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Analysis of the Effectiveness of Occupational Health and Safety (K3) Education for Health Workers: An Integrative Review of the Implementation of Minister of Health Regulation No. 66 of 2016 and Its Impact on Occupational Health IncidentsNeedlestick Injury

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ABSTRACT

Incident Needlestick Injury(NSI) is a major epidemiological threat and the most frequent occupational risk for healthcare workers, potentially transmitting blood-based diseases. In Indonesia, Minister of Health Regulation No. 66 of 2016 mandates the implementation of the Hospital Occupational Health and Safety Management System (SMK3RS), where OSH education is a key intervention for NSI prevention. This integrative review study aims to analyze the effectiveness of OSH education on NSI incidents, using Kirkpatrick's multi-level evaluation framework, and to review the role of the implementation of Permenkes 66/2016 in supporting the transfer of safe behaviors. The integrative review was conducted by synthesizing quantitative and qualitative literature from reputable databases (PubMed, Sinta, etc.) published since 2016. Data were analyzed using thematic synthesis and mapped to the Kirkpatrick Evaluation Model (Levels 1-4). OSH education in hospitals has been shown to be successful in increasing knowledge (Level 2), but has not been found to be significantly associated with a decrease in NSI incidents (Level 4) in many studies. This gap stems from the failure of knowledge transfer to behavior (Level 3), evidenced by the significant correlation between NSI andunsafe action($p < 0.05$). Level 3 failure is reinforced by the suboptimal implementation of Permenkes 66/2016; the main weakness lies in superficial supervision and administrative sanctions that do not provide a deterrent effect (Zainal, 2024), thus failing to create an organizational climate that supports K3 compliance. The effectiveness of NSI prevention is highly dependent on the ability of hospital management to ensure the transfer of safe behavior (Level 3) through the system. Reinforcement Consistent. The limitations of Minister of Health Regulation 66/2016 on systemic enforcement must be addressed by strengthening sanctions and integrating behavioral audits into K3RS supervision

ABSTRAK

Insiden Needlestick Injury (NSI) merupakan ancaman epidemiologis utama dan risiko kerja paling sering bagi petugas kesehatan, yang berpotensi menularkan penyakit berbasis darah. Di Indonesia, Permenkes No. 66 Tahun 2016 mengamanatkan penerapan Sistem Manajemen K3 Rumah Sakit (SMK3RS), di mana pendidikan K3 menjadi intervensi

kunci untuk pencegahan NSI. Penelitian tinjauan integratif ini bertujuan menganalisis efektivitas pendidikan K3 terhadap insiden NSI, melalui kerangka evaluasi multi-level Kirkpatrick, serta meninjau peran implementasi Permenkes 66/2016 dalam mendukung transfer perilaku aman. Tinjauan Integratif dilakukan dengan menyintesis literatur kuantitatif dan kualitatif dari basis data bereputasi (PubMed, Sinta, dll.) yang diterbitkan sejak 2016. Data dianalisis menggunakan sintesis tematik dan dipetakan ke dalam Model Evaluasi Kirkpatrick (Level 1-4). Pendidikan K3 di RS menunjukkan keberhasilan dalam meningkatkan pengetahuan (Level 2), tetapi ditemukan tidak berhubungan signifikan dengan penurunan insiden NSI (Level 4) pada banyak studi. Kesenjangan ini berasal dari kegagalan transfer pengetahuan ke perilaku (Level 3), dibuktikan dengan korelasi signifikan antara NSI dan unsafe action ($p < 0.05$). Kegagalan Level 3 diperkuat oleh implementasi Permenkes 66/2016 yang belum optimal; kelemahan utama terletak pada pengawasan yang superfisial dan sanksi administratif yang tidak memberikan efek jera (Zainal, 2024), sehingga gagal menciptakan iklim organisasi yang mendukung kepatuhan K3. Efektivitas pencegahan NSI sangat bergantung pada kemampuan manajemen RS untuk memastikan transfer perilaku aman (Level 3) melalui sistem reinforcement yang konsisten. Keterbatasan Permenkes 66/2016 pada aspek penegakan sistemik harus diperbaiki melalui penguatan sanksi dan integrasi audit perilaku dalam pengawasan K3RS.

INTRODUCTION

Hospitals are complex healthcare facilities characterized by the interaction of various potential hazards, including physical, chemical, psychosocial, and biological hazards (Damayanty, 2021). One of the most pressing occupational safety threats to hospital human resources (HR) is injury from sharp objects orNeedlestick Injury(NSI). NSI incidents not only cause economic and psychological losses, but more crucially, they become a major route of transmission of blood-based pathogens such asHuman Immunodeficiency Virus(HIV), Hepatitis B (HBV), and Hepatitis C (HCV), which have the potential to cause fatal occupational diseases (Smith, 2022). At the global and national levels, although data are often underreported, the prevalence of NSIs among healthcare workers remains a serious epidemiological problem, especially in developing countries (Smith, 2022; Yunihastuti et al., 2020).

In Indonesia, the primary legal basis for ensuring a safe work environment in the healthcare sector is regulated by the Regulation of the Minister of Health of the Republic of Indonesia Number 66 of 2016 concerning Occupational Safety and Health in Hospitals (Permenkes 66/2016) (Ministry of Health of the Republic of Indonesia, 2016). This regulation integrates Occupational Safety and Health (K3RS) as an integral part of overall hospital management, known as the K3RS Management System (SMK3RS) (Ministry of Health of the Republic of Indonesia, 2016). Based on Articles 4 and 7 of Permenkes 66/2016, the implementation of K3RS includes the establishment of policies, planning, implementation of K3RS risk management, safety and security, and occupational health services, including efforts to prevent occupational diseases through continuous education and training (Ministry of Health of the Republic of Indonesia, 2016).

Occupational Health and Safety (OHS) education and training (Diklat K3) is positioned as a central element in preventing workplace accidents, including NSI. Theoretically, OHS training aims to create positive change, starting from increasing OHS knowledge, developing attitudes that support safety, and ultimately resulting in changes in safe work behavior

(safe behavior) (Astari, 2019; Boediono, 2009). This behavioral change is crucial, as NSI prevention relies heavily on staff compliance with Standard Operating Procedures (SOPs) and consistent use of Personal Protective Equipment (PPE), which has been empirically shown to have a strong correlation with reduced accident incidence (Prameswari, 2021; Arifuddin et al., 2023). Therefore, the effectiveness of OHS education is assessed based on the extent to which the knowledge imparted is successfully transferred into workplace compliance.

Although a clearly defined regulatory framework has been established through Ministerial Regulation 66/2016 and the implementation of the Occupational Health and Safety (K3) training program, a review of domestic studies reveals significant gaps. The incidence of NSI in Indonesia, particularly in tertiary teaching hospitals, remains high (Yunihastuti et al., 2020). More worryingly, several studies have shown that participation in or possession of sound K3 knowledge is often lacking.not significantly correlatedwith a decrease in the incidence of NSI (Nur et al., 2024; Lestari, 2023). This phenomenon indicates a failure at a critical stage: the transfer of knowledge into applicable behavior. This failure is likely influenced by systemic factors and suboptimal work environment support.

Based on the empirical gaps and inconsistencies between knowledge and practice that occur, this integrative review report was prepared. The main objectives are: (1) To analyze the level of compliance with the implementation of Permenkes 66/2016, especially in the aspects of K3 education and NSI risk management; (2) To analyze the effectiveness of K3 education using a multi-level evaluation framework (Kirkpatrick Model), with a focus on the transition from Level 2 (Knowledge) to Level 3 (Behavior/Compliance); and (3) To synthesize the relationship between K3RS policy implementation and NSI incidents in healthcare workers, which is then used to formulate evidence-based policy recommendations.

METHODS

Resarch Design: Integrative Review (Intgrative Review)

This study uses an Integrative Review design (Integrative Review) to analyze and synthesize relevant literature. This method was chosen because it allows the integration of data from quantitative studies (on the correlation between variables and NSI incidence) and qualitative studies (on policy implementation and systemic barriers) (Winchester & Salji, 2016; Sutanto, 2024). This diverse data synthesis is essential for building a comprehensive understanding of the complex relationships between regulatory policies (Minister of Health Regulation 66/2016), OHS education interventions, officer behavior, and occupational safety outcomes (reduction in NSI).

Literature Search Strategy and Data Sources

The literature search strategy was based on the PICO/PEO framework focusing on K3RS and NSI in Indonesia. The population (P) was focused on Healthcare Workers (Nurses, Doctors, Laboratory Technicians) in Indonesian hospitals. Interventions/Exposures (I/E) included K3 Education, K3 Training, or K3RS Policies related to Permenkes 66/2016. The outcomes (O) measured were the incidence ofNeedlestick Injury(NSI), OHS Compliance (e.g., use of PPE), and Unsafe Acts (Unsafe Action).

The databases used include reputable international (PubMed, ScienceDirect, CrossRef) and national (Sinta portal) sources (Smith, 2022; Lestari, 2023). The search keywords used were in Indonesian and English, including: "Permenkes 66 2016", "Effectiveness of Occupational Health and Safety Training", "Needlestick Injury", "K3RS", "PPE Compliance", and "Unsafe Action" (Smith, 2022; Arifuddin et al., 2023; Nur et al., 2024). Inclusion criteria required publications published from 2016 (the year Permenkes 66/2016 was enacted) to the present, studies focused on the hospital environment, and havingDigital Object Identifier(DOI) or

registered on the Sinta portal with a minimum Sinta 4 category, and accessible for full review. A minimum of 60 libraries meeting these criteria were identified to ensure the depth and reliability of the synthesis.

Data Extraction and Analysis Procedures

Data extracted from each study included the research design, sample size, OHS variables measured (knowledge, attitude, training, compliance), and the results of statistical correlations between these variables and the incidence of NSI or other relevant work accidents (including p-values andOdds Ratioif available) (Nur et al., 2024; Lestari, 2023). Study quality assessment was conducted to ensure that only credible and methodologically sound literature was included in the synthesis.

Data analysis and synthesis were conducted using narrative thematic analysis andFramework Synthesis. The Key Analysis Framework applied isKirkpatrick Evaluation Model (Levels 1-4)(Kirkpatrick & Kirkpatrick, 2016). This model is used to classify the effectiveness of K3 education interventions (Level 1: Reaction, Level 2: Learning/Knowledge, Level 3: Behavior/Compliance, and Level 4: Outcome/NSI). Findings regarding the implementation of Permenkes 66/2016, particularly regarding supervision and sanctions, are integrated as a systemic context that directly influences the successful achievement of Kirkpatrick's Levels 3 and 4.

RESULTS

Implementation Status of Minister of Health Regulation No. 66 of 2016

In terms of regulations, Minister of Health Regulation 66/2016 has provided a strong framework for SMK3RS in Indonesia, outlining five main stages: policy determination, planning, implementation of the K3RS plan, monitoring and evaluation of K3RS performance, and review and improvement of performance (Ministry of Health of the Republic of Indonesia, 2016). However, the findings of an integrative review indicate a significant gap between the regulatory text and implementation in the field.

Several qualitative studies have highlighted that many hospitals still haven't optimally implemented all stages of K3RS (Damayanty, 2021). This incompleteness often occurs in technical aspects of facility risk management, such as providing adequate facilities and infrastructure for hazardous and toxic materials (B3) management and emergency preparedness (Damayanty, 2021).

The main criticism of the effectiveness of Permenkes 66/2016 lies in the implementation stage.Monitoring and Evaluation of K3RS Performanceand the accompanying sanction mechanisms (Zainal, 2024). Supervision, which should be carried out by the Minister, the Head of the Provincial Health Office, and the Head of the District/City Health Office, is deemed ineffective (Zainal, 2024). Supervision often consists of mere formality visits that focus more on general standards (such as waste management, sanitation, and accreditation) than on the in-depth substance of K3RS risk management (Zainal, 2024). Furthermore, the sanctions stipulated in Permenkes 66/2016 are onlyadministrative sanctions(Zainal, 2024). This light sanction is considered not to have a deterrent effect (deterrent effect) adequate for hospital management for negligence in implementing K3RS (Zainal, 2024).

Effectiveness of Occupational Health and Safety Education on NSI (Kirkpatrick Framework)

An integrated analysis of the findings of the effectiveness of K3 education on NSI prevention can be clearly mapped using the Kirkpatrick Model, highlighting successes at the initial level and critical failures at the advanced level.

Table 1: Synthesis of the Effectiveness of Occupational Health and Safety Education on NSI Prevention Based on the Kirkpatrick Evaluation Model

Kirkpatrick Evaluation Levels	Target Metrics	General Findings (Indonesian Study)	Correlation with NSI Incidents	Description/Implications
Level 1: Reaction	Satisfacti, perception of training relevance.	Generally positive. Healthcare workers expressed satisfaction with the K3 material presented.	Indirect.	Only measures participant experience; the weakest indicator of effectiveness.
Level 2: Learning	Improving K3/NSI Knowledge.	K3 training is often successful in increasing officers' knowledge scores post-intervention (Lestari, 2023).	Variable, Often Found Not Significant(Nur et al., 2024; Lestari, 2023).	Knowledge increases but does not guarantee changes in work behavior.
Level 3: Behavior	SOP compliance, use of PPE,unsafe action (unsafe action).	Compliance with PPE and good work attitude consistently demonstratedsignificant negative correlationwith occupational accidents/NSI (Prameswari, 2021; Arifuddin et al., 2023; Lestari, 2023).	Significant (Behavioral Compliance)	This is the missing causal variable; compliance is the desired outcome of OHS education.
Level 4: Results	Decrease in NSI Incident Rates.	The prevalence of NSI remains high, with several studies reporting that nearly one-third (28.6%) of nurses have experienced NSI (Yunihastuti et al., 2020; Lestari, 2023).	Often not achieved.	Level 4 failures mirror Level 3 failures and systemic support.

Prevalence of NSI and Behavioral Risk Factors

Non-specific SI (NSI) incidents remain an endemic problem in Indonesian hospitals (Smith, 2022; Yunihastuti et al., 2020). Data from a recent study showed that although the majority of subjects (98.2%) reported adherence to SOPs, the percentage of those who had experienced an NSI reached 28.6% of the total sample (Lestari, 2023).

The factors most strongly correlated with NSI incidence among healthcare workers are behavioral and attitudinal factors:

Unsafe Action (Unsafe Action):Studies show that unsafe acts have a highly significant relationship with the incidence of NSI (e.g., sig value = 0.002) (Nur et al., 2024). This includes acts such asrecappingsyringes, improper disposal, or negligence during the procedure.

Attitude and Compliance:Poor work attitudes were found to be significantly correlated with NSI (p-value 0.013) (Lestari, 2023). Similarly, non-compliance with PPE use

was also significantly correlated with workplace accidents (p-value 0.033) (Prameswari, 2021; Arifuddin et al., 2023).

On the other hand, the K3 Education/Training variable itself, when measured only aspresence or quantity, is often found to have no significant association with NSI (p-values of 0.350 and 1.00 in some studies) (Nur et al., 2024; Lestari, 2023). These results reinforce the conclusion that the failure to prevent NSI lies in behavioral aspects, not simply a knowledge deficit.

DISCUSSION

Effectiveness Transfer Gap Analysis (Kirkpatrick Level 3 Failure)

Findings indicate that OHS education interventions in Indonesian hospitals tend to be effective only up to Level 2 of the Kirkpatrick Model (Learning), namely increasing knowledge (Lestari, 2023). However, this effectiveness stalls at Level 3 (Behavior/Compliance), as evidenced by the finding that training often does not correlate with outcomes (Level 4: Reduction in NSI) (Nur et al., 2024). This phenomenon is referred to as the Level 3 Gap, where officersknowwhat is safe, but not consistentlydo it(unsafe action/unsafe actionremains high) (Nur et al., 2024).

In the frameworkBehavior-Based Safety(BBS) and the learning transfer model, sustainable behavioral change in the workplace requires more than just knowledge and skills; it requires the right work environment (right climate) and systemconsequence(consistent rewards or punishments) (Boediono, 2009; Iswanto et al., 2012). Failure to achieve Level 3 indicates that individual activator factors (knowledge, awareness) have been achieved, but environmental factors and organizational consequences (management roles, enforcement regulations) do not yet support safe behavior (Boediono, 2009; Iswanto et al., 2012). If the environment does not reward or even punishes (e.g., increasing working hours) OHS compliance, safe behavior will be difficult to maintain.

Integration of Failure to Implement Ministerial Regulation 66/2016 and the Occupational Health and Safety Organizational Climate

The failure of behavioral transfer at Level 3 cannot be separated from systemic weaknesses in the implementation of Minister of Health Regulation No. 66 of 2016. The Minister of Health Regulation mandates the organization of K3RS, policy establishment, and funding support for infrastructure facilities (Ministry of Health of the Republic of Indonesia, 2016). However, when external oversight by the Health Office or Ministry tends to focus on completing formalities (such as accreditation or general sanitation) and not in-depth audits of K3RS risk management (Zainal, 2024), the incentive for hospital management to prioritize K3 is substantially reduced.

This weakness is exacerbated by the purely administrative nature of sanctions. Because sanctions lack significant repressive or financial impact (Zainal, 2024), hospital management may view OHS as a minimal compliance burden, rather than a vital investment in safety (Putri, 2023). This lack of deterrent effect removes pressure for hospitals to invest in safer technologies (such as safety syringes), provide standardized and easily accessible PPE, and most importantly, implement a system ofreinforcementcredible to change the behavior of officers at Level 3. This poor working environment directly hinders the creation ofideal OSH culturewhich is part of the organization's identity (Setyaningtyas, 2024).

Transforming Occupational Health and Safety Education Towards Behavioral Competence

To address the Level 3 gap, OHS education must transform from an information-based approach to a competency- and behavior-based one. Studies show that factors such as OHS training (along with attitudes, knowledge, and communication) significantly influence safe behavior (Astari, 2019; Wulandari & Hartati, 2022). Therefore, the effectiveness of education must be measured through observable changes in behavior, not just knowledge test results.

Education should include job training (on-the-job training) and simulations that

emphasize NSI prevention and response skills, rather than just lecture sessions (Boediono, 2009). Effectiveness measurements should include a Job Performance Impact Assessment (Level 4) and, most importantly, an Observation of Workplace Implementation (Level 3) (Kirkpatrick & Kirkpatrick, 2016). Training should be repeated periodically (e.g., at least every six months) to ensure safe behaviors become habits (Boediono, 2009).

K3RS as Systemic Risk Management

Non-communicable diseases (NSIs) should be viewed as a manifestation of failure in K3RS risk management, as mandated by Ministerial Regulation 66/2016 (Ministry of Health of the Republic of Indonesia, 2016). As long as NSIs continue to be viewed as "accidents" or "individual errors" (of healthcare workers), rather than as organizational system failures, incidents will continue to recur. K3RS organizations must take full responsibility for overseeing the implementation of risk management (Ministry of Health of the Republic of Indonesia, 2016).

Therefore, hospital leadership must demonstrate a strong commitment, not only in writing (Article 6 of Minister of Health Regulation 66/2016), but also through the allocation of funding support, facilities, and supporting infrastructure (Ministry of Health of the Republic of Indonesia, 2016). This commitment includes the provision ofsafety engineered devicesand ensuring adequate PPE availability. When management creates a work climate where safety is valued and compliance is enforced, unsafe acts (the most correlated with NSI) can be controlled, and the causality arrow from OHS Education to NSI Reduction (Level 4) can be re-established.

CONCLUSION

This integrative review concludes that Occupational Health and Safety (OHS) education for healthcare workers in Indonesia, mandated by Ministerial Regulation No. 66 of 2016, has demonstrated limited effectiveness. While educational interventions have generally been successful in increasing knowledge (Kirkpatrick Level 2), significant failures have occurred at the stage of transferring knowledge into safe work behaviors (Level 3), manifested in high incidences of occupational accidents.Needlestick Injury (NSI) (Level 4).

This failure of behavioral transfer is due to the high prevalence of unsafe acts (unsafe action) which is strongly correlated with NSI. This condition is exacerbated by the suboptimal implementation of Permenkes 66/2016, characterized by weak oversight mechanisms that do not address the substance of K3RS risk management and a sanction system that is solely administrative (Zainal, 2024), thus failing to encourage managerial commitment to creating an organizational climate that supports K3 compliance.

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