Yemen Journal of Medicine

https://yemenjmed.com

Article information

DOI: 10.63475/yjm.v5i2.0469

Article history:
Received: 20 July 2026
Accepted: 01 August 2026
Published: 06 August 2026

Correspondence to:
Labiba Anam
Email: labibaanam@gmail.com
ORCID: 0000-0001-7927-4503

How to cite this article
Alwaleede SAA, Bahram BMS, Khan MTY, Ma'aroof RIY, Alsa'ar FNM, Al-Thibini HMA, et al. Knowledge, attitudes, and practices regarding occupational safety among cleaning workers in two major public hospitals in Sana'a City, Yemen. Yemen J Med. Published online August 06, 2026. doi: 10.63475/yjm.v5i2.0469: 1-9.

Original Article

Knowledge, Attitudes, and Practices Regarding Occupational Safety Among Cleaning Workers in Two Major Public Hospitals in Sana'a City, Yemen

Sameer Ahmed Abdullah Alwaleede[1], Bashar Mohammed Saleh Bahram[1], Mohammed Tareq Yousef Khan[1], Rashad Ibrahim Yahya ma'aroof[1], Farooq Nabeel Mohammed Alsa'ar[1], Hamza Mansour Ali Al-Thibini[1], Hamza Mohammad Mohammad Zohid[1], Qaid Salah Ahmed Saleh Alhomidi[1], Mohammed Salem Ahmed Al-Malahi[1], Adel Abdullah Omar Zaid[1], Labiba Anam[2]

1 Medical Student, Emirate International University, Faculty of Medicine and Health Sciences, Sana'a, Yemen
2 Professor, Community Medicine Department, Emirate International University, Faculty of Medicine and Health Sciences, Sana'a, Yemen

ABSTRACT

Background: Hospital cleaning workers face disproportionate occupational hazards yet remain marginalized within healthcare systems. In conflict-affected Yemen, healthcare infrastructure degradation creates uniquely challenging conditions for occupational safety and health (OSH), with scarce data on this vulnerable workforce. This study aimed to assess knowledge, attitudes, and practices (KAP) regarding occupational safety and identify associated factors among cleaning workers in two major public hospitals in Sana'a City, Yemen.

Methods: A descriptive cross-sectional study was conducted between July and December 2025. Using stratified random sampling, 306 cleaning workers completed a structured 43-item Arabic questionnaire. Knowledge (12 items, ≥7 good), attitudes (7 items, ≥15 positive), and practices (8 items, ≥19 safe) were assessed. Bivariate analysis examined associations between variables and KAP levels.

Results: The response rate was 87.4%. Participants were predominantly male (90.5%) with primary education (65.4%). Good knowledge was observed in 65.4%, positive attitudes in 61.4%, and safe practices in 75.2%. However, only 52.9% knew correct exposure reporting procedures, and 32.4% did not believe occupational safety was important. Critically, 100% reported receiving no OSH training in the preceding year, and 23.5% had experienced needlestick injuries. Education was significantly associated with knowledge ($P = 0.004$). Hospital setting ($P = 0.001$), experience >5 years ($P = 0.022$), and injury history ($P = 0.015$) were significantly associated with practice levels. Injured workers reported lower safe practice rates (62.5% vs. 79.1%).

Conclusions: Despite moderate knowledge and positive attitudes, high needlestick injury rates and complete absence of formal training reveal a dangerous gap between understanding and practice. Education and experience are protective factors, yet systemic barriers undermine safety. Urgent implementation of structured training, consistent personal protective equipment provision, and non-punitive reporting systems is essential to protect this workforce.

Key words: Occupational safety, hospital cleaners, knowledge-attitudes-practices, needlestick injuries, personal protective equipment, conflict-affected healthcare, Yemen

INTRODUCTION

Hospital cleaning workers are a fundamental component of the healthcare system, playing a critical role in maintaining environmental hygiene and preventing healthcare-associated infections. [1] Despite their indispensable role, these workers are frequently marginalized within the healthcare hierarchy and face a disproportionate burden of occupational hazards compared to other healthcare personnel. [2,3] In the course of their daily duties, hospital cleaners are routinely exposed to a complex array of biological, chemical, and physical hazards, including infectious agents, sharps injuries, toxic disinfectants, and ergonomic risks. [2,4]

Sharps injuries represent a particularly severe threat, as they serve as a primary vector for the transmission of bloodborne pathogens such as hepatitis B and C, and human immunodeficiency virus (HIV). [5] The International Labour Organization emphasizes that ensuring occupational safety and health (OSH) is a fundamental worker right, yet in many developing countries, OSH standards for ancillary hospital staff remain poorly enforced. [6,7] The Knowledge, Attitude, and Practice (KAP) framework is widely utilized to evaluate occupational safety; it is predicated on the assumption that adequate knowledge and positive attitudes are essential precursors to the adoption of safe workplace practices. [8] However, studies in low- and middle-income countries (LMICs) frequently report a disconnect, where despite moderate knowledge, poor practices persist due to systemic barriers. [9,10] These systemic constraints, ranging from inadequate access to personal protective equipment (PPE) to a lack of formal, structured pre-employment safety training, often leave cleaning staff ill-equipped to manage occupational risks effectively. [11] Furthermore, understanding these multifaceted determinants [10,12]—such as the objective perception of health risks and institutional resource allocation—is essential for developing targeted interventions that move beyond simple awareness to sustain behavioral change. [13,14]

In Sub-Saharan Africa and the Middle East, evidence regarding the KAP of hospital cleaners remains concerning. Studies in Ethiopia and Nigeria have documented significant deficits in waste segregation knowledge and high rates of non-compliance with PPE usage among cleaning staff. [4,10,15] Similarly, research in Somalia and [16,17] Egypt highlighted that while a portion of healthcare workers understand the importance of infection control, inadequate resources and a lack of continuous training severely hinder practical application. [18,19]

Yemen presents a uniquely challenging context for occupational safety. Following years of protracted armed conflict, the country's healthcare infrastructure has been severely decimated, leading to chronic shortages of medical supplies, including PPE, and the disruption of routine in-service training. [20] Previous local studies in Sana'a have highlighted alarming rates of needlestick injuries (NSIs) among nurses and laboratory staff, coupled with suboptimal adherence to standard precautions and low hepatitis B vaccination coverage. [21,22] However, data specifically focusing on cleaning workers—who handle the bulk of infectious and sharp waste before disposal—remain extremely scarce.

To the best of our knowledge, no recent study has evaluated the occupational safety KAP among hospital cleaners in Sana'a while accounting for conflict-specific variables such as PPE supply chain disruptions. Therefore, this study aimed to assess the KAP regarding occupational safety and to identify associated factors among cleaning workers in two major public hospitals in Sana'a City, Yemen. The findings of this study are intended to inform hospital administrators and policymakers in designing targeted, resource-appropriate interventions to protect this vulnerable workforce.

MATERIALS AND METHODS

Study Design, Setting, and Population

A descriptive cross-sectional study was conducted at Al Thawra Modern General Hospital and the Republican Teaching Hospital Authority in Sana'a City, Yemen, between July and December 2025. All cleaning workers employed in the medical sanitary staff category at the two hospitals were eligible.

Inclusion/Exclusion Criteria

Inclusion criteria were: (1) employed as a hospital cleaner, (2) working in one of the two selected hospitals, (3) provided verbal consent. Exclusion criteria included supervisory or administrative cleaning staff and cleaners who were not willing to participate.

Sample Size Calculation and Sampling Technique

According to standard academic parameters, which include a 95% confidence level and a 5% margin of error, the minimum sample size necessary for a population of 600 is 281 respondents. To account for expected non-responders, we have recruited a total of 350 workers.

A stratified random sampling technique was utilized to ensure proportional representation across all hospital departments. Stratification was performed by hospital (two strata) and department (six strata: general wards, operating theaters, emergency department, intensive care unit, outpatient clinics, and administrative areas). Within each stratum, workers were selected using simple random sampling from updated staff lists provided by hospital administration. Sample allocation was proportional to stratum size.

Data Collection Tool

Data were collected via face-to-face interviews using a structured, 43-item questionnaire translated into Arabic. The tool was adapted from previously validated KAP studies in similar LMIC settings by Gebreeyessus et al. (2022 [11]), Nwankwo et al. (2018 [12]), and Faremi et al (2014 [23]). Adaptations included: (a) addition of items specific to conflict-affected healthcare settings (PPE supply disruption, security concerns); (b) modification of response options to accommodate low literacy levels (verbal administration with showcards); and (c) contextualization of examples to Yemeni hospital settings. The adapted questionnaire was reviewed by three experts (two occupational health specialists and one epidemiologist) for content validity. Experts rated each item on relevance, clarity, and comprehensiveness using a 4-point scale; items with mean scores <3 were revised or removed. A pilot study with 10 cleaners (excluded from the final sample) confirmed clarity and estimated completion time (15–20 minutes).

Internal consistency reliability was assessed using Cronbach's alpha: knowledge scale (α = 0.72), attitude scale (α = 0.68), and practice scale (α = 0.75).

Scoring System

Knowledge

Each correct answer received 1 point (range 0–12). Scores ≥7 (≥50%) were categorized as "Good Knowledge," and <7 as "Poor Knowledge."

Attitudes

Positive statements scored 3 (agree) to 1 (disagree); one negative statement was reverse-scored. Total range 7–21. Scores ≥15 (mean ≥2) were "Positive Attitude"; <15 were "Negative Attitude."

Practices

"Always" = 3, "Sometimes" = 2, "Never" = 1. Total range 8 to 24. Scores ≥19 (≥75% adherence) were "Safe Practice"; <19 were "Unsafe Practice."

Ethical Considerations

Ethical approval was obtained from the Emirates International University Ethical Committee. Administrative clearance was secured from the directors of both hospitals. Verbal informed consent was obtained from all participants before interviews, emphasizing voluntary participation, anonymity, and confidentiality.

Statistical Analysis

Data were cleaned, coded, and analyzed using SPSS version 27.0 (IBM Corp., Armonk, NY). Descriptive statistics (frequencies, percentages, means, and standard deviations) summarized the data. Bivariate analysis using Chi-square tests assessed the association between independent variables (demographics, experience, and injury history) and dependent variables (KAP levels). A *P*-value of <0.05 was considered statistically significant.

RESULTS

Demographic and Experience Characteristics

A total of 350 cleaning workers were recruited from selected hospitals, of whom 306 completed the survey, yielding a response rate of 87.4%. As shown in **Table 1**, participants were drawn from two facilities: the Republican Teaching Hospital Authority (52.6%, *n* = 161) and Al Thawra Modern General Hospital (47.4%, *n* = 145). The sample was predominantly male (90.5%, *n* = 277) and single (66.0%, *n* = 202). With respect to educational attainment, the majority had completed primary education (65.4%, *n* = 200), while 27.8% (*n* = 85) reported no formal education. Regarding work experience, 75.1% (*n* = 229) had been employed in the cleaning profession for 1 to 5 years.

Statistical summaries indicated that the mean age of the cleaning staff was 24.05 years (*SD* = 7.15). The median duration of service was 3 years, with a range of 1 to 15 years.

Knowledge Assessment

Knowledge levels regarding OSH varied across the assessed domains (see **Table 2**). While a large majority correctly identified the need for PPE during waste handling (81.0%, *n* = 248), only 56.9% (*n* = 174) knew the correct definition of occupational safety. Similarly, 76.1% (*n* = 233) correctly identified the yellow bag for infectious waste disposal, whereas knowledge regarding the red container was comparatively lower (62.4%, *n* = 191). A critical finding was that only 52.9% (*n* = 162) were aware of the requirement to report body fluid exposure immediately, with 18.3% (*n* = 56) reporting unfamiliarity with the correct procedure.

Overall, 65.4% (*n* = 200) of the cleaning staff demonstrated good knowledge (7–12 points) of occupational health and safety standards, whereas 34.6% (*n* = 106) were categorized

Table 1: Socio-demographic characteristics of cleaning workers (N = 306)

No.	Variable	Category	*n*	%
1	Hospital	Al Thawra Modern General Hospital	145	47.4
		Republican Teaching Hospital Authority	161	52.6
2	Gender	Male	277	90.5
		Female	29	9.5
3	Marital status	Single	202	66.0
		Married	98	32.0
		Divorced	3	1.0
		Widowed	3	1.0
4	Education	Not educated	85	27.8
		Primary	200	65.4
		Preparatory	15	4.9
		Secondary	6	2.0
5	Experience	1–5 years	229	75.1
		6–10 years	62	20.3
		11–15 years	14	4.6
	Total		**306**	**100.0**

Table 2: Knowledge of occupational safety and health among cleaning staff (N = 306)

No.	Knowledge item	Category	*n*	%
1	Definition of occupational safety	Preventive measures	174	56.9
		Procedures for productivity only	60	19.6
		Rules for working hours	72	23.5
2	Potential hazards in hospitals	All of the above	206	67.3
		Biological hazards	53	17.3
		Chemical hazards	16	5.2
		Mechanical hazards	31	10.1
3	Personal protective equipment (PPE) must be worn when handling waste?	Yes	248	81.0
		No	58	19.0
4	Correct way to dispose of infectious waste	Infectious waste bag (yellow)	233	76.1
		Regular waste bin	22	7.2
		Recycling bin	17	5.6
		I don't know	34	11.1
5	Hands washed after removing gloves?	Yes	214	69.9
		No	92	30.1
6	PPE required for isolation rooms	All of the above	246	80.4
		Gown	30	9.8
		Gloves	22	7.2
		Eye protection	8	2.6
7	Must report exposure to fluids immediately?	Yes	162	52.9
		No	88	28.8
		I don't know	56	18.3
8	Does good ventilation reduce chemical exposure?	Yes	168	54.9
		No	88	28.8
		I don't know	50	16.3
9	What does the red container usually indicate?	Infectious waste	191	62.4
		Sharp tools	66	21.6
		Recyclable	33	10.8
		General waste	16	5.2
10	Diseases you can get from work	All of the above	221	72.2
		Hepatitis	34	11.1
		HIV	34	11.1
		Tuberculosis	17	5.6
11	Which is considered solid waste?	All of the above	236	77.1
		Metals and used needles	40	13.1
		Used cloth, gauze, and cotton	20	6.5
		Paper and dust only	10	3.3
12	Means of protection from diseases	Regular use of apron/protective gown	306	100.0
	Total		**306**	**100.0**

Table 3: Overall knowledge level among participants (N = 306)

No.	Knowledge level	*n*	%
1	Good Knowledge (7–12 points)	200	65.4
2	Poor Knowledge (0–6 points)	106	34.6
	Total	**306**	**100.0**

as having poor knowledge (0–6 points). These findings are summarized in **Table 3**.

Attitudes Assessment

Attitudes toward occupational safety standards were generally positive (see **Table 4**). A majority of workers felt confident in reporting unsafe conditions (72.2%, *n* = 221), and most (80.1%, *n* = 245) disagreed that wearing PPE hinders their work speed. However, a notable proportion (32.4%, *n* = 99) did not believe that occupational safety is fundamentally important.

In aggregate, 61.4% (*n* = 188) of respondents demonstrated a positive attitude toward safety protocols (15–21 points), whereas 38.6% (*n* = 118) exhibited a negative attitude (7–14 points), indicating a substantial subgroup requiring further motivational intervention (see **Table 5**).

Practices Assessment

Self-reported occupational safety practices are presented in **Table 6**. Handwashing after every task was the most consistently

Table 4: Attitudes of cleaning personnel toward workplace safety (N = 306)

No.	Attitude statement	Category	*n*	%
1	I feel confident reporting unsafe conditions	Agree	185	60.5
		Disagree	100	32.7
		Neutral	21	6.9
2	I feel supervisors care about our safety	Agree	192	62.7
		Disagree	92	30.1
		Neutral	22	7.2
3	Safety procedures are easy to follow	Agree	190	62.1
		Disagree	90	29.4
		Neutral	24	7.8
4	Using personal protective equipment (PPE) protects me from hazards	Agree	183	59.8
		Disagree	98	32.0
		Neutral	25	8.2
5	I believe occupational safety is important	Agree	174	56.9
		Disagree	99	32.4
		Neutral	33	10.8
6	Wearing PPE slows down my work	Disagree	245	80.1
		Neutral	39	12.7
		Agree	22	7.2
7	I feel confident reporting unsafe conditions	Agree	221	72.2
		Disagree	85	27.8
	Total		**306**	**100.0**

Table 5: Overall attitude level among participants (N = 306)

No.	Attitude level	*n*	%
1	Positive attitude (15–21 points)	188	61.4
2	Negative attitude (7–14 points)	118	38.6
	Total	**306**	**100.0**

reported practice (73.6%, *n* = 226). Waste separation by container color showed the lowest consistent compliance, with 67.0% (*n* = 205) reporting they "always" performed this practice. Approximately 23.0% of workers reported performing these safety practices only "sometimes," and 4.9% (*n* = 15) admitted to "never" disposing of needles in sharps containers.

The majority of the staff (75.2%, *n* = 230) reported safe practices in their daily routines (19–24 points), while 24.8% (*n* = 76) exhibited unsafe practices (8–18 points), representing a critical at-risk group (see **Table 7**).

Injury History and Training Factors

Professional training and injury history data revealed significant challenges (see **Table 8**). Notably, 100% of the cleaning workers reported receiving no OHS training in the preceding year. Furthermore, 23.5% (*n* = 72) reported having experienced at least one NSI during their work. Among those injured, 4.2% (*n* = 13) had sustained three or more separate incidents.

PPE Availability and Monitoring

The distribution of hospital-provided PPE and compliance monitoring is detailed in **Table 9**. The most common provision was a combination of gloves and masks with supervisor compliance monitoring (37.9%, *n* = 116). Comprehensive PPE sets were comparatively rare. Categories with very low frequencies (<2) were consolidated into an "Other" category to simplify the data presentation.

Association Between Independent Variables and Knowledge Level

As shown in **Table 10**, educational level was a statistically significant predictor of knowledge level, $P = 0.004$. Cleaning staff with primary education or higher were significantly more likely to be categorized as having good knowledge. No other demographic factors, including gender and work experience, demonstrated statistically significant associations with knowledge level.

Analysis of Attitude Levels

As presented in **Table 11**, none of the independent variables reached statistical significance ($P < 0.05$). This suggests that attitudes toward workplace safety were generally consistent among cleaning workers, regardless of their background or workplace setting.

Analysis of Practice Levels

As shown in **Table 12**, hospital setting ($P = 0.001$), work experience ($P = 0.022$), and needle injury history ($P = 0.015$) were statistically significant factors associated with practice levels. Workers at the Republican Teaching Hospital Authority and those with more than 5 years of experience demonstrated significantly safer practices.

Table 6: Self-reported occupational safety practices of cleaning staff (N = 306)

No.	Practice statement	Category	N	%
1	I wear gloves when cleaning	Always	224	73.2
		Sometimes	71	23.2
		Never	11	3.6
2	I wear a mask when using disinfectants	Always	225	73.5
		Sometimes	69	22.5
		Never	12	4.0
3	I wash my hands after every task	Always	225	73.6
		Sometimes	71	23.1
		Never	10	3.3
4	I separate waste by container color	Always	205	67.0
		Sometimes	91	29.7
		Never	10	3.3
5	I immediately report injuries (needlesticks)	Always	220	71.9
		Sometimes	71	23.2
		Never	15	4.9
6	I dispose of needles in sharps containers	Always	215	70.3
		Sometimes	76	24.8
		Never	15	4.9
7	I check my personal protective equipment condition before use	Always	224	73.2
		Sometimes	71	23.2
		Never	11	3.6
8	I follow standard cleaning procedures	Always	225	73.5
		Sometimes	71	23.2
		Never	10	3.3
	Total		**306**	**100.0**

Table 7: Overall practice level among participants (N = 306)

No.	Practice level	n	%
1	Safe practice (19–24 points)	230	75.2
2	Unsafe practice (8–18 points)	76	24.8
	Total	**306**	**100.0**

Table 8: Injury history and occupational safety and health training factors (N = 306)

No.	Variable	Category	n	%
1	History of needlestick injury	No	234	76.5
		Yes	72	23.5
2	Frequency of injury	0 times	234	76.5
		1 time	40	13.1
		2 times	19	6.2
		3 times or more	13	4.2
	Total		**306**	**100.0**

Table 9: Extent of hospital-provided personal protective equipment (PPE) and compliance monitoring (N = 306)

No.	PPE items and monitoring status	n	%
1	Gloves, masks (supervisors monitor compliance)	116	37.9
2	Gloves, masks, protective gown; supervisors monitor compliance	77	25.2
3	Gloves, masks, safety boots; supervisors monitor compliance	71	23.2
4	Gloves, protective gown, safety boots	17	5.6
5	Gloves, masks, safety boots	11	3.6
6	Other (items with frequency < 2)	14	4.5
	Total	**306**	**100.0**

DISCUSSION

This study assessed the KAP regarding occupational safety among cleaning workers in two major public hospitals in Sana'a, Yemen. The findings revealed that approximately two-thirds of the participants demonstrated good knowledge (65.4%) and safe practices (75.2%), while 61.4% exhibited positive attitudes. However, these seemingly favorable figures contrast starkly with a systemic failure: 100% of the workers reported receiving zero OSH training in the preceding year, and nearly a quarter (23.5%) reported a history of NSIs.

The 65.4% prevalence of good knowledge in our study is relatively comparable to findings from similar LMIC settings. For instance, a study on medical waste cleaners in Northwest Ethiopia reported a high level of knowledge among healthcare workers, [24] keeping staff in Indian laboratories found that the majority understood basic infection control protocols. [25] Interestingly, our study found that educational attainment was the only demographic variable significantly associated

Table 10: Association between socio-demographic variables and knowledge level (N = 306)

Independent variable	Category	Good knowledge *n* (%)	Poor knowledge *n* (%)	*P*
Hospital	Al Thawra Modern General Hospital	88 (60.7)	57 (39.3)	0.082
	Republican Teaching Hospital Authority	112 (69.6)	49 (30.4)	
Gender	Male	182 (65.7)	95 (34.3)	0.621
	Female	18 (62.1)	11 (37.9)	
Age	<25	134 (61.2)	85 (38.8)	0.075
	≥25	66 (75.9)	21 (24.1)	
Marital status	Single	135 (66.8)	67 (33.2)	0.540
	Married/other	65 (62.5)	39 (37.5)	
Education	Not educated	32 (37.6)	53 (62.4)	**0.004***
	Primary and above	168 (76.0)	38 (24.0)	
Experience	1–5 years	148 (64.6)	81 (35.4)	0.315
	>5 years	52 (67.5)	25 (32.5)	

*Statistically significant at $P < 0.05$.

Table 11: Association between independent variables and attitude level (N = 306)

Independent variable	Category	Positive attitude *n* (%)	Negative attitude *n* (%)	*P*
Hospital	Al Thawra Modern General Hospital	85 (58.6)	60 (41.4)	0.091
	Republican Teaching Hospital Authority	103 (64.0)	58 (36.0)	
Gender	Male	169 (61.0)	108 (39.0)	0.442
	Female	19 (65.5)	10 (34.5)	
Education	No formal education	50 (58.8)	35 (41.2)	0.412
	Primary and above	138 (62.4)	83 (37.6)	
Experience	1–5 years	137 (59.8)	92 (40.2)	0.215
	>5 years	51 (66.2)	26 (33.8)	
Needlestick injury	Yes	40 (55.6)	32 (44.4)	0.180
	No	148 (63.2)	86 (36.8)	

Table 12: Association between independent variables and practice level (N = 306)

Independent variable	Category	Safe practice *n* (%)	Unsafe practice *n* (%)	*P*
Hospital	Al Thawra Modern General Hospital	92 (63.4)	53 (36.6)	**0.001***
	Republican Teaching Hospital Authority	138 (85.7)	23 (14.3)	
Gender	Male	205 (74.0)	72 (26.0)	0.145
	Female	25 (86.2)	4 (13.8)	
Education	No formal education	58 (68.2)	27 (31.8)	0.115
	Primary and above	172 (77.8)	49 (22.2)	
Experience	1–5 years	165 (72.1)	64 (27.9)	**0.022***
	>5 years	65 (84.4)	12 (15.6)	
Needle injury	Yes	45 (62.5)	27 (37.5)	**0.015***
	No	185 (79.1)	49 (20.9)	

*Statistically significant at $P < 0.05$.

with knowledge level. Workers with primary education or higher were significantly more likely to have good knowledge, underscoring the critical role of basic literacy in comprehending occupational hazard abstracts, as also noted in studies among general healthcare workers. [9,19] However, specific critical knowledge gaps remained, such as the fact that only 52.9% knew the correct procedure for reporting body fluid exposure. This lack of reporting knowledge creates a silent reservoir of occupational risk, potentially delaying post-exposure pro.

es were significantly associated with attitude levels. This homogeneity suggests that attitudes toward workplace safety in this setting are not driven by individual factors (like age or education), but rather by a pervasive, shared organizational culture. The finding that 32.4% of workers did not believe occupational safety is fundamentally important is a concerning indicator of fatalism or normalization of risk—a common psychological adaptation among marginalized workers in high-hazard environments. [2,3]

The self-reported safe practice rate of 75.2% must be interpreted with extreme caution due to the high likelihood of social desirability bias, a common limitation in face-to-face interviews. [4] This overestimation is exposed by the contradiction between the high "safe practice" scores and the 23.5% prevalence of NSIs. Our bivariate analysis revealed a crucial, counterintuitive finding: workers with a history of NSIs were significantly less likely to report safe practices (62.5%) compared to those without injuries (79.1%). This indicates that injuries in this population are not serving as "teachable moments" that improve subsequent behavior; rather, they are a direct consequence of inherent unsafe practices. This aligns with research in Ethiopia, which found that poor safe work practices were the strongest predictor of occupational injuries among hospital cleaners. [15] Furthermore, workers with more than 5 years of experience demonstrated significantly safer practices, suggesting that experiential learning over time partially compensates for the absence of formal training.

The complete absence of OSH training (100%) in our study represents a catastrophic institutional failure, particularly when compared to local data. Previous studies in Sana'a have shown that even among higher-skilled cadres like nurses and lab technicians, OSH training was suboptimal, yet it still existed. [21,22] The finding that workers still possess moderate knowledge (65.4%) despite zero formal training suggests informal peer-to-peer learning or self-directed hazard awareness. However, informal learning is insufficient for complex tasks like chemical dilution or sharps handling. This training deficit is likely exacerbated by the ongoing conflict in Yemen, which has disrupted supply chains and institutional capacity. [20] This is further evidenced by our PPE availability data, which showed that comprehensive PPE sets (including gowns) were provided to only 25.2% of workers. It is impossible to practice what is not available; thus, the lack of PPE supply acts as a structural barrier to safe practices, independent of the worker's KAP. [7,26]

Limitations

This study has several limitations. First, the cross-sectional design precludes establishing causal relationships between independent variables and KAP outcomes. Second, the reliance on self-reported practice data introduces social desirability bias, likely inflating the "safe practice" percentages. Third, the Cronbach's alpha for the attitude scale (0.68) fell slightly below the conventional 0.70 threshold, indicating marginal internal consistency, though this is acceptable for exploratory research in low-literacy populations. Finally, the study was conducted in only two public hospitals in Sana'a, which may limit the generalizability of the findings to private healthcare facilities or rural hospitals in Yemen.

CONCLUSIONS

Despite a notable lack of formal OSH training and significant supply chain disruptions, a majority of cleaning workers in Sana'a demonstrated moderate knowledge and positive attitudes toward occupational safety. However, the high prevalence of NSIs—particularly among those reporting poor practices—indicates a dangerous gap between theoretical understanding and real-world application. Experience and education emerged as key protective factors. There is an urgent need for hospital administrations in Yemen to implement structured, literacy-appropriate OSH training programs for cleaning staff. Furthermore, ensuring a consistent supply of comprehensive PPE and fostering a non-punitive incident reporting culture are critical steps required to translate existing knowledge into life-saving practices.

AUTHORS' CONTRIBUTION

Each author has made a substantial contribution to the present work in one or more areas, including conception, study design, conduct, data collection, analysis, and interpretation. All authors have given final approval of the version to be published, agreed on the journal to which the article has been submitted, and agree to be accountable for all aspects of the work.

SOURCE OF FUNDING

None.

CONFLICT OF INTEREST

None.

REFERENCES

1. World Health Organization. Infection prevention and control. World Health Organization; 2023. Available from: https://www.who.int/health-topics/infection-prevention-and-control
2. Ilesanmi OS, Omotoso B, Falana D. Hazards of hospital cleaners in a tertiary health facility in Southwest Nigeria. Int J Occup Saf Health. 2015;4(1):5–10. https://doi.org/10.3126/ijosh.v4i1.10083
3. Owie HO, Apanga PA. Occupational health hazards prevailing among healthcare workers in developing countries. J AIDS Clin Res. 2016;7(8):1000596. Available from: http://doi.org/10.4172/2155-6113.1000596
4. Zenbaba D, Sahiledengle B, Beressa G, Tufa T, Teferu Z, Ahmed Y, et al. Exposure to occupational hazards and safe work practice among cleaners in public hospitals, Southeast Ethiopia: A convergent parallel mixed-method. National Academic Digital Repository of Ethiopia. 2025. https://doi.org/10.20372/nadre:8758
5. Rapiti E, Prüss-Üstün A, Hutin Y. Sharps injuries: Assessing the burden of disease from sharps injuries to health-care workers at national and local levels. World Health Organization; 2005.
6. Walters D, James P, Johnstone R. Fundamental principles and realities of practice: Work health and safety in low- and middle-income countries. Work Glob Econ. 2024;5(1):120–143. https://doi.org/10.1332/27324176y2024d000000024
7. International Labour Organization. ILO Guide to International Labour Standards on occupational safety and health. International Labour Organization; 2016.
8. Zheng L, Chen K, Ma L. Knowledge, attitudes, and practices toward COVID-19 among construction industry practitioners in China. Front Public Health. 2021;8:599769–599769. https://doi.org/10.3389/fpubh.2020.599769
9. Harun MdGD, Sumon SA, Anwar MMU, Mohona TM, Rahman A, Abdullah SAHM, et al. Infection prevention and control knowledge, attitudes, and practices of healthcare workers in Tertiary Care Hospitals in Bangladesh during COVID-19: A multicenter cross-sectional survey. Clin

Infect Dis. 2025;81(1):49–56. https://doi.org/10.1093/cid/ciaf246
10. Telayneh AT, Awudew D, Endalew B, Habtegiorgis SD, Aycheh MW. Safety precaution knowledge, attitude, practice, and associated factors among medical waste cleaners in governmental hospitals, Northwest Ethiopia. Sci Rep. 2025;15(1):42272. https://doi.org/10.1038/s41598-025-22577-z
11. Gebreeyessus GD. Knowledge, attitude, and practices on occupational health and safety principles among cleaners: The case of Tikur Anbassa Specialized Referral Hospital, Addis Ababa, Ethiopia. Open Health. 2022;3(1):22–33. https://doi.org/10.1515/openhe-2022-0004
12. Nwankwo C. Knowledge and practice of waste management among hospital cleaners. Occup Med. 2018;68(6):360–363. https://doi.org/10.1093/occmed/kqy078
13. Tolera ST, Gobena T, Geremew A, Toseva E, Assefa N. Data Sheet 1_Occupational health risk perceptions and determinants: knowledge and attitude of sanitary workers in public hospitals of Ethiopia.pdf. Figshare; 2025. https://doi.org/10.3389/fpubh.2025.1509595.s001
14. Sevinç N, Murad ZI, Nacar E, Arıcan AA. Assessing occupational hazards and safety: A study of healthcare workers' knowledge, attitudes, and practices in Iraq. Sci Rep Med. 2025;2(3):321–330. https://doi.org/10.37609/srinmed.62
15. Tolera ST, Assefa N, Gobena T, Geremew A. Co-occurrence of occupational outcomes and associated factors among hospitals cleaners, eastern Ethiopia: A cross sectional study. BMC Public Health. 2024;24(1):3108. https://doi.org/10.1186/s12889-024-20571-0
16. Zawiah M, Al-Ashwal FY, Saeed RM, Kubas MA, Saeed S, Khan AH, et al. Assessment of healthcare system capabilities and preparedness in Yemen to confront the novel coronavirus 2019 (COVID-19) outbreak: A perspective of healthcare workers. Front Public Health. 2020;8:419. https://doi.org/10.3389/fpubh.2020.00419
17. Alraimi AA, Shelke A. Effects of ongoing conflict on healthcare workers in Yemen. Arch Med Health Sci. 2025;13(1):153–155. https://doi.org/10.4103/amhs.amhs_275_24
18. Hakim SA, Mohsen A, Bakr I. Knowledge, attitudes and practices of health-care personnel towards waste disposal management at Ain Shams University hospitals, Cairo. East Mediterr Health J. 2014;20(5):347–354. https://doi.org/10.26719/2014.20.5.347
19. Elmi AH, Ahmed MM, Hassan MM, Dirie NI. Knowledge, attitudes and practices of occupational safety among healthcare professionals at Dr. Sumait Hospital, Mogadishu, Somalia. Sci Rep. 2026;16(1):14088. https://doi.org/10.1038/s41598-026-44762-4
20. Abdulmoughni MA, Ismail A, Suddin LS, Jamil AT, Nur AM, Sulong SA. Study on the Prevalence of Occupational Injuries and the Contributing Factors, among Health Care Workers at 48 Model Hospitals in Sana'a, Yemen 2016. Int Med J. 2019;26(3):195–190.
21. Al-Abhar N, Moghram GS, Al-Gunaid EA, Serouri AA, Khader Y. Occupational exposure to needle stick injuries and hepatitis B vaccination coverage among clinical laboratory staff in Sana'a, Yemen: Cross-sectional study. JMIR Public Health Surveill. 2020;6(1):e15812. https://doi.org/10.2196/15812
22. Alwabr GMA. Knowledge and practice of needlestick injury preventive measures among nurses of Sana'a city hospitals in Yemen. Indian J Health Sci Biomed Res. 2018;11(1):70–76. https://doi.org/10.4103/kleuhsj.kleuhsj_175_17
23. Faremi FA, Ogunfowokan AA, Olatubi MI, Ogunlade B, Ajayi OA. Knowledge of occupational hazards among cleaning workers: A study of cleaners of a Nigerian university. Int J Health Sci. 2014 Aug;8. 4(8):198-204
24. Nachinab GT Enkawol, Alem JN, Coffie GB. Knowledge, attitudes, and practices of occupational health and safety measures among nurses at Bolgatanga Regional Hospital of Ghana. BMC Health Serv Res. 2026. https://doi.org/10.21203/rs.3.rs-8329801/v1
25. Joshi P, Tiwari SK, Selvaraj D, Ritika, Sahoo S, Dutta AK, et al. A novel study to assess knowledge, attitude, and practices of housekeeping and sanitation workers for infection control in clinical service laboratories of a tertiary care hospital. J Lab Phys. 2025;17(1):95–101. https://doi.org/10.25259/jlp_272_2024
26. Alshahrani F, Elgujja AA, Alabdan L, Alharbi J, Rabaan AA, Alzayid I, et al. Knowledge attitudes and practices of healthcare workers on respirator fit testing and PAPR use at a university medical center. Sci Rep. 2025;15(1):27515. https://doi.org/10.1038/s41598-025-12507-4