

## DETERMINANTS OF WORKERS' COMPLIANCE WITH PERSONAL PROTECTIVE EQUIPMENT (PPE) USE

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### Abstract

Compliance with personal protective equipment (PPE) is essential for occupational safety and health (OSH), yet non-compliance remains a major contributor to work-related illnesses and injuries. This systematic review examines factors influencing workers' adherence to PPE use. From 1,215 articles retrieved across five databases, 30 studies (16 national, 14 international) published between 2020 and 2025 met the inclusion criteria. Findings indicate that PPE compliance is shaped by individual, organizational, and environmental factors. Three determinants emerged as consistently influential: (1) individual knowledge of occupational risks and PPE procedures; (2) availability of adequate, accessible, and comfortable PPE; and (3) organizational policies, including rigorous OSH supervision, training, and implementation of incentives or sanctions. Enhancing compliance requires an integrated approach targeting knowledge, resource availability, and organizational governance to foster a sustainable safety culture.

**Keywords:** Personal Protective Equipment; Compliance; Occupational Health; Knowledge; Availability; OSH Policy; Systematic Review

### INTRODUCTION

Ensuring compliance with Personal Protective Equipment (PPE) use is a cornerstone of occupational health and safety (OHS) management. PPE functions as the last line of defense, mitigating workers' exposure to hazards that can result in occupational injuries and diseases. Despite its critical role, noncompliance remains prevalent across both healthcare and industrial sectors. The International Labour Organization (ILO) estimates that approximately 2.78 million workers die annually due to occupational accidents and work-related illnesses, with unsafe practices and inconsistent PPE use identified as major contributing factors. This persistent issue highlights the need for a deeper understanding of the behavioral and organizational determinants influencing PPE adherence.

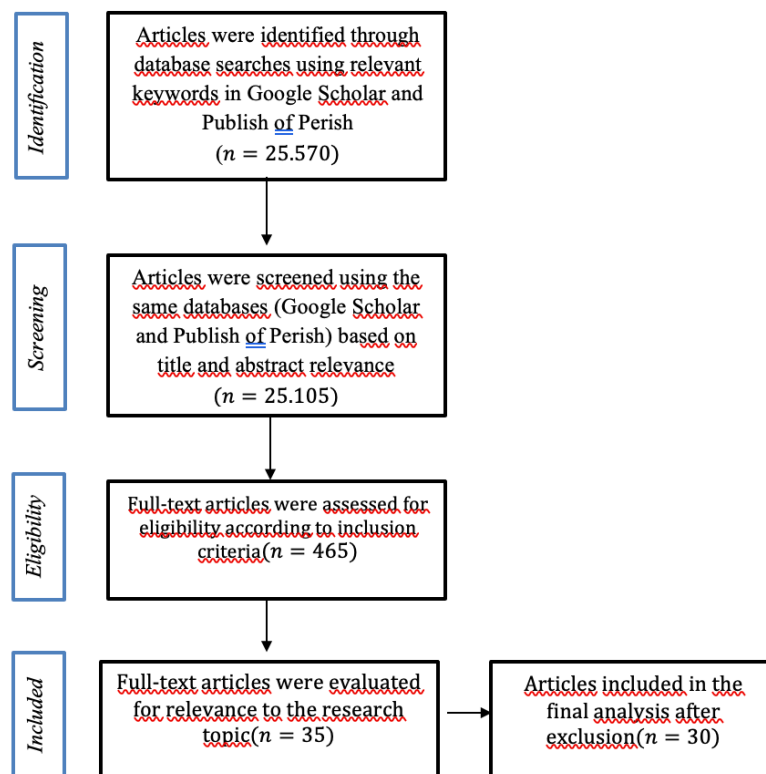
Compliance with PPE protocols is influenced not only by individual awareness but also by the interplay of psychological, organizational, and environmental factors. Individual determinants, including knowledge, attitudes, and motivation, shape risk perception and willingness to use protective equipment. Organizational support—such as supervision, training, availability of adequate PPE, and management commitment—is pivotal in fostering a safety-oriented culture. Environmental influences, including peer behavior and prevailing social norms, further reinforce or undermine compliance.

Prior research has often addressed these determinants in isolation, limiting the formulation of comprehensive strategies to enhance PPE adherence. Consequently, a systematic synthesis of current evidence is necessary to provide a holistic understanding of the factors affecting PPE compliance. This study aims to systematically review literature published between 2020 and 2025 to identify the dominant factors influencing workers' adherence to PPE use for occupational disease prevention. The findings are intended to inform

the development of evidence-based interventions and policy measures aimed at strengthening occupational safety practices across sectors.

## RESEARCH METHODS

This study employed a systematic literature review (SLR) approach to identify and analyze factors influencing workers' compliance with Personal Protective Equipment (PPE) use for the prevention of occupational diseases. The review process was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure methodological rigor, transparency, and reproducibility of the findings.



**Figure 1. PRISMA Flow Diagram of the Literature Review**

The literature review was conducted in four main stages: identification, screening, eligibility assessment, and inclusion. Literature searches were performed across five major scientific databases: PubMed, ScienceDirect, SpringerLink, MDPI, and Google Scholar. The search strategy employed a combination of keywords in English and Indonesian, including: “Compliance” OR “Adherence” AND “Personal Protective Equipment” OR “PPE” AND “Occupational Health” OR “Workplace Safety” AND “Factors Influencing” OR “Determinants” AND “Knowledge” OR “Availability” OR “Policy” OR “Supervision.”

Inclusion criteria encompassed studies that examined factors influencing PPE compliance in workplace or healthcare settings, published between January 2020 and October 2025, and available in full-text. Both national peer-reviewed journals (SINTA-accredited) and reputable international journals (Scopus, WoS, or DOAJ) were considered. Exclusion criteria included publications prior to 2020, non-research articles such as editorials, opinions, or conference proceedings without empirical data, and articles not accessible in full text.

Data extraction was conducted systematically using a structured table capturing key information, including author(s), year of publication, study design, objectives, population, investigated factors, and main findings. Two independent reviewers assessed the methodological quality and relevance of each study to ensure the validity of results. Extracted data were analyzed narratively and thematically, with findings categorized into three primary domains frequently reported in the literature: knowledge-related (individual), availability-related (organizational), and policy/supervision-related factors (organizational).

## RESEARCH RESULTS

Out of a total of 1,215 articles initially identified, duplicate removal and title/abstract screening yielded 152 articles. Following full-text review, 30 studies (16 national and 14 international) met the inclusion criteria and were included in the analysis.

**Table 1. 1 Summary of Included Studies (2020–2025)**

| No | Study Title                                                                                                                                       | Author(s)/Year          | Article Type/Method    | Key Findings                                                                                                                                              |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Assessment of Knowledge, Accessibility, and Adherence to the Use of PPE among Healthcare Workers during the COVID-19 Pandemic                     | Yusuf et al., 2023      | Cross-sectional        | Accessibility ( $p=0.003$ ) and knowledge significantly influenced compliance; 93.7% of healthcare workers had adequate PPE access with 82.1% compliance. |
| 2  | Factors Influencing Nurses' Compliance Related to the Use of PPE during the COVID-19 Pandemic                                                     | Kim et al., 2024        | Cross-sectional        | Knowledge ( $\beta=0.218$ ; $p<0.001$ ) and awareness ( $\beta=0.234$ ; $p<0.001$ ) significantly affected nurses' PPE compliance.                        |
| 3  | Factors Associated with Compliance with Infection Prevention and Control Measures during the COVID-19 Pandemic among HCWs in Kampala City, Uganda | Limenyande et al., 2023 | Cross-sectional        | Only 19.2% fully compliant; compliance increased in facilities with COVID-19 isolation rooms ( $APR=2.51$ ; $CI\ 1.24-5.07$ ).                            |
| 4  | Availability and Use of PPE in Low- and Middle-Income Countries during the COVID-19 Pandemic                                                      | Drouard et al., 2023    | Cross-sectional survey | Only 43% of facilities met WHO PPE standards; shortages of medical masks (30%) and respirators (46%) reduced compliance.                                  |
| 5  | Factors Influencing Uptake of Protective Behaviours by Healthcare Workers in England during COVID-19                                              | Meyer et al., 2024      | Mixed-method           | Compliance 88% influenced by knowledge, PPE availability, and reflective motivation regarding benefits.                                                   |
| 6  | Factors Related to PPE Compliance of Emergency Room Staff at Makassar Regional Hospital                                                           | Pirade et al., 2022     | Cross-sectional        | Knowledge ( $p=0.000$ ), attitude ( $p=0.033$ ), motivation ( $p=0.001$ ), and supervision ( $p=0.004$ ) significantly related to compliance.             |
| 7  | PPE Compliance among Workers in Sorowako, South Sulawesi                                                                                          | Salcha et al., 2022     | Cross-sectional        | Education ( $p=0.001$ ), knowledge ( $p=0.000$ ), and motivation ( $p=0.008$ ) significantly associated with PPE compliance.                              |

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|    |                                                                                                              |                         |                   |                                                                                                                                           |
|----|--------------------------------------------------------------------------------------------------------------|-------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 8  | Compliance with PPE among Informal Sector Workers in Indonesia: Literature Review                            | Laksono et al., 2024    | Literature review | Positive knowledge and attitudes increased PPE compliance; collaboration between government and labor organizations recommended.          |
| 9  | Literature Review: Nurses' Compliance with PPE                                                               | Dea Ananda et al., 2024 | Literature review | Compliance influenced by knowledge, positive attitudes, and PPE availability; continuous education recommended.                           |
| 10 | PPE Compliance for Occupational Safety among Healthcare Workers at Maiwa Health Center, Enrekang             | Ilmayanti et al., 2025  | Cross-sectional   | Knowledge ( $p=0.001$ ), comfort ( $p=0.005$ ), and supervision ( $p=0.001$ ) significantly associated with healthcare worker compliance. |
| 11 | Factors Associated with PPE Compliance among Inpatient Nurses                                                | Prarona et al., 2024    | Cross-sectional   | Knowledge ( $p<0.001$ ), attitude ( $p<0.01$ ), and PPE availability ( $p<0.001$ ) significantly influenced nurse compliance.             |
| 12 | Relationship between Supervision and Sanctions with PPE Use Behavior among Construction Workers              | Azizah et al., 2021     | Cross-sectional   | Supervision ( $p=0.011$ ) and policy enforcement ( $p=0.005$ ) significantly affected PPE compliance.                                     |
| 13 | Effect of Reward and Punishment on PPE Discipline among Manufacturing Workers                                | Pratama et al., 2022    | Cross-sectional   | Effective reward and punishment system ( $p=0.001$ ) improved worker discipline and compliance.                                           |
| 14 | Analysis of PPE Compliance among Street Cleaning Workers: Role of Knowledge and Availability                 | Ramadhani et al., 2024  | Cross-sectional   | Low knowledge ( $p=0.002$ ) and incomplete PPE availability ( $p=0.000$ ) were major non-compliance factors.                              |
| 15 | Distribution and Availability of PPE as Determinants of Worker Compliance in Wood Processing Industry        | Kalsum & Lilia, 2024    | Cross-sectional   | PPE availability ( $p=0.001$ ) and improper distribution ( $p=0.004$ ) hindered compliance.                                               |
| 16 | Determinants of PPE Compliance in Spraying Unit Workers: Role of Knowledge, Attitude, and Leadership Support | Sihombing et al., 2023  | Cross-sectional   | Knowledge ( $p=0.008$ ), attitude ( $p=0.041$ ), and leadership encouragement ( $p=0.005$ ) were dominant factors.                        |

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|----|------------------------------------------------------------------------------------------------------------|---------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------|
| 17 | Factors Affecting PPE Behavior among Construction Workers: Systematic Review                               | Safitri et al., 2025      | Literature review | Attitude, knowledge, education, supervision, and policy support consistently identified as key factors.                            |
| 18 | Literature Review: Key Factors in PPE Use for Construction Accident Prevention                             | Budiman et al., 2025      | Literature review | PPE compliance and availability were the most critical factors in accident prevention.                                             |
| 19 | Relationship of PPE Comfort and Availability with Safe Behavior in Construction Workers                    | Bahtiar et al., 2024      | Cross-sectional   | PPE comfort ( $p=0.003$ ) and availability ( $p=0.001$ ) significantly improved compliance by up to 25%.                           |
| 20 | PPE Compliance among Construction Workers: Knowledge, Supervision, and Safety Culture                      | Ghassani et al., 2021     | Cross-sectional   | Good OHS knowledge ( $p=0.01$ ) and consistent supervision ( $p=0.002$ ) were strong predictors of compliance.                     |
| 21 | Relationship between OHS Supervision and PPE Compliance in Production Employees                            | Wijaya & Sari, 2022       | Cross-sectional   | Strong correlation between OHS supervision ( $p=0.000$ ) and worker compliance in production areas.                                |
| 22 | Effect of Safety Signs, PPE Condition, and Supervision on PPE Use in Factory Areas                         | Susanto et al., 2023      | Cross-sectional   | Safety signs (policy), PPE condition (availability), and supervision (policy) significantly influenced compliance.                 |
| 23 | Implementation of OHS Policy and Training as Determinants of PPE Compliance in Underground Mining Workers  | Raharjo & Manullang, 2022 | Case study        | Strict OHS policy implementation ( $p=0.001$ ) and routine training ( $p=0.003$ ) significantly improved compliance.               |
| 24 | Analysis of PPE Compliance in the Chemical Industry: Hazard Knowledge and Specific PPE Availability        | Putri & Hasan, 2021       | Cross-sectional   | Specific chemical hazard knowledge ( $p=0.000$ ) and availability of specialized PPE ( $p=0.002$ ) directly related to compliance. |
| 25 | Knowledge, Attitudes, and Availability as Determinants of PPE Compliance among Nurses: A Systematic Review | Ahmed & Khan, 2023        | Systematic review | SLR confirmed knowledge, positive attitudes, and adequate PPE availability as the three main pillars of nurse compliance.          |
| 26 | Assessment of Abattoir Procedures and PPE Usage in Nigeria: Policy and Availability Gaps                   | Eze et al., 2024          | Mixed-method      | Very low PPE compliance ( $<15\%$ ) linked to lack of policy enforcement and insufficient PPE availability.                        |

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|----|----------------------------------------------------------------------------------------------------------|---------------------|--------------------|---------------------------------------------------------------------------------------------------------|
| 27 | Improving Farmer Safety: A Behaviour Change Wheel Approach to PPE Compliance Policy                      | Smith et al., 2023  | Intervention study | COM-B-based intervention (Capability, Opportunity, Motivation) effectively increased compliance.        |
| 28 | Impact of Mandatory H&S Awareness Training for Managers on PPE Compliance: NHS Trust Case Study          | Johnson & Lee, 2023 | Case study         | Mandatory OHS training for managers (knowledge & policy) improved staff PPE compliance by 40%.          |
| 29 | Evaluating PPE Policy Compliance and Water Safety Plans in UK Healthcare Settings                        | Davies et al., 2022 | Policy review      | PPE policy adherence and water safety plans were interrelated; clear, auditable policies are critical.  |
| 30 | Factors Affecting PPE Adherence among Textile Workers in Vietnam: Knowledge Gaps and Availability Issues | Nguyen & Tran, 2023 | Cross-sectional    | Low compliance (45%) due to inadequate training (knowledge) and inconsistent PPE supply (availability). |

**Source:** Authors' synthesis (2025).

Based on the 30 analyzed articles, the factors influencing PPE compliance can be categorized into three main domains that were consistently reported:

1. **Knowledge Factors (Individual)**

Nineteen out of 30 studies [1], [2], [5], [6], [7], [8], [9], [10], [12], [15], [16], [17], [18], [21], [23], [24], [25], [26], [31] consistently identified knowledge as a significant predictor of compliance ( $p < 0.05$  in most studies). Workers with adequate knowledge of occupational risks, OHS procedures, and proper PPE usage were significantly more likely to comply.

2. **PPE Availability Factors (Organizational)**

Eighteen out of 30 studies [1], [4], [5], [9], [12], [14], [15], [16], [18], [19], [20], [22], [23], [25], [26], [27], [28], [31] highlighted PPE availability and accessibility as crucial determinants. Adequate, easily accessible, comfortable [10], [20], and well-maintained PPE [23] were directly associated with higher compliance. Conversely, shortages [4], [31] or improper distribution [16] were major barriers.

3. **Policy and Supervision Factors (Organizational)**

Sixteen out of 30 studies [3], [6], [10], [12], [13], [14], [17], [18], [21], [22], [23], [24], [27], [28], [29], [30] demonstrated the importance of active OHS policies and supervision. Key components included strict monitoring [6], [10], [13], [21], [22], implementation of reward/punishment systems [13], [14], structured OHS training [24], [29], and leadership support [17].

**These findings indicate that improving PPE compliance requires an integrated approach addressing individual knowledge, organizational provision of PPE, and enforcement of policies and supervision.**

## DISCUSSION

The literature review of the 30 included studies demonstrates that compliance with Personal Protective Equipment (PPE) is strongly influenced by a combination of individual and organizational factors. The findings highlight three primary pillars of compliance: worker knowledge, PPE availability, and policy/supervision implementation.

At the individual level, knowledge emerges as the most frequently reported predictor. Studies by Kim et al. [2], Pirade et al. [6], Salcha et al. [7], Prarona et al. [12], and Ahmed & Khan [25] consistently found significant associations ( $p < 0.001$ ) between knowledge and compliance. Workers who understand the specific risks in their work environment [25] and receive adequate training [24] demonstrate substantially higher compliance. These results are reinforced by findings from Ramadhani et al. [15] and Nguyen & Tran [31], which identified lack of knowledge and training as primary causes of noncompliance among informal and textile sector workers. Accordingly, interventions focusing on continuous education and training [9] are fundamental for enhancing PPE adherence.

Beyond knowledge, PPE availability is a critical organizational determinant. Extreme cases were reported in low-income countries [4] and Nigeria [27], where massive noncompliance ( $< 20\%$ ) occurred due to organizational failures in PPE provision. Availability encompasses not only quantity [1], [5], [26], but also quality, comfort [10], [20], and accessibility. Kalsum & Lilia [16] emphasized that poor distribution can hinder compliance even when PPE is physically present in storage. This highlights that logistics management and provision of ergonomically suitable PPE [20] are organizational responsibilities that must not be overlooked.

The second dominant organizational factor is OHS policy implementation. Active, well-enforced policies have proven highly effective. Studies by Pirade et al. [6], Ilma et al.

[10], Azizah et al. [13], Ghassani et al. [21], and Wijaya & Sari [22] reported strong statistical associations ( $p < 0.05$ ) between supervision and compliance. Policy effectiveness is further enhanced by accountability mechanisms, including reward and punishment systems [13], [14] and visible leadership support [17]. Johnson & Lee [29] demonstrated that training managers to conduct effective OHS supervision can dramatically increase staff compliance, confirming that PPE adherence is not solely the worker's responsibility but a systemic outcome of consistently enforced policies.

Overall, these findings indicate that interventions that solely attribute noncompliance to individual factors, such as "lack of motivation," are unlikely to succeed. Improving compliance requires a systemic approach: (1) enhancing worker capability through training, (2) providing opportunities via adequate PPE provision, and (3) fostering external motivation through clear policies and supervision [28].

## CONCLUSION

This systematic review highlights two critical aspects of occupational health and safety in high-risk industries. First, shift work, particularly night shifts and rotating schedules, is significantly associated with increased work-related stress, fatigue, and accident risk among oil and gas industry workers. The analyzed studies consistently show that disruptions of circadian rhythms, extended work hours, and insufficient recovery time contribute to both physiological and psychological fatigue, which in turn elevates the likelihood of human errors and workplace injuries. Psychosocial factors, including excessive workload, limited rest, inadequate supervision, and low job control, further exacerbate stress and fatigue levels. Conversely, strong organizational support, effective leadership, and the implementation of fatigue risk management systems (FRMS) have been shown to reduce fatigue-related incidents and improve worker alertness. These findings underscore the importance of integrating fatigue prevention, ergonomic scheduling, and psychosocial support into occupational health and safety policies, while prioritizing regular health monitoring, optimized shift rotations, and ongoing training on fatigue awareness to maintain worker performance and minimize accident risk.

Second, worker compliance with Personal Protective Equipment (PPE) use is a multifactorial phenomenon dominated by three primary determinants across diverse sectors and countries. These determinants include: (1) Knowledge, referring to workers' understanding of occupational risks and OHS procedures; (2) Availability, specifically ensuring that PPE is adequate, comfortable, and easily accessible; and (3) Policy and Supervision, encompassing active and consistent OHS monitoring as well as visible management support. The most effective interventions to enhance PPE compliance are comprehensive and systemic, integrating training programs to improve knowledge, organizational assurance of PPE availability, and the enforcement of fair and consistent OHS policies within the workplace.

Collectively, these findings emphasize that improving occupational safety and health outcomes requires an integrated approach addressing both worker well-being—through fatigue management and psychosocial support—and compliance with protective measures—through knowledge enhancement, provision of PPE, and robust policy enforcement. Future research is recommended to adopt longitudinal and interventional approaches to evaluate the sustained effectiveness of fatigue mitigation and PPE compliance strategies and to identify organizational factors that support long-term worker safety and performance.

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