

## RESEARCH ARTICLE

# Assessment of healthcare worker's hand hygiene and infection prevention practices of their personal belongings in a healthcare setting: a survey in pre COVID-19 era and literature review on standard disinfection practices

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## Keywords

Healthcare workers • Mobile phones • Stethoscope • Hands • Aprons • Hygiene practices • COVID-19

## Summary

**Background.** Healthcare workers' (HCW) hands and personnel belongings are vehicles of transmission of nosocomial infections. Knowledge, attitude, and practice of hand hygiene have been extensively studied suggesting adequate knowledge but poor compliance. Similar data on aprons, mobile phone and stethoscope disinfection practices are lacking. This becomes an extensively important topic of discussion in current COVID-19 pandemic where inadequacy in hygiene practices is devastating.

**Aim.** To study the knowledge, attitude, and infection prevention practices of HCWs aprons, electronic devices, stethoscopes, and hands.

**Methods.** A cross sectional questionnaire-based survey was conducted among HCWs of Medicine ward and ICU.

**Results.** Sixty-six HCWs responded to the survey. Awareness that hands, aprons, mobile phones, stethoscopes could cause cross

transmission and knowledge of correct practices was present in majority of the respondents. Hand hygiene was performed by 65.2% of the respondents before touching a patient and 54.5% after touching the patient surroundings while 13.6% performed only when it was visibly soiled. Mobile phones and stethoscopes were disinfected by 13.6 and 30.3% of the respondents after each patient encounter, respectively. Aprons were washed after using them at a stretch for a median duration of 5 days (1-30 days). Forgetfulness, lack of reinforcement, lack of time, inadequate awareness on standard disinfection practices and fear of damaging electronic devices from disinfectants use were reasons for poor compliance.

**Conclusions.** There is an urgent need to spread awareness and formulate standard guidelines on disinfection practices especially for mobile phones, stethoscopes, and aprons in addition to reinforcing hand hygiene practices.

## Introduction

Developing countries face a high burden of nosocomial infections [1]. It affects the disease course of hospitalized patients by increasing length of hospital stay, morbidity, mortality and imposes an additional financial burden. Many of these infections are caused by drug resistant microorganisms which are difficult to treat [1, 2].

Microorganisms causing nosocomial infections could be acquired from the hospital environment. Healthcare workers (HCW) act as a potential source of transmission through their hand and contaminated personal belongings (clothes, stethoscopes and electronic devices) [3-7].

Hand hygiene is the single most effective intervention in reducing health care associated infections. Time and again this has been reinforced among HCWs yet the compliance of hand hygiene is low [8]. Despite adequate knowledge, callous attitude among HCWs has hampered the practice of hand hygiene.

Medical devices especially stethoscopes have been found to be contaminated by various pathogenic bacteria.

Studies have demonstrated the presence of Methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin-resistant Enterococci (VRE) and *Clostridium difficile* on their surfaces. In the absence of adequate disinfection practices they can cause cross transmission [9, 10]. Infection prevention compliance and instrument disinfection practices among healthcare workers is poor [11]. Similar is the case with mobile phones and aprons [12, 13].

Studies have mainly focused on assessing hand hygiene practices [14, 15]. However, HCWs' level of knowledge, attitude and practices of disinfecting their personal belongings, which are neglected yet potentially infectious sources is unexplored. It becomes important in the current scenario of COVID-19 pandemic where studies have shown the presence of the viral particles on hands and various inanimate objects acting as potential sources of infection [16]. Knowledge regarding immediate pre-COVID-19 era hygiene practices could help identify pitfalls and act imminently during COVID-19 era where every effort at infection prevention could prove exponentially beneficial. This study was

conducted with the objective of assessing knowledge, attitude, and infection prevention practices of HCWs aprons, electronic devices, stethoscopes, and hands.

## Methods

A questionnaire-based cross sectional study was conducted during November and December 2019 among health care workers working in wards and Intensive Care Unit (ICU) of Medicine Department at a tertiary care centre in New Delhi, India. Health care workers included doctors and nurses. This study was ethically approved by institute ethics committee.

A preformed questionnaire using the Google forms format was made. The questions were pertaining to hygiene practices among healthcare workers with respect to hand, aprons, stethoscope, and electronic devices. The questions under each section were framed to assess their knowledge, their attitude towards infection prevention, and their day-to-day practice. A set of questions were circulated as pilot among 10 participants and the following questions were finalized based on their feedback and applicability along with suggestion from experts. Final questionnaire (Tab. I) included five questions each for assessing hand hygiene, stethoscope, and apron disinfection, while there were six questions for electronic devices. The questionnaire was circulated among the HCW via the Google link and could be filled only once. The respondents could voluntarily take up the survey. Confidentiality was maintained by not using any respondent identifiers and making the responses to the questionnaire completely anonymous. A descriptive statistical analysis involving frequencies and percentages was performed to assess the hygiene practices.

## Results

Sixty-six healthcare workers in Medicine wards and ICU responded to the questionnaire during the study period (Tabs. I, II). It included 38 junior residents, 21 senior residents, 3 nurses, 2 consultants and 2 interns. Fifty-nine (89.4%) of them worked in medicine ward and seven (10.6%) of the HCWs worked in ICU. Median experience of working in a healthcare setup was 4 years (range: 1-18 years).

Assessment of hand hygiene practices revealed that, all healthcare workers were aware of the significance of hand washing and that lapses could cause cross transmission. Ninety four percent reported that they were sure of all the steps of hand washing and the rest were unsure. All HCWs reported that they washed their hands however the scenarios in which they did it were different. Majority, 81.8% HCW did hand washing before any clean or aseptic procedures, 87.9% of them washed their hands after encountering body fluids and 77.3% after touching a patient. However, only 65.2% of them practiced hand hygiene before touching a patient and 54.5% after touching the patient surroundings. Hand

hygiene practices were followed by 13.6% HCWs only on being visibly soiled. Alcohol based hand rubs were used by 94% of them and 71.2% washed their hands with soap and water when they were visibly soiled. Eight healthcare workers reported that they did not practice adequate hand washing due to forgetfulness, lack of on spot reinforcement and lack of time.

All healthcare workers carried electronic devices to the hospital which universally included the mobile phones. Other devices used were tablets, laptops, and pulse oximeters. Usage of electronic devices amidst patient care was reported by 78.8% HCWs. Although all were aware that electronic devices can cause cross transmission, only 89.4% of them cleaned their devices, out of which only 13.6% disinfected it after each patient encounter and 75.8% did it only when it was visibly soiled while 10.6% HCW never disinfected their devices. Alcohol based disinfectant were commonly used by 85.9% HCW to disinfect their devices. Lack of knowledge of correct technique of disinfection and the fear of damaging their devices due to disinfectant formulae were the reasons provided by those who did not disinfect their device.

Stethoscopes are routinely used for patient care by around 91% HCWs and infection prevention practices involving this commonly used medical device were evaluated in our study. Around 98.5% HCW were aware that stethoscopes could be potential sources of cross transmission of infection. Although 93.9% of them disinfected their stethoscopes only 30.3% of them did it after each patient encounter, 6.1% of them never disinfected and the rest of them did it only when it was visibly soiled. Alcohol based disinfectant was used by all of them and mainly the diaphragm (46.9%) was disinfected. Lack of knowledge was reported as the reason for not disinfecting their stethoscopes.

Aprons are worn by over 91% HCW regularly during patient care. About 97% HCW were aware of risk of cross contamination, yet most of the study population involving around 94% of them carried aprons back home after duty. Unwashed aprons were used at a stretch for a median of 5 days (range: 0-30 days). Tap water with detergent was used for disinfection. All of them reported of washing their aprons however those who did not regularly wash gave the reason of lack of time. Everyone, irrespective of the practicing speciality, reported the need for hospital scrubs for patient care which could thereafter be left back in the hospital itself for disinfection.

## Discussion

Our study was done to assess the knowledge, attitude, and practice of infection prevention measures amongst HCWs. All potential sources of infection including hands, electronic devices, clothing, and stethoscopes were analysed for hygiene practices. Wide spectrum of HCWs were sampled including consultants, residents, interns, and nurses working in both ward and ICUs. Almost all HCWs in our study reported that they were aware of the fact that hands, electronic devices, aprons,

Tab. I. Responses to the survey.

Question	Response - number (%), n = 66	
<b>I. Hand hygiene</b>		
1. Are you aware that hands can cause cross contamination and infection in your patients?	Yes: 66 (100%)	No: 0
2. Will you be able to perform all the steps of hand washing?	Yes: 62 (94 %)	Maybe: 4 (6%) No: 0
3. Under what scenarios do you wash your hands?	A. Before any clean or aseptic procedures: 54 (81.8%) B. After touching body fluids: 58 (87.9%) C. After touching the patient: 51 (77.3%) D. Before touching the patient: 43 (65.2%) E. After touching patient surroundings: 36 (54.5%) F. Only when hands are visibly soiled: 9 (13.6%)	
4. Disinfectant used	A. Alcohol based hand rub: 94% B. Soap and water when hands are visibly soiled: 71.2%	
5. Reasons for not performing adequate hand hygiene	8 (12.1%): forgetfulness and lack of on spot reinforcement, lack of time	
<b>II. Electronic device disinfection practices</b>		
1. Do you carry electronic devices to your workplace?	Yes: 66 (100%)	No: 0
2. What electronic devices do you carry?	A. Mobile phones: 66 (100%) B. Tablets: 20 (30.3%) C. Pulse oximeters: 20 (30.3%) D. Laptops: 12 (18.2%)	
3. Are you aware that electronic devices can cause cross contamination and infection in your patients?	Yes: 66 (100%)	No: 0
4. Do you use your device while caring for your patients?	Yes: 52 (78.8%)	No: 14 (21.2%)
5. Do you clean your devices and under what circumstances?	Yes: 59 (89.4 %) A. Only when visibly soiled: 50 (75.8%) B. After each patient encounter: 9 (13.6%)	No: 7 (10.6 %)
6. Disinfectant used	Alcohol based disinfectant: 85.9 %	
<b>III. Stethoscope disinfection</b>		
1. Do you use stethoscope during routine patient care?	Yes: 60 (91%)	No: 6 (9%)
2. Are you aware that stethoscopes can cause cross contamination and infection in your patients?	Yes: 65 (98.5%)	No: 1 (1.5%)
3. Do you clean your devices and under what circumstances?	Yes: 62 (93.9 %) A. Only when visibly soiled: 42 (63.6%) B. After each patient encounter: 20 (30.3%)	No: 4 (6.1%)
4. Which part of the stethoscope do you clean?	A. Diaphragm only: 31 (46.9%) B. Diaphragm and tubings: 18 (27.3%) C. Diaphragm, tubings and earpiece: 13 (19.7%) D. Soiled portion: 10 (15.2%)	
5. Disinfectant used	Alcohol based disinfectant: 100 %	
<b>IV. Apron disinfection</b>		
1. Do you use apron regularly during routine patient care?	Yes: 60 (91%)	No: 6 (9%)
2. Are you aware that aprons can cause cross contamination and infection in your patients?	Yes: 64 (97%)	No: 2 (3%)
3. How many days at a stretch do you wear your unwashed apron? Median (Range)	5 days (0-30 days)	
4. Disinfectant used	Tap water and detergent: 100%	
5. Which do you think is the best mode of getting your aprons washed?	Hospital should provide scrubs for patient care which can be left back in the hospital for disinfection: 100%	

and stethoscopes are potential fomites causing cross transmission and also agreed of having a fair knowledge on hygiene practices, however few lapses were observed in the responses pertaining to their practice of the same. Multiple studies have also reiterated the same with regards to poor compliance and practice of infection prevention hygiene practices among healthcare worker [12, 14, 15, 17-20]. WHO has recommended various steps and movements of hand hygiene [21]. However, the practice of five

movements around the patient zone was variable. Majority of them performed hand hygiene after patient contact, after exposure to body fluids and before aseptic procedures, however just above half of them did it before touching the patient and after touching the surroundings. Furthermore, 13.6% did it only when it was visibly soiled. A similar study reported 86% of respondents having knowledge about hands being a vehicle of transmission while only 53.8 and 32.5% knew about movements

Tab. II. Demographic profile.

Demographic characteristics		Number (%), n = 66
Designation	Consultant	2 (3%)
	Senior resident	21 (31.8%)
	Junior resident	38 (57.6%)
	Intern	2 (3%)
	Nursing staff	3 (4.5%)
Unit of surveillance	Ward	59 (89.4%)
	ICU	7 (10.6%)
Working experience-median (range)		4 (1-18) Years

and steps of hand hygiene [1]. A meta-analysis revealed compliance of 52% (27-86%) for hand hygiene [22]. If similar compliance rates are followed in the current COVID-19 pandemic era, infection prevention would be impossible to achieve and hospitals would thus be hotspots of infection transmission rather than control and prevention.

Hand hygiene is the corner stone for prevention of hospital acquired infections. Poor compliance despite adequate knowledge is a major bottle neck for adequate infection control and prevention. Respondents in our study blamed lack of time as the reason for inadequate hand hygiene similar to other studies which has identified “being busy” as one of the factors influencing hand hygiene behaviour [23]. Availability of point of care hand hygiene products which includes alcohol based hand rubs closer to the patients and on-site reinforcement of importance hand hygiene will facilitate better integration of hygiene practices in the workflow [24].

Mobile phones are universally used by all healthcare workers and majority reported of it being used during patient care. However only 13.6% of them disinfected after each patient encounter and 10.6% of them never disinfected their devices. Similar results have been published by a study wherein only 37% admitted of cleaning it regularly [25]. The benefit of using mobile phones in clinical areas should be weighed against the potential risk of contamination and cross infection. It is best avoided during patient care or to be disinfected with 70% isopropyl alcohol after each patient encounter taking care that moisture does not enter any of the openings and perform proper hand hygiene [26]. The most common reason for not disinfecting was out of the fear of damaging the device and many did not know the proper method of disinfection. There are concerns that more than 50% alcohol damages the screen and the phone manufacturing companies do not recommend any chemical being used. However in the wake of COVID-19 pandemic they too have recommended 70% isopropyl alcohol wipes [27-29]. There is no clear evidence that mobile phone hygiene reduces disease transmission. Nevertheless, mobile phone use should be minimized, hand washing, disinfectant wipes, headphone use and washable covers should be encouraged [26]. Extrapolating available data to current scenario could signify that HCW would carry coronavirus back home inevitably thus promoting fomite transmission of COVID-19 to family and friends. Hence there is an urgent need to stress on infection prevention

measures and even better refrained use of electronic devices during patient care in present day situation.

Stethoscopes are the most common medical device used and a recognized fomite, yet disinfection practices are poor. Only one third of them disinfected stethoscopes after each patient encounter and 6.1% never disinfected stethoscopes in our study. Studies by Sahiledengle B and Ghumman GW et al. have also reported that only 39.7% and 29% respectively disinfected their stethoscopes regularly, the rates have been less than 50% usually [18-20]. Several studies have concluded that disinfection of stethoscopes with 70% isopropyl alcohol reduces 99% of bacteria [30]. However lack of awareness of standard infection prevention guidelines and favourable attitude towards infection prevention are independent predictors of stethoscope disinfection after every use [20]. Regular disinfection of stethoscope, followed by hand hygiene and avoidance of sharing them has been suggested to prevent spread of COVID-19 [31].

Aprons/Lab coats are frequently used by healthcare workers during patient care. They are potential yet neglected cause of cross transmission. In our study it was seen that almost everyone carried back their aprons home and was washed at a median of 5 days with a maximum of a month at a stretch being unwashed. This is potentially dangerous and can lead to infection of the family members as well. Many agreed to lack of time being the reason for not washing their aprons. We suggest that hospital provide fresh scrubs daily for healthcare workers which can be left back for disinfection in the hospital before going back home.

The study design being cross sectional questionnaire-based survey, although throws light on important infection prevention practices prevailing, there might be response bias as the data is solely based on how faithfully HCWs reported on their practices as the study did not involve direct observation of their practices. Yet the reported correct practice was low in accordance with the published literature. Extrapolation of data on a larger scale would mandate larger prospective studies wherein the practices are observed for stronger evidence. Results may not be generalizable to various specialities of healthcare considering the setup of medical wards and ICU only considered in our study. Nevertheless, this study could be food for thought to implement more strict compliance with infection prevention measures by healthcare workers. The suggested recommendations on infection prevention hygiene practices in this manuscript can increase awareness among HCWs and help fight the COVID-19 pandemic.

## Conclusions

Healthcare workers and their belongings are undoubtedly potential sources of infection. Despite adequate knowledge, poor compliance to infection prevention practices has hampered the progress in reducing nosocomial infections. Akin to widespread dissemination of information on

hand hygiene, standard guidelines, and reinforcement of hygiene practices for potentially infectious yet neglected fomites like mobile phone, stethoscopes, and aprons among all cadre of healthcare workers is necessary. The immediate pre-COVID era data discussed acts as a baseline to evaluate infection prevention practices prevailing amongst HCW and hence could be helpful to formulate strategies and infection prevention guidelines to combat the infectious pandemic.

## Ethics statement

The work has been approved by institute ethics committee and that subjects gave informed consent to the work.

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## Conflicts of interest statement

The authors declare no conflict of interest.

## Authors' contributions

VCK, AK conceived the study. VCK, AK, NR and MS were involved in making the questionnaire and collecting the responses. VCK wrote the manuscript and was guided by AK. MAK was involved in statistical analysis and script editing. AK, NR and MS were involved in script editing. NW was involved in script editing and script critical review. All authors read and approved the final version of the manuscript.

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