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# Knowledge, attitude, and practice of healthcare workers of primary health facilities of Kathmandu district, Nepal on infection prevention and control

Karuna Bhandari*, Pariwesh Raj Bista, Sita Koirala, Archana Shah and Binjwala Shrestha

Institute of Medicine, Tribhuvan University, Kathmandu, Nepal

*Abstract*

***Introduction*:** Primary healthcare facilities are the first point of contact for the utilization of healthcare services. Adopting appropriate infection prevention and control (IPC) measures helps to control the emergence and spread of infection in the community. No study related to the knowledge, attitude, and practice of healthcare workers (HCWs) on IPC was done at the primary health facility level till the date of this study.
***Aim*:** To assess the knowledge, attitudes, and infection control practices among Nepalese HCWs working in primary health facilities.
***Methods*:** This was a descriptive cross-sectional study conducted among 156 health workers from municipalities of the Kathmandu district. Multistage simple random sampling was used in which five municipalities were selected randomly and health workers were selected proportionately afterward.
***Results*:** Out of the total participants, more than half of them had not obtained infection control training. Only 15.4 3.2, and 10.3% of the respondents achieved maximum scores for knowledge, attitude, and practice items, respectively. Although staff had good knowledge and a positive attitude towards most aspects of infection control, nearly two-thirds (62.8%) of the participants had not heard about methicillin-resistant *Staphylococcus aureus*.
***Conclusion*:** There was an irregular supply of basic supplies such as masks, gloves, aprons, supply of water, hand-washing basins, soap, and hand sanitizer. Therefore, every local level should equip all health facilities of its catchment area with the basic supplies as listed in the Minimum Service Standard guideline for the correct application of IPC.

Keywords: *infection prevention and control*; *health care workers*; *primary health facilities*; *Nepal*; *IPC guideline*

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Infection prevention and control (IPC) is a practical, evidence-based approach that prevents patients and health workers from being harmed by avoidable infection as a result of antimicrobial resistance (1). The minimum requirements are defined as IPC standards that should be in place at the national and facility level to provide minimum protection and safety to patients, healthcare workers (HCWs), and visitors, based on the World Health Organization (WHO) core components for IPC programs. These components include the organization and structure of IPC programs, surveillance, education and training, behavior change strategies, standard and transmission-based precautions, auditing, patient participation, target setting, and knowledge management (2). The recently published WHO's 'Strengthening IPC in Primary Care' document collates existing standards, measurement and implementation approaches, and resources for IPC in primary care (3).

Healthcare workers' awareness should include issues related to hand hygiene, wearing personal protective equipment (PPE), immunization for the prevention of communicable diseases, modes of infection transmission, assessment of patients for infection, medical instrument decontamination, healthcare waste handling, needlestick and sharp safety policy. Even more importantly, HCWs should be compliant with these IPC precautions, methods, and strategies to ensure hospital acquired infection (HAI) reduction in healthcare settings (4).

According to WHO, 'Strong IPC is vital for protecting health, stopping the spread of drug-resistant bacteria, and preparing for and responding to outbreaks'. Due to the recent pandemic of COVID-19 infection, the

importance of IPC measures has become more visible in the management of rapid transmission of highly infectious diseases.

The aim of this study is to assess the knowledge, attitude, and practice of HCWs regarding IPC measures at peripheral health facilities.

## Background

Primary health care facilities are the first point of contact for utilization of health care services. Adopting appropriate IPC measures in these settings helps to control the emergence and spread of infection in the community. Studies related to IPC have not been done at the primary health facility level till the date of this study.

At any one time, up to 7% of patients in developed countries and 10% in developing countries will acquire at least one HAI. These infections also present a significant economic burden at the societal level. However, a large percentage are preventable through effective IPC measures (1).

In the systematic review and meta-analysis of a study, the investigators analyzed pooled data from 220 selected publications from 1995 to 2008 where the prevalence of health-care-associated infections in developing countries was found to be 15.5 per 100 patients, at least double the rates published by the European Centre for Disease Prevention and Control (5) The risk of acquiring HAIs in developing countries is 2 to 20 times higher than in developed countries (6). In a fact-finding survey that was conducted to investigate the actual conditions of nosocomial infection control in Kathmandu City (2011), steady progress was observed in national hospitals in comparison with the results in 2003. Six hospitals had carried out in-service training over the past year, but seven hospitals responded that no staff had been trained. Manuals for infection control were used in 52.9% of the hospitals. An Infection Control Committee (ICC) was established in 41.2% of hospitals. In a comparison of nosocomial infection control conditions between 2003 and 2011, five national hospitals showed an improvement trend (7).

Nationally, some guidelines such as the Interim Guideline for IPC have been developed by the National Medical Council and the Infectious Disease Control Guideline by the Epidemiology and Disease Control division for providing a direction to IPC measures currently adopted (8).

An infection may cause no symptoms and be subclinical, or it may cause symptoms and be clinically apparent (9). In a point prevalence survey done in Switzerland in acute hospitals for HAI, common type of infection was surgical site infection (29%) and highest prevalence was identified in intensive care (20.6%) (10). On a study done on health care workers to assess knowledge, attitudes, and behavior in emergency departments in Italy, it was found that HCWs have high knowledge, positive attitudes, but low compliance concerning standard precautions (11).

## Methodology

A descriptive cross-sectional study was conducted where HCWs from the Kathmandu district were surveyed. The study process from proposal development to data collection and analysis was conducted from January to May 2022. Health care workers, either contracted or permanent, from municipalities of Kathmandu districts were surveyed. Five municipalities were selected randomly from a total of 10 municipalities, and 156 health workers were selected proportionately from 337 health workers. Simple random sampling was applied to select the participants from the list of HCWs obtained from each health section of the municipality office. The HCWs included doctors, nurses, auxiliary nurse midwives (ANM), health assistants (HA), and auxiliary health workers (AHW) of primary healthcare facilities and lab personnel, pharmacists and radiologists. The number may vary presently because of turnover and recruitment on a contract basis. The proportionate number required from each municipality was calculated as shown in Table 1.

A self-administered questionnaire was used to collect data from the representative sample. A questionnaire used in a similar study was used where the final version comprised questions related to demographic information and knowledge ($n$ = 14), attitudes ($n$ = 11), and practice ($n$ = 15) regarding infection control. Knowledge and attitude were assessed on a Likert-type scale (agree, 1 point; disagree or uncertain, 0 points), and behavior/practice items were categorized as always (1 point) and sometimes or never (0 points) (13). Data were analyzed using SPSS version 26. The study population included the health workers who are currently working at different government-based primary care facilities in different municipalities of the Kathmandu district. The necessary modifications were made to the questionnaire as per the requirement. The health workers who had recent transfers and those not willing to participate were excluded from the study.

*Table 1.* Proportion of participants from each municipality

| Municipalities | Total number | Required proportionate numbers |
|---|---|---|
| Kirtipur | 92 | 42 |
| Gokarneshwor | 58 | 27 |
| Budhanilkantha | 51 | 24 |
| Tarakeshwor | 91 | 42 |
| Tokha | 45 | 21 |
| **Total** | **337** | **156** |



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*Ethical considerations*

Ethical approval was obtained from the research ethics committee of the Institutional Review Committee (IRC) of the Institute of Medicine (IoM). Permission was obtained from the concerned municipality's authority before data collection. Verbal informed consent was obtained from all study subjects to allow the use of anonymous data in research. Confidentiality of the information was maintained.

## Results

*Demographic and educational characteristics*

Table 2 shows the demographic and educational characteristics of participants. Out of the total participants, 34% of them were male and 66% were female. The minimum age was 22 years and the maximum age was 59 years. Most participants were of the age group 20–40, that is 71.8%. The mean age of participants was 35.87 ± 9.19 years, and the average years of practice was 11.88 years. The median years of practice was 8 years. The participants were from different fields of the health sector consisting of various levels where the majority of the participants were Sr. ANM (20.5%) followed by HAs (19.2%). The majority of participants had the highest qualification of Proficiency Certificate Level (PCL) in general medicine and ANM course that is 26.3%.

*Basic characteristics and availability of basic amenities for infection prevention and control*

Out of the total participants, 48.7% had obtained training in IPC and 3.8% of the participants had studied abroad. Container for sharp disposal was unavailable in 10.3% of the participants' health facilities. Only 51.9% of the total sample had access to infection prevention control guidelines, and 37.2% of the participants had heard about methicillin-resistant *Staphylococcus aureus* as shown in Table 3.

Table 4 shows that out of the total participants, 1.9, 3.8, and 23.1% reported that they don't have a regular supply of masks, gloves, and aprons, respectively. When it comes to water supply, hand washing basin, soap, and hand sanitizer, 7.1, 5.1, 5.1, and 1.9%, respectively reported not having a continuous supply of these items.

*Descriptive findings of the statement of knowledge, attitude, and practice*

Knowledge

As the Table 5 shows, only 37.2% of participants had heard about methicillin-resistant *Staphylococcus aureus*, and 10.9% did not know that hepatitis B can be transmitted by needlestick injury. Likewise, 10.3% had no knowledge that gloves should be changed between each patient interaction, 17.3% were uncertain that gloves should be used while examining patients, 20.5% didn't have knowledge that invasive devices increase the risk of infection, and 26.3% disagreed with the statement that patient in critical condition increases the risk of infection. Similarly, 16% disagreed/were uncertain about the fact that inappropriate use of antibiotics increases the risk of infection and 14.1% disagreed/were uncertain regarding

*Table 2.* Demographic and educational characteristics ($n$ = 156)

| Characteristics | Number | Percentage |
|---|---|---|
| **Gender** | | |
| Female | 103 | 66 |
| Male | 53 | 34 |
| **Age group** | | |
| 20–30 | 56 | 35.9 |
| 30–40 | 56 | 35.9 |
| 40–50 | 29 | 18.6 |
| 50–60 | 15 | 9.6 |
| **Job title** | | |
| Sr. ANM | 32 | 20.5 |
| HA | 30 | 19.2 |
| Sr. AHW | 23 | 14.7 |
| ANM | 18 | 11.5 |
| Public Health Inspector (PHI) | 18 | 11.5 |
| Lab technician | 9 | 5.7 |
| AHW | 8 | 5.1 |
| Medical Superintendent/Officer | 8 | 5.1 |
| Staff Nurse/Nursing Inspector | 8 | 5.1 |
| Others | 2 | 1.3 |
| **Highest qualification** | | |
| PCL in General Medicine | 41 | 26.3 |
| ANM | 41 | 26.3 |
| Community Medicine Assistant (CMA) | 27 | 17.3 |
| Bachelors in Nursing | 10 | 6.4 |
| Bachelors in Medicine and Bachelors in Surgery (MBBS) | 7 | 4.5 |
| Nursing PCL | 7 | 4.5 |
| Others | 23 | 14.7 |
| Others | | |
| Paramedics | 19 | 82.6 |
| Master in Public Health (MPH) | 3 | 13.04 |
| Masters of Surgery | 1 | 4.35 |
| **Working ward** | | |
| Outpatient Department (OPD) | 76 | 48.7 |
| Maternal and Child Health (MCH) | 36 | 23.1 |
| Vaccination | 21 | 13.5 |
| Laboratory | 9 | 5.8 |
| Labor | 5 | 3.2 |
| Pharmacy | 1 | 0.6 |
| Radiology Department | 1 | 0.6 |

*Table 3.* Availability of basic requirements of infection prevention and control ($n$ = 156)

| Characteristics | Number | Percentage |
|---|---|---|
| **IP training obtained** | | |
| Yes | 76 | 48.7 |
| No | 80 | 51.3 |
| **Studied abroad** | | |
| Yes | 6 | 3.8 |
| No | 150 | 96.2 |
| **Container for sharp disposal** | | |
| Yes | 140 | 89.7 |
| No | 16 | 10.3 |
| **IP guideline** | | |
| Yes | 81 | 51.9 |
| No | 75 | 48.1 |
| **Heard of methicillin-resistant *Staphylococcus aureus*** | | |
| Yes | 58 | 37.2 |
| No | 98 | 62.8 |

the statement that strict compliance to infection prevention guidelines reduces the risk of hospital-acquired infection.

### Attitude

Table 6 shows the attitude of health workers towards infectious disease, 34.6% disagreed with the statement that patients with infectious diseases should be treated only in a specialist center, while 17.9% agreed with the statement that healthcare professionals refusing to provide care is understandable which is not a positive attitude. Similarly, 61.5% disagreed with the statement that fear of the health professionals of being infected by an infectious patient is understandable. All the participants agreed with the statement that health workers (staff) should be aware of aseptic policies, and 100% of the participants agreed that IPC training is important.

### Practice

Out of the total participants, regarding the questions on self-reported practice, 27.6% reported that they do not use waterproof aprons when there is a chance of blood and other bodily fluids spills, 9% of them reported not wearing clean and washed uniforms daily, and 12.8% reported not washing hands before and after examining the patients. Similarly, 48.7% of the participants reported that they consumed food and beverages in patients care area. Only 45.5% reported they don't recap used needles, and 74.4% reported that they protect themselves regardless of patient diagnosis status. A total of 19.9% reported that they change their usual care like being more cautious and taking strict hygiene measures if the patient has an infectious disease as shown in Table 7.

*Table 4.* Regular supplies of basic amenities ($n$ = 156).

| Regular supplies | Number | Percentage |
|---|---|---|
| **Mask** | | |
| Yes | 153 | 98.1 |
| No | 3 | 1.9 |
| **Gloves** | | |
| Yes | 150 | 96.2 |
| No | 6 | 3.8 |
| **Aprons** | | |
| Yes | 120 | 76.9 |
| No | 36 | 23.1 |
| **Availability of hand washing basin** | | |
| Yes | 148 | 94.9 |
| No | 8 | 5.1 |
| **Regular water supply** | | |
| Yes | 145 | 92.9 |
| No | 11 | 7.1 |
| **Availability of soap** | | |
| Yes | 148 | 94.9 |
| No | 8 | 5.1 |
| **Availability of alcohol-based hand sanitizer** | | |
| Yes | 153 | 98.1 |
| No | 3 | 1.9 |

#### *Maximum, minimum, mean and total score in knowledge, attitude, and practice sections*

Although the mean score of all three sections was high, that is 11.95 for knowledge, 8.75 for attitude, and 12.80 for practice section, only 15.4% answered the entire knowledge section, 3.2% entire attitude section, and 10.3% answered the entire practice section correctly. The minimum score of both knowledge and practice section was seven recorded by 1.9% of the participants, while that of attitude section was six scored by 1.3% of them as shown in Table 8.

The percentage of the participants who achieved the score ranging from minimum to maximum score is presented in Table 9. Maximum number of participants, that is 30.8% of the participants scored 13 in knowledge section, 40.4% of them in attitude section scored 9, and 39.7% of them in practice section scored 13.

#### *Correlation between independent variables age, years of practice and knowledge, attitude, and practice score*

While calculating the Spearman's correlation coefficient of knowledge, attitude and practice score with the independent variable (years in practice), there was a negative weak correlation between knowledge score and years of practice ($r$ = –0.184, $P$ = 0.023); that is, as the years of practice increase, knowledge of IPC tends to decrease.



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*Table 5.* Knowledge of healthcare workers on different IPC measures ($n$ = 156)

| Statements on knowledge | Agree % ($n$) | Disagree/Uncertain % ($n$) |
|---|---|---|
| Hospital infection transmitted between patients is caused by microorganisms | 95.5 (149) | 7 (4.5) |
| Hospital infection can be carried on the hands of health workers | 81.4 (127) | 18.6 (29) |
| Strict compliance to IP reduces the risk of hospital-acquired infection | 85.9 (134) | 14.1 (22) |
| Hospital instruments should always be sterilized | 99.4 (155) | 0.6 (1) |
| Invasive devices increase the risk of infection | 79.5 (124) | 20.5 (32) |
| Patients in critical conditions increase risk of infection | 73.7 (115) | 26.3 (41) |
| Inappropriate use of antibiotics increases the risk of infection | 84 (131) | 16 (25) |
| Hand should be washed before and after examining the patient | 99.4 (155) | 0.6 (1) |
| Gloves should be used while examining patients | 82.7 (129) | 17.3 (27) |
| Hands should be washed after gloves are used | 98.7 (154) | 1.3 (2) |
| Gloves should be changed between every patient | 89.7 (140) | 10.3 (16) |
| Use of gloves and aprons reduces the risk of infection | 99.4 (155) | 0.6 (1) |
| Hepatitis B can be transmitted by needle stick injury | 89.1 (139) | 10.9 (17) |
| Heard of methicillin-resistant *Staphylococcus aureus* | Yes | No |
| | 37.2 (58) | 62.8 (98) |

*Table 6.* Attitude of healthcare workers on different IPC measures ($n$ = 156)

| Statements on attitude | Agree % ($n$) | Disagree/Uncertain % ($n$) |
|---|---|---|
| Guidelines are necessary for the correct application of disinfection/sterilization procedures | 98.7 (154) | 1.3 (2) |
| It is necessary for health professionals to know whether a patient has an infectious disease | 94.2 (147) | 5.8 (9) |
| Patients with infectious diseases should be treated only in a specialist center | 65.4 (102) | 34.6 (54) |
| Healthcare professionals refusing to provide care for an infectious patient is understandable | 17.9 (28) | 82.1 (128) |
| The fear of health professionals of being infected by an infectious patient is understandable | 38.5 (60) | 61.5 (96) |
| Routine hand decontamination (e.g. handwashing) reduces the risk of infection in patients | 96.8 (151) | 3.2 (5) |
| Routine hand decontamination (e.g. handwashing) reduces the risk of infection in healthcare personnel | 98.7 (154) | 1.3 (2) |
| Hand decontamination between each patient protects both staff and patients | 98.1 (153) | 1.9 (3) |
| Advice should be given to patients and visitors about prevention and transmission of hospital-acquired infection | 99.4 (155) | 0.6 (1) |
| Staff should be aware of aseptic policies | 100 (156) | |
| Infection control training is important | 100 (156) | |

There was a negative weak correlation between age and knowledge score ($r$ = –0.174, $P$ = 0.03); that is, as the age of the health workers increases, the knowledge of IPC decreases.

A weak positive correlation was found between age and practice score ($r$ = 0.214, $P$ = 0.007); that is, as the age of the health workers increases, they are likely to adopt good practices in IPC measures.

### *Association of knowledge, attitude, and practice items with professional category and training status*

While finding the association between the knowledge of HCWs and their professional category, four items of the knowledge section had significant associations with the professional category which is presented in Table 10.

Doctors/paramedics are 3.038 times more likely to think that strict compliance to IP doesnot reduce the risk of hospital acquired infection. But, regarding the statement 'gloves should be used while examining the patients' and the statement 'gloves should be changed between every patient', the odds of participants from nursing profession disagreeing with those statements were 2.5 times and 3.194 more than doctors/paramedics respectively. Regarding knowledge of hepatitis B and its transmission by needle stick injury, the odds of disagreeing was 4.852 times more in nursing profession than in doctors/paramedics.

Those who had not obtained training of Infection prevention and control were 2.862 times more likely to disagree with the statement 'Health workers refusing to care infectious patient is understandable'; that is, training aided to the attitude of healthcare workers refusing to care infectious patient.

*Table 7.* Practice of healthcare workers on different IPC measures ($n$ = 156)

| Statements on practice | Always % ($n$) | Sometimes/Never % ($n$) |
|---|---|---|
| Wash hands before and after examining the patient | 87.2 (136) | 12.8 (20) |
| Dry hands after washing | 96.2 (150) | 3.8 (6) |
| Wear gloves when chances of contact with blood and bodily fluids | 100 (156) | 0 |
| Wash hands after removing disposable gloves | 98.7 (154) | 1.3 (2) |
| Wear waterproof aprons when chances of blood and other bodily fluids spill | 72.4 (113) | 27.6 (43) |
| Wear a mask when chances of blood and bodily fluids splashing | 96.8 (151) | 3.2 (5) |
| Wear clean and washed uniform daily | 91 (142) | 9 (14) |
| Dispose all contaminated items into a disposal bag | 99.4 (155) | 0.6 (1) |
| Immediately wipe up spills of blood and bodily fluids | 98.7 (154) | 1.3 (2) |
| Cover broken skin while coming to work | 92.9 (145) | 7.1 (11) |
| Change one's usual care if patient has infectious disease | 80.1 (125) | 19.9 (31) |
| Protect myself regardless of patient diagnosis status | 74.4 (116) | 25.6 (40) |
| Put used needles and sharps into the container | 98.1 (153) | 1.9 (3) |
| | Always/sometimes | Never |
| Recap used needles | 54.5 (85) | 45.5 (71) |
| Consume food and beverages in the patient care area | 48.7 (76) | 51.3 (80) |

*Table 8.* Participants scoring maximum, minimum, and mean score in knowledge, attitude, and practice sections ($n$ = 156)

| Section | Max% ($n$) | Min% ($n$) | (Max–Min) SD | Mean score |
|---|---|---|---|---|
| Knowledge | 15.4 (24) | 1.9 (3) | (14–7) 1.663 | 11.95 |
| Attitude | 3.2 (5) | 1.3 (2) | (11–6) 0.934 | 8.75 |
| Practice | 10.3 (16) | 1.9 (3) | (15–7) 1.428 | 12.80 |

*Association between specific supplies and good medical practice*

There was a significant association between the availability of water and washing of hands, that is, the odds of not washing hands was 4.607 times more among those who had irregular water supply. There was no significant association between availability of aprons and wearing of aprons when there are chances of blood and bodily fluids spills as presented in Table 11.

## Discussion

This study of HCWs identified good levels of knowledge and positive attitude towards IPC, but the maximum score of the entire knowledge, attitude, and practice section was obtained by only 15.4, 3.2, and 10.3% of participants respectively. In contrast, in a study conducted on Nepalese health care workers, the above indicators were 16, 14, and 0.3% respectively. Comparing them gives a similar score in the knowledge section, while the attitude section score was relatively lower in our study and practice score was greater in our study (13). A similar study conducted in Iran showed greater scores of knowledge, attitude, and practice than this study having scores of 66, 52, and 20% respectively (12), and another study in Italy reported a score of 53% for knowledge section (14).

*Table 9.* Total score achieved per section ($n$ = 156)

| Score | Knowledge % ($n$) | Attitude % ($n$) | Practice % ($n$) |
|---|---|---|---|
| 6 | - | 1.3 (2) | - |
| 7 | 1.9 (3) | 4.5 (7) | 1.9 (3) |
| 8 | 2.6 (4) | 34.6 (54) | - |
| 9 | 4.5 (7) | 40.4 (63) | - |
| 10 | 10.3 (16) | 16 (25) | 2.6 (4) |
| 11 | 12.2 (19) | 3.2 (5) | 9.0 (14) |
| 12 | 22.4 (35) | | 18.6 (29) |
| 13 | 30.8 (48) | | 39.7 (62) |
| 14 | 15.4 (24) | | 17.9 (28) |
| 15 | | | 10.3 (16) |

In this study, lower knowledge was seen in the statement 'Invasive devices increase the risk of infection' (79.5%), and 26.3% did not have knowledge about the statement 'A patient in critical conditions increases the risk of infection', while 62.8% did not have knowledge of methicillin-resistant *Staphylococcus aureus*. Only 37.6% of doctors/paramedics and 36.2% of nurses had knowledge of methicillin-resistant *Staphylococcus aureus* compared to the reference article of this study in which 86% of doctors and 25% of nurses had knowledge of *Staphylococcus aureus* (12), while another study conducted in the UK reported 100% awareness among health care workers (15). But this difference may be due to the sample selected in this study which included peripheral level health workers who had fewer opportunities for continued medical education, refresher training, and IPC training. Self-reported compliance with handwashing in this study was found to be 87.2% which



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*Table 10.* Association of different statements with professional category and training status ($n$ = 156)

| Statements | Disagree | Agree | Chi square value | *P* value | Odds ratio |
|---|---|---|---|---|---|
| **Knowledge: Strict compliance to IP reduces the risk of hospital-acquired infections** | | | | | |
| Doctors/paramedics | 18 (18.4) | 80 (81.6) | 3.958 | 0.047 | 3.038 |
| Nursing | 4 (6.9) | 54 (93.1) | | | |
| **Knowledge: Gloves should be used while examining patients** | | | | | |
| Nursing | 15 (25.9) | 43 (74.1) | 4.721 | 0.03 | 2.5 |
| Doctors/paramedics | 12 (12.2) | 86 (87.8) | | | |
| **Knowledge: Gloves should be changed between every patient** | | | | | |
| Nursing | 10 (17.2) | 48 (82.8) | 4.894 | 0.027 | 3.194 |
| Doctors/paramedics | 6 (6.1) | 92 (93.9) | | | |
| **Knowledge: Hepatitis B can be transmitted by needle stick injury** | | | | | |
| Nursing | 12 (20.7) | 46 (79.3) | 9.117 | 0.003 | 4.852 |
| Doctors/paramedics | 5 (5.1) | 93 (94.9) | | | |
| **Attitude: Health workers refusing to care for an infectious patient is understandable** | | | | | |
| Training not obtained | 18 (22.5) | 62 (77.5) | 5.115 | 0.024 | 2.862 |
| Training obtained | 7 (9.2) | 69 (90.8) | | | |

*Table 11.* Association between specific supplies and good medical practice

| Statements | Sometimes/never | Always | Chi-square value | *P* value | Odds ratio |
|---|---|---|---|---|---|
| **Wash my hands before and after examining patients** | | | | | |
| Irregular water supply | 4 (36.4) | 7 (63.6) | 5.869 | 0.036* | 4.607 |
| Regular water supply | 16 (11.0) | 129 (89.0) | | | |
| **Wear waterproof aprons when chances of blood and bodily fluids spills** | | | | | |
| Aprons not available | 12 (33.3) | 24 (66.7) | 0.780 | 0.377 | 1.435 |
| Aprons available | 31 (25.8) | 89 (74.2) | | | |

*Fisher's exact *P* value

was greater than the reference study done on Nepalese health care workers (70%) (12) and those studies done in the UK (54.43%) (16), US (23% before- 48% after) (17) and France (66.2% in 1997) (18), where compliance with handwashing was reportedly < 50%. In this study, 48.7% were given IPC training which is slightly greater than the reference study outcome (27%). There is a growing belief that the technical understanding of infection alone may be insufficient for infection control, and that education must also address issues such as availability of infection control guidelines, risk of cross-transmission, and indications for hand hygiene during patient care (19).

A total of 10.9% of the participants of this study did not have knowledge that hepatitis B can be transmitted by needle stick injury which is one of the important aspects of needle safety and preventing various health-facility-acquired infections.

The positive attitude of HCWs regarding the care of infectious patients was more among those who did not have IP training. It implies that by means of training, they understood the severity of infectious disease transmission, while they didn't consider their professional obligation of treating infectious patients by applying appropriate IPC measures.

Knowledge regarding needle stick injury and appropriate glove use was more lacking in those in nursing profession than in doctors/paramedics, while doctors/paramedics disagreed that strict compliance to IP reduces the risk of hospital-acquired infection. This lack of knowledge on needle stick injury and glove use might increase the risk of infections.

The Spearman correlation between knowledge attitude, practice, score with years of practice and age was very weak so, significance may have been due to effect size.

### *Limitations*

This was a cross-sectional study and there was no follow-up; this could have overestimated or underestimated the indicators of this study. The possible bias in self-reporting knowledge, attitude, and practice was that the participants were reluctant to express a lack of

knowledge, negative attitude, and ineffective practice. There was no possibility of an observational study of practices of IPC because of the limited time for data collection.

## Conclusion and recommendation

Although the mean score of knowledge, attitude, and practice was high, the percentage of participants who answered the entire knowledge, attitude, and practice section correctly was found to be very low. The health workers who had not taken the IP training were seen to be more willing to take care of infectious patients. Nurses significantly had lower knowledge on the transmission of hepatitis B by needle stick injury than doctors/paramedics. The odds of not washing hands was higher among those who had irregular water supply compared to those who had regular water supply.

Along with this, for the effective implementation of IPC, it is necessary to have sufficient supplies of masks, gloves, aprons, water, a hand washing basin, soap, hand sanitizer, and a container for disposal of sharps at every health facility. Orientation programs should be organized to support the staff of each health facility for the correct implementation of disinfection procedures. Targeted education should be provided to improve nurses' understanding of IPC practices, including needle safety and glove use. Since IP training was not seen to improve the attitude of health workers, it is recommended to emphasize the importance of IPC guidelines, risk awareness, and professional obligations in patient care in infection prevention training.

Public health authorities should therefore supervise and provide the necessary equipment to the health facilities and routinely assess the knowledge, attitude and practice of HCWs. This would help to improve the knowledge, develop positive attitude and adopt appropriate practices among HCWs. There has not been any survey related to the knowledge, attitude, and practice of HCWs on IPC conducted at the primary health facility level to date. Therefore, comparison of this study was not possible with the national statistics. The results might not be generalizable to national scenarios; but, since the national interventions in IPC are same for all the primary level health facilities, it might be probable that the other regions also have similar situations.

## Conflict of interest and funding

The authors have no conflict of interest to declare. All co-authors have seen and agreed with the contents of the manuscript. There was no funding for carrying out this study.

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***Karuna Bhandari**
Maharajgunj, Kathmandu 44600, Nepal
Email: bhandarikaru28@gmail.com