

INFECTION CONTROL PRACTICES AMONG HEALTHCARE STAFF AT A TERTIARY CARE HOSPITAL IN RAWALPINDI, PAKISTAN: A CROSS-SECTIONAL STUDY

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Abstract

Background: Healthcare facilities are important environments for the transmission of infectious diseases because patients, healthcare workers, attendants, and visitors interact within a shared environment. Inadequate infection prevention and control practices can facilitate the transmission of healthcare-associated infections and increase occupational risks to healthcare workers. Hand hygiene, appropriate use of personal protective equipment, environmental disinfection, sterilization, isolation precautions, and safe disposal of infectious waste are essential components of infection prevention and control.

Objective: To assess infection control practices among healthcare staff working at a tertiary care hospital in Rawalpindi, Pakistan.

Methods: A quantitative cross-sectional survey was conducted among healthcare staff at Holy Family Hospital, Rawalpindi, from January 1 to March 31, 2020. A total of 200 healthcare staff were recruited using convenience sampling. Data were collected using a self-structured questionnaire assessing hand hygiene, use of non-sterile gloves, personal protective equipment, cleaning of clinical equipment, occupational exposure to body fluids, needle-stick injuries, patient masking, infectious waste disposal, and perceptions of hospital infection-control practices. Data was entered into SPSS version 23 and analyzed using frequencies and percentages. Ethical approval was obtained from the Ethical Review Committee of Sarhad University, and written informed consent was obtained from participants.

Results: Among the 200 respondents, 70 (35%) were aged 30–34 years. Laboratory technicians and dressers each constituted 60 (30%) of the sample. Regarding hand hygiene, 100 (50%) reported washing their hands with running water and bar soap, while 40 (20%) used liquid handwash, 40 (20%) used skin disinfectant, and 20 (10%) used alcohol hand rub. Half of the respondents reported hand hygiene before invasive procedures. Twenty-five percent reported not using non-sterile gloves in any of the specified situations. Eighty percent of

respondents had experienced splashes of blood, vomit, or other body fluids, while 169 (84.5%) reported previous needle-stick injury. Following exposure to contaminated body fluids, 50 (25%) reported was washing the site with water, 70 (35%) with soap, and 80 (40%) reported scrubbing the contaminated area. For infectious waste disposal, 120 (60%) selected the red bag and 20 (10%) reported having no knowledge of the appropriate disposal method. Although 160 (80%) respondents perceived the hospital's infection-control practices as good, several individual infection-control practices remained suboptimal.

Conclusion: Important gaps were identified in infection prevention and control practices among healthcare staff, particularly regarding hand hygiene, PPE use, occupational exposure management, and infectious waste disposal. Continuous training, practical skill-based education, regular monitoring, and institutional enforcement of infection-control protocols are recommended.

Introduction

Healthcare facilities provide essential diagnostic and therapeutic services but also represent important environments for the transmission of infectious diseases. Patients with different diseases, healthcare workers, attendants, visitors, medical equipment, and environmental surfaces interact within healthcare settings, creating multiple opportunities for transmission of infectious organisms. Healthcare workers may contribute to the transmission of infection when appropriate infection prevention and control measures are not consistently followed (1, 2).

Healthcare-associated infections remain an important patient-safety concern because inadequate infection-control practices may expose both patients and healthcare workers to preventable infections. Effective infection prevention can reduce transmission and is therefore an important component of quality healthcare and patient safety (3, 4). Healthcare workers may also experience occupational exposure to blood, body fluids, contaminated equipment, and other potentially infectious materials, emphasizing the importance of appropriate standard precautions (5, 6).

Hand hygiene is considered one of the most fundamental measures for preventing transmission of infection in healthcare settings. Appropriate hand hygiene before and after patient contact and during relevant clinical procedures can interrupt transmission through contaminated hands (7). Despite the availability of hand hygiene recommendations, previous studies have

demonstrated considerable variability in healthcare workers' knowledge, attitudes, and compliance with recommended practices (5).

Personal protective equipment (PPE) provides an additional barrier against exposure to infectious materials. Depending on the clinical activity and anticipated exposure, PPE may include gloves, masks, gowns, eye protection, and face shields. Appropriate selection and use of PPE are important components of standard and transmission-based precautions (4, 8).

Other infection-control measures include sterilization, disinfection, environmental cleaning, isolation precautions, and appropriate management of healthcare waste. Sterilization and disinfection are essential for reducing contamination of reusable equipment and environmental surfaces, while appropriate waste segregation helps prevent exposure to infectious materials (9, 10).

Previous studies have reported deficiencies in infection-control practices among healthcare workers. Vinodhini et al. reported that infection-control practices among healthcare workers in a specialty hospital in Chennai were not optimal, particularly regarding waste management, disinfection and sterilization, and PPE use (11). Engelbrecht et al. reported that knowledge and attitudes were associated with infection-control practices among healthcare workers and emphasized the importance of positive attitudes and adequate knowledge (12). Similarly, Shrestha et al. reported deficiencies in tuberculosis infection-control knowledge and practices among

healthcare workers and highlighted the importance of education and training (13). Training and educational interventions have also been shown to have an important role in improving infection-control practices. Studies have reported improvements following educational interventions and have emphasized the need for continuous training and reinforcement of infection-control procedures (14, 15). In intensive care settings, substantial variability in hand hygiene compliance has also been reported, indicating the need for regular monitoring and multidisciplinary interventions (16).

In Pakistan, assessment of infection-control practices at the institutional level is important because healthcare workers have different professional responsibilities and may encounter infectious materials during routine clinical activities. Identifying specific deficiencies can help hospital infection-control committees develop targeted educational and monitoring strategies. Therefore, the present study was conducted to assess infection-control practices among healthcare staff at Holy Family Hospital, Rawalpindi. The study specifically evaluated hand hygiene, glove use, PPE practices, clinical equipment cleaning, occupational exposure, patient masking, infectious waste disposal, and perceptions regarding hospital infection-control practices.

Methods

Study Design and Setting

A quantitative cross-sectional survey was conducted among healthcare staff working at Holy Family Hospital, Rawalpindi, Pakistan. The study was conducted over a period of three months, from January 1 to March 31, 2020.

Study Population

The target population comprised healthcare staff working at the hospital. According to the study, doctors, nurses, OT technicians, and dressers were eligible for inclusion, while support staff, sanitary staff, and housekeeping staff were excluded.

Sample Size

Daniel's formula was used for sample-size calculation. A population proportion of 0.15, 95% confidence level, Z value of 1.96, and margin of error of 0.05 were used. The calculated sample size was approximately 195, after which 200 participants were recruited.

Sampling Technique

A convenience sampling technique was used to recruit 200 healthcare staff from the study population.

Data Collection Instrument

Data was collected using a self-structured questionnaire. The questionnaire assessed demographic characteristics and several domains of infection-control practice, including:

- hand hygiene;
- circumstances requiring hand hygiene;
- use of non-sterile gloves;
- use of PPE during different clinical activities;
- cleaning of stethoscopes;
- washing uniforms;
- exposure to blood and other body fluids;
- needle-stick injuries;
- actions following exposure to body fluids;
- patient masking;
- infectious waste disposal; and
- perception of hospital infection-control practices.

The original dissertation included the questionnaire as an annexure.

Data Collection Procedure

The questionnaire was administered to the study participants. After completion, the collected data were entered into SPSS version 23 for analysis.

Ethical Considerations

Ethical approval was obtained from the Ethical Review Committee of Sarhad University. Written informed consent was obtained from all study participants before data collection.

Statistical Analysis

Data was entered and analyzed using SPSS version 23. Descriptive statistics were used to summarize the study variables, including frequencies and percentages. The original study did not report inferential statistical tests; therefore, no associations or p-values have been added to the present manuscript.

Results

Demographic Characteristics

A total of 200 healthcare staff participated in the study. Thirty (15%) respondents were younger than 25 years, 60 (30%) were aged 25–29 years, 70 (35%) were aged 30–34 years, and 40 (20%) were aged 35 years or older. Regarding professional category, 20 (10%) respondents were doctors, 30 (15%) were nurses, 60 (30%) were laboratory technicians, 60 (30%) were dressers, and 30 (15%) were trainee/nursing students. Regarding years of service, 40 (20%) respondents had 1–5 years of service, 140 (70%) had 6–10 years, and 20 (10%) had 10 or more years of service.

Table 1. Demographic characteristics of healthcare staff (n=200)

Characteristic	n	%
Age		
<25 years	30	15
25–29 years	60	30
30–34 years	70	35
≥35 years	40	20
Profession		
Doctors	20	10
Nurses	30	15
Laboratory technicians	60	30
Dressers	60	30
Trainee/nursing students	30	15
Years of service		
1–5 years	40	20
6–10 years	140	70
≥10 years	20	10

Hand Hygiene Practices

Regarding the method of hand hygiene during duty hours, 100 (50%) respondents reported washing their hands with running water and bar soap, 40 (20%) with running water and liquid handwash, 40 (20%) with running water and skin disinfectant, and 20 (10%) with alcohol hand rub.

Age Distribution of Healthcare Staff (n=200)

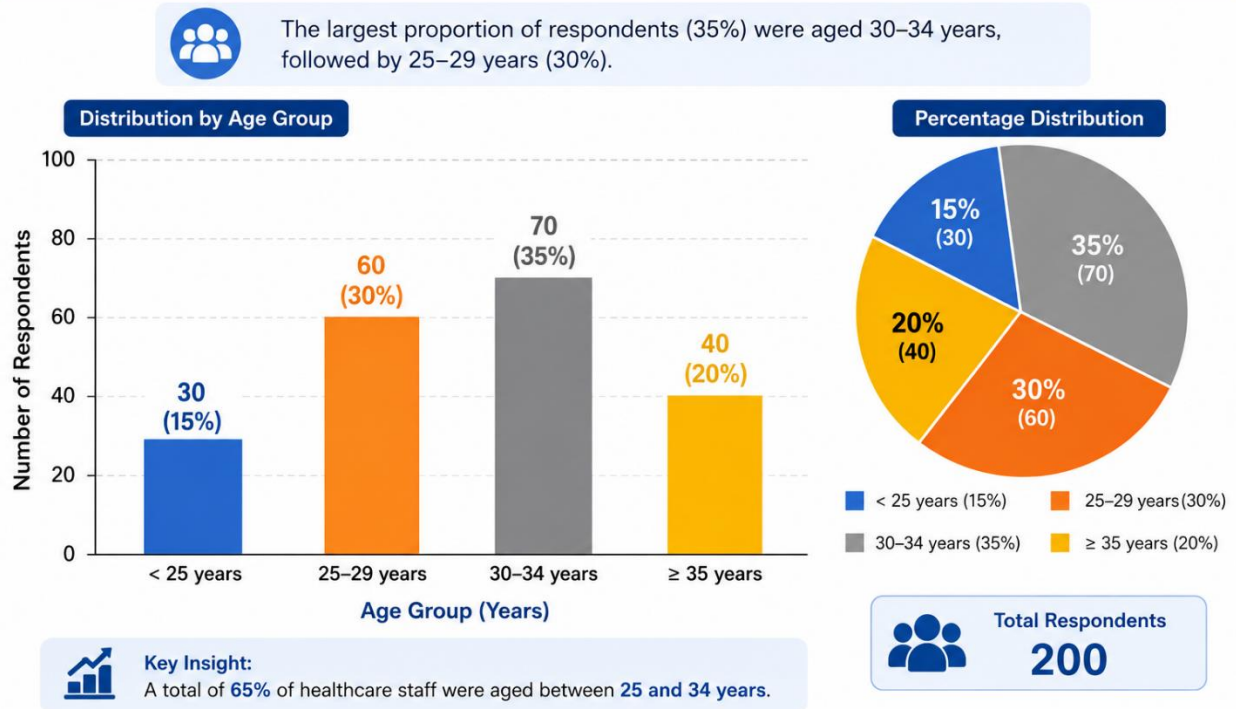


Figure 1: Age distribution of healthcare staff (n=200)

Table 2. Hand hygiene method used during duty hours (n=200)

Method	n	%
Running water and bar soap	100	50
Running water and liquid handwash	40	20
Running water and skin disinfectant	40	20
Running water and alcohol hand rub	20	10
Total	200	100

Regarding the situations in which respondents reported performing hand hygiene, 100 (50%) washed their hands before invasive bedside procedures, 30 (15%) before and after examining

patients, 30 (15%) before and after touching wounds, and 40 (20%) between two different procedures performed on different patients.

Table 3. Situations in which respondents practiced hand hygiene (n=200)

Situation	n	%
Before invasive bedside procedures	100	50
Before and after examining patients	30	15
Before and after touching wounds	30	15
Between procedures on different patients	40	20
Total	200	100

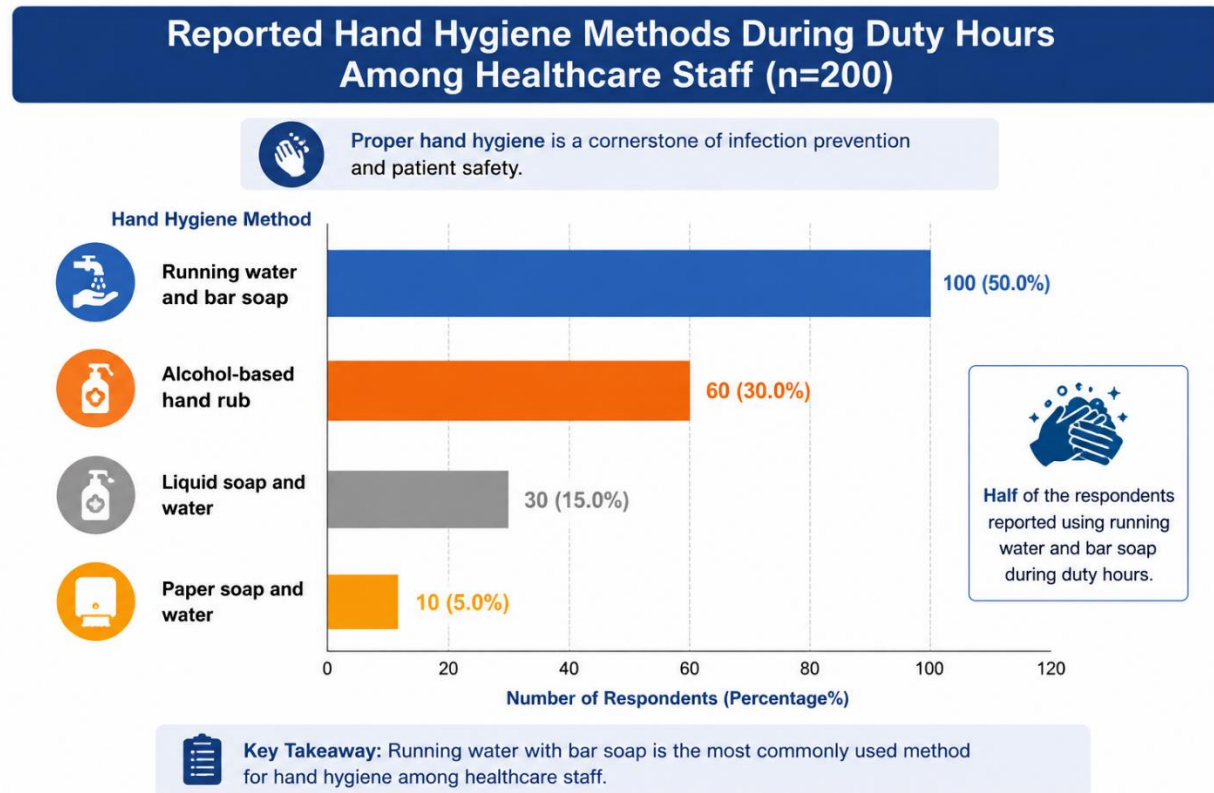


Figure 2. *Reported hand hygiene methods during duty hours among healthcare staff (n=200)*

Use of Non-Sterile Gloves

Twenty (10%) respondents reported using non-sterile gloves while using computers, desks, or patient-care equipment in wards. Thirty (15%)

reported using gloves while prescribing drugs, 40 (20%) during physical examination, and 60 (30%) during clinical rounds. Fifty (25%) reported not using gloves in any of the listed situations.

Table 4. Use of non-sterile gloves in specified situations (n=200)

Situation	n	%
Using computers, desks or patient-care equipment	20	10
Prescribing drugs	30	15
Performing physical examination	40	20
Making clinical rounds	60	30
None of the above	50	25
Total	200	100

Personal Protective Equipment

Reported PPE use varies according to the clinical activity. During transportation of coughing patients, 40 (20%) respondents reported glove use, 70 (35%) mask use, 10 (5%) goggles, 50 (25%) face shields, and 30 (15%) gowns.

During blood drawing, 120 (60%) reported using gloves, 40 (20%) masks, and 40 (20%) goggles.

During septic wound irrigation, 130 (65%) reported glove use and 50 (25%) mask use. During nasogastric suctioning, 70 (35%) reported gloves, 40 (20%) masks, and 90 (45%) goggles.

During lumbar puncture, 50 (25%) reported mask use, 90 (45%) goggles, 50 (25%) face shields, and 60 (30%) gowns. During NICU visits, 120 (60%)

reported gloves, 50 (25%) masks, and 30 (15%) goggles.

During physical examination, 110 (55%) reported gloves, 60 (30%) masks, and 30 (15%) goggles. For patients with fecal incontinence, 120 (60%)

reported gloves, 60 (30%) masks, and 20 (10%) goggles. During delivery of a baby of an HIV-positive woman, 130 (65%) reported gloves, 50 (25%) masks, and 20 (10%) goggles.

Table 5. Reported PPE use during different clinical activities

Clinical activity	Gloves n (%)	Mask n (%)	Goggles n (%)	Face shield n (%)	Gown n (%)
Transporting coughing patient	40 (20)	70 (35)	10 (5)	50 (25)	30 (15)
Drawing blood	120 (60)	40 (20)	40 (20)	0	0
Irrigating septic wound	130 (65)	50 (25)	20*	0	0
Nasogastric suctioning	70 (35)	40 (20)	90 (45)	0	0
Lumbar puncture	0	50 (25)	90 (45)	50 (25)	60 (30)
Visiting NICU	120 (60)	50 (25)	30 (15)	0	0
Physical examination	110 (55)	60 (30)	30 (15)	0	0
Fecal incontinence patient	120 (60)	60 (30)	20 (10)	0	0
Delivery of baby of HIV-positive woman	130 (65)	50 (25)	20 (10)	0	0

Stethoscope and Uniform Hygiene

Regarding cleaning of stethoscopes with antiseptic solution, 60 (30%) respondents reported cleaning their stethoscopes after examination of each patient, 50 (25%) reported daily cleaning, and 40 (20%) reported weekly cleaning.

Regarding uniform washing, 50 (25%) reported washing their uniform daily, 100 (50%) three times per week, and 50 (25%) twice per week.

Occupational Exposure to Body Fluids and Needle-Stick Injuries

A total of 160 (80%) respondents reported previous exposure to splashes of blood, vomit, or

other body fluids. Furthermore, 169 (84.5%) reported having sustained a needle-stick injury. Following exposure to contaminated body fluids, 50 (25%) reported washing the affected area with water, 70 (35%) with soap, and 80 (40%) reported scrubbing the contaminated area.

Patient Masking Practices

Seventy (35%) respondents reported masking patients with influenza, 40 (20%) reported masking patients with cough, and 90 (45%) reported masking all patients irrespective of their illness.

Table 6. Patient masking practices (n=200)

Practice	n	%
Patients with influenza	70	35
Patient with cough	40	20
All patients irrespective of illness	90	45
Total	200	100

Reported Occupational Exposure Among Healthcare Staff (n=200)



Healthcare workers are at risk of exposure to blood and body fluids and need strict adherence to standard precautions.

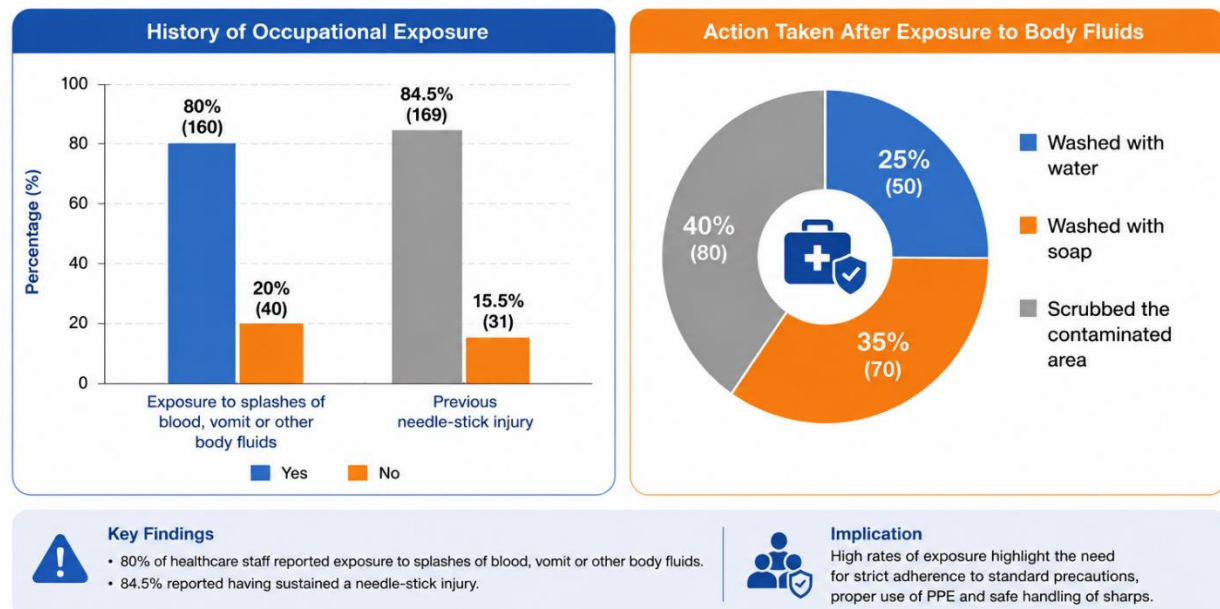


Figure 3. Reported occupational exposure among healthcare staff (n=200)

Infectious Waste Disposal

Twenty (10%) respondents selected the yellow bag for infectious waste disposal, 40 (20%) selected the

black bag, 120 (60%) selected the red bag, and 20 (10%) reported having no knowledge regarding the appropriate disposal method.

Table 7. Infectious waste disposal practices (n=200)

Disposal option	n	%
Yellow bag	20	10
Black bag	40	20
Red bag	120	60
No idea	20	10
Total	200	100

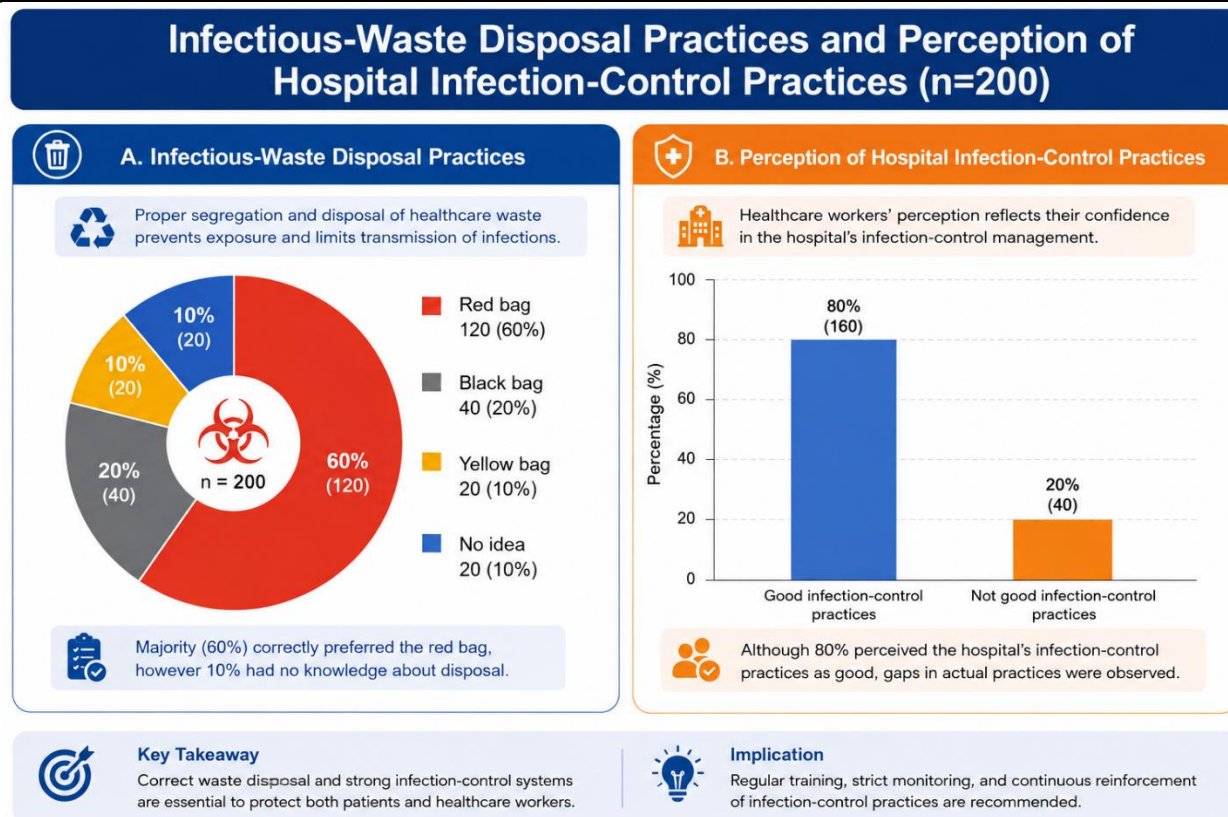


Figure 4. *Infectious-waste disposal practices and perception of hospital infection-control practices (n=200)*

Perception of Hospital Infection-Control Practices

When asked whether the hospital had good infection-control practices, 160 (80%) respondents answered yes, whereas 40 (20%) disagreed.

Discussion

The present study assessed infection-control practices among healthcare staff working at Holy Family Hospital, Rawalpindi. The findings demonstrate that although healthcare workers reported several infection-control practices, substantial gaps remained in hand hygiene, glove use, PPE use, occupational exposure management, patient masking, and infectious-waste disposal. Hand hygiene was one of the major areas assessed in this study. Half of the respondents reported using running water and bar soap, whereas the remaining respondents used liquid handwash, skin disinfectants, or alcohol hand rub. However,

only half reported hand hygiene before invasive bedside procedures, and smaller proportions reported hand hygiene before and after patient examination, before and after touching wounds, or between procedures involving different patients.

These findings are important because hand hygiene is recognized as one of the most fundamental measures for preventing healthcare-associated transmission (1). Previous research has demonstrated considerable variability in hand hygiene compliance among healthcare workers. Musu et al. reported substantial variability in adherence to best-practice hand hygiene among intensive-care healthcare workers and recommended effective infection-control strategies and periodic assessment of knowledge and practice (16). Educational interventions have also been shown to improve infection-control knowledge and practice among healthcare workers (10).

The present study also identified deficiencies in the use of non-sterile gloves. One-quarter of respondents reported not using non-sterile gloves in any of the specified situations. Appropriate use of gloves is an important component of standard precautions, particularly when contact with blood, body fluids, mucous membranes, non-intact skin, or contaminated equipment is anticipated (4).

PPE varied considerably according to clinical activity. The source study described gloves and masks as commonly used PPE but considered overall PPE practice insufficient. Similar deficiencies have been documented in previous studies. Vinodhini et al. reported poor infection-control practices among healthcare workers, including inadequate PPE use, disinfection, sterilization, and waste management (11). Qudeimat et al. also investigated infection-control knowledge and practices among healthcare workers in a clinical setting, highlighting the importance of appropriate infection-control behaviors (17).

Occupational exposure was another important finding. Eighty percent of respondents reported exposure to splashes of blood, vomit, or other body fluids, while 84.5% reported a previous needle-stick injury. These findings indicate substantial occupational exposure among healthcare workers and emphasize the importance of appropriate standard precautions and occupational safety measures. Healthcare workers should receive training regarding safe handling of sharps, use of appropriate PPE, and immediate management and reporting of occupational exposure (6).

The reported actions following body-fluid exposure were also variable. Twenty-five percent reported washing the contaminated site with water, 35% with soap, and 40% reported scrubbing. The findings suggest that standardized institutional post-exposure protocols and practical training should be strengthened.

Patient masking practices also varied. Forty-five percent of respondents reported masking all patients irrespective of illness, whereas 35% selected patients with influenza and 20% selected patients with cough. Appropriate source-control measures are important in preventing respiratory

transmission, particularly when patients present with symptoms suggestive of communicable respiratory infection. Infection-control programs should therefore provide clear instructions regarding when source-control measures are required (18).

Infectious-waste management was another area of concern. Sixty percent of respondents selected the red bag, while 10% reported having no knowledge about appropriate infectious-waste disposal. Healthcare facilities generate potentially infectious materials such as contaminated dressings, syringes, body fluids, and other clinical waste. Proper segregation at the point of generation and adherence to institutional waste-management procedures are important for reducing exposure and preventing transmission (9).

The study also found that 80% of respondents perceived the hospital's infection-control practices as good. However, this positive perception was not fully consistent with the deficiencies reported in individual practices. This discrepancy may indicate that healthcare workers recognize the institutional importance of infection control but may not consistently translate this perception into appropriate day-to-day practice.

Previous research suggests that knowledge and attitudes may influence infection-control behavior. Engelbrecht et al. reported that positive attitudes and adequate knowledge were associated with better TB infection-control practices among primary healthcare workers (12). Assefa et al. also reported relationships between infection-prevention training, work experience, positive attitudes, and adequate knowledge (19). Similarly, Shrestha et al. found deficiencies in TB infection-control knowledge and practices and emphasized the need for regular training and orientation (13). Educational interventions may therefore represent an important strategy for improving infection-control practices. Previous studies have demonstrated the effectiveness of teaching and educational interventions in improving infection-control practices among healthcare professionals (10). Training should include both theoretical and practical components, including hand hygiene technique, appropriate selection and use of PPE, safe handling of sharps, management of

occupational exposure, disinfection and sterilization, and healthcare-waste segregation. The findings of the present study are particularly relevant because data collection occurred during January–March 2020, immediately before the widespread impact of the COVID-19 pandemic. The original dissertation identified pre-COVID-19 timing as a limitation and suggested comparing pre- and post-COVID-19 infection-control practices. Studies conducted during the COVID-19 period have also emphasized the importance of PPE, screening, disinfection, and other infection-control measures in healthcare settings (18).

Overall, the findings indicate that improving infection-control practices requires more than simply providing written guidelines. Hospitals should establish continuous education, practical competency assessment, routine monitoring, feedback mechanisms, and institutional accountability. Regular assessment of infection-control knowledge and practice has been recommended by previous studies and may help identify areas requiring targeted intervention (14).

Strengths of the Study

The study assessed multiple domains of infection prevention and control rather than focusing exclusively on hand hygiene. These domains included glove use, PPE, equipment cleaning, occupational exposure, patient masking, waste disposal, and institutional perceptions. The inclusion of healthcare staff involved in different clinical activities also allowed assessment of infection-control practices across several routine healthcare procedures.

Limitations

This study has several limitations. First, cross-sectional design provides information about infection-control practices at a particular period and does not establish temporal or causal relationships. Second, convenience sampling was used, which limits the generalizability of the findings. Third, the study was conducted at a single hospital, which may limit applicability to other healthcare institutions. Fourth, the questionnaire relied on self-reported practices, which may be affected by recall and social-

desirability bias. Direct observational assessment could provide a more objective assessment of compliance. Fifth, the study was conducted before the COVID-19 pandemic, and infection-control behaviors may have changed following the pandemic. The original dissertation also identified this as a limitation and recommended comparison between pre- and post-COVID-19 periods. Finally, the available thesis does not report inferential statistical analyses. Therefore, associations between demographic characteristics, professional category, work experience, training, and infection-control practices could not be evaluated in this manuscript.

Conclusion

The present study identified important gaps in infection-control practices among healthcare staff at Holy Family Hospital, Rawalpindi. Although several respondents reported appropriate infection-control behaviors, inconsistencies were observed in hand hygiene, glove use, PPE use, occupational exposure management, patient masking, and infectious-waste disposal. The high proportion of respondents reporting exposure to body fluids and needle-stick injuries highlights the importance of strengthening occupational safety measures. Continuous infection-control education, practical competency-based training, regular monitoring, appropriate PPE availability, standardized post-exposure protocols, and strict institutional enforcement are needed to improve infection prevention and protect both healthcare workers and patients.

Recommendations

1. Healthcare workers should receive regular mandatory infection-prevention and control training.
2. Practical competency-based sessions should be conducted on hand hygiene and PPE use.
3. Newly inducted healthcare workers, students, and trainees should receive infection-control orientation before starting clinical duties.
4. Hand hygiene compliance should be monitored periodically through structured audits.

5. Appropriate PPE should be readily available in all relevant clinical areas.
6. Staff should receive training regarding correct selection, use, and disposal of PPE.
7. A standardized system for reporting and managing needle-stick injuries and other occupational exposures should be implemented.
8. Healthcare workers should be trained in appropriate immediate actions following exposure to potentially infectious body fluids.
9. Infectious-waste segregation should be reinforced through clear labeling and institutional monitoring.
10. Infection-control committees should conduct regular assessments of healthcare workers' knowledge and practices.
11. Future studies should use larger probability-based samples and include multiple hospitals.
12. Future research should examine associations between infection-control practices and professional category, training, education, and years of experience.
13. Comparative studies should assess infection-control practices before and after major infectious disease outbreaks.

Declarations

Ethics Approval and Consent to Participate

Ethical approval was obtained from the Ethical Review Committee of Sarhad University. Written informed consent was obtained from all participants before data collection.

Consent for Publication

Not applicable.

Availability of Data

The data were collected as part of the present research project. The original thesis does not report deposition of the dataset in a public repository.

Conflict of Interest

No conflict of interest was reported in the source thesis. This declaration should be confirmed by all authors before submission.

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No specific funding source was reported in the source thesis. This should be confirmed by the authors before submission.

Authors' Contributions

Author contributions should be stated according to the actual contribution of each author.

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