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Infection Prevention and Control Compliance among Healthcare Workers in a Rural Ugandan District: A Facility-Based Study

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Abstract

Hospital-acquired infections remain a significant public health challenge, and adherence to standard precautions and infection prevention and control (IPC) measures is essential to minimize transmission. However, compliance in rural health facilities is often inadequate. This study employed an institution-based cross-sectional design conducted over two months in 2021, involving all healthcare workers in 30 lower-level health facilities in Butambala District, Uganda. Inclusion of the entire workforce minimized selection bias and improved representativeness. Data were collected using structured questionnaires and focus group discussions. Chi-square tests, Fisher's exact tests, and multivariate logistic regression were used to identify factors associated with IPC compliance. Only 10.6% of healthcare workers fully complied with IPC measures. Professional cadre was significantly associated with compliance, with laboratory technicians showing higher adherence (AOR = 2.17, 95% CI [1.14–5.74], p = 0.037). COVID-19 vaccination status was also a significant factor; those who had received the second dose were more likely to comply (AOR = 3.94, 95% CI [1.04–5.74], p = 0.043). Conversely, an inadequate supply of personal protective equipment (PPE) was strongly linked to non-compliance (AOR = 0.012, 95% CI [0.03–0.45], p = 0.002). In conclusion, IPC compliance among healthcare workers in Butambala District was alarmingly low. Professional cadre, vaccination status, and PPE availability were key influencing factors. Strengthening IPC requires targeted interventions to improve PPE supply, enhance training, and promote adherence to national protocols to protect both healthcare workers and patients.

Keywords: *Compliance, Healthcare Workers, Hospital-Acquired Infections, Infection Prevention and Control (IPC); Personal Protective Equipment (PPE).*

Introduction

Hospital-acquired infections (HAIs) continue to pose a significant threat to patient safety and health system resilience [1]. They are primarily spread through poor adherence to infection prevention and control (IPC) measures, exposing healthcare workers and patients to avoidable risks [2, 3]. Health facilities are known hotspots for transmission of infectious diseases such as COVID-19 and Ebola [4], contributing to substantial morbidity, mortality, and economic burden [5–7]. The burden of healthcare-associated infections is particularly high in Africa, where limited resources and system constraints worsen transmission [8, 9].

Various IPC measures, such as hand hygiene, use of personal protective equipment (PPE), sterilization, environmental sanitation, and waste management, have proven effective in minimizing transmission [10–13]. Global

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and national guidelines, including World Health Organization (WHO) protocols, emphasize these measures [12, 18]. Despite their effectiveness, compliance remains low in many low- and middle-income settings, including Uganda, due to inadequate supplies, limited knowledge, poor attitudes, and systemic gaps [13–15, 21–24]. The COVID-19 pandemic further amplified the need for strict IPC practices, especially PPE use and hand hygiene [16].

Existing approaches include standard precautions, policy frameworks, and IPC guidelines at national and facility level [18, 19, 22]. While effective, their impact is constrained by weak implementation, limited training, and insufficient monitoring. Reported compliance rates in Ugandan healthcare facilities remain low [22], with rural settings being particularly underserved.

Persistent non-compliance with IPC measures among healthcare workers in rural health facilities remains a critical driver of elevated HAI rates. Although the WHO and the Ministry of Health (MOH) have established guidelines, conducted training, and implemented structured IPC programs, their translation into routine practice at lower-level facilities has been suboptimal. Evidence underscores that strict adherence to standard IPC precautions, including appropriate hand hygiene, consistent use of PPE, and proper waste management, constitutes the most effective strategy for mitigating HAIs. Nevertheless, effective implementation continues to be constrained by weak enforcement mechanisms, insufficient resources, limited knowledge among healthcare workers, and excessive workloads. Global estimates indicate that approximately 30% to 70% of HAIs are preventable through the consistent application of IPC measures [17], illustrating both the scale of the challenge and the substantial potential for improvement This study aimed to assess compliance with IPC measures and to identify enabling and constraining factors influencing adherence among healthcare workers in rural health facilities. Its novelty lies in its focus on rural settings in Uganda, a context where empirical evidence on IPC compliance factors remains limited despite a disproportionately high burden of HAIs.

Schematic Diagram

Figure 1. Flow sketch of IPC compliance factors showing how enablers such as professional cadre, vaccination status, knowledge and supervision, and barriers including PPE shortages, poor hygiene, workload, and attitudes influence compliance.

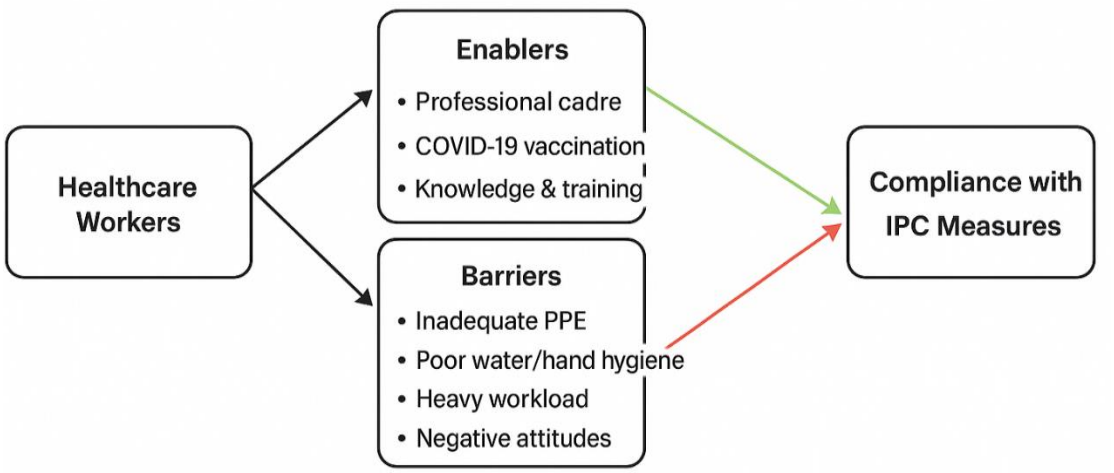

Figure 1. Conceptual framework showing enablers and barriers influencing compliance with IPC measures.
Developed by the author, 2025

Materials and Methods

Description of the Site

The study was conducted in Butambala District, located in the south-central region of Uganda, with an estimated population of approximately 150,331 people as of 2025 (Uganda Bureau of Statistics, 2025). The focus was on 30 lower-level health facilities, including Health Centre IIs and IIIs, operated by a mix of public, private not-for-profit, and private healthcare providers. Although the district has one general hospital, no Health Centre IVs are available, and the hospital was excluded from the study. Data collection was conducted over a two-month period.

Description of the Methods

A cross-sectional study design was used to collect data at a single point in time. A mixed-methods approach integrated both quantitative and qualitative techniques to comprehensively assess compliance with IPC practices among healthcare workers. Quantitative data were collected through structured questionnaires administered in face-to-face interviews with healthcare workers. Qualitative data were obtained through focus group discussions (FGDs) involving individuals in managerial or leadership positions. Due to COVID-19 restrictions at the time, FGDs were conducted via teleconferencing.

The study population consisted of 186 healthcare workers employed at the 30 selected lower-level facilities. A census sampling method was employed, ensuring all eligible healthcare workers in these facilities were included. Participants for FGDs were purposively selected based on their roles and knowledge. Inclusion criteria were: (i) at least six months of service, (ii) direct patient contact, and (iii) willingness to participate. Those who declined or were unavailable during the study period were excluded.

Description of the Laboratory Methods

No laboratory or clinical testing was undertaken as part of this study. Instead, the assessment focused on healthcare workers' compliance with IPC measures, including hand hygiene, use of PPE, safe injection practices, and needle recapping. Compliance was measured using a dichotomous response format, with "Yes" coded as 1 and "No" as 2. For those reporting compliance, a follow-up frequency scale was applied, categorized as "always," "sometimes," "rarely," or "never."

Compliance levels for each parameter were calculated as the proportion of respondents who selected "always" or "sometimes" relative to the total number of responses. Overall compliance was determined by aggregating compliance across the four parameters. This structured approach provided a comprehensive overview of healthcare workers' adherence to IPC practices in the study setting.

Data Collection Tools and Quality Assurance

Quantitative data were collected using pre-tested structured questionnaires, while qualitative data were collected through FGDs. To ensure data quality, research assistants were trained in data collection protocols, and fieldwork was monitored daily for completeness and accuracy.

Study Variables and Measurement

The dependent variable was healthcare worker compliance with IPC precautions, measured using the structured questionnaire. Independent variables included personal characteristics, individual factors, and facility-related factors. These variables were measured using dichotomous, numerical, categorical, and ordinal scales.

Statistical Methods

Quantitative data were entered, managed, and analyzed using STATA version 15.0. Descriptive statistics were used to summarize

data, while Chi-square tests, Fisher's exact tests, and multivariate logistic regression were applied to assess associations between dependent and independent variables. Qualitative data from FGDs were transcribed verbatim and analyzed thematically. Thematic analysis involved coding, generation of sub-themes, and development of overarching themes.

Ethical Approval

Ethical approval for this study was obtained from Hospice Africa Uganda Limited Research Ethics Committee (HAUREC) (Ref No: HAU-2025-207) and administrative authorization was granted by the Butambala District Health Office. Written informed consent was obtained from all study participants before data collection. Participation was voluntary, and confidentiality was ensured by removing personal identifiers from all datasets. The study adhered to the principles of the Declaration of Helsinki on research involving human subjects.

Results

The study examined socio-demographic characteristics, individual factors, and health facility-related factors associated with compliance with IPC measures. A total of 186 healthcare workers were targeted for participation, of whom 161 were successfully enrolled, representing a response rate of 86.6%. Here are the key findings of the study.

Socio-Demographic Characteristics

Out of the 161 participants, 67.7% were female, 51.6% identified as Catholic, and 61.5% were married. The majority of participants (64%) held a certificate as their highest level of education. Various professional cadres were represented, with enrolled nurses (27.3%) and enrolled midwives (18.6%) forming the largest groups. Additionally, 19.3% of participants had not received training on infection prevention and control (IPC) precautions. Nearly 39.8% had served for 2–4 years in their current positions. The detailed socio-demographic characteristics of respondents are presented in Table 1.

Table 1. Socio Demographic Characteristics of the Study Participants

Variable	Category	Frequency (n)	Percent (%)
Gender	Male	52	32.3
	Female	109	67.7
Age	20-24	13	8.1
	25-29	48	29.8
	30-34	51	31.7
	35-39	28	17.4
	40+	21	13.0
Marital Status	Single	45	28.0
	Married	99	61.5
	Others	17	10.6
Religion	Catholic	83	51.6
	Anglican	13	8.1
	Muslim	37	23
	Pentecostal	9	5.6
	Born again	14	8.7
	SDA	5	3.1
Educational level	Certificate	103	64
	Diploma	55	34.2

	Graduate	3	1.9
Cadre	Medical clinical officer	17	10.6
	Assistant Nursing Officer	24	14.9
	Laboratory Technician	10	6.2
	Laboratory Assistant	8	5
	Enrolled Midwife	30	18.6
	Enrolled Nurse	44	27.3
	Other (specify)	28	17.4
Duration in-service	Less than 1 year	42	26.1
	2 -4 Years	64	39.8
	5+	55	34.2

Level of Compliance with IPC by Healthcare Workers' Responses

The level of compliance was assessed across four key IPC parameters: hand hygiene, personal protective equipment (PPE) use, safe injection practices, and proper disposal of healthcare waste. The findings are summarized in Table 2.

Hand hygiene: A total of 93.2% of participants reported washing their hands between patients, indicating a high level of compliance with this essential IPC practice.

PPE: Overall adherence to PPE use was also relatively good. Eighty-two percent of healthcare workers reported changing gloves between patients, and 83.2% consistently wore protective clothing during procedures. In addition, 55.9% used mouth, nose, and eye protection when performing procedures, while 93.8% removed PPE before leaving the work area. Furthermore, 95.7% of participants reported wearing face masks, reflecting strong adherence to PPE guidelines.

Safe injection administration: Compliance with safe injection practices was comparatively low. Only 23% of participants consistently disinfected the rubber septum on medication vials with alcohol, and 18% reported recapping needles after use. These findings suggest a gap in adherence to safe injection protocols and highlight the need for targeted training and reinforcement.

Proper disposal of healthcare waste: A high level of compliance was observed for sharps disposal, with 96.9% of participants reporting appropriate handling and disposal of sharps, a critical aspect of IPC measures.

Table 2. Participants' Responses on Hand Washing, PPE Use, Safe Injection and Healthcare Waste Management

	Variable	**Category**	**Frequency (n)**	**Percentage (%)**
Hand washing between patients	Hand washing	Yes	150	93.2
		No	11	6.8
PPE use	Wear a different pair of gloves for each patient	Yes	132	82
		No	29	18
	Wear a protective clothing that covers skin	Yes	134	83.2
		No	27	16.8
	Wear mouth, nose and eye protection during procedures	Yes	90	55.9
		No	71	44.1
	Remove PPE before leaving the work area	Yes	151	93.8
		No	10	6.2

	Do u wear a face mask	Yes	154	95.7
		No	7	4.3
Injection safety	Recapping of needles	Yes	29	18
		No	132	82
	Disinfect the rubber septum on medication vial (multi-doses) with alcohol before piercing	Yes	37	23
		No	124	77
Healthcare waste management	Proper disposal of sharps	Yes	156	96.9
		No	5	3.1

Level of Compliance with IPC Measures Considering the Frequency of Healthcare Workers' Practices

The frequency of healthcare workers' practices was assessed across four IPC domains: hand hygiene, personal protective equipment (PPE) use, safe injection practices, and healthcare waste management. The findings are presented in Table 3.

Hand hygiene: Hand washing between patients was frequently practiced, with 66.5% of participants reporting "always," 26.7% "sometimes," and 6.8% "rarely or never" engaging in this practice.

PPE use: Compliance with PPE use varied across specific practices. Changing gloves between patients was reported as "always" by 65.2%, "sometimes" by 15.5%, and "rarely or never" by 18.0% of participants. Wearing appropriate protective clothing during procedures involving contact with blood or saliva was reported as "always" by 54.0%, "sometimes" by 29.2%, and "rarely or never" by 16.8%. Usage of mouth, nose, and eye protection during procedures with potential splashes was less frequent, with 37.9% reporting "always," 18.0% "sometimes," and 44.1% "rarely or never." Removal of PPE before leaving the work area was reported as "always" by 78.9%, "sometimes" by 14.9%, and "rarely or never" by 6.2%. Wearing face masks was reported as "always" by 74.5%, "sometimes" by 21.1%, and "rarely or never" by 4.3% of participants.

Table 3. Frequency of Practices on Hand Washing, PPE Use, Safe Injection and Health Care Waste Management

SP Component	**Practice**	**Always**	**Sometimes**	**Rarely**	**Never**
Hand washing	Hand washing between patients	107(66.5%)	43(26.7)		11(6.8%)
PPE	Change of gloves between patients	105(65.2%)	25(15.5%)	2(1.2%)	29(18.0%)
	Wearing clothes which cover skin during procedures or activities where contact with blood or saliva is anticipated	87(54.0%)	47(29.2%)		27(16.8%)
	Wearing mouth, nose and eyes protection during procedures that are likely to generate splashes or spattering of blood or other body fluids	61(37.9%)	29(18.0%)		71(44.1%)
	Removing of PPE before leaving the work area	127(78.9%)	24(14.9%)		10(6.2%)
	Wearing of face mask	120(74.5%)	34(21.1%)		7(4.3%)

Health care waste disposal	Disposing of used syringes and needles, scalpel blades, and other sharp items in appropriate puncture resistant containers located as close as possible to the area where the items are used	144(89.4%)	12(7.5%)		5(3.1%)
Safe injection	Disinfecting the rubber septum on a medication vial that has multi-doses with alcohol before piercing	16(9.9%)	21(13.0%)		124(77.0%)
	Not re-capping of needles	132(82.0%) *	29(18.0%)	0	0
	Entering medication containers (single and multi-dose vials) with a new needle and new syringe, even when obtaining additional doses for the same patient	95(59.0%)	19(11.8%)		47(29.2%)

** Always means never*

Healthcare waste management: Proper disposal of used syringes and sharp items was reported as "always" by 89.4%, "sometimes" by 7.5%, and "rarely or never" by 3.1% of respondents, reflecting strong adherence in this domain.

Safe injection practices: Compliance in this area was generally low. Disinfecting the rubber septum on multi-dose vials was reported as "always" by only 9.9%, "sometimes" by 13.0%, and "rarely or never" by 77.0% of participants. Not re-capping needles after use, a recommended safety practice, was reported as "always" by 59.0%, "sometimes" by 11.8%, and "rarely or never" by 29.2% of participants.

Overall, compliance was highest for hand hygiene, PPE use, and sharps disposal, while safe injection practices demonstrated significant gaps in adherence.

It is important to note that for certain safe injection practices, the response "Always" effectively indicates "Never" re-capping of needles, which reflects a high level of adherence to injection safety protocols among healthcare workers. Overall, the findings reveal significant variations in compliance across different IPC domains, highlighting the need for targeted interventions to strengthen specific areas where adherence remains suboptimal.

Interestingly, insights from the FGDs contrasted with the quantitative findings on hand hygiene. Participants reported that hand washing practices were generally poor, noting that many healthcare workers do not follow recommended guidelines, even when hand hygiene instructions are clearly displayed near hand washing stations in some facilities. This suggests that while reported compliance may appear high, actual practice may be lower, indicating potential gaps between knowledge, self-reported behavior, and routine implementation.

Focus Group Discussion (FGD) Results

Qualitative data from FGDs complemented the quantitative findings and provided deeper insights into healthcare workers' perceptions and experiences related to infection prevention and control (IPC). Five main themes emerged from the discussions: hand hygiene practices, PPE use, safe injection practices, waste disposal, and barriers and enablers to IPC compliance.

Theme 1: Hand Hygiene Practices

Participants consistently described hand hygiene compliance as low in practice, despite being recognized as a fundamental component of IPC. They reported that although hand washing stations and posters illustrating proper techniques are available in some facilities, many healthcare workers do not follow the guidelines. The main reasons cited included high patient workload, inconsistent availability

of running water, and inadequate supplies such as soap.

> "We have hand washing stations, but many staff just walk past them without washing. Even when the guidelines are displayed, they are ignored." *(Nurse, HCIII)*
>
> "Sometimes there's no water or soap, so people skip hand washing altogether." *(Midwife, HCII)*

Several participants also noted that hand hygiene practices tend to improve temporarily during outbreaks, such as COVID-19, when there is increased supply of hand sanitizers and heightened awareness.

Theme 2: PPE Use

Participants acknowledged improvements in PPE use compared to the pre-COVID period. However, they expressed concerns about inconsistent availability of gloves, masks, and gowns, particularly in lower-level facilities. Some healthcare workers reported reusing PPE or skipping glove changes due to shortages.

> "Sometimes gloves run out, and people end up reusing or skipping glove changes between patients." (Clinical Officer, HCIII)

They also highlighted that PPE use is more strictly followed during supervision visits but tends to decline in routine daily practice.

Theme 3: Safe Injection Practices

While most participants recognized the importance of injection safety, many admitted that compliance with some steps (such as disinfecting rubber septa on medication vials) was inconsistent. Some viewed this practice as "time-consuming," particularly during busy clinics. Others reported limited availability of alcohol swabs and other supplies.

> "People don't always clean the septum because it takes extra time, and sometimes the alcohol swabs are not there." *(Nurse, HCII)*

Needle recapping was also discussed. Most participants reported adherence to non-recapping policies, consistent with the quantitative finding of high compliance in this area.

Theme 4: Waste Disposal Practices

Participants generally reported good adherence to proper sharps disposal practices. Many indicated that safety boxes are routinely available and used. However, in some facilities, delays in replacing filled safety boxes were reported, creating risks of accidental needle stick injuries.

> "We normally dispose of needles in the safety boxes, but sometimes they get full and are not replaced on time." *(Midwife, HCIII)*

Theme 5: Barriers and Enablers of IPC Compliance

Participants identified several factors influencing IPC compliance. Key enablers included prior training on IPC, availability of supplies, and supportive supervision. Barriers included inadequate or inconsistent supply of PPE and hand hygiene materials, high workload, lack of functional infrastructure (such as water), and negative attitudes among some health workers.

> "Training helps a lot because once people are reminded, they follow the rules more." *(Health Assistant, HCII)*
>
> "If there is no water or gloves, how can you follow the guidelines?" *(Enrolled Nurse, HCIII)*

The Overall IPC Compliance

The study revealed that overall compliance with infection prevention and control (IPC) measures among healthcare workers in lower health facilities of Butambala District was remarkably low, at 10.6% (Table 4). Compliance was determined based on participants' self-reported frequency of practices related to hand washing, PPE use, safe

injection administration, and healthcare waste management. A respondent was classified as *compliant* if they reported performing a practice "always" or "sometimes," and *non-compliant* if they reported "rarely" or "never." Compliance was computed by summing the number of participants who responded "always" or "sometimes" (numerator) and dividing it by the total number of responses (denominator). Analysis was performed using STATA version 15.0.

Table 4. Compliance with Standard Infection Prevention and Control Measures - Butambala District

Dependent variable	Category	Frequency (n)	Percentage (%)
Compliance	Yes	17	10.6
	No	144	89.4

Individual-Related Factors Associated with Compliance with IPC

A considerable proportion of respondents (60.9%) indicated that adhering to all IPC precautions would interrupt workflow, highlighting competing priorities in service delivery. Half of the respondents (50.2%) reported having experienced needle stick injuries, with most of these incidents occurring within the past month. Additionally, 54% reported exposure to blood or body fluids, emphasizing their frequent contact with infectious materials in clinical settings.

Despite these occupational risks, a high vaccination coverage against Hepatitis B (85.1%) was observed, reflecting good uptake of preventive measures. However, 62.7% of respondents reported having suffered from a nosocomial infection, underscoring persistent IPC challenges.

Regarding occupational health and safety training, 54% of respondents had received training, with most (17.4%) reporting that their most recent training was within the past 4–6 months. More than half (58.5%) perceived themselves as being at high risk of contracting infections, indicating heightened awareness of occupational hazards.

In terms of work experience, 37.9% of respondents had 5–10 years of service, reflecting a mix of seasoned and relatively new healthcare workers. Notably, 77% had received at least one dose of the COVID-19 vaccine, indicating a positive response to vaccination campaigns aimed at protecting healthcare workers.

Health Facility-Related Factors Associated with Compliance with IPC

More than half of the respondents (51.1%**)** rated patient load at their health facilities as moderate, suggesting a substantial demand for effective IPC measures during service delivery. A majority of facilities (70.2%) had designated IPC focal persons, and 60.3% conducted internal supervision of IPC practices through facility in-charges. However, only 51.9% of these facilities provided feedback following supervision.

While 77.9% of respondents reported having received IPC training, only 42.7% indicated that in-charges provided incentives for good IPC performance**.** A significant challenge identified was inadequate availability of PPE, reported by 58.8% of respondents. Nevertheless, 65.6% reported that colleagues consistently observed standard operating procedures (SOPs) when handling patients, reflecting positive peer influence.

Regarding post-exposure precautions**,** 58.8% of respondents confirmed their availability at the health facilities, indicating

some level of preparedness for managing occupational exposures. Overall, these findings demonstrate that while certain IPC structures are in place, gaps in resources, supervision, and reinforcement mechanisms continue to limit full compliance.

Bivariate Analysis of Factors Associated with IPC Compliance

Socio-Demographic Characteristics

Bivariate analysis demonstrated that gender, educational level, and professional cadre were significantly associated with compliance to infection prevention and control (IPC) measures.

The relationship between gender and compliance was statistically significant (χ^2 = 6.12, df = 2, p = 0.013), with 80.8% of males and 93.6% of females classified as non-compliant, indicating gender-based differences in adherence levels.

Educational level also showed a significant association with compliance (F = 7.7, p = 0.006). Respondents with a graduate degree exhibited higher compliance rates (66.7%) compared to those with a certificate (6.8%) or diploma (14.6%), highlighting the potential role of education in promoting IPC adherence.

Similarly, professional cadre was significantly associated with compliance (F = 11.3, df = 2, p < 0.001). Medical clinical officers, laboratory technicians, and other cadres exhibited lower compliance levels compared to enrolled midwives, enrolled nurses, and laboratory assistants, suggesting variability in IPC practices across professional roles.

Individual-Related Factors

Awareness of standard IPC measures and number of COVID-19 vaccine doses received were significantly associated with compliance (F = 3.89, df = 2, p = 0.032). Awareness of IPC precautions and their perceived potential to disrupt workflow demonstrated borderline significance (χ^2 = 3.68, df = 2, p = 0.055).

None of the other individual-level variables showed a statistically significant association with compliance at the bivariate level.

Health Facility-Related Factors

Several health facilities–related factors were found to be significantly associated with compliance to infection prevention and control (IPC) measures.

The level of health facility was a significant determinant of compliance (χ^2 = 14.99, df = 1, p < 0.001). Health Centre II facilities recorded a compliance rate of 9.9%, compared to 18.9% at Health Centre III, indicating that higher-level facilities may provide more enabling environments for IPC adherence. Similarly, the type of health facility showed borderline statistical significance (χ^2 = 5.91, df = 2, p = 0.052). Compliance was 13.5% in public facilities, 0% in private facilities, and 14.8% in private not-for-profit facilities, suggesting variability in IPC implementation across ownership categories.

Institutional support also emerged as a critical factor. The presence of a designated IPC focal person was significantly associated with higher compliance (χ^2 = 4.93, df = 1, p = 0.026), with a compliance rate of 15.2% in facilities with such personnel. In-service training on IPC demonstrated a strong positive association with compliance (χ^2 = 9.33, df = 1, p = 0.002), with a compliance rate of 15.7% among trained healthcare workers. Moreover, the time elapsed since the last training influenced adherence (χ^2 = 13.89, df = 4, p = 0.008); those trained within the previous three months exhibited a compliance rate of 11.5%.

Motivational and resource-related factors were also strongly linked to compliance. Facilities that provided incentives for good IPC performance had a significantly higher compliance rate of 21.5% (F = 15.0, df = 2, p < 0.0001). Similarly, the availability of adequate PPE was significantly associated with compliance (F = 13.9, df = 2, p = 0.001), with

facilities that reported sufficient PPE achieving a compliance rate of 20.9%.

Staffing levels were another influential factor ($\chi^2 = 6.65$, df = 2, p = 0.036), with lower compliance observed in facilities reporting higher staffing levels, possibly reflecting increased workload and service pressure. Lastly, facilities equipped with color-coded waste bins recorded a compliance rate of 13.1%, indicating some degree of structural preparedness for IPC implementation.

Multivariate Logistic Regression Analysis

At the multivariate level, professional cadre, COVID-19 vaccination status, and adequate PPE supply remained significantly associated with compliance with infection prevention and control (IPC) measures (Table 5).

Table 5. Multivariate Logistic Regression of Factors Associated with Compliance

		Compliance: No: n [%]; Yes: n [%]		**COR**		**AOR**	
Variable	**Category**	**No: 144 [89.4%]**	**Yes: 17 [10.6%]**	**COR [95%CI]**	**p-value**	**AOR [95%CI]**	**Adj p-value**
Health worker demographic							
Gender	M	42 [80.8]	10 [19.2]	0.29 [0.10,0.81]	0.018	0.28 [0.05,0.47]	0.131
	F	102 [93.6]	7 [6.4]				
What is your current education level?				3.27 [1.33,8.03]	0.01	0.54 [0.06,0.97]	0.57
Professional cadre *							
Medical Clinical Officer		13 [76.5]	4 [23.5]			Reference	
Assistant Nursing Officer		20 [83.3]	4 [16.7]	0.88 [0.13,0.97]	0.898	0.65 [0.14,0.97]	0.586
Laboratory Technician		6 [60.0]	4 [40.0]	0.79 [0.12,0.99]	0.991	2.17 [1.14,5.74]	0.037
Laboratory Assistant		7 [87.5]	1 [12.5]	0.64 [0.04,0.87]	0.758	0.46 [0.04,0.86]	0.527
Enrolled Midwife		29 [96.7]	1 [3.3]	1		0.11 [0.01,0.34]	0.061
Enrolled Nurse		42 [95.5]	2 [4.6]	0.06 [0.00,0.71]	0.026	0.15 [0.03,0.94]	0.043
Other (Nursing assistant)		27 [96.4]	1 [3.6]	0.10 [0.01,0.41]	0.07	0.12 [0.01,0.89]	0.07
Individual factors							
Received Hepatitis B vaccination?	Y	90 [89.1]	11 [10.9]	1		1	
	N	54 [90.0]	6 [10.0]				
Awareness on the standard infection prevention and control measures?	Y	104 [86.7]	16 [13.3]			Reference	
	N	40 [97.6]	1 [2.4]	0.16 [0.02,0.57]	0.083	0.13 [0.01,0.61]	0.19
Comply with basic guidelines?	Y	68 [85.0]	12 [15.0]	Reference			

(Hand washing, PPE, Safe injection, disposal, PEP	N	76 [93.8]	5 [6.2]	0.37 [0.12,0.61]	0.077	6.13 [2.19,6.74]	10.84
Are you at risk of contracting infections in the line of duty?	Y	78 [85.71]	13 [14.29]	0.36 [0.11,0.67]	0.089	1.09 [1.04,7.95]	1.8
	N	66 [94.3]	4 [5.7]				
How many COVID-19 doses were received? *	One	57 [95.0]	3 [5.0]	Reference			
	Two	53 [82.8]	11 [17.2]	6.20 [1.32,9.17]	2.68	3.94 [1.04,5.74]	0.021
Health facility factors							
Level of health facility				1	(omitted)	1	
Type of health facility				0.42 [0.17,1.00]	0.051	8.1 [4.62,10.56]	10.61
Does this facility have a designated person who oversees work place and patient safety?	Y	78 [84.8]	14 [15.2]	Reference			
	N	66 [95.7]	3 [4.4]	0.25 [0.07,0.92]	0.037	1.93 [1.21,7.61]	2.18
Have you ever had an in-service training on standard precautions of infection control in this health facility?	Y	53 [36.8]					
	N	91 [84.3]	17 [15.7]	1	(omitted)	1	
How long ago was the in-service training?				0.47 [0.28,0.82]	0.008	0.09 [0.01,0.98]	0.12
As health workers are you given any incentives for positive work performance especially in safety?	Y	51 [78.5]	14 [21.5]	Reference			
	N	93 [96.9]	3 [3.1]	0.12 [0.03,0.43]	0.001	0.27 [0.03,0.54]	0.31
Adequate PPE to use when handling patients? *	Y	53 [79.1]	14 [20.9]	Reference			
	N	91 [96.8]	3 [3.2]	0.13 [0.02,0.69]	0.017	0.12 [0.03,0.45]	0.002
	High	21 [100.0]		Reference			

How would you rate the staffing levels at this facility?	Mod	91 [85.1]	16 [15]				
	Low	32 [97.0]	1 [3.0]	0.65 [0.40,0.99]	0.905	0.67 [0.09,0.89]	0.7
Does the health facility have colour coded bins at all procedure areas?	Y	113 [86.9]	17 [13.1]	Reference			
	N	1 [0.69]		1	(omitted)	1	

**Significant category p<0.05, AOR=Adjusted Odds Ratio, COR=Crude Odds Ratio*

Professional cadre was a significant predictor of IPC compliance. Laboratory technicians were 2.17 times more likely to comply with IPC measures compared to other professional categories (AOR = 2.17, 95% CI [1.14–5.74], p = 0.037). In contrast, other cadres demonstrated lower likelihood of compliance, with adjusted odds ratios indicating reductions ranging from 11% to 65%: Assistant Nursing Officers (AOR = 0.65, 95% CI [0.14–0.97], p = 0.586), Laboratory Assistants (AOR = 0.46, 95% CI [0.04–0.86], p = 0.527), Enrolled Midwives (AOR = 0.11, 95% CI [0.01–0.34], p = 0.060), Enrolled Nurses (AOR = 0.15, 95% CI [0.03–0.94], p = 0.430), and Nursing Assistants (AOR = 0.12, 95% CI [0.01–0.89], p = 0.070).

COVID-19 vaccination was also positively associated with IPC compliance. Healthcare workers who had received the second dose of the COVID-19 vaccine were 3.94 times more likely to comply with IPC precautions compared to those who had not completed the recommended doses (AOR = 3.94, 95% CI [1.04–5.74], p = 0.043). This finding was further supported by qualitative data from the FGDs, where one participant noted:

"In my opinion, those healthcare workers who have not received the recommended two COVID-19 vaccine doses seem not to be mindful of their lives." *(FGD1, September 8, 2021)*

Finally, PPE availability was found to have a significant negative association with non-compliance. Healthcare workers in facilities with inadequate PPE supply were less likely to comply with IPC measures (AOR = 0.012, 95% CI [0.003–0.45], p = 0.002), corresponding to an 88% reduction in the odds of compliance.

Discussion

This study aimed to assess compliance with IPC measures and identify factors influencing adherence among healthcare workers in lower-level health facilities in Butambala District. The overall compliance rate with IPC precautions was found to be 10.6%, which is alarmingly low considering that the study was conducted during the COVID-19 pandemic. This level of compliance was notably lower than anticipated given the heightened emphasis on IPC during this period. These findings are consistent with previous research in Uganda and Ethiopia, which also reported suboptimal IPC compliance among healthcare workers, particularly in lower-level health facilities [22, 29]. While hand washing and proper disposal of healthcare waste showed relatively higher compliance, critical practices such as disinfection of medication vials and use of eye and face protection during procedures recorded very low adherence.

The low compliance observed may reflect broader systemic challenges, including resource constraints, weak supervision, and inadequate institutional support. Globally, studies have shown that between 30% and 70% of healthcare-associated infections are preventable through effective IPC measures [1], underscoring the urgency of strengthening IPC implementation, particularly in resource-limited settings.

Socio-demographic characteristics, specifically professional cadre, were significantly associated with IPC compliance. Laboratory technicians were found to be 2.17 times more likely to comply with IPC measures compared to other cadres. This could be attributed to their specialized training, routine exposure to laboratory biosafety standards, and increased awareness of occupational risks. Similar findings have been reported in other studies [30], reinforcing the idea that professional role and training influence adherence to IPC. However, these results contrast with other studies conducted in Palestine and Jordan, where differences in IPC compliance among cadres were less pronounced [31, 32]. These inconsistencies could reflect contextual differences in IPC training, risk perception, and health system structure across settings.

COVID-19 vaccination status also emerged as a significant predictor of IPC compliance. Healthcare workers who had received two doses of the COVID-19 vaccine were 3.94 times more likely to comply with IPC measures than their unvaccinated or partially vaccinated counterparts. This finding suggests that those who adhere to vaccination guidelines may also be more likely to adopt broader IPC measures. Similar patterns have been observed in other studies [3, 34], which associate vaccine uptake with positive health behaviors and risk perception. Factors contributing to vaccine non-compliance may include misconceptions about vaccine safety, fear of side effects, or lack of trust in vaccine efficacy [35]. Furthermore, as supported by learning theory [36], healthcare workers' own behaviors influence community trust and adherence to public health measures. Thus, healthcare worker vaccination plays a dual role: protecting themselves and reinforcing community confidence in preventive interventions.

Health facility–related factors were also critical. Inadequate PPE supply was strongly associated with lower IPC compliance, with healthcare workers reporting insufficient PPE being 88% less likely to comply with IPC measures. This aligns with previous studies indicating that lack of PPE is a key barrier to adherence, particularly in low-resource settings [29, 31, 37]. Evidence from Palestine and Brazil similarly demonstrated that consistent PPE availability is essential to sustaining IPC compliance among healthcare workers [37]. However, some studies, such as one conducted in Kenya, reported a weaker association between PPE availability and compliance [38], suggesting that other contextual factors including institutional culture and worker motivation may also play a role. Nevertheless, ensuring a reliable supply of PPE remains a fundamental requirement for effective IPC implementation.

These findings align with the study objectives, which sought to identify individual, professional, and facility-level determinants of IPC compliance. They emphasize the critical role of adequate resources, vaccination, and professional capacity in enhancing IPC adherence. The results also highlight areas for targeted interventions, including ensuring consistent PPE availability, reinforcing cadre-specific IPC training, and integrating vaccination promotion into occupational health programs.

Future research should consider longitudinal designs to explore how compliance evolves over time and examine the effectiveness of targeted interventions such as supportive supervision, incentive mechanisms, and digital reporting systems. Qualitative research could also provide deeper insights into the behavioral and organizational factors influencing compliance in rural health facilities.

Equations

Equation 1 – Compliance Calculation

$$Compliance\ (\%) = \frac{Number\ of\ respondents\ who\ answered\ \text{Always" or "}Sometimes"\ X100}{Total\ number\ of\ respondents}$$

Equation 2 – Logistic Regression (Adjusted Odds Ratio model)

$$logit(p) = ln\frac{p}{1-p} = B_0 + B_1x_1 + B_2x_2 + \cdots + B_kx_k$$

Equation 3 – Adjusted Odds Ratio (AOR)

$$AOR = e^{Bi}$$

Equation 4 – Compliance per IPC Parameter

$$Compliance\ per\ IPC\ parameter = \frac{Numbe\ of\ respondnts\ \text{"Always" or "}Sometimes"\ Performing\ the\ pracice\ X\ 100}{Total\ number\ of\ respondents}$$

Conclusion

The findings of this study provide critical insights into infection IPC compliance among healthcare workers in lower-level health facilities in Butambala District. With an overall compliance rate of only 10.6%, far below the WHO-recommended 80% threshold, the results underscore an urgent need to strengthen IPC implementation in resource-limited settings. Low adherence at the frontline level not only places healthcare workers at increased occupational risk but also heightens the potential for healthcare-associated infections within the community.

The study demonstrates that compliance is influenced by multiple, interrelated factors. Professional cadre emerged as a significant determinant, with laboratory technicians exhibiting higher compliance compared to other categories of healthcare workers. This suggests that targeted IPC training and professional specialization may positively influence adherence. In addition, COVID-19 vaccination status was strongly associated with IPC compliance, indicating that vaccination may reflect broader health-protective behaviors among healthcare workers.

Equally important, the availability of personal protective equipment (PPE) was identified as a critical enabling factor. Inadequate PPE supply significantly reduced the likelihood of compliance, reinforcing the importance of strengthening health facility logistics and supply chains to ensure consistent access to essential IPC commodities.

These findings provide a strong justification for prioritizing capacity building**,** vaccine uptake promotion**,** and resource allocation for IPC in rural health facilities. Strengthening supportive supervision, regular refresher training, and ensuring continuous availability of PPE are essential strategies to close the compliance gap. Moreover, these insights can guide policymakers, district health teams, and implementing partners to design targeted interventions aimed at achieving safer healthcare environments for both patients and healthcare providers.

Data Availability

The datasets generated and analyzed during this study are available from the corresponding author (Dominic Savio Kakeeto) upon reasonable request. Due to ethical restrictions and confidentiality agreements with participating facilities, data are not publicly available.

Author Contributions

Dominic Savio Kakeeto: Conceptualization, data collection, formal analysis, writing of the original draft preparation.

Miisa Nanyingi: Methodological Guidance, Supervision, Writing basically Reviewing and Editing.

Both authors read and approved the final version of the manuscript.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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