



## 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, Pub-Med, 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 ("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])
	PubMed ("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 Female: 34 Male: 28 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 Female: 32 Male: 5 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 prediabetes. 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 Female: 7 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 Female: 9 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 Female: 22 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 Female: 7 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, IIs and metformin are acceptable treatment options	A qualitative approach	N: 35 Female 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 Female: 21 Male: 6 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 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 Female: 7 Male: 8 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 Women	The aim of the present study was explaining women's perception of regular physical activity based on PEN-3 model	Seyed Saeed Mazloomi 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 Female: 24 21-79 years	To assess factors associated with ever receiving prediabetes education, and to explore the health education and communication needs among primary care patients with prediabetes in Singapore	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 Brazil
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 Among Chinese American Immigrants with prediabetes or Type 2 diabetes	Sophia H. Hu, 2018 Chinese
Interacting with healthcare clinicians, seeking information online, taking a nutrition/diabetes management class Taking a nutrition/diabetes management class, lack of consistent/routine care BARRIER, lack of access to resources BARRIER	Qualitative study	N: 33 Female: 17 Male: 16 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 USA
Gaining knowledge, making lifestyle changes, encountering a life-changing event Transition, receiving social support, interacting with clinicians	A mixed-methods study on	N: 33 Female: 17 Male: 16 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 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 Female: 11 Male: 13 Age range: 40-73	To explore perspectives about weight loss from PRIDE participants of different racial and ethnic groups	Rintu Saju, 2022 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 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/whānau 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 Female: 13 Male: 12 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 India
Barriers, facilitators, strategies	A trajectory approach the qualitative sub-study	N:14 All woman 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 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 ---	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 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 Female: 24 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 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 Female: 30 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 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 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 Female: 24 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 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 Mazloomi 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.

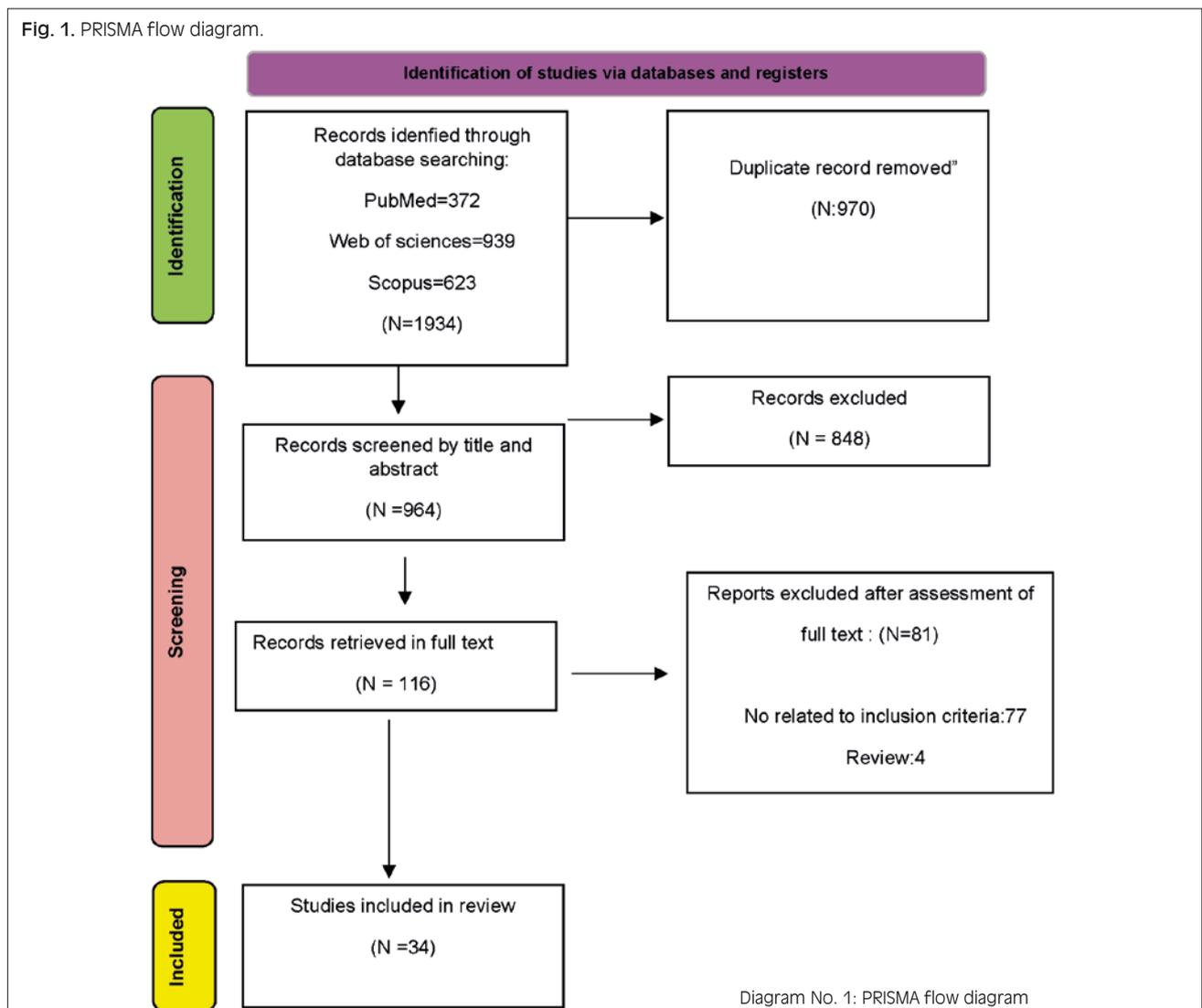
### QUALITY ASSESSMENT

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.



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 <ul style="list-style-type: none"> <li>• Symptoms and causes of developing the illness</li> <li>• Risk factors</li> <li>• Laboratory and screening tests</li> <li>• How to interpret them</li> <li>• Complications and how to control</li> <li>• Lifestyle change behaviors</li> </ul> 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.

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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 to 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 or 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>