**Journal of Public Health International**

Open Access - Peer-Reviewed - ISSN 2641-4538

Portico Archived | Crossref DOI | CC BY 4.0 Licensed

Research Article

# Knowledge, Attitudes and Practices towards Infection Prevention Control among Healthcare Workers in Selected Hospitals Located in Karongi district, Rwanda

**Jean Claude Haguminshuti [1], Ernest Safari [1], Monica Mochama [1], Erigene Rutayisire [1*]**

[1] Public Health Department, Mount Kenya University Rwanda

*** Correspondence:** Erigene Rutayisire, Public Health Department, Mount Kenya University Rwanda

**Published citation:** Jean Claude Haguminshuti, Ernest Safari, Monica Mochama, Erigene Rutayisire (2022) **Knowledge, Attitudes and Practices towards Infection Prevention Control among Healthcare Workers in Selected Hospitals Located in Karongi district, Rwanda**. *Journal of Public Health International* - 6(1):12-24. https://doi.org/10.14302/issn.2641-4538.jphi-22-4343

**Article DOI:** 10.14302/issn.2641-4538.jphi-22-4343

## Abstract

Most hospitals have infection prevention and control committees but some of them are struggling to maintain and to apply infection prevention and control protocols due to lack of enough resources. Healthcare workers' (HCWs) knowledge, attitude and practices (KAP) of infection prevention and control procedures are crucial for effective infection prevention and control (IPC). The study aimed to assess HCW's KAP towards IPC in Rwanda. A cross-sectional hospital based study was directed in three hospitals in Karongi district from February to March 2022. Data were collected from 215 healthcare workers using a pre-tested self-administered questionnaire using a stratified sampling technique. Data were collected, checked, coded, and entered into the Kobo Collect Toolbox before being transferred to SPSS version 21 for analysis. Bivariate and multiple logistic regression analyses were performed. The KAP Score was also calculated. P-values of less than 0.05 were considered statistically significant. We found that 50.7% of HCWs were males, 63.3% were between the ages of 18 and 58.2% had a secondary education. The overall 78.6% of HCWs demonstrated high level of knowledge, 79.5% with a positive attitude, and 63.3% with good IPC practice. The results revealed that being over 45 years old(AOR=3.1;95%CI=(2.16-5.25); p=0.024), having university level(AOR=3.3; 95%CI=(1.56-7.56);p=0.035), working experience between 5-10 years(AOR=1.7; 95%CI=(1.37-5.45); p=0.003), having high level of knowledge (AOR=2.7;95%CI: (1.68–7.95); p=0.045) and positive attitude(AOR=2.3; 95%CI:(1.36-7.72); p=0.017) towards IPC were associated with IPC good practice. Improving institutional supplies such as hand hygiene supplies, PPE, water supply and other facilities can improve safe infection prevention and control.

**Keywords:**
Knowledge; Attitudes; Practices; Infection prevention and control; Healthcare workers



| Article Information | |
|---|---|
| **Academic Editor** | Qiang Cheng, Biomedical Informatics Institute, Computer Science Department, University of Kentucky Lexington |
| Received Date | 12 October 2022 |
| Accepted Date | 18 October 2022 |
| Published Date | 26 October 2022 |
| Online | 26 October 2022 |
| Publication | Volume 6; Issue 1; Pages 12–24 |
| Copyright | © 2022 Jean Claude Haguminshuti, et al. |
| License | This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.<br>https://creativecommons.org/licenses/by/4.0/ |



## Introduction

The nosocomial infections and the related ones are known as infections emerging successively in the practice of care in a healthcare facility that was not existing/incubating at the time the client was admitted, complained after discharge or developed to facility personnel [1]. Studies revealed that ten percent of patients hospitalized mostly in countries of all economic status either developed or none developed suffer from those infections and consequently emanate in adverse negative impacts/outcomes such as length of stay, mortality, poverty and morbidity. In addition, in developing countries, the significant number/majority (90%) of these infections occurred [2,3,4]. The findings from various researchers showed that the burden of health care acquired infections were associated with poor risk reflection to infection prevention programs, which was not considered by authorities, unhygienic practices [5,6]. The moderate and efficient intervention for infection prevention are available and feasible but still the prevalence of such infections is still high in mostly under developed countries [7,8,9] and 15% in Ethiopia [6]. On world context, risks on contamination mount to 3% for HIV prevalence and hepatitis on 40% [10].

Annually due to occupational exposure, infection cases emerge continuously on the following scale to medical providers. More importantly, the fore mentioned infections can be prevented and controlled through effective IPC measures and significantly minimize the risks among health professionals [11].

The report from health international bodies presents that nearly 100,000 of two million patients die every year suffer from hospital-acquired infections. IPC non compliance the staff who mal-practice infection prevention measures had Hepatitis B, C and HIV infections. Thus, healthcare professionals are major front liners for protecting clients and themselves from infection [12].

Annually worldwide more than three million exposures are reported by World Health Organization, in Africa data indicate that needle stick injuries occur on average of range of two and four annually in South Africa Nigeria and Tanzania, while on medical staff the average injuries are 2.1 [13]. Reports indicate that precautions, including aseptic techniques, Overseeing injuring materials eg syringes and the likes, linen, spills, and maintaining of autonomous space, are tangible effective in preventing occupational exposures and mostly associated infections [14].

High-income countries follow IPC Standard Precautions to protect healthcare Workers from occupational exposure to blood and the risk of infection with blood-borne pathogens. In low-income countries, where standard accommodation is sometimes used, the situation is different [15].

Epidemiologically, the burden of health the nosocomial infection is also significantly high among low income earner's countries [16].Despite the fact that the feasible interventions with minimum costs, the meekness/acceptance with guidelines and policies for control practices remains no positive outcome [17].

Concession/compliance by medical personnel who make attention in service been proved as core role players to prevent and set mitigations in fighting nosocomial infections. The mentioned remedial outputs guarantee the safety of health facility workers and clients, the most among precautions highlighted are proper hand hygiene and use of PPES [18].

Even if the previous practices and interventions to curb down these infections at health facilities, still high prevalence remains persisting in our health facilities to our clients even the health personnel [19]. Furthermore, limited resources, a multi-sectorial approach plays a major concern based on improved healthcare infrastructures and facility structures, effective guidelines, behavioral changes, increased KAP adjustments, including efficient use of existing resources [20].

The health system of Rwanda achieved tangible efforts with positive progress in the area of disease burden reduction, country wide. That makes the strong need for personnel trainings on the subject matter at all health facilities levels [21]. Nevertheless various researches engrossed on knowledge of and pertaining with IPC precautions and preventive guidelines and SOPs. The research findings/insights have been generated on HCWs in hospitals about the subject matter was proved to be finite [22]. As far as there has been no similar study focusing on IPC in Kibuye, Kirinda and Mugonero hospitals, this study will aim to assess the healthcare workers' KAP in Rwanda. Another reason for this study is that the IPC standards in accreditation assessment has marked Karongi district at a low score with 42%. The overall objective of this study will be assessment for knowledge, attitude and practice (KAP) towards (IPC) among healthcare workers (HCWs) in Rwanda.

## Methods

### *Research Design*

This study was a descriptive cross-sectional study design. This research was a quantitative study in nature. This study aims to assess the HCWs'KAP towards IPC in Rwanda. The sample size for this study equals to 215 healthcare workers. A stratified sampling or cluster sampling was considered to identify the sample unit. Strata were constituted of hospitals targeted by this study. A self-completed questionnaire was used for data collection. Data entry and statistical analysis were performed using SPSS version 21. This study was conducted at Kibuye, Mugonero and Kirinda Hospitals located in Karongi district, Rwanda.

Karongi is a district in Western Province of Rwanda and it is divided into 13 sectors: Bwishyura, Gishyita, Gashari, Gitesi, Mubuga, Murambi, Murundi, Mutuntu, Rubengera, Rugabano, Ruganda, Rwankuba and Twumba. The 4th Rwanda Population and Housing Census (PHC4) counted 331,808 people in Karongi District, accounting for 13.4 percent of the Western Province's total population [23].

### *Target population*

According to hospital administration, Kibuye Hospital accounts for 187 HCWs, Kirinda Hospital has 132 HCWs and Mugonero Hospital accounts for 147 HCWs. This study was targeting a population of 466 healthcare workers working in those three hospitals (Karongi Integrated Personnel and Payroll System, 2021).

### *Sampling Design and Sampling Procedures*

Yamane's formula was used to estimate the sample size. When the researcher has a finite population and the population size is known, this formula is used [24].

The following formula was used: $n = N/(1+N(e)]^2$

Where:

n =corrected sample size,

N =population size, and,

e =margin oferror equals to 5% or 0.05 at 95% confidence interval.

Hereafter, $n = 466/[1+466(0.05)^2] = 215.2 \sim 215$

With a 95 percent confidence interval of 5 percent marginal error, the sample size for this research is 215 HCWs to be examined. The 215 HCWs were distributed proportionally within Kibuye, Kirinda and Mugonero Hospitals.

### *Inclusion and Exclusion Criteria*

Every healthcare worker who was working in the selected department (Doctors, Health officers, Midwives, Nurses, X-ray Technician, and Pharmacy laboratory staff) and who have worked at least 3 months in these hospitals was involved. Healthcare workers absent during data collection for annual leave or other reasons were excluded.

## Data Collection Procedure

For data collection, a self-administered questionnaire (SAQ) was distributed at the HCWs' work unit. The tool was created using a modified CDC Infection Prevention and Control tool for acute care hospitals [15] and related kinds of literature [26,27] and [28] and modified according to Rwanda context.

### *Data Processing and Analysis*

SPSS v.21 was used for data entry and statistical analysis. Socio-demographic characteristics were calculated using descriptive statistics such as frequencies and percentages and continuous variables expressed as means and standard deviations. The cut-off values were scores less than 60%, which were seen as low knowledge, negative attitudes, or bad practices, while those higher than 60% were seen as high knowledge, positive attitudes, and good practices. The KAP score was calculated by adding the total scores for each respondent. To assess the relationship between dependent and independent variables, bivariate and multivariate logistic regressions were used. Variables with a p-value less than 0.05 ($p<0.05$) in the bivariate analysis were then entered into a multivariable logistic regression to control for the effect of confounders. The statistical significance was confirmed at $p < 0.05$ with 95% of Confidence interval (CI).

### *Ethical Considerations*

The researcher considered ethical issues concerning research ethics. Mount Kenya University's Institute of Postgraduate Studies and Research has provided ethical clearance and an introduction letter. These documents were presented to the Karongi district administration in order to obtain permission to conduct the research. Prior to completing the pre-tested self-administered questionnaire, the sampled respondents signed an informed consent form. By coding questionnaires, storing data in a password-protected database, and only using data for academic purposes, confidentiality was always maintained.

## Results

### *Socio-Demographic Characteristics of The Respondents*

According to Table 1, 40.0 percent of respondents were from Kibuye Hospital, 50.7 percent were males, 63.3 percent were between the ages of 18 and 35 (mean age: 34.7 years, SD: 8.5, minimum age: 20 and maximum age: 58), married (66.0 percent), 58.2 percent had a secondary education level, more than half (50.2 percent) were nurses, and 52.6 percent had less than 5 years of experience.

### *Knowledge Towards IPC in Three Hospitals of Karongi District*

According to Table 2, the majority (95.8 percent) of respondents knew that disinfection prevents HCAIs, 90.7 percent believed that antiseptic prevents HCAIs, 56.7 percent believe that chemical sterilization is used for all equipment, 63.7 percent believe that physical sterilization (heat/radiation method) is used

**Table 1.** Sociodemographic characteristics of the respondents

| Variables | | Frequency (n) | Percent (%) |
|---|---|---|---|
| Hospital | Kibuye Hospital | 86 | 40.0 |
| | Kirinda Hospital | 61 | 28.4 |
| | Mugonero Hospital | 68 | 31.6 |
| Gender | Male | 109 | 50.7 |
| | Female | 106 | 49.3 |
| Age category | 18-35 years | 136 | 63.3 |
| | 36-45 years | 44 | 20.5 |
| | More than 45 years | 35 | 16.2 |
| Marital status | Single | 73 | 34.0 |
| | Married | 142 | 66.0 |
| Level of education | Primarylevel | 8 | 3.7 |
| | Secondary level | 125 | 58.2 |
| | University | 82 | 38.1 |
| Occupational status | Physicians | 18 | 8.4 |
| | Nurses | 108 | 50.2 |
| | Midwifes | 27 | 12.6 |
| | Lab technicians | 23 | 10.7 |
| | Administrative officers | 11 | 5.1 |
| | Cleaners | 28 | 13.0 |
| Work experience | <5 years | 113 | 52.6 |
| | 5-10 years | 58 | 27.0 |
| | >10 years | 44 | 20.4 |

Source: Primary data (2022)

for all equipment, and 61.4 percent believe that autoclaviation destroys all microorganisms including spores.

### *Overall Knowledge Score*

The SPSS score assessment was used to assess nine (9) questions related to IPC knowledge, and the score was two (2) marks for a right answer and zero (0) for a false answer. By adding the scores for each respondent across all nine (9) questions, an overall knowledge score was calculated. According to Table 3, 78.6 percent of respondents had a high level of knowledge about IPC, while 21.4 percent had a low level of knowledge about IPC. The mean knowledge score for all respondents was 11.7 out of a possible 18 (standard deviation = 1.4). The minimum and maximum scores were 10 and 16, respectively.

**Table 2.** Responses-related to the respondent's knowledge towards IPC

| Variables | Frequency (n) | Percent (%) |
|---|---|---|
| Disinfection prevents health care acquired infections. | | |
| Corrects answers | 206 | 95.8 |
| Incorrect answers | 9 | 4.2 |
| Antiseptic prevents health care acquired infections. | | |
| Corrects answers | 195 | 90.7 |
| Incorrect answers | 20 | 9.3 |
| All equipment is sterilized using a chemical process. | | |
| Corrects answers | 93 | 43.3 |
| Incorrect answers | 122 | 56.7 |
| For all equipment, physical sterilization (heat/radiation technique) is used. | | |
| Corrects answers | 78 | 36.3 |
| Incorrect answers | 137 | 63.7 |
| Autoclaving destroys all microorganisms, including spores. | | |
| Corrects answers | 132 | 61.4 |
| Incorrect answers | 83 | 38.6 |
| Each equipment needs decontamination before sterilization. | | |
| Corrects answers | 175 | 81.4 |
| Incorrect answers | 40 | 18.6 |
| Personal protective equipment minimizes health care acquired infection. | | |
| Corrects answers | 199 | 92.6 |
| Incorrect answers | 16 | 7.4 |
| Wearinggloves replace the need for handwashing. | | |
| Corrects answers | 62 | 28.8 |
| Incorrect answers | 153 | 71.2 |
| There is PPE for HIV after exposure. | | |
| Corrects answers | 209 | 97.2 |
| Incorrect answers | 9 | 2.8 |

Source: Primary data (2022)

*Participants' Attitudes Towards IPC in Three Hospitals of Karongi District*

According to the findings in Table 4, 45.1 percent of participants agreed that when caring for a patient, they must be concerned about exposing their family and friends to the risk of infection HCAIs. 58.1

**Table 3.** Distribution of respondents' knowledge, Attitude and Practices towards IPC

| | Frequency (n) | Percent (%) |
|---|---|---|
| Level of knowledge about IPC | | |
| Low (Score <60%) | 46 | 21.4 |
| High (Score ≥ 60%) | 169 | 78.6 |
| Minimum score: 10.0 | Mean score:11.7 ; Stand. Dev.:1.4 | |
| Maximum score: 16.0 | | |
| Attitudes towards IPC | | |
| Negative (Score < 60%) | 44 | 20.5 |
| Positive (Score ≥ 60%) | 171 | 79.5 |
| Minimum score: 6.0 | Mean score:22.2; Stand. Dev.:6.3 | |
| Maximum score: 30.0 | | |
| Practice towards IPC | | |
| Poor (Score < 60%) | 79 | 36.7 |
| Good (Score ≥ 60%) | 136 | 63.3 |
| Minimum score: 10.0 | Mean score:11.8; Stand. Dev.:2.1 | |
| Maximum score: 20.0 | | |

Source: Primary data (2022)

percent of HCWs in their institution are concerned about acquiring HCAIs while caring for patients; 44.2 percent agreed that washing hands before and after contact with patients reduces the risk of acquiring HCAIs; 70.2 percent agreed that PPE protects HCWs from infections. In the absence of standard safeguards, 42.3 percent agreed that Infection and nosocomial diseases can occur in health care facilities, while 34.0 percent disagreed that the threat of occupational infections between health workers in their workplaces is high.

### *Overall Attitude Score*

Each respondent's overall score for the setting was calculated by combining the scores of the six (6th) attitude-related questions. The answers were graded on a scale of 0 to 5. The responses were graded on a Likert scale. According to the results in Table 3, 79.5 percent of respondents have a positive attitude toward IPC, while 20.5 percent have a negative attitude toward IPC. The average attitude rating for all respondents was 22.2 (standard deviation = 6.3, minimum score = 6 points, maximum score = 30 points).

### *Practices Towards IPC in Three Hospitals of Karongi District*

The findings in Table 5 revealed that the majority of respondents (97.2 percent) wash their hands before caring for patients, 94.9 percent wash their hands using soap after patient care/contact with fluid, 65.6 percent did not wash their hands without using soap before and after patient care, 88.4 percent were using PPEs from where the majority of respondents (98.1 percent) protect themselves against HCAIs by using gloves, 91.2 percent are wearing face masks, 70.2 percent are wearing face masks. Almost all participants (96.3%) confirmed the presence of written infection control policies and procedures in their workplace, and 55.8 percent recapped needles before disposal. More than half (67.0 percent) had a history of blood, fluid, or stick injury contact. Following that, 39.0 percent of respondents used post-

**Table 4.** Responses-related to the respondent's attitudes towards IPC

| Variables | n (%) | | | | |
|---|---|---|---|---|---|
| | Strongly disagree | Disagree | Neutral | Agree | Strongly agree |
| When caring for a patient, you must be concerned about exposing your family and friends to HCAIs. | 21(9.8) | 23(10.7) | 17(7.9) | 97(45.1) | 57(26.5) |
| HCWs at my facility are concerned about contracting HCAIs while caring for patients. | 15(7.0) | 20(9.3) | 12(5.6) | 125(58.1) | 43(20.0) |
| Washing hands before and after contact with patients reduces the risks of getting HCAIs. | 19(8.8) | 15(7.0) | 4(1.9) | 95(44.2) | 82(38.1) |
| I believe PPE protects HCWs from infection. | 2(0.9) | 22(10.2) | 13(6.0) | 151(70.2) | 27(12.6) |
| In the absence of standard precaution, Infection and nosocomial diseases can occur in health care facilities. | 14(6.5) | 10(4.7) | 21(9.8) | 91(42.3) | 79(36.7) |
| In your workplace, there is a high risk of occupational infection among health workers. | 19(8.8) | 73(34.0) | 33(15.3) | 71(33.0) | 19(8.8) |

Source: Primary data (2022)

exposure prophylaxis (PEP) after being exposed to blood or sticky injury, 29.2 percent used alcohol to clean themselves, and 51.3 percent washed them with water. In terms of prevention, 91.6 percent of hospitals provided HCAI health education to patients, 95.8 percent confirmed that their hospitals had a competency-based hand hygiene training program, and 97.2 percent acknowledged that supplies needed for hand hygiene adherence are readily available in their patient care areas. (Table 5)

**Table 5.** Responses-related to the respondent's practices towards IPC

| Variables | | Frequency (n) | Percent (%) |
|---|---|---|---|
| Wash hands using soap before patient care | Yes | 209 | 97.2 |
| | No | 6 | 2.8 |
| Wash hands using soap after patient care/contact with fluid | Yes | 204 | 94.9 |
| | No | 11 | 5.1 |
| Wash hands without using soap before and after patient care | Yes | 74 | 34.4 |
| | No | 141 | 65.6 |
| Are using personal protective equipment (PPE) when taking care of patients? | Yes | 190 | 88.4 |
| | No | 25 | 11.6 |
| What kind of PPE are you using in patient care? (n=190) | Gloves | 186 | 98.1 |
| | Goggles | 112 | 59.1 |
| | Face masks | 173 | 91.2 |
| | Gown | 133 | 70.2 |

**Table 5 (continued)**

| Variables | | Frequency (n) | Percent (%) |
|---|---|---|---|
| | Other PPE | 25 | 13.0 |
| There are written infection control policies and procedures available. | Yes | 207 | 96.3 |
| | No | 8 | 3.7 |
| Recapping needles before disposing | Yes | 120 | 55.8 |
| | No | 95 | 44.2 |
| Ever had contact with blood, liquids or puncture wounds | Yes | 144 | 67.0 |
| | No | 71 | 33.0 |
| What are the IPC measures adopted after being exposed to blood/stick injury? (n=144) | Taking PEP | 56 | 39.0 |
| | Cleaning by alcohol | 42 | 29.2 |
| | Washing with water | 74 | 51.3 |
| Giving health education to the patients about HCAIs | Yes | 197 | 91.6 |
| | No | 18 | 8.4 |
| The hospital has a competency-based hand hygiene training program. | Yes | 206 | 95.8 |
| | No | 9 | 4.2 |
| Supplies necessary for adherence to hand hygiene are readily accessible in patient care areas. | Yes | 209 | 97.2 |
| | No | 6 | 2.8 |

Source: Primary data (2022)

*Overall Practice Score*

The 'practice' section included ten (10) IPC-related questions that were graded individually for each respondent. If a respondent gave the correct answer, they received two points. If he/she gave a false response, he/she received a zero. Each respondent received an overall practices score by adding the scores from the ten practice-related questions. According to the research findings presented in Table 3, 63.3 percent of respondents had "good practice" towards IPC, while 36.7 percent had "poor practice." The overall mean practice score was 11.8 (SD = 2.1). The minimum score was 10 and the maximum score was 20.

*Factors Associated with IPC in Three Hospitals of Karongi District*

Age, educational level, work experience, level of knowledge, and attitude toward IPC practices were factors that were significantly associated with IPC practice in the bivariate analysis. However, in the multivariate analysis, all variables were found to be meaningfully associated with IPC practice (Table 6). HCWs over the age of 45 were about 3.1 times more likely to engage in infection prevention activities than those between the ages of 18 and 35 (AOR = 3.1; 95 percent CI = (2.16-5.25); p=0.024). In terms of educational level, HCWs with a university level were 3.3 times (AOR = 3.3;95 percent CI = (1.56-7.56); p=0.035) more likely to practice Infection prevention activities than medical staff with diplomas (Table 4.9). Furthermore, HCWs with 5 to 10 years of experience had a higher likelihood

**Table 6.** Multivariate analysis on factors associated with IPC practices

| Variables | Items | Crude OR (95%CI) | P-value | Adjusted OR (95%CI) | P-value |
|---|---|---|---|---|---|
| Age category | 18-35 years | Ref. | | Ref. | |
| | 36-45 years | 2.1(1.78-5. 93) | 0.412 | 0.14(0.03-3.22) | 0.342 |
| | > 45 years | 2.7(1.9-5.07) | 0.017 | 3.1(2.16-5.25) | 0.024 |
| Level of education | Primary | Ref. | | Ref. | |
| | Secondary | 2.9(1.46-7.98) | 0.079 | 2.5(1.25-7.89) | 0.061 |
| | University | 2.4(1.19-6.89) | <0.001 | 3.3(1.56-7.56) | 0.035 |
| Work experience | <5 years | Ref. | | Ref. | |
| | 5-10 years | 3.1(1.92-4.89) | <0.001 | 2.9(1.37-5.45) | 0.003 |
| | >10 years | 2.1 (1.37-3.27) | 0.001 | 1.2 (0.69-1.97) | 0.561 |
| Level of knowledge | Low | Ref. | | Ref. | |
| | High | 2.6(1.48-6.98) | 0.031 | 2.7(1.68–7.95) | 0.045 |
| Attitude | Negative | Ref. | | Ref. | |
| | Positive | 2.5(1.70-7.44) | 0.014 | 2.3(1.36-7.72) | 0.017 |

Source: Primary data (2022)

of achieving infection prevention practices/activities than those with less than five years of experience (AOR = 1.7; 95 percent CI = (1.37-5.45); p=0.003) (Table 6).

According to multiple regression analysis, the odds of having good practice towards IPC were 2.7 times higher (AOR=2.7; 95 percent CI: (1.68-7.95); p=0.045) among HCWs with a high level of knowledge towards IPC compared to those with a low level of knowledge, and the odds of having good practice towards IPC were 2.3 times higher (AOR=2.3; 95 percent CI: (1.36-7.72); p=0.017) among those with.

## Discussion

According to this study, 78.6 percent of healthcare workers are knowledgeable about infection prevention and control. This result indicates that a high proportion of medical staff in the three hospitals studied have infection prevention and control skills, consistent with similar and related studies in Zambia (74.4 percent) [29]. The study finding was better than studies done in Nigeria(65%) [30],Nepal (22%) [31], Palestine (53.9%) [32] and Iran hospital (57%) [33]. Due to a difference in knowledge scores; despite being lower than studies done in Bahirdar city, 84.5 percent [27] and in Ethiopia (84.7%) [34], Addis-Abeba [26] and Dessie Referral Hospital (95.7%) [28]. This difference could be attributed to a lack of in-service training, a small sample size, or socio-demographic differences.

According to the findings of this study, approximately three-quarters (79.5 percent) of the respondents had positive attitudes toward IPC. This could be because the study was conducted during a novel coronavirus pandemic (COVID-19), during which people were more sensitive to IPC measures. Though, a similar study found a higher percentage (93.4 percent) of HCWs with a positive attitude toward IPC [22]. Another study found that a lower percentage (55.6 percent) of HCWs had a positive attitude toward infection prevention [27]. The differences observed in these studies could be attributed to differences in the study setting and study participant composition. A positive attitude towards IPC is preferred as it is believed to lead to best practices that are protective for healthcare workers.

According to a study directed in an Egyptian hospital, 63.3 percent of healthcare workers practice good infection prevention and control activities (67.1 percent) [35] and in Bahirdar city(64.2%) [27]. However, this is much lower than studies conducted in Dessie referral hospital, Ethiopia (87.5%) [28], Nepal (73.0%) [31] and Palestine (91.1%) [32]. This difference could be attributed to differences in infection prevention knowledge, methodology, sample size, socio-demographic differences, a lack of education and infection prevention services, and professional noncompliance with infection prevention.

In this study, age is one of the significant factors in infection prevention and control practice. It showed that health workers older than 45 years were about 3.1 times more likely to practice infection prevention and control activities than those who were 1835 years old. This is comparable with other studies conducted in Northwest Ethiopia [36] and in Wolaitta SodoOtona teaching and referral hospital [22]. This could be due to the fact that years of service increase with age; this, in turn, improves their performance over time.

In terms of educational attainment, higher levels of education were positively associated with better infection prevention intervention implementation than lower levels of education. This finding contradicts a study conducted in the Amhara region [36]. The difference could be due to sampling size, differences in study participants, or misreporting or self-reporting. This may also be due to the fact that higher educated healthcare workers may have acquired essential information, leading to the acquisition of infection prevention and control courses and trainings [30,32].

Furthermore, this study found that work experience is an important factor in the practice of infection prevention and control activities. According to a study conducted in Bahirdar, healthcare workers with 5 to 10 years of experience were 1.7 times more likely to engage in infection prevention and control activities [27]. This could be because healthcare workers are continually exposed and gaining experience as the number of years of practice increases.

In addition, up-to-date knowledge and skills in infection prevention and control can increase healthcare professionals' confidence in adhering to suggested procedures and available services. In this study, healthcare workers with a high level of knowledge about IPC were 2.7 times more likely to practice IPC than those with a low level of knowledge. This is consistent with the findings of studies conducted in Northwest Ethiopia [36] and Edo State, Nigeria [30]. This could be due to the fact that those who have never received training or consulted various sources of information on IPC are less likely to receive updated information, making it difficult to keep up with infection prevention knowledge.

## Conclusion

The specific objectives of my study were to determine and assess the knowledge, attitudes and practices of health care professionals regarding infection prevention and control in three hospitals of Karongi district and to identify factors associated with infection prevention and control practices in three hospitals of Karongi district are connected. This study revealed that most of the respondents were aware of IPC and its advantage to their health. Unfortunately, some respondents revealed a low level of knowledge (21.4%), a negative attitude (20.5%) and poor practice (36.7%) towards IPC activities. Among factors associated with IPC were: level of education, work experience, level of knowledge towards IPC and attitude towards IPC. The Ministry of Health and Hospitals, along with other stakeholders, have to reinforce awareness on IPC activities in hospitals facilities; to continue to support health facilities to organize regular trainings for HCWs on IPC.

## Competing Interests

The authors have declared that no competing interests exist.

## References

1. Benedetta, et. al. *Infection control in developing nations. A practical guide*. s.l. : WHO, 2017.
2. Nwankwo, E. 2012: Isolationof pathogenicbacteria from fomites in the operatingrooms of a specialisthospital in Kano, North-westernNigeria. *Pan AfricanMedical Journal*, pp. vol. 12, p. 1.
3. Menegueti, MG, et,. al. 2015. Evaluation of Nosocomial Infection Control Programs in health services. https://doi.org/10.1590/0104-1169.0113.2530

4. Nejad, S, et al. 2016. Health-care-associated infection in Africa: a systematic review. *Bulletin of the World Health Organization*, pp. vol. 89, no. 10, pp. 757–765.
5. M A Borg. Prevention and control of health care associated infections with in developing countries. 2010. *International Journal of Infection Control*
6. Yallew W, Kumie A, Yehuala F M. Riskfactors for hospital-acquired infections in teaching hospitals of Amhararegionalstate, Ethiopia: a matched-case control study. 2017:pp. PloSONE
7. Huskins, WC and Singh, N. 2013. Infection control practices during labor and delivery newborn care in resource limited setting: assessment and recommendations forim provement. *Antimicrobial resistant and. Infect Control*, p. 2(1):269.
8. Brisibe, A, Ordinioha, B and Gbeneolol, PK. 2014. Knowledge, attitude, and infection control practices of two tertiary hospitals in port-Harcourt, Nigeria. *Niger J Clin Pract*, pp. 17(6):691–5. https://doi.org/10.4103/1119-3077.144379
9. Sethi, A, et al. 2017. Infection control knowledge, attitudes, and practices among health care workers at Mulago hospital, Kampala, Uganda. *Infect Control Hosp Epidemiology*, pp. 33:917–23.
10. Prüss-Ustün A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am J Ind Med*. 2005;48(6):482-490. doi:https://doi.org/10.1002/ajim.20230
11. Prüss-Üstün, A and al., et. *Preventing disease through healthy environments: A global assessment of the environmental burden of disease* London : s.n., 2015. TY - JOUR DO - 10.1016/j.toxlet.2016.07.028
12. CDC. Healthcare Associated Infections. *Centers for Disease Control and Prevention*, Atlanta, GA, USA, 2013,. [Online] July 12, 2021. http://www.cdc.gov/sttpublichealth/psr/hai/.
13. Kamunge E. Knowledge, attitudes and practices of registered nurses regarding the spread of nosocomial infections and the impact of organizational support. 2015. *Antimicrobial Resistance and Infection Control, pp* 4:1-60. https://doi.org/10.1186/2047-2994-4-s1-p60
14. Admasu T E. Infectioncontrol knowledge, attitude and practice among health workers in AddisAbaba, Ethiopia. Infect Control Hosp Epidemiol. 2015
15. Franklin, OE. *The Knowledge And Practice Of Standard Precautions Among Health Care Workers In Public Secondary Health Facilities Abuja, Nigeria*. Abuja : University Of South Africa, 2019.
16. WHO. Health care-associated infections FACT SHEET. *Patient safety a world alliance for safer health care*. Geneva : World Health Organization, 2017a.
17. WHO. Infection prevention and control in health care: time for collaborative action. *Technical paper, Fifty-seventh Session*. Geneva : World Health Organization, 2017b.
18. Eshetu. *Knowledge, attitude, practice on infection prevention among health and medical Students*. Addis Ababa : s.n., 2017.
19. Talaat M, Kandeel A, El-Shoubary W, et al. Occupational exposure to needlestick injuries and hepatitis B vaccination coverage among health care workers in Egypt. *Am J Infect Control*. 2003;31(8):469-474. doi:https://doi.org/10.1016/j.ajic.2003.03.003
20. Emine, A, et al. 2016. Infection control practice in countries with limited resources., *Ann Clin Microbiol Antimicrob*, p. 10: 36.
21. Foley, Mary. Infection Control in Rwanda. Invitation to join a Training of Trainers Delegation with Dr. Mary Foley (Aug 20-27). [Online] July 12, 2021. https://www.global-engagement.org/infection-prevention-and-control-in-rwanda01/.
22. Hussen, S, et al. 2017. Knowledge, Attitude and Practice of Infection Prevention Measures among Health Care Workers in Wolaitta Sodo Otona Teaching and Referral Hospital., *J Nurs Care*, p. 6: 416.
23. NISR&MINECOFIN [Rwanda]. *Rwanda Fourth Population and Housing Census*. Kigali, Rwanda : National Institute of Statistics of Rwanda (NISR), Ministry of Finance and Economic Planning (MINECOFIN) [Rwanda], 2012.
24. Yamane T. Statistics: An introductory to Analysis, 2nd Edition. 1967:25. New York
26. Tenna, A, et al. 2013. Infection control knowledge, attitudes, and practices among healthcare workers in Addis Ababa, Ethiopia. *Infect Control Hosp Epidemiol Off J Soc Hosp Epidemiol Am.*, p. 34(12):1289. https://doi.org/10.1086/673979

27. Gulilat, K and Tiruneh, G. 2017. Assessent of knowledge, attitude and practice of health care workers on infection prevention in health institution Bahir Dar city administration., *Sci J Public Health*, pp. 2(5):384–3.
28. Alemayehu, R. 2016. Assessment of knowledge and practice on infection prevention among health Care Workers at Dessie Referral Hospital, Amhara region, SouthWollo zone, north East Ethiopia., *J Community Med Health Educ*, p. 6:487. https://doi.org/10.4172/2161-0711.1000487
29. Katowa, P, et al. 2014. Compliance with infection prevention guidelines by health care workers at Ronald Ross general hospital Mufulira District. *Med J Zambia*, p. 3(5).
30. Ekaete, T, et al. 2017. Knowledge and Practice of infection control among health workers in a tertiary hospital in Edo state, Nigeria. *Direct research journal of health and Pharmacology*, pp. 1(2):20–2.
31. Timilshina, N, et al. 2017. Risk of infection among primary healthcare workers in the Western Development Region, Nepal: Knowledge and compliance., *Journal of Infection in developing Countries*, pp. 5 (1); 18-22.
32. Fashafsheh, I, et al. 2015. Knowledge and Practice of Nursing Staff towards Infect Control Measures in the Palestinian Hospitals. *J Educ and Practice*, p. 6(4).
33. Sarani, H, et al. 2015. Knowledge, attitude and practice of nurses about standard precautions for hospital-acquired infection in teaching hospitals affiliated to Zabol University of Medical Sciences (2014). *Global J Health Sci.*, pp. 8(3):193-198. https://doi.org/10.5539/gjhs.v8n3p193
34. Desta, Melaku, et al. 2018. Knowledge, practice and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia. *BMC Health Services Research*, p. 18:465. https://doi.org/10.1186/s12913-018-3277-5
35. Abou El-Enein, NY and El-Mahdy, HM. 2017. Standard precautions: a KAP study among nurses in the dialysis unit in a University Hospital in Alexandria, Egypt. *J Egypt Public Health Assoc*, pp. 86:3-10.
36. Aklew, F and Worku, Z. 2015. Knowledge, practice, and associated factors towards prevention of surgical site infection among nurses working in Amhara regional state referral hospitals, Northwest Ethiopia. *Surgery Research and Practice*, p. 6.

**Publisher's Note**

All claims, opinions, data, and conclusions expressed in this article are solely those of the author(s) and contributor(s), and do not necessarily represent those of Open Access Pub, the journal, its editors, or reviewers. Open Access Pub does not guarantee or endorse any product, method, instruction, or claim discussed in the article, and disclaims responsibility for any injury to people or property resulting from ideas, methods, instructions, or products referred to in the content.