation, barriers and strategies in the process of health behaviour change among individuals with prediabetes. | Kirstine Schmidt, 2021 Denmark |
| Physical, capability physical, psychological capability, physical opportunity, social opportunity, reflective motivation, automatic motivation | A qualitative research method | N: 29 Female: 17 Male: 12 Age range:28-64 | This study aimed to identify facilitators and barriers to the uptake of a community-based diabetes prevention program (DPP) from the perspectives of decliners with prediabetes in a multi-ethnic Asian community | Sungwon Yoon, 2022 Singapore |
| Factors that supported making dietary changes. A strong determination not to develop diabetes, access to clear information and manageable strategies, supportive relationships, lack of household and family/whänau support, financial constraints, social expectations and pressures around food, other chronic health issues | Qualitative research methods | N: 20 Female: 10 Male: 10 Age range: 43-69 | To explore the experiences of people recently diagnosed with prediabetes and overweight or obese in making dietary changes following a six-month primary care nursedelivered dietary intervention pilot | Island S., 2018 New Zealand |
| Lack of time for self-care, perceived sufficiency of knowledge to prevent T2DM, self-management strategies for health, trust in other traditional and alternative therapies, spirituality, and religious belief, lack of information about the study, accessibility of the study site, accessibility of the study site, lack of trust in the study methods, lack of trust in the intervention | Exploratory qualitative study | N: 15 Female: 9 Male: 4 Age range: 40-69 | The objective of this study was to identify and explore why potential participants declined to participate in the feasibility RCT: Yoga Program for Type 2 Diabetes Prevention (YOGA-DP) Among High-Risk People | Pallavi Mishra, 2021 India |

**Tab III** (*follows*). The articles' specifications.

| Themes | Method | Samples: total number, female and male, the age range | Purpose of study | Author, year Country |
|---|---|---|---|---|
| Detailed information about recruitment and randomisation processes, poor experience in the control group regarding the enhanced care leaflet, the negative influence of non-participants, Frequency of the blood test, free blood tests, positive experiences of the testing process, to gain adequate information to prevent t2dm, professional behaviour of the site staff, the positive influence of friends | A qualitative study | N: 25<br>Female: 13<br>Male: 12<br>Age range: 25-64 | This qualitative study's objective was to identify and explore participants' trial- and intervention-related barriers and facilitators: Feasibility trial of yoga programme for type 2 diabetes Prevention (YOGA-DP) among high-risk people in India | Pallavi Mishra, 2022<br>India |
| Barriers, facilitators, strategies | A trajectory approach the qualitative sub-study | N:14<br>All woman<br>Age range: 48-65 | This study aimed to: (a) profile patterns of women's perceived PA (with prediabetes) journey over 1-year and (b) understand strategies used to engage in and maintain PA | Corliss Bean, 2020<br>Canada |
| Insufficient education for PA, health concerns regarding performing pa, work-related barriers: Busy schedule, too tired after work | A concurrent mixed-method | N: 67<br>--- | The aim of the study was to understand physical activity (PA) performance, PA information resources, and barriers to PA among Chinese American immigrants with type 2 diabetes/prediabetes | Mei Fu, 2018<br>USA |
| At the intrapersonal level, participants, the interpersonal level where, at the institutional/ organisation level, participants, at the community level, there was, at the societal/policy level, participants | A mixed methods approach | N: 48<br>Female: 24<br>Male: 24 | Assess factors associated with fulfilling the healthy plate recommendation, and to explore reasons for the behaviour among primary care patients with prediabetes in Singapore | Raymond Boon Tar Lim, 2019<br>Singapore |
| Determination to not get diabetes, wanting to be healthy and to contribute to others, encouragement of others, strong desire to be healthy for self and others, personal determination, feeling supported | Qualitative interview study | N: 58<br>Female: 30<br>Male: 28 | To understand motivators, facilitators and challenges to dietary change amongst a diverse sample of New Zealanders with prediabetes participating in a primary care nurse-led individualised dietary intervention | Sally L Abel, 2021<br>New Zealand |
| The patients' views toward SWAP-DM2-assisted prevention. | Interventional study | N: 20 | This study aims to develop and test an online Smart Web Aid for Preventing Type 2 Diabetes (SWAP-DM2) capable of addressing major barriers to applying proven interventions and integrating diabetes prevention into routine medical care | Penglai Chen, 2014<br>China |
| At the intrapersonal level, participa, at the interpersonal level where, at the institutional/organisational level, at the community level, at the societal/policy level, the availability | A mixed methods study | N: 48<br>Female: 24<br>Male: 24 | The objectives of the study were to assess factors associated with meeting the recommendation of at least 150 min of moderate/ vigorous physical activity weekly, and to explore facilitators and barriers related to the behaviour among primary care patients with prediabetes in Singapore | Raymond Boon Tar Lim, 2020<br>Singapore |

The exclusion criteria consisted of case reports, letters to editors, and systematic review and meta-synthesis studies, studies in non-English languages, and the lack of access to the full text of articles.

*Studies' Quality Assessment*

Two authors (MJ, MZ), separately, performed the qualitative assessment of the included studies based on the Critical Appraisal Skills Program (CASP) checklist for qualitative research [16]. The ten-question checklist allows for a systematic evaluation of the qualitative research evidence in the present review (Tab. IV).

The checklist guides the reviewer or the evaluator while evaluating the validity, results, and the relevance of each study. After the initial independent assessment, the assessment results were discussed, and a third reviewer (AE) was consulted to resolve any disagreements.

**Tab. IV.** CASP: Quality appraisal results of the included primary studies.

| Nr | Author, year country | Was there a clear statement of the research? | Is a qualitative methodology appropriate? | Was the research design appropriate to address the aims of the research? | Was the recruitment strategy appropriate for the aims of the research? | Was the data collected in a way that addressed the research issue? | Has the relationship between the researcher and participants been adequately considered? | Have ethical issues been taken into consideration? | Was the data analysis sufficiently rigorous? | Is there a clear statement of the findings? | How valuable is the research/ will the results help locally? | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Ramona S De Jesus, 2018 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 8/10 |
| 2 | Tainayah Thomas, 2018 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 3 | Karen L Roper, 2019 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 4 | Julienne Faletau, 2020 New Zealand | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 5 | Jayson Azzi, 2020 Canada | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 6 | Hannah Lawrence, 2016 New Zealand | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 7 | Matthew J, 2016 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 8 | Sharon A Brown, 2018 America | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 9 | Karen E. Dyer, 2020 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 10 | Linda Timm, 2019 Sweden | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 11 | Seyed Saeed Mazloomy Mahmoodabad, 2019 Iran | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 12 | Raymond Boon Tar Lima, 2019 Singapore | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 13 | Gabriela Lima de Melo Ghisi, 2021 Brazile | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 14 | Sophia H. Hu, 2018 Chinese | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 15 | Christy JW Ledford, 2020 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 16 | Christy JW Ledford, 2020 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 17 | Rintu Saju, 2022 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 18 | Tong Xia, 2022 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 19 | Ming-Chin Yeh, 2022 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 20 | Katherine Jane Williams, 2021 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 21 | Virginia Signal, 2020 New Zealand | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 22 | Helen Twohig, 2019 UK | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |

**Tab. IV** (*follows*). CASP: Quality appraisal results of the included primary studies.

| Nr | Author, year country | Was there a clear statement of the research? | Is a qualitative methodology appropriate? | Was the research design appropriate to address the aims of the research? | Was the recruitment strategy appropriate for the aims of the research? | Was the data collected in a way that addressed the research issue? | Has the relationship between the researcher and participants been adequately considered? | Have ethical issues been taken into consideration? | Was the data analysis sufficiently rigorous? | Is there a clear statement of the findings? | How valuable is the research/ will the results help locally? | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | Jeffrey T Kullgren, 2016 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 24 | Kirstine Schmidt, 2021 Denmark | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 25 | Sungwon Yoon, 2022 Singapore | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 26 | Island S, 2018 New Zealand | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 27 | Pallavi Mishra,2021 India | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 28 | Pallavi Mishra, 2022 India | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 29 | Corliss Bean, 2020 Canada | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 30 | Mei Fu, 2018 USA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 31 | Raymond Boon Tar Lim, 2019 Singapore | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 32 | Sally L Abel, 2021 New Zealand | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 33 | Penglai Chen, 2014 China | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |
| 34 | Raymond Boon Tar Lim, 2020 Singapore | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 10/10 |

*Analysis and Synthesis of the Results*

One approach to combining qualitative research findings is the thematic synthesis presented by Thomas and Harden (2008) [17]. The thematic synthesis approach is based on the thematic analysis method used in primary qualitative research, and provides the possibility of creating new insights, interpretations, and theories [18]. In order to analyze and combine the data, Thomas and Harden's thematic synthesis approach [17] was used, which consisted of three main stages:

1. line-by-line coding of the findings of the primary studies: after searching for articles and accessing the full file of 34 extracted articles through a systematic search in scientific databases, all the articles were studied in full. In order to extract data and codes, the results sections of the primary articles were used. For this purpose, inductive and line-by-line coding was done using the data obtained from the results section of the articles with a focus on understanding adults' needs in the prediabetes state. The new codes were generated independently of the original codes used in the primary studies. The codes were compared, and all codes with similarities in the primary studies which belonged to the same concept were categorized. The extracted codes originated from the full texts related to the results sections of the qualitative articles. These results contained the participants' quotes as well as classes, sub-classes, and the codes extracted from the participants' quotes;
2. development of descriptive themes: sub- and main themes were developed through merging and classifying the codes. The primary studies were read and reviewed by the other researcher to ensure that the main and subthemes reflected the main concepts of the data reported in the primary studies;
3. development of analytical themes: the developed main and subtheme were discussed and examined by the research team in relation to the research question. Finally, an attempt was made to create a new perception in relation to adults' needs in the prediabetes stage.

At this stage, the qualitative data analysis software MAXQDA Version 11 software was used.

## Results

### Search Results

Based on the search in databases, 1934 studies were obtained. After removing the duplicate studies, 964 studies remained. After reviewing the titles and the abstracts of the articles, the full texts of 116 studies were reviewed. Finally, based on the inclusion and the exclusion criteria, 34 studies were included in the meta-synthesis study (Fig. 1).

### The Study's Characteristics

The publication dates of the reviewed studies were between 2014 and 2022, including a total of 1063 participants. In the studies stating the age (N: 12-37.5%) and the gender (N: 24-70.5%) of the participants, it was found that the participants' age varied from 20 to 77 years, including 428 females (N: 24) and 284 male participants (N: 20). Fifteen studies were from the USA; five from New Zealand; four from Singapore; two studies from each of the countries of China, Canada, and India; and one study from each of the countries of Iran, Denmark, Sudan, UK, and Brazil. The participants' having experienced intervention or not was evaluated for each study. Thirteen cases had experienced direct intervention, eleven had experienced diabetes prevention programs, and ten had not experienced any intervention, as mentioned in the studies. The characteristics of the 34 studies have been presented are presented in Table III.

### Quality Assessment

The tool used to evaluate the quality of articles included 10 criteria, all the studies met these ten evaluation criteria, except for one, where the results were obtained through an open question. The results of the quality assessment of the studies are shown in Table IV.

### Thematic Synthesis of Qualitative Studies

A total of 805 codes were recorded based on the extracted data. Through the synthesis and the analysis of the primary

**Fig. 1.** PRISMA flow diagram.

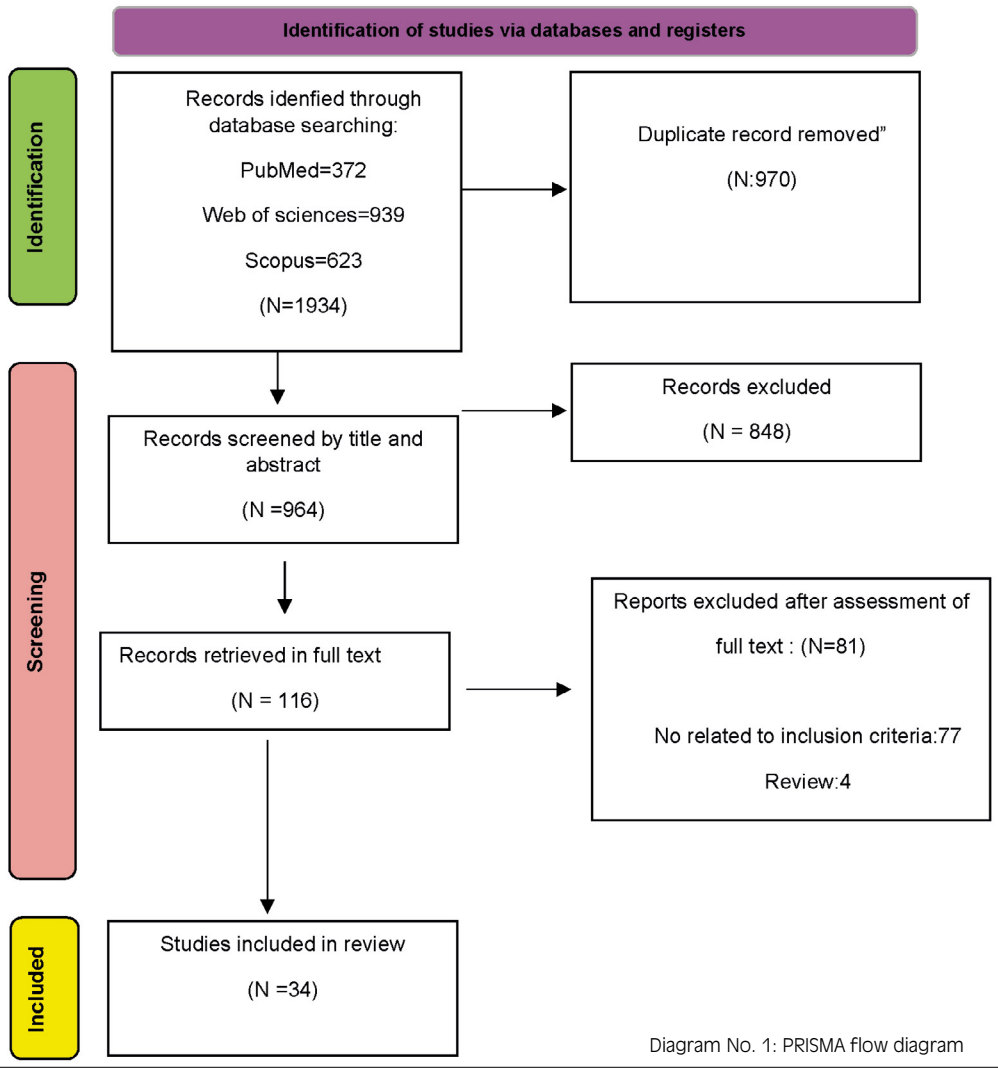


Diagram No. 1: PRISMA flow diagram

**Tab. V.** Codes, subclasses and extracted classed.

| Main Themes (Main domain) | Sub Themes | Codes | Nr reference |
|---|---|---|---|
| Information needs N: 48 | Activity | Immobility, resources and facilities, equipment, physical and mental activities, home, group sessions, face-to-face sessions, suitable and safe places, intensity, type of movement, duration of use and appropriateness to work plans, life responsibilities, compliance with other health promotion behaviors, blood sugar control, support for adherence, having a partner, physical limitations, other comorbidities, physical ability, how to perform, security, continuity and adherence, pain control, time, duration, type of exercise and adjustment to meals, daily activities and exercise, physical-psychological effects, therapeutic, workload, work-family responsibilities | 14 |
| | Nutrition | Timing of meals, limiting portions and food groups, main food components, amount, type, blood sugar level, types of fats, psychological factors, cooking and preparing food, healthy diet, unhealthy diet, calorie measurement, adjusting diet, food label, diet adjustment, selection skill, guidelines and instructions, preparation, food and snacks, advertisements, internal temptations, work environment, food supplements | 9 |
| | Health perception | Realizing the importance, improving perception, receiving information, recognition, awareness, learning, knowing, information, knowledge, correct perception, improving perception, types of diabetes, weight loss, blood sugar and blood pressure levels, prediabetes stage, and type 2 diabetes<br>• Symptoms and causes of developing the illness<br>• Risk factors<br>• Laboratory and screening tests<br>• How to interpret them<br>• Complications and how to control<br>• Lifestyle change behaviors<br>Physical fitness, diet, the results of the evidence-based measures taken, how to deal with emotions and excitement, control and management of prediabetes stage, various therapies and medical and complementary treatments, distinguishing between prediabetes and type 2 diabetes, family members, the consequences of not changing lifestyle, the methods of gaining energy, weight loss and reducing body mass index, situational conditions management, internal and external stimuli, accountability, controlling and monitoring the laboratory indicators and health status, how to use web-based programs and increase the level of electronic literacy, nutrition instructions, adherence to diet, cooking methods, physical activities, coping strategies, controlling excitement, comorbidities | 22 |
| | Medication | Therapy choices, therapeutic drugs, gaining drug information and how it is associated with lifestyle change behaviors, positive and negative effects of taking drugs and how to use them, time and purpose, patient preferences, behavioral therapies/drugs or both, improving individuals' perception of receiving natural and complementary medicines | 3 |
| Cultural needs N: 7 | Cultural | Cultural factors involved, cultural barriers, cultural preferences, cultural affinity, cultural appropriateness, cultural formation, cultural tendencies and preferences, knowing the culture, social culture, work culture, family culture, correct and appropriate culture | 7 |
| Psychological needs N: 38 | Self-efficacy | Inner potential and abilities, sense of individual responsibility, self-confidence, inner strength, management ability, commitment and adherence, self-management, self-efficacy, self-regulation, self-control, self-evaluation | 6 |
| | Belief, motivational, and attitudinal aspects | Positive self-talk, optimistic view, maintaining a positive perspective, paying attention to one's good mood, adjusting one's attitude, the ability to concentrate, empowering mental/emotional/psychological dimensions, strengthening inner motivation, promoting motivation, receiving rewards, correcting misbeliefs, receiving support, paying attention to tendencies, recognizing superstitions, optimistic mindset, inner stimuli | 13 |
| | Mental-psychological | Self-confidence, negative emotions, negative social labels, positive perceptions, stress, anxiety, depression, sadness, anger, adaptation skills, adaptation mechanisms, mental body image, mental image of health, negative thoughts, sources of stress, bad news | 8 |
| | Emotional | Worrying, fear, denial, panic, confusion, negative feelings, worrying and distress, feeling of numbness and lethargy, vulnerability, having power, being at risk, missing opportunities, being shocked, sadness, losing hope, being in danger, disbelief, ambiguity, danger, unclear/scattered/vague feelings, peace, support, stress | 11 |
| Social supportive needs N: 38 | Treatment staff supporters | Encouraging/supportive/experienced educators, active listening skills, objective and non-judgmental, non-punitive, individual/group health instruction, guidance, follow up, feedback, involving the patient, tracking, access to facilities and training, referral, response to questions, setting personal goals, effective communication, getting motivation | 16 |
| | Support from the family, friends, and treatment staff | Support, support from the spouse, peers, family members, friends, colleagues, governmental institutions and policy makers, relatives, neighbors, peer groups (in person and virtual), family education (spouse and children), medical staff, physicians, nurses, membership in peer groups, group meetings with peers under the guidance of an educator, having a partner in preventive and health promoting activities, communication with the physician, nurses, health experts, nutritionist, receiving information | 22 |

studies, 18 subthemes and 8 main themes have been developed regarding individuals' needs in the prediabetes stage (Tab. V): Information needs, Cultural needs, Psychological needs, Social support needs, Education needs, Financial needs, Service needs, Skill needs.

### Psychological needs

The results show that one of the most important and greatest needs of individuals with prediabetes is related to their psychological dimension. This dimension includes the motivational, belief and attitudinal, self-efficacy, and emotional issues of individuals with prediabetes regarding their situation. Studies have shown that finding out about their diagnosis, individuals with prediabetes experience different emotions and feelings. Some of them express disbelief about their prediabetes condition. Some of the individuals who have the experience of dealing with diabetic patients in their family and relatives and have closely seen the resulting complications such as foot amputation, blindness, and death have expressed the feelings of fear, despair, worry and distress, stress, and anxiety. Furthermore, due to the lack of awareness, they have reported the feelings of being confused and bewildered, as well as the feeling of moving on a dark path. Some people have been shocked after finding out about their diagnosis, due to not having diabetes family history. On the other hand, some have also been calm feeling that they have the power to change the situation through accepting it and being aware of the fact that this situation can be reversible and leading them towards health again [10, 19, 27].

In addition, many individuals with prediabetes have mentioned lots of factors as internal and external motivating factors, the existence and the strengthening of which has caused the desire to take action, and the adherence to preventive and health-promoting behaviors in these individuals. The feeling of independence and gaining health are among the mentioned internal motivators. The external motivating factors include the provision of facilities and resources, having access to educational programs and courses, receiving appropriate answers to questions, and the existence of follow-up programs and financial support, like receiving financial rewards and cash prizes for effective participation in educational programs [19, 20, 24, 26, 28, 36]. Furthermore, many individuals with prediabetes mention that their self-confidence has decreased in several ways, such as the lack of active participation in educational courses and receiving necessary health information, the inability to take part in discussions in group meetings (especially in the meetings including the opposite sex), and doubting their personal abilities regarding preventive and health-promoting behaviors as well as setting individual health goals and adhering to them. These individuals believe that various work and family obligations and responsibilities reduce their self-confidence for pursuing health behaviors. In addition, they put emphasis on the need to improve self-efficacy, self-management, and personal power, besides acquiring self-assessment, self-control, and self-regulation skills [10, 19, 20, 28, 30, 31, 33, 34, 37, 38].

In order to pursue health-promoting behaviors, and to quit or prevent returning to previous unhealthy behaviors, individuals with prediabetes try to acquire and improve their well-being through positive self-talk using meaningful sentences and words, strengthening positive thoughts, and having a meaningful perspective on life. In addition, they have also mentioned the stress and the anxiety caused by being at risk of type 2 diabetes and suffering from its complications [19, 20, 24, 26, 32, 34, 37, 39].

### Social support needs

Receiving social support is another extracted theme of individuals with prediabetes' needs. Individuals with prediabetes have mentioned receiving support from others, including family members, peer groups, friends and colleagues, and occupational entities. They believe being a member of their peer groups and using their experiences and practical strategies, as well as being accompanied by their friends and family members, especially their spouses, are of great importance in adapting to their individual roles and responsibilities, facilitating decision-making processes, improving motivation, increasing adherence to preventive and health promoting behaviors, and supporting them in using digital services and improving their electronic literacy.

In addition, they have pointed to the existence of positive interaction with experienced, supportive, and motivating experts and healthcare providers as another important support source helping them set health goals and giving them feedback. Individuals with prediabetes have mentioned that they expect their physicians to diagnose their condition and refer them to health programs and services; they have also complained about the lack of efficient interactions with their physicians. They feel that they are on an uncertain path and need to receive care instructions as well as educational content and programs from nurses and other health professionals such as nutritionists. They have also mentioned, both directly and implicitly, the importance of a close interaction with health educators and receiving appropriate feedback from them [11, 20, 23, 25, 27, 29, 35, 36, 40, 43].

### Information needs

*1. Health perception needs*

Individuals with prediabetes find it crucial to correct and improve their perception of prediabetes, and to distinguish it from type-2 diabetes, especially right after their diagnosis. They acknowledged their need to increase their knowledge and awareness of the symptoms, risk factors, laboratory tests, and screening. They demand to be informed about the up-to-date results of evidence-based measures taken in the field of prediabetes in order to improve their performance and adherence to implementing type 2 diabetes preventive behaviors, and to increase their individual motivation [10, 12, 19, 21, 23, 25, 27, 29, 32, 35, 38, 40, 42, 44].

*2. Activity needs*

Among the information needs mentioned by the adults in

the prediabetes stage, the need to improve the awareness of physical activity and nutrition is considered to be one of the most frequent needs in this regard. Speaking of their physical activity, they find it necessary to be aware and use the strategies preventing immobility during the day; to adapt physical activity to their age, health status, and clinical history; to be aware of the side effects of quitting physical activity; to have the knowledge of how to do exercise, its duration, the type of exercise, the gap with meals, timing between meals and activity time, the skill of adjusting physical activity and work activities, routine life responsibilities and activities, as well as the ability to distinguish between daily activities and exercise in the theme of physical activity [19, 20, 23, 25, 26, 28, 29, 34, 35, 38, 42, 44, 46].

*3. Nutrition needs*

Regarding nutrition, gaining knowledge and developing the skill of identifying and limiting food portions and groups, healthy and efficient methods of preparing and cooking food, measuring calories, adjusting meals according to the type of diet, as well as the skill of reading labels and selecting healthy foods have been mentioned in the theme of nutrition and diet related needs [12, 19, 20, 23, 25, 29, 32, 34, 38, 40, 41, 45, 47].

*4. Medication needs*

In most studies, the management of prediabetes stage has been focused on the implementation of the interventions related to physical activity and adjusting the received nutrition. In this regard, individuals with prediabetes are not informed about controlling the prediabetes stage through using oral drugs besides performing preventive and health promotion behaviors. Many prefer these behaviors over taking oral medications. Some have also stated that they will take these medicines if it is recommended by the physician and provided that they have a positive effect on their health. That's why they have mentioned the need to know the positive and negative effects of taking medicines, how and when to take them, and the purpose of taking them [10, 19, 29].

### Education needs

*1. Educational programs needs*

Individuals with prediabetes pointed out the need to access educational programs and courses- in person, virtual or, preferably, a combination of both. They also expressed their desire for digital educational programs, due to their high flexibility to be used in the time and place of user's choice. They are in favor of the programs with training sessions neither too long, which will be boring and almost impossible to participate in, nor too short, depriving these patients of the opportunity for deep discussions and effective interactions with health educators and peers. Furthermore, some of them preferred the existence of programs including the peer groups with maximum commonalities and gender uniformity [11, 21, 23, 25, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48].

*2. Source education needs*

Besides the need to receive information and increase knowledge and awareness, one of the other needs of individuals with prediabetes is related to the type and the quality of the sources of the received information. Individuals with prediabetes stated that they need to receive comprehensive and coherent, non-repetitive, new, up-to-date, interesting, understandable, and simple information from a credible, reliable, and scientific source. Although one of their challenges was receiving information from various sources, which could confuse or mislead them, some stated that receiving information from a single source may also lead to losing a lot of up-to-date and valid information [11, 12, 22, 26, 27, 31, 40, 46].

### Service needs

From the perspective of individuals with prediabetes, the most important needs related to services and facilities include the need for means of transportation and proper spaces in terms of security, cost, and accessibility to facilities such as sports halls, classes and conference halls, parks and walking areas close to their residence, access to digital services such as suitable educational applications, access to the Internet and digital hardware such as smartphones and laptops, access to free or low-cost consulting services, screening and diagnostic facilities and services, access to information and educational resources, the existence of reliable food centers at in the society, as well as access to promotional SMS and emails in the field of health [10, 20, 23, 26, 29, 30, 33, 35, 37, 39, 40, 43, 44, 48].

### Skill needs

In addition to increasing knowledge and awareness, as well as improving their perception of prediabetes stage, have, both implicitly and explicitly, pointed out the need to acquire a series of skills and capabilities in order to maintain their health. The skills believed to be necessary in order to maintain and improve health in the individuals with prediabetes include hard and soft skills.

*1. Management skill needs*

Adjusting the work schedule (time management), matching responsibilities and obligations with preventive and health-promoting behaviors (role management), managing different situations, adjusting work and sports activities (time management), maintaining and saving energy (energy management), time management, the management of other associated diseases and physical disabilities, self-evaluation, self-regulation, and self-control [10, 12, 20, 22, 26, 29, 31, 33, 34, 36, 38, 42, 45, 46, 48].

*2. Goal setting skill needs*

In addition to the above-mentioned, these patients prioritize setting personal health goals, and consider it as one of the motivational factors in adhering to their health behaviors and evaluating their performance. They desire to check their health status through getting feedback

from a health educator or with the help of digital trackers based on their set goals. They have prioritized setting individual, short-term, accessible goals, and updating them with the help of an educator, considering their physical abilities and limitations [10, 28, 34, 36, 41].

*3. Monitoring skill needs*

In order to monitor their health goals, the adults in the prediabetes stage find it necessary to have the ability to use a glucometer to check their blood sugar levels, to interpret the results, and to use the digital trackers which control health indicators. Besides, they consider it necessary to check and monitor their blood pressure so as to control cardiovascular complications [25, 34].

### Financial needs

Financial needs are among the other needs mentioned by individuals with prediabetes. If satisfied, it will be considered as a motivating and facilitating factor; if ignored, it will be among the obstacles and challenges which these people are facing. Their crucial needs include the need for financial support resources such as grants and cash prizes, insurance support and gratis services such as commuting services or free memberships in associations, low-cost services to facilitate their access to educational-skill programs and courses, sports facilities and equipment, as well as proper food. Of course, some have stated that they are willing to pay a reasonable fee to use or purchase educational services if they are provided with new information [19, 21, 23, 25, 29, 32, 33, 36, 39, 40, 42, 44].

### Cultural needs

Individuals with prediabetes have also stated that they need information sources appropriate to the culture and the background of the society in which they live. They need to know the cultural barriers in relation to adopting preventive and health promotion behaviors and learn the practical strategies. Moreover, they have expressed the need to create a culture within their family in order to gain their support in adjusting their self-care behaviors [23, 29, 32, 33, 40, 42, 46].

## Discussion

The purpose of the systematic literature review in the present meta-synthesis, study was to determine adults' needs in the prediabetes stage. The results of reviewing 34 studies showed that in the prediabetes stage, adults' needs can be categorized into 8 main classes. According to the reviewed studies, in the prediabetes stage, the extracted adults' needs, in order of importance, include Information needs, Psychological needs, Social support needs, Skill needs, Education needs, Service needs, Financial needs, and Cultural needs. In this regard, in the study of Lim et al. (2020), pointing out the preferences of the individuals with prediabetes regarding the educational programs' components, the most prioritized ones were related to healthy nutrition, physical activity, prediabetes status monitoring, stress management, and emotional support. All of these preferred components are among the most frequent need dimensions in the present study, too [40].

It was also reported in Lim's study that 26.6% of patients had received prediabetes education. It had a positive relationship with the level of education, glucose tolerance disorder, the number of comorbidities, having the family members or the peers with diabetes, being supported to reduce the risk of diabetes, and having self-confidence. However, it had a negative relationship with age. It was also found out that one of the common reasons for not receiving such training was the lack of physician referral. The patients preferred the health-related messages with the content focusing on the risk factors and the prevention of diabetes, as well as health and family, and avoiding the term "prediabetic" to address them. Moreover, their two most preferred educational components were healthy diets and physical activity, in the most favorable environments and social centers [33, 37, 40]. Furthermore, Ghisi et al. conducted a study (2021) with the aim of developing a structured training program, after four stages or steps of needs assessment, for the Brazilians with diabetes or prediabetes. The results of the interviews with the focus group were categorized in six topics/themes: self-management, physical activity, eating habits, diabetes medication, psychosocial being, and sleep, all of which have been considered and included in the developed educational program [19].

Comparing the results of the above studies with the ones obtained from the present study shows that the most important needs of individuals with prediabetes include acquiring prediabetes stage self-management skill, paying attention to the psychosocial aspects of this condition on individuals with prediabetes, health behaviors related to promoting physical activities and healthy diet, receiving appropriate support from the health care team and other social groups, along with receiving the necessary training in various dimensions. Although the above studies did not directly examine adults' needs in the prediabetes stage, the mentioned items are all consistent with the obtained adults' needs in the prediabetes stage in the present study, confirming the needs extracted through reviewing the literature in this study.

Another need of the adults in the prediabetes stage extracted in the current study is related to culture. In this dimension, prediabetic adults have pointed out the need to know the cultural barriers and facilitators to doing lifestyle-related activities, the educational materials' consistence with the society's culture, and the need to promote the governing cultures in different work and family domains. However, this dimension has not been mentioned in the study of Lim et al., which dealt with categorizing the preferences of individuals with prediabetes and the urgency of involving them in educational programs [40]. In connection with the importance of this need, the systematic study of Wadi et al. (2021) on sixteen randomized controlled trials,

presenting their programs according to the culture of prediabetic or diabetic patients, showed that paying attention to the individuals' culture could lead to improving their sugar index compared to the control group [49].

In the metasynthesis study by Skoglund et al. (2022), which reviewed the facilitators and the barriers to lifestyle change in individuals with prediabetes, three analytical themes shedding light on the perceived barriers and facilitators to lifestyle change were identified: individual assessment of the importance of initiating lifestyle change, coping strategies and mechanisms to maintain lifestyle changes, and the importance of supportive relationships and environments in initiating and maintaining lifestyle change. The first topic/theme focuses on the effect of the level of awareness, how to perceive the risk of prediabetes, internal struggle factors such as guilt and self-blame, internal motivational factors and positive health feedback such as the positive effect of exercise and a good mood on the individual's assessment of the importance of initiating lifestyle change. The second theme deals with planning, determining achievable goals, and the importance of knowledge and skills in creating and making lifestyle changes and behaviors. Finally, the third theme points out the role of supportive relationships, family support, health care providers, and peers in initiating and maintaining lifestyle changes [50]. In this study, Skoglund has divided the process of lifestyle change into three stages: initiation, action, and maintenance, and has pointed out the facilitators and obstacles that match some domains of adults' needs in prediabetes state. However, in the current study, in addition to categorizing the needs into main classes, the dimensions and the details of each of these main needs are discussed, too. Neither Skoglund's study, nor other above-mentioned studies have extensively discussed all the details of each of the dimensions of adults' needs in the prediabetes stage.

The educational programs and the interventions carried out in order to reverse the prediabetes condition and prevent its progression usually focus on building self-confidence and self-care skills such as improving the diet and physical activity, weight management, and periodic medical follow ups or checkups [51, 52]. Furthermore, Rhoon et al. have conducted a systematic study in 2020, which is a systematic review of behavior change techniques and digital features in technology-based type 2 diabetes preventive interventions. This study shows that in digital interventions include behavior change features and techniques, such as setting goals and planning, feedback and monitoring, social support, knowledge formation, the rules for reducing negative emotions, the comparison of results in order to increase motivation, and receiving rewards. Based on the results of the present study, it can be claimed that these programs and interventions have not addressed the needs of individuals with prediabetes comprehensively, and that there is still a need to add other digital features and techniques, or to design programs and interventions to meet adults' other needs in the prediabetes state [50, 53].

In a study titled as "experiences and perceptions of self-management in people with prediabetes", Wang et al. (2023) stated that health care providers should improve their professional skills to help modify self-management programs (systematic 2023). The results of the present study show that healthcare providers can improve their professional skills and help to improve prediabetes self-management programs through considering the main classes of educational needs and social support as well as paying attention to the characteristics mentioned regarding educational programs and courses, and educational resources, as well as the characteristics that the adults in the prediabetes state expect educators, counselors, and therapists to possess [54].

### Application of Research Results

The obtained results can be a basis for preparing and developing comprehensive educational packages, enriching diabetes prevention programs, and the features of digital applications. They can be used to help not only the adults in the prediabetes stage, but also the families and all the healthcare providers in this field. Furthermore, these results can make health policymakers familiar with the needs of the adults in the prediabetes stage, and help them to make large-scale decisions and macro policies, especially in relation to meeting the patients' service and financial needs.

### Recommendations

Identifying the dimensions of adults' needs in the prediabetes stage can be used as a guide to design a needs assessment tool for the adults with prediabetes. Identifying and prioritizing the needs at the beginning of designing diabetes prevention programs can lead to purposeful care and treatment processes.

### Research limitations

Lack of access to other scientific information is one of the most important limitations of this research.

## Conclusions

The present study provides specialists and healthcare providers with important insight into recognizing the needs of individuals with prediabetes in various dimensions. A comprehensive knowledge of the needs, obtained from the perceptions and statements of the adults in the prediabetes state, is necessary to design patient-centered and family-centered care programs for preventing diabetes, controlling the progress of the prediabetes stage towards type 2 diabetes, and delaying its onset. In this study, information needs, psychological needs, Social support needs, Skill needs, and Education needs were among the most frequently mentioned needs, followed by Service needs, Financial needs, and Cultural needs. The discovered needs are consistent with other studies in the field of prediabetes. In addition to categorizing the needs into main classes, it also points out the details of each need in each dimension and class.

Moreover, it refers to the cultural needs of the adults in the prediabetes stage. Besides, educational programs and resources can help to improve healthcare providers' skills and promote diabetes prevention programs through pointing out the perceived needs regarding the characteristics of health advocates. In addition, it is necessary to develop diabetes prevention programs which pay attention to all adults' needs, and to promote their self-care in the prediabetes stage.

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## Conflict of interest statement

The authors declare no competing interests.

## Authors' contributions

The first author (MJ, MZ) conducted the literature search, the initial screening. MJ, MZ, AE and AM the selection of the studies and the quality appraisal. MJ, MZ, AE and AM synthesized and analysed the data. MB and MM contributed to the methodology. MJ prepared the manuscript. All authors contributed to editing of the manuscript and submission of the final manuscript.

### References

[1] Kong AP, Luk AO, Chan JC. Detecting people at high risk of type 2 diabetes- How do we find them and who should be treated? Best Pract Res Clin Endocrinol Metab 2016;30:345-55. https://doi.org/10.1016/j.beem.2016.06.003

[2] Hostalek U. Global epidemiology of prediabetes - present and future perspectives. Clin Diabetes Endocrinol 2019;5:5. https://doi.org/10.1186/s40842-019-0080-0

[3] Katibeh M, Hosseini S, Soleimanizad R, Manaviat MR, Kheiri B, Khabazkhoob M, Daftarian N, Dehghan MH. Prevalence and risk factors of diabetes mellitus in a central district in Islamic Republic of Iran: a population-based study on adults aged 40-80 years. East Mediterr Health J 2015;21:412-9. https://doi.org/10.26719/2015.21.412

[4] Zand A, Ibrahim K, Patham B. Prediabetes: why should we care? Methodist Debakey Cardiovasc J 2018;14:289-97. https://doi.org/10.14797/mdcj-14-4-289

[5] Ogurtsova K, da Rocha Fernandes JD, Huang Y, Linnenkamp U, Guariguata L, Cho NH, Cavan D, Shaw JE, Makaroff LE. IDF Diabetes Atlas: global estimates for the prevalence of diabetes for 2015 and 2040. Diabetes Res Clin Pract 2017;128:40-50. https://doi.org/10.1016/j.diabres.2017.03.024

[6] Barry E, Roberts S, Oke J, Vijayaraghavan S, Normansell R, Greenhalgh T. Efficacy and effectiveness of screen and treat policies in prevention of type 2 diabetes: systematic review and meta-analysis of screening tests and interventions. BMJ 2017;356:i6538. https://doi.org/10.1136/bmj.i6538

[7] Griauzde D, Kullgren JT, Liestenfeltz B, Ansari T, Johnson EH, Fedewa A, Saslow LR, Richardson C, Heisler M. A Mobile phone-based program to promote healthy behaviors among adults with prediabetes who declined participation in free diabetes prevention programs: mixed-methods pilot randomized controlled trial. JMIR Mhealth Uhealth 2019;7:e11267. https://doi.org/10.2196/11267

[8] Messina J, Campbell S, Morris R, Eyles E, Sanders C. A narrative systematic review of factors affecting diabetes prevention in primary care settings. PLoS One 2017;12:e0177699. https://doi.org/10.1371/journal.pone.0177699

[9] O'Brien MJ, Moran MR, Tang JW, Vargas MC, Talen M, Zimmermann LJ, Ackermann RT, Kandula NR. Patient perceptions about prediabetes and preferences for diabetes prevention. Diabetes Educ 2016;42:667-77. https://doi.org/10.1177/0145721716666678

[10] Timm L, Daivadanam M, Lager A, Forsberg B, Östenson CG, Mölsted Alvesson H. "I did not believe you could get better"-Reversal of diabetes risk through dietary changes in older persons with prediabetes in region Stockholm. Nutrients 2019;11:2658. https://doi.org/10.3390/nu11112658

[11] Lawrence H, Nathan Reynolds A, Joseph Venn B. Perceptions of the healthfulness of foods of New Zealand adults living with prediabetes and type 2 diabetes: a pilot study. J Nutr Educ Behav 2017;49:339-45.e1. https://doi.org/10.1016/j.jneb.2016.10.020

[12] Paterson BL. "It looks great but how do I know if it fits?": an introduction to meta-synthesis research. In: Hannes K, Lockwood C, eds. Synthesizing qualitative research: choosing the right approach. John Wiley & Sons 2011, pp. 1-20.

[13] Sandelowski M, Barroso J. Handbook for synthesizing qualitative research. Springer Publishing Co. 2006.

[14] Tong A, Flemming K, McInnes E, Oliver S, Craig J. Enhancing transparency in reporting the synthesis of qualitative research: ENTREQ. BMC Med Res Methodol 2012;12:1-8. https://doi.org/10.1186/1471-2288-12-181

[15] Cooke A, Smith D, Booth A. Beyond PICO: the SPIDER tool for qualitative evidence synthesis. Qual Health Res 2012;22:1435-43. https://doi.org/10.1177/1049732312452938

[16] Unit P. Critical Appraisal Skills Programme (CASP): making sense of evidence-10 questions to help you make sense of qualitative research [Internet]. Londres: Public Heal Resour Unit 2006. Available at: https://casp-uk.net/checklists/casp-qualitative-studies-checklist-fillable.pdf (Accessed on: 20/12/2023).

[17] Thomas J, Harden A. Methods for the thematic synthesis of qualitative research in systematic reviews. BMC Med Res Methodol 2008;8:1-10. https://doi.org/10.1186/1471-2288-8-45

[18] Flemming K, Noyes J. Qualitative evidence synthesis: where are we at? Int J Qual Methods 2021;20:1609406921993276. https://doi.org/10.1177/160940692199327

[19] GL de Melo Ghisi, Seixas MB, Pereira DS, Cisneros LL, Ezequiel DGA, Aultman C, Niole Sandison N, Oh P, Silva LPD. Patient education program for Brazilians living with diabetes and prediabetes: findings from a development study. BMC Public Health 2021;21:1236. https://doi.org/10.1186/s12889-021-11300-y

[20] Mahmoodabad SSM, Vafa FS, Vaezi A, Karimi H, Fallahzadeh H. Explanation of the perceptions of women with prediabetes affecting physical activity: a qualitative study. Int J Ayurvedic Med 2019;10:95-104.

[21] Roper KL, Thomas AR, Hieronymus L, Brock A, Keck J. Patient and Clinician perceptions of prediabetes: a mixed-methods primary care study. Diabetes Educ 2019;45:302-314. https://doi.org/10.1177/0145721719845347

[22] Ledford CJW, Fisher CL, Cafferty LA, Jackson JT, Crawford PF, Seehusen DA. How patients make sense of a diabetes diagnosis: an application of Weick's model of organizing. Diabetes Res Clin Pract 2020;162:108117. https://doi.org/10.1016/j.diabres.2020.108117

[23] Twohig H, Hodges V, Hobbis C, Mitchell C. Response to diagnosis of pre-diabetes in socioeconomically deprived areas: a qualitative study. BJGP Open 2019;3:bjgpopen19X101661. https://doi.org/10.3399/bjgpopen19X101661

[24] Schmidt K, Faerch K, Zoffmann V, Amadid H, Varming AR. The process of health behaviour change following participation in a randomised controlled trial targeting prediabetes: a qualitative study. Diabet Med 2022;39:e14748. https://doi.org/10.1111/dme.14748

[25] Yoon S, Wee S, Loh DHF, Bee YM, Thumboo J. Facilitators and Barriers to Uptake of Community-Based Diabetes Prevention Program Among Multi-Ethnic Asian Patients With Prediabetes. Front Endocrinol (Lausanne) 2022;13:816385. https://doi.org/10.3389/fendo.2022.816385

[26] Mishra P, Greenfield SM, Harris T, Hamer M, Lewis SA, Singh K, Nair R, Mukherjee S, Krishnamurthy Manjunath N, Harper DR, Tandon N, Kinra S, Prabhakaran D, Chattopadhyay K. Yoga Program for Type 2 Diabetes Prevention (YOGA-DP) among high-risk people: qualitative study to explore reasons for non-participation in a feasibility randomized controlled trial in india. Front Public Health 2021;9:682203. https://doi.org/10.3389/fpubh.2021.682203

[27] Abel S, Whitehead LC, Coppell KJ. Making dietary changes following a diagnosis of prediabetes: a qualitative exploration of barriers and facilitators. Diabet Med 2018;35:1693-9. https://doi.org/10.1111/dme.13796

[28] DeJesus RS, Clark MM, Rutten LJF, Hathaway JC, Wilson PM, Link SM, Sauver JS. Wellness coaching to improve lifestyle behaviors among adults with prediabetes: patients' experience and perceptions to participation. J Patient Exp 2018;5:314-9. https://doi.org/10.1177/2374373518769118

[29] Brown SA, Perkison WB, García AA, Cuevas HE, Velasquez MM, Winter MA, Hanis CL. The Starr County Border Health Initiative: Focus Groups on Diabetes Prevention in Mexican Americans. Diabetes Educ 2018;44:293-306. https://doi.org/10.1177/0145721718770143

[30] Dyer KE, Moreau JL, Finley E, Bean-Mayberry B, Farmer MM, Bernet D, Kress A, Lewis JL, Batuman FK, Haskell SG, Hamilton AB, Moin T. Tailoring an evidence-based lifestyle intervention to meet the needs of women Veterans with prediabetes. Women Health 2020;60:748-62. https://doi.org/10.1080/03630242.2019.1710892

[31] Ledford CJ, Fisher CL, Cafferty LA, Jackson JT, Seehusen DA, Crawford PF. Turning points as opportunities to partner with patients living with type 2 diabetes or prediabetes. J Am Board Fam Med 2020;33:211-9. https://doi.org/10.3122/jabfm.2020.02.190136

[32] Abel SL, Whitehead LC, Tipene-Leach DC, Coppell KJ. Proximal and distal influences on dietary change among a diverse group with prediabetes participating in a pragmatic, primary care nurse-led intervention: a qualitative study. Public Health Nutr 2021;24:6015-26. https://doi.org/10.1017/S1368980021001968.

[33] Lim RBT, Wee WK, For WC, Ananthanarayanan JA, Soh YH, Goh LML, Tham DKT, Wong ML. Correlates, Facilitators and Barriers of Healthy Eating Among Primary Care Patients with Prediabetes in Singapore-A Mixed Methods Approach. Nutrients 2019;11:1014. https://doi.org/10.3390/nu11051014

[34] Bean C, Dineen T, Jung ME. "It's a life thing, not a few months thing": profiling patterns of the physical activity change process and associated strategies of women with prediabetes over 1 year. Can J Diabetes 2020;44:701-10. https://doi.org/10.1016/j.jcjd.2020.09.001

[35] Mishra P, Harris T, Greenfield SM, Hamer M, Lewis SA, Singh K, Nair R, Mukherjee S, Manjunath NK, Tandon N, Kinra S, Prabhakaran D, Chattopadhyay K. Feasibility Trial of Yoga Programme for Type 2 Diabetes Prevention (YOGA-DP) among high-risk people in India: aA qualitative study to explore participants' trial- and intervention-related barriers and facilitators. Int J Environ Res Public Health 2022;19:5514. https://doi.org/10.3390/ijerph19095514

[36] Baucom KJW, Pershing ML, Dwenger KM, Karasawa M, Cohan JN, Ozanne EM. Barriers and facilitators to enrollment and retention in the National Diabetes Prevention Program: perspectives of women and clinicians within a health system. Womens Health Rep (New Rochelle) 2021;2:133-41. https://doi.org/10.1089/whr.2020.0102.

[37] Faletau J, Nosa V, Dobson R, Heather M, McCool J. Falling into a deep dark hole: Tongan people's perceptions of being at risk of developing type 2 diabetes. Health Expect 2020;23:837-45. https://doi.org/10.1111/hex.13056

[38] Azzi JL, Azzi S, Lavigne-Robichaud M, Vermeer A, Barresi T, Blaine S, et al. Participant Evaluation of a Prediabetes Intervention Program Designed for Rural Adults. Can J Diet Pract Res 2019;81:80-5. https://doi.org/10.3148/cjdpr-2019-033

[39] Xia T, Lopes S, Chen L, Roth R, Zinzow H, Jones K, Zhang L, Shi L, Jindal M. A feasibility study on low-dose mindfulness-based stress reduction intervention among prediabetes and diabetes patients. Complement Ther Med 2022;65:102810. https://doi.org/10.1016/j.ctim.2022.102810

[40] Lim RBT, Wee WK, For WC, Ananthanarayanan JA, Soh YH, Goh LML, Tham DKT, Wong ML. Health education and communication needs among primary care patients with prediabetes in Singapore: a mixed methods approach. Prim Care Diabetes 2020;14:254-64. https://doi.org/10.1016/j.pcd.2019.08.008

[41] Signal V, McLeod M, Stanley J, Stairmand J, Sukumaran N, Thompson DM, Henderson K, Davies C, Krebs J, Dowell A, Grainger R, Sarfati D. A Mobile- and Web-Based Health Intervention Program for Diabetes and Prediabetes Self-Management (BetaMe/Melon): process evaluation following a randomized controlled trial. J Med Internet Res 2020;22:e19150. https://doi.org/10.2196/19150

[42] Chen P, Chai J, Cheng J, Li K, Xie S, Liang H, Shen X, Feng R, Wang D. A smart web aid for preventing diabetes in rural China: preliminary findings and lessons. J Med Internet Res 2014;16:e98. https://doi.org/10.2196/jmir.3228

[43] Saju R, Castellon-Lopez Y, Turk N, Moin T, Mangione CM, Norris KC, Vu A, Maranon R, Fu J, Cheng F, Duru OK. Differences in weight loss by race and ethnicity in the PRIDE trial: a qualitative analysis of participant perspectives. J Gen Intern Med 2022;37:3715-22. https://doi.org/10.1007/s11606-022-07521-5.

[44] Thomas T, Samuel-Hodge CD, Porterfield DS, Alva ML, Leeman J. Scaling up diabetes prevention programs in North Carolina: perceptions of demand from potential program recipients and providers. Diabetes Educ 2019;45:116-24. https://doi.org/10.1177/0145721718811564

[45] Creatore MI, Booth GL, Manuel DG, Moineddin R, Glazier RH. Diabetes screening among immigrants: a population-based urban cohort study. Diabetes Care 2012;35:754-61. https://doi.org/10.2337/dc11-1393

[46] Yeh MC, Lau W, Chen S, Wong A, Tung HJ, Ma GX, Wylie-Rosett J. Adaptation of diabetes prevention program for Chinese Americans - a qualitative study. BMC Public Health 2022;22:1325. https://doi.org/10.1186/s12889-022-13733-5

[47] Fu M, Liu S, Lin Y-K, Chan W-Y. Physical activity of Chinese American immigrants with type 2 diabetes/prediabetes: a mixed method study. Am J Nurs 2018;118:24. https://doi.org/10.1097/01.NAJ.0000530221.87469.86

[48] Kullgren JT, Knaus M, Jenkins KR, Heisler M. Mixed methods study of engagement in behaviors to prevent type 2 diabetes among employees with pre-diabetes. BMJ Open Diabetes Res Care 2016;4:e000212. https://doi.org/10.1136/bmjdrc-2016-000212

[49] Wadi NM, Asantewa-Ampaduh S, Rivas C, Goff LM. Culturally tailored lifestyle interventions for the prevention and management of type 2 diabetes in adults of Black African ancestry: a systematic review of tailoring methods and their effectiveness. Public Health Nutr 2022;25:422-36. https://doi.org/10.1017/S1368980021003682

[50] Skoglund G, Nilsson BB, Olsen CF, Bergland A, Hilde G. Facilitators and barriers for lifestyle change in people with prediabe-

tes: a meta-synthesis of qualitative studies. BMC Public Health 2022;22:1-27. https://doi.org/10.1186/s12889-022-12885-8

[51] Glechner A, Keuchel L, Affengruber L, Titscher V, Sommer I, Matyas N, Wagner G, Kien C, Klerings I, Gartlehner G. Effects of lifestyle changes on adults with prediabetes: a systematic review and meta-analysis. Prim Care Diabetes 2018;12:393-408. https://doi.org/10.1016/j.pcd.2018.07.003

[52] Bergman M. Inadequacies of current approaches to prediabetes and diabetes prevention. Endocrine 2013;44:623-33. https://doi.org/10.1007/s12020-013-0017-9

[53] Van Rhoon L, Byrne M, Morrissey E, Murphy J, McSharry J. A systematic review of the behaviour change techniques and digital features in technology-driven type 2 diabetes prevention interventions. Digit Health 2020;6:2055207620914427. https://doi.org/10.1177/2055207620914427

[54] Wang Z, Shi Q, Zeng Y, Li Y. Experiences and perceptions of self-management in people with prediabetes: a qualitative meta-synthesis. J Clin Nurs 2023;32:5886-903. https://doi.org/10.1111/jocn.16713

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## Additional file 1

ENTREQ checklist: Enhancing transparency in reporting the synthesis of qualitative research

| Nr | Item | Guide and description | Reported on section |
|---|---|---|---|
| 1 | Aim | State the research question the synthesis addresses | Introduction |
| 2 | Synthesis methodology | Identify the synthesis methodology or theoretical framework which underpins the synthesis, and describe the rationale for choice of methodology (*e.g.* meta-ethnography, thematic synthesis, critical interpretive synthesis, grounded theory synthesis, realist synthesis, meta-aggregation, meta-study, framework synthesis) | Method |
| 3 | Approach to searching | Indicate whether the search was pre-planned (comprehensive search strategies to seek all available studies) or iterative (to seek all available concepts until they theoretical saturation is achieved) | Method, Table 1 |
| 4 | Inclusion criteria | Specify the inclusion/exclusion criteria (*e.g.* in terms of population, language, year limits, type of publication, study type) | Method |
| 5 | Data sources | Describe the information sources used (*e.g.* electronic databases (MEDLINE, EMBASE, CINAHL, psycINFO, Econlit), grey literature databases (digital thesis, policy reports), relevant organisational websites, experts, information specialists, generic web searches (Google Scholar) hand searching, reference lists) and when the searches conducted; provide the rationale for using the data sources | Method |
| 6 | Electronic search strategy | Describe the literature search (*e.g.* provide electronic search strategies with population terms, clinical or health topic terms, experiential or social phenomena related terms, filters for qualitative research, and search limits) | Method |
| 7 | Study screening methods | Describe the process of study screening and sifting (*e.g.* title, abstract and full text review, number of independent reviewers who screened studies) | Method |
| 8 | Study characteristics | Present the characteristics of the included studies (*e.g.* year of publication, country, population, number of participants, data collection, methodology, analysis, research questions) | Method, Table 3 |
| 9 | Study selection results | Identify the number of studies screened and provide reasons for study exclusion (e,g, for comprehensive searching, provide numbers of studies screened and reasons for exclusion indicated in a figure/flowchart; for iterative searching describe reasons for study exclusion and inclusion based on modifications t the research question and/or contribution to theory development) | Result, Figure 1 |
| 10 | Rationale for appraisal | Describe the rationale and approach used to appraise the included studies or selected findings (*e.g.* assessment of conduct (validity and robustness), assessment of reporting (transparency), assessment of content and utility of the findings) | Method, results and Figure 1 |
| 11 | Appraisal items | State the tools, frameworks and criteria used to appraise the studies or selected findings (*e.g.* Existing tools: CASP, QARI, COREQ, Mays and Pope; reviewer developed tools; describe the domains assessed: research team, study design, data analysis and interpretations, reporting) | Method, results and Figure 1 |
| 12 | Appraisal process | Indicate whether the appraisal was conducted independently by more than one reviewer and if consensus was required | Method |
| 13 | Appraisal results | Present results of the quality assessment and indicate which articles, if any, were weighted/ excluded based on the assessment and give the rationale | Result |
| 14 | Data extraction | Indicate which sections of the primary studies were analysed and how were the data extracted from the primary studies? (*e.g.* all text under the headings "results /conclusions" were extracted electronically and entered into a computer software) | Method |
| 15 | Software | State the computer software used, if any | Method |
| 16 | Number of reviewers | Identify who was involved in coding and analysis | Method |
| 17 | Coding | Describe the process for coding of data (*e.g.* line by line coding to search for concepts) | Finding Table 5 |
| 18 | Study comparison | Describe how were comparisons made within and across studies (*e.g.* subsequent studies were coded into pre-existing concepts, and new concepts were created when deemed necessary) | Method AND Finding Table 5 |
| 19 | Derivation of themes | Explain whether the process of deriving the themes or constructs was inductive or deductive | Method AND Finding Table 5 |
| 20 | Quotations | Provide quotations from the primary studies to illustrate themes/constructs, and identify whether the quotations were participant quotations of the author's interpretation | Table 5 |
| 21 | Synthesis output | Present rich, compelling and useful results that go beyond a summary of the primary studies (*e.g.* new interpretation, models of evidence, conceptual models, analytical framework, development of a new theory or construct) | Discussion |

### Reference

Tong A, Flemming K, McInnes E, Oliver S, Craig J. Enhancing transparency in reporting the synthesis of qualitative research: ENTREQ. BMC Med Res Methodol 2012;12:181. https://doi.org/10.1186/1471-2288-12-181

HEALTH PROMOTION

# Nurses' knowledge, attitude, and practice regarding osteoporosis prevention and its correlation with their nutritional behaviors

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Keywords

Awareness • Belief • Eating habits • Nutritional behaviors • Osteoporosis • Preventive measures

Summary

**Background**. *Nurses have good opportunities to communicate with osteoporotic patients and the public as well as convey osteoporosis prevention education to them. Therefore, nurses require specific knowledge, attitude, practice (KAP), and desirable nutritional behaviors for osteoporosis prevention and treatment strategies. Little is known about the KAP for osteoporosis prevention and nutritional behaviors among nurses in Iran.*

**Purpose**. *The present study was conducted to evaluate nurses' KAP and nutritional behaviors for osteoporosis prevention.*

**Methods**. *This cross-sectional study included 195 nurses working in three hospitals in southeastern Iran. Nurses were selected using a stratified random sampling method between April and June 2020. The data collection tools included questionnaires of KAP and nutritional behaviors to prevent osteoporosis.*

**Findings**. *According to the findings, nurses' knowledge regarding osteoporosis prevention was high level (20.23 ± 3.79) and their attitude (72.71 ± 6.97), practice (48.25 ± 6.38), and nutritional behavior scores (110.12 ± 13.68) were desirable. In addition, nurses' KAP regarding osteoporosis prevention was correlated with their nutritional behaviors (p = 0.001).*

**Conclusions**. *Given the high levels of knowledge, desirable practices, and in Iranian nurses regarding the prevention of osteoporosis, they can play a significant role in changing KAP and nutritional behaviors of people to prevent this disease. To this end, educational and support programs should be implemented in clinical and community settings to develop a healthy lifestyle in the community.*

## Introduction

Osteoporosis is a metabolic disease characterized by loss of bone density, loss of quality bone structure, and increased risk of fracture [1]. Globally, more than 200 million people have osteoporosis [2] One in three women and one in five men, over the age of 50, experience osteoporotic fractures in their lifetime [3]. In Iran, according to statistics, 22.2% of women and 11% of men over 50 years of age suffer from osteoporosis [4]. Osteoporosis and related fractures can lead to physical disability, decreased self-sufficiency, and increased hospitalization and mortality rates [5]. The number of osteoporotic fractures might rise up to 4.66 million at costs of 5.91 million dollars by 2035 and in total with medical costs of 25.43 billion dollars by 2050 [6].

Although osteoporotic is not curable, it can be largely prevented by optimizing bone density during growth, maintaining bone density in adulthood, and minimizing bone loss in old age [7]. To introduce effective prevention of osteoporosis, the knowledge, attitude, and practice (KAP) theory could be useful. In the KAP theory, the process of changing human behavior is divided into three stages: obtaining knowledge, creating attitudes, and forming behaviors/practices, during which human health-related behaviors can also be changed effectively. The KAP theory enables people to participate in health behaviors and maintain their health actively; therefore, it plays a significant role in the prevention of disease, its control, and rehabilitation [8].

Researchers have emphasized the changes needed regarding the policy on osteoporosis prevention and the need for nurses to completely develop their roles (*e.g.,* clinical specialists, educators, consultants, researchers, collaborators, managers, and innovators). Prevention of osteoporosis is an important priority for all scope and practice nurses. Nurses can identify patients who require participation in continuous therapeutic interventions or rehabilitation programs and develop patient-specific follow-up protocols [9]. Furthermore, it is important for nurses to pinpoint and follow up on lifestyle and risk factors that increase osteoporosis, for example, inadequate nutritional behaviors (*e.g.*, dietary intake that is low in calcium, smoking, and drinking alcohol), low body weight, and lack of regular physical activity and exercise too much [10].

The term "nutritional behaviors" refers to the eating habits that can help prevent osteoporosis [11]. These

behaviors encompass all the planned, spontaneous, or habitual measures taken by individuals or social groups to obtain, prepare, and consume food. While a diet rich in dietary protein, calcium, vitamin D, fruits, and vegetables can significantly promote bone health, higher rates of fracture have been linked to high calorie and alcohol intake [12]. Unfortunately, many people are unaware of the connection between osteoporosis, lifestyle, and nutrition behaviors [7]. Since preventing this disease is a cost-effective achievement, it is important to implement osteoporosis prevention programs. Given the crucial role of healthcare providers in maintaining and promoting community health, the healthcare system should assess and promote the knowledge, attitudes, and practices (KAP) of healthcare providers and their nutritional behaviors before conducting any educational programs on osteoporosis prevention in the community [6].

When nurses are knowledgeable and well-prepared, they are a significant source of health information for their clients [6]. Nurses need sufficient KAP for osteoporosis prevention, risk factors, and nutritional behaviors to perform their teaching role. Lack of proper KAP concerning osteoporosis among nurses may negatively influence their participation in preventative behaviors negatively [6, 13] and ultimately affect the progression and prognosis of osteoporosis in their patients. In this regard, nurses could warmly welcome the opportunity to communicate with osteoporotic patients and provide them with the necessary instructions [14], and present the general public with the primary and secondary prevention trainigns regarding osteoporosis [15].

According to the literature review, some studies in different countries merely investigated nurses' knowledge and awareness of osteoporosis [6, 13-17]. To the best of our knowledge, only one study has evaluated nurses' KAP regarding osteoporosis in India [10]. One study evaluated levels of mastery and use of musculoskeletal assessment skills among Iranian nurses [18] and another evaluated knowledge and attitude regarding national clinical osteoporosis guideline among the nurses in orthopedic wards in Iran [19]. However, we could not find any study on Iranian nurses' knowledge and nutritional behaviors for osteoporosis prevention and its extent to correlation among these variables. Furthermore, as community health nurses and nurse educators in universities, we believe that, given the significant role of nurses in maintaining and promoting health in the community, it is necessary to evaluate nurses' KAP regarding osteoporosis prevention in different societies to obtain comprehensive information. Therefore, the present study aimed to evaluate nurses' KAP and nutritional behaviors for osteoporosis prevention.

## METHODS

### Study design & settings

This cross-sectional study was conducted in three hospitals (Dr. Gharazi, Imam Reza, and Velayat) affiliated with Sirjan University of Medical Sciences in southeastern Iran in 2020.

### Population And Sampling

The study population included all nurses working in the aforementioned hospitals (N = 375). Based on Cochran's formula ($\alpha = 0.05$, $p = 0.5$, $q = 0.5$, $d = 0.06$, $Z = 1.96$), the sample size was 170. Considering about 15% dropout probability, 195 nurses were selected from the hospitals using a stratified random sampling method proportionate to the number of nurses per hospital. Therefore, 85 nurses from Dr. Gharazi Hospital (N = 165), 100 nurses from Imam Reza Hospital (N = 195), and 10 nurses from Velayat Hospital (N = 15) were selected (Fig. 1). The inclusion criteria were nurses with a bachelor's or higher degree, work experience of at least one year, and their consent to participate in this study. Nurses who did not fully answer the questionnaire were excluded from the study [18].

### Instruments

Data collection was done using five questionnaires:

*1. Demographic Information Questionnaire*

This questionnaire included items about the participants' gender, age, marital status, shift work, education level, work experience, position, hospital ward, corticosteroid use, and source of information on osteoporosis prevention.

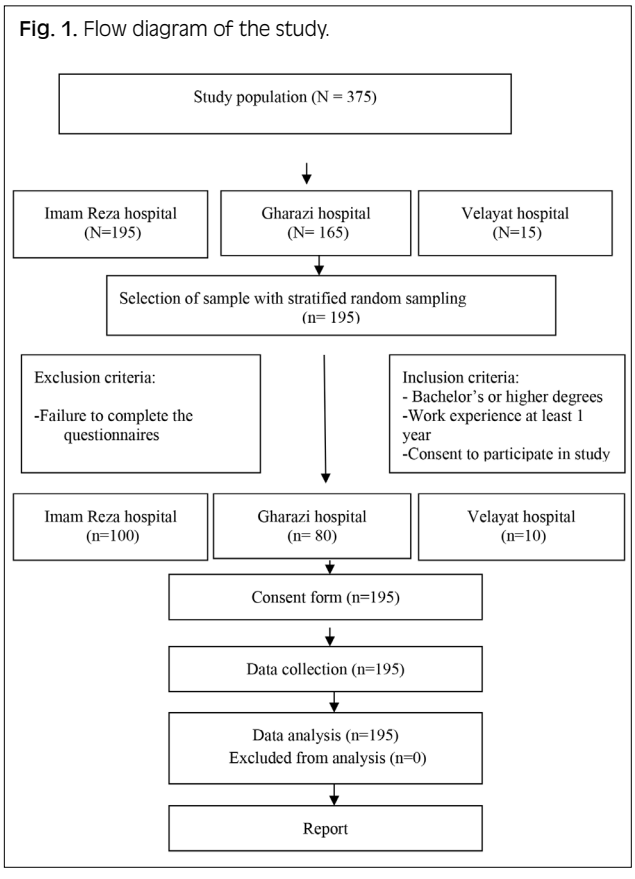


Fig. 1. Flow diagram of the study.

*2. Osteoporosis Prevention Knowledge Questionnaire*

This questionnaire designed and validated in Iran by Forouzi et al. [20] with 30 items. Each item has a response option of "True", "False", and "Do not know". Correct answers received one score, while incorrect answers and I don't know received zero scores. The minimum score was zero and maximum score was 30. According to the designers of the questionnaire, scores of 20-30 showed high levels of knowledge, scores within the range of 10-20 indicated moderate levels of knowledge, and scores of less than 10 represented low levels of knowledge. The content validity of the questionnaire was confirmed by a panel of experts consisting of 10 nursing professionals. The calculated content validity index (CVI) was 0.88. Test-retest ($r = 0.85$) and internal consistency ($\alpha = 0.74$) were also conducted by its designers to determine the reliability of the questionnaire [21].

*3. Attitude Toward Prevention of Osteoporosis Questionnaire*

This questionnaire was designed by Forouzi et al. [20] and has 18 items on a five-point Likert scale. Positive items (1, 4, 6, 7, 10, 12, 13, 15, 16, and 17) were scored as follows: strongly agree (5), agree (4), no idea (3), disagree (2), and strongly disagree (1). However, negative items were scored in reverse. The minimum score on this questionnaire was 18, and the maximum score was 90. According to the designers of this questionnaire, scores higher than 66 indicate a desirable level of attitude, scores within the range of 42-66 indicate somewhat desirable attitudes, and scores lower than 42 indicate undesirable attitudes. The content validity method and a panel of experts (10 nursing faculty members) were used to determine the validity of the questionnaire. The calculated content validity index (CVI) was 0.86. Test-retest ($r = 0.56$) and internal consistency ($\alpha = 0.66$) were also conducted by its designers to determine the reliability of the questionnaire [21].

*4. Practice for Prevention of Osteoporosis Questionnaire*

This questionnaire was developed in Iran by Forouzi et al. [21], and contains 23 items. Items with correct practices (1, 2, 4, 6, 7, 8, 11, 13, 15, 16, 18) were scored in the following way: always/often (score 3), sometimes (score 2), rarely/ never (score 1), while items with incorrect practices were scored in reverse. The minimum score on this questionnaire was 23, and the maximum score was 69. According to these designers, scores within the range of 46-69, 23-46, and lower than 23 indicate desirable, somewhat, and undesirable levels of practice, respectively. The questionnaire's validity was confirmed using the content validity method and opinions of 10 nursing faculty members, and its CVI was 0.86. Its reliability was corroborated by the internal consistency method ($\alpha = 0.74$) [21].

*5. Nutritional Behaviors for Prevention of Osteoporosis Questionnaire*

This questionnaire was prepared by Seyedabadi et al. (2016) [22] for the assessment of eating habits to prevent osteoporosis, such as adequate dietary protein, calcium, vitamin D, fruits, and vegetables, intake of appropriate calories, and alcohol consumption. The questionnaire consists of 29 items. Positive items (1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 23, and 24) were scored as strongly agree (score 5), agree (score 4), no idea (score 3), disagree (score 2), and strongly disagree (score 1), whereas negative items were scored in reverse. The minimum score on this questionnaire was 29, and the maximum score was 145. Scores higher than 107 indicated desirable nutritional behavior, scores within the range of 68-107 indicate somewhat desirable, and scores lower than 68 indicated undesirable nutritional behavior. The content validity of the questionnaire was confirmed using the opinions of ten nursing faculty members and its validity index was 0.88, and its reliability were determined using the internal consistency method ($\alpha = 0.91$).

### Data collection procedure

Data were collected using an anonymous self-report questionnaire from April to June 2020. To collect data, the first researcher referred to the study settings in different shift works, distributed the questionnaires among eligible participants, and explained the study aims. She also explained how the nurses filled out the questionnaires. To achieve the highest response rate, the researcher spent a lot of time collecting data and arranged a date to deliver the completed questionnaires. She sent reminders via WhatsApp or a phone to collect the completed questionnaires at the arranged time. All the completed questionnaires were anonymous and confidential.

### Data Analysis

Data were analyzed using SPSS 21 using descriptive statistics (frequency, percentage, mean, and standard deviation) and inferential (independent-samples *t*-test, analysis of variance, Tukey's test, Pearson's correlation coefficient, and multivariate linear regression) statistics. The Kolmogorov-Smirnov test showed that the data followed a normal distribution. The significance level was set at $p < 0.05$.

## Results

All 195 nurses completed the survey (response rate: 100%). The results revealed that the majority of the nurses were female (74.4%), aged 31-40 (47.2%), married (77.4%), permanently hired (68.2%), had less than 10 years of work experience (43.1%), and had a bachelor's degree (82.6%). Furthermore, 68.7% of them obtained information about osteoporosis prevention from the mass media (Tab. I).

The total score of nurses' attitudes was also at a desirable

**Tab. I.** Nurses' demographic information, and its relationship with knowledge, attitude, practice regarding osteoporosis prevention, and nutritional behaviors.

| Variables | N (%) | Knowledge | | Attitude | | Practice | | Nutritional behaviors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean (SD) | Statistic test (*p*-value) | Mean (SD) | Statistic test (*p*-value) | Mean (SD) | Statistic test (*p*-value) | Mean (SD) | Statistic test (*p*-value) |
| **Gender** | | | | | | | | | |
| Female | 145 (74.4) | 20.45 (3.69) | t = 1.36 (0.07) | 72.81 (7.25) | t = 0.34 (0.73) | 49.14 (6.36) | **t = 3.41 (0.001)*** | 111.42 (13.98) | **t = 2.27 (0.02)*** |
| Male | 50 (25.6) | 19.60 (4.05) | | 72.40 (6.14) | | 45.66 (5.76) | | 106.36 (12.13) | |
| **Work experience** | | | | | | | | | |
| < 10 years | 84 (43.1) | 19.42 (4.04) | **F = 4.32 (0.02)*** | 72.51 (6.62) | F = 0.66 (0.51) | 47.65 (6.32) | F = 1.22 (0.29) | 107.45 (14.05) | F = 2.89 (0.058) |
| 10-20 years | 74 (37.9) | 20.50 (3.33) | | 72.35 (6.66) | | 48.24 (6.41) | | 119.91 (12.90) | |
| 20-30 years | 37 (19) | 21.51 (3.77) | | 73.89 (8.57) | | 49.62 (6.40) | | 112.59 (13.64) | |
| **Age groups** | | | | | | | | | |
| 20-30 years | 38 (19.5) | 20.02 (3.88) | F = 2.75 (0.66) | 72.73 (6.58) | F = 0.29 (0.74) | 47.78 (5.86) | F = 0.78 (0.45) | 108.50 (11.72) | F = 0.43 (0.64) |
| 31-40 years | 92 (47.2) | 19.69 (4.04) | | 72.34 (7.13) | | 47.86 (6.47) | | 110.08 (14.39) | |
| 41-50 years | 65 (33.3) | 21.10 (3.24) | | 73.21 (7.02) | | 49.06 (6.57) | | 111.12 (13.82) | |
| **Type of employment** | | | | | | | | | |
| Hired (permanent) | 133 (68.2) | 20.53 (3.83) | F = 1.21 (0.30) | 73.36 (7.34) | F = 3.76 (0.38) | 48.21 (6.32) | F = 1.31 (0.33) | 111.49 (14.43) | F = 1.10 (0.35) |
| Hired (experimental)[a] | 15 (7.7) | 19.66 (4.54) | | 70.33 (7.28) | | 49.33 (6.48) | | 107.53 (9.94) | |
| Contract recruiters[b] | 16 (8.2) | 18.68 (3.60) | | 71.43 (5.66) | | 48.18 (7.79) | | 108.93 (13.91) | |
| Contract recruiters[c] | 15 (7.7) | 20.40 (2.64) | | 71 (5.74) | | 50.13 (7.08) | | 105.06 (11) | |
| Committed[d] | 16 (8.2) | 19.50 (3.70) | | 72.37 (5.20) | | 45.87 (4.08) | | 107.06 (11.39) | |
| **Education degree** | | | | | | | | | |
| Bachelor's | 161 (82.6) | 20.24 (3.65) | t = 0.009 (0.92) | 72.30 (7.07) | t = 3.20 (0.07) | 48.58 (6.27) | t = 2.52 (0.11) | 110.09 (13.48) | t = 0.003 (0.95) |
| Master's | 34 (17.4) | 20.17 (4.45) | | 74.64 (6.20) | | 46.67 (6.77) | | 110.23 (14.80) | |
| **Shift work** | | | | | | | | | |
| Fixed | 27 (13.8) | 21.70 (3.78) | **t = 2.18 (0.03)*** | 73.25 (6.02) | t = 0.43 (0.66) | 49.59 (5.79) | t = 1.15 (0.25) | 111.85 (13.50) | t = 67 (0.50) |
| Rotational | 168 (86.1) | 19.99 (3.76) | | 72.62 (7.14) | | 48.06 (6.47) | | 109.94 (13.71) | |
| **Position** | | | | | | | | | |
| Head nurse | 17 (8.7) | 22.05 (3.28) | **F = 2.67 (0.03)*** | 73.70 (5.34) | **F = 2.68 (0.03)*** | 50.11 (6.81) | F = 1.89 (0.11) | 113.82 (13.64) | **F = 4.25 (0.03)*** |
| Nurse | 165 (84.7) | 19.94 (3.76) | | 72.18 (6.81) | | 47.85 (6.36) | | 108.88 (13.18) | |
| Nurse manager | 13 (6.6) | 22 (3.88) | | 79 (7.45) | | 52.50 (5.93) | | 120.30 (16.39) | |
| **Marital status** | | | | | | | | | |
| Single | 44 (22.6) | 19.75 (3.95) | t = -0.95 (0.34) | 72.90 (6.28) | t = 0.21 (0.83) | 46.88 (6.05) | t = -1.61 (0.10) | 105.88 (12.08) | t = -2.36 (0.02)* |
| Married | 151 (77.4) | 20.37 (3.75) | | 72.65 (7.17) | | 48.64 (6.44) | | 111.35 (13.91) | |

**Tab. I** (*follows*). Nurses' demographic information, and its relationship with knowledge, attitude, practice regarding osteoporosis prevention, and nutritional behaviors.

| Variables | N (%) | Knowledge | | Attitude | | Practice | | Nutritional behaviors | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean (SD) | Statistic test (*p*-value) | Mean (SD) | Statistic test (*p*-value) | Mean (SD) | Statistic test (*p*-value) | Mean (SD) | Statistic test (*p*-value) |
| **Workplace section** | | | | | | | | | |
| Medical and surgical | 108 (55.5) | 19.76 (4.08) | F = 0.946 (0.46) | 71.80 (5.86) | F = 1.37 (0.21) | 46.88 (6.10) | F = 1.02 (0.41) | 111.2 (13.90) | F = 1.97 (0.06) |
| Emergency and operating room | 58 (29.8) | 20.08 (3.75) | | 72.40 (8.03) | | 47.81 (6.16) | | 106.83 (13.76) | |
| Critical care | 29 (14.9) | 21.66 (3.17) | | 73.81 (5.75) | | 50.69 (6.89) | | 110.87 (9.54) | |
| **Corticosteroids use** | | | | | | | | | |
| Yes | 28 (14.4) | 20.75 (4.23) | t = -0.77 (0.43) | 72.89 (6.26) | t = 0.14 (0.83) | 46.14 (5.30) | t = -1.90 (0.059) | 109.87 (15.81) | t = -0.14 (0.88) |
| No | 167 (85.6) | 20.14 (3.72) | | 72.68 (7.09) | | 48.60 (6.49) | | 110.17 (13.34) | |
| **Information source** | | | | | | | | | |
| Mass media | 134 (68.7) | 20.26 (3.83) | F = 0.160 (0.87) | 72.96 (7.45) | F = 0.74 (0.460) | 47.68 (5.99) | F = 1.53 (0.12) | 109.75 (14.06) | F = 1.60 (0.17) |
| Books | 99 (50.8) | 20.32 (4.01) | | 73.23 (7.07) | | 48.16 (6.89) | | 110.90 (14.35) | |
| Official and ducational programs | 107 (54.9) | 19.50 (3.69) | | 73.59 (6.99) | | 45.60 (5.76) | | 108.49 (13.47) | |
| Magazines/newspapers | 25 (12.8) | 21 (2.84) | | 74.08 (8.54) | | 50.36 (7.51) | | 113.76 (14.75) | |
| Friends/ relatives | 59 (30.3) | 20.18 (3.87) | | 72.45 (7.57) | | 48.23 (4.99) | | 111.01 (14.43) | |
| Medical staff | 121 (62.1) | 20.12 (3.67) | | 73.12 (7.21) | | 47.59 (5.64) | | 111.11 (13.30) | |
| Others | 6 (3.1) | 21 (4.38) | | 71.66 (5.50) | | 52.16 (3.86) | | 116.33 (19.86) | |

* Bold p-values are significant at level of ≤ 0.05. [a] They are hired as pilot or testable nurses for two years and then hired permanently. [b] Annually contracted with payment similar to hired nurses. [c] Annually contracted with payment less than hired nurses. [d] It is obligatory to work for government for two years at a lower rate of pay.

level (72.71 ± 6.97; range, 18-90), so that 81% of the nurses had desirable attitudes. Nurses' highest attitude scores were related to item of "osteoporosis prevention is easier than cure," while their lowest attitude scores were related to item of "financial problems are a major obstacle to osteoporosis prevention".

The total score of nurses' practice was at a desirable level (48.25 ± 6.38; range, 23-69) and 57.4% of them had high practice scores. The highest and lowest practice scores of nurses were related to "intense and heavy physical activity" and weight gain, respectively. In addition, the total score of nurses' nutritional behaviors was at a desirable level (110.12 ± 13.68; range, 29-145) and 57.4% of them obtained desirable scores in nutritional behaviors for the prevention of osteoporosis. Nurses' highest nutritional behavior score was attributed to items of "I do my best to include calcium-rich food such as milk, yogurt, vegetables, fish, *etc.* in my diet," while their lowest nutritional behavior score was for item of "a calcium-rich diet to prevent osteoporosis is expensive" (Tab. II).

Moreover, table I shows a significant difference in

**Tab. II.** Description of nurses' knowledge, attitude, practice and nutritional behaviors regarding osteoporosis prevention.

| Variables | Category | N | % | Mean ± SD |
|---|---|---|---|---|
| Knowledge | Low | 2 | 1 | 20.33 ± 3.79 |
| | Moderate | 86 | 44.1 | |
| | High | 107 | 54.9 | |
| Attitude | Somewhat desirable | 37 | 19 | 72.71 ± 6.97 |
| | Desirable | 158 | 81 | |
| Practice | Somewhat desirable | 83 | 42.6 | 48.25 ± 6.38 |
| | Desirable | 112 | 57.4 | |
| Nutritional behaviors | Somewhat desirable | 83 | 42.6 | 110.12 ± 13.68 |
| | Desirable | 112 | 57.4 | |

Tab. III. Correlation between nurses' knowledge, attitude, practice, and nutritional behaviors.

| Variables | Nutritional behaviors | |
|---|---|---|
| | Pearson coefficient | p-value |
| Knowledge | 0.40 | 0.001* |
| Attitude | 0.40 | 0.001* |
| Practice | 0.44 | 0.001* |

*Bold p-values are significant at level of ≤ 0.05

nurses' knowledge scores based on their job position (F = 2.67, $p$ = 0.03), shift work (t = 2.18, $p$ = 0.03), and work experience (F = 4.32, $p$ = 0.02). Nurses with fixed shifts and job positions had higher knowledge scores. Tukey's test indicated a significant difference in work experience between nurses who had 10-20 and 21-30 years of work experience.

Attitude scores were significantly different based on the job position of nurses (F = 2.68, $p$ = 0.03), such that nurse managers had higher attitude scores. Regarding practice scores, a significant difference was found with regard to nurses' gender (t = 3.41, $p$ = 0.001), with women receiving higher scores in terms of practice. A significant difference was also found in nutritional behaviors based on gender, (t = 2.27, $p$ = 0.02), job position (F = 4.25, $p$ = 0.03), and marital status (t = -2.36, $p$ = 0.02). Therefore, nurse managers and married nurses exhibited higher nutritional behaviors (Tab. I).

The Pearson correlation test showed that nurses' knowledge (r = 0.40, $p$ = 0.001), attitude (r = 0.4, $p$ = 0.001), and practice (r = 0.44, $p$ = 0.001) had a direct and moderate correlation with their nutritional behaviors regarding the prevention of osteoporosis (Tab. III).

In addition, to verify and control the effect of demographic variables on the correlations, the multivariate linear regression was conducted. The results showed that knowledge (β = 0.2, $p$ = 0.002), attitude (β = 0.3, $p$ <0.001), and practice (β=0.37, $p$ <0.001) related to osteoporosis prevention were the significant predictors for nutritional behaviors. Moreover, demographic variables were not significant predictors of nutritional behaviors in nurses (Tab. IV).

## Discussion

Based on the findings, nurses' knowledge regarding the prevention of osteoporosis was at a high level, and their attitudes, practices, and nutritional behaviors were at desirable levels. Furthermore, nurses' KAP scores were directly correlated with their nutritional behaviors for the prevention of osteoporosis. In about section results of KAP regarding prevention of osteoporosis, two studies showed high scores of knowledge about prevention of osteoporosis among the nurses [14, 23]. However, some studies have shown that orthopedic nurses have inadequate knowledge (6, 16) and inadequate knowledge and attitudes toward osteoporosis guidelines [19]. One study also showed that nurses' levels of mastery and use of musculoskeletal assessment skills were not satisfactory [18]. Ramli et al. (2018) reported that the allied health sciences students had moderate level of knowledge and attitude but poor practice regarding osteoporosis [24]. One study focused on the KAP of nurses and general medical practitioners regarding osteoporosis. The results showed that KAP towards osteoporosis were not sufficient in participants, and nurses had lower KAP scores compared with general medical practitioners [10]. These studies explained that although the education of healthcare professionals has improved in recent years, more plans are needed to empower nurses. Therefore, the use of motivational/practical training methods, revision, and changes in nursing curricula are necessary.

Our findings show that nurses had desirable nutritional behaviors to prevent osteoporosis. In agreement with our study, a study showed that most of nurses stated they had improved nutritional behaviors, had increased calcium and milk/dairy intake in their diet and had changed their lifestyle and diets to "eat healthily" for the prevention of osteoporosis [13]. On the contrary, a study showed that a large number of nursing students reported unhealthy habits, such as coffee drinking, low milk drinking, and lack of exercise. Most of them have vitamin D and calcium deficiencies and excessive cholesterol and sodium intake [19]. Park et al. (2015) showed that despite their high levels of knowledge regarding the effects

Tab. IV. Multivariate regression model of knowledge, attitude, practice, gender, work experience, position, shift work, marital status and nutritional behaviors.

| Variables | β | t | p-value | 95% CI | |
|---|---|---|---|---|---|
| | | | | lower | upper |
| Knowledge | 0.20 | 3.07 | 0.002* | 0.25 | 1.16 |
| Attitude | 0.30 | 4.82 | <0.001* | 0.35 | 0.83 |
| Practice | 0.37 | 5.90 | <0.001* | 0.52 | 1.05 |
| Gender | -0.04 | -0.74 | 0.46 | -5.01 | 2.28 |
| Work experience | -0.06 | -0.73 | 0.46 | -0.41 | 0.18 |
| Shift work | -0.01 | -0.23 | 0.81 | -6.74 | 5.30 |
| Position | 0.05 | 0.72 | 0.47 | -1.89 | 4.09 |
| Marital status | 0.11 | 1.61 | 0.10 | -0.84 | 8.41 |

*Bold ***p***-values are significant at level of ≤ 0.05

of diet and healthy behaviors on bone health, most nursing students had unhealthy behaviors and poor eating habits [25].

The results showed that nurses' KAP had a direct and significant correlation with their nutritional behaviors regarding the prevention of osteoporosis. Similar to the present study, several studies on healthcare providers, including nurses and nursing students, have confirmed our results [10, 13, 26-29]. Chan et al. (2021), in a systematic review, revealed the correlation between KAP, lifestyle, and dietary habits among adolescents and young adults. The lack of awareness and misconceptions about osteoporosis led to poor practices, low perceived susceptibility, and seriousness of osteoporosis. Non-compliance with osteoporosis prevention recommendations may be due to the misconception that the younger generation is not prone to osteoporosis. To improve the practice of osteoporosis prevention, people must consider the susceptibility and severity of the disease. Nurses can influence individuals' beliefs to improve their knowledge and practices by planning educational interventions that are suitable for the younger generation [7].

In the present study, the nurses' KAP scores had significant differences based on some demographic variables, including work experience, shift work, job positions, gender, and marital status. However, none of these demographic variables were found to be significant predictors of nutritional behaviors amog nurses. These findings were confirmed by previous studies that have reported differences in KAP regarding osteoporosis prevention based on some academic and demographic information such as age, gender, and university major [6, 24, 27, 30]. We recommend further studies to assess the different determinants (individual, familial, and social) of KAP and nutritional behaviors regarding osteoporosis prevention.

Overall, our results may be fairly similar to or different from those of the aforementioned studies. However, the differences between some of our results and the studies are likely attributable to the differences in design and setting, sampling method, data collection tools, and diversity of the study population in terms of gender, age, socioeconomic status, educational backgrounds, subjective norms, culture of societies, conditions of the healthcare system, and nurses' job status. Our study suggests that nurses are professionally responsible for clients' positive health outcomes (individual, family, community, and population). Due to equipping nurses with high KAP and nutritional behaviors in preventing osteoporosis, they are in a good position to encourage clients in this case. The strategies for the involvement of clients' behaviors in preventing osteoporosis should be based on the conditions of each community.

### Limitation and strength

Considering the limitations of this study, data were collected from nurses working in three hospitals in a city in southeastern Iran. Therefore, these participants might not be representative of all Iranian nurses, and the generalization of the findings should be made with caution. The self-report nature of the administered questionnaires can be considered another limitation of the present study, since participants' responses may be subject to memory failures or other personal issues. Moreover, we used questionnaires originally developed for assessing KAP and nutritional behaviors that were not subscales among non-health professional populations and not among nurses. Therefore, we recommend multicenter studies with specific instruments for nurses to obtain more objective results. Given the strength of the present study, this is the first study in Iran to evaluate the kap and nutritional behaviors of nurses regarding the prevention of osteoporosis.

## Conclusions

The findings showed that Iranian nurses had high levels of knowledge and desirable attitudes, practices, and nutritional behaviors related to osteoporosis prevention. Moreover, the nurses' KAP scores were directly correlated with their nutritional behaviors. Nurses play a key role in influencing public attitudes, enhancing knowledge, promoting healthy practice and nutritional behaviors, and identifying risk factors in patients to prevent osteoporosis. They can help their clients adopt health-promoting lifestyles, engage in osteoporosis prevention behaviors, and make health decisions. In the future, nursing researchers should conduct more studies on the level of KAP and nutritional behaviors of different groups, especially vulnerable groups who are prone to osteoporosis and provide valuable interventions to promote preventive behaviors.

## Ethical Approval

This paper was derived from a thesis on nursing for a master's degree (project code. 96001083) and was approved by the Ethics Committee of Kerman University of Medical Sciences (code of ethics No. IR.Kmu.REC.1396.2479). At the request of the Ethical Committee, the study was conducted in accordance with the Declaration of Helsinki and Ethics Publication on Committee (COPE). No ethical issues were involved in the study or in data collection. The study was conducted after receiving the required permissions from the authorities of the hospitals under study. Informed consent forms were obtained from all participants.

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## Conflict of interest statement

The authors declare that they have no competing interests.

## Authors' contributions

AEM, GF, MM and JF conceived and designed the study. The data were collected, analyzed, and interpreted by AEM. GF, MM, and JF contributed equally to writing and revising the manuscript and approved the final manuscript.

### References


[1] El-Tawab SS, Saba EKA, Elweshahi HMT, Ashry MH. Knowledge of osteoporosis among women in Alexandria (Egypt): A community based survey. Egypt Rheumatol 2016;38:225-31. https://doi.org/10.1016/j.ejr.2015.08.001

[2] Khan JA, McGuigan FE, Akesson KE, Ahmed YM, Abdu F, Rajab H, Albaik M. Osteoporosis knowledge and awareness among university students in Saudi Arabia. Arch Osteoporos 2019;14:8. https://doi.org/10.1007/s11657-019-0560-y

[3] Sözen T, Özışık L, Başaran NÇ. An overview and management of osteoporosis. Eur J Rheumatol 2017;4:46-56. https://doi.org/10.5152/eurjrheum.2016.048

[4] Tootee A, Larijani B. World osteoporosis day: celebrating two decades of progress in preventing osteoporotic fractures in Iran. J Diabetes Metab Disord 2019;18:725-7. https://doi.org/10.1007/s40200-019-00465-4

[5] Nguyen VH. Osteoporosis prevention and osteoporosis exercise in community-based public health programs. Osteoporos Sarcopenia 2017;3:18-31. https://doi.org/10.1016/j.afos.2016.11.004

[6] Peng L, Reynolds N, He A, Liu M, Yang J, She P, Zhang Y. Osteoporosis knowledge and related factors among orthopedic nurses in Hunan province of China. Int J Orthop Trauma Nurs 2020;36:100714. https://doi.org/10.1016/j.ijotn.2019.100714

[7] Chan CY, Mohamed N, Ima-Nirwana S, Chin KY. A Review of Knowledge, Belief and Practice Regarding Osteoporosis among Adolescents and Young Adults. Int J Environ Res Public Health. 2018;15:1727. https://doi.org/10.3390/ijerph15081727

[8] Wang J, Chen L, Yu M, He J. Impact of knowledge, attitude, and practice (KAP)-based rehabilitation education on the KAP of patients with intervertebral disc herniation. Ann Palliat Med 2020;9:388-93. https://doi.org/10.21037/apm.2020.03.01

[9] Tian X, Lian J-x, Yi L-j, Ma L, Wang Y, Cao H, et al. Current status of clinical nursing specialists and the demands of osteoporosis specialized nurses in Mainland China. Int J Nurs 2014;1:306-13. https://doi.org/10.1016/j.ijnss.2014.07.007

[10] Dange AK, Premchand P. Knowledge, attitude and practice of General Medical Practitioners and Nursing professionals regarding osteoporosis. J Cont Med A Dent 2016;4:45-9.

[11] Davies A, Rangan A, Allman-Farinelli M. Dietary Behaviors That Place Young Adults at Risk for Future Osteoporosis. Nutrients 2020;12:1800. https://doi.org/10.3390/nu12061800

[12] Chiavarini M, Naldini G, Fabiani R. The Role of Diet in Osteoporotic Fracture Healing: a Systematic Review. Curr Osteoporos Rep 2020;18:138-47. https://doi.org/10.1007/s11914-020-00573-8

[13] Hannon C, Murphy K. A survey of nurses' and midwives' knowledge of risks and lifestyle factors associated with osteoporosis. J Orthop Nurs 2007;11:30-7. https://doi.org/10.1016/j.joon.2006.12.006

[14] Park CH, Lee YK, Koo KH. Knowledge on Osteoporosis among Nurses. J Bone Metab 2017;24:111-5. https://doi.org/10.11005/jbm.2017.24.2.111

[15] Riaz MS, Kanwal N, Rasool RG. To assess the knowledge of nurses regarding prevention of osteoporosis among nurses of Jinnah Hospital and General Hospital Lahore Pakistan. Int J Soc Sci Manag 2017;4:202-9. https://doi.org/10.3126/ijssm.v4i3.17803

[16] Fourie H, Floyd S, Marshall B. Exploring New Zealand orthopaedic nurses' knowledge of osteoporosis. Orthop Nurs 2015;34:29-35. https://doi.org/10.1097/NOR.0000000000000111

[17] Zhang R, Chandran M. Knowledge of osteoporosis and its related risk factors among nursing professionals. Singapore Med J 2011;52:158-62.

[18] Moradi T, Adib-Hajbaghery M, Safa A, Ahmadishad M. Iranian nurses self-reported mastery and use of musculoskeletal assessment skills. Nurs Midwifery Stud 2021;10:272-7. https://doi.org/10.4103/nms.nms_125_19

[19] Mahdaviazad H, Keshtkar V, Emami MJ, Kargarshouroki Z, Vosoughi AR. Osteoporosis guideline awareness among Iranian nurses: results of a knowledge and attitudes survey. J Prev Med Hyg 2021;62:E415. https://doi.org/10.15167/2421-4248/jpmh2021.62.2.1738

[20] Forouzi M, Haghdoost A, Saidzadeh Z, Mohamadalizadeh S. Study of knowledge and attitude of Rafsanjanian female teachers toward prevention of osteoporosis. J Birjand Univ Med Sci 2009;16:71-7.

[21] Forouzi M, Haghdoost A, Saidzadeh Z, S M. Study of knowledge and attitude of Rafsanjanian female teachers toward prevention of osteoporosis. Thesis of Master in nursing, Kerman University of Medical Sciences 2007.

[22] Seyd Abadi Z, Mohammadi M, Mehri A, Akrami R. Development and Psychometric Assessment of Nutritional Preventive Treatment of osteoporosis in women based on protection motivation theory. J Ilam Univ Med Sci 2017;25:24-33. https://doi.org/10.29252/sjimu.25.4.24

[23] Alshammari KF. Women knowledge, attitude and practices about osteoporosis prevention "Riyadh Saudi Arabia". World J Medical Sci 2014;11:422-31. https://doi.org/10.5829/idosi.wjms.2014.11.3.85242

[24] Ramli N, Rahman NAA, Haque M. Knowledge, Attitude, and Practice Regarding Osteoporosis Among Allied Health Sciences Students in a Public University in Malaysia. Erciyes Med J 2018;40(4). https://doi.org/10.5152/etd.2018.18103

[25] Park DI, Choi-Kwon S, Han K. Health behaviors of Korean female nursing students in relation to obesity and osteoporosis. Nurs Outlook 2015;63:504-11. https://doi.org/10.1016/j.outlook.2015.02.001

[26] Bilal M, Haseeb A, Merchant AZ, Rehman A, Arshad MH, Malik M, Rehman AHU, Rani P, Farhan E, Rehman TS, Shamsi US, Aminah S. Knowledge, beliefs and practices regarding osteoporosis among female medical school entrants in Pakistan. Asia Pac Fam Med 2017;16:6. https://doi.org/10.1186/s12930-017-0036-4

[27] Ghaffari M, Nasirzadeh M, Rakhshanderou S, Bakhtiari MH, Harooni J. Osteoporosis-related knowledge among students of a medical sciences university in Iran: Calcium intake and physical activity. J Med Life 2015;8:203.

[28] Graves RJ, Williams SG, Hauff C, Fruh SM, Sims B, Hudson GM, McDermott RC, Sittig S, Shaw T, Campbell M, Barinas JL, Hall HR. Undergraduate versus graduate nursing students: Differences in nutrition, physical activity, and self-reported body mass index. J Am Coll Health 2022;70:1941-6. https://doi.org/10.1080/07448481.2020.1842421

[29] Ghajari H, Ghaderi N, Valizadeh R, Shakerinezhad G, Haghighizadeh MH. Knowledge, attitude and nutritional behavior of female high school students about consumption of calcium-rich foods in Khorramshahr City, South West of Iran. Int J Pediatr 2016;4:3837-46. https://doi.org/10.22038/ijp.2016.7795

[30] Khan JA, McGuigan FE, Akesson KE, Ahmed YM, Abdu F, Rajab H, Albaik M. Osteoporosis knowledge and awareness among university students in Saudi Arabia. Arch Osteoporos 2019;14:1-7. https://doi.org/10.1007/s11657-019-0560-y

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HEALTH PROMOTION

# Psychotherapy, artificial intelligence and adolescents: ethical aspects

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Keywords

Mental health app • Artificial intelligence • Mental disorder • Ethics • Psychotherapy

Summary

*Artificial intelligence (AI) has rapidly advanced in various domains, including its application in psychotherapy. AI-powered psychotherapy tools present promising solutions for increasing accessibility to mental health care. However, the integration of AI in psychotherapy raises significant ethical concerns that require thorough consideration and regulation to ensure ethical practice, patient safety, and data privacy. This article discusses the ethical considerations surrounding the utilization of AI in psychotherapy, emphasizing the need for responsible implementation, patient privacy, and the human-AI interaction.*

*The challenge raised by the use of artificial intelligence requires a comprehensive approach. Schools, in particular, are crucial in providing both knowledge and ethical guidance, helping young individuals decipher the complexities of online content. Additionally, parental support is essential, requiring the provision of time, fostering relationships, encouraging dialogue, and creating a safe environment to share experiences amidst the intricacies of adolescence. Reimagining social and healthcare services tailored for adolescents is equally crucial, taking into account recent societal changes. The integration of AI in psychotherapy has vast potential to transform mental healthcare. However, ensuring its accuracy and effectiveness demands a proactive approach to address associated ethical considerations. By adopting responsible practices, preserving patient autonomy, and continually refining AI systems, the field can leverage the benefits of AI in psychotherapy while maintaining high ethical standards.*

## Introduction

The introduction of artificial intelligence (AI) in the treatment of mental distress is challenging a range of assumptions and certainties within the professional and epistemological landscape of clinical psychology, raising ethical questions about its impact in psychotherapy, as well as the effects in patients and psychotherapists [1, 2].

The integration of chatbots and other AI apps into psychotherapy doesn't just impact the traditional biomedical ethical concerns of autonomy, beneficence, non-maleficence, and justice; it significantly influences the trust dynamics and relationships between patients and psychotherapists [3, 4].

The increasingly significant proliferation of companies providing digitally-mediated psychotherapy services has begun to gain prominence, particularly in conjunction with the recent pandemic situation [5].

While official statistics providing information about the actual number of patients utilizing these services are not yet available, it is noteworthy that there is a growing number of digital agencies offering such support. Unlike the past, these companies are providing new and valuable insights into the extent of mental distress in Italy, as they are no longer exclusively reliant on data provided by the public healthcare system.

AI-driven tools have proven highly effective in delivering cost-effective and accessible therapeutic solutions. However, these new healthcare services prompt multiple reflections regarding the specific offerings of these applications, the characteristics of the patients accessing these platforms, the interactions created with the intervention recipients, the therapy vision conveyed by marketing strategies, and the effectiveness of the treatment path [6]. In addition, these advancements in AI for mental health, introduce ethical challenges around its uses in psychotherapy that require in-depth consideration on the topics of respect for autonomy, access to treatment, non-discrimination, fulfillment of people's needs, protection of dignity, data privacy and much more [3].

From the limited and still incomplete data provided by digital agencies, it can be inferred that the most prominent users seeking these services primarily consist of adolescents and post-adolescents, aged between 16 and 25 years [7, 8].

These are young individuals who were born and raised in a world deeply immersed in digital technology, a generation accustomed to mediating all forms of relationships and communication through smartphones, social networks, messaging apps; a generation that experienced the most significant moments of their growth within their homes due to the pandemic [9].

These young people have a different perspective on psychotherapy compared to previous generations, even to adults only slightly older (30-40 years old) who grew up with the image of a patient lying on a couch and talking to a psychotherapist physically present in the room.


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With the advent of new technologies and the introduction of digital forms of psychotherapy, the very techniques, tools of the discipline, or the structural rituals of the clinical encounter concerning the physical environment, space, time, and the centrality of the setting have indeed been questioned [10].

Historically, all approaches to mental health have recognized the importance of two fundamental aspects of care: restoring meaning to the dimensions of time and space, often compromised by illness (Eugene Minkowski - Ludwig Binswanger), and externally reorganizing the individual's relationship with these coordinates of reality when the individual themselves was temporarily unable to do so [11].

The tools used for this purpose were precisely represented by those rituals (regularly attending the therapist's office, respecting session times, scheduling appointments in advance, interrupting during the vacation period, and so on), which AI has profoundly altered, giving rise to heated debates.

In digital sessions, access to the clinician's office is no longer necessary, the schedule is flexible, and distances are no longer a reason for interruption. Digital psychotherapies overcome the limits of territoriality, allowing access to treatments for individuals who traditionally had to forego them due to work or geographic distance from treatment facilities [12, 13]. Such innovations therefore allow the possibility of democratizing medicine as a perspectives of justice and care, reducing the gap in access to mental health, which particularly affects the most vulnerable individuals.

On the other hand, there is significant criticism regarding the possibility that such apps might be profit-driven, designed to generate revenue by misleading users with false promises of improving their health. Other concerns raised pertain to the lack of conclusive evidence regarding their effectiveness in diagnosing and treating mental illnesses, as well as the absence of humanistic qualities in chatbots – such as empathy, reflective ability, professionalism, and reliability – essential for delivering widespread mental health treatments [3].

## Technological innovation and mental health

This potential to receive care potentially anywhere and at any time is changing the perception of psychotherapy, enabling an increase in patient intake. However, it also gives rise to new challenges [14].

One of the most significant challenges is related to dropouts, which are associated with the ease of access and familiarity with the digital medium [15, 16]. This particularly affects younger age groups who, after a few months of sessions without observing significant changes, tend to prematurely abandon the therapy and consider it ineffective. As is known, this phenomenon also affects the individual's future willingness to seek help from another therapist. Research shows that for the subsequent five years, individuals, despite continued distress, do not re-engage with any treatment system [17, 18].

The questioning of the fundamental pillars of psychotherapy, particularly the centrality of the setting, a concept common to all clinical approaches regardless of their theoretical foundations, prompts reflection on the epistemological framework of the discipline itself.

The majority of current psychotherapists might assert that digital offerings cannot and should not be identified or recognized as genuine psychotherapy. However, there is also a significant number of scholars who advocate a more cautious approach, suggesting a suspension of judgment to further explore the subject and the cultural changes surrounding the emergence of these new forms of mental health care [19].

Currently, AI governs the majority of algorithms in the online services we interact with daily, It guides our searches on search engines and the advertisements we are continuously exposed to on the internet [20].

This raises a question: based on what criteria will patients be directed to choose a psychotherapist? What elements will the ranking system used by various platforms be based on? Could a ranking of psychotherapists be established based on their professional credentials, or should we consider that this ranking will be calibrated based on user evaluations using parameters that may not necessarily be meaningful, such as the duration of the therapeutic relationship? And what will be considered as positive? Brief therapy or long-term therapy? This presents a challenge, as some schools of thought, like strategic psychotherapy, consider the brevity of the treatment process as a strength, while others, like psychodynamic approaches, view this as a weakness.

If, as can be easily imagined, algorithms decide which intervention is qualitatively more valid, there will be consequences in terms of education as well. Education will inevitably be steered towards models of schools that better cater to the needs of the market, even if they are not based on studies and research backed by scientific evidence. This perspective should indeed prompt significant actions to protect the health of citizens, not only by professional associations and legislators but also by the entire European community.

In the United States, the situation is even more complex, as the government has already authorized several insurance companies to recognize the validity of treatments performed through digital psychotherapy [21].

Among these, some applications targeted at young individuals suffering from depression are equipped with algorithms that can identify, based on linguistic exchanges with the chatbot, certain patterns and words that may indicate suicidal risk [22, 23]. These patterns can be identified by frequency, memory of past situations, or data uploaded by the psychotherapist.

In this case, the machine proves to be more efficient than even the most experienced psychotherapist because it possesses vastly superior computational power, allowing it to analyze billions of data points in minutes and rapidly discriminate high-risk situations. However, the responsibility for treatment remains within the domain

of the therapist, both for ethical and professional reasons that emphasize the irreplaceable value of the human relationship and for legal accountability concerns.
However, the integration of digital tools within the context of a therapeutic relationship between a professional and a patient raises ethical concerns about how mental health apps will impact the therapeutic relationship. For instance, the use of this technology might diminish the therapist's monitoring role, thereby heightening therapeutic risks for patients.
AI could, therefore, play a sort of frontline role (like first aid), enabling the assessment of emergency situations and promptly notifying the clinician. Other applications are aimed at individuals with eating disorders or the treatment of initial psychotic episodes [24]. In these cases, doubts arise about the AI's actual ability to fully meet its intended purposes. While algorithms can identify patterns, they do not possess human intelligence. This highlights the need for collaboration between AI and human therapists to achieve the best results, where AI can provide valuable insights and rapid assessments, while human therapists bring their expertise, ethical considerations, and nuanced understanding of individual cases to the treatment process.
It's therefore crucial to have a human therapist involved in the process to oversee and interpret AI-generated insights. The absence of human judgment might indeed result in misinterpretation or misdiagnosis of patient concerns, potentially causing harm. Patients should be aware of AI involvement in their therapy and its implications. They must provide informed consent and retain autonomy in decisions regarding their treatment. Ensuring transparency and comprehensibility in AI's role is vital for maintaining patient trust.

## Digital therapies for adolescents: Risks and benefits

Certainly, the introduction of AI in the field of mental health brings benefits but also risks and weaknesses. The first limitation relates to the machine's inability to grasp the emotional, symbolic, relational, and anthropological dimensions of the data it is meant to interact with, as it can only decipher the empirical reality. A word holds no evocative value for a machine; it lacks emotional meaning. However, every therapist knows that to understand the individual and their anxieties, the internal and emotional resonances of words are more relevant. For example, consider the power of certain words like "mother", "death", "love", or seemingly innocuous ones for algorithms but bearers of disturbing memories for an individual.
The lack of human supervision in patient interactions not only results in flat and uniform narratives but also poses the risk of dangerous self-diagnosis, without any opportunity for correction [25].
Ensuring that AI systems comply with data protection regulations and safeguarding the privacy of patients' information is an ethical imperative in relation to adverse consequences for individuals and society (Article 8 of the European Convention on Human Rights).
Another ethical and professional concern pertains to privacy and data protection, as well as the type of content being discussed. Where will the data from these conversations be stored? Who will be responsible for the clinical records, the conversation history stored in the cloud? Companies managing this data could go out of business or sell the data, for instance, to prospective employers seeking to acquire personality profiles of potential employees.

## Artificial intelligence and the psychological distress of the youth world

As previously mentioned, the generation turning to these new forms of digital psychotherapy is predominantly composed of adolescents [26]. These are young individuals who are more comfortable interacting with digital media now prevalent in diverse areas of social life (technology, healthcare, finance, culture and more), as they have grown up with it [27]. They often feel misunderstood by adults and are driven by loneliness to seek a non-human other that can listen and be accessed without physical, economic, and social barriers.
As Pietropolli Charmet and Lancini assert, today's youth are growing up in a fragile family environment where both parents usually work, mothers and fathers play distant roles, and relationships lack physical presence. Parents idealize, immortalize, constantly photograph, and put their children on display, burdening them with expectations of achievement and popularity [28, 29].
These images of a magnificent, grandiose self, free from limitations and projected toward every success, expose adolescents to dangerous feelings of disappointment. These emotions are related to the shame of not becoming what was expected, shame for their vulnerabilities, and shame regarding their bodies. The contemporary illnesses affecting adolescents arise from the ideal of an inflated self that collapses during adolescence and leads to the emergence of so-called shame-based pathologies that include social withdrawal, substance use, eating disorders, depression, anxiety, and severe self-harming behavior.
Adolescence, often described as the age of omnipotence and invincibility, is, in reality, the age of confronting limits and one's own vulnerability. Unlike children who fear the death of a parent, adolescents discover that they themselves can die. They uncover their own limitations and vulnerabilities.
The problem of dropping out of school, which predominantly affects males and has been on the rise in recent years, is also related to shame-based pathologies, particularly feelings of inadequacy and unpopularity. It's about the inability to cope with disappointment, frustration, and the challenges of growing up. Furthermore, today's adolescents are often unmotivated to pursue educational qualifications that may have no practical usage and that no longer offer the hope of a better life, as they did in the past.

The generation gap reflects an ever increasing distance between students and teachers, who no longer serve as strong role models for young people. While adults lose credibility and authority, peers, mass media subculture, the internet, YouTubers, and influencers gain influence.
The internet (the virtual world) is one of the modern contexts in which adolescents face the challenge of identity. For them, the internet is a stage that can offer popularity and success but can also lead to dangerous setbacks [9].

## Conclusions

Online, young people are turning to new forms of psychotherapy that they perceive as more accessible and less judgmental. Robots and animals lack ulterior motives, which helps adolescents overcome shame and engage in discussions on intimate and difficult topics [30].
In reality, the exponential increase in adolescent distress, evident from the rising number of adolescents admitted to psychiatric wards, the unprecedented suicide rates, and the significant school dropout rates, requires complex, coordinated efforts among institutions, companies, and associations that are in daily contact with young people. These interventions, however, have so far been isolated and fragmented.
In this context, it is crucial and a top priority to ensure that schools once again provide knowledge and ethical tools to help young people decode the messages of the internet [31]. Additionally, parents need support to offer time, relationships, dialogue, and a space to share their children's pain and support the complexities of growing up.
It is also essential to rethink social and healthcare services for adolescents, taking into account the changes that have occurred in recent years [32]. Despite obvious needs during this phase of life, there are still significant barriers to accessing existing services in local communities. All of this is challenging to accomplish when continuous bureaucratic and political obstacles make every change and progress arduous.
Acknowledging the problem and developing appropriate, comprehensive responses is now essential.
The integration of AI in psychotherapy holds immense potential to revolutionize mental health care. However, to ensure their correctness and effectiveness, it is imperative to address the associated ethical concerns. By incorporating responsible practices, maintaining patient autonomy, and continually refining AI systems, the field can harness the benefits of AI in psychotherapy while upholding ethical standards.

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## Authors' contributions

All authors conceived the study and contributed to the preparation of the manuscript related to their sections and approved the final version to be submitted.

### References

[1] Yan WJ, Ruan QN, Jiang K. Challenges for Artificial Intelligence in Recognizing Mental Disorders. Diagnostics (Basel) 2022;13:2. https://doi.org/10.3390/diagnostics13010002

[2] Ciliberti R, Schiavone V, Alfano L. Artificial intelligence and the caring relationship: ethical profiles. Medicina Hist 2023;7:e2023016.

[3] Manríquez Roa T, Biller-Andorno N, Trachsel M. The Ethics of Artificial Intelligence in Psychotherapy. Oxford Handbook of Psychotherapy Ethics. Oxford: Oxford University Press 2021. https://doi.org/10.1093/oxfordhb/9780198817338.001.0001

[4] Swartz HA, Novick DM. Psychotherapy in the Digital Age: What We Can Learn From Interpersonal Psychotherapy. Am J Psychother 2020;73:15-21. https://doi.org/10.1176/appi.psychotherapy.20190040

[5] Fiorentino V, Romakkaniemi M, Harrikari T, Saraniemi S, Tiitinen L. Towards digitally mediated social work – the impact of the COVID-19 pandemic on encountering clients in social work. Qual Soc Work 2023;22:448-64. https://doi.org/10.1177/14733250221075603

[6] Stoll J, Müller JA, Trachsel M. Ethical Issues in Online Psychotherapy: A Narrative Review. Front Psychiatry 2020;10:993. https://doi.org/10.3389/fpsyt.2019.00993

[7] Orsolini L, Pompili S, Salvi V, Volpe U. A Systematic Review on TeleMental Health in Youth Mental Health: Focus on Anxiety, Depression and Obsessive-Compulsive Disorder. Medicina (Kaunas) 2021;31;57:793. https://doi.org/10.3390/medicina57080793

[8] Mortimer R, Somerville MP, Mechler J, Lindqvist K, Leibovich L, Guerrero-Tates B, Edbrooke-Childs J, Martin P, Midgley N. Connecting over the internet: Establishing the therapeutic alliance in an internet-based treatment for depressed adolescents. Clin Child Psychol Psychiatry 2022;27:549-68. https://doi.org/10.1177/13591045221081193

[9] Khalaf A M, Alubied A A, Khalaf A M, Rifaey AA. Impact of social media on the mental health of adolescents and young adults: A systematic review. Cureus 2023;15:e42990. https://doi.org/10.7759/cureus.42990

[10] Berler M, Trub L, Magaldi D. The therapist's evolving public self in a digitally disrupted marketplace. J Psychother Integr 2023;33:285-301. https://doi.org/ https://doi.org/10.1037/int0000295

[11] Binswanger L. Il problema dello spazio in psicopatologia. Macerata: Quodlibet 2022.

[12] Weightman M. Digital psychotherapy as an effective and timely treatment option for depression and anxiety disorders: Implications for rural and remote practice. J Int Med Res 2020;48:300060520928686. https://doi.org/10.1177/0300060520928686

[13] Renn BN, Hoeft TJ, Lee HS, Bauer AM, Areán PA. Preference for in-person psychotherapy versus digital psychotherapy options for depression: survey of adults in the U.S. NPJ Digit Med 2019;11;2:6. https://doi.org/10.1038/s41746-019-0077-1

[14] McDonald A, Eccles JA, Fallahkhair S, Critchley HD. Online psychotherapy: trailblazing digital healthcare. BJPsych Bull 2020;44:60-6. https://doi.org/10.1192/bjb.2019.66

[15] Fredum HG, Rost F, Ulberg R, Midgley N, Thorén A, Aker JFD, Johansen HF, Sandvand L, Tosterud L, Dahl HJ. Psychotherapy dropout: Using the Adolescent Psychotherapy Q-set to explore the early in-session process of short-term psychodynamic psychotherapy. Front Psychol 2021;22;12:708401. https://doi.org/10.3389/fpsyg.2021.708401

[16] Cohen K A, Schleider JL. Adolescent dropout from brief digital mental health interventions within and beyond randomized trials, Internet Interv 2002;27:100496. https://doi.org/10.1016/j.invent.2022.100496

[17] de Bruin EJ, Meijer AM. The impact of online therapeutic feedback on outcome measures in Internet-CBTI for adolescents with insomnia. Sleep Med 2017;29:68-75. https://doi.org/10.1016/j.sleep.2016.05.017

[18] Victor P, Krug I, Vehoff C, Lyons N, Willutzki U. Strengths-based CBT: Internet-based versus face-to-face therapy in a randomized controlled trial. J Depress Anxiety 2018;7:2. https://doi.org/10.4172/2167-1044.1000301

[19] Imondi V. iConscious: L'Inconscio connettivo: Psicopatologia delle masse nell'era di Internet e analisi dell'Io digitale - 2020.

[20] Busuioc M. Accountable artificial intelligence: Holding algorithms to account. Public Adm Rev 2021;81:25-836. https://doi.org/10.1111/puar.13293

[21] Santoro E. La digital health a supporto della professione medica. Ric&Pra 2021;37:15-22. https://doi.org/10.1707/3556.35319

[22] Khan NZ, Javed MA. Use of artificial intelligence-based strategies for assessing suicidal behavior and mental illness: A literature review. Cureus 2022;14:e27225. https://doi.org/10.7759/cureus.27225

[23] Menon V, Vijayakumar L. Artificial intelligence-based approaches for suicide prediction: Hope or hype? Asian J Psychiatr 2023;88:103728. https://doi.org/10.1016/j.ajp.2023.103728

[24] Di Leo D. Terapie digitali ed intelligenza artificiale, applicazioni pratiche e quadro normativo. Tendenze nuove 2021;2:3-11. https://doi.org/10.32032

[25] Bauer M, Glenn T, Monteith S, Bauer R, Whybrow PC, Geddes J. Ethical perspectives on recommending digital technology for patients with mental illness. Int J Bipolar Disord 2017;5:1-14. https://doi.org/10.1186/s40345-017-0073-9

[26] Lehtimaki S, Martic J, Wahl B, Foster KT, Schwalbe N. Evidence on digital mental health interventions for adolescents and young people: Systematic overview. JMIR Ment Health 2021;8:e25847. https://doi.org/10.2196/25847

[27] Licata M, Larentis O, Tesi C, Fusco R, Ciliberti R. Tourism in the time of Coronavirus. Fruition of the "minor heritage" through the development of bioarchaeological sites, our proposal. Tourism Management 2020;21:19. https://doi.org/https://doi.org/10.3390/heritage4020042

[28] Lancini M. Il ritiro sociale degli adolescenti. La solitudine di una generazione iperconnessa. Milano: Raffaello Cortina 2019.

[29] Polli Charmet P. Fragili e spavaldi: ritratto degli adolescenti di oggi. Bari: Laterza ed. 2010.

[30] Opel DJ, Kious BM, Cohen IG. AI as a mental health therapist for adolescents. JAMA Pediatr 2023;177:1253-1254. https://doi.org/10.1001/jamapediatrics.2023.4215

[31] Gulino M, Patuzzo S, Baldelli I, Gazzaniga V, Merlo DF, Maiorana L, Murialdo G, Picozzi M, Armocida G, Cattorini P, Montaguti E, Bonometti S, Grossi AA, DeStefano F, Ciliberti R. Bioethics in Italian medical and healthcare education. A pilot study. Acta Biomed 2018;89:519-31. https://doi.org/10.23750/abm.v89i4.7238

[32] Ciliberti R, Alfano L, Baldelli I, De Stefano F, Bonsignore A. Self-determination, healthcare treatment and minors in Italian clinical practice: ethical, psychological, juridical and medical–legal profiles. Acta Biomed 2018;89:34-40. https://doi.org/10.23750/abm.v89i1.6368

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HEALTH PROMOTION

# Ethics in aquaculture: animal welfare and environmental sustainability

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Keywords

EU aquaculture • Sentience • Fish • Food • Animal welfare

Summary

*In recent decades, also driven by the European Union, aquaculture has undergone significant development to meet the increasing demand for seafood products. However, the concentration of efforts and resources in the fishing industry raises complex ethical issues that have yet to be fully explored, concerning animal welfare, environmental impact, and social justice. Balancing economic interests with environmental and ethical concerns is a challenging yet crucial task to ensuring a sustainable future for aquaculture. The adoption of ethical values in the fishing industry not only promotes economic, environmental, and social responsibility but also fosters consumer trust in responsible food sourcing. Interventions such as developing animal welfare standards, implementing sustainable farming techniques, adopting environmental management policies, and promoting ethically responsible business practices are pivotal. A multidimensional approach is essential to ensure an ethical and sustainable future for aquaculture, critical for global food security and marine environmental well-being. This holistic approach requires collaborative efforts from various stakeholders, including policymakers, researchers, industry players, and consumers, to address the multifaceted challenges faced by the aquaculture sector. Additionally, raising awareness among consumers about the impact of their choices on the environment and animal welfare can further drive the demand for ethically produced seafood and encourage responsible practices within the industry.*

## Introduction

Aquaculture represents a crucial resource bridging the growing global food demand and environmental sustainability promoted by the European 'Green Deal' program aimed at reducing greenhouse gas emissions by 50% by 2030 [1, 2]. As part of efforts to achieve this ambitious goal, farmed fish products, as a source of protein for food and feed with a low carbon footprint, emerge as a highly valuable resource in building a sustainable food system. Additionally, certain aquaculture activities, such as bivalve farming, can play a significant role in ecosystem decarbonization [3, 4].
Among the EU member States, in 2017, Italy ranked as the third-largest aquaculture producer alongside the United Kingdom (14%), following Spain (21%) and France (15%). However, in terms of production value, the United Kingdom took the lead (21%), followed by France (16%) and Spain [5]. Over the past decade, the European Commission has increased efforts to enhance the EU's aquaculture potential, including the publication of its "New strategic guidelines for more sustainable and competitive EU aquaculture for the period 2021-2030" (COM(2021)0236) [6].
The new guidelines complement the overall "Farm to Fork" strategy aimed at accelerating the EU's transition toward a sustainable food system, acknowledging the potential of sustainable aquaculture to provide low-carbon footprint food and feed. These guidelines place particular emphasis on fish health and welfare (2.1.3; 2.2.2) [7]. These aspects, which have significant moral implications, are also considered strategic concerning the economic benefits for the sector. Specifically, they highlight the need to address the following challenges:

- lack of good practices and species-specific farming technologies within aquaculture;
- the need to better prevent diseases and parasite infestations, thus reducing the need for veterinary medicines;
- the necessity to decrease the reliance on pharmaceutical products, including antimicrobials and antiparasitic substances, which can harm the environment or contribute to antimicrobial resistance;
- gaps in research (including the fish microbiome, potential impacts of climate change on fish health, and stress effects on fish immune systems);
- limited availability of specific veterinary medicines (including vaccines) for use in aquatic animals;
- lack of good practice for early detection, prevention, and control of aquatic diseases not listed in relevant EU legislation.

## Fish welfare: what regulatory attention?

Despite fish welfare receiving less attention in recent times compared to that of other farmed animals, various

measures have been implemented on an international scale within the legal framework [8, 9].

On December 5, 2005, the Permanent Committee of the European Convention for the Protection of Animals Kept for Farming Purposes adopted the "Recommendation concerning farmed fish" (which entered into force on June 5, 2006). This recommendation provides specific guidelines for best practices in fish farming to ensure welfare, considering significant interspecies differences in water conditions, social behavior, and environmental structures. Although somewhat generic, these elements are fundamental in promoting the health and welfare of farmed fish. Specific training for all individuals involved in fish farming, tailored to their diverse managerial responsibilities, is considered an essential component in this regard [10].

In 2008, the World Organisation for Animal Health adopted guidelines concerning the welfare of farmed fish during transport (Welfare of farmed fish during transport - OIE Aquatic Animal Health Code, Chapter 7.2-10/06/2016) [11].

The Marine Strategy Framework Directive 2008/56/EC represents the initial binding regulatory tool for EU Member States to consider the marine environment systemically [12]. Also noteworthy is Directive 2010/63/EU (2010) on the protection of animals used for scientific purposes. In Recital 8, it specifies that its scope includes "not only vertebrate animals, which include cyclostomes" but also cephalopods "since their ability to experience pain, suffering, distress, and lasting harm has been scientifically proven".

Directive N. 2014/89/EU establishes a framework for maritime spatial planning, aiming to promote sustainable growth of economies associated with the sea and sustainable development of marine areas while ensuring the responsible use of resources. Additionally, the previously mentioned "New strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021-2030" (COM(2021)0236) from the European Commission deserve special consideration.

This document explicitly refers to both Council Directive 98/58/EC concerning the protection of animals kept for farming purposes (establishing general standards for the protection of animals of all species kept for the production of food, wool, skin, fur, or other agricultural purposes, including fish, reptiles, and amphibians) and Council Regulation (EC) N. 1099/2009 on the protection of animals at the time of killing, which identifies general requirements for the preservation, transport, and slaughter of farmed fish. In addition, these guidelines explicitly reference Council Regulation (EC) No. 889/2008 on organic production, which defines more specific requirements such as maximum stock density levels, restrictions on the use of artificial light and oxygen, *etc*.

Despite the importance of these international regulatory references, the European Commission considers them insufficient for safeguarding fish welfare, explicitly urging the adoption of further measures to:

- develop best practices concerning fish welfare during rearing, transportation, and slaughter;
- establish common, validated, species-specific, and measurable indicators concerning fish welfare throughout the entire production chain (including transportation and slaughter);
- pursue research and innovation, particularly on species-specific welfare parameters, including nutritional requirements in different farming systems; and
- provide fish welfare knowledge and expertise to fish farmers and other operators involved in managing farmed live fish.

## The topic of sentience and the welfare of fish

The issue of sentience and fish welfare is undoubtedly central to ethical reflections that emphasize the need to overcome the traditional view of animals merely as instruments serving humans, acknowledging them as entities with specific value, dignity, and in some cases, even subjectivity [13, 14].

However, attention to the welfare of fish destined for human consumption has received limited recognition (even legally) in the broader debate on animal welfare, which has been almost exclusively focused on terrestrial animals.

The topic of fish welfare -in the context of experimentation and dietary practices- is relevant in connection to recognizing the intrinsic value of the animal itself and its sentience- its capacity to consciously receive and react to stimuli, perceiving them within its own consciousness, and relating to environmental contexts consciously, following a continuity line with humans. This is also in relation to the public interest in benefiting from high standards of animal health and welfare, ensuring the quality of the consumed product [15].

The significance of the neocortex in the neural mechanism in humans, correlated with its absence in fish (as well as in non-mammalian animals), has long generated the belief that such animals were exempt from the subjective experience of suffering.

According to Rose et al. (2014), the extensive literature on surgical interventions in fish reports normal feeding and activity immediately after these procedures, emphasizing their post-operative normalcy. This study highlights that C-fiber nociceptors are the most widespread type in mammals and responsible for lancinating pain in humans while they are rare in teleosts, and absent in elasmobranchs. Additionally, A-delta nociceptors, not yet found in elasmobranchs but relatively common in teleosts, likely serve to signal rapid and less harmful injuries, triggering flight and avoidance responses [16]. However, empirical studies, while emphasizing that the capacity to suffer may differ in "degree" and "type" from human experience, have shown that painful stimuli are strongly aversive to fish [17]. Specifically, these studies have identified, in addition to behavioral

responses, a peripheral nociceptive system and recorded specific changes in fish brain activity during nociceptive stimulation. Based on these observations, teleost fish should be considered capable of nociception and, according to some opinions, perception of pain.

As a result, injuries or experience of other harmful conditions are a concern in terms of the well-being of individual fish. Growing evidence also highlights that fish can experience states akin to fear and avoid situations where they have encountered adverse conditions [18]. Sneddon indicates that the nociceptive system biology in fish is surprisingly similar to that of mammals. In addition, potentially painful events trigger behavioral and physiological changes such as reduced activity, vigilant behavior, suspension of normal behavior, increased ventilation rates, and anomalous behaviors, all of which are prevented using pain-relief medications [19].

The welfare of farmed fish, as sentient beings with specific ethological needs, thus becomes an essential point that requires particular and appropriate conditions not only to ensure the absence of pain but also to uphold the right to live in a suitable environment. This environment should enable the expression of a wide range of natural behaviors, access to proper nutrition, and minimize diseases and stress. Ensuring living conditions similar to their wild counterparts not only aligns with an important ethical principle of respecting otherness and vulnerability but can also ensure the success of restocking plans [20].

In general, providing favorable conditions for the welfare of non-human animals kept in captivity is more easily achievable when dealing with a few individuals. However, this becomes much more challenging, if not impossible, in intensive farming conditions that may involve a high number of animals living in large groups. While this is an intrinsic problem in intensive animal farming, it is particularly evident in aquaculture practices, often relying on extremely high numbers.

In general, the assessment of the welfare of fish in aquaculture can be done using the freedoms proposed in 1992 by the Farm Animal Welfare Council of the United Kingdom, which outlined the five notable freedoms for animals: (1) freedom from hunger or thirst; (2) freedom from discomfort; (3) freedom from pain, injury, or disease; (4) freedom to express normal behavior; and (5) freedom from fear or distress.

These recommendations imply a commitment to provide animals with accommodation, environment, food resources, water, and care suitable for their health and well-being. This involves continuous and careful monitoring of transport conditions, housing environments, and the ability to take appropriate and timely measures to eliminate deficiencies, pain, suffering, distress, or lasting harm. Additionally, animals must be transported under adequate conditions. The European Commission provides clear guidelines on its dedicated Animal Welfare website [21].

Ensuring the welfare of farmed fish in aquaculture farms is a complex issue involving a plurality of species-specific variables that require adequate knowledge, consideration, and monitoring. These necessitate adequate knowledge, consideration, and monitoring. Parameters such as the physicochemical aspects of water, welfare indicators, environmental complexity, stocking density, and the social and foraging behaviors of the animals become particularly relevant in this context [22].

According to Ashley (2007), the concept of welfare should encompass not only physical health but also a broader aspect related to the absence of mental suffering. However, it's important to note that, according to this author, the stress response is an adaptive function and doesn't necessarily equate to suffering or poor well-being [23].

Ensuring the welfare of fish thus requires a thorough understanding of the biology of the various species housed, each having specific anatomical, physiological, and behavioral characteristics. These characteristics necessitate physical and chemical requirements.

These factors make it challenging to provide generalized recommendations or requirements for all fish species, highlighting the need for a comprehensive understanding of the physiology and ecology of each farmed species. It is also crucial to consider the equipment and appropriate resources necessary to provide a suitable environment that considers both the biodiversity of fish species and the unique aspects of each environmental context [22].

Supporting the commitment outlined by the EU towards greater attention to animal welfare, certain unique aspects of aquaculture in comparison to other forms of interaction with animals cannot be ignored. These aspects complicate the determination of individual animal welfare [24]. As highlighted in the document by the Bioethical Committee for Veterinary and Agri-food in aquaculture, evaluating individual welfare conditions must be based on objective parameters inherent to the sensitivity, suffering, and species-specific perceptual capacity [25]. This necessity inevitably entails acquiring data from studies conducted on a sufficiently extensive population of specimens to ensure statistical significance, given the high physiological and behavioral diversity among the various aquatically farmed species. Each species is uniquely characterized by specific dietary, health, and behavioral needs.

A particularly critical aspect involves the inferential methodology based on observing a subset of the population to draw conclusions that can be species-specific or generalized to the entire population. In addition, it is important to note that scientific knowledge regarding species physiology applies to an individual within the species group only through deduction from the entire species. The very practices in aquaculture, concentrating a very high number of specimens in a confined space, lead to perceiving fish as a homogeneous entity where individuality holds no significance.

In its report (Command Paper 2836, 1965), the Brambell Committee stated that "welfare is a broad term encompassing both the physical and mental well-being of the animal. Therefore, an attempt to assess welfare must take into account the scientific evidence available

on the feelings of animals, which can be inferred from their structure, functions, and behavior" [26].

## Ethical dilemmas and decision-making complexities: conclusions

Aquaculture has become a significant source of global food supply. While it offers solutions to the growing demand for seafood, it also presents a multitude of ethical challenges that require careful consideration.

One crucial ethical issue of aquaculture concerns its environmental impact. Industry expansion often leads to habitat alteration, pollution and genetic interactions with wild populations. Ensuring responsible practices that minimize environmental degradation and safeguard biodiversity is critical to ethical and sustainable aquaculture.

Another major ethical concern in aquaculture is the balance between production needs and fish welfare.

Assessing the welfare of fish is a complex ethical challenge requiring a multidimensional approach [27]. Parameters such as water quality, population density, environmental enrichment, and feeding regimes must be carefully monitored to ensure the well-being of different aquatic species. This requires an ongoing research effort to identify new welfare indicators that are specific and more effective for different fish species [28, 29].

Establishing clear ethical standards and effective regulations is crucial. Ethical guidelines must ensure adequate space for aquatic organisms, responsible use of resources, mitigation of environmental impacts, and proper training of staff in assessing and managing fish welfare. Regulatory frameworks must evolve to address these complex ethical challenges, ensuring compliance and accountability throughout the aquaculture sector. Clear and comprehensive guidelines are imperative not only to ensure the welfare of aquatic species, but also to avoid compromising the future development of the industry. Moreover, the distinct nature of fish farming, regulated by aquatic ecosystems, underscores the need for tailor-made ethical parameters.

Implementing strict animal welfare standards, promoting sustainable farming practices, adopting environmental management policies, using innovative technologies, and training staff in assessing and managing fish welfare are all essential. In addition, consumer education on sustainable practices and their environmental impact plays a critical role in shaping ethical choices in purchasing preferences [30, 31].

Alongside the increasing focus on fish welfare, it is important to highlight the significance the EU Commission places on social acceptance and recognizing the benefits and value of aquaculture activities and products for the growth of this sector. Among the particularly important factors in achieving this goal, effective communication about the practices of sustainable aquaculture plays a fundamental role [28, 32].

Stakeholders' negative perceptions of aquaculture activities, particularly in terms of their impact on the environment and other economic activities is a dangerous barrier to the establishment of new aquaculture facilities. Therefore, a public awareness campaign should emphasize the numerous, often largely unknown, benefits of aquaculture: job creation in remote areas, providing access to a low-carbon food source, and offering ecosystem services.

Continued research and technological innovation also play an important role in this area. Advances in aquaculture technology, genetic selection and sustainable food alternatives may indeed offer new avenues towards more ethical and environmentally conscious practices.

Balancing production needs with animal welfare, minimizing environmental impacts, establishing robust ethical standards, promoting transparency, and encouraging innovation are key pillars in ensuring an ethical and sustainable future for the aquaculture industry. By integrating ethical considerations into practices and policies, we can work towards greater protection of aquatic life and the planet as a whole.

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## Conflict of interest statement

The authors declare no conflict of interest.

## Authors' contribution

All authors conceived the study and contributed to the preparation of the manuscript related to their sections and approved the final version to be submitted.

### References

[1] Metz S, Claudet J. Research for PECH Committee – Workshop on the European Green Deal – Challenges and opportunities for EU fisheries and aquaculture – Part II: Marine biodiversity aspects, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels; 2023. Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2023/747295/IPOL_STU(2023)747295_EN.pdf (Accessed on: 8/11/2023).

[2] Aquaculture Advisory Council. The provision of ecosystem services by European aquaculture. Brussels: Aquaculture Advisory Council (AAC) 2021. http://dx.doi.org/10.25607/OBP-1707 (Accessed on: 8/11/2023).

[3] Gallardi D. Effects of bivalve aquaculture on the environment and their possible mitigation: a review. Fish Aquac J 2014;5:3. https://doi.org/10.4172/2150-3508.1000105

[4] Filgueira R, Guyondet T, Comeau LA, Tremblay R. Bivalve aquaculture-environment interactions in the context of climate change. Glob Chang Biol 2016;22:3901-13. https://doi.org/10.1111/gcb.13346

[5] European Parliament. Aquaculture production in the European Union. 2023. Available at: https://www.europarl.europa.eu/

factsheets/en/sheet/120/aquaculture-production-in-the-european-union (Accessed on: 8/11/2023).

[6] European Commission. COM(2021) 236 final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021 to 2030 - 2021. Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:bab1f9a7-b30b-11eb-8aca-01aa75ed71a1.0022.02/DOC_1&format=PDF (Accessed on: 8/11/2023).

[7] Dara M, Carbonara P, La Corte C, Parrinello D, Cammarata M, Parisi MG. Fish welfare in aquaculture: physiological and immunological activities for diets, social and spatial stress on Mediterranean aqua cultured species. Fishes 2023;8:414. https://doi.org/10.3390/fishes8080414

[8] Segner H, Reiser S, Ruane N, Rösch R, Steinhagen D, Vehanen, T. Welfare of fishes in aquaculture. FAO Fisheries and Aquaculture Circular N. C1189. Budapest: FAO 2019.

[9] Martini M, Penco S, Baldelli I, Biolatti B, Ciliberti R. An ethics for the living world: operation methods of animal ethics committees in Italy. Ann Ist 2015;51:244-7. https://doi.org/10.4415/ANN_15_03_13

[10] Standing Committee of the European Convention for the Protection of Animals kept for farming Purposes (T-AP). Recommendation concerning farmed fish - 5 December 2005. Available at: https://www.coe.int/t/e/legal_affairs/legal_co-operation/biological_safety_and_use_of_animals/Farming/Rec%20fish%20E.asp (Accessed on: 1/11/2023).

[11] World Organisation for Animal Health. Protecting animals, preserving our future. Aquatic Animal Health Code. 22th ed. 2019. Available at: https://rr-europe.woah.org/wp-content/uploads/2020/08/oie-aqua-code_2019_en.pdf (Accessed on: 1/11/2023).

[12] [12] Directive 2008/56/CE of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02008L0056-20170607&from=PL (Accessed on: 1/11/2023).

[13] Italian Committee for Bioethics. Bioethics and veterinary science, animal well-being and human health. 2001; Available at: https://bioetica.governo.it/en/opinions/opinions-responses/bioethics-and-veterinary-science-animal-well-being-and-human-health/ (Accessed on: 1/11/2023).

[14] [14] Ciliberti R, Monteleone R, Bandini, P Alfano L. The constitutional protection of animals, the environment, biodiversity, and ecosystems. Let's change: an invitation collected. Medicina Hist 2022;6(S1):e2022025

[15] Baldelli I, Biolatti B, Santi P, Murialdo G, Bassi AM, Santori G, Ciliberti R. Conscientious objection to animal testing: a preliminary survey among Italian medical and veterinary students. Altern Lab Anim 2019;47:30-8. https://doi.org/10.1177/0261192919840452

[16] Rose JD, Arlinghaus R, Cooke SJ, Diggles BK, Sawynok W, Stevens ED, Wynne CDL. Can fish really feel pain? Fish Fish 2014;15:97-133. https://doi.org/https://doi.org/10.1111/faf.12010

[17] Sneddon LU. Pain perception in fish: indicators and endpoints. ILAR J 2009;50:338-42. https://doi.org/10.1093/ilar.50.4.338

[18] Schroeder P. Pain sensitivity in fish. CAB Rev 2018;13:1-6. https://doi.org/10.1079/PAVSNNR201813049

[19] Sneddon LU. Evolution of nociception and pain: evidence from fish models. Philos Trans R Soc Lond B Biol Sci 2019;374:20190290. https://doi.org/10.1098/rstb.2019.0290

[20] [20] Huntingford FA, Adams C, Braithwaite V, Kadri S, Pottinger T, Sandøe P, Turnbull J. Current issues in fish welfare. J Fish Biol 2007;70:1311-6. https://doi.org/https://doi.org/10.1111/j.0022-1112.2006.001046.x

[21] European Commision. Animal welfare. Eurobarometer: attitudes of Europeans towards animal welfare. 2023. Available at: https://food.ec.europa.eu/animals/animal-welfare_en (Accessed on: 1/11/2023).

[22] Toni M, Manciocco A, Angiulli E, Alleva E, Cioni C, Malavasi S. Review: assessing fish welfare in research and aquaculture, with a focus on European directives. Animal 2019;13:161-70. https://doi.org/10.1017/S1751731118000940

[23] Ashley PJ. Fish welfare: current issues in aquaculture. Appl Anim Behav Sci 2007;104:199-235. https://doi.org/1010.1016/j.applanim.2006.09.001

[24] Torgerson-White L, Sánchez-Suárez W. Looking beyond the Shoal: fish welfare as an individual attribute. Animals (Basel) 2022;12:2592. https://doi.org/10.3390/ani12192592

[25] Comitato Bioetico per la Veterinaria e l'agroalimentare nella acquacoltura. Acquacoltura: profili bioetici e biogiuridici. 2020. Available at: https://www.istitutoibva.it/wp/Doc%20Acquacoltura.pdf (Accessed on: 1/11/2023).

[26] Brambell FWR. Report of the technical committee to enquire into the welfare of animals kept under intensive livestock husbandry systems. 1th ed. London: Her Majesty's Stationery Office 1965.

[27] Grigorakis K. Ethical issues in aquaculture production. J Agric Environ Ethics 2010;23:345-70. https://doi.org/10.1007/s10806-009-9210-5

[28] Bovenkerk B, Meijboom F. Ethics and the welfare of fish. In: Kristiansen TS, Fernö A, Pavlidis MA, van de Vis H, eds. The welfare of fish. Cham: Springer 2020, pp. 19-42.

[29] Evans JC. The ethics of fish welfare. J Fish Biol 2009;75:2872-4. https://doi.org/10.1111/j.1095-8649.2009.02463.x

[30] Fiorile G, Puleo S, Colonna F, Mincione S, Masi P, Herranz Solana N, Di Monaco R. Consumers' awareness of fish traceability and sustainability: an exploratory study in Italy and Spain. Sustainability 2023;15:14103. https://doi.org/10.3390/su151914103

[31] Peiró-Signes A, Miret-Pastor L, Galati A, Segarra-Oña M. Consumer demand for environmental, social, and ethical information in fishery and aquaculture product labels. Front Mar Sci 2022;9. https://doi.org/10.3389/fmars.2022.948437

[32] Nicheva S, Waldo S, Nielsen R, Lasner T, Guillen J, Jackson E, Motova A, Cozzolino M, Lamprakis A, Zhelev K, Llorente I. Collecting demographic data for the EU aquaculture sector: what can we learn? Aquaculture 2022;559:738382. https://doi.org/10.1016/j.aquaculture.2022.738382

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HEALTH PROMOTION

# Predictive factors of breast cancer mammography screening among Iranian women

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Keywords

Breast cancer • Mammography • Lifestyle • Predictors

Summary

**Introduction**. *Understanding the factors that influence women's cancer screening behavior is crucial in reducing cancer mortality through early detection. Therefore, the objective of this study was to examine the status of mammography and related factors among women who presented to the health centers of Khorasan Razavi province, Iran.*

**Methods**. *For this study, a sample of 251,011 women who visited healthcare centers affiliated with Mashhad University of Medical Sciences was selected. The study examined several variables, including sociodemographic information, current smoking, nutrition status, and physical exercise. All analyses were performed using Python programming language and SPSS software. Furthermore, to handle imbalanced data, we used SMOTE balancing method that is an oversampling method and produce synthetic samples from the minority class.*

**Results**. *The factors of age, education, being employed, having children, family history of cancer, physical activity, smoking status, and diet were all predictors of mammography screening. Moreover, findings showed that age and family history of breast cancer were most important variables to predict mammography status, respectively.*

**Conclusions**. *By examining various variables such as dietary habits, exercise, smoking, and demographic properties, it sheds light on the relationships between these factors and mammography screening. This provides valuable insights into the associations between breast cancer screening behavior and preventive lifestyle behaviors. By targeting both preventive lifestyle choices and breast cancer screening behaviors, interventions can effectively promote positive changes in behavior and ultimately reduce the incidence and impact of breast cancer.*

## Introduction

Breast cancer is a significant health concern globally, ranking as the second leading cause of death after cardiovascular disease [1]. In Iran, the incidence of breast cancer has shown an upward trend according to national cancer registry reports from 2003 to 2017, affecting both women and men. The age-specific incidence rates of breast cancer among women were 15.96 per 100,000 in 2003 and increased to 40.72 per 100,000 in 2017 [2]. Unfortunately, the findings also indicate that Iranian women have low awareness of breast cancer preventive behaviors. Additionally, the utilization of screening methods such as self-examination, clinical examination, and mammography is also low [3].

Early detection plays a crucial role in reducing both the mortality and morbidity associated with cancer. Cancer screening techniques, such as mammography, have proven to be effective in identifying breast cancer at an early stage. Without early diagnosis, the costs of treatment tend to increase, resources may not be utilized efficiently, and the need for supportive services may rise [3]. Study conducted by Uhachi et al. have specifically examined the rate of early detection of breast cancer using screening accompanied by mammography. Their findings indicated that with screening accompanied by mammography, a higher number of breast cancers can be identified and detected compared to screening without mammography [4]. These results highlight the importance of incorporating mammography into breast cancer screening programs to enhance the effectiveness of early detection efforts.

Previous studies have highlighted that screening behavior for breast cancer is influenced by various factors within social environments. These factors include age, income, marital status, education, screening service delivery, perception of disease risk, cultural barriers, and physician's recommendation [5, 6]. Furthermore, there is substantial evidence indicating that lifestyle and health behaviors, such as cigarette smoking, diet, exercise, and mental well-being, play a significant role in the development of breast cancer and the likelihood of undergoing screening tests. Women who maintain a healthy lifestyle throughout their lives are more likely to regularly participate in screening tests [7]. Therefore, it is crucial to enhance our understanding of the factors associated with consistent mammography screening, particularly those related to lifestyle and health promotion. In this regard, in addition to examining sociodemographic factors, we assessed certain lifestyle factors, including smoking status, physical activity, and attention to diet, which may impact participation in mammography screening.


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Increasing public awareness about the risk factors associated with breast cancer is indeed crucial, considering the low awareness among women. It is important to educate women about these risk factors to empower them to take proactive measures for early detection and prevention [8]. Studies conducted in Iran have shown that women often delay seeking medical attention for breast cancer diagnosis, leading to a decreased chance of survival. This emphasizes the need for timely detection and intervention to improve outcomes [9]. Therefore, the objective of this study was to examine the status of mammography and related factors among women who presented to the health centers of Khorasan Razavi province, Iran. By understanding the current situation and associated factors of mammography utilization, appropriate interventions can be developed to improve screening rates and ultimately enhance breast cancer outcomes in the region.

## Methods

This cross-sectional descriptive study, conducted in 2023, focused on women who sought healthcare services in the health centers of Razavi Khorasan province of Iran. The data for this study was obtained from the Sina electronic health record system database, which is supervised by Mashhad University of Medical Sciences. Since 2015, the Sina system has been utilized in Razavi Khorasan Province to electronically register health records of clients in the province's health centers. The system contains various information, including demographic data, individual health records, reports from doctors and healthcare providers, as well as screening and care forms for different age groups.

For this study, a sample of 251,011 women who visited healthcare centers affiliated with Mashhad University of Medical Sciences was selected. The study examined several variables, including sociodemographic information such as age, educational level, marital status, employment status, family history of cancer, and whether they had children. Furthermore, to assess lifestyle behaviors, several factors were taken into account, including current smoking (yes or no), nutrition status (desirable or undesirable), and physical exercise (desirable or undesirable). Leisure-time physical activity was measured using the International Physical Activity Questionnaire [10]. Participants who reported engaging in at least 150 minutes of walking or moderate physical activity per week, or at least 60 minutes of strenuous physical activity per week, were classified as physically active (desirable). On the other hand, those who reported less than 150 minutes of walking or moderate physical activity per week, or less than 60 minutes of strenuous physical activity per week, were considered physically inactive (undesirable). Regarding nutrition status, the study examined the desirable and undesirable rankings of three food groups: dairy products, vegetables and fruits, and fast food. The desirable consumption of each food group, including dairy products, fruits, and vegetables, was defined as consuming 3-2 units per day. On the other hand, the undesirable definition of nutrition was consuming less than 3-2 units of dairy products, fruits, and vegetables daily. As for fast food, consuming it rarely or never was considered desirable, while consuming it more than twice a month was considered undesirable.

The dependent variable was whether or not individuals had undergone a mammography test within the last three years. This variable was used to assess the frequency of mammography screenings among the study participants.

### Data analysis

All analyses in this study were performed using Python programming language version 3.0 and SPSS software version 25. To check the normality assumption of age, the Kolmogorov–Smirnov test was used. Initial association between independent variables and outcome was studied using Chi-square statistical test. Before model building, data were preprocessed and a comprehensive review of the data was done. After removing inaccurate, irrelevant, missing, and incomplete data, a complete dataset with 9 variables and 251,011 instances remained. Furthermore, to handle imbalanced data, we used SMOTE (Synthetic Minority Over-sampling Technique) balancing method that is an oversampling method and produce synthetic samples from the minority class [11].

### Modeling

To model data, two machine learning techniques including binary logistic regression and binary decision tree were used as classifier to perform the classification task. Logistic regression is a widely statistical method in the medical researches. The popularity of the LR model compared to other methods among medical researchers is that the exponentiated slope coefficient in the LR model can be interpreted as an odds ratio (OR) [12, 13]. Decision tree algorithm are non-parametric and non-linear methods. On the other hand, these used in the most fields, especially medical sciences which applies to classification problems (binary or multiple outcomes) as well as the regression problems [14-16]. To predict the outcome, predictors in each nodes are split into hierarchical nodes based on the entropy or Gini impurity indices [17]. One of the reasons for the popularity of the decision tree among doctors and decision makers is the simple interpretability of it [14].

### Parameter estimation techniques

The K-fold cross-validation (CV) procedure was used to estimate the optimal hyper parameters with respect to that this procedure provides almost unbiased estimates. The K-fold CV approaches were combined with grid search method to set the best model hyper-parameters and evaluate the performance of model on training and test dataset as well.

There are some hyper parameters in decision tree that must be tuned. The max_depth that refers to the maximum depth of the tree, Gini index/entropy/ information gain as a criterion for measuring impurity of

**Tab. I.** Description of demographics and clinical characteristics

| Attribute | Level | Mammography- | Mammography+ | Effect size/Phi coefficient (p value) |
|---|---|---|---|---|
| Age | - | 45.0 (14.0)* | 52.0 (11.0)* | 0.065 (< 0.001) |
| Having a child | No | 14,009(5.6) | 375 (0.1) | 0.023 (< 0.001) |
| | Yes | 225,686 (89.9) | 10,941 (4.4) | |
| Family history of breast cancer | No | 231,682 (92.3) | 9,832 (3.9) | 0.106 (< 0.001) |
| | Yes | 8,013 (3.2) | 1,484 (0.6) | |
| Smoking | No | 220,150 (87.7) | 10,468 (4.2) | -0.005 (0.012) |
| | Yes | 19,545 (7.8) | 848 (0.3) | |
| Dietary | Desirable | 221,397 (88.5) | 10,650 (4.3) | -0.015 (< 0.001) |
| | Undesirable | 17,637 (7.0) | 623 (0.2) | |
| Physical Activity | Desirable | 124,665 (49.7) | 5,470 (2.2) | 0.015 (0.023) |
| | Undesirable | 115,030 (45.8) | 5,846 (2.3) | |
| Marriage | Single | 1,350 (0.5) | 32 (0.0) | 0.008 (0.001) |
| | Married | 214,883 (85.6) | 10,151 (4.0) | |
| | Widow | 15,023 (6.0) | 710 (0.3) | |
| | Divorced | 8,439 (3.4) | 423 (0.2) | |
| Occupation | Unemployed | 220,345 (87.8) | 9,644 (3.8) | 0.050 (< 0.001) |
| | Employed | 19,350 (7.7) | 1,672 (0.7) | |
| Education | Not having a university education | 209,543 (83.5) | 9,019 (3.6) | 0.048 (< 0.001) |
| | Having a university education | 30,152 (12.0) | 2,297 (0.9) | |

Data were reported as N (%) and * referred to median (Interquartile range).
Mann-Whitney U test and Chi-square test were used. Phi coefficient was computed for Chi-square tests.

a node, min_samples_split, and min_samples_leaf refers to the minimum number of samples required to split an internal node and the minimum number of samples required to be at a leaf node, respectively.

### Model evaluation

To assess the classifiers' performance, some evaluation criteria are essential, such as sensitivity, specificity, and accuracy with the following formulas:

| Sensitivity = $\frac{TP}{TP + FN}$ | Specificity = $\frac{TN}{TN + FP}$ | Accuracy = $\frac{TP + TN}{TP + TN + FP + FN}$ |
|---|---|---|

TP, FN, FP, and TN are True Positive, False Negative, False Positive, and True Negative, respectively [18-20]. In addition, another important criterion is the Area Under the Curve (AUC) of the Receiver Characteristic Operator (ROC) that measures the ability of a classifier to classify between classes [21].

## Results

A total of 251,011 records were analyzed. In this sample, 239,695 (95.5%) of the subjects do not get mammography done and 11,316 (4.5%) get mammography done. We denote visiting and not visiting for mammography with mammographyì+ and mammography-, respectively. The average age ± standard deviation in mammography groups was 51.47 ± 7.44 years and 46.25 ± 8.98 years in mammography- group. Further information regarding the research variables has been detailed in Table I. The Kolmogorov–Smirnov test was showed that the age variable was not distributed as normal in both Mammography+ and - groups. To assess the initial association of mammography status with independent variables, Mann-Whitney U and Chi-square test showed a statistically significant association. Furthermore, we reported the effect size for Mann-Whitney U and Phi coefficient for Chi-square test to show intensity of associations.

The logistic regression was fitted using backward elimination approach and the associated factors were showed in Table II. According Table II, individuals with family history of breast cancer had the highest effect in classifying the mammography status with an OR equal to 4.454 [CI: 4.189, 4.736]. After that having a university education had high OR equal to 2.338 [2.201, 2.484] and placed in the second rank in terms of effectiveness. Other factors such as age, having at least one child, occupation had a similar OR (almost the same effect) between OR minimum value = 1.082 and OR maximum value = 1.441. Furthermore, others had a protective effect with an OR less than one according to Table II. The only factor of marriage did not have a significant effect in predicting mammography status. The crude OR was showed in Table II, too. The crude OR refers to the presence of the desired variable alone in the model.

In the second step, we trained the decision tree and logistic regression models. To found the optimum value of hyper parameters and evaluate the model's performance 5-fold CV method was applied. During the optimization process, we found the entropy impurity

**Tab. II.** The associated factors with mammography status using Backward logistic regression.

| Variable | Crude model | Full model | | |
|---|---|---|---|---|
| | OR (95% CI) | p value | OR (95% CI) | p value |
| **Age** | 1.065 (1.063,1.068) | < 0.001 | 1.082 (1.079, 1.085) | < 0.001 |
| **Family history of breast cancer** | | | | |
| No | Ref. | | Ref. | < 0.001 |
| Yes | 4.364 (4.11, 4.62) | < 0.001 | 4.454 (4.189, 4.736) | |
| **Smoking** | | | | |
| No | Ref. | | Ref. | 0.042 |
| Yes | 0.912 (0.85, 0.98) | 0.012 | 0.927 (0.861, 0.997) | |
| **Dietary** | | | | |
| Favorable | Ref. | | Ref. | < 0.001 |
| Unfavorable | 0.734 (0.676, 0.797) | < 0.001 | 0.794 (0.730, 0.864) | |
| **Physical Activity** | | | | |
| Unfavorable | Ref. | | Ref. | < 0.001 |
| Favorable | 0.863 (0.831, 0.897) | < 0.001 | 0.882 (0.848, 0.916) | |
| **Having a child** | | | | |
| No | Ref. | | Ref. | < 0.001 |
| Yes | 1.811 (1.63, 2.01) | < 0.001 | 1.403 (1.258, 1.565) | |
| **Marriage** | | | | |
| Single | Ref. | | Ref. | |
| Married | 0.502 (0.353, 0.713) | < 0.001 | 0.833 (0.572, 1.214) | 0.342 |
| Widow | 1.00 (0.926, 1.081) | 0.991 | 1.431 (0.978, 2.093) | 0.065 |
| Divorced | 1.061 (0.960, 1.172) | 0.244 | 1.353 (0.935, 1.956) | 0.108 |
| **Occupation** | | | | |
| Unemployed | Ref. | | Ref. | |
| Employed | 1.974 (1.87, 2.084) | < 0.001 | 1.441 (1.350, 1.539) | < 0.001 |
| **Education** | | | | |
| Under university | Ref. | | Ref. | |
| University | 1.770 (1.688, 1.856) | < 0.001 | 2.338 (2.201, 2.484) | < 0.001 |

criterion, max_depth = 4, min_samples_split = 60, and min_samples_leaf = 30 as the optimal hyper parameters and decision tree was optimized.

The results of model's performance have been reported in Table III. Performance metrics were showed the decision tree outperformed compared to logistic regression in both train and test phases. The accuracy values on training and testing data for decision tree (logistic regression) were 76.95% and 76.80% (75.95% and 71.15%), respectively. The sensitivity, specificity, and AUC were 70.50, 73.50, and 71.12 for decision tree on the unseen data or test dataset, respectively. On the other hand, logistic regression had sensitivity = 65.45%, Specificity = 71.42%, and AUC = 69.40% on the test dataset. Therefore, decision tree classifier compared to logistic regression can predicts mammography status accurately.

The trained decision tree was led to 16 rules. Extracted rules are expressed as if-then rules for predicting the positive class (mammography+) and negative class (mammography-) according to Table IV. As well, we have shown the feature importance bar plot (blue horizontal bars) in the construction of the tree in the background of Table IV. This plot is showed that age, family history of breast cancer, education, and dietary status were most important variables to predict mammography status, respectively.

Rule 9 are showed that you might observe that patients who are older than 44.5 and also have university education and age more than 48.5 years, and having favorable life style are more likely to refer for doing mammography test (percent of probe = 86.84%).

In another subgroup, we can see, if the age is older than 44.5 and individuals have under university education,

**Tab. III.** The model's performance evaluation using 5-fold CV

| Index | Decision tree | | Logistic regression | |
|---|---|---|---|---|
| | Train | Test | Train | Test |
| Accuracy | 76.95 ± 0.042 | 76.80 ± 0.061 | 75.95 ± 0.052 | 71.15 ± 0.067 |
| Sensitivity | 76.31 ± 0.046 | 70.50 ± 0.057 | 75.85 ± 0.050 | 65.45 ± 0.058 |
| Specificity | 77.59 ± 0.052 | 73.50 ± 0.068 | 76.05 ± 0.044 | 71.42 ± 0.063 |
| AUC | 82.10 ± 0.048 | 71.12 ± 0.059 | 80.20 ± 0.049 | 69.40 ± 0.069 |

Indices was reported as mean ± standard deviation.

**Tab. IV.** The 16 rules extracted from the trained decision tree model.

| Rule | If (A sequence of attributes) | Then class is: | Probe (%) |
|---|---|---|---|
| 1 | if (age > 44.5) and (Education = under university) and (family history of breast cancer = no) and (age > 49.5) | + | 58.51 |
| 2 | if (age > 44.5) and (education = under university) and (family history of breast cancer = no) and (age ≤ 49.5) | - | 51.32 |
| 3 | if (age ≤ 44.5) and (age <= 39.5) and (family history of breast cancer = no) and (age > 34.5) | - | 80.36 |
| 4 | if (age ≤ 44.5) and (age > 39.5) and (family history of breast cancer = no) and (education = under university) | - | 69.63 |
| 5 | if (age > 44.5) and (education = university) and (age > 48.5) and (dietary = favorable) | + | 86.84 |
| 6 | if (age > 44.5) and (education = under university) and (family history of breast cancer = yes) and (Marriage = widow) | + | 85.65 |
| 7 | if (age ≤ 44.5) and (age ≤ 39.5) and (family history of breast cancer = no) and (age ≤ 34.5) | - | 89.78 |
| 8 | if (age ≤ 44.5) and (age > 39.5) and (family history of breast cancer = no) and (education = university) | - | 51.60 |
| 9 | if (age > 44.5) and (education = university) and (age <= 48.5) and (dietary = favorable) | + | 73.36 |
| 10 | if (age ≤ 44.5) and (age > 39.5) and (family history of breast cancer = yes) and (dietary = favorable) | + | 74.26 |
| 11 | if (age ≤ 44.5) and (age ≤ 39.5) and (family history of breast cancer = yes) and (age > 36.5) | + | 52.38 |
| 12 | if (age ≤ 44.5) and (age ≤ 39.5) and (family history of breast cancer = yes) and (age ≤ 36.5) | - | 69.06 |
| 13 | if (age > 44.5) and (education = under university) and (family history of breast cancer = yes) and (marriage = single or married or widow) | + | 64.24 |
| 14 | if (age > 44.5) and (education = university) and (age > 48.5) and (dietary = unfavorable) | + | 57.51 |
| 15 | if (age ≤ 44.5) and (age > 39.5) and (family history of breast cancer = no) and (dietary = unfavorable) | - | 67.27 |
| 16 | if (age > 44.5) and (education = university) and (age ≤ 48.5) and (dietary = unfavorable) | - | 71.64 |

and have a positive family history of breast cancer and also being widow then chance of reference for doing mammography is 85.65%. Other rules are detailed in Table IV.

## Discussion

Understanding the factors that influence women's cancer screening behavior is crucial in reducing cancer mortality through early detection. By gaining a comprehensive understanding of these factors, we can develop more effective interventions that encourage women to choose to undergo cancer screening. The objective of this study was to examine the current status of mammography screening and identify the factors that are associated with it among women.

In the current study, we found a positive significant relationship between age and having mammography. The risk of developing breast cancer increases with age. As women get older, their chances of developing breast cancer also increase, which makes regular mammograms more important for early detection and treatment; and the findings obtained in this study can be due to the above. Moreover, with advancing age, individuals tend to become more conscious of their health and take proactive measures to prevent diseases. Older women may prioritize their health and recognize the significance of mammograms as a preventive measure. Also, menopause and hormonal changes at older ages, which can increase the risk of breast cancer, may be another reason that makes older women more eager and sensitive to mammography. Studies dealing with woman's cancer screening behaviors have demonstrated that screening behavior is affected by age [22]. In the study of Ricardo-Rodrigues et al., age was found to be a strong predictor of breast cancer screening uptake. In this study, regarding mammography, uptake was found to increase with age up to 69 years [23]. In the study of Sun et al., age was positively associated with screening attendance, too [6]. Despite the variability in findings regarding age and breast cancer screening, it is important to recognize that women aged 65 or older are still at risk of developing breast cancer, as incidence and mortality rates increase with age. Breast cancer incidence rates begin to rise after the age of 40 and are highest in women over the age of 70 [24]. Therefore, it is crucial to encourage cancer screening in high-risk groups, and specifically, to promote breast cancer screening among elderly women.

The findings of the current study indicated no significant association between marital status and the mammography for breast cancer screening. While there is limited evidence on the impact of marital status on cancer screening [6, 23], previous studies have shown similar trends. For example, no association was observed between marital status and the mammography screening for Hispanics women in the study done by Borrayo et al. [25]. Another study also did not find any link between marital status and attendance for mammography [26]. It should also be noted that emotional support, which is often present in marital relationships, has been identified as a factor that promotes healthy behaviors and may increases adherence to cancer screening [27]. On the other hand, it is concerning to note that non-married women are at a greater risk of breast cancer, as highlighted by a recent systematic review [28]. Since Iranian women did not perform mammography regularly, so results of studies are not comparable. To gain a comprehensive understanding of the impact of marital status on breast cancer screening, future studies should prioritize longitudinal analyses, focus on high-risk groups, and explore how this factor may shape healthcare utilization and screening practices.

The current study suggested that higher levels of education were associated with a greater likelihood of compliance with mammography screening. Women with higher education levels may have easier access to opportunistic cancer screening programs like mammography. This could be due to their increased awareness of their health conditions and the importance of preventive measures [29]. In a study by Ricardo-Rodrigues et al., it was found that women with higher education levels, particularly those who had completed university, were more likely to undergo mammography [23]. A systematic review conducted by Islam et al., identified education level as one of the variables that facilitated breast cancer screening uptake in women [30]. However, it is worth noting that some studies, such as Sun et al. [6] and Charkhchi's research [31], reported no significant relationship between education level and screening uptake. Further research is needed to better understand the mechanisms through which education level influences screening uptake.

The results of the current study indicated that being employed was a statistically significant positive predictor of adherence to mammography screening. A study conducted by Sun et al. focusing on breast cancer screening adherence among Chinese women found that employed women were more likely to participate in screening compared to those who were unemployed or out of work [6]. Similarly, Charkhchi's study revealed that being employed significantly increased breast screening adherence [31]. Financial independence in employed women can be a reason for doing more mammography in this group. Furthermore, this may be attributed to the fact that women with employment have greater access to information and knowledge about screening through interactions with colleagues and more opportunities for physical examinations organized by their workplace. Women in professional occupations are often more aware of their health conditions and the importance of preventive measures [8].

The current study suggested that having children was associated with a higher likelihood of compliance with mammography. Studies conducted by Sun et al. [6] and Leinonen [32] found that having children was significantly linked to screening attendance. The presence of childcare responsibilities among women with children may contribute to their heightened health awareness and engagement in preventive health behaviors [6]. Therefore, it is crucial to strengthen advocacy and education efforts regarding breast cancer screening for women without children. However, it is worth noting that a few studies, such as the one conducted by Farshbaf et al. [33], have reported contrasting results. This suggests that the relationship between breast cancer screening and the number of children may be influenced by various factors that require further investigation in the future.

The findings of this study indicated that women with a family history of cancer were more likely to undergo mammography screening tests. This aligns with the observations made in Oran et al.'s study, where academicians who reported a family history of cancer were more inclined to have mammography tests done [34]. In Bahrami et al.'s study, which surveyed the prevalence of breast cancer screening behavior and related factors, it was found that the family history of cancer was among the significant factors affecting screening tests [35]. These findings highlight the importance of family history in influencing women's awareness and participation in breast cancer screening. Having a family history of cancer can serve as a motivating factor for women to prioritize and engage in regular screening tests.

The findings of the study indicated that there were high rates of mammography screening among women with insufficient physical activity. This finding contrasts with previous research that has shown a positive relationship between physical activity and mammography screening [36, 37]. Limited evidence suggests that women who engage in less physical activity are more likely to have undergone mammograms. For instance, a study by Ng'ang'a found high screening rates among individuals with insufficient physical activity [38]. Another study by Spongier and Konen found a negative correlation between exercise and screening mammography [39]. The inverse relationship between exercise and screening mammography is puzzling and could be attributed to various factors such as differences in sample size, the population under study, and the measurement method used. It is also possible that women who exercise regularly may be healthier overall, have fewer encounters with the healthcare system, and therefore may be less likely to be referred for annual screening mammography. Another factor that may have influenced these results is the method used to collect information on physical activity, which relied on self-report questionnaires. It is important to note that self-report measures of physical activity have been found to vary in accuracy, leading to both under- and over-estimation of physical activity levels. A recent meta-analysis highlighted the differences in accuracy among self-report measures [40]. Moreover, high screening rates have been observed among women who engage in little physical activity, suggesting that primary prevention programs should target all populations, including those with healthy habits, rather than solely focusing on individuals with unhealthier lifestyles. Therefore, it is crucial to address this factor in health promotion programs and interventions, particularly in the context of breast cancer prevention among women.

The current study indicated that being a smoker was associated with lower odds of undergoing mammography screening. This aligns with the findings of several other studies, which have consistently reported lower rates of mammography screening among cigarette smokers compared to non-smokers [41, 42]. For example, study conducted by Byrne et al. found a significant association between smoking status and both the likelihood of ever having received a specific screening test and compliance with national screening guidelines for breast cancer [43]. These findings suggest that smokers, in general, may

be less compliant with preventive care measures, more inclined to take risks, and more likely to underestimate the health risks associated with smoking, such as cancer. It is important to note that these observations are based on the available research and may not apply to every individual.

In this study, it appeared that there were high rates of mammography screening among women who have a desirable diet. While there have been limited studies on the relationship between diet and mammography screening. For example, in a study conducted by Richard et al., it was observed that individuals who did not pay attention to their diet participated significantly less in screening [44]. Generally, women with unhealthy behaviors, such as an improper diet, may have lower health consciousness compared to individuals with healthier habits. As a result, they may be less likely to adhere to regular cancer screening [45]. These mentioned findings indicate that encouraging women to prioritize regular mammography screening may be influenced by promoting healthy behaviors, such as maintaining a proper diet.

It is important to acknowledge the limitations of this study to ensure a comprehensive understanding of the findings. The cross-sectional design of the study prevents us from establishing causality between the identified associations. Additionally, the use of secondary data restricts the analysis to variables available in the datasets, potentially missing important factors such as women's knowledge and attitude towards preventive services, which could have provided a more detailed understanding of the associations. It is worth noting that factors such as lack of knowledge, low motivation, cultural or cognitive beliefs, attitudes, self-efficacy, and fear of tests are known to influence cancer screening behaviors in women [46]. Therefore, examining these factors alongside other variables would have provided a more comprehensive analysis. Furthermore, caution should be exercised when comparing uptake data from different sources and countries, as variations in screening programs and target populations can affect the results. To improve breast cancer screening behaviors among women, it may be necessary to consider interpersonal and community factors in addition to individual factors. This broader approach can help identify additional correlates of prevention behaviors and contribute to more effective strategies for promoting breast cancer prevention.

Indeed, this study has its strengths, particularly in its population-based sample size of 251,011 women. By examining various variables such as dietary habits, exercise, smoking, and demographic properties, it sheds light on the relationships between these factors and mammography screening. This provides valuable insights into the associations between breast cancer screening behavior and preventive lifestyle behaviors. By targeting both preventive lifestyle choices and breast cancer screening behaviors, interventions can effectively promote positive changes in behavior and ultimately reduce the incidence and impact of breast cancer.

## Conclusions

Understanding the factors that influence women's cancer screening behavior is crucial in reducing cancer mortality through early detection. In the current study, the factors of age, higher education, being employed, having children, family history of cancer, physical activity, smoking status, and diet were all predictors of mammography screening. By examining various variables such as dietary habits, exercise, smoking, and demographic properties, it sheds light on the relationships between these factors and mammography screening. This provides valuable insights into the associations between breast cancer screening behavior and preventive lifestyle behaviors. By targeting both preventive lifestyle choices and breast cancer screening behaviors, interventions can effectively promote positive changes in behavior and ultimately reduce the incidence and impact of breast cancer.

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## Conflict of interest statement

The authors declare that they have no conflicts of interest.

## Authors' contributions

SM participated in the writing and design of the study, performed the statistical analysis and drafted the manuscript. EMF participated in the design of the study, and read the paper critically for theoretical content. NT participated in design of the study and statistical analysis.

### References

[1] GBD 2015 Mortality and Causes of Death Collaborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet 2016;388:1459-544. https://doi.org/10.1016/S0140-6736(16)31012-1

[2] Bener A, Barışık CC, Acar A, Özdenkaya Y. Assessment of the gail model in estimating the risk of breast cancer: effect of cancer worry and risk in healthy women. Asian Pac J Cancer Prev 2019;20:1765-71. https://doi.org/10.31557/APJCP.2019.20.6.1765

[3] Tahmasebi R, Noroozi A. Factors influencing breast cancer screening behavior among Iranian women. Asian Pac J Cancer Prev 2011;12:1239-44.

[4] Uchida K, Ohashi H, Kinoshita S, Nogi H, Kato K, Toriumi Y, Yamashita A, Kamio M, Mimoto R, Takeyama H. Breast cancer screening and the changing population pyramid of Japan.

Breast Cancer 2015;22:172-6. https://doi.org/10.1007/s12282-013-0470-6

[5] Cui Z, Kawasaki H, Tsunematsu M, Cui Y, Kakehashi M. Factors affecting the cervical cancer screening behaviors of Japanese women in their 20s and 30s using a health belief model: a cross-sectional study. Curr Oncol 2022;29:6287-302. https://doi.org/10.3390/curroncol29090494

[6] Sun Y, Ma Y, Cao M, Hu Z, Lin W, Chen M, He Y. Breast and cervical cancer screening adherence in Jiangsu, China: an ecological perspective. Front Public Health 2022;10:967495. https://doi.org/10.3389/fpubh.2022.967495

[7] Sarkeala T, Heinävaara S, Fredman J, Männistö S, Luoto R, Jäntti M, Malila N. Design and respondent selection of a population-based study on associations between breast cancer screening, lifestyle and quality of life. BMC Public Health 2015;15:1256. https://doi.org/10.1186/s12889-015-2603-7

[8] Bahmani F, Vakilian K, Faramarzi M. Effects of motivational interview on awareness, attitude, and practice of breast self-examination in high-risk women: a clinical trial study. Curr Womens Health Rev 2019;15:301-7. https://doi.org/10.2174/1573404815666190327171814

[9] Keshavarzi A, Asadi S, Asadollahi A, Mohammadkhah F, Khani Jeihooni A. Tendency to breast cancer screening among rural women in Southern Iran: a Structural Equation Modeling (SEM) analysis of theory of planned behavior. Breast Cancer (Auckl) 2022;16:11782234221121001. https://doi.org/10.1177/11782234221121001

[10] Hagströmer M, Oja P, Sjöström M. The International Physical Activity Questionnaire (IPAQ): a study of concurrent and construct validity. Public Health Nutr 2006;9:755-62. https://doi.org/10.1079/phn2005898

[11] Maldonado S, López J, Vairetti C. An alternative SMOTE oversampling strategy for high-dimensional datasets. Appl Soft Comput 2019;76:380-9. https://doi.org/10.1016/j.asoc.2018.12.024

[12] Schober P, Vetter TR. Logistic regression in medical research. Anesth Analg 2021;132:365. https://doi.org/10.1213/ANE.0000000000005247

[13] Bagley SC, White H, Golomb BA. Logistic regression in the medical literature: standards for use and reporting, with particular attention to one medical domain. J Clin Epidemiol 2001;54:979-85. https://doi.org/10.1016/s0895-4356(01)00372-9

[14] Yang L, Liu S, Tsoka S, Papageorgiou LG. A regression tree approach using mathematical programming. Expert Syst Appl 2017;78:347-57. https://doi.org/10.1016/j.eswa.2017.02.013

[15] Brownlee J. Classification And Regression Trees for Machine Learning Machine Learning Mastery. Available at: https://machinelearningmastery.com/classification-and-regression-trees-for-machine-learning/ (Accessed on: 10/09/2023).

[16] Tavakolian A, Farhanji M, Shapouran F, Zal A, Taheri Z, Ghobadi T, et al. Investigating the association of acute kidney injury (AKI) with COVID-19 mortality using data-mining scheme. Diagn Microbiol Infect Dis 2023;107:116026. https://doi.org/10.1016/j.diagmicrobio.2023.116026

[17] Saheb-Honar M, Dehaki MG, Kazemi-Galougahi MH, Soleiman-Meigooni S. A Comparison of three research methods: logistic regression, decision tree, and random forest to reveal association of type 2 diabetes with risk factors and classify subjects in a military population. J Arch Mil Med 2022;10:e118525. https://doi.org/10.5812/jamm-118525

[18] Nellore SB. Various performance measures in Binary classification - An overview of ROC study. Int J Innov Sci Eng Technol 2015;2:596-605.

[19] Tong Z, Liu Y, Ma H, Zhang J, Lin B, Bao X, et al. Development, validation and comparison of artificial neural network models and logistic regression models predicting survival of unresectable pancreatic cancer. Front Bioeng Biotechnol 2020;8:196. https://doi.org/10.3389/fbioe.2020.00196

[20] Fawcett T. An introduction to ROC analysis. Pattern Recognit Lett 2006;27:861-74. https://doi.org/10.1016/j.patrec.2005.10.010

[21] Bhandari A. AUC-ROC Curve in Machine Learning Clearly Explained Analytics Vidhya 2022. Available at: https://www.analyticsvidhya.com/blog/2020/06/auc-roc-curve-machine-learning/ (Accessed on: 10/09/2023).

[22] Ho V, Yamal JM, Atkinson EN, Basen-Engquist K, Tortolero-Luna G, Follen M. Predictors of breast and cervical screening in Vietnamese women in Harris County, Houston, Texas. Cancer Nurs 2005;28:119-29. https://doi.org/10.1097/00002820-200503000-00005

[23] Ricardo-Rodrigues I, Jiménez-García R, Hernández-Barrera V, Carrasco-Garrido P, Jiménez-Trujillo I, López de Andrés A. Social disparities in access to breast and cervical cancer screening by women living in Spain. Public Health 2015;129:881-8. https://doi.org/10.1016/j.puhe.2015.02.021

[24] Lee SY, Lee E, Natipagon-Shah B, Toyama J. Factors associated with breast cancer screening among Korean American women in California: results from the California Health Interview Survey 2015-2016. Asian Pac J Cancer Prev 2018;19:3271-7. https://doi.org/10.31557/APJCP.2018.19.11.3271

[25] Borrayo EA, Hines L, Byers T, Risendal B, Slattery ML, Sweeney C, Baumgartner KB, Giuliano A. Characteristics associated with mammography screening among both Hispanic and non-Hispanic white women. J Womens Health (Larchmt) 2009;18:1585-94. https://doi.org/10.1089/jwh.2008.1009

[26] Simon MS, Gimotty PA, Coombs J, McBride S, Moncrease A, Burack RC. Factors affecting participation in a mammography screening program among members of an Urban Detroit Health Maintenance Organization. Cancer Detect Prev 1998;22:30-8. https://doi.org/10.1046/j.1525-1500.1998.00009.x

[27] Blom J, Yin L, Lidén A, Dolk A, Jeppsson B, Påhlman L, et al. Toward understanding nonparticipation in sigmoidoscopy screening for colorectal cancer. Int J Cancer 2008;122:1618-23. https://doi.org/10.1002/ijc.23208

[28] M, Han M, Chen Z, Tang Y, Ma J, Zhang Z, Liu Z, Zhang N, Xi C, Liu J, Tian D, Wang X, Huang X, Chen J, Wang W, Zhai S. Does marital status correlate with the female breast cancer risk? A systematic review and meta-analysis of observational studies. PLoS One 2020;15:e0229899. https://doi.org/10.1371/journal.pone.0229899

[29] Ascunce N, Salas D, Zubizarreta R, Almazán R, Ibáñez J, Ederra M. Cancer screening in Spain. Ann Oncol 2010;21(Suppl 3):iii43-51. https://doi.org/10.1093/annonc/mdq085

[30] Islam RM, Billah B, Hossain MN, Oldroyd J. Barriers to cervical cancer and breast cancer screening uptake in low-income and middle-income countries: a systematic review. Asian Pac J Cancer Prev 2017;18:1751-63. https://doi.org/10.22034/APJCP.2017.18.7.1751

[31] Charkhchi P, Schabath MB, Carlos RC. Breast, cervical, and colorectal cancer screening adherence: effect of low body mass index in women. J Womens Health (Larchmt) 2020;29:996-1006. https://doi.org/10.1089/jwh.2019.7739

[32] Leinonen MK, Campbell S, Klungsøyr O, Lönnberg S, Hansen BT, Nygård M. Personal and provider level factors influence participation to cervical cancer screening: a retrospective register-based study of 1.3 million women in Norway. Prev Med 2017;94:31-9. https://doi.org/10.1016/j.ypmed.2016.11.018

[33] Performance conditions of breast cancer screening methods and its efficient factors among women referring to Health Centers of Tabriz. Iran J Nurs Midwifery Res 2009;4:27-38.

[34] Oran N, Can H, Senuzun Aykar F, Aylaz R. Health promotion lifestyle and cancer screening behaviors: a survey among academician women. Asian Pac J Cancer Prev 2008;9:515-8.

[35] Bahrami M, Taymoori P, Bahrami A, Farazi E, Farhadifar F. The prevalence of breast and cervical cancer screening and related factors in woman who refereeing to Health Center of Sanandaj city in 2014. Zanko J Med Sci 2015;16:1-12.

[36] Patrão AL, de Almeida MDCC, Matos SMA, Menezes G, Gabrielli L, Goes EF, Aquino EM. Healthy lifestyle behaviors and the periodicity of mammography screening in Brazilian women. Womens Health (Lond) 2021;17:17455065211063294. https://doi.org/10.1177/17455065211063294

[37] Lagerlund M, Drake I, Wirfält E, Sontrop JM, Zackrisson S. Health-related lifestyle factors and mammography screening attendance in a Swedish cohort study. Eur J Cancer 2015;24:44-50. https://doi.org/10.1097/CEJ.0000000000000025

[38] Ng'ang'a A, Nyangasi M, Nkonge NG, Gathitu E, Kibachio J, Gichangi P, Wamai RG, Kyobutungi C. Predictors of cervical cancer screening among Kenyan women: results of a nested case-control study in a nationally representative survey. BMC Public Health 2018;18(Suppl 3):1221. https://doi.org/10.1186/s12889-018-6054-9

[39] Spongier JG, Konen JC. Annual screening mammography, among diabetic women: demographics, psychological stress, and family functioning. Fam Community Health 1996;18:1-8.

[40] Prince SA, Adamo KB, Hamel ME, Hardt J, Gorber SC, Tremblay M. A comparison of direct versus self-report measures for assessing physical activity in adults: a systematic review. Int J Behav Nutr Phys Act 2008;5:56. https://doi.org/10.1186/1479-5868-5-56

[41] Rakowski W, Clark MA, Truchil R, Schneider K, Meersman S. Smoking status and mammography among women aged 50–75 in the 2002 behavioral risk factor surveillance system. Women Health 2005;41:1-21. https://doi.org/10.1300/J013v41n04_01

[42] Lian M, Jeffe DB, Schootman M. Racial and geographic differences in mammography screening in St. Louis City: a multilevel study. J Urban Health 2008;85:677-92. https://doi.org/10.1007/s11524-008-9301-z

[43] Byrne MM, Davila EP, Zhao W, Parker D, Hooper MW, Caban-Martinez A, Dietz N, Huang Y, Messiah A, Lee DJ. Cancer screening behaviors among smokers and non-smokers. Cancer Epidemiol 2010;34:611-7. https://doi.org/10.1016/j.canep.2010.06.017

[44] Richard A, Rohrmann S, Schmid SM, Tirri BF, Huang DJ, Güth U, Eichholzer M. Lifestyle and health-related predictors of cervical cancer screening attendance in a Swiss population-based study. Cancer Epidemiol 2015;39:870-6. https://doi.org/10.1016/j.canep.2015.09.009

[45] Muus KJ, Baker-Demaray TB, Bogart TA, Duncan GE, Jacobsen C, Buchwald DS, Henderson JA. Physical activity and cervical cancer testing among American Indian women. J Rural Health 2012;28:320-6. https://doi.org/10.1111/j.1748-0361.2011.00394.x

[46] McFarland DM. Cervical cancer and Pap smear screening in Botswana: knowledge and perceptions. Int Nurs Rev 2003;50:167-75. https://doi.org/10.1046/j.1466-7657.2003.00195.x

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HEALTH PROMOTION

# Prevalence of excess screen time among secondary school children in rural India

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Keyword:

School-children • Rural • Screen-time • Sleep • BMI

Summary

**Introduction**. *Screen time has increased during the COVID-19 pandemic, especially among children and teenagers. This has come at the expense of their healthy eating habits, physical activity and adequate amount of quality sleep. The excessive use of screen-device can lead to addiction which starts during adolescent years. Objectives: Primary Objective: to assess prevalence of excess screen time among secondary school children; Secondary Objective: to correlate Body Mass Index (BMI), sleep duration, duration of physical activity and food habits with screen time duration.*
**Material and Methods**. *Study settings and design: cross-sectional study was conducted in secondary schools in the rural field practice area of a private medical college in Pune, India. The study included 184 school children from eighth to tenth standard. Data was collected using a self-administered, questionnaire.*
**Results**. *Prevalence of excess screen time among secondary school children was 83.2%. Mobile phone was the most used device (98.9%). There was a significant association between excess screen time and inadequate sleep.*
**Conclusions**. *The present study reports high prevalence of excess screen time in rural school going children in rural India. There is a need for strategies to combat this in school health programs on priority.*

## Introduction

Children of today are surrounded by technological advances and have access to a range of devices, like television, mobile phones and other gadgets [1]. Electronic devices have become part of their daily lives, and young people have begun spending more time than ever before engaging in screen-based activities [2, 3]. Excessive use of devices can lead to technology addiction, which is most likely to start during the adolescent years [4].
Screen time refers to the amount of time spent watching television, including videos, playing games on video consoles or on computers; and using computers for other purpose [5].The American Academy of Paediatrics (AAP) suggests that youngsters limit their entertainment-related screen time to less than one to two hours a day [6], while the Indian Academy of Paediatrics (IAP) advocates for a more balanced approach that includes both outdoor physical activity and other activities such as school work, meals, hobbies, peer interaction, and family time [7]. The World Health Organization's 2020 global guidelines recommend that children and adolescents should engage in at least 60 minutes of moderate-to-vigorous physical activity each day, and also participate in muscle-strengthening activities at least 3 days a week [8].
The COVID-19 pandemic led to an increase in online education and movement restrictions, which has led to more time in front of screens for education, entertainment and socializing. Although this has helped maintain a sense of normalcy, it has led to screen time beyond the recommended two hours per day [9]. This has been particularly significant among school-aged children and teenagers, and is often at the expense of physical activity [10].
Extended screen time has also been linked to dietary issues, including low consumption of fruits and vegetables and high consumption of high-calorie, high-fat, high-sugar, and high-sodium foods [11]. Some studies even suggest a correlation with eating disorders [12, 13].
Too much screen time can also reduce sleep quality through multiple mechanisms, such as night-time exposure to bright lights, which can decrease melatonin production, and the displacement of other activities that are useful for sleep. According to the American Academy of Paediatrics, it is recommended to avoid screens at least 1 hour before bedtime. This practice will reduce sleep disturbances [14].
The usage of display screens may also add to the danger for mental issues, like, despondency, nervousness, self-destruction, and thoughtlessness among youngsters and young people [15]. With the increased availability of cell phone networks in rural India, young people living in

these areas now have access to more screen time beyond just watching television. This is especially true for rural areas near large cities, where devices such as mobile phones, personal computers, and tablets are more readily available [16]. Expanded smart phone access in rural India is prompting innovation teaching in school. The innovation enslavement possibly adds to poor scholastic presentation [4].

Several studies related to screen time in children had been conducted in countries outside India in the past. A secondary data analysis of international children's accelerometry database conducted in 2013 shows that at least two third of the participants exceeded two hours per day of screen time [17]. A systematic review and meta-analysis conducted in Brazil in 2017 showed that the prevalence of excess screen time in Brazilian adolescents was 70.9% [18]. A comparative study of screen time among urban and rural high school students conducted in Karnataka, India showed a mean total screen time of 177 minutes in urban school students and 93 minutes in rural school students [19]. A study conducted in children aged two to five years showed that 59.5% of children had excess screen time[20]. There are limited studies conducted on the prevalence of screen time in secondary children in rural India.

Screen time has risen during the COVID-19 era due to government-enforced public health protocols [21]. Studies have been conducted in the pre-pandemic times. However, only a few studies have been conducted during the pandemic and post-pandemic time to assess prevalence of screen time. The cut-off criteria according to their studies do not fit AAP criteria. This study was conducted in the post-pandemic times when school education had returned to normal. This study was conducted with following objectives

Primary Objective: to assess prevalence of excess screen time in secondary school children in rural area.

Secondary Objective: to correlate Body Mass Index (BMI), sleep duration, physical activity duration and food habits with screen time duration in these children.

## Material and Methods

### Study design

Cross-sectional study.

### Study setting

The study was carried out in the three English medium secondary schools located in the villages under the rural field practice area of a private medical college in Pune district of Maharashtra. The schools were selected by convenience sampling method. Study was conducted from May 2022 to July 2022.

### Study participants

Students of class $8^{th}$-$10^{th}$ were included in the study. Students present on the days of administration of the questionnaire were included in the study.

### Data measurement

*Tool for data collection*

The study was conducted using a validated (by community medicine and Ophthalmology specialists), self-administered questionnaire. It had questions related to:

a. Socio-demographic details;
b. Details related to screen usage: type of device/s used, duration of usage on an average in a day and the purpose of usage;
c. Sleep: bedtime and waking up time on a weekend and weekday;
d. Duration of physical activity;
e. Food habits: consumption of junk food. These foods are defined as "foods (packed or non-packed, processed or non-processed) which contains little or limited presence of proteins, vitamins, phytochemicals, minerals and dietary fibre but are rich in fat (saturated fatty acids), salt and sugar and high in energy (calories) that are known to have negative impact on health if consumed regularly or in high amounts" [22];
f. Anthropometric measurements: height and weight measured by standard techniques.

*Methodology for data collection*

After obtaining permission from the school, investigators briefed the students about the objectives of the study. Assent form was given to the children. Consent form for their parent to sign and participant information sheet were handed over to them to take home. Those children who submitted the consent form signed by their parents were included in the study. The questionnaire was distributed, discussed and doubts clarified. After the forms were filled, anthropometric measures were taken by standardised procedure.

*Sampling size estimation*

Considering 68% prevalence of excess screen-time in secondary school children [23], allowing a permissible error of 5% with 95% confidence interval, sample size was calculated to 118 [$n = [(z \times \alpha)^2 \times (SD)^2] \div [d]^2$]. However, data of 184 students was finally included.

*Study variable*

The primary outcome variable was prevalence of excess screen-time. Other outcome variables were duration of physical activity, adequate sleep, BMI and eating behaviour. The definition of the outcomes measured were as follows:

- Screen time: screen time refers to the amount of time spent watching television, including videos; playing computer games on video consoles or on computers; and using computers for other purposes. As per the recommendation of AAP, the recommended screen-time is not more than two hours per day [6];
- Adequate sleep: children between thirteen to eighteen years of age should sleep eight to ten hours in a day [24];
- Adequate physical activity: the centre for Disease

Control (CDC) recommends sixty minutes of moderate to vigorous physical activity in children between six to seventeen years of age [25];
- Body Mass Index (BMI): BMI is a person's weight divided by the square of height in meters [6]. BMI of a secondary school child should be between -1SD to +1SD as per WHO BMI chart. +1 to +2 SD is overweight and more than +2 SD is obese;
- Eating behaviour: eating behaviour is a broad term that encompasses food choice and motives, feeding practices, dieting. Here we focussed on their food choice (such as inclusion of junk food and soft drinks in their diet and influence of screen on their diet).

### Statistical analysis

Statistical analysis was done using SPSS software (version 28.0). Continuous variable results were shown by descriptive statistics. Categorical variable result was shown by frequency and percentages. Chi-square test was used to test association between different risk factors, demographic variables with screen time. Throughout results, 5% level of significance was used. All results are shown with 95% level of confidence. P-value < 0.05 was considered as significant.

### Ethics statement

Study was conducted after obtaining permission from the institutional ethics committee (IEC) [BVDUMC/IEC/51D].

## Results

Total 184 children participated in this study of whom 64.7% were males (Tab. I). Their mean age was 14.91 ± 0.98.

Just 3.3% of the parents lacked formal education, while the rest had at least completed their primary schooling.

Out of the total, 2.17% female students were obese and 1.63% were overweight. Among the boys, 3.80% were obese and 7.07% were overweight.

All students used some kind of screen-device (television, computer/laptop, mobile phone, tablets or video game device). The most frequently used was mobile phone (98.9%), followed by television (92.9%). Out of all students, 64 (34.8%) owned at-least one of the above-mentioned devices. The majority (39.1%) had been using one of these device for more than 04 years. Majority of the study participants *i.e.*, 120 (65.2%) did not own the device. On an average per day, 63 students spent more than three hours on screen device. The prevalence of excess screen time was 83.2% (Tab. II).

A significant association was present between excess screen time, bed time on a weekday (p value 0.001). No significant association was present between other variables (Tabs. III, IV).

One hundred and thirty-two children consumed junk food and 94 children consumed soft drinks. Eighty children responded that their food habits were influenced by advertisements and shows on screen. All the children had some form of physical activity throughout the day either in school or after school-hours.

**Tab. I.** Socio-demographic details of the children (n = 184).

| Variable | | Frequency (Percentage %) |
|---|---|---|
| Gender | Male | 119 (64.7) |
| | Female | 65 (35.3) |
| Grade | Eighth | 90 (48.9) |
| | Ninth | 70 (38) |
| | Tenth | 24 (13) |
| Mother's education | Uneducated | 6 (3.3) |
| | Primary school | 7 (3.8) |
| | Secondary school | 119 (64.7) |
| | Graduate | 44 (23.9) |
| | Postgraduate | 8 (4.3) |
| Father's education | Uneducated | 0 (0) |
| | Primary school | 4 (2.2) |
| | Secondary school | 110 (59.8) |
| | Graduate | 67 (36.41) |
| | Postgraduate | 3 (1.6) |

**Tab. II.** Screen usage (n =184).

| Variable | | Frequency (Percentage %) |
|---|---|---|
| Screen-device used | Mobile phone | **182 (98.9)** |
| | Television | 171 (92.9) |
| | Computer/ laptop | 89 (48.4) |
| | Tablet | 33 (17.9) |
| | Video game device | 27 (14.7) |
| Owning a device | Yes | 64 (34.8) |
| | No | 120 (65.2) |
| Years of usage | < 2 years | 59 (32.1) |
| | 2-4 years | 53 (28.8) |
| | > 4 years | 72 (39.1) |
| Duration of mobile phone usage in a day | < 1 hour | 53 (28.8) |
| | 1-3 hours | 65 (35.3) |
| | > 3 hours | 63 (34.2) |
| | Not used | 3 (1.6) |
| Duration of television usage in a day | < 1 hour | 74 (40.2) |
| | 1-3 hours | 64 (34.8) |
| | > 3 hours | 33 (17.9) |
| | Not used | 13 (7.1) |
| Duration of Computer/ laptop usage in a day | < 1 hour | 63 (34.2) |
| | 1-3 hours | 19 (10.3) |
| | > 3 hours | 6 (3.3) |
| | Not used | 96 (52.2) |
| Duration of tablet usage in a day | < 1 hour | 22 (12) |
| | 1-3 hours | 10 (5.4) |
| | > 3 hours | 1 (0.5) |
| | Not used | 151 (82.1) |
| Duration of video game device usage in a day | < 1 hour | 17 (9.2) |
| | 1-3 hours | 6 (3.3) |
| | > 3 hours | 2 (1.1) |
| | Not used | 159 (86.4) |
| **Excess screen-time** | | **153 (83.2)** |

**Tab. III.** Association of screen-device with various variables (n = 184).

| Variable | | Excess Screen time | | Total | Chi-square value | p-value |
|---|---|---|---|---|---|---|
| | | Yes | No | | | |
| Bed-time on a weekday | 8 pm-10 pm | 49 | 21 | 70 | 13.95 | 0.001* |
| | 10 pm-12 pm | 104 | 10 | 114 | | |
| Bed-time on a weekend | 8 pm-10 pm | 26 | 12 | 38 | 7.42 | 0.006 |
| | 10 pm-12 am | 127 | 19 | 146 | | |
| If you sleep after 9 pm, do you sleep late because you use these devices? | Yes | 43 | 7 | 50 | 0.4 | 0.53 |
| | No | 110 | 24 | 134 | | |
| Wake-up time on a weekday | Before 6 am | 43 | 10 | 53 | 0.22 | 0.64 |
| | 6 am-8 am | 110 | 21 | 131 | | |
| Wake-up time on a weekend | Before 6 am | 6 | 4 | 10 | 4.05 | 0.04 |
| | 6 am-8 am | 147 | 27 | 174 | | |
| Physical activity during school hours | Do not play | 0 | 1 | 1 | 5.55 | 0.06 |
| | < 30 minutes | 73 | 12 | 85 | | |
| | > 30 minutes | 80 | 18 | 98 | | |
| Physical activity after school hours | Do not play | 9 | 3 | 12 | 6.91 | 0.03 |
| | ≤ 1 hour | 65 | 20 | 85 | | |
| | > 1 hour | 79 | 8 | 87 | | |
| Type of diet | Mixed | 130 | 25 | 155 | 0.36 | 0.55 |
| | Veg | 23 | 6 | 29 | | |
| Consumption of junk food | Yes | 112 | 20 | 132 | 0.96 | 0.33 |
| | No | 41 | 11 | 52 | | |
| Consumption of soft drinks | Yes | 84 | 10 | 94 | 5.29 | 0.02 |
| | No | 69 | 21 | 90 | | |
| Is the consumption of your food influenced by advertisements or shows on screen? | Yes | 67 | 13 | 80 | 0.04 | 0.85 |
| | No | 86 | 18 | 104 | | |

* Significant association between excess screen time and bed time on a weekday.

**Tab. IV.** Association with BMI (n = 184).

| | Excess Screen time | N | Mean | SD | t-value | p-value |
|---|---|---|---|---|---|---|
| BMI | Yes | 153 | 19.17 | 3.67 | 1.18 | 0.86 |
| | No | 31 | 19.29 | 3.67 | | |

## Discussion

Our study showed that 83.2% of secondary school children spent more than the recommended two hours on screen-device in a day. This was more than reported in a similar study conducted in other parts of India as discussed further.

A cross sectional study conducted in rural western India among pre-schoolers showed that more than 80% of the children exceeded the recommended screen time [26]. Another study conducted in a rural community of North India showed that prevalence was 61.8% [27]. In an urban study conducted in adolescent children before the COVID-19 pandemic the prevalence was found to be 68% [23]. This can be explained by the less screen-based device usage before COVID-19 pandemic. A study conducted by Pooja et al. (2021) in rural school on children aged 10-19 years found only 17% [16] of students spending excess screen time. The current results were similar to the study conducted in an urban setting in Kerala. It was observed that 87.7% [28] of children engaged in excess screen-time. This similarity in observation between the current study and the latter can be explained by the close proximity of the current study setting to a metropolitan city. The children in peri-urban area have more access to device and a lifestyle different from the typical villages in India.

The excess screen-time in these children had a negative impact on their sleep. There is a significant association between sleep and late bed-time. A cross-sectional study conducted in 2022 reported that adolescents who spent more than two hours of screen-time had 1.55 times less sleep than others [29]. Cartanyà-Hueso et al. (2021), conducted a study in Spain and found significant association between delayed sleep and excess screen time [30]. A systematic review conducted before 2020 (in 2018) concludes weak evidence between excess screen time and delayed sleep time [31]. However, a systematic review conducted after 2020 (in 2021) contradicts the latter [32].

A study in secondary school children in Tamil Nadu found significant association between screen time and physical activity [33]. This is contradicting a study conducted in Aligarh in 2020 [34]. A similar observation was reported in Stockholm County in adolescent school children [35]. Physical activity period is compulsory in the school curriculum of the children included in our

study. This is why their physical activity has not been affected. This also explains the normal range of BMI. However, a significant association was found between age and physical activity. A decline in physical activity with increase in age was found in a study conducted in children between eight to 13 years of age [36]. Thus, overtime it is likely that their physical activity will be affected which can affect their BMI in the future.

A study conducted by Shang et al. (2015) [37], showed that longer the screen time the increased the odds of unhealthy dietary habits such as consuming junk food. No significant association was found between the diet consumed by them in this study. This can be explained by the habit of eating home cooked food which is followed by every Indian family in the rural areas.

Clear rules have to be laid at home to control the screen time of secondary school children. As evident from this study, excess screen time affects their sleep. This will be evident as irritability, anxiety, inability to concentrate, poor scholastic performance, *etc*. in them. Even though their BMI and diet had not been affected by excess screen time as of now, there are chances of developing unhealthy eating habits and obesity later in future. It is important to give health education to the children regarding the importance of screen time less than two hours.

## Conclusions

The prevalence of excess screen time in secondary school children in a rural area in Pune is more than the recommendation of AAP. Mobile phones being the most commonly used device, followed by television. This trend can be attributed to the shift towards online classes brought about by the pandemic, replacing traditional in-person classes. Furthermore, a noteworthy association was observed between prolonged screen time and delayed bedtime.

## Limitations

This study was conducted only in secondary school children of English medium schools.

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## Conflict of interest statement

The authors have no conflicts of interest associated with the material presented in this paper.

## Authors' contributions

RJ, ABP: conceptualization. RJ, SS: data curation. NM: funding acquisition. RJ ABP: methodology. RJ, SS, APSN: project administration. RJ, ABP, ACR: writing – original draft. RJ, ABP, AC: writing – review & editing. RD: statistical analysis.

### References:

[1] Roberts DF, Foehr UG. Trends in media use. Future Child 2008;18:11-37. https://doi.org/10.1353/foc.0.0000

[2] Bucksch J, Sigmundova D, Hamrik Z, Troped PJ, Melkevik O, Ahluwalia N, Borraccino A, Tynjälä J, Kalman M, Inchley J. International Trends in Adolescent Screen-Time Behaviors From 2002 to 2010. J Adolesc Health 2016;58:417-25. https://doi.org/10.1016/j.jadohealth.2015.11.014

[3] Kontostoli E, Jones AP, Pearson N, Foley L, Biddle SJH, Atkin AJ. Age-related change in sedentary behavior during childhood and adolescence: a systematic review and meta-analysis. Obes Rev 2021;22:e13263. https://doi.org/10.1111/obr.13263

[4] Jamir L, Duggal M, Nehra R, Singh P, Grover S. Epidemiology of technology addiction among school students in rural India. Asian J Psychiatr 2019;40:30-8. https://doi.org/10.1016/j.ajp.2019.01.009

[5] Krebs NF, Jacobson MS; American Academy of Pediatrics Committee on Nutrition. Prevention of pediatric overweight and obesity. Pediatrics 2003;112:424-30. https://doi.org/10.1542/peds.112.2.424.

[6] Council on Communications and Media. Children, Adolescents, and the Media. Pediatrics 2013;132:958-61. https://doi.org/10.1542/peds.2013-2656

[7] Gupta P, Shah D, Bedi N, Galagali P, Dalwai S, Agrawal S, John JJ, Mahajan V, Meena P, Mittal HG, Narmada S, Smilie C, Ramanan PV, Evans YN, Goel S, Mehta R, Mishra S, Pemde H, Basavaraja GV, Parekh BJ, Rich M; IAP Guideline Committee On Digital Wellness And Screen Time In Infants, Children, And Adolescents. Indian Academy of Pediatrics Guidelines on Screen Time and Digital Wellness in Infants, Children and Adolescents. Indian Pediatr 2022;59:235-44. https://doi.org/10.1007/s13312-022-2477-6

[8] Chaput JP, Willumsen J, Bull F, Chou R, Ekelund U, Firth J, Jago R, Ortega FB, Katzmarzyk PT. 2020 WHO guidelines on physical activity and sedentary behaviour for children and adolescents aged 5-17 years: summary of the evidence. Int J Behav Nutr Phys Act 2020;17:1-9. https://doi.org/10.1186/s12966-020-01037-z

[9] Moitra P, Madan J. Impact of screen time during COVID-19 on eating habits, physical activity, sleep, and depression symptoms: a cross-sectional study in Indian adolescents. PLoS One 2022;17:e0264951. https://doi.org/10.1371/journal.pone.0264951

[10] UNICEF. The state of the world's children 2017 Children in a digital world. Available at: https://www.unicef.org/reports/state-worlds-children-2017 (Accessed on: 10/03/2023).

[11] Lowry R, Wechsler H, Galuska DA, Fulton JE, Kann L. Television viewing and its associations with overweight, sedentary lifestyle, and insufficient consumption of fruits and vegetables among US high school students: differences by race, ethnicity, and gender. J Sch Health 2002;72:413-21. https://doi.org/10.1111/j.1746-1561.2002.tb03551.x

[12] Moriarty CM, Harrison K. Television exposure and disordered eating among children: a longitudinal panel study. J Commun 2008;58:361-81. https://doi.org/10.1111/j.1460-2466.2008.00389.x

[13] Harrison K, Hefner V. Media exposure, current and future body ideals, and disordered eating among preadolescent girls: a longitudinal panel study. J Youth Adolesc 2006;35:153-63. https://doi.org/10.1007/s10964-005-9008-3

[14] Dohnt H, Tiggemann M. The contribution of peer and media influences to the development of body satisfaction and self-esteem in young girls: a prospective study. Dev Psychol 2006;42:929-36. https://doi.org/10.1037/0012-1649.42.5.929

[15] Liu S, Yang L, Zhang C, Xiang YT, Liu Z, Hu S, Zhang B. Online mental health services in China during the COVID-19 outbreak. Lancet Psychiatry 2020;7:e17-8. https://doi.org/10.1016/S2215-0366(20)30077-8

[16] Pooja RS, Joseph M, John DM, John J, Biradar B, Naidu C, Johnson A. Is excessive screen time a problem among rural adolescents? A cross-sectional study in four schools of Magadi Taluk, Ramanagara District, South Karnataka. Ann Community Health 2021;9:41-7.

[17] Atkin AJ, Sharp SJ, Corder K, van Sluijs EM; International Children's Accelerometry Database (ICAD) Collaborators. Prevalence and correlates of screen time in youth: an international perspective. Am J Prev Med 2014;47:803-7. https://doi.org/10.1016/j.amepre.2014.07.043

[18] Schaan CW, Cureau FV, Sbaraini M, Sparrenberger K, Kohl Iii HW, Schaan BD. Prevalence of excessive screen time and TV viewing among Brazilian adolescents: a systematic review and meta-analysis. J Pediatr (Rio J) 2019;95:155-65. https://doi.org/10.1016/j.jped.2018.04.011

[19] Chandran S, SN P, Sadar A, Jayaram R. A comparative study of screen time, sleep duration and behavioural disturbances in urban and rural high school children. J Indian Assoc Child Adolesc Ment Health 2020;16:119-4. https://doi.org/10.1177/0973134220200408

[20] Kaur N, Gupta M, Malhi P, Grover S. Prevalence of Screen Time Among Children Aged 2 to 5 Years in Chandigarh, a North Indian Union Territory. J Dev Behav Pediatr 2022;43:e29-e38. https://doi.org/10.1097/DBP.0000000000000964

[21] Pandya A, Lodha P. Social connectedness, excessive screen time during COVID-19 and mental health: a review of current evidence. Front Hum Dyn 2021;22:3. https://doi.org/10.3389/fhumd.2021.684137

[22] Draft Guidelines for regulating food high in fat, sugar and salt (HFSS) also popularly known as junk food. Available at: www.indiaenvironmentportal.org.in/.../Junk%20Food%20Guidelines%20-%20January (Accessed on: 01/06/2023).

[23] Dubey M, Nongkynrih B, Gupta SK, Kalaivani M, Goswami AK, Salve HR. Screen-based media use and screen time assessment among adolescents residing in an Urban Resettlement Colony in New Delhi, India. J Family Med Prim Care 2018;7:1236-42. https://doi.org/10.4103/jfmpc.jfmpc_190_18

[24] Paruthi S, Brooks LJ, D'Ambrosio C, Hall WA, Kotagal S, Lloyd RM, Malow BA, Maski K, Nichols C, Quan SF, Rosen CL, Troester MM, Wise MS. Pediatric sleep duration consensus statement: a step forward. J Clin Sleep Med 2016;12:1705-6. https://doi.org/10.5664/jcsm.6368

[25] Centers for Disease Control and Prevention. Physical activity. How much physical activity do children need? Available at: https://www.cdc.gov/physicalactivity/basics/children/index.htm#:~:text=60%20minutes%20or%20more%20of,should%20include%20vigorous%2Dintensity%20activities (Accessed on: 03/06/2023).

[26] Shah RR, Fahey NM, Soni AV, Phatak AG, Nimbalkar SM. Screen time usage among preschoolers aged 2-6 in rural Western India: a cross-sectional study. J Family Med Prim Care 2019;8:1999-2002. https://doi.org/10.4103/jfmpc.jfmpc_206_19

[27] Malhotra S, Kant S, Rath R, Ahamed F, Sathiyamoorthy R, Gupta SK. Excess Screen Time and its Associated Factors among Young Men in a Rural Community of North India. Indian J Public Health 2022;66:327-30. https://doi.org/10.4103/ijph.ijph_2027_21

[28] Nair AN, Jayan AJ, Santhosh MM, Lalichen LM, Santosh A, Indu PS. High screen time and associated factors among high school students in an urban setting of Kerala: a cross-sectional study. Int J Community Med Public Health 2022;9:767-71. https://doi.org/10.18203/2394-6040.ijcmph20220237

[29] Maurya C, Muhammad T, Maurya P, Dhillon P. The association of smartphone screen time with sleep problems among adolescents and young adults: cross-sectional findings from India. BMC Public Health 2022;22:1686. https://doi.org/10.1186/s12889-022-14076-x

[30] Cartanyà-Hueso À, Lidón-Moyano C, Martín-Sánchez JC, González-Marrón A, Matilla-Santander N, Miró Q, Martínez-Sánchez JM. Association of screen time and sleep duration among Spanish 1-14 years old children. Paediatr Perinat Epidemiol 2021;35:120-9. https://doi.org/10.1111/ppe.12695

[31] Stiglic N, Viner RM. Effects of screentime on the health and well-being of children and adolescents: a systematic review of reviews. BMJ Open 2019;9:e023191. https://doi.org/10.1136/bmjopen-2018-023191

[32] Drumheller K, Fan CW. Unprecedented times and uncertain connections: a systematic review examining sleep problems and screentime during the COVID-19 pandemic. Sleep Epidemiol 2022;2:100029. https://doi.org/10.1016/j.sleepe.2022.100029

[33] Kumar S. Santha, Shirley S. Alph. Association of screen time with physical activity and BMI in middle school children at Tamil Nadu, India. Int J Contemp Pediatrics 2020;7:78-83. https://doi.org/10.18203/2349-3291.ijcp20195730

[34] Ahmad S, Ansari MA, Khalil S, Abedi AJ, Khan MN. Physical activity and screen time: a cross-sectional study in aligarh, North India. The Indonesian Journal of Public Health 2021;16:166-76. https://doi.org/10.20473/ijph.v16i2.2021.166-176

[35] Dahlgren A, Sjöblom L, Eke H, Bonn SE, Trolle Lagerros Y. Screen time and physical activity in children and adolescents aged 10-15 years. PLoS One 2021;16:e0254255. https://doi.org/10.1371/journal.pone.0254255

[36] Sherar LB, Esliger DW, Baxter-Jones AD, Tremblay MS. Age and gender differences in youth physical activity: does physical maturity matter? Med Sci Sports Exerc 2007;39:830-5. https://doi.org/10.1249/mss.0b013e3180335c3c

[37] Shang L, Wang J, O'Loughlin J, Tremblay A, Mathieu MÈ, Henderson M, Gray-Donald K. Screen time is associated with dietary intake in overweight Canadian children. Prev Med Rep 2015;2:265-9. https://doi.org/10.1016/j.pmedr.2015.04.003

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HEALTH CARE MANAGEMENT

# Healthcare infections and antimicrobial consumption in pre-COVID-19 era: a point prevalence survey in three hospitals in a region of Central Italy

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Keywords

Antibiotics • Antimicrobial stewardship • Infection control • Hospital acquired infection • Indication for prescription • Point prevalence survey

Summary

**Introduction**. *Healthcare-associated infections (HAIs) are a major global public health concern, increasing the transmission of drug-resistant infections. This point prevalence survey investigated HAIs occurrence and antimicrobial consumption (AMC) in pre-COVID-19 era in the public hospitals of a region of Central Italy.*
**Methods**. *Data were collected using the protocol standardised by the European Centre for Disease Prevention and Control.*
**Results**. *Three-hundred and sixty-four patients were included (59.3% male) in the study. Overall, HAIs prevalence was 6.6% (95%CI 4.4-9.5), ranging from 5.2% to 7.1% within the surveyed hospitals, with at least one infection in 24 patients (ten each in medical and surgical specialties wards, and four in intensive care). Risk factors for HAIs were advanced age, having undergone surgery and wearing invasive devices. At time of the survey, 44.7% (95%CI 39.7-49.9) of patients was under treatment with at least one antibiotic, and AMC varied between 43% and 48% within hospitals. In all hospitals, a prevalence higher than 10% was found for the prescription reasons other than prophylaxis or therapy.*
**Conclusions**. *The results revealed a HAIs prevalence lower than that estimated compared to the most recent national data, in contrast to higher antimicrobial usage. These findings highlight the need to reinforce hygiene practices and develop bundles for HAIs, as a broad implementation of infection prevention and control practices extensively applied to both hub and spoke hospitals could significantly reduce their occurrence, as well as to implement antimicrobial stewardship for prescriptive appropriateness.*

## Introduction

Healthcare-associated infections (HAIs) can be severe and life-threatening, leading to a significant increase of hospital stay and costs, and causing 90,000 deaths and billions of dollars in preventable expenditures annually [1]. Treatment of HAIs includes antibiotic selection, and the injudicious usage is likely to result in escalated rates of antimicrobials resistance (AMR), aggravated by a decreased development of new antimicrobial drugs [2]. The global burden associated with drug-resistant infections in 2019 was estimated in 5 million deaths [3].
The COVID-19 pandemic had an unprecedent impact on healthcare systems globally, and the effect on HAIs and antimicrobial resistance are still under investigation [4]. COVID-19 has likely caused profound repercussions on hospital ecology, leading to additional increased AMR rates, associated with the disruption of antimicrobial stewardship and infection prevention and control (IPC) activities, widespread use of broad-spectrum antimicrobials, and rise in critical admissions in settings where multidrug resistance (MDR) is already highly endemic [5]. Considering that infection surveillance represents an integral element of any comprehensive IPC, point prevalence surveys (PPSs) are used to assess HAIs prevalence and antimicrobial consumption (AMC), generating valuable information to highlight and address challenges and critical issues for improvement [6].
This study aimed at describing and comparing HAIs prevalence and AMC in all public hospitals for acute care in Molise region, Central Italy (with one hospital previously included in 2016-2017 European PPS coordinated by the European Centre for Disease Control and Prevention) [7]. The study findings provide insights regarding the most important concerns at a regional level and possible public health interventions for HAIs and AMR prevention and control, highlighting the possible relations among different hospitals where patients circulate according to their healthcare needs.

## Methods

### Study setting

The network of public hospitals in the Molise region is structured according to the "hub and spoke" model, with the main hospital as hub in the capital city of Campobasso (hospital A), and the other two acting as spoke (hospital B and hospital C in the city of Isernia and in town of

Termoli, respectively), both characterized by low-level intensity care compared to the hub hospital managing complex case-mix patients. Ethical conduct of research was largely ensured as data collected were de-identified, coded, and were anonymously analyzed in accordance with ethics guidelines, and approval or institutional review was not needed for this study as no experimental procedure was applied to individuals. Each participant was given an informed consent prior to the admission to hospitals, and ethical approval was not required due to the analysis of medical records with previous consent of the hospitals administration to participate to the survey here described, and in similar studies carried out in the same hospitals. Furthermore, it should be considered that the study complied with the exemption conditions from Guidelines for Ethical Review Applications and Reports (downloaded at http://www.gssey.com/llwyhd/7948.jhtml) for collection of archived data, documents, or records, and where information is recorded with the investigators unable to contact any subject, either directly, or through an identifier.

### Data collection

During May 2019, a PPS was conducted in all three hospitals mentioned above. Healthcare personnel with the accountability for IPC were involved after a proper training on the protocols standardized by the European Centre for Disease Prevention and Control (ECDC) [8]. Hospital, ward, and patient data including McCabe score were collected through ECDC HelicsWin v2.3.4 software. Furthermore, information was collected on HAIs, use of invasive devices, infected site/organ, microbiological examination, AMR patterns of pathogens, and use of antibiotics by Anatomical Therapeutic Chemical (ATC) Classification System code, therapeutic indication, and reasons for prescription.

### Statistical analysis

Means, standard deviations (SD) and medians were calculated for the continuous variables, while the categorical ones were numerically defined and expressed as relative frequencies. Percentage variation (Δ%) was evaluated for the aggregated data associated with the hospital indicators. HAIs description included number of infections per patient, affected sites/organs, and ward. Prescription and therapeutic indication for antibiotics were described, together with the use by molecule and class according to the ATC classification system, and reasons for treatment.

Comparison between prevalence data in the three hospitals was carried out using Chi-square or Fisher's exact test and one-way ANOVA for the qualitative variables, while Student's t test for independent samples was applied for the quantitative ones. Univariate analysis was also performed, estimating the relationship between a single risk factor and HAIs or AMC, using Chi-square or Fisher's exact test. Statistical significance was defined for p-values less than 0.05 for two-tailed hypothesis test. All data were analyzed using IBM SPSS software version 28.0.

## Results

### Characteristics of the included hospitals

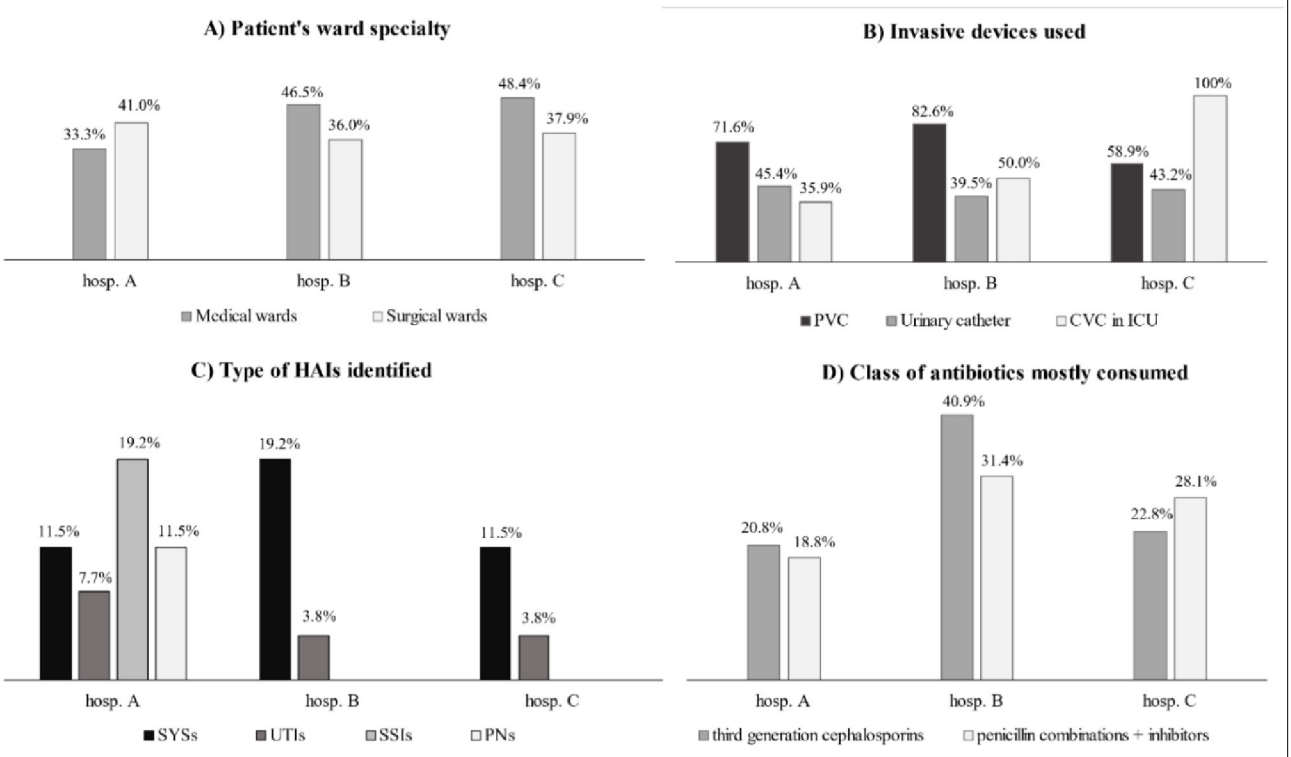
During 2019, the regional network of the public hospitals had 539 total beds for acute and 25 for intensive care (ICU) beds. There were 258, 151 and 130 acute beds for the hospital A, B and C, respectively, and 10, 9 and 6 ICU beds, with number of patient-days per year of 71,855, 47,085 and 43,350 for the three hospitals, respectively. PPS revealed concerns for the hospital hygiene indicators, as there was an insufficient use of alcohol-based solution for hand hygiene (359, 129.5, and 143 liters per year for hospital A, B and C, respectively) corresponding to gel consumption of 4.7, 2.9, and 3.4 liters/1,000 patient-days). Furthermore, a lack of full-time equivalent (FTE) nurses and FTE doctors in charge involved in the IPC, and FTE employees for antimicrobial stewardship was observed for all hospitals.

The IPC strategies and the participation in the surveillance networks, guidelines, and training courses on the management of pneumonia, blood (BSIs) and urinary tract infections (UTIs) were only available in the hospital A. While checklists, audits, surveillance programs, feedback, and bundles for a responsible use of antibiotics and management of surgical site infections (SSIs) were lacking in all the examined hospitals, there was the opportunity to request a microbiological examination during the weekend. Nine wards were present in all hospitals and were examined, including internal medicine, cardiology, general surgery, orthopaedics, anaesthesia and resuscitation, gynaecology and obstetrics, paediatrics, mixed specialties, and psychiatry. Hence, 16 wards were included in the PPS for the hospital A, which had seven additional wards, comprising infectious diseases, nephrology, urology, otolaryngology, neonatal intensive care, rehabilitation, and neonatology. For the hospital B, the wards of urology and neonatology were also included, and that of oncology for the hospital C, for a total of 11 and 10 wards, respectively.

### Patients included in the PPS

A total of 364 patients (183, 86, and 95 for hospital A, B and C, respectively) were included in this PPS: 59.3% were male (n = 216) and proportion was similar in all hospitals (n = 113, 61.7%; n = 52, 60.5%; n = 51, 53.7% for hospital A, B and C respectively). The median age was 72 years (mean 65.9) with 53.8% (n = 144) between 51 and 80 years old. The mean/median age of patients in the hospital C was slightly high (70.2 ± 19.8 years/76 years) than that in the hospital B (68.6 ± 19.7 years/75 years) and hospital A (62.4 ± 24.8 years/69 years). Patients included in the PPS were hospitalised in medical or surgical specialties wards (Fig. 1A). According to the McCabe score, 83.8% (n = 305) of patients had clinical conditions classified as non-fatal disease status, while 16.2% (n = 59) were defined as with a severe prognosis. Twenty percent (n = 30) of these patients were in medical specialties, 17.6% (n = 25) in surgical specialties, 15% (n = 3) in ICU, and 8.4% (n = 1) in gynecology and obstetrics wards.

Fig. 1. Ward specialty, invasive devices, HAIs, and antibiotic consumption among the surveyed hospitals.




PVC: peripheral venous catheter; CVC: central venous catheter; SYSs: systemic infections; UTIs: urinary tract infections; SSIs: surgical site infections; PNs: pneumonia infections.

The length of stay from ward admission to date of the survey was on average 9.7 ± 12.9 (median 6 days) in the hospital A, 7.1 ± 6.2 days (median 6 days) for the hospital B, and 7.6 ± 7.5 (median 5 days) for the hospital C. Furthermore, 80.7% (n = 294) of patients had at least one invasive device (peripheral venous catheter – PVC, central venous catheter – CVC, urinary catheter, or were intubated), and 91.2% were hospitalised in medical wards, or a combination of specialties (90%) and surgical wards (88.7%). In detail, 147 (80.3%), 75 (87.1%), and 72 (75.9%) patients in the hospital A, B and C had at least one invasive device, respectively. No significant differences in the use of invasive devices were found between the hospitals, neither for number, nor for type. PVC was the most used invasive device in medical (93.4%, 95% and 65.2% for hospital A, B and C, respectively) and surgical (82.7%, 87.1% and 69.4% for hospital A, B and C, respectively) specialties, while CVC in patients admitted to ICUs (71.9%, 50% and 100% in the hospital A, B and C) (Fig. 1B).

At time of the survey, 25.7% (n = 50) of patients underwent surgery at the hospital A, while 14% and 13.7% at the hospital B and C, respectively, with significant different distribution of the interventions between hospitals ($p < 0.01$).

### HAIs prevalence

Amongst the 364 patients, HAIs prevalence was 6.6% (95%CI 4.4-9.5), with at least one infection in 24 patients: 10 (6.8%) patients were in wards of medical specialties, 10 (7%) and 4 (20%) in surgical specialties and ICU, respectively (Tab. I). There were 13 (7.1%) patients with HAIs in the hospital A, while 6 (7%) and 5 (5.2%) cases in the hospital B and C, respectively (Tab. I). In all the facilities, HAIs were most frequent in ICU, with a prevalence of 14.3%, 50% and 25% in the hospital A, B and C, respectively. Twenty-two patients with HAI had a single infection, while two patients in the hospital A had a dual infection, particularly UTI and pneumonia, and SSI associated with BSI.

SSIs were the most frequent HAIs in the hospital A accounting for 19.5% of all, followed by systemic (SYSs) and respiratory infections (both 11.5%), while in the hospital B and C SYSs occurred in 19.2% and 11.5%, respectively (Fig. 1C). In all hospitals, the most common bacteria causing HAIs were gram positive cocci, followed by gram negative bacteria and fungi. A microbiological examination was not routinely performed, or results were not found in medical records, as occurred in the 60%, 66.6%, and 20% of all detected cases for the hospital A, B, and C, respectively. Particularly, 7, 2 and 4 microorganisms were isolated through a microbiological confirmation from six, two and four HAIs detected in the hospital A, B, and C, respectively (Tab. II). The most common microorganisms identified were gram positive cocci, including *Enterococcus faecium* and *Enterococcus faecalis* for the hospital A. Gram negative microorganisms such as *Klebsiella pneumoniae* (hospital

Tab. I. HAIs prevalence stratified by hospitals included in the survey.

| | N. patients | N. HAI patients | % HAI patients | N. HAIs |
|---|---|---|---|---|
| **Hospital A** | | | | |
| Medical specialties | 61 | 3 | 4.9 | 3 |
| Surgical specialties | 75 | 8 | 10.7 | 9 |
| ICU | 14 | 2 | 14.3 | 3 |
| **Hospital B** | | | | |
| Medical specialties | 40 | 3 | 7.5 | 3 |
| Surgical specialties | 31 | 2 | 6.5 | 2 |
| ICU | 2 | 1 | 50 | 1 |
| **Hospital C** | | | | |
| Medical specialties | 46 | 4 | 8.7 | |
| Surgical specialties | 36 | - | - | - |
| ICU | 4 | 1 | 25 | 1 |
| **All hospitals** | | | | |
| Medical specialties | 147 | 10 | 6.8 | 10 |
| Surgical specialties | 142 | 10 | 7 | 11 |
| ICU | 20 | 4 | 20 | 5 |

HAIs: healthcare-acquired infections; ICU: intensive care unit.

Tab. II. Microbiological examinations and percentages calculated on total HAIs.

| | Hospital A N. (%) | Hospital B N. (%) | Hospital C N. (%) |
|---|---|---|---|
| At least one microorganism identified | 6 (40) | 2 (33.2) | 4 (80) |
| Results not available at day of the survey | 3 (20) | 1 (16.6) | 0 (0) |
| No tests performed | 6 (40) | 4 (50) | 1 (20) |

A), *Escherichia coli* (hospital B), and *Acinetobacter baumannii* (hospital A and C) were also detected. HAIs sustained by fungi (*Candida albicans* and other species) were also found in the hospital A and C.

## AMC

At time of the survey, considering all hospitals, 44.7% (163 out of the 364) of patients was under treatment with at least one antibiotic (95%CI 39.7-49.9), and included 80 (43.7%) patients in the hospital A, 37 (43.0%) in the hospital B, and 46 (48.4%) in the hospital C.

Antibiotic prophylaxis was mostly documented in surgical specialties, as observed in 26 (53.3%) of total patients in surgical wards in the hospital A. Antimicrobial consumption for therapeutic purposes was more commonly recorded among medical specialties and ICUs than in other wards. In all hospitals, a prevalence higher than 10% was found for the prescription reasons other than prophylaxis or therapy, especially in the hospital B and C (Tab. III).

Significant differences were found between the hospitals for the treatment of community-acquired infection ($p < 0.01$), surgical prophylaxis longer than one day ($p < 0.01$), and indeterminate motivation ($p < 0.01$).

The most widely used classes of antibiotics in both hospital A and B were third generation cephalosporins, and penicillin combinations plus β-lactamase inhibitors, while the latter and third generation cephalosporins were the most used antibiotics in the hospital C (Fig. 1D). Use of fluoroquinolones was also relatively consistent in the hospital B (18.2%).

Ceftriaxone was the most used antibiotic for the surgical prophylaxis and treatment of community-acquired infections in the hospital A, while meropenem for HAIs (23.1%), followed by linezolid, colimycin and tigecycline (15.8%). Amoxicillin with clavulanic acid were the most used agents for community-acquired infections and ciprofloxacin for medical prophylaxis (each 60%) in the hospital B, and ceftriaxone was largely used (52.3%).

In the hospital C, ceftriaxone (25%) and piperacillin-tazobactam (25%) were the drugs prescribed for community infections, while fluconazole (40% of prescriptions) for HAIs treatment.

Tab. III. Antibiotic use by ward specialty and prescriptive indication available in the medical record.

| | N. treated patients (%) | | | N. antibiotics for prophylaxis (%) | | | N. antibiotics for therapy (%) | | | N. antibiotics for other reasons* (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wards** | **Hospital A** | **Hospital B** | **Hospital C** | **Hospital A** | **Hospital B** | **Hospital C** | **Hospital A** | **Hospital B** | **Hospital C** | **Hospital A** | **Hospital B** | **Hospital C** |
| Medical specialties | 26 (42.6) | 14 (40) | 19 (41.3) | 2 (6) | 2 (13) | 1 (4) | 28 (85) | 8 (53) | 18 (69) | 3 (9) | 5 (33) | 7 (27) |
| Surgical specialties | 40 (53.3) | 20 (64.5) | 19 (52.7) | 26 (6) | 22 (92) | 11 (55) | 10 (24) | 1 (4) | 2 (9) | 6 (14) | 1 (4) | 9 (41) |
| ICU | 10 (71.4) | 2 (100) | 4 (100) | 9 (56) | 1 (33) | - | 7 (44) | 2 (67) | 3 (60) | 0 (0) | 0 (0) | 2 (40) |
| Gynaecology and Obstetrics | 1 (11.1) | 0 (0) | 1 (100) | 0 (0) | - | 1 (100) | | | | | | |
| Paediatrics | - | - | 3 (100) | - | - | 0 (0) | - | - | 3 (100) | - | - | 0 (0) |
| Mixed specialties | 3 (42.8) | 1 (33.3) | - | 0 (0) | 2 (100) | - | 4 (100) | 0 (0) | - | 1 (100) | 0 (0) | - |

* Other reasons include Indeterminate Indication (UI) and Unknown Motivation (UNK); UI code was used whenever an antibiotic therapy did not fall specifically into the previous categories (Therapy/Prophylaxis) in case of empirical treatment for non-specific signs and/or symptoms of infection, or did not meet the case definition, or for treatment of "secondary" prophylaxis, in case of suspicion of already acquired infection (for example increases in body temperature or white blood cells), to avoid the full-blown disease; UNK code was used whenever antibiotic therapy without motivation has been prescribed.

Tab. IV. Risk factors significantly associated with a) HAIs occurrence and b) AMC.

| | | Hospital A | Hospital B | Hospital C |
|---|---|---|---|---|
| a) | | | | |
| | **Patient characteristics** | | | |
| | Fatal McCabe score | 0.62§ | 0.10§ | 0.01§ |
| | Having undergone surgery | 0.04§ | > 0.99§ | > 0.99§ |
| | **Indwelling invasive devices** | | | |
| | CVC | < 0.01§ | 0.05§ | 0.01§ |
| | Urinary catheter | < 0.01* | 0.21§ | 0.01§ |
| | Intubation | 0.10§ | 0.13§ | < 0.01§ |
| b) | | | | |
| | **Patient characteristics** | | | |
| | Fatal McCabe score | 0.01* | 0.59§ | 0.09§ |
| | Having undergone surgery | 0.01* | 0.02* | 0.03* |
| | HAI | < 0.01* | < 0.01* | 0.02* |
| | **Indwelling invasive devices** | | | |
| | CVC | < 0.01* | 0.22* | < 0.01* |
| | PVC | < 0.01* | 0.04* | 0.23* |
| | Urinary catheter | < 0.01* | < 0.01* | < 0.01* |
| | **Hospital wards** | | | |
| | Surgical specialties | 0.03* | < 0.01* | 0.53* |
| | ICU | 0.04* | 0.18* | 0.05* |
| | Rehabilitation | 0.03§ | - | - |
| | Neonatology | 0.01§ | - | > 0.99§ |

* Chi-square test; § Fisher's exact test.

## Risk factors associated with HAIs and AMC

Significant relationships were observed in the hospital A between HAIs risk and having undergone surgery and use of CVC or use of urinary catheter. In the hospital C, HAIs risk correlated with McCabe score, CVC, urinary catheter, and intubation (Tab. IVa). No risk factors were identified for the hospital B.

AMC in the hospital A was significant related with patients' characteristics, HAIs occurrence, having undergone surgery during hospitalization, clinical severity, CVC, PVC, urinary catheter, and being hospitalised in ICU and surgical, rehabilitation, and neonatology wards. For the hospital B, a significant relationship between AMC and HAIs, having undergone surgery, PVC, urinary catheter, and being hospitalised in surgical specialties. In the hospital C, AMC was linked to surgery and HAIs, in addition to the use of invasive devices (Tab. IVb).

## Discussion

This study evaluated the epidemiology related to HAIs and antibiotics use in all the public hospitals in the Molise region. The survey revealed critical issues to rapidly address, with further considerations on the regional demographic structure characterized by a high proportion of elderly population increasing the infectious risk. If age does not represent a modifiable factor for reducing HAIs prevalence, the appropriate use of antibiotics is necessary to target drug-resistant bacterial infections, and prevent emerging of bacterial resistance [9].

The overall HAIs prevalence of 6.6% was in line with the 6.5% estimated by the ECDC in the European PPS conducted in 2016-2017, including 1,209 EU acute hospitals [10]. HAIs prevalence was 7.1% in the hospital A, as well as previously found in the PPS conducted in 2016 [7], 7% and 5.2% in the hospital B and C, respectively not surveyed before this PPS. Hence, HAIs prevalence was higher in the hub hospital than in spokes, as reported in the literature [11] and this is probably related to the presence of high-risk wards, as well as to the intrinsic function of hub hospitals, leading to the admission of the most complicated cases. Furthermore, patients' movement may facilitate HAIs transmission, who may then be transferred or treated in other regional hospitals. Indeed, spatial variation in hospital sizes, presence or absence of an ICU, degree of connectivity, and inter-hospital transfer rate may promote source-sink dynamics at a regional scale, and the reintroduction of an infectious agent may re-establish local transmission [12]. HAIs occurrence in the hospitals was lower than that previously found (approximately 10%) related to other Italian regions [13]. It is of note that there was a different prevalence of HAIs in ICUs in the three hospitals included in this survey, being high in the hospital B and C, unlike the hospital A, in which a targeted infection control program was implemented following an outbreak of *K. pneumoniae* carbapenemase-producing (KPC) in ICU [14]. Among the three hospitals, there were further differences regarding type of HAIs, being SSIs resulted as the most frequent in the hospital A, which is likely due to hospitalization of patients with comorbidities, and different type of interventions [15], while these infections were not detected in the other two hospitals, due to a low complexity of the managed patients.

In all surveyed hospitals, a great number of patients had at least one invasive device, a known risk factor associated to HAIs occurrence [16], and was higher than that previously observed in the hospital A [17]. Indeed, all the patients with UTIs in the hospital A had a urinary catheter, as well as the affected patient in the hospital C. Hence, despite the availability of guidelines and training courses to prevent UTIs in the hospitals, there is likely an over-exposure to invasive devices due to patients' characteristics with UTIs. SYS (sepsis from unspecified origin) represented the most frequent HAIs in the hospital B and C, accounting for 80% and 60% of all HAIs respectively, a rate higher than that found in other studies on large and complex hospitals (17.2%) [13, 18].

Concerning antibiotic use, the prevalence of patients under treatment for any reason did not differ between the hospitals. AMC was higher than the 30.5% estimated in the European acute care hospitals in the PPS 2016-2017 [19], but lower than 46% reported in another Italian study [16]. Administration of antibiotics for prophylactic

purposes for at least three days after surgery was very high in the hospital A and B. The use of third generation cephalosporins was limited in other Italian settings [13] in contrast to the present survey; this class of antibiotics was the most frequently prescribed, especially for surgical prophylaxis, which is not recommended as promoting the development of resistant strains [20]. A significant difference in the antibiotics prescribed for surgical prophylaxis was found comparing the three hospitals, highlighting the need for antimicrobial stewardship. This study further underlines the need of guidelines for antibiotic prophylaxis, considering the frequency of prescriptions for indeterminate or unknown reasons, or without any indication in the medical record, implying that patients may have received inappropriate therapy. Indeed, there is evidence that antimicrobial stewardship programs significantly improve the prescriptive appropriateness in the hospital setting, with positive effects on clinical outcomes, adverse events, costs, and control of microbial resistance [21].

After the survey described here, the activity of a multidisciplinary working group was launched for the definition of an antimicrobial stewardship document. The use of empirical therapy was considered high also for a reduced number of laboratory tests performed in the hospitals; for example, a microbiological examination was not carried out for 60% patients with HAIs in the hospital A. Analysis of tests performed in this hospital highlighted gram positive bacteria such as *Enterococcus faecium* and *E. faecalis*, according to other reports [18], while a higher prevalence of *C. difficile* in another Italian study was described [13].

The present survey allowed evaluation of hospital indicators and revealed a limited use of alcoholic gel solution for hand hygiene, which should be at least equal to 20 liters per 1,000 patient-days [22]. Moreover, by removing transient skin flora, proper hand hygiene is known to decrease microbial proliferation, reducing infection risk and overall healthcare costs. A further critical issue was the lack of alcoholic gel dispensers at the point-of-care, likely contributing to low compliance with hand hygiene practices. Although use of alcohol-based gel is the optimal solution for infection control [21], it was not possible to evaluate whether the low use, especially in the hospital B and C, was balanced with an increased hand washing, which was not assessed through the adopted protocol. These data are likely expected to be different considering the ongoing SARS-CoV-2 pandemic, as a renewed attention to hand hygiene practices due to the COVID-19 emergency might have changed compliance towards the use of alcoholic gel solution. The survey further revealed an incomplete set of practices for preventing infections in the hospital A, being equipped only by guidelines and training courses for health personnel on some areas or infections, while guidelines were not present in the other two hospitals. Furthermore, the lack of bundle approach for HAIs prevention and control was detected, also in ICUs, although effectiveness has been demonstrated [23]. In the examined hospitals, an antimicrobial stewardship post-prescription review was established only in 2019, which applied a formal procedure to assess prescriptive appropriateness. Benefits of such approaches have been extensively documented to reduce the inappropriate use of antibiotics, related costs, secondary *C. difficile* infections, and circulation of resistant microorganisms [24]. Although the introduction of specific staff to these tasks implies a cost in terms of both human and economic resources, evidence suggested that investing the equivalent of one FTE per 100 beds allows implementation and maintenance of an effective antimicrobial stewardship program over time [25].

## Conclusions

A lower HAIs prevalence was estimated through PPS compared to the most recent national data, in contrast to higher antimicrobial usage. This study confirmed that a broad implementation of IPC practices extensively applied to both hub and spoke hospitals could significantly reduce HAIs occurrence. Specific interventions at the organizational level are needed to improve appropriateness of treatments and to reduce risk factors for the AMR emergence. An increased awareness of AMR threat by all health professionals and of HAIs prevention should be widely promoted. The ongoing COVID-19 pandemic has renewed attention on prevention and control of infectious diseases, even by adherence to simple hygiene rules. Indeed, COVID-19 could be seen as an opportunity, due to overlapping key areas, considering that approaches for the management of hospitalised patients with SARS-CoV-2 infection are similar to those applied in patients with HAIs. Furthermore, IPC practices essential for limiting SARS-CoV-2 spread, with hand hygiene above all, significantly contribute to reduce the occurrence of HAIs and the emergence of AMR bacteria.

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## Conflict of interest statement

The authors report there are no competing interests to declare.

## Ethical approval

Ethical approval was not required since patients signed an informed consent at the hospital admission, due to the analysis of medical records with previous consent of the hospitals administration to participate to the survey here

described, and in similar studies carried out in the same hospitals. Furthermore, it should be considered that the study complied with the exemption conditions from Guidelines for Ethical Review Applications and Reports (downloaded at http://www.gssey.com/llwyhd/7948.jhtml) for collections or studies of previously archived data, documents, or records, and where information is recorded with the investigators unable to contact any subject either directly, or through an identifier.

## Authors' contributions

All authors have made substantial contributions to the conception and design of the study, acquisition, analysis and interpretation of data, drafting or revising the article critically for important intellectual content, and final approval of the submitted version. MT was responsible of data analysis, manuscript drafting and editing. AS collected and reviewed data and protocols, and critically interpreted results. MLS contributed to data collection and interpretation. GR was responsible for the design, organization and coordination of the study, and critically revised and edited the manuscript. All authors contributed to the writing and revision of the final version of the manuscript.

## Availability of data and material

The relevant data are reported in the manuscript; however, the authors are available to provide any further details or information on request.

### References


[1] Shafer CW, Allison JR, Hogue AL, Huntington MK. Infectious disease: health care-associated infections. FP Essent 2019;476:30-42.

[2] Nimer NA. Nosocomial infection and antibiotic-resistant threat in the Middle East. Infect Drug Resist 2022;15:631-9. https://doi.org/10.2147/IDR.S351755

[3] Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. Lancet 2022;399:629-55. https://doi.org/10.1016/S0140-6736(21)02724-0

[4] Stevens MP, Doll M, Pryor R, Godbout E, Cooper K, Bearman G. Impact of COVID-19 on traditional healthcare-associated infection prevention efforts. Infect Control Hosp Epidemiol 2020;41:946-7. https://doi.org/10.1017/ice.2020.141

[5] Ghosh S, Bornman C, Zafer MM. Antimicrobial Resistance Threats in the emerging COVID-19 pandemic: where do we stand? J Infect Public Health 2021;14:555-60. https://doi.org/10.1016/j.jiph.2021.02.011

[6] Saleem Z, Godman B, Hassali MA, Hashmi FK, Azhar F, Rehman IU. Point prevalence surveys of health-care-associated infections: a systematic review. Pathog Glob Health 2019;113:191-205. https://doi.org/10.1080/20477724.2019.1632070

[7] Ripabelli G, Salzo A, Mariano A, Sammarco ML, Tamburro M. Collaborative Group for HAIs Point Prevalence Surveys in Molise Region. Healthcare-associated infections point prevalence survey and antimicrobials use in acute care hospitals (PPS 2016-2017) and long-term care facilities (HALT-3): a comprehensive report of the first experience in Molise Region, Central Italy, and targeted intervention strategies. J Infect Public Health 2019;12:509-15. https://doi.org/10.1016/j.jiph.2019.01.060

[8] European Centre for Disease Prevention and Control. Studio di prevalenza europeo sulle infezioni correlate all'assistenza e sull'uso di antibiotici negli ospedali per acuti. Stockholm: ECDC 2016. Available at: https://docs.wixstatic.com/ugd/5df5a1_e94d3f5124374a5da184862b222c4d6a.pdf (Accessed on: 06/04/2022).

[9] Morehead MS, Scarbrough C. Emergence of Global Antibiotic Resistance. Prim Care 2018;45:467-84. https://doi.org/10.1016/j.pop.2018.05.006

[10] Suetens C, Latour K, Kärki T, Ricchizzi E, Kinross P, Moro ML, Jans B, Hopkins S, Hansen S, Lyytikäinen O, Reilly J, Deptula A, Zingg W, Plachouras D, Monnet DL. Healthcare-Associated Infections Prevalence Study Group. Prevalence of healthcare-associated infections, estimated incidence and composite antimicrobial resistance index in acute care hospitals and long-term care facilities: results from two European point prevalence surveys, 2016 to 2017. Euro Surveill 2018;23:1800516. https://doi.org/10.2807/1560-7917.ES.2018.23.46.1800516

[11] Arnoldo L, Smaniotto C, Celotto D, Brunelli L, Cocconi R, Tignonsini D, Faruzzo A, Brusaferro S; FVG Regional 'Safety Care' Group. Monitoring healthcare-associated infections and antimicrobial use at regional level through repeated point prevalence surveys: what can be learnt? J Hosp Infect 2019;101:447-54. https://doi.org/10.1016/j.jhin.2018.12.016

[12] Vilches TN, Bonesso MF, Guerra HM, Fortaleza CMCB, Park AW, Ferreira CP. The role of intra and inter-hospital patient transfer in the dissemination of heathcare-associated multidrug-resistant pathogens. Epidemics 2019;26:104-15. https://doi.org/10.1016/j.epidem.2018.11.001

[13] Antonioli P, Bolognesi N, Valpiani G, Morotti C, Bernardini D, Bravi F, Di Ruscio E, Stefanati A, Gabutti G. A 2-year point-prevalence surveillance of healthcare-associated infections and antimicrobial use in Ferrara University Hospital, Italy. BMC Infect Dis 2020;20:75. https://doi.org/10.1186/s12879-020-4791-8

[14] Ripabelli G, Tamburro M, Guerrizio G, Fanelli I, Flocco R, Scutellà M, Sammarco ML. Tracking Multidrug-Resistant Klebsiella pneumoniae from an Italian hospital: molecular epidemiology and surveillance by PFGE, RAPD and PCR-Based resistance genes prevalence. Curr Microbiol 2018;75:977-87. https://doi.org/10.1007/s00284-018-1475-3

[15] Ripabelli G, Salzo A, Sammarco ML, Guerrizio G, Cecere G, Tamburro M. Infections and colon surgery: preliminary results from a surveillance program in an Italian Hospital. Hosp Top 2023;101:27-38. https://doi.org/10.1080/00185868.2021.2006103

[16] Monegro AF, Muppidi V, Regunath H. Hospital acquired infections. In: StatPearls. Treasure Island, FL: StatPearls Publishing 2023.

[17] Salzo A, Ripabelli G, Sammarco ML, Mariano A, Niro C, Tamburro M. Healthcare-associated infections and antibiotics consumption: a comparison of point prevalence studies and intervention strategies. Hosp Top 2021;99:140-50. https://doi.org/10.1080/00185868.2021.1902758

[18] Russo Fiorino G, Maniglia M, Marchese V, Aprea L, Torregrossa MV, Campisi F, Favaro D, Calamusa G, Amodio E. Healthcare-associated infections over an eight year period in a large university hospital in Sicily (Italy, 2011-2018). J Infect Prev 2021;22:220-30. https://doi.org/10.1177/17571774211012448

[19] Plachouras D, Kärki T, Hansen S, Hopkins S, Lyytikäinen O, Moro ML, Reilly J, Zarb P, Zingg W, Kinross P, Weist K, Monnet DL, Suetens C; Point Prevalence Survey Study Group. Antimicrobial use in European acute care hospitals: results from the second point prevalence survey (PPS) of healthcare-associated infections and antimicrobial use, 2016 to 2017. Euro

Surveill 2018;23:1800393. https://doi.org/10.2807/1560-7917.ES.23.46.1800393

[20] International Society for Infectious Diseases (ISID). Guide to infection control in the healthcare setting. Hand hygiene - 2018. Available at: https://isid.org/guide/infectionprevention/hand-hygiene/ (Accessed on: 01/05/2022).

[21] Schuts EC, Hulscher MEJL, Mouton JW, Verduin CM, Stuart JWTC, Overdiek HWPM, van der Linden PD, Natsch S, Hertogh CMPM, Wolfs TFW, Schouten JA, Kullberg BJ, Prins JM. Current evidence on hospital antimicrobial stewardship objectives: a systematic review and meta-analysis. Lancet Infect Dis 2016;16:847-56. https://doi.org/10.1016/S1473-3099(16)00065-7

[22] Hansen S, Schwab F, Gastmeier P; PROHIBIT study group; Pittet D, Zingg W, Sax H, Gastmeier P, Hansen S, Grundmann H, van Benthem B, van der Kooi T, Dettenkofer M, Martin M, Richet H, Szilágyi E, Központ OE, Heczko PB, Holmes A, Kyratsis Y, Ahmad R, Allegranzi B, Magiorakos A, Cookson B, Wu AW. Provision and consumption of alcohol-based hand rubs in European hospitals. Clin Microbiol Infect 2015;21:1047-51. https://doi.org/10.1016/j.cmi.2015.09.019

[23] Yazici G, Bulut H. Efficacy of a care bundle to prevent multiple infections in the intensive care unit: a quasi-experimental pretest-posttest design study. Appl Nurs Res 2018;39:4-10. https://doi.org/10.1016/j.apnr.2017.10.009

[24] Nathwani D, Varghese D, Stephens J, Ansari W, Martin S, Charbonneau C. Value of hospital antimicrobial stewardship programs [ASPs]: a systematic review. Antimicrob Resist Infect Control 2019;8:35. https://doi.org/10.1186/s13756-019-0471-0.

[25] Echevarria K, Groppi J, Kelly AA, Morreale AP, Neuhauser MM, Roselle GA. Development and application of an objective staffing calculator for antimicrobial stewardship programs in the Veterans Health Administration. Am J Health Syst Pharm 2017;74:1785-90. https://doi.org/10.2146/ajhp160825

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HEALTH CARE MANAGEMENT

# Involving medical students in re-orienting health services: a photovoice study

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Keywords

Reorienting health services • Health promotion • Photovoice • Qualitative research • Medical education.

Summary

**Introduction**. *Healthcare reorientation aims for health services focused not exclusively on diseases but also on prevention and health promotion. The implementation depends strongly on professionals' willingness to actively participate in the reorientation. An effective strategy to boost reorientation is to reorient education and role definition of future professionals. This paper examines whether photovoice can be a suitable method to i) increase future health professionals' awareness of users' needs and expectations; and ii) enable a process of critical reflection on role definition and health services organisation.*

**Methods**. *One hundred and seventy-two medical students participated in the photovoice project. Participants were asked to produce one photo combined with a caption, responding to a pre-identified question: "What is, in your opinion, the main aspect affecting users' satisfaction/dissatisfaction in a healthcare facility?". Participants discussed their photos in group discussions (n = 16) and participated in data analysis sessions (n = 4).*

**Results**. *Participants' contributions revolved around how services were delivered (e.g., kindness, accessibility, attention to additional needs) rather than the service provided. The students showed their empathic side and proposed smart and inclusive solutions to improve overall users' experience.*

**Conclusions**. *This study demonstrated the value of using photovoice to reach medical students and to integrate health promotion into their professional identities. The photovoice process, teamwork, and discussions opened a breach into traditional thinking regarding aspects of healthcare services that are taken for granted or are overlooked. Furthermore, participants' proposals often implied a change in the behaviour of professionals – their future selves – towards patients and low-cost improvements of organisational practices.*

## Introduction

The Ottawa Charter for health promotion [1] stated the urgency to reorient health services. This call for action is still pressing due to the numerous challenges of the health system, such as changes in health care needs relating to demographics (*e.g.*, chronic diseases, malnutrition, *etc*.), migrations, decreases in resources, pandemics, changing social values, and medicine and technology evolution [2]. The reorientation aims for health services focused not exclusively on illness and diseases but also disease prevention and health promotion. In response to these needs, the World Health Organisation (WHO) created the Health Promoting Hospitals (HPH) project and established the HPHs network, relying on the central role of hospitals in advocating for health promotion [1]. Although the need for change in the health services approach to users is recognized, the transition still needs to be broadly implemented [1].

The Charter identifies the responsibility for health promotion in health services as shared among individuals, community groups, health professionals, health service institutions and governments. It also acknowledges the importance of paying attention to health research and changes in professional education and training for a refocus on the needs of the individual seen as a whole person [1]. Evelyne De Leeuw (2009) affirms that hospitals are like other professional bureaucracies, with operating procedures that maintain the organisation's integrity – "but based on tradition, historical fact, belief system and some degree of cultural bias (and not on any salutogenic principle), the health care institution works towards a continuity of work, not continuity of care" [3]. Wieczorek et al. (2015) highlighted how health promotion, aiming for more client-oriented healthcare services, has used organisational change strategies primarily applied in business organisations [4]. This approach, however, fails to recognize the nature of hospitals as 'professional organisations'. This is described by Wieczorek et al. (2015) as expert-driven, skill-oriented, and based on the delicate interaction between professionals and users/patients, difficult to monitor and supervise by healthcare management [4]. Unfortunately, a significant impediment to health promotion implementation is identified in the unwillingness of professionals to make the approach their own in standard routines with patients [4-6]. It is clear that any top-down decision or attempt to guide and control the application of health promotion approaches is hardly effective due to professional autonomy to decide how and when to engage with reorientation

attempts [4]. The implementation is therefore proven to be strongly influenced by the autonomy of professionals and by their willingness to actively participate in the reorientation, which is an important step towards a sustainable change [8].

The field of health promotion has adopted the concept of salutogenesis by Aaron Antonovsky as a guide theory: the sense of coherence (SOC), shaped by life experiences, determines individuals' movement on the health ease/disease continuum, mobilising resources to cope with life stressors [9]. Salutogenesis and SOC construct can be integrated indirectly into healthcare by health promotion re-orientation [10]. Salutogenesis has been developed in opposition to the pathogenic paradigm, namely, a disease-oriented approach primarily followed by healthcare [10]. Applying salutogenesis to healthcare introduces a positive-oriented approach, which limits the disease-oriented one, complementing it in everyday practice and research and unlocking the potential of health care to be more preventive, protective, and promotive of positive health [10]. However, Bauer et al. (2020) highlighted the need for advancement of the overall salutogenic model of health [11]. In their position paper, they point out how extending the salutogenic model of health, with an additional positive continuum and a path of positive health development, will support health promotion researchers and practitioners in focusing on positive aspects of health experience [11]. Whatever their title, health promotion practitioners should act accountably, share best practices, and uphold the principles of the Ottawa Charter for Health Promotion [1]. The International Union for Health Promotion and Education (IUHPE) aims to promote quality assurance in health promotion practice, education, and training [12]. Promoting partnerships among professionals who agree on the international definition of health promotion could maximise the best use of resources in meeting shared goals [12]. Despite the efforts of the health promotion community, it is important to note that there is still little evidence on specific training paths to form specialised health promotion practitioners in Europe.

How can we face the necessity of integrating health promotion in professionals' identities and values other than in their knowledge? Different strategies could be adopted for health promotion integration in professionals' routines. This includes their direct involvement in the process of creation and implementation of the programs (developing programs that match professionals' practices), the presentation of changes as opportunities for professional improvement (career opportunities or enhancement of professional status), and the harmonization between the program and professionals' role definition (identities, values, knowledge) [4]. An important aspect often overlooked is education and role definition of future professionals. Worldwide, health professionals' education usually consists of advanced university-based lessons and practical training; the latter is crucial for applying abstract knowledge to actual clinical cases [3-11]. This theoretical-practical training approach should also be applied to health promotion concepts, but unfortunately, professional education still needs to catch up with the modern challenges that healthcare services are facing [14]. The reorientation of health services cannot be separated from the reorientation of the university education of future professionals, otherwise graduates will be ill-equipped for the long-term goals of health promotion. Wieczorek et al. (2015) showed that hospitals' reorientation might often be unsuccessful due to organisational change programs that do not reflect professionals' identities, values, and knowledge [4]. A response strategy could be the essential mix of advanced education and practical training addressed to undergraduates. Reaching young professionals during education while they are still developing their professional identities could be an effective and low-cost strategy. It may boost health promotion reorientation and critical reflection "from within," making students familiar with health promotion values, goals, and applications [15].

Following these considerations, we introduced the visual participatory method 'photovoice' to examine users' satisfaction/dissatisfaction in healthcare facilities. Photovoice is a community-based participatory research (CBPR) method originally developed by Wang & Burris in 1997 [16]. It focuses on individual and community assets, co-creation of knowledge, community building, and individual and community empowerment through a specific photographic technique [14-17]. Photovoice is grounded in the approach promulgated by Paulo Freire [13, 19] consisting of education for critical consciousness. It is conceived as an essential tool for people to reflect on their community and its intrinsic contradictions through the visual image [22]. Following Freire's purpose to stimulate individuals to discover and create their own learning through doing, photovoice encourages common discussions on the needs of the community and spurs the participants to intervene to resolve the critical issues identified [16]. The CBPR approach to photography turns the camera into a resource and images into tools for social change [16]. The mean is easy to use, and the language of images is universally understandable and capable of conveying and transmitting new ideas and perspectives that otherwise could stay unheard. Photovoice has proven to be a very flexible method and can be adapted to specific objectives, different groups and communities and distinct public health needs [14, 15, 20-23].

Health professionals' views on what users value the most could be unconsciously biassed by their role. Critical reflection and empathy are two essential attributes enabling professionals to understand the lived reality of healthcare users. Encouraging current and future health professionals to reflect on these attributes by using visual participatory methods might stimulate them to respond to users' needs and participate actively and willingly in reorientation.

## Study aims

By adopting a CBPR approach, we actively engaged a group of sixth-year medical school students to: (i) self-

reflect on their practice as future health professionals, (ii) communicate their views on what makes a user satisfied with a healthcare service, and (iii) identify community recommendations to actively improve the users' experience. This paper examines whether photovoice i) increased awareness of future health professionals about users' needs, expectations, and perceptions and ii) enabled a process of critical reflection on role definition and health services organisation.

## Methods

### Study context

The study took place from November 2021 in the context of a practice learning activity addressed to the sixth-year medical students of the University of Cagliari, Italy. The project was carried out in synchronous distance learning using the Zoom Meeting platform. The activity consisted of a mix of lessons, team-work, and comparison among students, with the engagement of teachers and tutors.

### Participants and Recruitment

All students in the sixth year of medicine (academic year 2021-2022) participated in the project, for a total of 172 contributors. Participants were divided into 16 teams composed of 10 to 12 participants: 8 teams started their photovoice activity in November 2021 and ended it in February 2022; the other 8 started in March and ended in May 2022.

### Procedures

In our study, we slightly modified the photovoice methodology by Wang & Burris (1997) to adapt our project to sixth-year medical students [16]. We also adapted the methodology to the SARS-CoV 2 emergency and the need for social distancing. We developed the project online and tried to maximise the experience for participants revealing one contribution at a time, slowly unravelling each share as in a physical exposition. This approach also helped us to elicit discussions among participants.

### Phases of the project

- PHASE 1: each participant received by email a photovoice pack containing a summary of the study aims and photo-task. If needed, the research team (ADL, AL, SMP, PC) was available to answer questions about the project. The training (which lasted two hours) focused on (i) an introduction about users' satisfaction in health services and (ii) an overview of photovoice. Participants were asked to produce one photo combined with an accompanying caption, responding to a pre-identified question (photo-task): "What is, in your opinion, the main aspect/some of the most important aspects affecting users' satisfaction/ dissatisfaction in a healthcare facility?".
- PHASE 2: participants took photographs over a period of a week using their smartphones.
- PHASE 3: photos and accompanying captions were submitted by participants through the free Google Forms service, and successively analysed by four researchers (ADL, AL, SMP, PC). We examined participants' contributions following a pre-existent analytical framework about users' satisfaction in healthcare facilities, which emerged from a pilot-edition of this practice learning activity and based on the review of the literature [24-26]. See Table I for: i) details about performance areas, services, and related specific issues raised by participants; ii) preliminary distribution of the photovoice contributions to the pre-identified themes.
- PHASE 4: participatory data analysis.
- PHASE 5: within four weeks, each team submitted a report on their experience of taking part in the photovoice project and a summary of the emerging concepts discussed during the focus group discussions.
- PHASE 6: at the end of the activities, we held two final online meetings (lasting 3 hours) using the world café [27, 28] to create a cooperative and meaningful dialogue on the key themes that emerged through the photovoice. 168 out of 172 participants took part in the world café, split in two groups (81; 87 participants). We tried to catalyse dynamic conversations about 1) staff, 2) instrumental and hotel services, 3) organisational matters, 4) additional services, by creating four virtual rooms. Each virtual room was occupied by 10-12 participants at a time for about 20 minutes. The discussion was moderated by one researcher for each room (ADL, AL, SMP, PC). At the end of the 20 minutes, we asked the participants to switch rooms, and briefly recapped the main emerging points for the new entering participants.

### Ethical considerations

The present study adopting a community-based participatory research approach did not require ethics committee approval as per direct consultation with the institutional ethical committee of Cagliari University. All participants were provided with detailed written and oral information about the activities and expressed their consent to participate by signing up through an online registration system.

Photovoice presents some ethical considerations related to the use of photographs such as individuals appearing in the photographs. We followed ethics guidance by Wang & Redwood-Jones (2001) and Evans-Agnew & Rosemberg (2016) [20, 29]. Participants were left free to take any object/person/place, ensuring to: i) ask for written consent if people other than the participants were portrayed; ii) anonymise sensitive information. To promote authenticity, we guaranteed anonymity of photos and accompanying captions. Each participant was let free to unveil their authorship and comment on the photo and caption.

### Data analysis

We adopted a thematic approach to the analysis, whereby we identified themes and subthemes from the transcripts,

drawing on techniques from thematic analysis [30–32]. Our analysis was informed by a predefined analytical framework (refer to Supplemental Materials 1 and 2). This included the definition of areas and themes of Citizen Satisfaction related to health services provided by the Monserrato teaching hospital – AOU Cagliari (*e.g.*, medical service; organisational aspects, *etc*.) and was informed by earlier work by [24-26]. Further details about how the initial framework was developed are presented in Supplemental Materials 1 and 2.

Our analysis focused on aspects contributing to users' satisfaction. One of the researchers (AL) collected all the photovoice data (n = 172 photos; n = 16 focus groups), anonymized it and organised it in a.pptx file. Transcripts of the focus groups were reviewed one-by-one, individually by each of the four researchers (ADL, AL, SMP, PC), and provisional attributions to themes were applied based on the topic (*e.g.*, medical service). Based on our initial analytical framework, we sorted participants' photos and accompanying captions (identified in PHASE 4) into four main themes: staff, instrumental and hotel services, organisational matters, and additional services.

Each photo was analysed in relation to the meaning that the participant attached to it through the sentence matched [35]. To ensure we captured the intentions of participants in the data analysis accurately, we discussed the emerging themes and sub-themes with each team during focus group discussions (Supplemental Materials Tables I and II), and made changes accordingly (*e.g.*, we clarified some aspects about user satisfaction). Subsequently, the research team (ADL, AL, SMP, PC) discussed together the final set of sub-themes and themes, to ensure agreement among team members.

## Results

One hundred and seventy-two students aged between 23 and 35 participated in this study (demographics are in Tab. I) and discussed a total of 172 photos.

In this section we present selected findings on three of the four main themes discussed (staff, instrumental and hotel services, organisational matters, and additional services; see Supplemental Materials 2). The captions accompanying each picture were translated from Italian to English by the researchers involved in the activity, guaranteeing respect of the original meaning.

### Staff

Through the photographs, participants identified a shared thought about empathy and human relationships in healthcare services. The relationship between users and professionals is based on mutual respect, trust, and understanding. In the opinion of participants, making users and patients feel understood and treated as individuals in their entirety seems to be a fundamental piece of users' satisfaction puzzle.

An example is shown in Figure 1, a creative contribution where the participant made a step further elaborating on the photo taken to stress the concept: people in a waiting room are depicted as numbers with legs.

"What makes a user satisfied is mostly the feeling of being treated and managed as a person and not as a number." (Participant 159, F, age 26; see Fig. 1).

Healthcare services are often forced to find a middle ground between offering a continuous and fast service and the essential need of people to be approached in a human and sympathetic manner. An empathetic approach is essential and may be taken for granted, however most participants felt the need to point it out as a critical juncture.

Tab. I. Details of participants taking part in the photovoice study.

| N. participants | 172 | |
|---|---|---|
| | Age | |
| Mean | 25.5 | |
| Median | 25.0 | |
| Minimum | 23 | |
| Maximum | 35 | |
| Gender | N. | % |
| F | 101 | 58.7% |
| M | 71 | 41.3% |
| Education Level | N. | % |
| High School Diploma | 152 | 88.4% |
| Graduate/Post-Graduate | 20 | 11.2% |

### Instrumental and hotel services

Photographic representation is particularly suited to provide details and context on participants' perceptions of the accessibilities and environments of the healthcare facilities. The images show views and corners taken by participants, evoking spontaneous reactions to colours, shapes, and signs. An example is shown in Figure 2, which depicts a long grey corridor between two rows of windows that ends in a dark space.

"Get lost in the dark: the user who accesses a hospital does not always find the location of the visit due to a lack of linear and precise indications." (Participant 34, F, age 24; see Fig. 2).

The snapshot could be interpreted as a mix between a sense of physical disorientation, which can occur in any new place without clear indications, and bewilderment linked to health concerns. Signs that make clear where we are and how to reach our target (waiting rooms, consulting rooms, surgery rooms, wards, laboratories *etc*.) are essential to improve the user's overall experience and decrease the sense of abandonment. The user/patient should be guided and supported during the time spent in the healthcare facility to value their time and independence, by giving them a better and more inclusive service, and addressing their need to feel secure and oriented.

### Additional services

During the project, participants reported a multitude of views about the importance, feasibility, and appropriateness of providing additional services. These services comprehend all those amenities designed to meet

**Fig. 1.** Example of what is perceived as unsatisfying about human relationships in healthcare services (Participant 159, F, age 26).


personal needs. User's needs may depend on physical, social, religious, ideological, ethical, and personal reasons, as well as on age and gender. In this category we comprehend tangible goods and services (meals, space to profess faith, suitable environments for kids/elders, *etc*.) and intangible services. Intangible services depend on organisational imprint and professionals' approach to users' needs, which in turn is strongly influenced by other inviolable services: instruction and training.

Most participants agreed that healthcare organisations should meet individuals' needs where possible and promote discussions and initiatives about creating dedicated services. They also pointed out that professionals should be the first allies to patients/users and show an open and caring approach to their needs. The discussions about additional services were perceived as authentic self-reflection moments in which each participant abandoned the static role of professionals and embraced users' condition as human beings, reflecting on what makes us who we are and how we could improve users/patients' experience. Several suggestions emerged: barbering service and additional hygiene services on request, library service, safe social spaces dedicated to patients and visitors, improvement of privacy in multiple rooms, services dedicated to families and kids, and others.

An example of what was considered a successful additional service during the SARS-CoV-2 pandemic is depicted in Figure 3.

"The big step forward that hospitals are making during the pandemic: put in safety a hug like this" (Participant 92, M, age 25; see Fig. 3).

Figure 3 shows a parent holding their newborn son. Usually, this is not considered an additional service. However, during the SARS-CoV-2 pandemic, several essential services, usually taken for granted, were abolished in the name of security. Sometimes, even if it seemed possible to guarantee these services, through testing and the use of protective equipment, the lack of personnel, scarce resources, and overworked staff prevented it.

### Impact of photovoice methods on future professionals' awareness

The process of photo-production offered participants an opportunity for critical thinking about several aspects of healthcare, spurring the students to observe healthcare from a different point of view: the one of the user. Most participants stated that photovoice engaged them in a new way, completely different from the traditional learning they were used to.

The following quotes are extracted from participants' final reports:

- "We had the opportunity to learn a new, powerful, immediate, and effective communication strategy. The power and effectiveness of communication result from an initial curiosity: associating a photo with an idea summed up in a few words captures the observer's gaze and attention immediately, leaving open the possibility of analysis and alternative interpretations of the concept itself. We appreciated the chosen modalities for the project, configuring a new and interactive experience." (Team 3).
- "During Photovoice, it was possible to notice how

**Fig. 2.** Example of a perceived lack of accessibility in healthcare facilities (Participant 34, F, age 24).

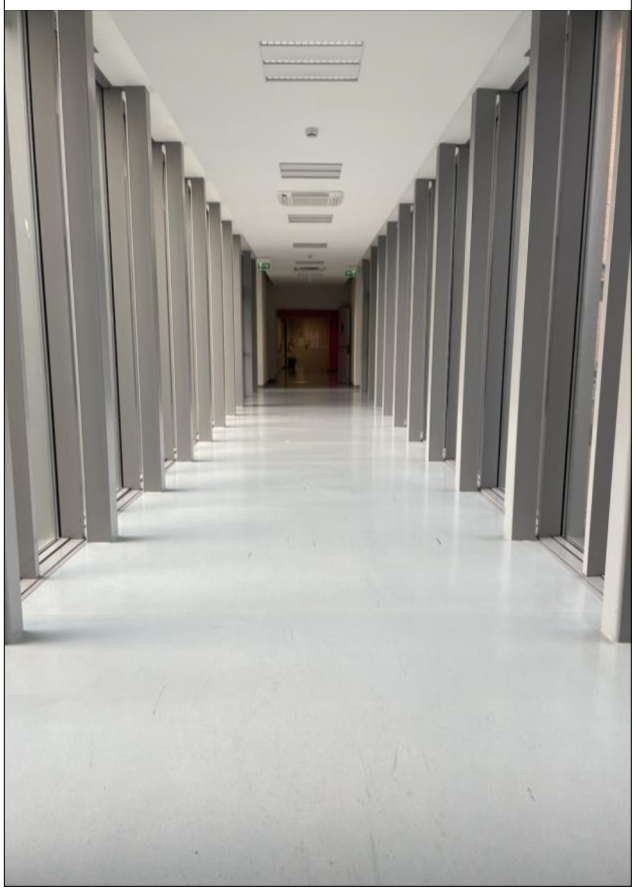

**Fig. 3.** Example of additional services perceived as satisfactory (Participant 92, M, age 25).

sometimes notably conflicting messages could arise from a single image. Only the addition of the caption, in most cases, clarified the author's intention." (Team 2).

- "Personal experiences and character inclinations sometimes lead to highly different opinions and points of view in the face of the same situations." (Team 5).
- "The photovoice offered moments of reflection, discussion, and comparison. A common thought emerged on the importance of a doctor-patient relationship based on trust, understanding, empathy, and mutual respect." (Team 4).
- "Overall, the photovoice project was very interesting and provided much food for thought, especially about the elements that strongly affect the satisfaction and dissatisfaction of users who access the services guaranteed by the National Health Service." (Team 7).

## Discussion

Over the last decades, the necessity of integrating health promotion in professionals' identities and values has become increasingly urgent [2, 3, 12, 35-37]. This study demonstrates the value of using photovoice to reach medical students while still training to integrate health promotion into their professional identities. The photovoice process, teamwork, and discussions opened a breach into traditional thinking about aspects of healthcare services often taken for granted or overlooked. By adopting a CBPR approach, the sixth-year medical school students were actively engaged to self-reflect and identify critical points and community recommendations about users' satisfaction. Through the choice of the subject to represent and the active generation of the image, participants gradually became interpreters of the topic, by stimulating a discussion that promoted respect and social inclusion, community action, and perhaps, in the future, informed advocacy. In this study, participants' reflections revolved more around how services are delivered than the actual service provided. The students showed their empathic human side and made efforts to propose smart and inclusive solutions to improve users' overall experience. These solutions often implied a change in the behaviour of professionals (their future selves) towards patients and simple and low-cost improvements of organisational practices.

The photovoice data and participants' final considerations on the visual participatory approach demonstrated the ways through which this project managed to raise future health professionals' awareness of users' needs, expectations, and perceptions, enabling

a critical reflection on role definition and health services organisation.

As proposed in the present study, future interventions should consider low-cost strategies to boost health promotion reorientation of healthcare. Mixing advanced education with CBPR activities effectively stimulates critical reflection "from within" and familiarises students with theoretical health promotion values and, above all, practical goals, and applications. Moreover, these findings support the use of photovoice as a valuable method for a genuine participation of medical school students. Although our study has shown some promising results regarding the use of photovoice as a method to explore medical students' awareness of users' needs and elicit critical reflection for reorienting health services, further research is needed to assess the long-term effects the photovoice experience has on participants and their professional identities, as well as of advantages and limitations of the process.

An intrinsic limitation of photovoice is linked to participants' personal judgement. Namely, what they choose to photograph or not for various internal and external reasons (*e.g.*, embarrassment, desire to please the researchers, time constraint and many others) [17]. A key strength of our study is represented by the creation of an informal safe space for self-expression. We would empirically define our study participants as highly sensitive to judgement and distressed by the idea of 'being wrong'. In this study, we tried to create a safe space for self-expression, and we guaranteed the anonymity of the material shared and the absence of judgement. Surprisingly, most participants spontaneously explained their photographs to the group, confirming that creating a safe atmosphere may enhance authenticity and participation of all individuals of a group.

Due to the SARS-CoV-2 emergency and the need for social distancing, we had to adapt the methodology and conduct the study online. To maximise the experience for participants we showed one contribution at a time, as in a physical exposition. This approach helped us to elicit spontaneous discussions between participants and demonstrated photovoice flexibility. We were, in fact, able to carry on the project online, despite the pandemic, offering the participants an opportunity for informal gathering and obtaining positive results. Despite photovoice being a versatile method, the activities suffered from limitations linked to online meetings, such as less face-to-face contact; technical difficulties; "bystander effect" applied to meetings: individuals are less likely to contribute when surrounded by others due to diffusion responsibility and wait for someone else to engage first.

## Conclusions

This study highlighted the opportunities in using photovoice to bring medical students closer to a conscious change toward the reorientation of health services. Photovoice revealed to be a valuable method for medical students' genuine participation and critical reflection stimulation. Using photovoice with students is a low-cost strategy that has the potential to produce medical doctors responsive to users' needs and effectively boost health promotion reorientation of healthcare.

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## Ethical approval

The present study adopting a community-based participatory research approach did not require ethics committee approval as per direct consultation with the institutional ethical committee of Cagliari University.

## Conflict of interest statement

The authors declare no conflict of interest.

## Authors' contributions

All the authors made substantial contribution to different aspects of the work: SMP, SR, PC: conceptualization; SMP, SR: writing -original draft; SMP, AL, ADS, PC: investigation, formal analysis, results interpretation; AL: visualization; ADS: project administrator; SR: validation; PC: resources, supervision; SMP, SR, AL, ADL, PC: writing -review and editing.

### References

[1] World Health Organization. Ottawa Charter for Health Promotion First International Conference on Health Promotion. Health Promotion 1986. https://www.who.int/publications/i/item/WH-1987 (Accessed on: 30/08/2023).

[2] Kickbusch I. A critical review of reorienting health services - Suggestions for next steps. The International Conference on Health Promoting Hospitals and Health Services [Online]. Available: https://www.hphconferences.org/fileadmin/user_upload/conferences/Vienna2017/Proceedings/Plen5_Kickbusch.pdf (Accessed on: 30/08/2023).

[3] De Leeuw E. Have the health services reoriented at all? Health Promot Int 2009;24:105-7. https://doi.org/10.1093/heapro/dap015

[4] Wieczorek CC, Marent B, Osrecki F, Dorner TE, Dür W. Hospitals as professional organizations: challenges for reorientation towards health promotion. Health Sociol Rev 2015;24:123-36. https://doi.org/10.1080/14461242.2015.1041541

[5] Lee CB, Chen MS, Chien SH, Pelikan JM, Wang YW, Chu CMY. Strengthening health promotion in hospitals with capacity building: a Taiwanese case study. Health Promot Int 2015;30:625-36 https://doi.org/10.1093/heapro/dat089

[6] Lee CB, Chen MS, Wang YW. Barriers to and facilitators of the implementation of health promoting hospitals in Taiwan: a top-

down movement in need of ground support. Int J Health Plann Manage 2014;29:197-213 https://doi.org/10.1002/hpm.2156

[7] Rootman I, Goodstadt M, Hyndman B, McQueen D, Potvin L. Evaluation in health promotion: principles and perspectives, no. 92. 2001 [Online]. Available: http://www.euro.who.int/__data/assets/pdf_file/0007/108934/E73455.pdf (Accessed on: 30/08/2023).

[8] Wise M, Nutbeam D. Enabling health systems transformation: what progress has been made in re-orienting health services? Promot Educ 2007;(Suppl 2):23-7. https://doi.org/10.1177/10253823070140020801x

[9] Antonovsky A. Health, stress and coping. New perspectives on mental and physical well-being. San Francisco, CA: Jossey-Bass 1979;11:206. https://doi.org/10.1017/s003329170005371x

[10] Mittelmark MB, Bauer GF, Vaandrager L, Pelikan JM, Sagy S, Eriksson M, Lindström B, Magistretti CM, Barry MM. The Handbook of Salutogenesis. 2nd Ed. Springer Cham 2022. https://doi.org/10.1007/978-3-030-79515-3

[11] Bauer GF, Roy M, Bakibinga P, Contu P, Downe S, Eriksson M, Espnes GA, Jensen BB, Juvinya Canal D, Lindström B, Mana A, Mittelmark MB, Morgan AR, Pelikan JM, Saboga-Nunes L, Sagy S, Shorey S, Vaandrager L, Vinje HF. Future directions for the concept of salutogenesis: a position article. Health Promot Int 2020;35:187-95. https://doi.org/10.1093/heapro/daz057

[12] Battel-Kirk B, Barry MM, van der Zanden G, Contu P, Gallardo C, Martinez A, Speller V, Debenedetti S. Operationalising and piloting the IUHPE European accreditation system for health promotion. Glob Health Promot 2015;22:25-34. doi:10.1177/1757975914545386

[13] Roberts N. The system of professions. An essay on the division of expert labor. J Librariansh Inf Sci 1989;21:212-4. https://doi.org/10.1177/096100068902100308

[14] Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, Fineberg H, Garcia P, Ke Y, Kelley P, Kistnasamy B, Meleis A, Naylor D, Pablos-Mendez A, Reddy S, Scrimshaw S, Sepulveda J, Serwadda D, Zurayk H. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. Lancet 2010;376:1923-58. https://doi.org/10.1016/S0140-6736(10)61854-5

[15] Freire P. Paul Freire. Pedagogy of the oppressed: 30th anniversary edition. 30th Anniversary Ed. Continuum 2000.

[16] Wang C, Burris MA. Photovoice: concept, methodology, and use for participatory needs assessment. Health Educ Behav 1997;24:369-87. https://doi.org/10.1177/109019819702400309

[17] Ronzi S, Pope D, Orton L, Bruce N. Using photovoice methods to explore older people's perceptions of respect and social inclusion in cities: opportunities, challenges and solutions. SSM Popul Health 2016;2:732-45. https://doi.org/10.1016/j.ssmph.2016.09.004

[18] Castleden H, Garvin T; Huu-ay-aht First Nation. Modifying Photovoice for community-based participatory Indigenous research. Soc Sci Med 2008;66:1393-405. https://doi.org/10.1016/j.socscimed.2007.11.030

[19] Brush BL, Mentz G, Jensen M, Jacobs B, Saylor KM, Rowe Z, Israel BA, Lachance L. Success in long-standing Community-Based Participatory Research (CBPR) partnerships: a scoping literature review. Health Educ Behav 2020;47:556-68. https://doi.org/10.1177/1090198119882989

[20] Israel BA, Parker EA, Rowe Z, Salvatore A, Minkler M, López J, Butz A, Mosley A, Coates L, Lambert G, Potito PA, Brenner B, Rivera M, Romero H, Thompson B, Coronado G, Halstead S. Community-based participatory research: lessons learned from the Centers for Children's Environmental Health and Disease Prevention Research. Environ Health Perspect 2005;113:1463-71. https://doi.org/10.1289/ehp.7675

[21] Garner SL, Faucher MA. Perceived Challenges and Supports Experienced by the Family Caregiver of the Older Adult: a Photovoice Study. J. Community Health Nurs 2014;31:63-74. https://doi.org/10.1080/07370016.2014.901070

[22] Wang CC, Redwood-Jones YA. Photovoice ethics: perspectives from Flint Photovoice. Health Educ Behav 2001;28:560-72. https://doi.org/10.1177/109019810102800504

[23] Catalani C, Minkler M. Photovoice: a review of the literature in health and public health. Health Educ Behav 2010;37:424-51. https://doi.org/10.1177/1090198109342084

[24] Haffejee F. The use of photovoice to transform health science students into critical thinkers. BMC Med Educ 2021;21:237. https://doi.org/10.1186/s12909-021-02656-1

[25] Nykiforuk CIJ. Engaging patients in research using photovoice methodology. CMAJ 2021;193:E1050-1. https://doi.org/10.1503/cmaj.210963

[26] Jahoda M, Fishbein M. Readings in attitude theory and measurement. Br J Sociol 1968;19:220-1. https://doi.org/10.2307/588703

[27] Raimondi M. Marketing del Prodotto-Servizio. Milano: Ulrico Hoepli 2005.

[28] Serpelloni G. La valutazione della Customer Satisfaction: modello teorico e rilevamento su pazienti e operatori del centro di medicina preventiva. In: Serpelloni G, Macchia T, Mariani F, eds. OUTCOME, La valutazione dei risultati e l'analisi dei costi nella pratica clinica nelle tossicodipendenze. Verona: Editrice La Grafica 2006, pp. 293-326.

[29] Pagliarini R. The World Café - Shaping our futures through conversations that matter. J Organ Change Manag 2006;19:266-8. https://doi.org/10.1108/09534810610648951

[30] Löhr K, Weinhardt M, Sieber S. The "World Café" as a participatory method for collecting qualitative data. Int J Qual Methods 2020;19. https://doi.org/10.1177/1609406920916976

[31] Evans-Agnew RA, Rosemberg MA. Questioning photovoice research: whose voice? Qual Health Res 2016;26:1019-30. https://doi.org/10.1177/1049732315624223

[32] Alhojailan MI, Ibrahim M. Thematic analysis: a critical review of its process and evaluation. WEI Int Eur Acad Proc 2012;1:8-21. Available: https://faculty.ksu.edu.sa/sites/default/files/ta_thematic_analysis_dr_mohammed_alhojailan.pdf

[33] Braun V, Clarke V. Thematic analysis. In: Cooper H, Camic PM, Long DL, Panter AT, Rindskopf D, Sher KJ, eds. APA handbook of research methods in psychology, Vol. 2. Research designs: quantitative, qualitative, neuropsychological, and biological. American Psychological Association 2012, pp. 57-71. https://doi.org/10.1037/13620-004

[34] Willig C, Rogers WS. The SAGE handbook of qualitative research in psychology. SAGE Publications Ltd 2017, pp. 17-37. https://doi.org/10.4135/9781526405555

[35] Budig K, Diez J, Conde P, Sastre M, Hernán M, Franco M. Photovoice and empowerment: evaluating the transformative potential of a participatory action research project. BMC Public Health 2018;18:432. https://doi.org/10.1186/s12889-018-5335-7

[36] Afshari A, Mostafavi F, Latifi A, Ghahnaviyeh LA, Pirouzi M, Eslami AA. Hospitals reorientation towards health promotion: a qualitative study of barriers to and strategies for implementation of health promotion in hospitals of Isfahan, Iran. J Educ Health Promot 2018;7:72. https://doi.org/10.4103/jehp.jehp_135_17

[37] Alami H, Gagnon MP, Ghandour EK, Fortin JP. [Reorientation of health services and health promotion: a review of the situation]. Sante Publique 2017;29:179-84. https://doi.org/10.3917/spub.172.0179.

[38] Baum F, Van Eyk H, Hurley C. Re-orientation of health services towards health promotion: an Australian case study of aborted health service reform. Aust J Prim Health 2006;12:24-33. https://doi.org/10.1071/PY06019

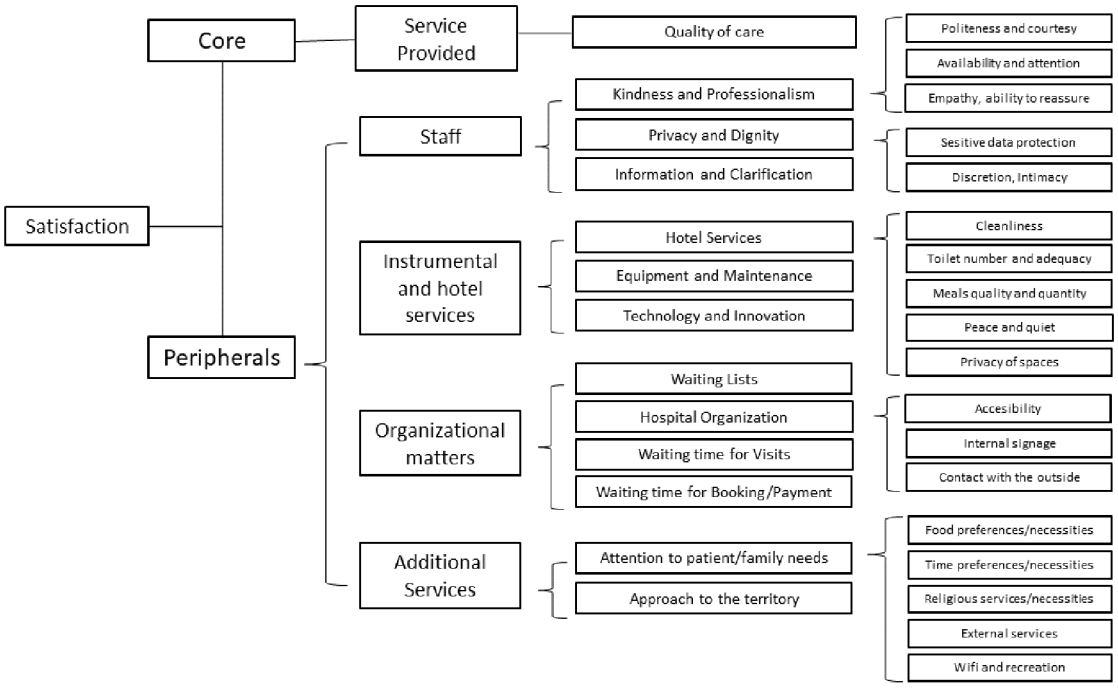
## Supplemental Materials

### 1. Development of the analytical framework

When evaluating Citizen Satisfaction, the user's overall experience should be decomposed into areas and aspects that can be specifically attributed to offered services. As for Fishbein's attitude model [1] this approach allows a more accurate analysis of single components of the service experienced, allowing to identify the sectors in which to invest to raise the overall level of Citizen Satisfaction. Following the process proposed by Raimondi [2], we constructed a Tree of Satisfaction (see Supplemental Materials 2) through the progressive breakdown of the service into performance areas, services, and user problems. Having detailed analytical information is necessary to focus on the aspects to be modified and to calibrate interventions aimed at solving individual problems. To detect the issues occupying the distal branches of the Tree we should take advantage of all the interaction opportunities between the user and the service provision, as well as of the opinion of staff and experts in the specific sector. Once perfected, the Tree constitutes a rather complete map of the elements users consider to evaluate the specific healthcare service and, therefore, a precious guide for interpreting the results of community-based participatory research tools and surveys. Following the Problem Detection System (PDS), we tried to quantify the importance attributed by users to the various critical aspects of the service and to determine to what extent the solution to a specific problem can influence satisfaction. The first phase, Problem Generation, was divided into three consecutive moments: photo voice, brainstorming, and world café. It involved a sample of professionals from the master's degree courses of Health Professions with various previous work experience, aiming to determine and break down the elements contributing to Monserrato teaching hospital – AOU Cagliari users' satisfaction. As a further element of confirmation that could support the gathered information, we collected the points of view of the medical and nursing staff through short interviews. A total of 15 interviews were carried out, (5 with members of the permanent medical staff, 8 with residents, and 2 with members of the permanent nursing staff). The analysis of the opinions collected led to a substantial confirmation of the elements previously emerged. At the end of the preliminary phase, during Problem List Building, we grouped the categories that emerged into five performance areas: service provided; staff; instrumental and hotel services; organizational matters and additional services. These areas have been divided into core and peripherals performance, as expressed by Serpelloni [3], to create a Satisfaction Tree culminating in the twelve original categories (see Supplemental Materials 2).

### 2. Tree of Satisfaction and list of Themes and Sub-themes

**Supplemental Materials 2 Fig. 1.** Initial analytical framework. 'Tree of Satisfaction': areas divided by core and peripherals, themes, and sub-themes.



**Supplemental Materials 2 Tab. I.** Peripheral aspects of satisfaction in healthcare services: first layer of detail of areas and themes discussed by participants during focus group discussions (refer to Phase 5 of Procedures).

| Areas | Themes | |
|---|---|---|
| Staff | 1 | Kindness and Professionalism |
| | 2 | Privacy and Dignity |
| | 3 | Information and explanation |
| Instrumental and Hotel services | 4 | Hotel services |
| | 5 | Equipment and maintenance |
| | 6 | Technology and innovation |
| Organizational matters | 7 | Waiting lists |
| | 8 | Waiting time for visits |
| | 9 | Waiting time for booking/payment |
| | 10 | Hospital organization |
| Additional Services | 11 | Attention to patients/family members |
| | 12 | Approach to the territory |

**Supplemental Materials Tab. II.** Peripheral aspects of satisfaction in healthcare services: second layer of detail of themes and sub-themes discussed by participants during focus group discussions (refer to Phase 5 of Procedures).

| Themes | Sub-themes | |
|---|---|---|
| 1 | Kindness and Professionalism | Politeness and courtesy |
| | | Availability and attention |
| | | Empathy, ability to reassure |
| 2 | Privacy and Dignity | Sensitive data protection |
| | | Discretion, Intimacy |
| 4 | Hotel Services | Cleanliness |
| | | Toilets number and adequacy |
| | | Meals' quality and quantity |
| | | Peace and quiet |
| | | Privacy of spaces |
| 10 | Hospital Organization | Accessibility |
| | | Internal signage |
| | | Contact with the outside |
| 11 | Attention to patient/family needs | Food preferences/necessities |
| | | Time preferences/necessities |
| | | Religious services/necessities |
| | | External services |
| | | Wi-Fi and recreation |

## References

[1] Jahoda, M, Fishbein M. Readings in attitude theory and measurement. Br J Sociol 1968;19:220. https://doi.org/10.2307/588703

[2] Raimondi M. Marketing del Prodotto-Servizio. Milano: Ulrico Hoepli 2005.

[3] Serpelloni G. La valutazione della Customer Satisfaction: modello teorico e rilevamento su pazienti e operatori del centro di medicina preventiva. In: Serpelloni G, Macchia T, Mariani F, eds. OUTCOME, La valutazione dei risultati e l'analisi dei costi nella pratica clinica nelle tossicodipendenze. Verona: Editrice La Grafica 2006, pp. 293-326.

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Occupational medicine and hygiene

# Prevalence of Body Dysmorphic Disorder (BDD) among the Lebanese University students: associated risk factors and repercussion on mental health

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## Keywords

Body Dysmorphic Disorder • Mental health • Lebanese University students

## Summary

**Introduction**. *Body Dysmorphic Disorder (BDD) is a psychological illness characterized by persistent and intrusive preoccupation with an imagined or slight defect in appearance. This study aimed to determine the prevalence of BDD and investigate its association with mental health status (depression and anxiety), religiosity, eating disorder risk, and self-esteem among Lebanese University students.*

**Methods**. *A cross-sectional study was conducted in March 2020, involving students from the Lebanese University. Data were collected using the dysmorphic concern questionnaire (DCQ), Rosenberg self-esteem scale (RSE), religiosity scale, patient health questionnaire (PHQ-9), generalized anxiety disorder assessment (GAD-7), Eating Attitude test-26 scale (EAT-26).*

**Results**. *A total of 6,448 participants were enrolled in our study. The overall prevalence of BDD among university students was (6.4%).Our results showed that Lebanese students with BDD were more likely to have anxiety ORadj 1.3 (95% CI: 1.2-1.7) p-value 0.001, depression ORadj 1.2 (95% CI: 1.15-1.5) p-value 0.007, and eating disorder (Bulimia & Food preoccupation ORadj 1.06 (95% CI: 1.03-1.2) p-value 0.0, and oral control ORadj 1.09 (95% CI: 1.05-1.1) p-value < 0.001) compared to those with no BDD. We also found that students with BDD had Lower Self-esteem ORadj 0.88 (95% CI: 0.78-0.9) p-value < 0.001), and less likely to be religious ORadj 0.88 (95% CI: 0.82-0.9) p-value 0.02) compared to those with no BDD.*

**Conclusions**. *This pioneering study sheds light on the prevalence of BDD among Lebanese university students and its associated factors. Our findings underscore the importance of early detection of BDD during adolescence and young adulthood, necessitating timely psychological intervention to prevent chronicity and complications.*

## Introduction

Body Dysmorphic Disorder (BDD) is a significant psychological illness affecting approximately 3% of the general population in Western countries [1]. It is noteworthy that BDD is relatively common in adolescents, affecting both males and females [2]. This disorder is characterized by a persistent and intrusive preoccupation with an imagined imperfection or slight defect in one's physical appearance [3].

BDD victims frequently complain about facial or head features, this preoccupation can extend to anybody area or even encompass the entire body [4]. As a result, individuals suffering from BDD often experience clinically significant distress and impairment in social functioning [5]. Moreover, BDD is associated with an elevated risk of psychiatric hospitalization and suicide attempts [6]. The treatment of BDD poses considerable challenges due to the complexity of the disorder, necessitating a combination of cognitive-behavioral therapy, corrective surgery, and antidepressant medication [7, 8].Despite being recognized for centuries, the term "BDD" has been relatively recent in the diagnostic lexicon. Initially categorized as a somatoform disorder, it was later described as dysmorphophobia in the Diagnostic and Statistical Manual of Mental Disorder, 3rd edition (DSM-III), and eventually classified as BDD in DSM-IV [9]. In the current DSM-V, BDD is classified under Obsessive-Compulsive and Related Disorders [10, 11]. Disturbingly, nearly 80% of BDD patients have reported lifetime suicidal ideation, and approximately 24% to 28% have attempted [12]. The suicide completion rate among BDD patients is alarmingly high at 0.3%, surpassing the rates observed in most other mental illnesses [13]. Additionally, a United States study indicated that 40% of plastic surgeons reported receiving threats, either physical or legal, from dissatisfied patients with [14]. BDD has been reported in numerous countries worldwide. Studies in western societies have shown a higher prevalence of BDD among university students (5.3%) compared to the general population (1.8%) [15]. Similarly, a recent study in The Kingdom of Saudi Arabia found a prevalence of 4.4% among female medical students in 2016 [16]. While BDD remains a significant concern

among university students in developed countries [17], there is limited research on this matter in the Middle East region. University students are exposed to many new environmental and lifestyle changes coupled with heightened concern for their appearance, which might increase their risk of BDD [15]. To date, no studies have been conducted to determine the prevalence of BDD among university students in Lebanon. Consequently, our study aims to address this gap by investigating the prevalence of BDD among Lebanese university students and assessing its association with various risk factors and its impact on mental health (anxiety, depression, eating disorders), religiosity, and self-esteem in their daily lives.

## Methods

### Study design and population

A cross-sectional study was conducted among university students at the Lebanese University in March 2020. It includes Lebanese students from 16 faculties (Faculty of Letters and Human Sciences, Faculty of Law and Political and Administrative Sciences, Faculty of Sciences, Faculty of Fine Arts and Architecture, Faculty of Pedagogy, Faculty of Information, Faculty of Economics and Business Administration, Faculty of Engineering, Faculty of Agronomy, Faculty of Public Health, Faculty of Medical Sciences, Faculty of Dental Medicine, Faculty of Pharmacy, Faculty of Tourism and Hospitality Management, and Faculty of Technology). The study enrolled all eligible Bachelor, Masters, and Ph.D. students registered at the Lebanese University for the academic year 2019-2020, resulting in a total of 6,504 participants. Data collection was carried out using an online questionnaire distributed through social media platforms, primarily "WhatsApp," utilizing a snowball sampling technique. The questionnaire was designed using a Google form.

### Ethical consideration

Ethical approval was obtained by the scientific research committee of the Neuroscience Research Center, Faculty of Medical Sciences at the Lebanese University. Participants will answer a yes–no question to confirm their willingness to participate voluntarily. All the necessary measures to safeguard participants' anonymity and confidentiality of information were respected. Written informed consent was obtained from all the participants. The methods were performed in accordance with the declaration of Helsinki.

### Sample size

The sample size was calculated using the online Raosoft sample size calculator designed specifically for population surveys. Assuming 80,000 students are registered in the Lebanese University, the required calculated sample size was 383 with a confidence level of 95% and a 5% margin of error. A total number of 6504 students were recruited in the present study.

### Questionnaire and instruments

The data were collected using an online survey to cover all the branches of faculties in all governates. A self-administered questionnaire was created in Arabic after a thorough search in the literature and sent online to the students to cover all the branches of the faculties at the Lebanese University.

1. Socio-demographic characteristics included age, gender, faculty, level of education, place of residence (Beirut, Mount Lebanon, North, South, and Beqaa), marital status (single, married, divorced, or widowed). Information about health behaviors included questions about cigarette and waterpipe smoking, alcohol consumption, physical activity, and its duration on a weekly basis.
2. Dysmorphic Concern Questionnaire (DCQ) is a 7-item self-report scale where the respondents rate their concern about their physical appearance relative to others on a 4-point scale. This score is a brief, sensitive, and specific screening instrument for BDD, which has a reliable cutoff of "9" [18]. The participants were categorized into "no BDD" and "with BDD" based on DCQ score, $< 9$ and $\geq 9$ respectively.
3. The Arabic Rosenberg self-esteem (RES) scale is used to assess the self-esteem of the student [19]. It is a 10-item self-report scale that measures self-esteem by assessing positive and negative feelings about the self. This score ranges from 0 to 30 by which the numbers less than 15 indicate low self-esteem [20].
4. The Arabic religiosity scale is a 5-item self-report questions that have a measure of religious belief, practice, and importance in the daily life of adult psychiatric patients (including times of difficulties) and it has an acceptable and reliable validity [21].
5. The Arabic Patient health questionnaire (PHQ-9) is a brief self-report measure of 9 items, employed to assess and grade depression severity over the past 2 weeks. Responses ranged from 0 to 3 (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day). Total scores, obtained by summing the responses to each item, range from 0 to 27 [22].
6. The Arabic Generalized anxiety disorder assessment (GAD-7) is widely used as a self-reporting scale to assess the symptoms of anxiety. It consists of 7 items that measure anxiety over the past 2 weeks. Items are rated on a 4-point Likert-type scale (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day). The GAD-7 score is calculated by summing up the seven items with higher scores indicating a greater risk of anxiety [22].
7. The Arabic Eating Attitude test-26 (EAT-26) scale is s a 26-item self-report known for its high sensitivity, reliability, and validity in the Arabic population and usefulness for screening large populations. It measures eating disorder risk based on attitudes, feeling and behaviors related to eating. In addition, two EAT-26 subscales (Preoccupation scale and oral control scales) were used in this study [23].

The permission to use the previously mentioned scales was received from the original authors via emails. The preliminary final version of the questionnaire was administered to a sample of 20 eligible students. The aim was to check the clarity, coherence, and intelligibility of the questions with the average time needed for the participants to complete it. The data from the pilot study was removed from the final analysis.

### Data collection

The data was collected using an online survey. An arabic questionnaire was created and designed by the authors after a thorough search in the literature and a link was sent to the participants including a brief introduction on the background, the aim of the study, voluntary nature of participation, declarations of confidentiality and anonymity, and instructions for filling in the questionnaire.

### Statistical analysis

Statistical analysis was carried out using the statistical software SPSS (Statistical Package for Social Sciences), version 23.0. Descriptive statistics were reported using means and standard deviations (SD) for continuous variables and frequency with percentages for categorical variables. Multivariate logistic regression was used to identify factors associated with BDD as a dependent variable. The variables in bivariate analysis with p-value < 0.2 were entered into multivariable logistic regression. Adjusted odds ratio and their 95% confidence intervals were reported. The statistical significance level was set at p-value < 0.05 (two-sided).

## Results

### Characteristics of the study sample

The baseline characteristics of the entire study sample by DCQ score were described in Table I. The total number of students was 6448 of which 414 (6.4%) were diagnosed with BDD. The overall mean age of the study sample was 20.85 (SD = 3.81) years old, 78.2% were

**Tab. I.** Baseline characteristics of the participants with and without BDD among Lebanese University students.

| Characteristics | All students n = 6448 n (%) | No BDD n = 6034 (93.6) n (%) | With BDD n = 414 (6.4) n (%) | p-value |
|---|---|---|---|---|
| **Age** (mean ± SD)†† | 20.85 ± 3.81 | 20.83 ± 3.84 | 21.07 ± 3.29 | 0.2 |
| **BMI** (mean ± SD)†† | 23.06 ± 4.07 | 22.99 ± 3.98 | 23.98 ± 5.11 | < 0.001* |
| **Gender** | | | | |
| Male | 1405 (21.8) | 1324 (21.9) | 81 (19.6) | 0.25 |
| Female | 5043 (78.2) | 4710 (78.1) | 333 (80.4) | |
| **Marital status** | | | | |
| Single | 5507 (85.4) | 5134 (85.1) | 373 (90.1) | 0.02* |
| Married | 888 (13.8) | 850 (14.1) | 38 (9.2) | |
| Other† | 53 (0.8) | 50 (0.8) | 3 (0.7) | |
| **Place of residence** | | | | |
| Beirut | 317 (4.9) | 291 (4.8) | 26 (6.3) | 0.03* |
| North Lebanon | 2576 (40) | 2421 (40.1) | 155 (37.4) | |
| South Lebanon | 2060 (31.9) | 1938 (32.1) | 122 (29.5) | |
| Beqaa | 440 (6.8) | 417 (6.9) | 23 (5.6) | |
| Mount Lebanon | 1055 (16.4) | 967 (16) | 88 (21.3) | |
| **University level** | | | | |
| 1st year | 2454 (38.1) | 2321 (38.5) | 133 (32.1) | 0.005* |
| 2nd year | 1526 (23.7) | 1434 (23.8) | 92 (22.2) | |
| 3rd year | 1284 (19.9) | 1195 (19.8) | 89 (21.5) | |
| 4th year | 751 (11.6) | 695 (11.5) | 56 (13.5) | |
| 5th year | 296 (4.6) | 267 (4.4) | 29 (7) | |
| > 5th year | 137 (2.1) | 122 (2) | 15 (3.6) | |
| **Cigarette smoking** | | | | |
| Non-smoker | 6076 (94.2) | 5690 (94.3) | 386 (93.2) | 0.3 |
| Current smoker | 372 (5.8) | 344 (5.7) | 28 (6.8) | |
| **Waterpipe smoking** | | | | |
| Non-smoker | 5158 (80) | 4819 (79.9) | 339 (81.9) | 0.3 |
| Current smoker | 1290 (20) | 1215 (20.1) | 75 (18.1) | |
| **Physical activity** | | | | |
| Absent | 3556 (55.1) | 3298 (54.7) | 258 (62.3) | 0.002* |
| Present | 2892 (44.9) | 2736 (45.3) | 156 (37.7) | |
| **Drinking alcohol** | | | | |
| No | 5820 (90.3) | 5466 (90.6) | 354 (85.5) | 0.001* |
| Yes | 628 (9.7) | 568 (9.4) | 60 (14.5) | |

† Divorced or widowed. †† Mean ± Standard deviation. * p-value < 0.05 is considered significant.

**Tab. II.** Bivariate analysis of BDD among Lebanese University students.

| Scales | All students n = 6448 (mean ± SD)†† | No BDD n = 6034 (93.6) (mean ± SD)†† | With BDD n = 414 (6.4) (mean ± SD)†† | p-value |
|---|---|---|---|---|
| RSE | 19.97 ± 4.79 | 20.31 ± 4.55 | 14.94 ± 5.39 | < 0.001* |
| Religiosity | 10.03 ± 2.78 | 10.11 ± 2.73 | 8.90 ± 3.32 | < 0.001* |
| GAD-7 | 8.95 ± 5.16 | 8.63 ± 4.99 | 13.65 ± 5.41 | < 0.001* |
| PHQ-9 | 9.03 ± 5.75 | 8.62 ± 5.48 | 14.94 ± 6.28 | < 0.001* |
| EAT-26 | 61.11 ± 23.80 | 61.98 ± 23.36 | 48.36 ± 26.43 | < 0.001* |
| Bulimia & food Preoccupation | 2.52 ± 2.19 | 2.46 ± 2.14 | 3.50 ± 2.74 | < 0.001* |
| Oral control | 3.10 ± 3.46 | 2.92 ± 3.29 | 5.76 ± 4.56 | < 0.001* |

†† Mean ± Standard deviation. * p-value < 0.05 is considered significant.
RSE: Rosenberg self-esteem scale; GAD-7: Generalized Anxiety Disorder-7; PHQ-9: Patient Health Questionnaire-9, EAT-26: Eating Attitude test-26 scale.

female and the majority of the participants were single (85.4%). The association between BDD and students' characteristics showed that the score was significantly associated with BMI, material status, place of residency, university level, physical activity and, drinking alcohol with p-value < 0.001, 0.02,0.03,0.005,0.002 and 0.001 respectively. Our results also showed that age, gender, and smoking were not statistically associated with BDD (p-value 0.2, 0.25 and 0.3 respectively).

Bivariate analysis of the association of BDD and RES, religiosity, GAD-7, PHQ-9, EAT-26

Bivariate analysis showed high significant association between BDD and all the scales with a p-value < 0.001 (Tab. II). Participants with BDD showed higher scores of GAD-7 (13.65 ± 5.41), PHQ-9 (14.94 ± 6.28), Preoccupation scale (3.50 ± 2.74), and Oral control scale (5.76 ± 4.56) but lower scores of RES (14.94 ± 5.39), Religiosity (8.90 ± 3.32), and EAT-26 (48.36 ± 26.43) compared to the participants with no-BDD.

### Multivariate Logistic Regression

The associations between BDD and the scales were also assessed by multivariate logistic regression after controlling the socio-demographic characteristics (age, gender, smoking, place of residence, level of education, gender, cigarette smoking status, physical activity, and alcohol consumption in the total sample (Tab. III). Our results showed that Lebanese students with Body dysmorphic Disorder were more likely to have anxiety ORadj 1.3 (95% CI: 1.2-1.7) p-value 0.001, depression ORadj 1.2 (95% C:1.15-1.5) p-value 0.007, and eating disorder (Bulimia & Food preoccupation ORadj 1.06 (95% CI: 1.03-1.2) p-value 0.0, and oral control ORadj 1.09 (95% CI: 1.05-1.1) p-value < 0.001, compared to those with no BDD. We also found that students with BDD had Lower Self-esteem ORadj 0.88 (95% CI: 0.78-0.9) p-value < 0.001, and less likely to be religious ORadj 0.88 (95% CI: 0.82-0.9) p-value 0.02, compared to those with no BDD.

**Tab. III.** Adjusted odds ratio with their 95% confidence intervals from multivariate logistic regression of BDD for the study sample.

| Scale | ORadj | 95% CI | p-value |
|---|---|---|---|
| RSE | 0.88 | 0.78-0.9 | < 0.001* |
| Religiosity | 0.82 | 0.82-0.9 | 0.02* |
| GAD-7 | 1.3 | 1.2-1.7 | 0.001* |
| PHQ-9 | 1.2 | 1.15-1.5 | 0.007* |
| Bulimia & Food Preoccupation | 1.06 | 1.03-1.2 | 0.01* |
| Oral Control | 1.09 | 1.05-1.1 | < 0.001* |

95% CI: 95% Confidence Interval, ORadj: adjusted odds ratio; RSE Rosenberg self-esteem scale; GAD-7: Generalized Anxiety Disorder-7; PHQ-9: Patient Health Questionnaire-9. * p-value < 0.05 is considered significant.

## Discussion

To our knowledge, this is the first epidemiological cross-sectional study on a large sample of Lebanese University students to assess the prevalence of BDD and to evaluate its association with different factors including self-esteem, religiosity, anxiety, depression, and eating disorders.

Our study showed that the prevalence of BDD among Lebanese University students was 6.4% of the collected sample which was somehow close to several results of studies reporting the prevalence of BDD among college students. The prevalence of BDD among various students' populations ranges from 2.3% in Australia [24], to 4.4% in Saudi Arab [16], 4.5% in Iran [25], 4.8% in Turkey [26], 4.9% in China [27], 5.1% in South Africa [28], 5.3% in Germany [15], and 5.8% in Pakistan [29]. Our result is most likely to be consistent with the result of other studies. This could be due to the similar mean of age (~20). Also, younger generations are usually more concerned about their look than elders. In addition, the impact of social media significantly affects opinions about body appearance and personality. Moreover, university students are exposed to many new environmental and habitual changes where appearances play an important role in the academic fields.

In terms of gender distribution of BDD, 80.4% of students with BDD were females which was nearly similar to these studies reporting a consistently higher prevalence among female students than male [15, 16, 24, 25, 28, 29]. The high prevalence of BDD among females could be explained by the fact that females in the early twenties are more concerned about their body image than males. Moreover, it is likely due in part to cultural

expectation, societal standards, and body changes during menarche.

This study showed a significant association between BDD and self-esteem by which a moderate negative relationship was found between BDD and self-esteem. This is in line with previous findings suggesting that BDD is accompanied by low self-esteem [5, 15, 30-32]. Thus, BDD is not only limited to appearance but may also extend to other domains of the self and personality. This negative association between BDD and self-esteem might be partly explained by the depression status where people with BDD often suffer from depression which is in turn associated with low self-esteem [32]. However, it is unclear whether low self-esteem predisposes one to BDD or is a consequence of BDD; but a negative correlation is present.

The results of our study also indicated an association between BDD and religiosity. Poor religious believes and/or practices were significantly linked to BDD taking into consideration that religious obsessions are common and predominant in Middle Eastern countries including Lebanon. Even though we could not find any research focusing on the relation between BDD and religious behavior, religious devotion has been reported as a risk factor for mental illness such as anxiety disorders [33] and depression [34, 35]. Yet, highly religious people tend to have higher self-esteem [36], this could explain the positive relationship between BDD and poor religious practices.

Regarding depression and anxiety, higher depression and anxiety scores were found to be linked to BDD. In our study, those who were diagnosed with BDD obtained significantly higher scores on the GAD-7 and PHQ-9 compared to those who were not diagnosed with BDD. Also, a positive association was found between BDD and anxiety and depression. This survey was in agreement with previous studies reporting a positive association between BDD on one hand and depression and anxiety on the other hand [15, 37-40]. A possible explanation for this association could be related to bodily concerns by which BDD individuals are usually dissatisfied with their appearance and often concerned about being negatively judged.

Regarding eating disorders, our study suggested an association between eating disorders and BDD considering two subscales of the EAT-26 (Bulimia & Food Preoccupation and oral control scales) which showed a slight positive correlative association. Our results are consistent with previous studies that revealed a link between BDD and eating disorders [5, 25, 41, 42]. The environmental factors should be taken into consideration by which some BDD subjects may experience awkward criticisms compared to others or even a slight defect is often emphasized by others. Hence, BDD patients usually experience low-calorie or unsuitable diets in order to improve their physical appearance.

Due to the underrecognized nature of this disorder and its substantial impact on an individual's quality of life, our research findings underscore the critical importance of raising public awareness and promoting psychological precautions. In light of this, the development of targeted social media campaigns for young adults should be approached with careful consideration of image-related content to avoid exacerbating Body Dysmorphic Disorder (BDD) symptoms. These associations, as highlighted in our study, can serve as valuable resources for health education professionals, parents, and communities, guiding them in their efforts to implement preventive measures and curb the chronicity of this distressing disorder.

The implications of our study's findings are particularly significant for professionals working in counseling and psychology, especially in educational settings. As part of their practice, these professionals may benefit from incorporating assessments for students who have experienced bullying, as such individuals may be more susceptible to other forms of violence, suicidality, and various health risk behaviors and conditions. Proactive measures aimed at preventing and addressing body shaming should be integrated into their strategies to foster a healthier and more supportive environment for those affected by BDD.

Our study has many strengths. To our knowledge, this is the first study investigating the prevalence of BDD and its associated factors (self-esteem, religiosity, anxiety, depression and eating disorders) among Lebanese University students. A comprehensive battery of well-validated with high-reliability measures and a large sample size enabled robust data analysis. Moreover, our results are highly consistent with the findings of other studies. However, we were aware that our research may have several limitations. First, the cross-sectional nature of the study can only demonstrate association and not a cause-effect relationship. Second, the representativeness of the total population of the Lebanese University students might be affected, our sample was not based on a random selection, and it is only from the Lebanese University, which is a public university in Lebanon, the findings did not reflect the whole picture of all students enrolled in private and public universities in Lebanon. Finally, the reliance on self-reported information may subject the study to response bias which could eventually underestimate the associations our study has shown. Despite the limitations identified, we believe that the study addresses a major health problem that challenges university students in Lebanon.

## Conclusions

This pioneering study in Lebanon sheds light on the prevalence of BDD among Lebanese university students and its associated factors. BDD was found to be significantly linked to elevated levels of depression, anxiety, and eating disorders, along with lower levels of self-esteem and religiosity. These findings underscore the importance of early detection of BDD during adolescence and young adulthood, necessitating timely psychological intervention to prevent chronicity and

complications. Moreover, promoting widespread awareness through various social media and public platforms is essential to address this psychological issue effectively.

## Acknowledgments

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## Conflict of interest statement

The authors have no potential conflicts of interest to declare.

## Authors' contributions

AS and YJ developed the project idea. OI and RD formulated the questionnaire. AS and YJ organized and analyzed the survey. LAA, ZN, and AS drafted and critically reviewed the paper. ZN reviewed the manuscript for important intellectual content. All authors read and agreed on the final version.

### References

[8] Hartmann AS,Buhlmann U. Prevalence and underrecognition of body dysmorphic disorder. In: Phillips KA, ed. Body dysmorphic disorder: advances in research and clinical practice. Oxford University Press 2017, pp. 49-60. https://doi.org/10.1093/med/9780190254131.003.0005

[9] Mufaddel A, Osman OT, Almugaddam F, Jafferany M. A review of body dysmorphic disorder and its presentation in different clinical settings. Prim Care Companion CNS Disord 2013;15:PCC.12r01464. https://doi.org/10.4088/PCC.12r01464

[10] Cororve MB, Gleaves DH. Body dysmorphic disorder: a review of conceptualizations, assessment, and treatment strategies. Clin Psychol Rev 2001;21:949-70. https://doi.org/10.1016/s0272-7358(00)00075-1

[11] Phillips KA. Body dysmorphic disorder: recognizing and treating imagined ugliness. World Psychiatry 2004;3:12-7.

[12] Biby EL. The relationship between body dysmorphic disorder and depression, self-esteem, somatization, and obsessive-compulsive disorder. J Clin Psychol 1998;54:489-99. https://doi.org/10.1002/(sici)1097-4679(199806)54:4<489::aid-jclp10>3.0.co;2-b

[13] Phillips KA, Diaz SF. Gender differences in body dysmorphic disorder. J Nerv Ment Dis 1997;185:570-7. https://doi.org/10.1097/00005053-199709000-00006

[14] Higgins S, Wysong A. Cosmetic surgery and body dysmorphic disorder - An update. Int J Womens Dermatol 2017;4:43-48. https://doi.org/10.1016/j.ijwd.2017.09.007

[15] Ipser JC, Sander C, Stein DJ. Pharmacotherapy and psychotherapy for body dysmorphic disorder. Cochrane Database Syst Rev 2009;2009:CD005332. https://doi.org/10.1002/14651858.CD005332.pub2

[16] Fischer BA. A review of American psychiatry through its diagnoses: the history and development of the Diagnostic and Statistical Manual of Mental Disorders. J Nerv Ment Dis 2012;200:1022-30. https://doi.org/10.1097/NMD.0b013e318275cf19

[17] Toro-Martínez E. [DSM-5: OCD and related disorders]. Vertex 2014;25:63-7.

[18] Rosenfield E. Overview of DSM-5 changes. Massachusetts General Hospital ocd and related disorders program, 2013. Available from: https://mghocd.org/dsm-5/ (Access on: 5/1/2024).

[19] Phillips KA. Suicidality in body dysmorphic disorder. Prim Psychiatry 2007;14:58-66.

[20] Phillips KA, Menard W. Suicidality in body dysmorphic disorder: a prospective study. Am J Psychiatry 2006;163:1280-2. https://doi.org/10.1176/ajp.2006.163.7.1280

[21] Sarwer DB. Awareness and identification of body dysmorphic disorder by aesthetic surgeons: results of a survey of American Society for Aesthetic Plastic Surgery members. Aesthet Surg J 2002;22:531-5. https://doi.org/10.1067/maj.2002.129451

[22] Bohne A, Wilhelm S, Keuthen NJ, Florin I, Baer L, Jenike MA. Prevalence of body dysmorphic disorder in a German college student sample. Psychiatry Res 2002;109:101-4. https://doi.org/10.1016/s0165-1781(01)00363-8

[23] Shaffi Ahamed S, Enani J, Alfaraidi L, Sannari L, Algain R, Alsawah Z, Al Hazmi A. Prevalence of body dysmorphic disorder and its association with body features in female medical students. Iran J Psychiatry Behav Sci 2016;10:e3868. https://doi.org/10.17795/ijpbs-3868

[24] Koran LM, Abujaoude E, Large MD, Serpe RT. The prevalence of body dysmorphic disorder in the United States adult population. CNS Spectr 2008;13:316-22. https://doi.org/10.1017/s1092852900016436

[25] Mancuso SG, Knoesen NP, Castle DJ. The Dysmorphic Concern Questionnaire: a screening measure for body dysmorphic disorder. Aust N Z J Psychiatry 2010;44:535-42. https://doi.org/10.3109/00048671003596055

[26] Zaidi U, Awad SS, Mortada EM, Qasem HD, Kayal GF. Psychometric evaluation of Arabic version of Self-Esteem, Psychological Well-being and Impact of weight on Quality of life questionnaire (IWQOL-Lite) in female student sample of PNU. European Medical, Health and Pharmaceutical Journal 2015;8:29-33. https://doi.org/10.12955/emhpj.v8i2.703

[27] Rosenberg M. Rosenberg Self-Esteem Scale (RSE). Acceptance and Commitment therapy. Measures Package 1965;61:18.

[28] Khalaf DR, Hlais SA, Haddad RS, Mansour CM, Pelissolo AJ, Naja WJ. Developing and testing an original Arabic religiosity scale. Middle East Curr Psychiatry [Internet] 2014;21:127-38. https://doi.org/10.1097/01.XME.0000444753.76812.79

[29] Sawaya H, Atoui M, Hamadeh A, Zeinoun P, Nahas Z. Adaptation and initial validation of the Patient Health Questionnaire - 9 (PHQ-9) and the Generalized Anxiety Disorder - 7 Questionnaire (GAD-7) in an Arabic speaking Lebanese psychiatric outpatient sample. Psychiatry Res 2016;239:245-52. https://doi.org/10.1016/j.psychres.2016.03.030

[30] Al-Subaie A, al-Shammari S, Bamgboye E, al-Sabhan K, al-Shehri S, Bannah AR. Validity of the Arabic version of the Eating Attitude Test. Int J Eat Disord 1996;20:321-4. https://doi.org/10.1002/(SICI)1098-108X(199611)20:3<321::AID-EAT12>3.0.CO;2-2

[31] Bartsch D. Prevalence of body dysmorphic disorder symptoms and associated clinical features among Australian university students. Clin Psychol 2007;11:16-23. https://doi.org/10.1080/13284200601178532

[32] Aflakseir A, Jamali S, Mollazadeh J. Prevalence of Body Dysmorphic Disorder Among a Group of College Students in Shiraz. Zahedan J Res Med Sci 2021;23:e95247. https://doi.org/10.5812/zjrms.95247

[33] Cansever A, Uzun O, Dönmez E, Ozşahin A. The prevalence and clinical features of body dysmorphic disorder in college students: a study in a Turkish sample. Compr Psychiatry 2003;44:60-4. https://doi.org/10.1053/comp.2003.50010

[34] Zhu H, Deng Y. The prevalence of the body dysmorphic disorder among undergraduate students in Hainan [in Chinese]. J

Hainan Med Univ 2010;16:123-26. https://doi.org/10.13210/j.cnki.jhmu.2010.01.032

[35] Dlagnikova A, Van Niekerk RL. The prevalence of body dysmorphic disorder among South African university students. S Afr J Psychiatry 2015;21:104-06. https://doi.org/10.4102/sajpsychiatry.v21i3.668

[36] Taqui AM, Shaikh M, Gowani SA, Shahid F, Khan A, Tayyeb SM, Satti M, Vaqar T, Shahid S, Shamsi A, Ganatra HA, Naqvi HA. Body Dysmorphic Disorder: gender differences and prevalence in a Pakistani medical student population. BMC Psychiatry 2008;8:20. https://doi.org/10.1186/1471-244X-8-20

[37] Baykal B, Erdim I, Ozbay I, Oghan F, Oncu F, Erdogdu Z, Kayhan FT. Evaluation of relationship between body dysmorphic disorder and self-esteem in rhinoplasty candidates. J Craniofac Surg 2015;26:2339-41. https://doi.org/10.1097/SCS.0000000000002082

[38] Hartmann AS, Thomas JJ, Greenberg JL, Matheny NL, Wilhelm S. A comparison of self-esteem and perfectionism in anorexia nervosa and body dysmorphic disorder. J Nerv Ment Dis 2014;202:883-8. https://doi.org/10.1097/NMD.0000000000000215

[39] Kuck N, Cafitz L, Bürkner PC, Hoppen L, Wilhelm S, Buhlmann U. Body dysmorphic disorder and self-esteem: a meta-analysis. BMC Psychiatry 2021;21:310. https://doi.org/10.1186/s12888-021-03185-3

[40] Agorastos A, Demiralay C, Huber CG. Influence of religious aspects and personal beliefs on psychological behavior: focus on anxiety disorders. Psychol Res Behav Manag 2014;7:93-101. https://doi.org/10.2147/PRBM.S43666

[41] Bonelli R, Dew RE, Koenig HG, Rosmarin DH, Vasegh S. Religious and spiritual factors in depression: review and integration of the research. Depress Res Treat 2012;2012:962860. https://doi.org/10.1155/2012/962860

[42] Gupta S, Avasthi A, Kumar S. Relationship between religiosity and psychopathology in patients with depression. Indian J Psychiatry 2011;53:330-5. https://doi.org/10.4103/0019-5545.91907

[43] Papazisis G, Nicolaou P, Tsiga E, Christoforou T, Sapountzi-Krepia D. Religious and spiritual beliefs, self-esteem, anxiety, and depression among nursing students. Nurs Health Sci 2014;16:232-8. https://doi.org/10.1111/nhs.12093

[44] Hakim RF, Alrahmani DA, Ahmed DM, Alharthi NA, Fida AR, Al-Raddadi RM. Association of body dysmorphic disorder with anxiety, depression, and stress among university students. J Taibah Univ Med Sci 2021;16:689-694. https://doi.org/10.1016/j.jtumed.2021.05.008

[45] Liao Y, Knoesen NP, Deng Y, Tang J, Castle DJ, Bookun R, Hao W, Chen X, Liu T. Body dysmorphic disorder, social anxiety and depressive symptoms in Chinese medical students. Soc Psychiatry Psychiatr Epidemiol 2010;45:963-71. https://doi.org/10.1007/s00127-009-0139-9

[46] Shaw AM, Arditte Hall KA, Rosenfield E, Timpano KR. Body dysmorphic disorder symptoms and risk for suicide: the role of depression. Body Image 2016;19:169-74. https://doi.org/10.1016/j.bodyim.2016.09.007

[47] Phillips KA, Siniscalchi JM, McElroy SL. Depression, anxiety, anger, and somatic symptoms in patients with body dysmorphic disorder. Psychiatr Q 2004;75:309-20. https://doi.org/10.1023/b:psaq.0000043507.03596.0d

[48] Kollei I, Schieber K, de Zwaan M, Svitak M, Martin A. Body dysmorphic disorder and nonweight-related body image concerns in individuals with eating disorders. Int J Eat Disord 2013;46:52-9. https://doi.org/10.1002/eat.22067

[49] Rabe-Jablonska Jolanta J, Sobow Tomasz M. The links between body dysmorphic disorder and eating disorders. Eur Psychiatry 2000;15:302-5. https://doi.org/10.1016/s0924-9338(00)00398-9

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HOSPITAL HYGIENE

# Hand hygiene with interventions: an observational study from a tertiary care institute over 2 years

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Keywords

Hand hygiene • Adherence rate • World health organization • Intensive care unit and wards

Summary

**Background**. *Appropriate adherence to hand hygiene (HH) practices by health care workers (HCWs) reduces the transmission of pathogens and subsequently the incidence of hospital acquired infections (HAIs), in health care settings. Strict monitoring and auditing of this simple and cost-effective intervention is very important, as it significantly contributes in reducing the HAIs.*
**Material and methods**. *A retrospective observational study, evaluating the HH audits from June 2021 till May 2023 in a tertiary health care facility in North India. HH audits were conducted in the ICUs and wards daily, by the trained infection control nurses (ICNs), using direct observation method based on World health organization (WHO) hand hygiene observational forms. HH total adherence (HHTAR), partial adherence (HHPAR) and complete adherence rate (HHCAR) were analyzed in Microsoft Excel sheet. HHTAR rates were compared among different profession, moments and the month wise trend was also observed over the period.*
**Results**. *A total of 24,740 HH opportunities were observed. The compliance rate for HHCAR, HHPAR and HHTAR were 20.3%, 41.5% and 61.4% respectively. Overall better compliance was reported from the ICUs, profession-specific compliance was highest among nurses (62.8%) and doctors (61.5%). Significant increase in adherence rate was appreciated post intervention 46.1% to 67.3%, (p value < 0.01).*
**Conclusions**. *Continuous monitoring and reinforcement with timely feedback for intervention and regular auditing is a necessity to improve and maintain the appropriate HH practices among the HCWs. Low- and middle-income countries need to focus more on this simple and promising measure to combat the increasing HAI rates.*

## Introduction

Unholy hands of "holy physicians" were the astute observation of the Hungarian obstetrician Ignac Semmelweis in the 19th century [1]. He pioneered the enforcement of hand hygiene (HH) among the physicians and medical students, foreseeing them to be responsible for the transmission of childbed fever. Hand washing with chlorine water was made compulsory for all the physicians and students, before entering the labor room for one year and at the end, the mortality rate dropped [1]. This was the first established evidence-based association between unclean hands and the disease transmission. Subsequently in 1975, Centre for Disease Control and Prevention (CDC) published the guidelines for hospitals highlighting the importance of Hand washing [2]. Further recognizing the growing burden of Hospital acquired infections (HAIs) with Multi-drug resistant organisms (MDROs), World health organization (WHO) launched a global campaign on HH in 2005 as a first Global patient safety alliance [3]. Presently 5th May is marked as HH day globally, to raise awareness and reinforce the importance of HH to combat the rising trend of HAIs globally.
HAIs had always been the matter of concern for the health authorities. HH being the basic fundamental component of Infection control practices (IPCs), it is important to ensure that HH is being followed meticulously. The most effective quality indicator is the regular monitoring and auditing of the HH compliance. As per WHO the monitoring can be done by various methods including direct and indirect methods [3]. Indirect methods include measuring of hand rub/ antiseptic soaps, self-reporting by Health care workers (HCWs), use of automatic sinks or hand rub dispenses to monitor their use and also relating HH compliance with HAI surveillance data. Direct methods include direct observation by the trained auditors and lately surveillance with electronic devices and video monitoring is gaining importance. All these direct methods have their own drawbacks but still the direct observation is considered as the gold standard [3]. Apart from being most economic and feasible methodology in resource limited settings like India, direct observation also minimizes "Hawthorne effect". Moreover, it also gives the detail compliance of various professionals and all the five moments of hand hygiene. Its major limitation is the requirement of the trained, certified staff for auditing and needs large efforts for data assessment.
Our study for the period of two years, includes the auditing of HH in a tertiary care center to evaluate HH compliance in both ICUs and wards. Simultaneously, the frequency of the activities related to the awareness of hand hygiene was increased and the result of these interventional activities were evaluated.


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## Material and methods

This is a prospective observational 2-year study, analyzing the Hand hygiene auditing from the ICUs and wards of a tertiary care hospital in North India. The auditing at our institute was initiated as a part of the multicenter study, with approval from the ethical committee. Hand hygiene auditing had been an essential part of routine IPC practices in various areas of the hospital including all the critical areas, ICUs and wards. The auditing was done by the trained Infection control nurses (ICNs) as per the observational form provided by World Health Organization (WHO) for auditing [4]. The ICNs were trained in the direct observation method using the WHO audit guidelines and observation form. They were assessed using dummy audit programs and case scenarios, to evaluate their competency. Along with the initiation of HH auditing in June 2021, the awareness and reinforcement classes of all the cadre of HCWs were also increased. Every cadre was taught separately to maintain the uniformity of the level of teaching. The classes were taken on weekly basis, including doctors, residents, nurses, technicians, class 3 and 4, students of every section (MBBS, nursing, BSC *etc*.), kitchen staff as well as the security guards.

On the daily basis, the HH auditing included at least two areas, one from the ICU and the other from the wards. Auditing was done randomly during routine HAI surveillance and environmental surveillance by the ICNs, to minimize the Hawthorne effect. Minimum of 20 opportunities were recorded, for a period of at least 20 minutes or more. All the five moments and the steps of Hand hygiene were observed as per WHO. The audit parameters were: (a) Hand hygiene complete adherence rate (HHCAR) when all the 6 WHO steps were followed for a duration of ≥ 20 seconds for hand rub or ≥ 40 seconds for the hand wash; (b) Hand hygiene partial adherence rate (HHPAR) ≥1 WHO HH steps were missed and/or the duration followed was not for appropriate duration. (c) Hand hygiene total adherence rate (HHTAR) = HHCAR + HHPAR [5].

In our analysis we evaluated the HHCAR, HHPAR, HHTAR, profession specific HHTAR and moment specific analysis, comparing the first and the second year of the study. Profession specific analyses were observed for doctors, nurses, ward attendants and others including allied staff and cleaning staff of the hospital. Moment (M) specific analysis included - Before touching the patient (M1), before aseptic procedures (M2), after body fluid exposure (M3), after touching the patient (M4), after touching the patient surroundings (M5). Month wise analysis of the trend of HHTAR was also observed to analyze the effect of the interventions (classes, feedback, bedside teaching *etc*.) focusing the importance of hand hygiene, in healthcare settings. The data collected were entered into Microsoft Excel for the analysis. The HHCAR, HHPAR, and HHTAR, monthly HHTAR, profession-specific and moment specific adherence rates were reported as percentages. The association between various parameters of HH compliance among ICUs and wards, also between the year June 2021-May 2022 and June 2022-May 2023 were done with Chi-square test, using Openepi.com, p-value of $< 0.05$ was considered significant.

## Results

Over the observation period of 2 years, total of 24,740 HH opportunities were available and only 5022 moments (20.3%) were completely followed. In our study HHCAR was 20.3% HHPAR was 41.5% and HHTAR was 61.9% during the 2-year period.

More opportunities were available from the wards during both the years, and the compliance of HHCAR, HHPAR and HHTAR was better in the ICUs, the difference in the HHTAR was significant (p-value $< 0.0001$). Various compliance parameters were compared between ICUs and Wards.

The hand hygiene adherence rate was calculated separately for all the five moments of HH as per the WHO. The overall adherence rate reported were M1 (39.5%), M2 (46.9%), M3 (89.5%), M4 (83.2%) and M5 (55.7%), over the period of two years. The compliance of moment 3 (after body fluid exposure) and moment 4 (after touching the patient) was maximum and the compliance was minimum for moment 1 (before touching the patient). Moment specific compliance separately for ICUs and wards, is shown in Figure 1 and for year 2021-22 and year 2022-23 in Figure 2.

Profession specific HHTAR was maximum among nurses (62.8%) and doctors (61.5%), followed by attendants (51.6%) and others (45%). Comparing the HHTAR for both years shows improvement in the second year of observation in all the parameters.

Monthly HHCAR, HHPAR and HHTAR are plotted in figure 3, to appreciate the difference, with continuous HH reinforcement activities in the hospital. Though variation were reported every month, but progressive increase was observed during these 2 years of observation. Initially in June 2021 HHTAR was 46.1% and in May 2023 it was observed to be 66.5%. Maximum HHTAR was documented in the April 2023 *i.e.*, 67.5%, though the HHTAR was reported to be more than 65% since November 2022 till May 2023. The improvement in HHTAR (June 21 & May 23) is significant (p-value $< 0.0000001$).

## Discussion

We started HH auditing in June 2021 as a part of a multi-centric project initiated by JIPMER Pondicherry, with trained ICNs. The data compilation in this study is also as per the project parameters calculating HHCAR, HHPAR and HHTAR. The partial adherence rate was calculated to highlight the fact that though the HH was followed but most of the times incompletely, which does not reduce the rate of HAIs. It helped to further emphasize that all the 5 moments of HH as per WHO have equal importance and contribution in reducing HAIs. Further poor complete

**Fig. 1.** Comparing the HH compliance and the adherence rate in ICUs and wards.

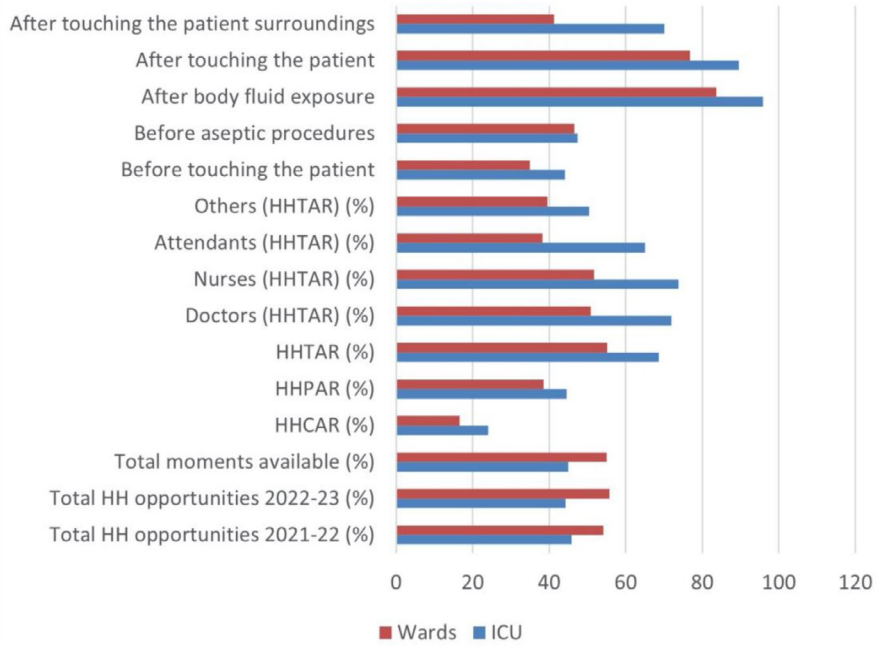
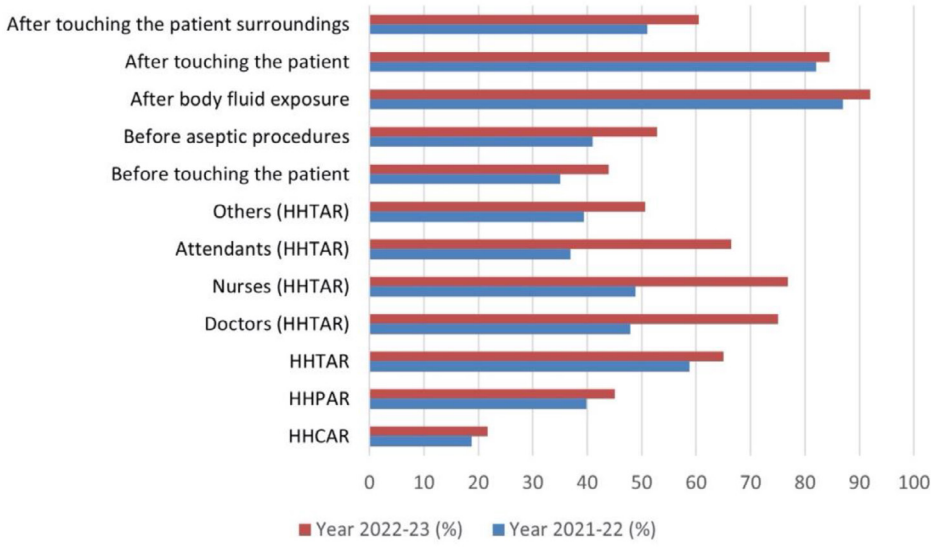


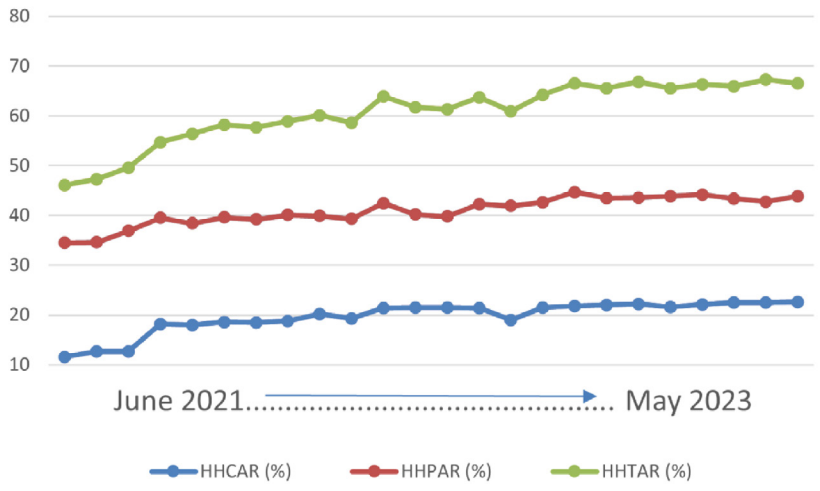

**Fig. 2.** Comparison of the parameters of Hand hygiene adherence rate (Profession specific and Moment specific) between 2 years (June 21-May 22 and June 22-May 23).




adherence rate may be disheartening, and HHPAR may encourage the HCWs to follow all the HH moments and HH steps, as per WHO targeting complete adherence.

HH practices are reported to be very poor in low- and middle-income countries, this may be due to multiple reasons like limited availability of resources, lack of awareness and motivation among HCWs and overburden of work [6]. In our study a total of 24,740 opportunities were observed over the period of 2 years with average HHTAR, HHPAR and HHCAR of 61.4%, 41.5% and 20.3% respectively. The HH compliance rate reported in the literature has a wide range from 14% reported by Dalen et al. [7] to 73.17% by Abdo et al. [8]. The HH compliance reported from low- and middle-income countries ranges from 9-32% in a systematic review, which is much lower than the high-income countries [9, 10]. A recent multi-centric study from India has reported HHTAR of 59.7% and HHCAR of 27.3%, the compliance from the northern zone was 19.9% (our institute also lies in northern India) [11]. Our results are comparable with these studies. Compliance rate was significantly more in the ICUs, owing to the fact that the nurse-to-patient ratio in ICUs is 1: 2/3 and it is around 1: 10-15 in wards, supporting the inverse relationship of more workload and multiple interventions with less HH compliance rate. Profession specific HH compliance rate has been reported to be more in nurses and doctors, in a number of studies. [5, 11, 12]. Among them the compliance in nurses is higher than the doctors, in most of the studies.

**Fig. 3.** Monthly % rate of HHTAR, HHPAR and HHCAR over the period of 2 years.




We also reported higher compliance in nurses, closely followed by the doctors. Higher compliance in nurses may be due to their more interaction and patient care activities, making them habitual for the practice. The compliance in attendance and other group of HCWs is reported to be low in all the studies attributing to their low educational status, less awareness leading to poor attitude and acceptance to the HH practice.

The moment specific compliance of all the 5 moments of Hand hygiene, as per WHO was observed and evaluated separately. After moments (after body fluid exposure and after touching the patient) have significantly higher compliance (M3 89% and M4 83%) than before moments M1 (39%) and M2 (47%). The higher compliance in after moments have also been reported in multiple studies. [5, 13-15]. This reflects that may be the HCWs are more concerned about contacting or carrying infection from the patients, than transmitting infection to the patient. This data directed our efforts to emphasize more on, before moments during the reinforcement classes. Few studies have reported comparable compliance in moment before aseptic procedures (M2) also [16]. This owes to the awareness in HCWs regarding transmitting infection to the patient from the hospital environment.

In addition to the awareness classes, it was insured that the visual reminders for the steps and moments of hand hygiene as per WHO were displayed along every sink and hand washing area in the hospital. Bedside teaching and observation by the ICNs were also emphasized for motivation, incorrect techniques, misconceptions and poor availability of resources if any. To evaluate the effect of the increased and focused educational programs the data of two years was compared in Figure 2. The bars of the year 2022-23 were larger than 2021-22 in all the parameters, signifying improvement in overall rates, moment specific as well as in the profession specific compliance rates. Similar post interventions, results were reported in the literature also [7, 13, 17]. Monthly percentages of HHTAR, HHPAR and HHCAR were evaluated, though continuous increase was not appreciated but the overall improvement in HHTAR was significant (p-value < 0.0000001). Further, the compliance was consistently more than 65% from November 2022 till May 2023.

The study had various limitations some due to the ongoing practical issues like shift variations. Auditing was done during the morning or afternoon hours, as auditing during evening and night hours was not feasible. The auditing included all the HCWs irrespective of their work experience, which could have been a bias, other limitations could be the area of work of the HCWs.

## Conclusions

Concluding the study, it was observed that ICU settings and the hand moments after body fluid exposure and after touching the patients (M3 & M4) had better HH compliance rates, further profession specific compliance was observed to be better among Nurses and Doctors. Moreover, comparing these parameters for two years, second year (June 22-May 23) had improved compliance rates. Owing to the periodic feedback, given to the Nursing incharge of the particular area on monthly basis, by the ICNs and reinforcement of the HH practices among the HCWs during HH audits and training sessions. It was concluded that the behavioural changes among HCWs seems to be the only possible practical solution to achieve sustainable standards of HH, with the present workload and limited resources in a developing country like India. We target to increase the HH compliance as per the WHO recommendation with continuous awareness classes, monitoring and auditing of hand hygiene, further targeting to reduce the hospital associated infection rates.

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## Conflict of interest statement

The authors declare no conflict of interest.

## Authors' contributions

PC: manuscript writing, concept and design of study, data analysis and interpretation. VG: critical revision of the manuscript and approval for the final submission. The manuscript has been read and approved by all the authors, and the requirements for the authorship have been met, and each author believes that the manuscript represents honest work. The data of the study has not been presented anywhere and it was not a clinical trial.

### References

[1] Tyagi U, Barwal KC. Ignac Semmelweis–Father of Hand Hygiene. Indian J Surg 2020;82:276-7. https://doi.org/10.1007/s12262-020-02386-6

[2] Mathur P. Hand hygiene: back to the basics of infection control. Indian J Med Res 2011;134:611-20. https://doi.org/10.4103/0971-5916.90985

[3] World Health Organization, WHO Patient Safety. WHO guidelines on hand hygiene in health care 2009. Available at: www.who.int/patientsafety/en (Accessed on: 25/7/2023).

[4] WHO launches first ever global report on infection prevention and control. Available at: https://www.who.int/news/item/06-05-2022-who-launches-first-ever-global-report-on-infection-prevention-and-control (Accessed on: 21/11/22).

[5] Krishnamoorthi S, Priyadarshi K, Rajshekar D, Sundaramurthy R, Dhandapani S, Madigubba H, Sastry AS. Impact of conducting hand hygiene audit in COVID-19 care locations of India – A large scale national multicentric study – HHAC study. Indian J Med Microbiol 2023;43:39-48. https://doi.org/10.1016/j.ijmmb.2022.09.002

[6] Mvukiyehe JP, Tuyishime E, Ndindwanimana A, Rickard J, Manzi O, Madden GR, Durieux ME, Banguti PR. Improving hand hygiene measures in low-resourced intensive care units: experience at the Kigali University Teaching Hospital in Rwanda. Int J Infect Control 2021;17. https://doi.org/10.3396/ijic. v17.20585

[7] Dalen Rv, Gombert K, Bhattacharya S, Datta SS. Mind the mind: results of a hand-hygiene research in a state-ofthe-art cancer hospital. Indian J Med Microbiol 2013;31:280-2. https://doi.org/10.4103/0255-0857.115639.

[8] Abdo NM, Al-Fadhli M. Improving hand hygiene compliance among healthcare workers in intensive care unit: an interventional study. Int J Community Med Public Health 2018;5:3747-52. https://doi.org/10.18203/2394-6040.ijcmph20183558

[9] Lenglet A, Van Deursen B, Viana R, Abubakar N, Hoare S, Murtala A, Okanlawon M, Osatogbe J, Emeh V, Gray N, Keller S, Masters P, Roolvink D, Davies J, Hickox K, Fotso A, Karla Bil K, Nwankwo C I, Ahmad B, Caluwaerts A, Lessard I, Dimeglio S, Malou N, Kanapathipillai R, McRae M,Wong S, Hopman J. Inclusion of Real-Time Hand Hygiene Observation and Feedback in a Multimodal Hand Hygiene Improvement Strategy in Low-Resource Settings. JAMA Netw Open 2019;2:e199118. https://doi.org/10.1001/jamanetworkopen.2019.9118

[10] Lambe KA, Lydon S, Madden C, Vellinga A, Hehir A, Walsh M, O'Connor P. Hand hygiene compliance in the ICU: a systematic review. Crit Care Med 2019;47:1251-7. https://doi.org/10.1097/CCM.0000000000003868

[11] Anguraj S, Ketan P, Sivaradjy M, Shanmugam L, Jamir I, Cherian A, Sastry AS. The effect of hand hygiene audit in COVID intensive care units in a tertiary care hospital in South India. Am J Infect Control 2021;49:1247-51. https://doi.org/10.1016/j.ajic.2021.07.008

[12] Wang Y, Yang J, Qiao F, Feng B, Hu F, Xi Z ang, Wu W, Ni Z, Liu L, Yuan Y. Compared hand hygiene compliance among healthcare providers before and after the COVID-19 pandemic: a rapid review and meta-analysis. Am J Infect Control 2022;50:563-71. https://doi.org/10.1016/j.ajic.2021.11.030

[13] Dhandapani S, Rajshekar D, Priyadarshi K, Krishnamoorthi S, Sundaramurthy R, Madigubba H, Sastry AS and Contributors of HHAC Study Group. Comparison of hand hygiene compliance among healthcare workers in Intensive care units and wards of COVID-19: a large scale multicentric study in India. Am J Infect Control 2023;51:304-12. https://doi.org/10.1016/j.ajic.2022.09.028

[14] Clancy C, Delungahawatta T, Dunne CP. Hand-hygiene-related clinical trials reported between 2014 and 2020: a comprehensive systematic review. J Infect Control 2021;111:6-26. https://doi.org/10.1016/j.jhin.2021.03.007

[15] Gould D, Purssell E, Jeanes A, Drey N, Chudleigh J, McKnight J. The problem with 'My Five Moments for Hand Hygiene.' BMJ Qual Saf 2022;31:322-6. https://doi.org/10.1136/ bmjqs-2021-013680

[16] Lohiya SB, Rameshkumar R, Vagha J. Hand hygiene compliance and efficacy of a multimodal intervention strategy in improving hand hygiene compliance in a tertiary level pediatric intensive care unit. J Pediatr Assoc India 2019; 8:64-64.

[17] Ganesan V, Sundaramurthy R, Thiruvanamalai R, Raghavan M, Chavan SKD, Pusa R, Sakthivadivel V, Gaur A, Balan Y. Hand hygiene auditing: is it a roadway to improve adherence to hand hygiene among hospital personnel? Cureus 2022;14:e25221. https://doi.org/10.7759/cureus.25221

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ENVIRONMENTAL HYGIENE

# The health of mankind and the health of the planet in a historical-ethical perspective: an inseparable relationship and a single destiny

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Keywords

Environmental ethics • Global health • Increased temperatures • Waterborne pathogens • Weather Variability (RWV)

Summary

*Recent years have seen increasingly severe natural disasters, the consequences of which have been catastrophic. Clearly, our global environment is undergoing major changes. The climate is becoming deranged and pollution on a global scale afflicts air, water, and land. We are faced with an unprecedented shortage of cultivable land and fresh water for drinking, irrigation, and livestock farming, while our marine systems are breaking down.*

*These environmental changes have a very high anthropogenic component; they are induced by human activities that are potentially dangerous for both the environment and human life. Moreover, not only do they have an enormous impact on the environments in which we live and on our way of life, they also have harmful effects on our health. Indeed, we must understand that our body – as Hippocrates explained long ago – is a system that constantly interacts with the surrounding environment.*

## Introduction

Every living organism is part of an ecosystem, which constitutes the condition sine qua non of its very existence, and "the relationship with the environment is one of the fundamental determinants of the state of health of the human population" [1]. "The health of humans, domestic and wild animals, plants, and the wider environment are closely linked and inter-dependent" [2]. At the same time, the environment is constantly modified by the set of actions and relationships implemented by the living beings that inhabit it. Therefore, it is essential to understand that human health is inseparable from the health of the Planet and from that of all other living beings. Human health is closely linked to the state of the natural systems on which it depends: and together they determine Planetary Health [3].

## The effects of anthropization and climate change on human health

The scientific literature indicates that such important, and in part irreversible, changes that are affecting our planet because of anthropization can have both immediate and medium - and long-term effects on health. Indeed, back in 2006, the Italian National Federation of Orders of Physicians, Surgeons, and Dentists (FNOMCeO) introduced into its code of conduct a specific article regarding the "Promotion of health, the environment and global health".
This article states that "Considering the living and working environment and the levels of education and social equality to be fundamental determinants of individual and collective health, doctors will collaborate in the implementation of suitable educational and preventive measures and policies to combat health inequalities and will promote the adoption of healthy lifestyles by providing information on the main risk factors. Based on the available knowledge, they will foster communication on exposure and vulnerability to environmental risk factors and promote the appropriate use of natural resources, in order to create a well-balanced ecosystem in which both present and future generations can live" [4].
The doctor must therefore tackle any risks to human health, including those of an environmental nature, before their consequences arise.
An analysis updated to 2016 – the most up to date among those available – has shown that 24% of deaths worldwide (and 28% of deaths among children under 5 years of age) are due to modifiable environmental factors [5].
"Factors include air pollution, water and sanitation, increasing severe weather events, harmful exposure to chemicals and more" [6].
Furthermore, the climate crisis has increased the average global temperature and is leading to more frequent high-temperature extremes, such as heatwaves.
The last few years have been the hottest on average as long as records have existed, and more than 400 weather stations all around the World have beaten their heat records in 2021 (reaching up to 48.8°C in Italy on 20 July, 49.6°C in Canada on 29 June or even 54.4°C in the US on 9 July) [7].

Although full-year data is not yet available, 2023 is set to become the hottest year in history according to data from Copernicus, the European Commission's Earth observation programme coordinated and managed by the European Commission, dedicated to monitoring our planet and its environment. The news is reported by the most important news agencies and at the opening of Cop28, the United Nations Conference on Climate Change, held in Dubai from November 30 to December 13, 2023, the UN Secretary-General, Antonio Guterres, confirmed that 2023 is the hottest year ever, with record temperatures and Antarctic Sea ice at historic lows. "We are experiencing climate collapse in real time" Guterres said [8].

According to the WMO (World Meteorological Organization), in 2022 [9], the global mean temperature, which combines near-surface temperature measurements over land and ocean, was 1.15 [1.02-1.28] °C above the 1850–1900 pre-industrial average.

Shifts in climate can influence the structure and diversity of microbial communities [10].

*Candida auris* is considered the first "novel" pathogen to have evolved in response to climate change, although this remains speculative and awaits conclusive evidence [11]. The transformation of *Candida auris* from an environmental fungus to a human pathogen could be also due to thermal adaptation induced by climate change, enabling it to survive in human body temperatures. *Candida auris* may have originated as an environmental fungus in wetlands, and due to its adaptation to rising temperatures, it may have infected birds as an intermediary species before further adapting to the higher body temperatures of humans [12-14].

Changes in precipitation and temperature were also noted to affect human social gatherings and the transmissibility of viruses such as influenza and COVID-19 [15].

Emerging and re-emerging viral outbreaks are becoming more frequent due to increased international travel and global warming.

The emergence of the Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) in 2002, followed by the H1N1 influenza outbreak in 2009 [16] and the most recent SARS-CoV-2 pandemic [17, 18] underscored the potential of viruses to swiftly disrupt global health and economies [19].

Liu [20] demonstrated that rapid weather variability (RWV) also played a significant role in changing the strength of the influenza epidemic in the past. In a warming climate, the RWV will intensify, and the influenza epidemic risk can increase by up to 50% in some northern mid-latitude regions.

The consequences of global warming and resulting climate change are expected to have effects on waterborne infections in the future. Longer seasonal warm periods due to hot summers or prolonged warm autumns lead significant increases in temperatures even in the polar areas [21] with a relative increase in the temperature of waters (marine and continental) at high latitudes.

These increased temperatures can favour the multiplication of waterborne pathogens like Legionella, that causes various clinical manifestations, including the form of pneumonia commonly known as Legionnaires' pneumonia illness [22].

Given the rising average of global temperatures, also the base temperature of cold water will increase. Such an effect could lead to increased *Legionella* growth in cold water, which in turn could lead to increased *Legionella* concentrations in both cold and hot water [23].

Another serious drawback of global warming is the increase in antibiotic resistance. This is a major public health problem and a cause of substantial morbidity and mortality among hospitalized patients, especially in at-risk wards [24-27].

In a 30-country cross-sectional study conducted by Kaba et al. [28] the six-year prevalence of carbapenem-resistant *Pseudomonas aeruginosa* (CRPA), *Klebsiella pneumoniae* (CRKP), Multiresistant *Escherichia coli* (MREC), and Methicillin-resistant *Staphylococcus aureus* (MRSA) was determined based on > 900 k clinical isolates. Bi- and multivariate analysis were performed to identify associations with climatic variables using healthcare and socio-economic confounders. CRPA was significantly associated with the warm-season change in temperature. Moreover, they found significant associations of CRKP, MREC, and MRSA with the warm-season mean temperature, which had a higher contribution to MRSA variance explanation than outpatient antimicrobial drug use.

## The link between climate change and cholera epidemics

To all this we must add environmental disasters due to climate change and the improper use of land. Malawi, for example, is currently experiencing the deadliest cholera epidemic in its history. "Between March 3 2022 and February 3 2023, a total of 36,943 cases, including 1,210 deaths, were reported from all 29 districts in Malawi (overall case-fatality rate (CFR) 3.3%) with active transmission ongoing in 27 of the 29 districts. There was a 143% increase in the number of cases in January (17,078) in comparison with December (7,017 cases)" [29]. And the situation in recent months tends to worsen further.

Cholera has been endemic in Malawi since 1998, with seasonal outbreaks reported during the rainy season (November to May). The conditions for the present severe outbreak were probably created by the tropical storms that hit the country just over a year ago. However, the fact that the current epidemic has extended throughout the dry season is a sign of a worsening situation, which is evidently linked both to problems concerning water and sanitary infrastructure and to the interruption of cholera prevention campaigns due to the COVID-19 pandemic. A peak of cholera cases – over 28,000 cases – was also recorded in mid-March 2023 in Mozambique, where the disease has been growing exponentially since December 2022.

Cyclone Freddy, the resulting flooding and heavy rains

in the first weeks of last February further worsened the situation. "Weak surveillance and late reporting, inadequate WASH conditions (lack of access to safe drinking water, poor sanitation and hygiene practices), a weak health system and the exhaustion of a workforce that has to respond to multiple emergencies threaten to favor the spread of the disease, as do the ongoing heavy seasonal rains" [30].

The situation also continues to be alarming in Pakistan, where, since last year's floods, the risk of cholera remains high [31], and where polio outbreaks persist [32].

In 2022 there were 20 cases of WPV Polio in Pakistan and already 2 cases were recorded in 2023 [33].

But above all, polio has reappeared in the last year in various countries of Africa, after the World Health Organization declared the African continent polio-free on August 25, 2000 [34, 35].

The World Health Organization (WHO) has expressed concern over the risk of the potential spread of these diseases to other countries in the area, given the significant cross-border traffic between Pakistan and neighboring countries.

Returning to talk about cholera [36], which today is widespread in Africa [37] but also in Haiti, India, Pakistan, the Philippines and Syria [38], it should be remembered that in February 2023, the United Nations health agency pointed out that the greatest challenges in the fight against epidemic diseases, starting with cholera include climate change, which has led to droughts or floods in many parts of the world, resulting in increased population migrations and reduced access to safe water.

Of particular interest in this regard are the studies that correspond climate variations with the ENSO phenomenon, El Niño Southern Oscillation.

Since the late 1970s, in fact, the warm periods originating from ENSO have become more and more intense and the increase in temperatures on a regional scale, due to climate change and ENSO, can facilitate the proliferation of bacteria that populate salty waters and thrive at high temperatures.

These results were reached by the working group coordinated by Xavier Rodó, an ICREA research professor and head of the Climate and Health program at the Barcelona Global Health Institute (ISGlobal), where he directs the climate and health research programme, studying the interplay between climate and health [39-42].

## Wars and famines at the root of the resurgence of epidemic diseases

Moreover, in many areas, the disasters caused by climate change and environmental problems are compounded by war, famine, and the marginalization of entire ethnic groups. As a result, thousands of people are driven from their homes and are often forced to flee to refugee camps, where drinking water is scarce and toilets facilities inadequate owing to the frequent breakdown of aqueducts and sewage systems. Added to this is the lack or limited availability of medical care, which can aggravate epidemics once they occur.

In this regard, the case of Syria is exemplary; for 12 years, the country has been racked by a bloody civil war, which to date has caused hundreds of thousands of deaths, mass displacements and the destruction of civil infrastructure. This difficult situation has led to the constant recurrence of a series of epidemics that are decimating the population: cholera, Wild polio virus, measles, leishmaniasis, diarrhea, scabies, lice, hepatitis A and leptospirosis, in addition to COVID -19. Against this backdrop of serious social and health difficulties, last February many disastrous earthquakes hit the north-western area of Syria, on the border with Turkey [43].

The destruction due to war and earthquakes, which have damaged water infrastructure and made access to clean water extremely limited, and access to water purification tools is made difficult by the restrictions imposed on the country, have caused the return of cholera to Syria thirteen years after its disappearance [44], as happened in Haiti, whose population in recent years has had to endure very strong storms and floods, earthquakes, hurricanes and famines, accompanied by epidemic diseases, with a return of cholera in October 2022 [45].

Such extreme situations are becoming increasingly frequent, above all when, as in Syria, a situation of poverty is aggravated by environmental disasters or earthquakes which deprive people of the means of sustenance and impair their physical and mental health.

This is the case of Afghanistan - already hit by an earthquake in June 2022 - and of Pakistan, Chile, and Libya, which suffered earthquakes of magnitude greater than 6 on the Richter scale in March 2023 [46].

These situations immediately give rise to problems such as dehydration and dysentery, caused by the lack of drinking water and poor hygiene, which lead to the spread of epidemics [47]. A particularly worrying phenomenon is the rapid increase in measles infections among Afghan children, owing to low vaccination coverage, as well as among children who are experiencing the dramatic situation of the war in Ukraine [48, 49].

Measles damages children's immune systems, making it more difficult to fight off complications such as respiratory infections and pneumonia. Moreover, without treatment, measles mortality can be as high as 20%.

In addition to measles, various vaccine-preventable diseases can strike in similar contexts, precisely because of the impossibility of carrying out vaccination campaigns.

In the periods following earthquakes or other disasters, the risk of respiratory diseases absolutely must not be underestimated. Indeed, the risk of outbreaks of infectious diseases caused by respiratory viruses is particularly high, especially in temporary reception camps, owing to both overcrowding and low seasonal temperatures.

Finally, one of the heaviest burdens borne by survivors of a natural disaster concerns the mental health problems caused by the severe trauma and the serious losses

suffered, in terms of both human lives and the loss of one's home and one's certainties [50, 51].

## Conclusions

These few data highlight an incontrovertible fact: mankind cannot live in a ruined environment. We must rebuild that "bridge" imagined by Van Rensselaer Potter (1911-2001), the father of bioethics: a bridge between the present and the future, and, above all, between man and nature, between human health and that of the planet, between the future of mankind and that of the environment in which we live [52, 53].
Understanding this simple but fundamental reality should prompt us to adopt radically different lifestyles and models of consumption that are sustainable in terms of their environmental impact. It may also raise our awareness of the fragility of man and other living beings in the face of global change and extreme natural events. If so, scientists, governments and society may be able to implement appropriate and timely interventions, albeit in the knowledge that it is becoming increasingly difficult, if not impossible, to respond simultaneously to multiple epidemics, owing to the lack of resources, drugs, and medical and healthcare personnel.

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## Conflict of interest statement

The authors declare no conflict of interest.

## Authors' contributions

DO: designed the study; MM: conceived the study; DO, MM, MLC: drafted the manuscript; DO, MM, MLC and AMS, MS: critically revised the manuscript. DO, MM, AMS, MLC: performed a search of the literature; furthermore: MM, DO and MLC: methodology; MLC and AMS, MS: validation and data curation; MS: formal analysis; MM, MLC, DO: final editing.
All authors critically revised the manuscript. All authors have read and approved the latest version of the paper for publication.

### References

[1] Istituto Superiore di Sanità EpiCentro. L'epidemiologia per la sanità pubblica. Ambiente e salute. Available at: https://www.epicentro.iss.it/ambiente/ (Accessed on: 18/12/2023).

[2] One Health: a call for ecological equity. Lancet 2023;401:169. https://doi.org/10.1016/S0140-6736(23)00090-9.

[3] Whitmee S, Haines A, Beyrer C, Boltz F, Capon AG, de Souza Dias BF, Ezeh A, Frumkin H, Gong P, Head P, Horton R, Mace GM, Marten R, Myers SS, Nishtar S, Osofsky SA, Pattanayak SK, Pongsiri MJ, Romanelli C, Soucat A, Vega J, Yach D. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation-Lancet Commission on planetary health. Lancet 2015;386:1973-2028. https://doi.org/10.1016/S0140-6736(15)60901-1. Erratum in: Lancet. 2015 Nov 14;386(10007):1944.

[4] Federazione Nazionale italiana degli Ordini dei Medici Chirurghi e degli Odontoiatri (FNOMCeO). Codice deontologico. Available at: https://portale.fnomceo.it/codice-deontologico/ (Accessed on: 18/12/2023).

[5] World Health Organization - WHO. Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks. 2018. Available at: https://www.who.int/publications/i/item/9789241565196 (Accessed on: 18/12/2023).

[6] World Health Organization - WHO. Estimating environmental health impacts. Available at: https://www.who.int/activities/environmental-health-impacts (Accessed on: 18/12/2023).

[7] Ibáñez A., Garrido-Chamorro S., Barreiro C. Microorganisms and climate change: a not so invisible effect. Microbiol Res 2023;14:918-47. https://doi.org/10.3390/microbiolres14030064.

[8] Cop28, Guterres: il 2023 è stato l'anno più caldo della storia umana. Available at: https://askanews.it/2023/11/30/cop28-guterres-il-2023-e-stato-lanno-piu-caldo-della-storia-umana/ (Accessed on: 04/01/2024).

[9] World Meteorological Organization (WMO). State of the global climate 2022. Available at: https://library.wmo.int/viewer/66214/download?file=Statement_2022.pdf&type=pdf&navigator=1 (Accessed on: 18/12/2023).

[10] Cavicchioli R, Ripple WJ, Timmis KN, Azam F, Bakken LR, Baylis M, Behrenfeld MJ, Boetius A, Boyd PW, Classen AT, Crowther TW, et al. Scientists' warning to humanity: microorganisms and climate change. Nat Rev Microbiol 2019;17:569-86. https://doi.org/10.1038/s41579-019-0222-5

[11] Nnadi NE, Cart DA. Climate change and the emergence of fungal pathogens. PLoS Pathog 2021;17: e1009503. https://doi.org/10.1371/journal.ppat.1009503

[12] Branigan D. Climate Change May Be Responsible For The Rise Of Deadly Fungus Candida auris. Available at: https://healthpolicy-watch.news/climate-change-may-be-responsible-for-the-rise-of-deadly-fungus-candida-auris/ (Accessed on: 18/12/2023).

[13] Cristina ML, Spagnolo AM, Sartini M, Carbone A, Oliva M, Schinca E, Boni S, Pontali E. An Overview on Candida auris in healthcare settings. J Fungi (Basel) 2023;9:913. https://doi.org/10.3390/jof9090913

[14] Casadevall A, Kontoyiannis DP, Robert V. On the Emergence of Candida auris: climate change, azoles, swamps, and birds. mBio 2019;10:e01397-19. https://doi.org/10.1128/mBio.01397-19

[15] Mora C, McKenzie T, Gaw IM, Dean JM, von Hammerstein H, Knudson TA, Setter RO, Smith CZ, Webster KM, Patz JA, Franklin EC. Over half of known human pathogenic diseases can be aggravated by climate change. Nat Clim Chang 2022;12:869-75. https://doi.org/10.1038/s41558-022-01426-1

[16] Gasparini R, Bonanni P, Amicizia D, Bella A, Donatelli I, Cristina ML, Panatto D, Lai PL. Influenza epidemiology in Italy two years after the 2009-2010 pandemic: need to improve vaccination coverage. Hum Vaccin Immunother 2013;9:561-7. https://doi.org/10.4161/hv.23235

[17] Parisini A, Boni S, Vacca EB, Bobbio N, Puente FD, Feasi M, Prinapori R, Lattuada M, Sartini M, Cristina ML, Usiglio D, Pontali E. Impact of the COVID-19 pandemic on epidemiology of antibiotic resistance in an Intensive Care Unit (ICU): the experience of a North-West Italian Center. Antibiotics (Basel) 2023;12:1278. https://doi.org/10.3390/antibiotics12081278

[18] Sartini M, Del Puente F, Oliva M, Carbone A, Blasi Vacca E, Parisini A, Boni S, Bobbio N, Feasi M, Battistella A, Pontali E, Cristina ML. Riding the COVID waves: clinical trends, outcomes, and remaining pitfalls of the SARS-CoV-2 pandemic: an analysis of two high-incidence periods at a hospital in Northern Italy. J Clin Med 2021;10:5239. https://doi.org/10.3390/jcm10225239

[19] Han JJ, Song HA, Pierson SL, Shen-Gunther J, Xia Q. Emerging infectious diseases are virulent viruses-are we prepared? An overview. Microorganisms 2023;11:2618. https://doi.org/10.3390/microorganisms11112618

[20] Liu Q., Tan Z, Sun J, Hou Y, Fu C, Wu Z. Changing rapid weather variability increases influenza epidemic risk in a warming climate. Environ Res Lett 2020;15:044004. https://doi.org/10.1088/1748-9326/ab70bc

[21] Post E, Alley RB, Christensen TR, Macias-Fauria M, Forbes BC, Gooseff MN, Iler A, Kerby JT, Laidre KL, Mann ME, Olofsson J, Stroeve JC, Ulmer F, Virginia RA, Wang M. The polar regions in a 2°C warmer world. Sci Adv 2019;5:eaaw9883. https://doi.org/10.1126/sciadv.aaw9883

[22] Spagnolo AM, Sartini M, Cristina ML. Microbial contamination of Dental Unit Waterlines and potential risk of infection: a narrative review. Pathogens 2020;9:651. https://doi.org/10.3390/pathogens9080651

[23] Dupke S, Buchholz U, Fastner J, Förster C, Frank C, Lewin A, Rickerts V, Selinka HC. Impact of climate change on waterborne infections and intoxications. J Health Monit 2023;8:62-77. https://doi.org/10.25646/11402

[24] Cristina ML, Sartini M, Ottria G, Schinca E, Cenderello N, Crisalli MP, Fabbri P, Lo Pinto G, Usiglio D, Spagnolo AM. Epidemiology and biomolecular characterization of carbapenem-resistant Klebsiella pneumoniae in an Italian hospital. J Prev Med Hyg 2016;57:E149-56.

[25] Cristina ML, Spagnolo AM, Cenderello N, Fabbri P, Sartini M, Ottria G, Ottria P. Multidrug-resistant Acinetobacter baumannii outbreak: an investigation of the possible routes of transmission. Public Health 2013;127:386-91. https://doi.org/10.1016/j.puhe.2013.01.025

[26] Sticchi C, Alberti M, Artioli S, Assensi M, Baldelli I, Battistini A, Boni S, Cassola G, Castagnola E, Cattaneo M, Cenderello N, Cristina ML, De Mite AM, Fabbri P, Federa F, Giacobbe DR, La Masa D, Lorusso C, Marioni K, Masi VM, Mentore B, Montoro S, Orsi A, Raiteri D, Riente R, Samengo I, Viscoli C, Carloni R. Regional point prevalence study of healthcare-associated infections and antimicrobial use in acute care hospitals in Liguria, Italy. J Hosp Infect 2018;99:8-16. https://doi.org/10.1016/j.jhin.2017.12.008

[27] Cristina ML, Spagnolo AM, Ottria G, Sartini M, Orlando P, Perdelli F; Galliera Hospital Group. Spread of multidrug carbapenem-resistant Acinetobacter baumannii in different wards of an Italian hospital. Am J Infect Control 2011;39:790-4. https://doi.org/10.1016/j.ajic.2011.01.016

[28] Kaba HEJ, Kuhlmann E, Simone Scheithauer S. Thinking outside the box: association of antimicrobial resistance with climate warming in Europe - A 30 country observational study. Int J Hyg Environ Health 2020;223:151-8. https://doi.org/10.1016/j.ijheh.2019.09.008

[29] World Health Organization - WHO. Cholera - Malawi. 2023. Available at: https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON435 (Accessed on: 18/12/2023).

[30] World Health Organization - WHO. Cholera - Mozambique. 2023. Available at: https://www.who.int/emergencies/disease-outbreak-news/item/2023-DON443 (Accessed on: 18/12/2023).

[31] Naveed A, Umer M, Ehsan M et al. The cholera outbreak in Lahore, Pakistan: challenges, efforts and recommendations. Trop Med Health 2022;50:62. https://doi.org/10.1186/s41182-022-00458-9

[32] Martini M, Orsini D. Armed conflict in the world threatens the eradication of Poliomyelitis: risks of humanitarian crises. Pathog Glob Health 2022;116:267-8. https://doi.org/10.1080/20477724.2022.2081785

[33] Pakistan Polio Eradication Program. Polio Cases District Wise. Available at: https://www.endpolio.com.pk/polioin-pakistan/district-wise-polio-cases (Accessed on 18/12/2023).

[34] Martini M, Orsini D. The fight against poliomyelitis through the history: past, present and hopes for the future. Albert Sabin's missing Nobel and his "gift to all the world's children". Vaccine 2022;40:6802-5. https://doi.org/10.1016/j.vaccine.2022.09.088

[35] Martini M, Orsini D. The ghost of polio haunts us once again. The appeal of the scientific community is clear: "Vaccinate your kids today!". Vaccine 2023;41:5338-41. https://doi.org/10.1016/j.vaccine.2023.07.029

[36] World Health Organization (WHO). Cholera. 2023. Available at: https://www.who.int/news-room/fact-sheets/detail/cholera (Accessed on: 18/12/2023).

[37] Sack DA, Debes AK, Ateudjieu J, et al. Contrasting Epidemiology of Cholera in Bangladesh and Africa. J Infect Dis 2021;224(12 Suppl 2):S701-9. https://doi.org/10.1093/infdis/jiab440

[38] Chowdhury F, Ross AG, Islam MT, McMillan NAJ, Qadri F. Diagnosis, Management, and Future Control of Cholera. Clin Microbiol Rev 2022;35:e0021121. https://doi.org/10.1128/cmr.00211-21

[39] Varo R, Rodó X, Bassat Q. Climate change, cyclones and cholera - Implications for travel medicine and infectious diseases. Travel Med Infect Dis 2019;29:6-7. https://doi.org/10.1016/j.tmaid.2019.04.007

[40] Martinez PP, Reiner RC Jr, Cash BA, Rodó X, Shahjahan Mondal M, Roy M, Yunus M, Faruque AS, Huq S, King AA, Pascual M. Cholera forecast for Dhaka, Bangladesh, with the 2015-2016 El Niño: lessons learned. PLoS One 2017;12:e0172355. https://doi.org/10.1371/journal.pone.0172355

[41] Cash BA, Rodó X, Emch M, Yunus M, Faruque AS, Pascual M. Cholera and shigellosis: different epidemiology but similar responses to climate variability. PLoS One. 2014;9:e107223. https://doi.org/10.1371/journal.pone.0107223

[42] Rodo X, Pascual M, Fuchs G, Faruque AS. ENSO and cholera: a nonstationary link related to climate change? Proc Natl Acad Sci USA 2002;99:12901-6. https://doi.org/10.1073/pnas.182203999

[43] OCHA Office for the Coordination of Humanitarian Affairs. Syrian Arab Republic: earthquakes - Situation Report No. 5, as of 28 March 2023. 28 March 2023. Available at: https://reliefweb.int/report/syrian-arab-republic/syrian-arab-republic-earthquakes-syria-situational-updates-28-march-2023 (Accessed on: 18/12/2023).

[44] Davide Orsini, Martini M. The insidious return of cholera in the Eastern Mediterranean Region, Lebanon and Syria: a worrying signal! Past, present, and future forthcoming. J Prev Med Hyg 2023;64:E27-33. https://doi.org/10.15167/2421-4248/jpmh2023.64.1.2910

[45] World Health Organization (WHO). Cholera - Haiti. 2022. Available at: https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON415. Accessed on: 18/12/2023

[46] Martini M, Minet C, Orsini D. The specter of cholera in Libya and North Africa: natural disasters and anthropization threaten human health during recent years. J Prev Med Hyg 2023;64:E340-4. https://doi.org/10.15167/2421-4248/jpmh2023.64.3.3102

[47] Najafi S, Rezayat AA, Beyzaei SF, et al. Incidence of infectious diseases after earthquakes: a systematic review and meta-analysis. Public Health 2022;202:131-8. https://doi.org/10.1016/j.puhe.2021.11.005

[48] Orsini D, Martini M. Measles: a new danger for Ukraine's children! The need for an effective and timely vaccination prevention campaign for an insidious disease that comes from afar. J

Prev Med Hyg 2023;64:E204-8. https://doi.org/10.15167/2421-4248/jpmh2023.64.2.2996

[49] Bifulco M, Di Zazzo E, Pisanti S, Martini M, Orsini D. The nineteenth-century experience of the kingdom of the two Sicilies on mandatory vaccination: an Italian phenomenon? Vaccine 2022;40:3452-4. https://doi.org/10.1016/j.vaccine.2022.04.052

[50] Newnham EA, Mergelsberg ELP, Chen Y, Kim Y, Gibbs L, Dzidic PL, Ishida DaSilva M, Chan EYY, Shimomura K, Narita Z, Huang Z, Leaning J. Long term mental health trajectories after disasters and pandemics: a multilingual systematic review of prevalence, risk and protective factors. Clin Psychol Rev 2022;97: 102203. https://doi.org/10.1016/j.cpr.2022.102203

[51] Agyapong B, Shalaby R, Eboreime E, Obuobi-Donkor G, Owusu E, Adu MK, Mao W, Oluwasina F, Agyapong VIO. Cumulative trauma from multiple natural disasters increases mental health burden on residents of Fort McMurray. Eur J Psychotraumatol 2022;13:2059999. https://doi.org/10.1080/20008198.2022.2059999

[52] Potter VR. Bioethics: bridge to the future. Englewood Cliff: Prentice-Hall, Inc., 1971.

[53] Sartea C. Cinquant'anni di Bioetica. Il sapere normativo della civiltà tecnologica e i suoi dilemmi. Jus 2020;5:190-234. https://doi.org/10.26350/004084_000103

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# The effect of diabetes training through social networks on metabolic control of individuals with type 2 diabetes; a randomized controlled trial

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## Keywords

Diabetes mellitus • Education • Social media • Mobile Health Units

## Summary

**Background**. *Due to spread of smart phones, opportunity to train patients with diabetes and communicate with them using social media is rising. Aim of this study was to evaluate the effect of training through two popular social networks in Iran ("Telegram" and "Soroush") and the metabolic control of people with Type 2 diabetes.*

**Methods**. *In this randomized controlled trial, we recruited 134 patients with type 2 diabetes, which randomly allocated into two groups: the intervention and the control group on a 1:1 basis. The studied tools included demographic information and awareness of diabetes and international physical activity questionnaires. The intervention comprised a training package that delivered to the intervention group via social media for 45 days. The primary outcome measures included awareness of diabetes management and physical activity level while secondary outcome measures were HbA1c and lipid profile.*

**Results**. *Social network training led to the increase of the patients' awareness (44.31 ± 2.78 to 46.88 ± 2.25 in intervention group vs 44.14 ± 3.85 to 44.41 ± 3.87 in control group) and physical activities level (23.64 ± 8.46 to 31.68 ± 7.12 in intervention group vs 26.20 ± 9.39 to 30.20 ± 8.11 in control group) (p-value < 0.001). Besides, LDL and HDL levels, and HbA1c (8.19 ± 2.10 to 8.05 ± 1.96 in intervention group vs. 7.53 ± 1.67 to 7.45 ± 1.34 in control group) decreased significantly (p-value < 0.05).*

**Conclusions**. *Changes in lifestyle and challenges of the patients' attendance in diabetes training sessions, declared that use of social networks can be useful to train diabetes patients remotely, and it is feasible to send training messages to help them improve their diabetes care.*

## Background

Diabetes is a non-communicable disease that is known as the epidemic disease of the third millennium [1, 2]. It is estimated that the number of people with diabetes will exceed 642 million in the world in 2040 [3, 4]. In Iran, about 4 million patients had diabetes in 2008, and the experts predict that this number will be tripled in the next 15 years [1, 5]. According to the World Health Organization, training is the basis of treating diabetes [6]. Changes in the lifestyle and awareness of the patients are effective strategies in the prevention of Type 2 diabetes [7]. Therefore, training of people with diabetes indifferent areas such as diet, exercise, physical activity is the basis of treatment, well before the pharmacotherapy. The treatment of diabetes is effective only when the patient knows the nature of his disease well and takes positive steps in treating it [8]. Since training of self-care skills in diabetes is a vital factor in caring for all the patients had diabetes, it seems that the virtual training to provide all the patients with the training services is a need [9].

It is estimated that 1 billion people use cellphones in the world [10]. The results of a survey in 2016 in 31 provinces of Iran, revealed that 53% of the Iranians are users of at least one of the social networks. "Telegram" is considered as the most popular social network among the Iranians and 45% of the Iranian population use this popular social network [11].

Mobile-based social networks have been used for virtual teaching and learning with various success rates. Virtual learning is independent of the time and place, and when the content is presented through text, images, voice, or video, it is more attractive to the audience [12]. Today, because of the industrialization of the cities and the changes of the lifestyle, it is not possible for all of the people to have active participation in the training, therefore, the social networks have been introduced as a very effective and complementary method for the traditional methods of training due to its multimedia capability and remarkable effectiveness [13].

The research studies on the virtual and web-based training show that virtual training can decrease the blood HbA1c level in diabetes patients and bring it to

the normal level [14, 15]. Another study done by Amini et al. indicated that electronic and long-distance training can increase daily physical activity and reduces the body mass index [16, 17]. While most of the studies on virtual training for diabetes have been via web-based solutions, the provision of such training through mobile-based social networks has not been well explored. So, the aim of this study was to investigate the effect of virtual training through two most popular social networks in Iran ("Telegram" and "Soroush") on the metabolic control of people with type 2 diabetes.

## Methods and Materials

### Study design

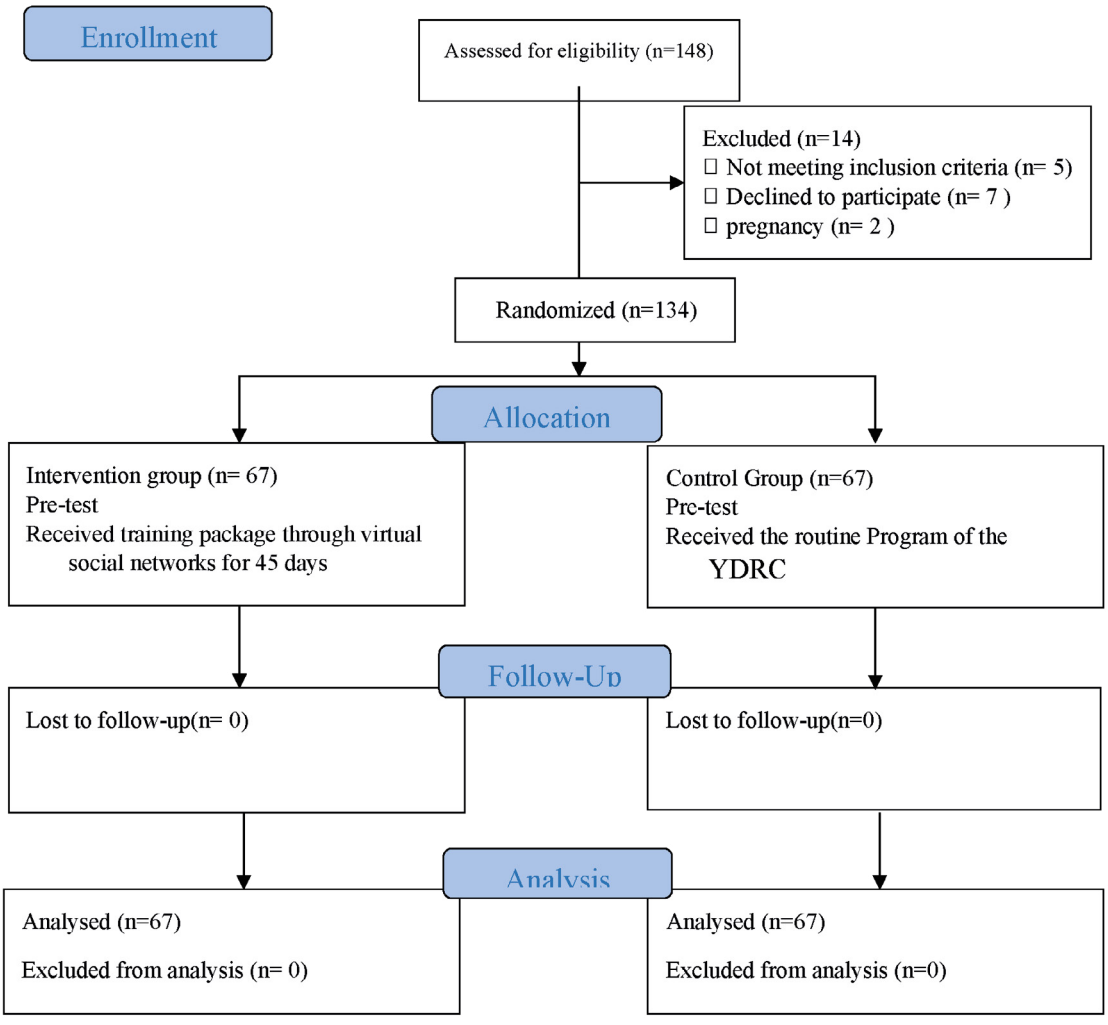
This was a randomized controlled trial with two groups (intervention and control) conducted in Yazd Diabetes Research Center (YDRS), in which the educational program through virtual networks was the intervention and the primary outcome measures included awareness of diabetes management and physical activity level while secondary outcome measure included HbA1c and lipid profile. Yazd Diabetes Research Center (YDRS) is one of the largest centers located in the central of Iran and services patients with diabetes from the southern region of the country [18-20]. The flowchart of the study is briefly shown in Figure 1.

### Participants

The study population was patients with type 2 diabetes, who referred to the YDRC. The inclusion criteria included: patients with Type 2 diabetes, of ages above 18, having reading and writing abilities, attending in the training-briefing classes before entering the study, having a smartphone, and being able to use the social networks such as "Telegram" or "Soroush" applications. The patients who did not intend to cooperate, those with incurable disease, and pregnant women were not entered the study.

Considering the confidence level of 0.95 and the mean of HbA1c in the patients with diabetes of referring to YDRC (report extracted from the center system) and predicting a 10% decrease in its amount, the required

**Fig. 1.** Consort Flowchart of the study.



sample size was estimated to be 60 people in each group. Due to the possibility of attrition in the participants, 67 people in each group were included in the study.
Totally 148 people were assessed for egilibity, based on the information recorded in the patients' files at the YDRC and a short phone call with them. From them, 134 people meet the inclusion criteria and were selected as study participants and were randomly allocated into two groups of intervention and control (67 each group). To prevent exchange of information between groups, the intervention started after complete measurements of the control group.

### Intervention

The educational program started after the intervention group selection and the first training-briefing session. Participants over 45 days and via Telegram or Soroush social networks. Furthermore, to increase participants' motivation, a number of inspirational messages were sent to them on Fridays and other national holidays. Moreover, participants were invited to attend the YDRC biweekly and met one of the research team carrying out process evaluation. There was also an opportunity for them to ask their questions about content of the training package.
The pre-test was administered after participants joined the relevant group Telegram or Soroush groups. The post-test was administered Six weeks after the end of the training period and posting the last message to the channel. Concerning the control group, all the relevant variables were assessed both before the study began and three months after it. The training content included texts, pictures, charts, and clips produced based on the standard curriculum of the International Diabetes Federation. In addition, some arrangements were made with YDRC specialists in endocrinology, nutrition, Iranian traditional medicine, and health education for the time and order of posting the relevant messages to increase their effectiveness.
The use of short texts, pictures, and clips which were optimized for internet use and which described diabetes and provided information about how to control the disease and avoid its harmful effect and also consideration of a fixed time for posting the relevant messages, *i.e.* 8:00 a.m. every day, led to patients' satisfaction and made them interested. Overall, 80 messages were sent over a period of 45 days, *i.e.* two messages per day, except for holidays.

### Data collection instruments

In this study, before (baseline) and after the intervention, the participants completed demographic information, awareness of diabetes and international physical activity questionnaires. In addition, lipid profile and HbA1c were also measured.
International Physical Activity Questionnaire (IPAQ) - short form, was used to measure physical activity level [21, 22]. This questionnaire consists of seven questions in four parts of intense, moderate, walking and sitting activities, which includes sports activities, work environment activities and resting activities. This questionnaire finally accounts the amount of energy used during activities based on activity intensity and metabolic equivalent coefficient. The validity and reliability of the Persian version of this questionnaire has been confirmed [23]. Diabetes awareness questionnaire whose validity and reliability was approved in the study by Niroomand et al. was used for measuring the participants knowledge level regarding diabetes [24].
This study followed all the ethical considerations and approved by ethical committee (IR.SSU.SPH.REC.1396.61) in Shahid Sadoughi University of medical Sciences in Yazd, IRAN.

### Data analysis

Descriptive statistics (mean ± standard deviation), the frequency (percentage) of quantitative and qualitative variables were calculated respectively. After checking the normality of the variables using Kolmogorov–Smirnov test, paired sample and independent T-test were used, for comparing the mean and the differences of the variables before (baseline) and after the intervention respectively when the data were normally distributed. Equivalent non-parametric tests were used when the data were not normally distributed. All analyzes were done in spss software version 21.

## Results

Most of the participants were between 50 to 70 years old, female, with elementary education level, married, and housewife as shown in Table I.
Since the samples were chosen randomly, the two groups were compared based on gender, marital status, education, and occupation and there was no significant difference between the two groups which shows the homogeneity of the groups.
The comparison of the average awareness score of the study participants in the two groups before and after the intervention showed that there was no significant difference between the two groups before the intervention, while after the intervention there was a significant difference between the two groups (Fig. 2). In addition, the comparison of the before and after the intervention difference in the two groups, also showed a statistically significant difference, which means that the educational intervention has a significant effect on the level of awareness of the participants in the intervention group (Tab. II).
Table III shows that the amount of HDL was more in the intervention group compared to the control groups after the intervention. The comparison of the difference in the averages shows that the increase was more in the control group (Fig. 2).
The comparison of the HbA1c means of the study participants in the two groups before and after the intervention showed that there was a significant difference between the two groups before the intervention and after the intervention. But the comparison of the before and after the intervention difference in the two groups, showed a statistically significant difference, which means that the educational intervention has a significant

**Tab. I.** The frequency and the characteristics of the patients in intervention and control groups.

| Variables | | Intervention group N (%) | Control group N (%) | p-value |
|---|---|---|---|---|
| Age | 18 to 50 | 16 (23) | 18 (27) | 0.61 |
| | 50 to 70 | 39 (58) | 41 (61) | |
| | Above 70 | 12 (18) | 8 (12) | |
| Gender | Male | 27 (40) | 38 (57) | 0.08 |
| | Female | 40 (60) | 29 (43) | |
| Education | Illiterate[a] | 9 (13) | 15 (22) | 0.25 |
| | Elementary | 40 (60) | 34 (51) | |
| | Diploma or Associate's degree | 14 (21) | 17 (25) | |
| | Bachelor's degree or more | 4 (5.5) | 1 (1.5) | |
| Occupation | Clerk | 16 (23.9) | 13 (19.4) | 0.07 |
| | Housewife | 38 (56.7) | 29(43.3) | |
| | Freelancer | 13 (19.4) | 25 (37.3) | |

[a] They were able to read and write.

**Tab. II.** The comparison of awareness of diabetes management means before (baseline) and after the intervention program in the intervention and control groups.

| Awareness of diabetes management | Before (baseline) | | After | | Difference | | p-value |
|---|---|---|---|---|---|---|---|
| | Median (IQR) | Mean ± SD | Median (IQR) | Mean ± SD | Median (IQR) | Mean ± SD | |
| Intervention group | 46 (11) | 45.31 ± 2.78 | 48(3) | 46.88 ± 2.25 | -2 (2) | -1.56 ± 1.32 | 0.000[a] |
| Control group | 45 (7) | 44.12 ± 3.85 | 45(6) | 44.41 ± 3.87 | 0 (1) | -0.26 ± 0.44 | 0.000 |
| P-value | 0.11[b] | | 0.000[b] | | 0.000[b] | | |

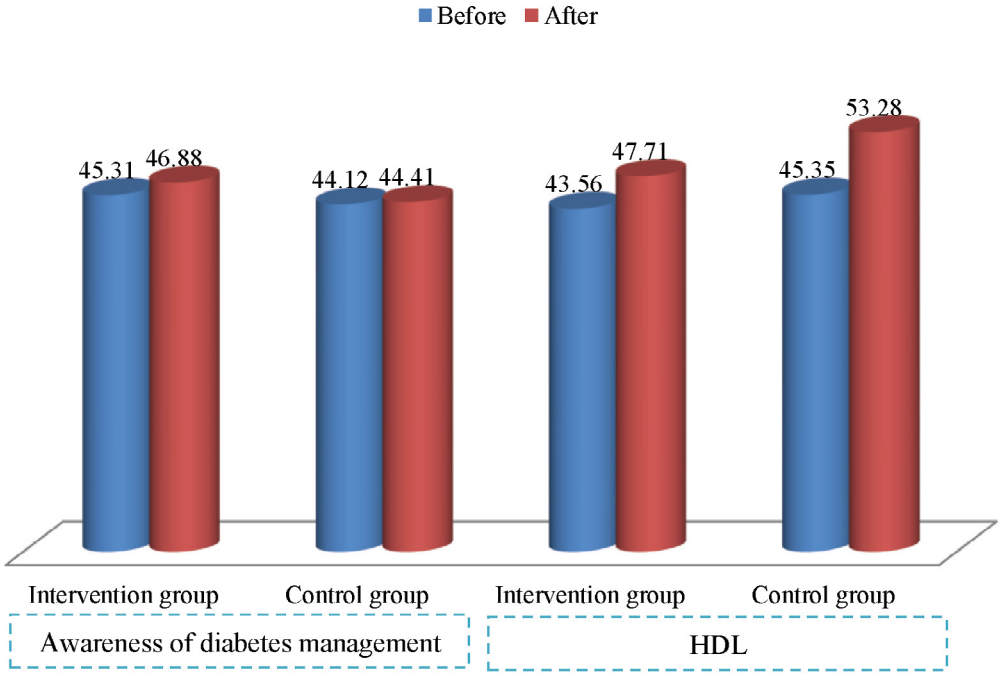
[a] Statistical significance of differences calculated using Wilcoxon test. [b] Statistical significance of differences calculated using Mann-Whitney test

**Tab. III.** The comparison of the HDL average before(baseline) and after the training intervention between the two groups.

| HDL | Before (baseline) | | After | | Difference | | p-value |
|---|---|---|---|---|---|---|---|
| | Median (IQR) | Mean ± SD | Median (IQR) | Mean ± SD | Median (IQR) | Mean ± SD | |
| Intervention group | 43 (12) | 43.56 ± 10.36 | 47 (12) | 47.71 ± 9.48 | -4 (2) | -4.14 ± 1.92 | 0.001[a] |
| Control group | 42 (14) | 45.35 ± 17.33 | 50 (14) | 53.28 ± 17.11 | -8 (5) | -7.92 ± 6.31 | 0.001[a] |
| P-value | 0.82[b] | | 0.04[b] | | 0.001[b] | | |

[a] Statistical significance of differences calculated using Wilcoxon test. [b] Statistical significance of differences calculated using Mann-Whitney test.

**Fig. 2.** The comparison of mean for awareness of diabetes management and HDL before (baseline) and after the intervention program in two groups.



**Tab. IV.** The comparison of the HbA1c means before (baseline) and after the training treatment in the intervention and control groups.

| $HbA_{1c}$ | Before (baseline) | | After | | Difference | | p-value |
|---|---|---|---|---|---|---|---|
| | Median (IQR) | Mean ± SD | Median (IQR) | Mean ± SD | Median (IQR) | Mean ± SD | |
| Intervention group | 7.70 (2.60) | 8.19 ± 2.10 | 7.50 (2.10) | 8.05 ± 1.96 | 0.20 (0.20) | 0.14 ± 0.21 | 0.001[a] |
| Control group | 7 (1.70) | 7.53 ± 1.67 | 7 (1.40) | 7.45 ± 1.34 | 0.0 (0.60) | 0.08 ± 0.48 | 0.410[a] |
| P- value | 0.03[b] | | 0.06[b] | | 0.04[b] | | |

[a] Statistical significance of differences calculated using Wilcoxon test. [b] Statistical significance of differences calculated using Mann-Whitney test.

**Tab. V.** The comparison of the score of the physical activity before (baseline) and after the intervention in the two groups.

| IPAQ | Before (baseline) | | After | | Difference | | p-value |
|---|---|---|---|---|---|---|---|
| | Median (IQR) | Mean ± SD | Median (IQR) | Mean ± SD | Median (IQR) | Mean ± SD | |
| Intervention group | 24 (10) | 23.64 ± 8.46 | 32 (8) | 31.68 ± 7.12 | 8 (7) | 8.04 ± 6.33 | 0.000[a] |
| Control group | 24 (15) | 26.20 ± 9.39 | 28 (12) | 30.20 ± 8.11 | 4 (4) | 4 ± 3.59 | 0.000[a] |
| P-value | 0.08[b] | | 0.20[b] | | 0.000[b] | | |

[a] Statistical significance of differences calculated using Wilcoxon test. [b] Statistical significance of differences calculated using Mann-Whitney test

**Tab. VI.** The comparison of the LDL average before (baseline) and after the training between intervention and control groups.

| LDL | Before (baseline) | | After | | Difference | | p-value |
|---|---|---|---|---|---|---|---|
| | Median (IQR) | Mean ± SD | Median (IQR) | Mean ± SD | Median (IQR) | Mean ± SD | |
| Intervention group | 80 (41) | 85 ± 30.12 | 76 (37) | 81.10 ± 29 | 4 (2) | 4.17 ± 2.10 | 0.000[a] |
| Control group | 81 (49) | 86 ± 36.83 | 70 (49) | 79 ± 34.82 | 6 (5) | 7.04 ± 6.43 | 0.000[a] |
| P value | 0.82[b] | | 0.28[b] | | 0.000[b] | | |

[a] Statistical significance of differences calculated using Wilcoxon test. [b] Statistical significance of differences calculated using Mann-Whitney test.

effect on HbA1c of the participants in the intervention group (Tab. IV).

Table V shows that the amount of physical activity (IPAQ) was higher in the intervention group than in the control group after the training and this difference was statistically significant. The comparison of the mean difference indicates that there was an increase in the intervention group and the participants of this group increased their daily activities during the training period and this increase is significant (Fig. 3).

Table VI indicates that the amount of LDL was more in the intervention group than in the control group after the training and this difference is significant. The comparison of the difference between the average of the groups shows that the difference was more in the control group. During the training period, the average difference between the two groups is an indication of the effect of the training (Fig. 3).

## Discussion

This study aimed to evaluate the effect of training through two popular social networks in Iran ("Telegram" and "Soroush") and the metabolic control of people with Type 2 diabetes.

The results of the study showed the positive effect of the intervention based on virtual social networks on the level of awareness of the participants in the intervention program. Several studies have shown the effectiveness of such interventions on the level of awareness of patients [25-27]. Patients' satisfaction with the process of receiving information through virtual social networks has increased their interest and, as a result, increased awareness.

The results revealed that the level of HbA1c has decreased significantly in the intervention group after the training through the social network. This is consistent with the studies done by Shaya et al. in Baltimore which was on the study of the effect of training of the patients with Type 2 diabetes through the social network [15]. The results also were consistent with what was reported by Sadeghian et al. on the significant effect of Type 2 diabetes patients' self-care on the decrease of the HbA1c [7]. Similarly, the results are in line with the studies of Heisler et al. which led to the decrease of the HbA1c level [14].

Another important variable that was investigated in this study was the rate of physical activity of the participants. According to the present study, the amount of physical activity increased significantly in the intervention group after the training. This is in line with a similar study done by Amini et al. in which they concluded that electronic and long-distance training can affect the body mass index and the rate of physical activity and can lead to the increase of physical activity [16].

The other variable which was scrutinized in this study was the comparison of the amount of blood LDL before and after the training in the two groups, According to the present study, the amount of LDL, decreased in the intervention group after the training and this decrease is significant and the result of the virtual training. This also is in line with the study done by Rezaei et al. in Aligoudarz which indicated that virtual training could have a positive effect on reducing LDL [28]. Besides, the studies of Goodarzi et al. aligns this study and confirms that the long-distance training can lead to a decrease in the LDL [29].

The amount of blood's HDL was also measured in the

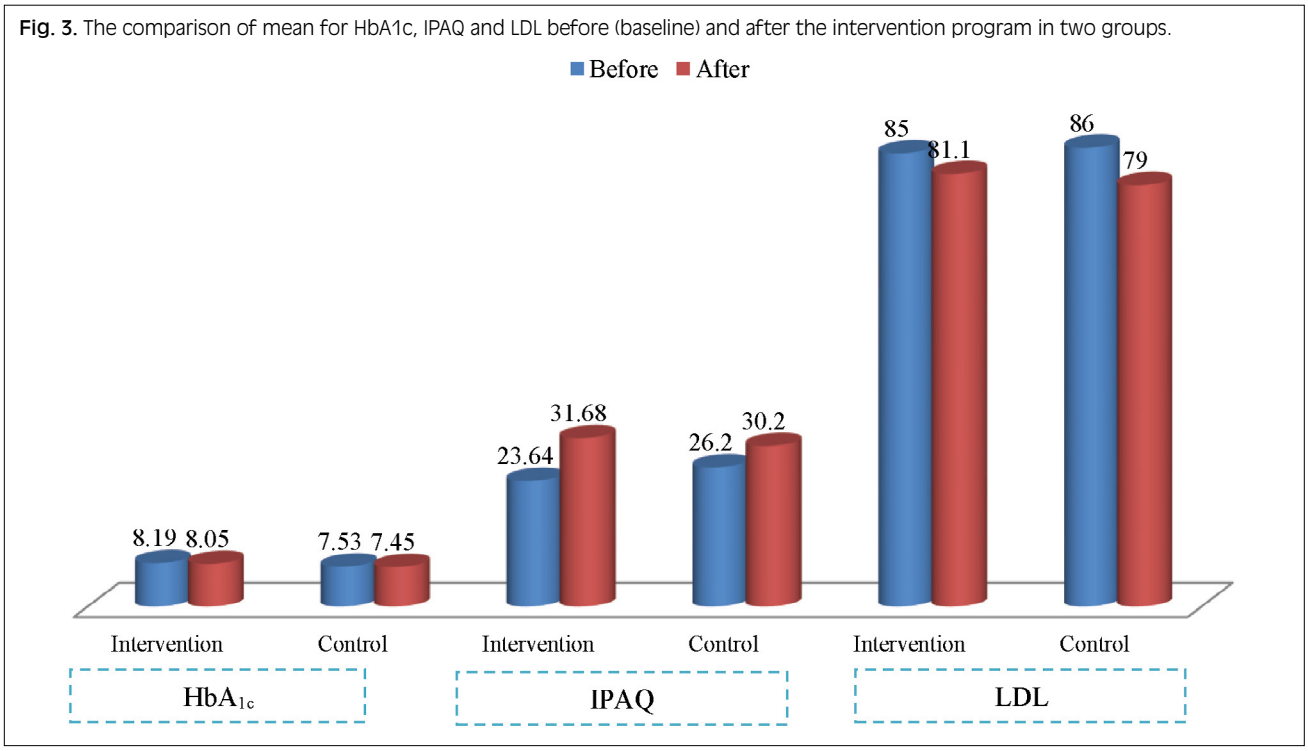



**Fig. 3.** The comparison of mean for HbA1c, IPAQ and LDL before (baseline) and after the intervention program in two groups.

two groups before and after the intervention. According to the results, the amount of the HDL increased significantly in the intervention group after the training which proves the effectiveness of the virtual training on increasing the HDL level. This is in line with the study of Wolf et al. which was done on 62 patients by a web-based intervention. The result of the web-based training showed that long-distance training could increase the blood HDL level [30].

According to the study of Abbasi-Shavazi et al., information support is one of the most important aspects of social support in a virtual supporting community for MS patients. According to these researchers, access to supporting information is one of the main reasons the patients join these communities. They assert that the patient cooperation in the virtual supporting communities can empower the patients to have an effective confrontation to the different challenges they may face and the virtual supporting communities which are related to the illness can be a supplementary source of social support for the patients with chronic diseases [31]. One of the main limitations of the present study was sample size. It may not be perfectly representative of other patients in Iran. Therefore, our results should be applied to other populations with caution.

## Conclusions

Changes in lifestyle and challenges of the patients' attendance in diabetes training sessions, declared that use of social networks can be useful to train diabetes patients remotely, and it is feasible to send training messages to help them improve their diabetes care. Social networks could be used as a modern and useful tool for the training of people with diabetes. The results confirm that the patients have more tendency toward long-distance training through social networks than traditional and face to face training. They also use more interesting training information. Moreover, the use of social networks, particularly "Telegram" and "Soroush" applications is effective in increasing the patients' participation in improving the health level, controlling and managing the illness, and the patients' quality of life.

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## Ethics approval and consent to participate

The collection and analysis of this data was approved by the University of Shahid Sadoughi University of Medical Sciences (approval no. IRSSU.SPH.REC.1396.61).

## Consent for publication

The written informed consent to the publication of this article was obtained from the patient.

## Availability of supporting data

Not applicable.

## Conflict of interest statement

The authors declare that they have no conflict of interest.

## Authors' contributions

Study design and statistical analysis and interpretation of the data: HAS and AD Drafting of the manuscript: MKS and FF critical revision of the manuscript for important intellectual content: HAS and FF. All the authors have read and approved the final manuscript.

### References


[1] Haghdoost A, Rezazadeh Kermani M, Sadghirad B, Baradaran H. Prevalence of type 2 diabetes in the Islamic Republic of Iran: systematic review and meta-analysis. East Mediterr Health J 2009;15: 591-9.

[2] Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care 2004;27:1047-53. https://doi.org/10.2337/diacare.27.5.1047

[3] Fatehi F, Gray LC, Russell AW. Mobile Health (mHealth) for diabetes care: opportunities and challenges. Diabetes Technol Ther 2017;19:1-3. https://doi.org/10.1089/dia.2016.0430

[4] Katibeh M, Kalantarion M, Mariotti SP, Safi S, Shahraz S, Kallestrup P, Rahmani S, Mohammadi S-F, et al. A stakeholder perspective on diabetes mellitus and diabetic retinopathy care in Iran; a qualitative study. Arch Iran Med 2017;20:288-94.

[5] Sardari M, Pazokian M. Relationship between type 2 diabetes and depression: a systematic review. Int J Med Rev 2017;3:423-8.

[6] Organization WH. Management of diabetes mellitus: standards of care and clinical practice guidelines. World Health Organization, Regional Office for the Eastern Mediterranean 1994.

[7] Sadeghian HA, Madhu SV, Agrawal K, Kannan AT, Agrawal K. Effects of a self-management educational program on metabolic control in type 2 diabetes. Turk J Med Sci 2016;46:719-26. https://doi.org/10.3906/sag-1501-115

[8] Kitsiou S, Paré G, Jaana M, Gerber B. Effectiveness of mHealth interventions for patients with diabetes: an overview of systematic reviews. PLoS One 2017;12:e0173160. https://doi.org/10.1371/journal.pone.0173160

[9] Shrivastava SR, Shrivastava PS, Ramasamy J. Role of self-care in management of diabetes mellitus. J Diabetes Metab Disord 2013;12:14. https://doi.org/10.1186/2251-6581-12-14

[10] Obile W. Ericsson mobility report, On the pulse of the networked society. Mobility World, Congress Edition, February 2016.

[11] Rezaei M, Shobeiri SM. The effect of social networks usage on the promotion of pro-environmental behavior in Tourism (Case Study: Telegram Social Network). Journal of Tourism Planning and Development 2017;6:28-53. https://doi.org/10.22080/JTPD.2017.1527

[12] Welch G, Garb J, Zagarins S, Lendel I, Gabbay RA. Nurse diabetes case management interventions and blood glucose control: results of a meta-analysis. Diabetes Res Clin Pract 2010;88:1-6. https://doi.org/10.1016/j.diabres.2009.12.026

[13] Salehmoghaddam AR, Khosravi Bonjar A, Karimi Moonaghi H, Gholami H. An investigation of the effect of e-learning education method on dietary regimen in type 2 diabetic patients. Evid Based Care J 2013;3:51-8. https://doi.org/10.22038/EBCJ.2013.1798

[14] Heisler M, Smith DM, Hayward RA, Krein SL, Kerr EA. How well do patients' assessments of their diabetes self-management correlate with actual glycemic control and receipt of recommended diabetes services? Diabetes Care 2003;26:738-43. https://doi.org/10.2337/diacare.26.3.738

[15] Shaya FT, Chirikov VV, Howard D, Foster C, Costas J, Snitker S, Frimpter J, Kucharski K. Effect of social networks intervention in type 2 diabetes: a partial randomised study. J Epidemiol Community Health 2014;68:326-32. https://doi.org/10.1136/jech-2013-203274

[16] Amini N, Shojaeezadeh D, Saffari M. The study of the effect of e-education on physical activity and body mass index of female employees. sjsph 2014;11:95-106.

[17] Davies MJ, Heller S, Skinner TC, Campbell MJ, Carey ME, Cradock S, Dallosso HM, Daly H, Doherty Y, Eaton S, Fox C, Oliver L, Rantell K, Rayman G, Khunti K; Diabetes Education and Self Management for Ongoing and Newly Diagnosed Collaborative. Effectiveness of the diabetes education and self management for ongoing and newly diagnosed (DESMOND) programme for people with newly diagnosed type 2 diabetes: cluster randomised controlled trial. BMJ 2008;336:491-5. https://doi.org/10.1136/bmj.39474.922025.BE

[18] Zare F, Ameri H, Madadizadeh F, Reza Aghaei M. Health-related quality of life and its associated factors in patients with type 2 diabetes mellitus. SAGE Open Med 2020;8:2050312120965314. https://doi.org/10.1177/2050312120965314

[19] Zare F, Ameri H, Madadizadeh F, Aghaei MR. Validity and reliability of the EQ-5D-3L (a generic preference-based instrument used for calculating quality-adjusted life -years) for patients with type 2 diabetes in Iran. Diabetes Metab Syndr 2021;15:319-24. https://doi.org/10.1016/j.dsx.2021.01.009

[20] Arab-Zozani M, Safari H, Dori Z, Afshari S, Ameri H, Namiranian N, Hoseini E, Jafari A. Estimating Utility Values for Health States of DFU Patients Using EQ-5D-5L and cTTO. Int J Low Extrem Wounds 2022;21:41-9. https://doi.org/10.1177/15347346211014392

[21] Wendel-Vos GC, Schuit AJ, Saris WH, Kromhout D. Reproducibility and relative validity of the short questionnaire to assess health-enhancing physical activity. J Clin Epidemiol 2003;56:1163-9. https://doi.org/10.1016/s0895-4356(03)00220-8

[22] Hagströmer M, Oja P, Sjöström M. The International Physical Activity Questionnaire (IPAQ): a study of concurrent and construct validity. Public Health Nutr 2006;9:755-62. https://doi.org/10.1079/phn2005898

[23] Seyed-Emami R, Eftekhar Ardebili H, Golestan B. Effect of a health education intervention on physical activity knowledge, attitude and behavior in health volunteers. Hayat 2016;16:48-55.

[24] Niroomand M, Ghasemi SN, Karimi-Sari H, Kazempour-Ardebili S, Amiri P, Khosravi MH. Diabetes knowledge, attitude and practice (KAP) study among Iranian in-patients with type-2 diabetes: a cross-sectional study. Diabetes Metab Syndr 2016;10(1 Suppl 1):S114-9. https://doi.org/10.1016/j.dsx.2015.10.006

[25] Eslami K, Kouti L, Noori A. Different methods of medical sciences virtual education in Iran and assessment of their efficacy; a review article. Educational Development of Judishapur. 2016;7:128-37.

[26] Kebede MM, Pischke CR. Popular diabetes apps and the impact of diabetes app use on self-care behaviour: a survey among the digital community of persons with diabetes on social media. Front Endocrinol (Lausanne) 2019;10:135. https://doi.org/10.3389/fendo.2019.00135

[27] Rasoul AM, Jalali R, Abdi A, Salari N, Rahimi M, Mohammadi M. The effect of self-management education through weblogs on the quality of life of diabetic patients. BMC Med Inform Decis Mak 2019;19:1-12. https://doi.org/10.1186/s12911-019-0941-6

[28] Rezaei N, Tahbaz F, Kimiagar M, Alavi Majd H. Effect of nutrition education on knowledge, attitude and practice of type 1 diabetic patients from Aligoodarz. J Shahrekord Univ Med Sci 2006;8:52-9.

[29] Goodarzi M, Ebrahimzadeh I. Impact of Distance Education via short message service of Mobile Phone on metabolic control of Patients with Type 2 Diabetes Mellitus in Karaj-Iran. Horizon Med Sci 2014;19:224-34.

[30] Bond GE, Burr R, Wolf FM, Price M, McCurry SM, Teri L. The effects of a web-based intervention on the physical outcomes associated with diabetes among adults age 60 and older: a randomized trial. Diabetes Technol Ther 2007;9:52-9. https://doi.org/10.1089/dia.2006.0057

[31] Shavazi MA, Morowatisharifabad MA, Shavazi MTA, Mirzaei M, Ardekani AM. Online social support for patients with multiple sclerosis: a thematic analysis of messages posted to a virtual support community. Int J Community Based Nurs Midwifery 2016;4(3):188.

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History of medicine and ethics

# The history of pertussis: from an ancient scourge to a contemporary health burden

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Keywords

History of infectious diseases • History of medicine • Immunisation • Pertussis • Palaeopathology • Vaccination • Whooping cough

Summary

*The present article offers a historical overview on pertussis (whooping cough) by analysing the ancient epidemic manifestations of the disease and the path towards the discovery of an effective vaccine against it. The original mentions of pertussis are examined with reference to Mediaeval Afghanistan and the famous AD 1578 Paris epidemic described by the French physician Guillaume de Baillou. The historical data are then matched with information derived from analyses of phylogenetic trees of B. pertussis. Finally, this article also highlights some recent challenges posed to public health by this infectious disease.*

## Introduction: cough from a physiological reflex to an excessive pathological manifestation

Coughing is one of the most common acts in everyday life. Sometimes it is a matter of little fits, other times of somewhat more bursting accesses, the latter being of interest for clinical medicine and research. Cough involves a highly complex reflex arc, that is an automatic response of the nervous system to a stimulus, namely the stimulation of peripheral sensory fibers that act as cough receptors. This reflex allows for the clearance of the respiratory airways from an obstruction that makes breathing difficult, such as when a food bolus does not enter, as it should, the oesophagus, or in the presence of irritants or excess mucus. This physiologic response, characterised by a coordinated mechanism of vigorous inhalation followed by sudden exhalation with closure of the glottis, *i.e.* the space between the vocal cords and the larynx, and elevation of the soft palate, is mostly an involuntary phenomenon, but it can also be intentional. Moreover, conspicuous differences have been noted between the male and female sexes in the cough reflex [1-3].

With reference to paediatric medicine, the cough reflex is, therefore, a very useful neural pathway for humans in that it is capable of saving children's lives by enabling them to expel foreign bodies that their tender age and unconsciousness have not restrained them from swallowing, almost as a primary cognitive experience and exploration of the world they are beginning to discover, and thus not to suffocate. Like all physiological phenomena of the human organism, however, even a natural response can, if excessive or otherwise very vigorous, prove harassing. This represents the focus of the pathophysiological studies on the role and mechanisms of coughing in clinical conditions such as infectious diseases, both acute and chronic in their presentation. Indeed, a decidedly exuberant form of cough is that which occurs in pertussis (from the Latin *per-tussis*, per = much, excessive + tussis = cough), also known in English as "whooping cough", which is an infectious disease that mainly affects children from a few months of age to six years of age (without sparing adolescents and adults), extremely contagious and with a marked epidemic nature, caused by the Gram-negative aerobic coccobacillus *Bordetella pertussis*.

This pathogen produces toxins capable of altering the function of the cilia of the superficial layer of the respiratory tract. These are long, thin organelles that by their movement propel mucus from the lungs to the mouth, also removing bacteria. Once the mechanism is compromised, bacteria are free to reach lung tissue. The disease usually begins as a common cold and with other entirely nonspecific symptoms and low fever, which would by no means suggest a particularly noxious condition, and then alternates with a phase of great catarrh production what in clinical jargon is called the paroxysmal stage, that is, the characteristic phase of the disease, the moment when a series of repetitive coughs are experienced and are followed by an inspiratory whoop. In the most severe cases there can be severe bronchopneumonia, haemorrhage, with obvious neurological damage in the event that the coughing acts lead to a protracted interruption of breathing and poor oxygen supply to the brain (hypoxia). If one is lucky enough to survive the disease, immunity is obtained, but it does not last forever, and the risk of reinfection cannot be ruled out. There appears to be today a trend of trivialisation of the danger posed by a disease such as

whooping cough, superficially arguing that it is a low-risk disease or that we have antibiotics with which to treat it anyway, so vaccinations would be useless (or even risky according to well-noted antivaccination campaigns). Nothing could be falser than such an assumption. First of all, pertussis is an extremely dangerous disease with a high lethality rate with World Health Organization (WHO) statistics clearly indicating that in 2008 there were 195,000 deaths of children worldwide, particularly in developing countries [7]. Secondly, as for all infectious vaccine-preventable diseases, that is, when it is possible to prevent upstream the onset of a disease, it is simply unreasonable to allow it to occur and decide to intervene only when observable symptoms and lesions are present. Indeed, the golden rule of medicine should be prevention [8].

## The palaeopathology of pertussis

Reconstructing the history and evolution of pertussis is by no means simple, since its origins seem to be lost in the mists of time. Highly refined molecular studies that followed the sequencing of the complete genome of it aetiologic agent, *B. pertussis*, in 2003 suggested the possibility that the bacterium is truly very ancient, dating back as far as about 2.5 million years ago, thus it may have closely accompanied the journey of the human species from its dawn. Subsequent research aimed at reconstructing the overall phylogenetic tree of the bacterium has shown how its two branches derived their origin from a common ancestor about 2,000 years ago. It is very interesting to note that one of those branches, which collects in itself 98% of all strains of the bacterium, have made its way very rapidly within the human population only in the last five hundred years of our history. This seems to support the available historical evidence [9].

As a matter of fact, although in his *Naturalis Historia* Pliny the Elder (AD 23-79) mentions a pernicious cough (*Perniciosa tussis*) that has led some medical historians, especially Penso, to think of pertussis, there is, however, no firm evidence of the existence of the disease in the ancient world [10].

Equally deficient, especially in terms of the epidemiology and symptoms of the disease described, is the evidence for two more recent epidemics, a late mediaeval one in Paris in 1414 and one in the Early Modern Age in London in 1540, while some possible allusions to pertussis have been identified in the literatures of 14th-century Korea and early 16th-century India [9].

The first ascertained epidemic of pertussis undoubtedly occurred in Europe, in Paris, in the late summer of 1578. Accurately describing it was Guillaume de Baillou (1538-1616, Fig. 1), in his work *Epidemia et Ephemerides*, first published only posthumously in 1635 [11].

The brilliant Parisian physician noted how he was unaware of any such pathological cases in the medical literature available at the time and renamed it quinta or quintana. This much peculiar name seems to derive alternately either from the characteristic noise emitted during the coughing act (thus it would represent an onomatopoeia, a word that traces a sound or noise) or from the fact that the paroxysms of the cough recurred with maximum intensity at four – or five-hour intervals. De Baillou also made the important epidemiological observation that the disease preferentially affected children between 4 and 10 years of age, but also those of frailer constitution, only a few months old [11, 12]. The picture of the disease given by the French doctor proves as vivid as it is terrifying and leaves no room for imagination:

> *Huius gravia sunt symptomata. Pulmo ita irritatur, ut omni contentione nitens excutere id quod molestum est, nec admittat spiritum, nec vicissim facile reddat. Intumescere videtur, et quasi strangulabundus aeger mediis faucibus haerentes spiritus habet* [12].

Its [*i.e.*, the disease's] symptoms are severe. The lung is so irritated that, at every attempt to expel the cause of his distress, he can neither inhale nor exhale. The sufferer seems to swell up and, as if about to strangle himself, holds his breath (translation by the authors).

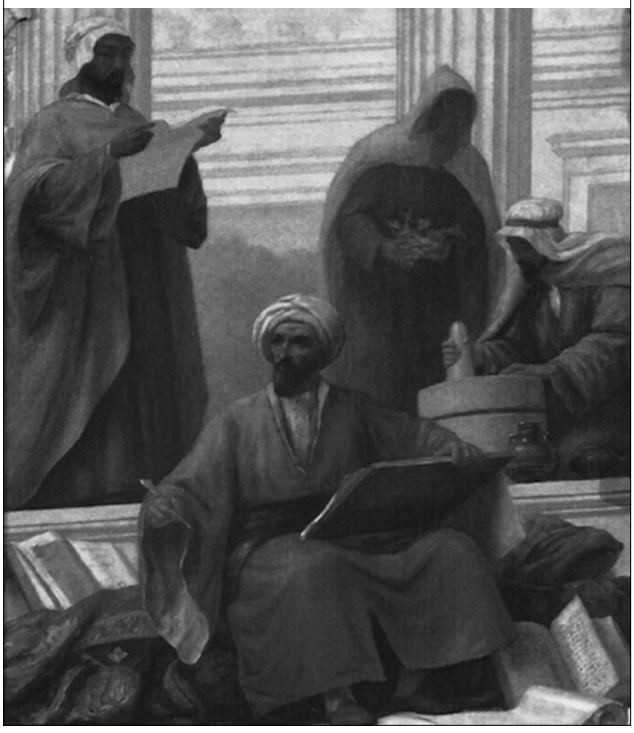
Despite these brilliant epidemiological and symptomatological observations, de Baillou was unable

**Fig. 1.** Guillaume de Baillou. Image in the public domain from: http://psychiatrie.histoire.free.fr/pers/bio/baillou.htm.

to understand the mechanism by which the disease manifested itself, nor, more importantly, its cause. He can hardly be blamed for this: just as in the case of another keen observer of pathological phenomena, this time a Mediaeval one, Giovanni Boccaccio (1313-1375), who, short of an accurate clinical description of the plague that ravaged Florence in 1348, was forced to pause helplessly before the mystery of nature, at that time still an absolute ruler over the human condition [13]. The pathophysiological interpretations of the time were, in fact, still strongly influenced by the humoral doctrines of the classical Hippocratic-Galenic school, and the new medical science, based on anatomo-clinical correlations and the Galilean scientific method, had yet to see the light of day. What is more, germ theory, with its leading proponents Koch and Pasteur, would have to wait until the second half of the 19th century, a little over 150 years ago in good measure, to establish itself, supplanting outdated schemes and erroneous reasoning. In light of this backwardness of the medical art, it is hardly surprising that de Baillou thought that the origin of this explosive cough should be sought in the matter of the lung itself and interpreted through the lens of humoural pathology.

For a long time, de Baillou's description was considered the first historical account of a pertussis epidemic. Nonetheless, the recent historical-medical review of Persian medical literature has, however, shown that prior to the Paris epidemic of 1578, more epidemics occurred with all the clinical features of whooping cough. The author of these reports is the Persian physician Mohammad Hussain Nurbakhshi, otherwise known as Bahā'al-Dawlah Razi (1455-1509, Fig. 2), who summarised them in his work Summary of Medical Experiences (finished in 1501) [14].

Fig. 2. Bahā'al-Dawlah Razi, original image from: https://www.mizajresearch.com/history-of-medicine/baha-al-dawlah-razi/.



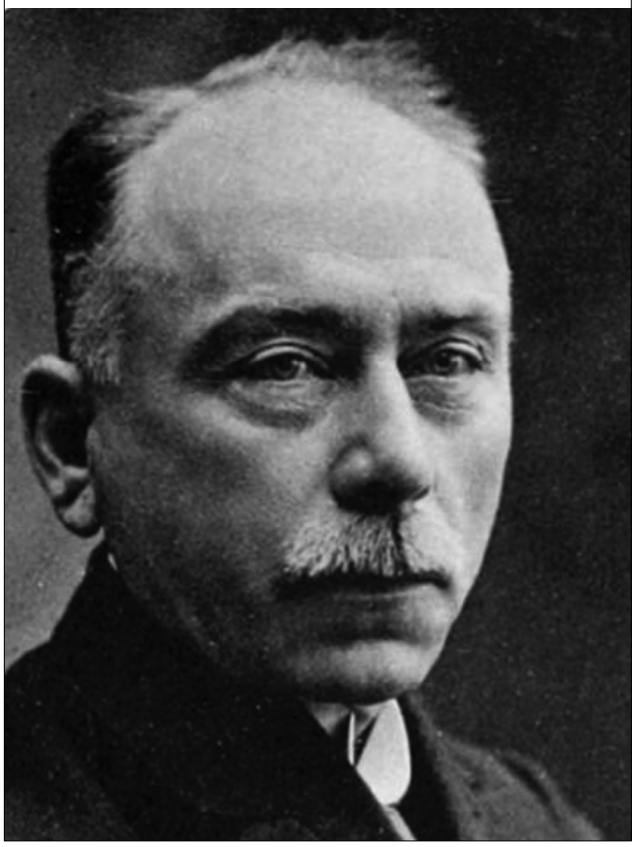
At an unspecified date, but almost certainly between 1484 and 1495, two violent epidemics occurred in Herat, in modern-day Afghanistan, spaced a few months apart. In addition to the typical symptoms of whooping cough, a very interesting fact to consider is that both infants and adults fell ill during the first epidemic [15]. This allows us to understand that at the time of the first epidemic the population could not have developed any immunity, having not come into contact with the pathogen. During the second epidemic, another equally interesting aspect occurred: far fewer people died. Razi attributed the cause of this reduction in the lethality of the disease to the use of ginger as a therapy, however, our modern knowledge firmly allows us to look at this phenomenon in terms of the development of an immune response. It is, therefore, not difficult to understand that it was mainly the infants, who lacked immunity, who suffered in this second epidemic wave [15].

Five hundred years after the Herat epidemics, the principle remains most valid. Giving an infant as soon as possible the opportunity to develop the antibodies necessary to defend against whooping cough is a duty and a responsibility to the overall health of our home communities. While the dates of the Herat epidemics are uncertain, unquestioned is the date of a third major epidemic, that occurred in Rey (in the heart of Iran, not far from Tehran), dating back to 1501. Razi himself provides a further accurate description of the symptomatology of whooping cough and, for the first time in the history of medicine and about a century before de Baillou, understands how the main route of contagion was by air. As lucidly noted by Aslanabadi and colleagues in their study [15], Herat and Rey are roughly 1,000 km apart and were both located along the Silk Road, the route along which trade and cultural exchange between East and West took place. Although definitive evidence is lacking and historical research is still thoroughly investigating these aspects, it is reasonable to think that the descriptions by Razi, chronologically compatible with recent genetic data, testify to the pathogen's transition from a nonepidemic to an epidemic phase. Moreover, the communication routes between East and West allow us to assume that pertussis reached Europe, with its previously mentioned first epidemic manifestation in France, precisely from Asia. One should never make the mistake of thinking that it is only armies, trade goods, fleets and ideas that move from one world to another. Pathogens are, indeed, seasoned travellers.

## From the past to the future: the return of pertussis

While the origins of pertussis remain, as described above, uncertain, there is absolutely no question that the disease took to reaping victims at an ever-increasing rate.

Fig. 3. The Belgian microbiologist Jules Bordet. From Wikimedia Commons, https://en.wikipedia.org/wiki/Jules_Bordet#/media/File:Jules_Bordet_signed.jpg.



Suffice it to consider that still between 1926 and 1930 as many as 33,013 deaths were recorded in the United States of America. The time for a breakthrough was, however, ripe. In 1906 Jules Bordet (1870-1961, Fig. 3) and Octave Gengou (1875-1957, Fig. 4) identified the pathogen, which ended up being named after the former of the two (*Bordetella pertussis*) [16].

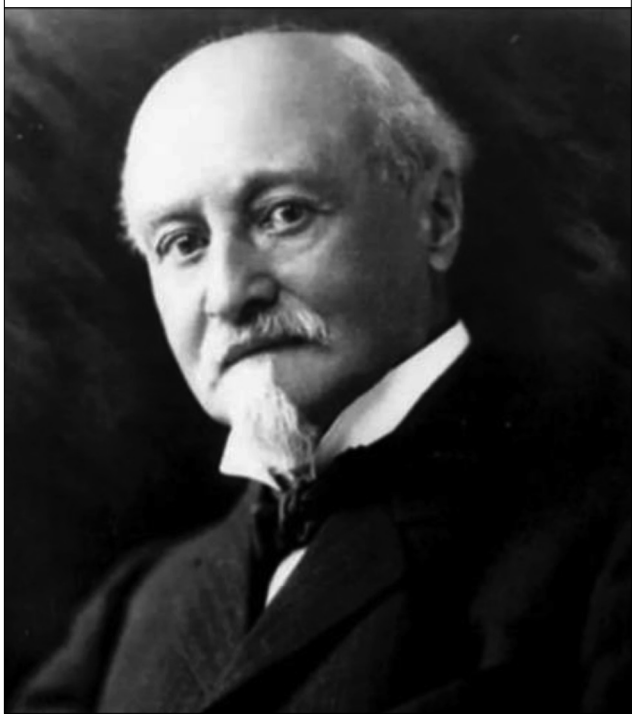
The same researchers are credited with initiating the description of the bacterium's toxins. Then, in the 1930s, whole-cell vaccines were developed in the United States, the large-scale use of which enabled a 157-fold reduction in the incidence of pertussis by 1970 [16]. This was a very hard blow dealt by science to this dangerous enemy of health, especially of children, ready to be "driven back" into the pre-vaccine world from which it had come. In the following years, to solve the problem of adverse reactions observed with the whole-cell vaccine, a new type of vaccine was developed, known as acellular, that is, containing purified components of *B. pertussis*, for example, inactivated toxins of the bacterium. The use of these pertussis vaccinations has resulted in a huge reduction in pertussis mortality, so much so that the WHO estimates that in 2008 the use of vaccinations prevented about 687,000 deaths [17]. Additionally, vaccination in pregnant women also proved effective in preventive pertussis in newborns, especially when performed during the second or early third trimester of pregnancy [18].

Such great achievements, however, should not make science relax. The eradication of the pathogen is a very difficult goal to achieve, not only because of the stubbornness of those who persist in refusing vaccination, but also because of the mutations that occur over time in the genetic makeup of the bacterium. Numerous authors have spoken, causing some alarm, of a "return of pertussis" in recent years. Others, such as J.D. Cherry, however, urge against catastrophic tones [9, 19]. What is certain is that new cases of whooping cough are continually being recorded; in particular, a recent Italian study highlighted the increase in prevalence in Apulia [20]. Finally, recent research highlights how receipt of pertussis vaccine grants short-term protection against pertussis but this status wanes quite rapidly with the acellular pertussis vaccine [21].

## Conclusions

To this date the antiquity of pertussis can be confidently estimated to be of around 500 years based on historical sources and phylogenetic trees. Much older strains of the bacterium and potential epidemics cannot be confirmed only based on literary sources and only new biomolecular analyses on ancient human remains could add more light on that. *Bordella pertussis* remains an insidious pathogen still claiming thousands of victims, while administration of vaccines and long-term efficacy of certain vaccine types remain a key question for public health.

Fig. 4. The Belgian microbiologist Octave Gengou. From https://alchetron.com/Octave-Gengou.



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## Conflict of interest statement

The authors declare no conflict of interest.

## Authors' contributions

FMG: designed the study; FMG conceived the study; FMG drafted the manuscript; EV and MM critically revised the manuscript; FMG, EV and MM performed a search of the literature; furthermore: EV, FMG, MM: methodology; EV and MM: validation and data curation; FMG, EV, MM: formal analysis; EV, MM: final editing; MM: supervision. All authors critically revised the manuscript. All authors have read and approved the latest version of the paper for publication.

### References

[1] Chang AB, Widdicombe JG. Cough throughout life: children, adults and the senile. Pulm Pharmacol Ther 2007;20:371-82. https://doi.org/10.1016/j.pupt.2006.10.004

[2] Plevkova J, Buday T, Kavalcikova-Bogdanova N, Ioan I, Demoulin-Alexikova S. Sex differences in cough reflex. Respir Physiol Neurobiol 2017;245:122-29. https://doi.org/10.1016/j.resp.2016.12.001

[3] Hennel M, Brozmanova M, Kollarik M. Cough reflex sensitization from esophagus and nose. Pulm Pharmacol Ther 2015;35:117-21. https://doi.org/10.1016/j.pupt.2015.10.007

[4] Kilgore PE, Salim AM, Zervos MJ, Schmitt HJ. Pertussis: Microbiology, Disease, Treatment, and Prevention. Clin Microbiol Rev 2016;29:449-86. https://doi.org/10.1128/CMR.00083-15

[5] Gabutti G, Azzari C, Bonanni P, Prato R, Tozzi AE, Zanetti A, Zuccotti G. Pertussis. Hum Vaccin Immunother 2015;11:108-17. https://doi.org/10.4161/hv.34364

[6] Gabutti G, Rota MC. Pertussis: a review of disease epidemiology worldwide and in Italy. Int J Environ Res Public Health 2012;9:4626-38. https://doi.org/10.3390/ijerph9124626

[7] Brosio F, Kuhdari P, Cocchio S, Stefanati A, Baldo V, Gabutti G. Impact of Pertussis on the Italian population: analysis of hospital discharge records in the period 2001-2014. Int J Infect Dis 2020;91:143-8. https://doi.org/10.1016/j.ijid.2019.10.027

[8] Orsini D, Bianucci R, Galassi FM, Lippi D, Martini M. Vaccine hesitancy, misinformation in the era of COVID-19: lessons from the past. Ethics Med Public Health 2022;24:100812. https://doi.org/10.1016/j.jemep.2022.100812

[9] Cherry JD, The history of pertussis (whooping cough); 1906–2015: facts, myths, and misconceptions. Curr Epidemiol Rep 2015;2:120-30. https://doi.org/10.1007/s40471-015-0041-9

[10] Penso G. La Medicina Romana. Noceto: Essebiemme 1985, p. 318.

[11] Ruhräh J. Guillaume de Baillou (Ballonius) 1538-1616. Am J Dis Child 1928;36:1263-65. https://doi.org/10.1001/archpedi.1928.01920300172017

[12] de Baillou G. Opera omnia medica. Venetiis: Apud Angelum Jeremiam 1774, pp. 155-56.

[13] Galassi FM, Toscano F, Armocida E, Spani G, Papio M, Rühli FJ. Giovanni Boccaccio's (1313-1375) disease and demise: the final untold tale of liver and heart failure. Homo 2017;68:289-97. https://doi.org/10.1016/j.jchb.2017.06.001

[14] Yarmohammadi H, Bahmani Kazeruni MH, Soofi A, Zargaran A. The First Report of Epidemic Pertussis by Bahaodowle Razi From the 15th Century Anno Domini. Iran Red Crescent Med J 2015;17:e13454. https://doi.org/10.5812/ircmj.13454

[15] Aslanabadi A, Ghabili K, Shad K, Khalili M, Sajadi MM. Emergence of whooping cough: notes from three early epidemics in Persia. Lancet Infect Dis 2015;15:1480-44. https://doi.org/10.1016/S1473-3099(15)00292-3

[16] Kuchar E, Karlikowska-Skwarnik M, Han S, Nitsch-Osuch A. Pertussis: history of the disease and current prevention failure. Adv Exp Med Biol 2016;934:77-82. https://doi.org/10.1007/5584_2016_21

[17] Pertussis (Whooping Cough). Vaccine Knowledge – Oxford University. Available at: https://vaccineknowledge.ox.ac.uk/pertussis-whooping-cough (Accessed on: 8/01/2024).

[18] Abu-Raya B, Forsyth K, Halperin SA, Maertens K, Jones CE, Heininger U, Hozbor D, Wirsing von König CH, Chitkara AJ, Muloiwa R, Tan TQ. 2022. Vaccination in pregnancy against pertussis: a consensus statement on behalf of the global pertussis initiative. Vaccines (Basel)2022;10:1990. https://doi.org/10.3390/vaccines10121990

[19] Cherry JD. Pertussis: challenges today and for the future. PLoS Pathog 2013;9:e1003418. https://doi.org/10.1371/journal.ppat.1003418

[20] Loconsole D, De Robertis AL, Morea A, Metallo A, Lopalco PL, Chironna M. Resurgence of Pertussis and Emergence of the Ptxp3 Toxin Promoter Allele in South Italy. Pediatr Infect Dis J 2018;37:e126-e31. https://doi.org/10.1097/INF.0000000000001804

[21] Wilkinson K, Righolt CH, Elliott LJ, Fanella S, Mahmud SM. Pertussis vaccine effectiveness and duration of protection - A systematic review and meta-analysis. Vaccine 2021;39:3120-30. https://doi.org/10.1016/j.vaccine.2021.04.032

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