

Association of OHS Knowledge and Supervision with Safety Behavior and Occupational Accident Risk among Hospital Cleaning Service Workers: A Targeted Narrative Review

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Article Information

Received: September 07, 2026

Revised: September 18, 2026

Online: September 30, 2026

Keywords

Occupational Health and Safety,
Hospital Cleaning Service,
Supervision, Safety Behavior,
Occupational Accident

ABSTRACT

Background: Hospital cleaning service workers face biological/sharps, chemical, ergonomic, and slip, trip, and fall hazards. Existing studies do not clearly distinguish whether OHS knowledge and supervision are associated mainly with proximal safety behavior or with actual accident occurrence.

Purpose: This review synthesizes evidence on associations of OHS knowledge and supervision with safety behavior and occupational accident risk among hospital cleaning service workers. **Methods:** A targeted narrative review was conducted in August 2026 and updated on 15 September 2026 using PubMed/MEDLINE, Google Scholar, GARUDA, and publisher/DOI records, supplemented by WHO, ILO, OSHA/NIOSH, CDC, and Indonesian regulatory sources. Thirteen peer-reviewed studies and seven authoritative guidance/regulatory documents were retained. **Results:** OHS knowledge and supportive supervision were more consistently associated with safer behavior, hazard recognition, PPE compliance, and fewer unsafe action than with actual accident occurrence. Direct accident findings were mixed and were modified by PPE and equipment availability, workload, waste-management systems, and safety climate. **Implications:** Hospitals should combine competency-based training with field supervision, resource verification, near-miss reporting, and corrective action rather than relying on knowledge alone. **Conclusion:** Evidence is stronger for safety behavior than for direct accident outcomes; larger longitudinal and multi-hospital studies are needed to clarify associations with specific injuries.

INTRODUCTION

Occupational injury remains a major global safety problem: the International Labour Organization estimates that 2.93 million workers die annually from work-related factors and about 395 million sustain non-fatal work injuries (ILO, 2023). Hospitals are high-risk workplaces, and Indonesian Minister of Health Regulation No. 66 of 2016 requires systematic prevention of



occupational accidents and work-related disease in hospitals. Globally, contaminated sharps injuries alone were estimated to have caused about 66,000 hepatitis B, 16,000 hepatitis C, and 1,000 HIV infections among health-care workers in 2000 (Prüss-Üstün et al., 2005).

Hospital cleaning service workers (environmental service workers) are exposed simultaneously to contaminated surfaces and waste, disinfectants, repetitive manual tasks, sharps, and wet floors. Reported outcomes include puncture and cut injuries, slips and falls, musculoskeletal strain, and respiratory effects from cleaning agents (Alamgir & Yu, 2008; Bell et al., 2008; Ndlela & Naidoo, 2023). Environmental cleaning and disinfection also sit at the interface of infection prevention and occupational illness prevention, because practices that protect patients can expose cleaning staff to harmful agents unless products and procedures are selected carefully (Quinn et al., 2015).

OHS knowledge supports hazard recognition, correct PPE use, chemical handling, waste segregation, and incident response, but knowledge may not translate into safe practice when equipment, staffing, or organizational support are inadequate. For example, Mehrifar et al. (2023) found important gaps in hospital cleaners' recognition of chemical hazard pictograms despite generally positive safety-culture scores. Conceptually, safety knowledge and motivation are proximal determinants of safety performance, whereas safety climate acts as a more distal influence (Griffin & Neal, 2000), and longitudinal evidence links safety climate, safety motivation, and safety behavior with subsequent accidents (Neal & Griffin, 2006). A meta-analysis likewise found that safety knowledge and motivation were most strongly related to safety performance behaviors, whereas group safety climate showed the strongest association with accidents and injuries (Christian et al., 2009). Evidence on training shows a similar pattern: a systematic review found strong evidence that OHS training improves worker behaviors but insufficient evidence of effects on injuries or illness (Robson et al., 2012), and more engaging methods, such as hands-on training and behavioral modeling, were associated with greater knowledge gains and fewer accidents, illnesses, and injuries (Burke et al., 2006). In hospital settings, training combined with safety-engineered devices reduced needle-stick injury risk more than training alone (Tarigan et al., 2015).

Supervision can convert policy into practice through observation, feedback, reinforcement, resource verification, and incident follow-up. Low supervisor safety support has been associated with greater injury vulnerability, while poor safety management and supervision have been linked with unsafe work behavior among hospital environmental service workers (Yanar et al., 2019; Tamene et al., 2022). Safety leadership research further shows that both transformational and active transactional leadership styles are associated with safety behaviors (Clarke, 2013), which is consistent with a systems perspective in which unsafe acts are understood in relation to the conditions under which people work rather than as individual failings alone (Reason, 2000).

A key evidence gap remains. Studies often measure different outcomes: some link knowledge or supervision to PPE compliance, unsafe action, or other safety behavior, whereas direct evidence for occupational accident occurrence is limited and inconsistent. Murni et al. (2021) found no significant direct association of knowledge or supervision with accident risk in a small cleaning-service sample, while Puspitasari et al. (2026) found a significant association between knowledge and OHS behavior. Thus, the pathway from knowledge and supervision to accidents may be indirect and strongly modified by work-system conditions.

Accordingly, this targeted narrative review examines: (1) associations of OHS knowledge with safety behavior and occupational accident risk; (2) associations of supervision with unsafe actions and injury risk; and (3) organizational conditions that strengthen or weaken these relationships. Its contribution is to separate proximal safety-behavior evidence from direct accident evidence rather than treating both as equivalent outcomes.

METHODS

This study used a targeted narrative review. Searches were conducted in August 2026 and updated on 15 September 2026. Bibliographic searching used PubMed/MEDLINE, Google Scholar, and GARUDA (Garba Rujukan Digital); publisher and DOI records were used to verify bibliographic details. Authoritative guidance and regulation were sought from WHO, ILO, OSHA/NIOSH, CDC/HICPAC, and the Indonesian Ministry of Health.

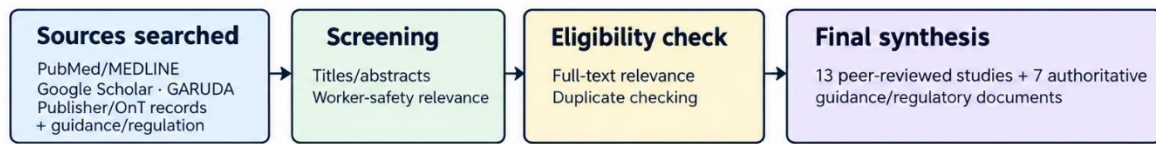
Search concepts combined population terms ("hospital cleaner", "cleaning service", "environmental service worker") with OHS terms ("occupational safety", OHS, injury, "occupational accident") and determinants/outcomes (knowledge, supervision, "safety behavior", "unsafe action", PPE, "medical waste"). Indonesian equivalents were used in GARUDA. Priority was given to peer-reviewed studies from 2019-2026, while earlier landmark studies were retained when they provided directly relevant cleaner-injury or prevention evidence.

Eligible studies addressed hospital cleaners/environmental service workers or, when direct evidence was sparse, closely related worker groups that clarified the knowledge-supervision-safety mechanism. Outcomes included occupational injury/exposure, safety behavior, unsafe action, PPE compliance, hazard recognition, and supervisory support. Patient-only studies and sources without worker-safety relevance were excluded. Titles/abstracts were screened first, followed by full-text relevance assessment and duplicate checking by title/DOI.

The final synthesis comprised 13 peer-reviewed studies and seven authoritative guidance/regulatory documents. The extracted data included the study setting, population, design, sample size, determinants or exposures, outcomes, principal findings, and implications for prevention. Because designs and outcomes were heterogeneous, no meta-analysis was attempted; findings were synthesized thematically. The review process and conceptual pathway are summarized in Figure 1.

For interpretation, OHS knowledge was defined as understanding of hazards, SOPs, PPE, chemical safety, medical-waste handling, ergonomics, and incident response. Supervision included communication, observation, feedback, corrective action, reinforcement, resource verification, and incident follow-up. Safety behavior/unsafe action were treated as proximal outcomes, whereas reported injury and exposure events were treated as direct accident outcomes. As no primary human-participant data were collected, institutional ethical approval was not required.

A. Review process



B. Conceptual pathway

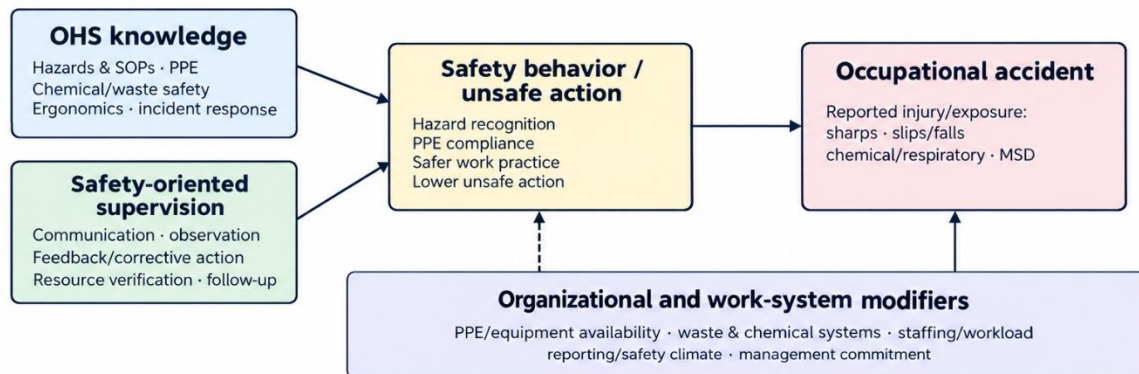


Figure 1. Review Process and Conceptual Pathway Linking OHS Knowledge and Supervision to Safety Behavior and Occupational Accident Risk

RESULTS

1. Occupational Accident and Hazard Profile among Hospital Cleaning Workers

The evidence shows several interacting hazard groups. Biological and sharps hazards include contact with contaminated materials and improperly segregated needles or sharp objects, leading to puncture wounds and biological exposure. Chemical hazards arise from detergents and disinfectants and are associated with eye, skin, airway, and respiratory effects. Ergonomic hazards include repetitive mopping, pushing, lifting, and awkward postures, contributing to musculoskeletal strain. Physical/safety hazards include wet floors and transport tasks, contributing to slips, trips, and falls. Alamgir and Yu (2008) reported an injury incidence of 32.1 per 100 person-years among healthcare cleaners, while Bell et al. (2008) identified housekeeping staff among groups at high risk for slip, trip, and fall injuries.

These hazard categories are linked by work-system conditions. Ndlela and Naidoo (2023) demonstrated respiratory risk from cleaning/disinfecting exposure, while WHO and OSHA/NIOSH guidance emphasizes training, safer chemical selection and dilution, ventilation, PPE, point-of-generation waste segregation, appropriate sharps containers, and controlled waste transport (OSHA & NIOSH, 2012; WHO, 2014, 2023). Thus, an injury experienced by a cleaner may reflect both worker behavior and upstream failures in waste, chemical, equipment, or facility controls.

2. Association of OHS Knowledge

Across the reviewed studies, OHS knowledge was more consistently associated with safety

behavior than with reported accident occurrence. Puspitasari et al. (2026) found a significant association between knowledge and OHS behavior among 68 hospital cleaning workers ($p = .001$). Fauzi et al. (2024) similarly reported an inverse association between OHS knowledge and unsafe actions ($p = .001$; $r = -.491$), while Marcia et al. (2024) reported links among hospital OHS knowledge, safety behavior, and workplace accidents in nurses.

Direct accident evidence among cleaning workers was weaker. Murni et al. (2021) found that knowledge was not significantly associated with accident risk ($p = .087$) in a sample of 30 cleaners, whereas PPE availability, work experience, and compliant medical-waste containers showed stronger relationships. This suggests that knowledge is an upstream competency whose effect depends on whether workers can apply it within adequately controlled work conditions.

Knowledge should therefore be assessed as task competence rather than attendance at training alone. Hazard-symbol recognition, correct PPE selection and removal, chemical dilution, waste segregation, spill response, and safe lifting are practical competencies that can be demonstrated and reinforced during work (Mehrfar et al., 2023).

3. Association of Supervision

Supervision is associated with safety through monitoring, feedback, reinforcement, and resource control. Yanar et al. (2019) found that the combination of OHS vulnerability and low supervisor safety support was associated with at least a 3.5-fold higher injury risk than the reference condition. Tamene et al. (2022) also identified poor safety management and supervision as contributors to unsafe work behavior among hospital environmental service workers.

Direct evidence for accident occurrence is less consistent. Murni et al. (2021) reported no significant association between supervision and accident risk ($p = .531$), whereas Fauzi et al. (2024) found supervision inversely associated with unsafe actions ($p = .001$; $r = -.528$). Systematic reviews likewise suggest that education is more effective when combined with feedback and organizational support (Hewage et al., 2021; Thomas et al., 2022).

The relevant construct is therefore safety-oriented supervision rather than simple inspection frequency. Effective supervision observes critical tasks, checks control availability, corrects unsafe conditions, supports near-miss reporting, and coordinates responsibilities between hospital units and contractors when cleaning services are outsourced (OSHA, 2016).

4. Integrated Evidence and Conceptual Pathway

Taken together, the evidence supports a mediated pathway: OHS knowledge increases the capacity to recognize hazards and select safe actions, while supervision increases the consistency with which those actions are applied. The strongest evidence is for proximal outcomes such as PPE compliance, unsafe actions, and safety behavior; the link with actual accident occurrence is weaker and more context dependent. PPE/equipment availability, waste and chemical systems, staffing/workload, reporting culture, and management commitment may strengthen or weaken this pathway (Figure 1).



5. Organizational Conditions that Modify the Relationship

Material and organizational conditions can be more proximal to injury than knowledge alone. PPE, compliant sharps and waste containers, suitable trolleys, warning signs, spill kits, chemical-dosing systems, adequate staffing, and safe equipment determine whether workers can apply what they know. Murni et al. (2021) support this interpretation because PPE and waste-container adequacy were associated with accident risk even when knowledge and supervision were not.

Supervision should therefore include workload adjustment, verification of resources, safe chemical management, and a learning-oriented reporting culture. OSHA/NIOSH guidance emphasizes safer products, correct dilution, ventilation, labeling, worker training, and appropriate protection; near-miss review can identify problems before injury occurs (OSHA & NIOSH, 2012; OSHA, 2016).

6. Practical Indicators for Hospital OHS Programs

Hospital OHS programs should combine leading and lagging indicators. Leading indicators include training completion and demonstrated competence, documented supervisory observations, PPE/equipment availability, compliant waste containers, near-miss reporting, and corrective-action closure time. Lagging indicators should distinguish sharps injuries, slips/falls, chemical splashes or respiratory symptoms, musculoskeletal injuries, and biological exposures by task, area, shift, and employment arrangement where possible.

Table 1. Summary of Key Evidence Relevant to OHS Knowledge, Supervision, and Accident Prevention

Study	Population/Design	Main finding	Interpretation
Alamgir & Yu, 2008	Healthcare cleaners	145 injuries; incidence 32.1 per 100 person-years; elevated injury risk in acute care.	Establishes high injury burden among cleaners.
Yanar et al., 2019	2,390 workers	OHS vulnerability plus low supervisor support was associated with ≥3.5 times higher physical injury risk.	Supports protective role of supervisor safety support.
Murni et al., 2021	30 hospital cleaning workers	Knowledge ($p = .087$) and supervision ($p = .531$) were not significant for accident risk; PPE and waste-container availability were significant.	Shows contextual and resource factors can dominate direct accident outcomes.
Hewage et al., 2021	Systematic review of ESW practices	Education/training and performance feedback were associated with better cleaning practices.	Suggests knowledge works best with feedback and organizational reinforcement.

Study	Population/Design	Main finding	Interpretation
Tamene et al., 2022	25 hospital environmental service workers/managers	Poor safety management and supervision, hazardous conditions, and inadequate skills/training contributed to unsafe behavior.	Direct qualitative support for supervision and competency.
Thomas et al., 2022	Systematic review	Training, workload, cleaning practices, and supervision were central dimensions requiring stronger evaluation.	Highlights system-level management of ESW performance.
Mehrfar et al., 2023	68 hospital cleaning workers	Correct perception of 9/11 GHS hazard signs was below ANSI threshold; safety culture correlated with hazard-sign perception ($p = .009$).	Shows important knowledge gaps in chemical safety.
Fauzi et al., 2024	85 workers	Knowledge and supervision were both associated with lower unsafe actions (both $p = .001$); supervision showed stronger multivariable contribution.	Supports a knowledge-supervision-safety behavior pathway.
Marcia et al., 2024	123 hospital nurses	OHS knowledge improved safety behavior and was negatively associated with workplace accidents.	Hospital evidence linking knowledge, behavior, and accidents.
Puspitasari et al., 2026	68 hospital cleaning workers	Knowledge significantly associated with OHS behavior ($p = .001$).	Recent direct evidence among cleaning service workers.

DISCUSSION

This review indicates that OHS knowledge and supervision are complementary determinants of hospital-cleaner safety, but the strength of evidence differs by outcome. Associations are most consistent for proximal safety outcomes, including hazard recognition, cleaning practices, PPE compliance, and unsafe actions, whereas direct associations with occupational accident occurrence are less consistent (Hewage et al., 2021; Murni et al., 2021; Puspitasari et al., 2026).

The distinction is important because accidents are heterogeneous and can arise despite adequate knowledge when upstream controls fail. A worker may be injured by an incorrectly discarded needle, an unexpected spill, a defective trolley, or unavailable PPE. Conversely, strong supervision and resources may temporarily compensate for limited formal knowledge. Cross-sectional designs and small samples further limit causal interpretation.



The practical implication is to combine worker-level competence with system-level controls. Training should be task-specific and verified through demonstration, while supervisors should observe critical tasks, provide immediate feedback, verify PPE/equipment, and review incidents and near misses. Hospital OHS requirements and WHO guidance support shared responsibility across cleaning services, infection prevention, waste management, facility management, and contractors.

Knowledge and supervision should also be positioned within the hierarchy of controls rather than used as substitutes for safer work design. Safer chemicals, controlled dilution, ventilation, ergonomic transport equipment, puncture-resistant waste containers, adequate staffing, and repaired floor hazards reduce exposure before reliance on administrative controls and PPE (OSHA, 2016).

For research, larger multi-hospital and longitudinal studies should use validated measures of knowledge and supervision, separate specific accident types from near misses and unsafe behavior, and adjust for PPE availability, workload, safety climate, employment arrangement, and equipment condition. Intervention studies comparing training alone with training plus structured supervision would clarify the added value of supervisory reinforcement.

The main limitation is heterogeneity in populations, designs, and outcomes, and several included studies were outside the hospital-cleaning population. This targeted narrative review therefore supports association and a plausible pathway, not causation. Its principal contribution is to show that evidence is stronger for safety behavior than for actual accident occurrence and that organizational conditions are essential to interpretation.

CONCLUSIONS

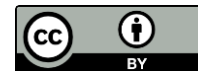
OHS knowledge and safety-oriented supervision are modifiable components of hospital-cleaner safety, with the most consistent evidence linking them to proximal outcomes such as hazard recognition, PPE compliance, safer work behavior, and lower unsafe actions. Evidence for a direct association with actual occupational accident occurrence is limited and inconsistent. Accident prevention should therefore integrate competency-based training and supportive supervision with adequate PPE and equipment, safe waste and chemical systems, workload control, near-miss reporting, and corrective action. Larger longitudinal and multi-hospital studies are needed to determine whether improvements in knowledge and supervision produce measurable reductions in specific injury outcomes.

ACKNOWLEDGMENT

The authors acknowledge the contributions of occupational safety and health practitioners, hospital environmental service personnel, and researchers whose work has advanced understanding of cleaner safety in healthcare settings.

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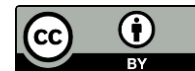
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