BKM
Berita Kedokteran Masyarakat

Volume 42 Number 05, 2026, Pages e29314
DOI: 10.22146/bkm.v42i05.29314

Identifying critical behavioral gaps in standard precautions among healthcare workers: a CSPS-based study at an academic hospital in Yogyakarta

Marselinus Edwin Widyanto Daniwijaya[1,2]*, Anwar Rovik[1], Nesti Desi Ari[1], Purwadi Sujalmo[3,4], Ratna Dewi Puspita[1,5]

Submitted:
March 15th, 2026
Accepted:
May 28th, 2026
Published:
May 30th, 2026

[1]Universitas Gadjah Mada Academic Hospital, Yogyakarta, Indonesia

[2]Department of Microbiology, Faculty of Medicine, Public Health, and Nursing. Universitas Gadjah Mada, Yogyakarta, Indonesia

[3]Department of Basic and Emergency Nursing, Faculty of Medicine, Public Health, and Nursing, Yogyakarta, Indonesia

[4]Faculty of Medicine, Nursing, and Health Sciences, Monash University, Australia

[5]Department of Physiology, Faculty of Medicine, Public Health, and Nursing. Universitas Gadjah Mada, Yogyakarta, Indonesia

***Correspondence:**
m.edwin.d@ugm.ac.id

Abstract

Purpose: Compliance with standard precautions is essential to mitigate healthcare-associated infections (HAIs) and occupational hazards. However, behavioral gaps often persist despite institutional policies. This study aimed to evaluate compliance with standard precautions among healthcare workers at Universitas Gadjah Mada (UGM) Academic Hospital. **Methods:** This cross-sectional study was conducted in 2024 among 120 healthcare workers across the outpatient, inpatient, and emergency units at UGM Academic Hospital in Yogyakarta. Participants were selected according to predefined inclusion and exclusion criteria. Adherence was assessed using the 20-item Compliance with Standard Precautions Scale (CSPS), with responses recorded on a 4-point Likert scale (ranging from never to always). Data were analyzed using descriptive statistics and the Kruskal-Wallis test to assess the significance of demographic factors. **Results:** The mean compliance score was 80.458, and 66.67% of participants were categorized as having "Moderate" compliance. Critical deficits were identified in needle recapping (Item 4; score 67/120) and ocular protection (Item 13; score 67/120). Work duration had no significant effect ($p > 0.05$), whereas educational background significantly influenced compliance ($p < 0.05$), with Diploma IV and Bachelor-graduated staff outperforming those with advanced specialist or doctoral degrees. Compliance levels were consistent across all workplace units, with no statistically significant differences ($p > 0.05$). **Conclusion:** Selective compliance remains a challenge in clinical settings. Institutional interventions should move beyond theoretical training to prioritize targeted behavioral reinforcement for staff at all educational levels.

Keywords: academic hospital; hospital-acquired infections; quality improvement; standard precautions

INTRODUCTION

Healthcare-associated infections (HAIs) constitute a critical public health crisis, affecting millions of patients worldwide and significantly increasing morbidity, mortality, and healthcare expenditures [1,2]. In low- and middle-income countries, the burden is particularly acute, with infection rates markedly higher than in developed nations, often leading to prolonged hospital stays and a substantial drain on limited clinical resources [3,4]. As pathogens increasingly develop antimicrobial resistance, preventing nosocomial

transmission has become a global priority [5]. Standard Precautions (SPs), which encompass hand hygiene, use of personal protective equipment (PPE), and safe sharps management, serve as the primary defense against the transmission of infectious agents between patients and healthcare workers (HCWs) [6,7].

In the Indonesian context, SPs have been formally codified under the Ministry of Health Regulation No. 27 of 2017. However, the scale of HAI transmission remains a formidable challenge, necessitating a rigorous evaluation of how these safety protocols are internalized in high-stakes clinical environments [8,9]. Extensive research has used the Compliance with Standard Precautions Scale (CSPS) to quantify adherence to SPs among clinical staff worldwide [6,7]. Previous studies have consistently shown that although hand hygiene compliance is often high due to intensive institutional monitoring, other domains frequently lag [10–13]. Research across various tertiary settings has found that the clinical workforce often reaches a compliance plateau, in which adherence remains at a "Moderate" or "Good" level but falls short of the "High" threshold required for total pathogen containment [14–16]. Furthermore, the literature suggests that demographic variables, such as professional tenure and educational background, play a significant role in shaping risk perception [12]. However, empirical findings across diverse cultural and geographic contexts remain inconsistent and occasionally contradictory [10–13].

A significant research gap remains regarding the specific behavioral nuances of HCWs in Indonesian academic teaching hospitals, particularly selective compliance. Most existing local studies focus on general awareness rather than identifying specific high-risk procedural failures [9]. Moreover, while the global literature discusses the impact of education [9-12], there is a lack of empirical evidence in the Indonesian context on how different levels of academic training influence the transition from theoretical knowledge to clinical practice. Previous research has often failed to explain why highly educated or experienced staff might resort to heuristics or neglect specific procedural safety measures despite their advanced medical training. Furthermore, the influence of the specific clinical workplace on compliance remains a subject of debate. The varying pressures of emergency units, inpatient wards, and outpatient clinics may create distinct micro-cultures of safety. In addition, few studies have examined whether institutional IPC training leads to uniform adherence across these diverse settings. Understanding whether compliance deficits are unit-specific or systemic is essential for developing effective administrative interventions.

As a primary referral and teaching center, Universitas Gadjah Mada (UGM) Academic Hospital manages complex microbiological risks, and any breach of standard precautions can have systemic repercussions. This study aims to address the identified gaps by conducting a comprehensive CSPS-based analysis of HCWs' compliance. Specifically, this research seeks to correlate adherence scores with educational background, workplace, and professional tenure, providing an empirical foundation for targeted interventions. By identifying the weakest links in the infection control chain, this study aims to provide strategic insights to inform the development of more effective, context-specific biosafety training programs in academic hospital settings.

METHODS

Study design and setting

A cross-sectional, descriptive-analytic study was conducted in 2024 to evaluate compliance with standard precautions among HCWs at UGM Academic Hospital, a tertiary-level teaching hospital in Yogyakarta, Indonesia. This setting was selected for its dual role as a referral center and a clinical training site, which necessitates stringent adherence to biosafety protocols. The study population comprised all active healthcare professionals at the hospital. The minimum sample size was determined using the Slovin formula to ensure statistical representativeness.

The population was divided by professional role. With a total population of N = 1000 and a margin of error of 10% (e = 0.10), the estimated minimum sample size was approximately 90 participants (n). The study population comprised clinical staff, including nurses, physicians, and specialists, who were actively involved in direct patient care across outpatient clinics, inpatient wards, and the emergency department. A total of 120 HCWs were recruited using a purposive sampling technique to ensure representation across educational backgrounds and professional tenures. Participation was voluntary, and all respondents provided informed consent before data collection.

Participants were selected based on the following inclusion criteria: 1) active HCWs currently engaged in clinical services, 2) personnel providing direct, face-to-face patient care, and 3) a minimum clinical tenure of two months at UGM Academic Hospital. Exclusion criteria were applied to: 1) HCWs on active leave (e.g., maternity, sick, or sabbatical leave) during the data collection period, and 2) personnel who

declined to provide informed consent or participate in the study.

Data collection

The survey was administered using a structured self-report questionnaire. To minimize social desirability bias, questionnaires were completed anonymously. Respondents were also provided with a brief demographic section to record their educational background (Diploma III, Diploma IV, Bachelor, Master, Specialist, Doctoral, or Sub-specialist) and work duration (< 1 year, 1–5 years, 6–10 years, or > 10 years).

Data were collected using the CSPS, originally developed and validated by Lam [17]. The instrument consists of 20 items across five domains: 1) Hand hygiene, 2) Use of personal protective equipment, 3) Handling of sharps and needles, 4) Waste management, and 5) Decontamination of equipment and environment. Each item is scored on a 4-point Likert scale ("Never," "Seldom," "Sometimes," and "Always"). For items representing positive behavior, a score of 1 was assigned to "Always" and 0 to the other responses. For the four reverse-coded items (Items 2, 4, 6, and 15), a score of 1 was assigned to "Never" and 0 to the other responses. The total score ranges from 0 to 20, with higher scores indicating better compliance. For categorical analysis, scores were divided into three levels: Low Compliance (< 13), Moderate Compliance (13–16), and High Compliance (17–20).

Data analysis

Data were analyzed using IBM SPSS Statistics. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize demographic characteristics and CSPS scores. The normality of the data distribution was assessed using the Shapiro-Wilk test. Nonparametric tests were employed. The Kruskal-Wallis H-test was used to determine whether there were significant differences in compliance scores across the four work-duration groups and the various educational-background categories. Following a significant Kruskal-Wallis result, Dunn's post hoc test was conducted to identify specific pairwise differences between groups. Item-by-item analysis of total scores for each of the 20 items was calculated (Max = 120) to identify specific procedural strengths and weaknesses. Statistical significance was set at $p < 0.05$.

RESULTS

A total of 120 HCWs at UGM Academic Hospital participated in the study (Table 1). The group was mostly composed of nurses (n=87; 72.50%), followed by general practitioners (n=16; 13.34%), specialist doctors (n=10; 8.33%), and midwives (n=7; 5.83%). Regarding gender distribution, the respondent pool was predominantly female (n=99; 82.50%), with males comprising only 17.50% (n=21). The participants' educational backgrounds were diverse, with most holding a bachelor's degree (n=78; 65.00%). Post-graduate qualifications were less common: 5.00% (n=6) were specialists, 2.50% (n=3) held doctoral degrees, and 0.83% (n=1) each held a master's and a sub-specialist degree. Respondents' ages ranged from 24 to 55 years, with an average age of 32 years.

Table 1. Sociodemographic characteristics of HCWs working in UGM Academic Hospital, Yogyakarta, in 2024 (n=120)

Variable	n	%
Professional role		
Doctor (specialist)	10	8.33
General practitioner	16	13.34
Nurses	87	72.50
Midwife	7	5.83
Assigned place		
Outpatient clinic	32	26.67
Inpatient ward	41	34.16
Emergency unit	47	39.17
Educational background		
Diploma III	26	21.67
Diploma IV	5	4.17
Bachelor	78	65.00
Master	1	0.83
Doctoral	3	2.50
Specialist	6	5.00
Sub-specialist	1	0.83
Gender		
Male	21	17.5
Female	99	82.5
Age (years)		
Min	24	—
Max	55	—
Average	32	—
Length of work at UGM hospital (years)		
< 1	15	12.50
1-5	49	40.83
6-10	26	21.67
> 10	30	25.00
Total length of work (years)		
< 1	8	6.67
1-5	50	41.67
6-10	28	23.33
11-15	28	23.33
16-20	5	4.17
> 20	1	0.83

This youthful demographic is reflected in their tenure at UGM Academic Hospital and in their broader professional experience. Notably, 40.83% of the staff have been at UGM Academic Hospital for 1 to 5 years, indicating a workforce mostly in the early stages of their careers. Only a small fraction (0.80%) of respondents had more than 20 years of total work experience.

Overall, participants demonstrated high adherence to foundational infection control practices, particularly hand hygiene and basic barrier precautions (Table 2).

The highest levels of compliance ("Always") were observed for waste segregation and basic hygiene. Specifically, 99.17% of HCWs reported disposing of sharps in dedicated containers, and nearly all respondents (97.50%) reported wearing gloves when exposed to body fluids. Hand hygiene after patient contact and immediately after glove removal both showed excellent adherence, with 96.67% of respondents consistently performing these tasks. Additionally, respiratory protection was well observed, with 95.00% of HCWs ensuring that both the mouth and nose were covered when wearing a mask. Despite high overall hygiene scores, several critical gaps were identified, particularly in needle recapping (16.67%; "Never") and inadequate ocular protection (5.83%; "Always").

Table 2. Level of compliance with SPs among HCWs working in UGM Academic Hospital, in 2024 (n=120)

ID	Component of SPs	Level of compliance n (%)		
		Always	Sometimes	Seldom
Q1	I perform hand hygiene after contact with patients.	116 (96.67)	4 (3.33)	0 (0.00)
Q2	I use only water for handwashing.	34 (28.33)*	44 (36.67)	15 (12.50)
Q3	I use alcohol-based hand rub as an alternative when my hands are not visibly soiled.	77 (64.17)	37 (30.83)	6 (5.00)
Q4	I recap used needles after administration of injections.	20 (16.67)*	23 (19.17)	10 (8.33)
Q5	I dispose of sharps into dedicated sharps containers.	119 (99.17)	1 (0.83)	0 (0.00)
Q6	Sharps containers are disposed of only when they are completely full.	29 (24.17)*	42 (35.00)	20 (16.67)
Q7	I doff personal protective equipment (PPE) in designated areas.	111 (92.50)	9 (7.50)	0 (0.00)
Q8	I take a shower if significantly splashed with fluids, even after wearing PPE.	85 (70.83)	26 (21.67)	6 (5.00)
Q9	I cover my wounds or lesions with waterproof dressings before patient contact.	87 (72.50)	24 (20.00)	7 (5.83)
Q10	I wear gloves when exposed to body fluids, blood products, and other excretions.	117 (97.50)	3 (2.50)	0 (0.00)
Q11	I change gloves between patient contacts.	104 (86.67)	14 (11.67)	1 (0.83)
Q12	I perform hand hygiene immediately after glove removal.	116 (96.67)	4 (3.33)	0 (0.00)
Q13	I wear a surgical mask alone or with goggles, a face shield, and an apron whenever splashes or sprays are likely.	67 (55.83)	42 (35.00)	11 (9.17)
Q14	Both my mouth and nose are covered when I am wearing a mask.	114 (95.00)	5 (4.17)	1 (0.83)
Q15	I reuse disposable surgical masks or other single-use PPE.	84 (70.00)*	14 (11.67)	14 (11.67)
Q16	I wear a gown or apron when there is a risk of exposure to blood, body fluids, or patient excretions.	93 (77.50)	22 (18.33)	4 (3.33)
Q17	Waste contaminated with blood, body fluids, secretions, or excretions is placed in yellow biohazard bags regardless of the patient's infection status.	105 (87.50)	7 (5.83)	3 (2.50)
Q18	I decontaminate surfaces and medical equipment after each use.	89 (74.17)	30 (25.00)	1 (0.83)
Q19	I wear gloves when cleaning visibly soiled used equipment.	104 (86.67)	14 (11.67)	1 (0.83)
Q20	I immediately clean up blood or other body fluid spills using disinfectant.	94 (78.33)	22 (18.33)	2 (1.67)

Note: *always means never

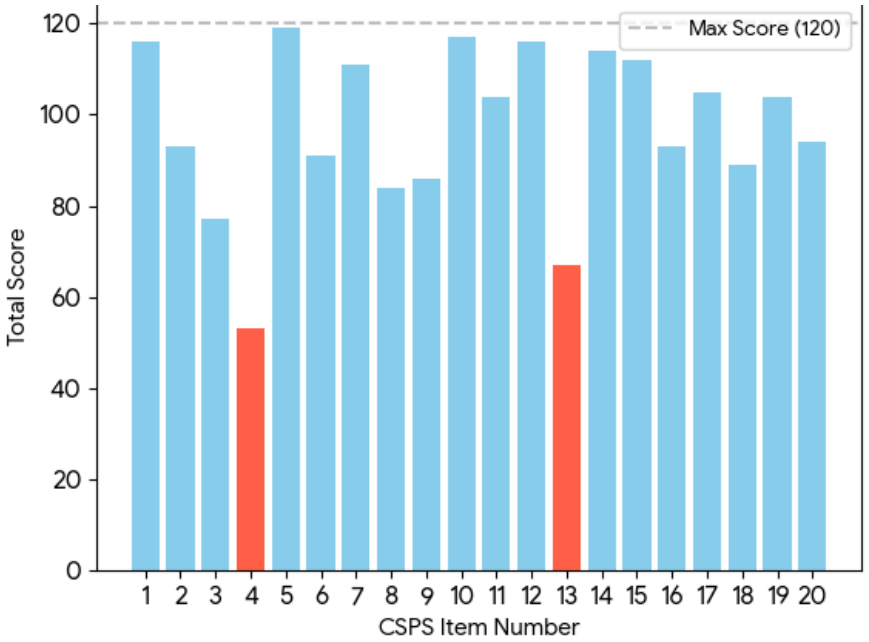

Figure 1. Distribution of CSPS score per item evaluated from HCWs working in UGM Academic Hospital, Yogyakarta, in 2024 (n=120)

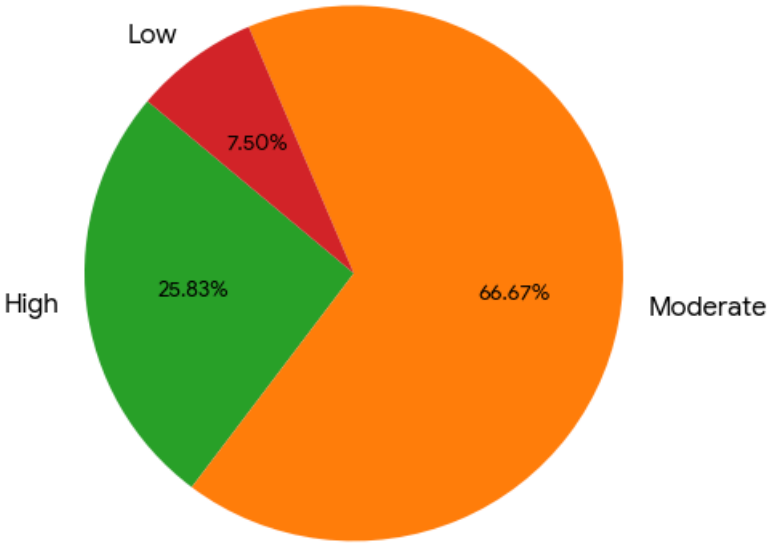

Figure 2. Overall compliance level to SPs among HCWs working in UGM Academic Hospital, Yogyakarta, in 2024 (n=120)

The distribution of scores reveals a high baseline of adherence to hygiene protocols, contrasted by significant behavioral deficits in specific high-risk procedural domains (Figure 1). The highest compliance scores were observed in waste management and basic barrier precautions. Item 5 (Sharps disposal into dedicated containers) achieved the highest adherence, with 119 of 120 HCWs (99.17%) reporting consistent compliance. This compliance was closely followed by Item 10 (Glove use during fluid exposure) at 117 (97.50%), and by Items 1 and 12 (Hand hygiene post-patient contact and post-glove removal), both at 116 (96.67%). Additionally, respiratory protection through proper mask-wearing (Item 14) showed high adherence at 114 (95.00%). A major gap was identified in Item 2, where only 27 HCWs (22.50%) correctly avoided washing their hands with water alone, suggesting a high prevalence of inadequate handwashing technique. While disposal in containers is high, the process's safety is compromised. Only 29 HCWs (24.17%) reported avoiding overfilling sharps containers (Item 6), and only 67 HCWs (55.83%) consistently avoided the high-risk practice of needle recapping (Item 4).

The overall adherence to standard precautions among HCWs at UGM Academic Hospital was categorized into three levels: Low, Moderate, and High. The majority of the participants exhibited a Moderate level of compliance, accounting for 66.67% (n=80) of the total sample (Figure 2). This data indicates that while most HCWs are familiar with and implement basic safety protocols, there remains a consistent gap in achieving full adherence to all evaluated safety components. Conversely, 7.50% (n=9) of the respondents were classified within the Low compliance category.

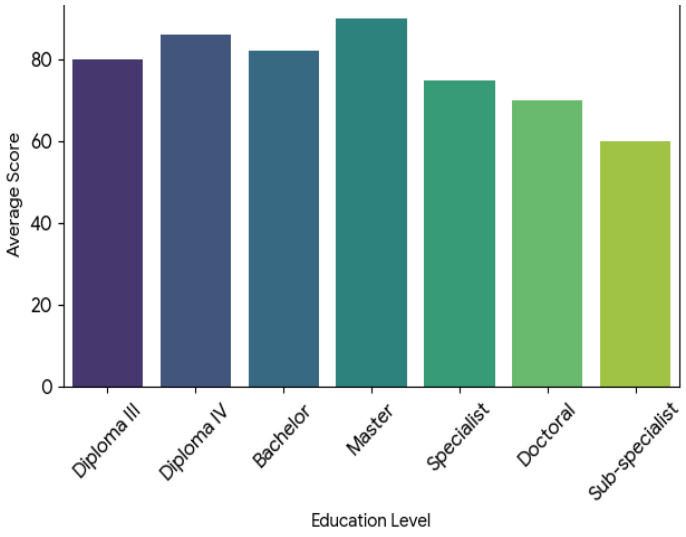

Figure 3. Mean CSPS score by education level among HCWs working in UGM Academic Hospital, Yogyakarta, in 2024 (n=120)

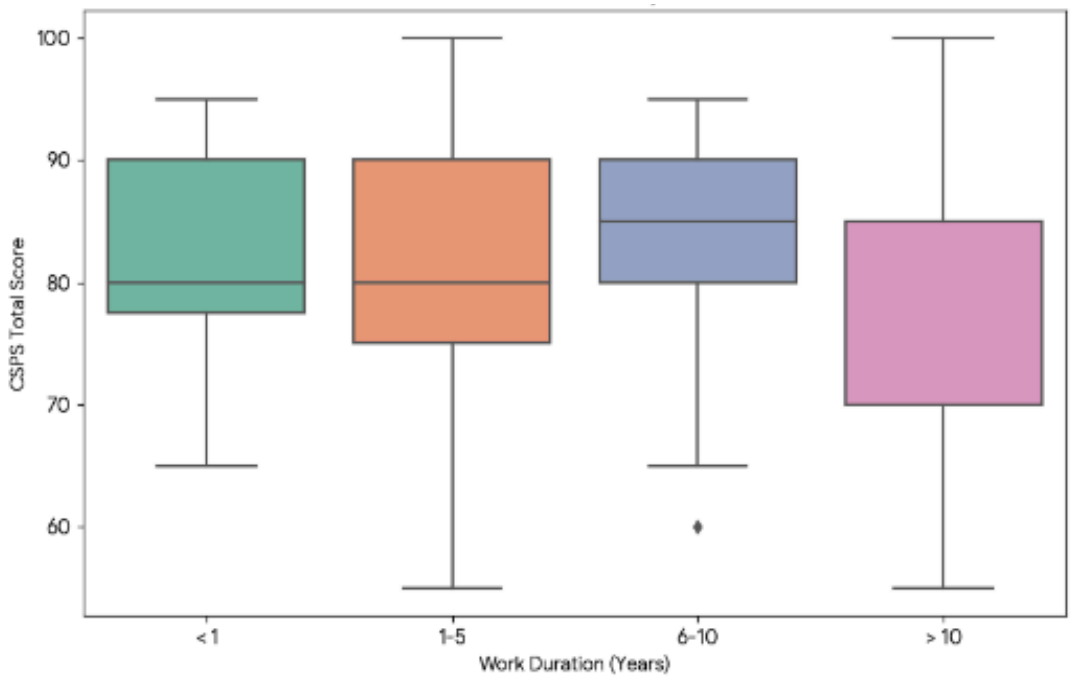

Figure 4. Distribution of CSPS score by working duration among HCWs working in UGM Academic Hospital, Yogyakarta, in 2024 (n=120)

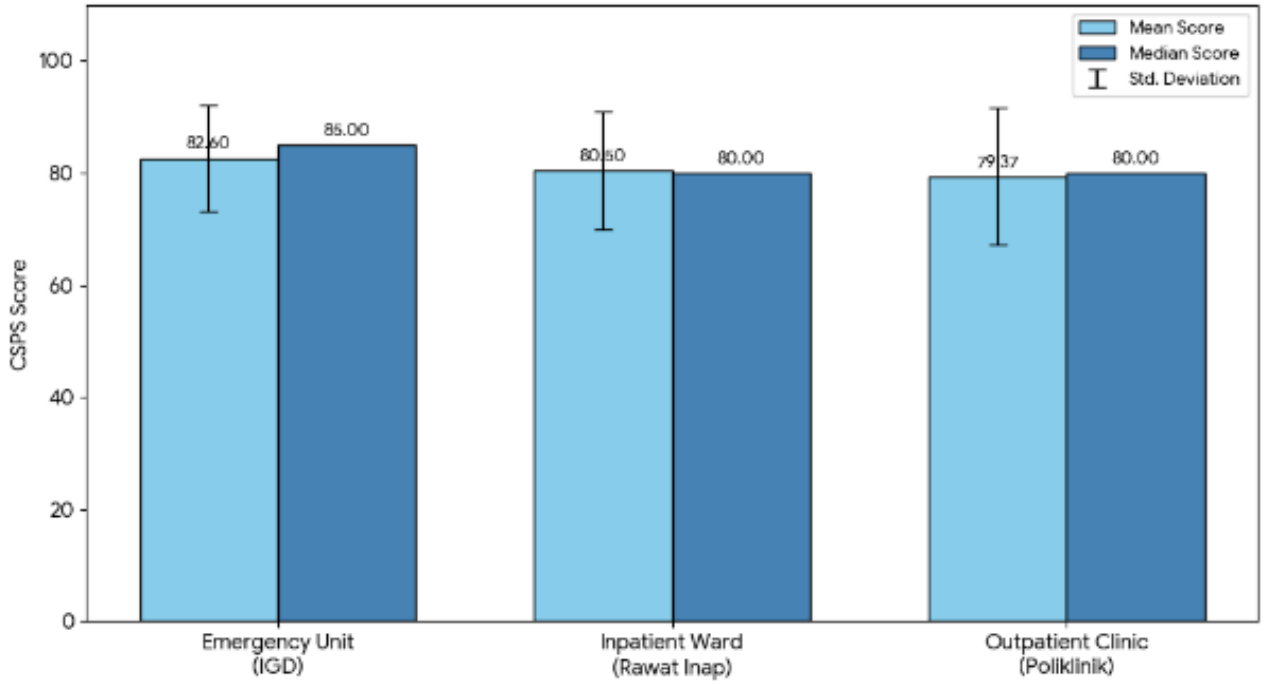

Figure 5. Comparison of CSPS compliance score by designated place among HCWs working in UGM Academic Hospital, Yogyakarta, in 2024 (n=120)

Educational background significantly influenced compliance with standard precautions among HCWs ($p < 0.05$). However, the data were predominantly represented by the Bachelor (n=78) and Diploma III (n=26) cohorts (Figure 3). The sample sizes for advanced educational groups (Doctoral and Specialist) were notably small; consequently, low scores from only one or two individuals may have disproportionately skewed the mean scores for these specific groups. There was no statistically significant difference in CSPS compliance scores across work durations ($p > 0.05$). Professional tenure was not a primary determinant of healthcare workers' adherence to standard precautions at this institution (Figure 4). Both junior and senior staff demonstrated a similar likelihood of falling within any given compliance category.

Statistical analysis revealed no significant correlation between the clinical workplace and CSPS compliance scores ($p > 0.05$). While the Emergency Unit (IGD) recorded the highest mean score (82.60 ± 9.56), a comparative analysis showed no statistically significant difference from the Inpatient Ward (80.50 ± 10.48) or the Outpatient Clinic (79.37 ± 12.16). This uniform distribution of moderate compliance scores suggests that the institutional safety culture is consistently implemented across the hospital, regardless of the clinical setting's inherent risk level (Figure 5).

DISCUSSION

The results of this study reveal a complex landscape of infection control adherence at UGM Academic Hospital, characterized by a stark contrast between strong hand hygiene performance and alarming deficiencies in specific safety protocols. The overall mean score of 80.458 classifies the institution's compliance as "Moderate," with the majority of staff (66.67%) falling within this middle tier (Table 2; Figure 2). While the institutional safety climate effectively promotes visible hygiene practices, it has not yet achieved the "High" compliance threshold required for a robust biosafety environment. This result suggests that current training programs successfully foster basic awareness but fail to eliminate entrenched, high-risk behaviors that deviate from international standard precaution guidelines.

A critical behavioral gap was identified in sharps management and equipment sustainability, specifically regarding needle recapping and the reuse of disposable PPE (Table 2; Figure 1). Despite long-standing CDC and WHO prohibitions, the low adherence to these items indicates a profound "knowledge-to-practice" gap. The tendency to recap needles often stems from a misguided attempt to prevent accidental injury during transport [18]. At the same time, the reuse of single-use masks or gowns may be influenced by perceived resource constraints or a lack of environmental awareness. From a public health perspective, these represent severe occupational hazards; needlestick injuries (NSIs) remain primary vectors for bloodborne pathogens such as HBV, HCV, and HIV, posing a systemic threat to the long-term sustainability of the healthcare workforce [18–20].

In addition to sharps mismanagement, this study identifies significant deficits in ocular protection and in fundamental handwashing standards (Table 2). While adherence to masking and gloving was nearly universal, the use of goggles or face shields during splash-prone procedures remains suboptimal (score: 67/120). Furthermore, reliance on water alone for handwashing (Item 2, score: 93/120) suggests that, while handwashing is socialized, the use of antiseptic agents is frequently neglected. This selective compliance indicates that HCWs may perceive ocular or non-antiseptic exposures as lower risk than percutaneous or respiratory exposures, reflecting an incomplete internalization of the standard precautions philosophy, which mandates consistent protection regardless of the patient's perceived infection status.

The most significant demographic finding in this study was the influence of educational background on compliance scores ($p < 0.05$). Statistical analysis revealed that Diploma IV and Bachelor-prepared staff maintained higher average scores than specialists or those with doctoral degrees (Figure 3). This difference may be attributed to the intensive, practice-oriented Infection Prevention and Control (IPC) training prevalent in nursing and allied health curricula [11]. Conversely, advanced medical tracks may focus more heavily on complex diagnosis and therapy, inadvertently de-emphasizing foundational biosafety protocols [6,11]. However, it must be noted that the smaller sample size among advanced degree holders makes their mean scores more susceptible to individual outliers, necessitating cautious interpretation of this educational paradox.

Conversely, professional tenure was not significantly correlated with compliance scores ($p > 0.05$). Whether a HCW had less than one year of experience or more than a decade, their adherence to the CSPS remained statistically similar (Figure 4). This adherence implies that "experience" alone does not naturally cultivate better safety habits. In fact, the lack of improvement among senior staff may point to compliance fatigue or the development of habitual shortcuts over time [12]. This finding suggests that institutional IPC interventions must be universal and continuous, rather than focused solely on new employee orientation, to prevent the erosion of safety standards across all career stages.

Similarly, the clinical workplace unit (Emergency Unit, Inpatient Ward, or Outpatient Clinic) did not significantly influence compliance levels (Figure 5; $p > 0.05$). The relative uniformity of "Moderate" scores across these diverse environments suggests that the barriers to reaching "High" compliance—such as time pressure, cognitive load, or equipment accessibility—are systemic rather than unit-specific. While one might expect heightened vigilance in the Emergency Unit due to the acute nature of care, the consistent results across the hospital indicate that the transition from theoretical knowledge to habitual practice remains a universal institutional challenge [7,12].

The public health implications of these findings are particularly acute for academic teaching hospitals. As tertiary referral centers and training sites, these institutions set the behavioral standard for future clinicians. If unsafe practices, such as needle recapping or overfilling sharps containers, are normalized in a teaching environment, students and residents may adopt these behaviors as norms, perpetuating a cycle of suboptimal safety culture throughout the regional health system [16]. Bridging the gap to "High" compliance requires a shift from theoretical education to systemic engineering, including the mandatory implementation of safety-engineered devices and the optimization of sharps container ergonomics to eliminate the perceived need for high-risk manual interventions.

Despite its insights, this study is limited by its cross-sectional design and reliance on self-reported data, which may be subject to social desirability bias, in which participants overestimate their adherence to avoid scrutiny [21]. The uneven distribution of educational categories also warrants caution when generalizing findings for the highest academic tiers. Future research should use direct observation and qualitative interviews to explore the underlying psychological drivers of selective compliance in high-pressure environments. Nevertheless, this study provides a crucial baseline for UGM Academic Hospital to refine its IPC strategies and prioritize eliminating the specific procedural valleys identified in this evaluation.

CONCLUSION

Healthcare workers at UGM Academic Hospital demonstrate a "Moderate" level of compliance with standard precautions, marked by strong adherence to hand hygiene but significant lapses in sharps management and ocular protection. The high prevalence of needle recapping and suboptimal use of goggles indicates that theoretical knowledge has not fully translated into safe clinical habits. Notably, seniority or work duration does not guarantee better compliance, whereas educational background is a significant predictor of safety behavior. The lower compliance scores among staff with higher academic or specialist degrees highlight the need to revitalize IPC training within advanced medical curricula. To bridge the gap toward "High" compliance, the hospital should prioritize implementing safety-engineered devices and fostering a comprehensive safety culture that addresses the specific behavioral barriers identified in this study.

Acknowledgements
We thank the Director of Universitas Gadjah Mada Academic Hospital for granting permission and support for the research.

Author's contribution
Conceptualization: M.E.D.W. and P.S.; Methodology: P.S., M.E.D.W., N.D.A., and R.D.P.; Investigation: M.E.D.W., N.D.A., and P.S.; Data curation: A.R. and R.D.P.; Formal analysis: M.E.D.W., A.R., N.D.A., and P.S.; Writing—original draft: A.R. and M.E.D.W.; Writing—review & editing: all authors; Supervision: M.E.D.W.; Funding acquisition: P.S. and R.D.P.; All authors have read and approved the final version of the manuscript.

Conflict of interest
The author declares no conflict of interest in this study.

Funding
We thank the Universitas Gadjah Mada Academic Hospital for funding support through the 2024 Research Grant No. 1492/UN1/RSA.2/AR/B/2024.

Data availability
The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethical considerations
The study protocol was approved by the Medical and Health Research Ethics Committee of the Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada - Dr. Sardjito General Hospital Ref. No. KE/FK/1377/EC/2024. Participants were informed of their right to withdraw at any time, and data confidentiality was maintained throughout the study.

Use of artificial intelligence (AI)
Portions of this article were edited using Gemini and Grammarly. All AI-assisted content has been reviewed and validated by the authors. The authors are solely responsible for the final product.

REFERENCES

1. Anand G, Lahariya R. Healthcare-associated infections. GMS Hygiene and Infection Control. 2025;20.
2. Hessels AJ, Kuo YH, Ahmed N. Epidemiology and impact of healthcare-associated infections in trauma patients: A national data analysis. Surgical Infections. 2020;21(10):871–6.
3. Gandra S, Alvarez-Uria G, Turner P, Joshi J, Limmathurotsakul D, van Doorn HR. Antimicrobial resistance surveillance in low- and middle-income countries: progress and challenges in eight South Asian and Southeast Asian countries. Clinical Microbiology Reviews. 2020;33(3):e00048–19.
4. Sati H, Carrara E, Savoldi A, Hansen P, Garlasco J, Campagnaro E, et al. The WHO Bacterial Priority Pathogens List 2024: a prioritisation study to guide

research, development, and public health strategies against antimicrobial resistance. Lancet Infectious Diseases. 2025;25(9):1033–43.
5. 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.
6. Donati D, Biagioli V, Cianfrocca C, De Marinis MG, Tartaglini D. Compliance with standard precautions among clinical nurses: validity and reliability of the Italian version of the compliance with standard precautions scale (CSPS-It). International Journal of Environmental Research and Public Health. 2019; 16(1):121.
7. Elseesy NAM, Al-Zahrani AE, Kandil FS, Mahsoon A, Elhady MM. Compliance among registered nurses and doctors in critical care units: challenges affecting their adherence to standard precautions. Healthcare. 2023;11(22):2975.
8. Mustika GI, Kusbaryanto K. Literature review the implementation of infection prevention and control programs on the medical staff. JMMR (Jurnal Medicoeticolegal dan Manajemen Rumah Sakit). 2021;10(2):189–206.
9. Wibowo H, Firna L. Integration of professional ethics, SOP compliance, and health worker professionalism in improving the quality of health services: case study in Indonesian health institutions. Journal of Health Management, Administration and Public Health Policies. 2025; 3(1):28–37.
10. Fitria N, Yulianita H, Sugiharto F, Astari DW, Eriyani T. The factors associated with performance among infection prevention and control linked nurse during Covid-19 pandemic. SAGE Open Nursing. 2023;9.
11. Angue JK, Barrieta KEP, Brar SJJK, Dimayuga BSA, Maganes MMO, Mondina JGF, et al. Identifying gaps between theory and clinical practice among fourth-year nursing students for skill enhancement. Celebes Nursing Journal. 2025;2(1):1–20.
12. Haile TG, Engeda EH, Abdo AA. Compliance with standard precautions and associated factors among healthcare workers in Gondar University Comprehensive Specialized Hospital, Northwest Ethiopia. Journal of Environmental Public Health. 2017;2017:1–8.
13. Senbato FR, Wolde D, Belina M, Kotiso KS, Medhin G, Amogne W, et al. Compliance with infection prevention and control standard precautions and factors associated with noncompliance among healthcare workers working in public hospitals in Addis Ababa, Ethiopia. Antimicrobial Resistance & Infection Control. 2024;13(1):32.
14. Anandadurai D, Praisie R, Venkateshvaran S, Nelson SB, Thulasiram M. Awareness, perception, and practice regarding needle-stick injury and its prevention among healthcare workers in a tertiary care hospital in Southern India. Cureus Journal of Medical Science. 2024;16(3):e55820.
15. Qazi AR, Siddiqui FA, Faridi S, Nadeem U, Umer NI, Mohsini ZS, et al. Comparison of awareness about precautions for needle stick injuries: a survey among health care workers at a tertiary care center in Pakistan. Patient Safety in Surgery. 2016;10(1):19.
16. Phan HT, Zingg W, Tran HTT, Dinh APP, Pittet D. Sustained effects of a multimodal campaign aiming at hand hygiene improvement on compliance and healthcare-associated infections in a large gynaecology/obstetrics tertiary-care centre in Vietnam. Antimicrobial Resistance & Infection Control. 2020;9(1):51.
17. Lam SC. Universal to standard precautions in disease prevention: Preliminary development of compliance scale for clinical nursing. International Journal of Nursing Studies. 2011;48(12):1533–9.
18. Bouya S, Balouchi A, Rafiemanesh H, Amirshahi M, Dastres M, Moghadam MP, et al. Global prevalence and device related causes of needle stick injuries among health care workers: a systematic review and meta-analysis. Annals of Global Health. 2020; 86(1):35.
19. Centers for Disease Control and Prevention. Workbook for designing, implementing and evaluating a sharps injury prevention program. 2008. Available from: [Website]
20. Fathizadeh H, Alirezaie Z, Saeed F, Saeed B, Gharibi Z, Biojmajd AR. Prevalence of needle stick and its related factors in Iranian health worker: an updated systematic review and meta-analysis. Journal of Global Health. 2023;13:04104.
21. Bispo Júnior JP. Social desirability bias in qualitative health research. Revista de Saúde Pública. 2022;56: 101.