Ethiopian Journal of Medical and Health Sciences
2024, Volume 4, Issue 1
https://journals.hu.edu.et/hu-journals/index.php/ejmhs

Open Access
ISSN (online): 2789-7087

Original Article

Knowledge, Attitude, and Practice of Infection Prevention among Healthcare Providers at Hawassa University Comprehensive Specialized Hospital (HUCSH), Sidama Region

Alemayehu Abebe[1*], Fekadeselassie Berhie[1], Gemechu Beraso[1], Meron Tafesse[2]

[1]Public Health Academic and Service Directorate, [2]Medical Laboratory Academic and Service Directorate, College of Medicine and Health Sciences, Hawassa University, Hawassa, Ethiopia

*Corresponding author; E-mail: aleab27@yahoo.com

Abstract

Background: Healthcare-associated infections (HAIs) remain a critical global challenge, significantly increasing patient morbidity and mortality. Healthcare providers' knowledge, attitudes, and practices (KAP) toward infection prevention (IP) are pivotal in combating these infections. Despite its importance, data on KAP among healthcare providers in Ethiopia are scarce. This study aimed to evaluate the KAP of healthcare providers and examine associated factors at Hawassa University Comprehensive Specialized Hospital.

Methods: A cross-sectional study was conducted from December 1 to December 15, 2024, involving 191 healthcare providers, yielding a 96.9% response rate. Data were collected using a structured questionnaire, entered into EpiData, and analyzed in STATA. Multivariable logistic regression was performed to identify factors influencing KAP, with findings reported as adjusted odds ratios (AOR) and 95% confidence intervals. Statistical significance was set at $p < 0.05$.

Results: Among participants, 72.8% demonstrated good IP knowledge [AOR = 18.21, 95% CI (2.54-62.4)], with IP manuals at the workplace significantly enhancing knowledge AOR = 4.22, 95% CI (2.48-9.68)]. Favourable attitudes toward IP were reported by 66.5%, influenced by sufficient PPE availability [AOR = 3.12, 95% CI (1.65, 5.82)] and recent IP training [AOR = 1.89, 95% CI (1.12-3.95)]. Good IP practices were observed in 60.8%, strongly associated with good knowledge [AOR = 3.50, 95% CI (1.70-7.23)] and adequate PPE [AOR = 2.64, 95% CI (1.40-4.80)].

Conclusion: The findings highlight suboptimal IP KAP among healthcare providers, despite significant associations with knowledge, training, and resources. Enhancing KAP requires addressing gaps in PPE supply, IP manuals, and training programs. Institutional and policy-level interventions are imperative to foster effective infection control practices.

Keywords: Infection prevention, healthcare providers, knowledge, attitudes, practices, Ethiopia.

Introduction

One crucial strategy designed to protect patients, communities, and healthcare providers (HCPs) from healthcare-associated infections (HAIs) is infection prevention (IP). These infections have a profound consequence on the health outcomes of individuals who are in healthcare facilities and the entire healthcare structure worldwide, particularly in resource-limited environments (1, 2). As indicated by the World Health Organization (WHO), around 15% of individuals who need healthcare services hospitalized in low- and middle-income countries (LMICs) acquire at least one HAI during their stay, with approximately 10% of these patients succumbing to their infections (3).

HAIs present a serious threat to patient safety and the quality of healthcare services. However, these infections can be effectively prevented through the application of evidence-based IP strategies (4). In Africa, data indicate that only about 25% of healthcare facilities fully comply with IPC standards, including, access to personal protective equipment (PPE), proper waste segregation, and hand hygiene practices. This situation highlights systemic deficiencies in training, resource distribution, and adherence to established protocols (5).

A systematic review and meta-analysis revealed an overall low prevalence of infection prevention and control (IPC) practices across healthcare providers in Low and Middle-Income Countries (LMICs), but this differed from one country to another (6). Additionally, according to a different systematic study, Ethiopia is well known for its healthcare providers' poor IP procedures (7).

Healthcare-associated infections (HAIs) can have severe adverse effects on health, including extended hospital stays, permanent disabilities, increased drug resistance, financial burdens on both patients and the healthcare system, and even fatalities (8). Ethiopia has a strikingly high rate of HAIs (9). Implementing infection control measures successfully is severely hampered by a lack of facilities, expertise, and resources. According to (10), this often leads to delays or even disregard for following appropriate infection control measures.

While Ethiopia's Ministry of Health has issued guidelines, the lack of regular training and resources hinders progress. In this context, assessing HCPs' Knowledge, Attitude, and Practice (KAP) of IPC provides critical insight into gaps and opportunities for improvement. Hawassa University Comprehensive Specialized Hospital (HUCSH) serves as a referral hospital for southern Ethiopia, delivering specialized care across multiple disciplines. Despite its importance, there is limited data on the IPC KAP levels among HCPs in this institution. As reported in the HUCSH annual health information management system, the implementation of infection prevention (IP) measures has been largely overlooked, as evidenced by the high prevalence of healthcare-associated infections (HAIs). Addressing this issue necessitates a thorough understanding of healthcare providers' knowledge, attitudes, and practices (KAP) regarding IP, as this information

is critical for designing effective IP strategies. Consequently, this study was conducted to evaluate the KAP of IP and identify factors influencing these aspects among healthcare providers at HUCSH, located in southwest Ethiopia.

Methods and materials

Study Setting

Hawassa University Comprehensive Specialized Hospital (HUCSH) is a comprehensive specialized and teaching hospital located in Hawassa city, southern Ethiopia. The hospital serves as a hub for specialized medical care across a range of disciplines, including surgery, internal medicine, paediatrics, Gyn/Obs, emergency services and other service-providing units. Its role as a teaching institution adds complexity, as it includes HCPs with varying levels of experience.

Study Design

A cross-sectional study design was employed, which is suitable for capturing a snapshot of HCPs' IPC-related KAP at a single point in time. This method allows for identifying trends, gaps, and associations between various factors without requiring extensive follow-up.

Study Period

The study was conducted from December 1 to December 15, 2024.

Study Population

All HCPs working at HUCSH were the source population. All HCPs who work for at least 6 months and are directly involved in patient care including physicians, nurses, midwives, laboratory technicians, pharmacists, x-ray technicians and public health professionals were included. The diverse professional mix provides a comprehensive view of IP practices across the hospital's departments.

Sample Size Determination

The formula used for this calculation was:
n=Z2·p·(1−p)d2$n=\frac{d^2}{Z^2 \cdot p \cdot (1-p)}$
Where:

- n is the sample size,
- Z is the Z-value corresponding to the desired confidence level (1.96 for 95%),
- p is the estimated proportion (0.5),
- d is the margin of error (0.05).

Thus, the calculation resulted in:
n=(1.96)2·0.5·(1−0.5)(0.05)2=384$n=\frac{(0.05)^2}{(1.96)^2 \cdot 0.5 \cdot (1-0.5)}=384$

Since the total population is less than 10,000, the corrected sample size formula was used:

N=n1 + (n/N) =3841+ (384/333) =179$N=\frac{1}{+ (n/N)}$ $n=\frac{1}{+ (384/333)}384=179$.

After adding 10% for non-response compensation, the final sample size was: 197.

Study variables

The study's dependent variables were the knowledge, attitudes, and practices (KAP) related to infection prevention (IP). The independent variables included socio-demographic attributes such as age, sex, marital status, educational attainment, professional qualifications, and years of work experience. Additionally, occupational factors, including the availability of adequate personal protective equipment (PPE), the presence of IP manuals, and access to IP training, were also examined as independent variables.

Operational definitions

In this study, specific operational definitions were employed to evaluate the knowledge, attitudes, and practices (KAP) of healthcare providers regarding infection prevention. Healthcare providers were classified as having "good knowledge" if they correctly answered 70% or more of the knowledge-related questions; those who scored below this threshold were categorized as having poor knowledge (11, 12). Similarly, a "favorable attitude" was defined as providing positive responses to at least 70% of the attitude-related questions, while scores below this benchmark indicated an unfavorable attitude (11, 12). Finally, "good practice" was determined by the demonstration of appropriate infection prevention practices, assessed through correct responses to 70% or more of the practice-related questions; scores below this cutoff indicated poor practice (11, 12). Additionally, a scoring system was established where each correct response contributes to the assessment of good knowledge, favorable attitudes, and good practices. The term "sufficient personal protective equipment (PPE)" refers to the availability of adequate PPE required for daily activities within hospital wards or units. The presence of an "infection prevention (IP) manual at work" denotes the availability of current, updated standard precaution documents that outline essential infection prevention and control measures aimed at safeguarding both patients and healthcare providers. Furthermore, "taking IP training" applies to healthcare providers who have participated in infection prevention training within the past 24 months, regardless of the frequency of such training sessions. These definitions established a standardized framework for assessing the KAP of healthcare providers within the context of this study.

Data Collection Tool and Procedures

A structured self-administered questionnaire was meticulously developed following an extensive review of relevant literature. Initially prepared in English, the questionnaire was subsequently translated into Amharic and then back-translated into English to ensure linguistic consistency and accuracy. The instrument incorporated questions addressing the KAP of infection prevention (IP) alongside the socio-demographic characteristics of the respondents. To ensure content validity, a healthcare expert specializing in occupational health conducted a face validity assessment. Reliability was evaluated using Cronbach's alpha, which demonstrated a high-reliability coefficient (Cronbach's alpha: 0.81).

A pretest was conducted on 5% of the target population, selected from the study hospital, excluding those participating in the main study. The pretest aimed to evaluate the questionnaire's ability to accurately measure the intended constructs and to identify any ambiguous or unclear questions. Prior to data collection, data collectors and supervisors underwent relevant training on the study's objectives, data collection procedures, and methods for addressing ambiguities in the questionnaire. This preparation ensured the accuracy and quality of the data collection process.

Data entry and analysis

The collected data were initially entered into EpiData and subsequently exported to STATA for comprehensive analysis. A multivariable logistic regression model was utilized to identify factors influencing the knowledge, attitudes, and practices (KAP) of infection prevention (IP). Categorical variables were presented as frequencies and percentages in tabular format, while continuous variables were summarized using mean and standard deviation. To identify potential independent predictors of the dependent variables, a bivariate logistic regression analysis was conducted. Variables with a p-value of <0.25 in the bivariate analysis were included in the multivariable logistic regression model to adjust for potential confounders. Multicollinearity among the independent

variables was assessed, and the variance inflation factor (VIF) was determined to be acceptable (less than 2). Model fitness was evaluated using the Hosmer-Lemeshow goodness-of-fit test, which confirmed an adequate fit to the data ($p = 0.431$). Statistical significance was established at a p-value of 0.05.

Results

Sociodemographic characteristics and health facility factors

In this study, a total of 197 healthcare providers (HCPs) were initially invited to participate. Out of these, 191 HCPs consented to take part, resulting in a response rate of about 96.9%. This high level of engagement underscores the relevance and interest of the study within the healthcare community.

The age distribution of the participating HCPs ranged from 23 to 44 years, with a mean age calculated at 31.2 years (±2.4 standard deviation). This indicates a relatively young demographic among the participants. Furthermore, the professional experience of the HCPs varied significantly, spanning from 5 years, primarily among nurses, to 44 years. The average professional experience was determined to be 8.1 years (±2.3 standard deviation), reflecting a diverse range of expertise within the group.

Notably, a small number of participants, specifically 41 healthcare providers (21.5%), reported having undergone Infection Prevention (IP) training within the preceding 24 months. This low proportion indicates a need for increased efforts to improve infection control practices among healthcare providers.

Additionally, 121 HCPs confirmed the presence of IP guidelines at their respective workplaces, indicating an established Table approach to infection prevention within the hospital.

Knowledge of healthcare providers about IP

"Every participant in the study displayed a solid understanding of personal protective equipment (PPE), with 170 individuals representing 89%, recognizing that the use of PPE significantly reduces infection risk. Moreover, 122 respondents (63.9%) were well-informed about the maximum amount of sharp medical supplies that should be maintained in safety boxes, while 165 participants (79%) understood the World Health Organization's recommendations concerning the ideal timeframe for commencing HIV post-exposure prophylaxis (Table 1).

The mean knowledge score related to infection prevention among these respondents was 9.8 (±1.5 SD) out of a total of 13, with individual scores ranging from 6 to 12. Notably, a considerable number i.e., 139 (72.8%) of participants demonstrated a good level of knowledge of infection prevention strategies (Figure 1).

Healthcare providers' attitude toward IP

The data revealed that a significant majority, 182 (95.3%) of the respondents, recognized the critical importance of occupational health and safety training for healthcare providers. On the other hand, 166 (86.9%) healthcare providers reported being at elevated risk of exposure to infections. The survey findings further highlighted a notable discrepancy in attitudes toward infection prevention practices, with more than a quarter (28.5%)) of participants expressing disagreement with the statement, "needles should be capped after use" (Table 2).

In terms of infection prevention (IP) attitudes, the mean score was 34 (±3.4 SD), with a range from 12 to 38. A substantial proportion of participants, 127 (66.5%), demonstrated a positive/favorable attitude toward infection prevention (Figure 1)

Table 1: IP Knowledge-related questions among healthcare providers in HUCSH, Sidama Region

Questions	Yes N (%)	No N (%)
Is occupational safety a problem for healthcare organizations?	139(72.7)	52(27.3)
Are healthcare professionals responsible for occupational health and safety?	180(94.2)	11(5.7)
Do you know how to use PPE?	100(0)	0(0)
Does wearing PPE reduce the risk of infection?	170(89)	21(11)
Do you know how to perform a risk assessment?	159(83.2)	32(16.8)
Do you know the transmission mechanisms of infectious agents?	182(95.3)	9(4.7)
Does washing hands before and after contact with patients reduce infection?	159(83.2)	32(16.8)
Are you aware of the risks of your working environment?	181(94.8)	10(5.2)
Do you know how to handle used needles and sharps safely?	174(91)	17(8.9)
Do you know about colour coding segregation of healthcare wastes?	172(90)	19(10)
Do you know the maximum fill level recommended for safety boxes used for sharp materials?	122(63.9)	69(36.1)
Are you aware of the World Health Organization's recommended maximum delay for initiating HIV post-exposure prophylaxis?	164(85.9)	27(14.1)
Do you know any health hazards associated with healthcare waste?	171(89.5)	20(10.5

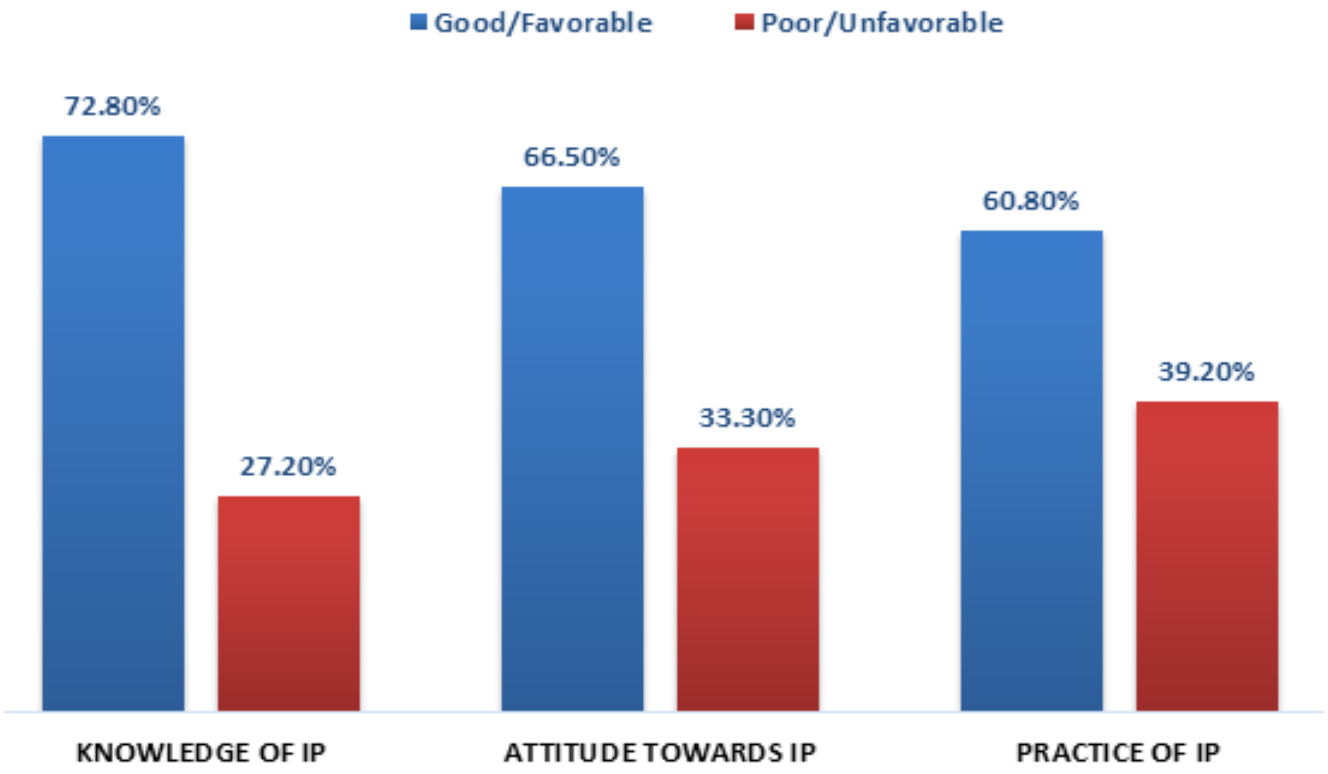

Figure 1: The status of KAP regarding IP among respondents at HUCSH, Sidama Region

Table 2: IP Attitude-related questions among healthcare providers in HUCSH, Sidama Region

Questions	Disagree N (%)	Neutral N (%)	Agree N (%)
IP is important for healthcare organizations.	16(8.4)	3(1.6)	172(90)
Occupational health and safety training is important for healthcare professionals	4(2.1)	5(2.6)	182(95.3)
Your healthcare environment may expose you to occupational hazards	14(7.3)	11(5.8)	166(86.9)
Healthcare professionals are at high risk of infection	8(4.2)	3(1.8)	180(94.2)
All PPE should be accessible in the working department/section of the healthcare facility.	16(8.4)	7(3.7)	168(87.9)
Individual workplace risk exposure should be considered a crisis for the community	25(13.1)	30(15.7)	136(71.2)
Risk assessment is important for IP	12(6.3)	7 3.7)	172(90)
Sharp materials should be discarded in a safety box	47(24.6)	15(7.9)	129(67.5)
Needles should be recapped after use	55(28.5)	5(2.6)	132(69.1)
If you didn't take the HBV vaccine before, are you willing to take it?	13(6.8)	65(34)	113(59.2)
Wearing a facemask and eye goggles during procedures with aerosol production is mandatory	9(4.7)	27(14)	155(81.2)
Vaccination for healthcare professionals is mandatory	5(2.6)	13(6.8)	173(90.6)
Hepatitis B virus may be transmitted through biomedical wastes	15(7.9)	33(17.3)	143(74.8)

Healthcare providers IP practice

In relation to infection prevention practices, a substantial proportion of respondents demonstrated adherence to recommended protocols. Specifically, 152 (79.5%) participants consistently wore gloves during high-risk procedures, while 118 (61.8%) reported regular use of appropriate personal protective equipment (PPE) during their professional practice. Additionally, 162 (84.8%) participants consistently followed proper clinical waste disposal procedures, and 142 (74.3%) reported changing gloves between patient interactions (Table 3). The mean infection prevention practice score was 18 (±2.8 SD), with scores ranging from a minimum of 10 to a maximum of 30. Notably, 116 (60.8 %) of the respondents exhibited strong adherence to infection prevention practices, as indicated by a good practice score (Figure 1).

Factors associated with the knowledge, attitude, and practice of IP

A multivariable logistic regression identified key factors influencing infection prevention (IP) knowledge, attitudes, and practices. Being a General Practitioner (GP) or Specialist was strongly associated with good IP knowledge (AOR = 18.2, 95% CI: 2.54, 62.4), as was the availability of an IP manual in the workplace (AOR = 4.22, 95% CI: 2.48, 9.68), and taking IP training (AOR = 2.53, 95% CI: 1.31, 4.78) (refer to table 4). Favorable attitudes toward IP were linked to sufficient PPE in the work area (AOR = 3.12, 95% CI: 1.65, 5.82), IP Manual at Work (AOR = 0.14, 95% CI: 0.09, 0.35)), and participation in IP training (AOR = 1.89, 95% CI: 1.12, 3.95) (refer to table 5). Good IP practices were significantly associated with strong knowledge (AOR = 3.50, 95% CI: 1.70, 7.23) and the availability of adequate PPE in the Work Area (AOR = 2.64, 95% CI: 1.40, 4.80),

and taking IP training (AOR = 1.98, 95% CI: 1.05, 3.40) (refer to Table 6). These findings underscore the importance of knowledge, training, and resource availability in fostering effective IP practices.

Table 3: IP Practice-related questions among healthcare providers in HUCSH, Sidama Region

Questions	Always N (%)	Sometimes N (%)	Never N (%)
When needed, how often do you use IP guidelines/manuals at your workplace?	55(28.8)	119(62.3)	17(8.9)
How often do you wear gloves during risky procedures?	172(90.1)	15(7.9)	4(2.1)
How often do you wash your hands with proper detergent after contact with patients/working time?	76(39.8)	111(58.1)	4 (2.1)
How often do you use proper PPE during your professional practice?	118(61.8)	67(35.1)	6(3)
How often do you clean your working area after the end of the working shift?	65(34)	99 (51.8)	27(14.1)
How often do you monitor your working area waste management system?	81(42.4)	86 (45)	24(12.6)
How often do you practice the segregation of healthcare waste disposal?	162(84.8)	26(13.6)	3(1.57)
How often do you perform risk assessment in your working department/section?	92(48.2)	73(38.2)	26(13.6)
How often do you change gloves between contacts with different patients?	142 (74.3)	46 (24.1)	3 (1.57)
How often do wash your hands after the removal of gloves?	52 (27.2)	127 (66.5)	121 (6.3)
How often do you recap used needles?	143 (74.9)	39 (20.4)	9 (4.7)
How often do you treat infectious wastes with disinfectants?	113 (59.2)	66 (34.6)	12 (6.2)

Table 4: Factors associated with knowledge of IPC among healthcare providers in HUCSH, Sidama Region

Variables	Categories	Knowledge of IPC		COR (95%CI)	AOR (95%CI)	*P*-Value
		Poor (N)	Good (N)			
Age	<30	41(Poor), 92(Good)	41 (Poor), 92 (Good)	1		
	⩾30	13	45	1.47 (0.72-3.00)*	1.39 (0.73-3.10)	0.270
Sex	Male	15	65	1		
	Female	38	73	2.25 (1.15-4.40)**	2.30 (1.17-4.52)	0.116
Professional qualification	GP/Specialist	1	40	18.87 (2.53-140.8) **	18.21 (2.54-62.4)	0.004
	Nurses and other allied health professionals	53	97	1		

Sufficient PPE in the work area	Present	23	90	2.61 (1.43-4.76)*	3.13 (1.42-4.78)	0.042
	Absent	30	48	1		
IP manual at work	Present	29	114	4.93 (2.50-=9.72)**	4.22 (2.48-9.68)	0.001
	Absent	23	21	1	1	
Taking IP training	Yes	16	62	2.48 (1.30-4.72)	2.53 (1.31-4.78)	0.036
	No	70	43	1	1	

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; IPC, Infection Prevention, and Control; PPE, Personal protective equipment. *P < .25. **P < .05.

Table 5. Factors associated with attitude toward IP among healthcare providers in HUCSH, Sidama Region

Variables	Categories	Attitude toward IPC		COR (95%CI)	AOR (95%CI)	*P*-VALUE
		Unfavorable (N)	Favorable (N)			
Marital status	Unmarried	37	82	0.56 (0.31-1.01)*	0.32 (0.32-1.12)	0.110
	Married	32	40	1		
Work experience (y)	<5	58	118	0.25 (0.08-0.75)*	0.19 (0.09-0.95)	0.040
	≥5	10	5	1		
Knowledge of IPC	Poor	22	31	1		
	Good	43	95	1.52 (0.81-2.86)	1.60 (0.83-3.10)	0.160
Sufficient PPE in the work area	Present	31	87	3.23 (1.76-5.92)**	3.12 (1.65-5.82)	0.003
	Absent	38	35	1		
IP manual at work	Present	91	23	0.17 (0.09-0.32)**	0.14 (0.09-0.35)	0.011
	Absent	41	36	1		
Taking IP training	Yes	23	55	2.03 (1.10-3.74)**	1.89(1.12-3.95)	0.023
	No	70	43	1		

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; IPC, Infection Prevention, and Control; PPE, Personal protective equipment. *P < .25. **P < .05.

Discussion

Healthcare-associated infections (HAIs) are a major concern due to their contribution to prolonged hospital stays, increased mortality, and rising healthcare costs (13). Preventing and managing healthcare-associated infections (HAIs) is a critical public health priority (14). To effectively address this, assessing healthcare providers' knowledge, attitudes, and practices (KAP) related to infection prevention (IP) is crucial (15, 16). This study aimed to evaluate the KAP of IP among healthcare workers at Hawassa University Comprehensive Specialized Hospital (HUCSH) in the Sidama region.

Table 6. Factors associated with practice toward IP among healthcare providers in HUCSH

Variables	Categories	Practice of IPC		COR (95%CI)	AOR (95%CI)	*P*-Value
		Poor (N)	Good (N)			
Professional qualification	GP/Specialist	25	14	0.396 (0.19-0.83)*	0.28 (0.20-2.19)	0.050
	Nurses and other health professionals	63	89	1		
The attitude toward IP	Unfavorable	28	40	1		
	Favorable	63	60	1.5 (0.84-2.68)*	1.72 (0.750-2.60)	0.280
Knowledge of IPC	Poor	13	41	1		
	Good	76	61	3.93 (1.92-8.04)*	3.50 (1.70-7.23)	0.021
Sufficient PPE in the work area	Present	64	53	2.85 (1.56-5.22)**	2.64 (1.40-4.80)	0.003
	Absent	22	52	1		
IP manual at work	Present	72	67	1.87 (0.98-3.56)*	1.77 (0.90-3.20)	0.100
	Absent	19	33	1		
Taking IP training	Yes	38	40	2.03 (1.13-3.65)**	1.98 (1.05-3.40)	0.035
	No	36	77	1		

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; IPC, Infection Prevention, and Control; PPE, Personal protective equipment. ****P* **< .25. *****P*** **< .05.**

The study found that 72.8% (95% CI: 66.5%–79.1%) of respondents demonstrated good IP knowledge, which aligns with findings in Saudi Arabia (67.6%) (14) and Ethiopia (70.8%) (17) but is lower than higher Ethiopian studies 86.4% (18), 99.3% (19), and 90% (12). On the other hand, the knowledge rate at HUCSH was higher than in countries like Trinidad and Tobago (20.3%) (20), Palestine (53.9%) (21), Nigeria (51.1%) (22), and Saudi Arabia (60.1%) (23).

Regarding IP attitudes, 66.5% (95% CI: 60.2%–72.8%) of respondents had a favourable attitude, consistent with 61.5% in Saudi Arabia (14) and 57.2% in Ethiopia (12), but lower than 78.6% in Nigeria (22) and 76.4% in one Ethiopian study (18). However, the attitude at HUCSH was higher than in Trinidad and Tobago i.e., 46.7% (20), and Ethiopia i.e., 40.8% (25).

For IP practices, 60.8% (95% CI: 54.5%–67.1%) of respondents demonstrated good practices, comparable to 47.7% in Nigeria (22) and 60.5% and 60.4% in Ethiopian studies (19, 26). However, the practice rate was lower than (91.1%) in Palestine (21), (73.2%) in Saudi Arabia (14), and 77% in Ethiopia (18). In contrast, HUCSH performed higher than 44% in Trinidad and Tobago (20), 24.6% in Saudi Arabia (23), and 36% in Ethiopia (12). These results highlight the variability in IP practices and the need for targeted interventions to improve infection control across different regions.

The observed variations between this study and others can be attributed to several factors, including differences in sample size, the number of questions used to assess knowledge, attitudes, and practices (KAP), and the operational

definitions applied. The outcomes of KAP studies are often influenced by the sample size, as larger samples tend to provide more reliable estimates. Additionally, the number of questions employed to measure IP KAP is not standardized across studies, with some utilizing as few as five questions, while others incorporate up to 22 questions. The variation is also compounded by the use of different cut-off values for categorizing KAP as either "good/favourable" or "poor/unfavourable." While some studies have employed the mean or median as cut-offs, others have used percentages (e.g., 70%) or thresholds like ≥80%, which contribute to inconsistent classifications of IP KAP.

Notably, general practitioners (GPs) and specialists were found to be significantly more knowledgeable about infection prevention (IP), making them nine times more likely to possess higher IP knowledge than other healthcare providers. This finding aligns with studies from Saudi Arabia (24) and Nigeria (22), which similarly found that infection-related training and specialized roles correlate with better IP knowledge (25). This disparity may arise from general practitioners and specialists engaging in a greater number of infection-related training programs compared to their counterparts in other healthcare providers.

Moreover, healthcare providers with an IP manual in their workplace were four times more likely to exhibit better IP knowledge than those without such resources. This is consistent with findings from Northeast Ethiopia (17), suggesting that access to updated IP guidelines enhances healthcare providers' understanding and adherence to infection control practices. The limited awareness among nurses regarding the IP guidelines may play a significant role in their inconsistent adherence to evidence-based practices aimed at preventing infections (26).

Furthermore, healthcare providers with adequate personal protective equipment (PPE) in their work environment were three times more likely to maintain a favourable attitude toward IP compared to those lacking sufficient PPE. This mirrors a study conducted in Jordan, which highlighted that inadequate PPE and insufficient infection control training contribute to negative attitudes toward IP (27). Ensuring a safe working environment, including the availability of PPE, is crucial for fostering positive IP attitudes among healthcare providers (28).

Notably, healthcare providers who have received recent IP training demonstrated a 2-fold higher likelihood of adhering to have a favourable attitude toward IP compared to their counterparts without such training. This observation is consistent with research conducted in Saudi Arabia (24), which underscores a strong association between heightened awareness of IP and better adherence to preventive measures. It is imperative that all healthcare providers participate in infection control training programs. Such initiatives not only provide the necessary knowledge and skills but also cultivate positive attitudes towards infection prevention (29).

Healthcare providers demonstrating a good knowledge of infection prevention (IP) were observed to be approximately four times more likely to implement effective IP practices compared to their counterparts with limited knowledge).This finding resonates with prior studies conducted in Ethiopia, which underscore a strong positive association between knowledge and practice (30, 31). However, this association is not universally observed. Evidence from other studies suggests that comprehensive knowledge alone does not always translate into effective practice (32, 33). Successful implementation of IP protocols depends not only on knowledge but also on sustained infrastructure, continuous training, and the availability of essential resources (34, 35).

Moreover, the availability of adequate personal protective equipment (PPE) emerged as a critical determinant of effective IP practices. Healthcare workers with sufficient PPE in their work environment were 2.64 times more likely to adhere to IP measures than those who did not. This finding, which aligns with previous studies conducted in Ethiopia (36, 37, 38), highlights the foundational role of resource availability in ensuring compliance with infection control standards. Inadequate access to personal protective equipment (PPE) hinders the effective implementation of infection prevention practices (39, 40). The shortage of necessary materials and equipment not only contributed to but also intensified the problem of non-compliance with established precautionary guidelines (41).

Limitations of the Study

This study presents certain limitations that must be acknowledged when interpreting the results. The limited sample size may influence the reliability of the findings and restrict their applicability to a wider population. Additionally, focusing exclusively on a single health institution restricts the applicability of the results to other healthcare settings, potentially overlooking variations in practices. Furthermore, the use of a self-administered questionnaire introduces the risk of self-preservation bias, where participants may provide socially desirable responses rather than accurate reflections of their practices. These factors could influence the accuracy and reliability of the reported data.

Conclusion

The study revealed that the overall knowledge, attitudes, and practices (KAP) related to infection prevention (IP) among healthcare providers were suboptimal. Additionally, the analysis identified significant associations between sociodemographic factors and health facility-related characteristics with IP-KAP. To enhance these outcomes, it is crucial to ensure the availability of sufficient personal protective equipment (PPE), comprehensive IP manuals, and continuous in-service training programs. Such interventions are likely to improve healthcare providers' KAP regarding IP. Consequently, it is recommended that the College and hospital management, in collaboration with relevant stakeholders such as the Federal Ministry of Health, regional health bureau, and local NGOs, provide sustained support in the form of training, necessary resources, and infrastructural improvements. These efforts are essential for fostering a culture of infection prevention and integrating universal precautions into routine healthcare delivery.

Acknowledgement

First, we would like to thank all the study participants for their participation. Second, our gratitude goes to the HUCSH management who gave us full collaboration during the study period.

Ethical considerations

Ethical clearance (Ref. No: IRB/416/17) was obtained from the Institutional Review Board (IRB) of Hawassa University College of Medicine and Health Sciences (CMHS). An official letter of permission was obtained from the Academic and Clinical Service Director of the CMHS. The Declaration of Helsinki was followed when conducting this study. Participants were told of its aim, their freedom to decline participation, the study's anonymity, and data confidentiality. Participants in the study provided written informed consent.

Data availability statement

The data set is handled by the corresponding author and can be provided upon request.

Conflicts of interest

The authors declared no conflicts of interest exist.

Funding statement

The authors received no financial support for the research, authorship, and/or publication of this article.

Authors' contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

.

References

1. Kubde D, Badge AK, Ugemuge S, Shahu S. Importance of hospital infection control. Cureus. 2023; 15(12). https://doi.org/10.7759/cureus.50931.
2. Jamiran NS, Ludin SM. Knowledge, attitude and practice on infection control among IIUM Kuantan nursing students during Coronavirus 2019 disease (COVID-19) outbreak. Int J Care Sch. 2021; 4:58-65. https://doi.org/10.31436/ijcs.v4isupp1.219
3. World Health Organization. The first-ever global report on infection prevention and control. 2022. Available from: https://www.who.int/publications/i/item/9789240051164.
4. Igwe U, Okolie OJ, Ismail SU, Adukwu E. Effectiveness of infection prevention and control interventions in healthcare facilities in Africa: A systematic review. Am J Infect Control. 2024. https://doi.org/10.1016/j.ajic.2024.06.004.
5. Yallew WW, Kumie A, Yehuala FM. Barriers to infection prevention and controlpractice among Amhara region teaching hospitals in Ethiopia: qualitative study. Int J Infect Control. 2019;15(2). https://doi.org/10.3396/ijic.v15i2.007.19
6. Yilma M, Taye G, Abebe W. Magnitude of standard precautions practices among healthcare workers in health facilities of low and middle-income countries: A systematic review and meta-analysis. PLoS ONE. 2024;19(4):e0302282. https://doi.org/10.1371/journal.pone.0302282.
7. Sahiledengle B, Tekalegn Y, Woldeyohannes D. The critical role of infection prevention overlooked in Ethiopia: Only one-half of health-care workers had safe practice: A systematic review and meta-analysis. PLoS ONE. 2021;16(1):e0245469. https://doi.org/10.1371/journal.pone.0245469. https://doi.org/10.1371/journal.pone.0245469.
8. Allegranzi B, Nejad SB, Combescure C, Graafmans W, Attar H, Donaldson L, et al. Burden of endemic health-care-associated infection in developing countries: Systematic review and meta-analysis. Lancet. 2010; 377:228–41. https://doi.org/10.1016/S0140-6736(10)61258-0.
9. Alemu AY, Endalamaw A, Bayih WA. The burden of healthcare-associated infection in Ethiopia: A systematic review and meta-analysis. Trop Med Health. 2020; 48:77. https://doi.org/10.1186/s41182-020-00263-2
10. Tu R, Elling H, Behnke N, Tseka JM, Kafanikhale H, Mofoloc I, et al. A qualitative study of barriers and facilitators to adequate environmental health conditions

and infection control for healthcare workers in Malawi. H2Open J. 2022; 5(1). https://doi.org/10.2166/h2oj.2022.139
11. Yosef T. Healthcare Professionals' Knowledge, Attitude and Practice of Infection Prevention in Southwest Ethiopia. Environmental Health Insights. 2023 ; 17:11786302231218819. https://doi.org/10.1177/11786302231218819
12. Bayleyegn B, Mehari A, Damtie D, Negash M. Knowledge, attitude and practice on hospital-acquired infection prevention and associated factors among healthcare workers at university of gondar comprehensive specialized hospital, northwest ethiopia. Infect Drug Resist. 2021; 14:259-266. https://doi.org/10.2147/idr.s290992
13. Gidey K, Gidey MT, Hailu BY, Gebreamlak ZB, Niriayo YL. Clinical and economic burden of healthcare-associated infections: a prospective cohort study. PLoS One. 2023; 18(2):e0282141. https://doi.org/10.1371/journal.pone.0282141
14. Abalkhail A, Al Imam MH, Elmosaad YM, et al. Knowledge, attitude and practice of standard infection control precautions among health-care workers in a university hospital in Qassim, Saudi Arabia: a cross-sectional survey. Int J Environ Res Public Health. 2021; 18:1-13. https://doi.org/10.3390/ijerph182211831.
15. Tenna A, Stenehjem EA, Margoles L, et al. Infection control knowledge, attitudes, and practices among healthcare workers in Addis Ababa, Ethiopia. Infect Control Hosp Epidemiol. 2013; 34:1289-1296. https://doi.org/10.1086/673979.
16. Alhumaid SAAD, Al Alawi AA, Alsuliman M, et al. Knowledge of infection prevention and control among healthcare workers and factors influencing compliance: a systematic review. Antimicrob Resist Infect Control. 2021; 10:86. https://doi.org/10.1186/s13756-021-00957-0.
17. Assefa J, Alen GD, Adane S. Infection prevention knowledge, practice, and its associated factors among healthcare providers in primary healthcare unit of Wogdie District, Northeast Ethiopia, 2019: a cross-sectional study. Antimicrob Resist Infect Control. 2020;9:1-9. https://doi.org/10.1186/s13756-020-00802-
18. Hailemariam G, Emebet L, Fikrte A, et al. Health care workers knowledge, attitude and practice towards hospital acquired infection prevention at Dessie referral hospital, Northeast Ethiopia. Clin J Nurs Care Pract. 2019; 3:059-063. https://doi.org/10.29328/journal.cjncp.1001019.
19. Hussen S, W E, Es M, Moga F. Knowledge, attitude and practice of infection prevention measures among health care workers in Wolaitta Sodo Otona teaching and referral hospital. J Nurs Care. 2017;06:1-7. https://doi.org/10.4172/2167-1168.1000416.
20. Unakal CG, Nathaniel A, Keagan B, et al. Assessment of knowledge, attitudes, and practices towards infection prevention among healthcare workers in Trinidad and Tobago. Int J Community Med Public Health. 2017; 4:2240. https://doi.org/10.18203/2394-6040.ijcmph20172813.
21. Fashafsheh Ahmad Ayed I, Eqtait L, Harazneh F. Knowledge and practice nursing staff towards infection control measures in the Palestinian hospitals. J Educ Pr. 2015; 6:79-91. https://doi.org/10.1515/ijnes-2023-0117.
22. Adeke AS, Onoh RC, Umeokonkwo CD, Azuogu BN, Ogah EO. Knowledge, attitude and practice of infection prevention and control among healthcare workers: one year after an outbreak of nosocomial Lassa fever in a tertiary hospital in southeast Nigeria. Afr J Clin Exp Microbiol. 2021; 22:457-464. https://doi.org/10.4314/ajcem.v22i4.5.

23. Hamid H, Mustafa MM, Al-Rasheedi M, et attitudes and practices (KAPS) on activities related to prevention and control of hospital acquired infections. Int J Prev Treat. 2019; 8:1-7. 14.
24. Almohammed OA, Aldwihi LA, Alragas AM, et al. Knowledge, attitude, and practices associated with COVID-19 among healthcare workers in Hospitals: a cross-sectional study in Saudi Arabia. Front Public Health. 2021;9:1-11. https://doi.org/10.3389/fpubh.2021.643053.
25. Ekaete TD, Ikponwonsa O, G E. Knowledge and practice of infection control among health workers in a tertiary hospital in Edo state, Nigeria. Direct Res J Heal Pharmacol. 2013; 1:20-22.
26. Labeau S, Vandijck DM, Claes B, Van Aken P, Blot SI. Critical care nurses' knowledge of evidence-based guidelines for preventing ventilator-associated pneumonia: an evaluation questionnaire. Am J Crit Care. 2007;16:371-377. https://doi.org/10.4037/ajcc2007.16.4.371.
27. Amro FM, Rayan AH, Eshah NF, ALBashtawy MS, ALBashtawy MS. Knowledge, attitude, and practices concerning Covid-19 preventive measures among healthcare providers in Jordan. Sage Open Nurs. 2022; 8:23779608221106422. https://doi.org/10.1177/23779608221106422.
28. McCauley L, Kirwan M, Matthews A. The factors contributing to missed care and non-compliance in infection prevention and control practices of nurses: a scoping review. Int J Adv Nurs Stud. 2021; 3:100039. https://doi.org/10.1016/j.ijnsa.2021.100039.
29. Farotimi AA, Ajao EO, Nwozichi CU, Ademuyiwa IY. Effect of training on knowledge, perception and risk reduction regarding infection control among nurses in selected teaching hospitals in Nigeria. Iran J Nurs Midwifery Res. 2018;23:471-477. https://doi.org/10.4103/ijnmr.ijnmr_208_17.
al. Assessment of hospital staff knowledge,
30. Bhargava JK, Jain A, Patel V, Prakash B, Prakash V, B, Knowledge, attitude, and practice about air-borne infection control guidelines: a cross-sectional study among residents doctors of tertiary care hospital in central India. Asian J Med Sci. 2022;13:185-192. https://doi.org/10.71152/ajms.v13i6.3851.
31. Zenbaba D, Sahiledengle B, Bogale D. Practices of healthcare workers regarding Infection Prevention in Bale Zone Hospitals, Southeast Ethiopia. Adv Public Health. 2020; 2020:17. https://doi.org/10.1155/2020/4198081.
32. Iliyasu G, Habib D, Tiamiyu Z, Abubakar A, Mijinyawa S, M, Knowledge and practices of infection control among healthcare workers in a tertiary referral center in north-western Nigeria. Ann Afr Med. 2016; 15:34. https://doi.org/10.4103/1596-3519.161724.
33. Ogoina D, Pondei K, Adetunji B, et al. Knowledge, attitude and practice of standard precautions of infection control by hospital workers in two tertiary hospitals in Nigeria. J Infect Prev. 2015; 16:16-22. https://doi.org/10.1177/1757177414558957.
34. Magadze TA, Nkhwashu TE, Moloko SM, Chetty D. The impediments of implementing infection prevention control in public hospitals: nurses' perspectives. Heal SA. 2022; 27:2033. https://doi.org/10.4102/hsag.v27i0.2033.
35. Melesse G, Belda N, Zelalem JW. Knowledge, attitude and practice ofinfection prevention among health care workers in public health facilities in West Guji Zone, Oromia. J Womens Health Care. 2021; 10:1-7. https://doi.org/10.21203/rs.3.rs-936593/v1.
36. Mulat Endalew S, Abebe Melake B, Geremew A, et al. Healthcare workers'

compliance with standard precautions and associated factors in Bahir dar town, Ethiopia. Environ Health Insights. 2022; 16:11786302221117071. https://doi.org/10.1177/11786302221117071.

37. Desta M, Ayenew T, Sitotaw N, et al. Knowledge, practice and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia. BMC Health Serv Res. 2018; 18:465-510. https://doi.org/10.1186/s12913-018-3277-5.
38. Hussien Sado M, Fasil N, Bekere A. Assessment of infection prevention practice and associated factors among healthcare providers in the case of Bishoftu Referral Hospital. Clin Med Res. 2021; 10:212. https://doi.org/10.11648/j.cmr.20211006.17.
39. Beyamo A, Dodicho T, Facha W. Compliance with standard precaution practices and associated factors among health care workers in Dawuro Zone, South West Ethiopia, cross sectional study. BMC Health Serv Res. 2019; 19: 381-386. https://doi.org/10.1186/s12913-019-4172-4.
40. Lee R. Occupational transmission of bloodborne diseases to healthcare workers in developing countries: meeting the challenges. J Hosp Infect. 2009; 72:285-291. https://doi.org/10.1016/j.jhin.2009.04.013.
41. Wubneh, Chalachew Adugna, Birye Dessalegn Mekonnen, Tewodros Getaneh Alemu, Masresha Asmare Techane, Nega Tezera Assimamaw, Getaneh Mulualem Belay, Tadesse Tarik Tamir et al. "Knowledge, attitude and practice of healthcare workers on infection prevention and control in Ethiopia: A systematic review and meta-analysis." Plos one 19, no. 9. 2024: e0308348. https://doi.org/10.1016/j.vaccine.2022.01.053.