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Analysis of the Implementation of the Hospital Occupational Safety and Health Management System (SMK3RS) in East Java (A Case Study of Regional General Hospitals)

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Abstract

Hospitals are high-risk workplaces that require a comprehensive Occupational Safety and Health Management System (SMK3RS) to protect healthcare workers, patients, visitors, and the hospital environment. This study aims to analyze the implementation of SMK3RS at Karsa Husada Regional General Hospital, Batu City, East Java, with a focus on hazard identification, risk assessment, and risk control in three priority units: CSSD and Laundry, Hospital Facilities and Infrastructure Management Unit (IPSRS), and the Laboratory and Blood Bank Unit (BDRS). This research employed a case study approach involving 70 workers, with 60 respondents selected through stratified random sampling using the Slovin formula. Data were collected through questionnaires, in-depth interviews, focus group discussions, and document analysis. Instrument reliability was tested using Cronbach's Alpha ($\alpha > 0.70$). Hazard and risk analysis were conducted using Job Safety Analysis (JSA), Hazard Identification, Risk Assessment, and Risk Control (HIRARC), and Failure Mode and Effect Analysis (FMEA). The results showed that the Laboratory and BDRS unit had the highest risk exposure, with two activities categorized as extreme risk, while the IPSRS unit had one extreme-risk activity related to working at heights without adequate PPE. Eight failure modes were identified as priority hazards requiring immediate control. Recommended corrective actions were formulated based on the Hierarchy of Controls, including elimination, substitution, engineering controls, administrative controls, and PPE compliance. In conclusion, the implementation of SMK3RS at the hospital still requires strengthening, particularly in high-risk units, to improve occupational safety performance and compliance with Minister of Health Regulation No. 66 of 2016.

INTRODUCTION

Occupational safety and health (OSH) is an essential component of modern businesses and organizations, encompassing efforts to ensure the health and safety of workers in the workplace, which in turn affects their efficiency and work outcomes (Adekunle, 2025; Assey, 2019; Bathan & Joy, 2023; Mixafenti, Karagkouni, et al., 2025; Mixafenti, Moutzouri, et al., 2025; Žižek et al., 2026). More specifically, occupational safety includes measures used to make the workplace safer for workers, while occupational health refers to various initiatives aimed at guaranteeing the emotional and physical well-being of workers. To limit risks and provide a safe, efficient, and productive workplace, SMK3 is an important component of every company's management system (Herlinawati, 2020). In accordance with the provisions of Law Number 1 of 1970 (Indonesia, 1970) concerning Occupational Safety, which aims to protect workers and other parties in the workplace, SMK3 is implemented as a means to create a safe, healthy, and prosperous work environment, free from harmful exposures, diseases, and accidents, while encouraging increased productivity (Birana et al., 2023; Harum, 2025; Hulu et al., 2025; Muhammad & Marsuki, 2023; Sitompul & Simarmata, 2022). The Safety Management System (SMS) theory, as emphasized by Andrew D. Cooper (2000), states, "The backbone of every company is its Safety Management System. All the rules, regulations, and practices that are put in place to keep people safe and reduce potential harm make up this system." Based on Government Regulation Number 50 of 2012, all companies in Indonesia with 100 or more employees and a high risk of injury are required to implement SMK3 (Herlinawati and Zulfikar, 2020). The Regulation of the Minister of Health Number 66 of 2016 regulates SMK3RS more specifically, particularly in relation to hospital work environments (Budiono et al., n.d.; Ekawati, 2025; Widjaja, 2026). Meanwhile, according to Pertiwi (2019), every hospital is required to implement SMK3RS as part of its overall management strategy to mitigate risks related to hospital work processes and to ensure that all employees, patients, visitors, and other stakeholders can carry out their activities in a safe environment.

The government mandates the implementation of SMK3 in hospitals because they serve public health needs, employ a diverse workforce, and present significant risks to the safety and well-being of staff, patients, visitors, and the surrounding environment (Explanation of Attachment to Permenkes No. 66 of 2016). Based on Article 2 of the Minister of Health Regulation Number 66 of 2016, there is an urgent need to adopt SMK3RS to achieve the optimal, effective, efficient, and sustainable implementation of occupational safety and health (K3) in hospitals.

Data from the East Java BPJS Employment Regional Office show that in 2023 there were 22,443 workplace accidents, representing 56.90% of all work accident cases. In addition, there were 4,808 accidents outside the workplace (12.20%) and 12,190 traffic accidents (30.90%). The number of employees in East Java who died or suffered serious injuries due to work accidents has shown a downward trend over the past three years. According to the East Java Regional Office of BPJS Employment (2024), the number of deaths decreased from 755 in 2021 to 516 in 2022 and 480 in 2023. Hospitals are recognized as environments with a high potential for occupational accidents; in particular, they present unique risks to the safety and well-being of employees. With more than one hundred employees (health workers) and significant potential exposure to K3 hazards, Karsa Husada Batu Regional General Hospital is categorized as an institution required to implement SMK3RS. However, work accidents still occur due to various issues related to operational procedures and healthcare service delivery.

Work accident data indicate that the hospital experiences an average of 20.6 accidents per year. Given that the goal of implementing SMK3RS is to eliminate workplace accidents entirely, this figure remains relatively high. The year 2022 was highlighted by Mahdika (2022) as a point of concern. All parties, from entry-level workers to hospital leadership, must demonstrate honesty and active involvement to ensure the successful implementation of SMK3 in Regional General Hospitals (RSUD). Management must establish rules and methods to control potential hazards, and all personnel must understand how to behave safely in the workplace in accordance with the SMK3 framework.

The research involves a study conducted by qualified and competent K3 control teams at Regional General Hospitals. The purpose of this evaluation is to determine whether procedures and activities have implemented SMK3RS in accordance with applicable regulations. The researchers employed the JSA (Job Safety Analysis), HIRARC (Hazard Identification, Risk Assessment, and Risk Control), and FMEA (Failure Mode and Effects Analysis) methods to identify potential hazards in hospitals, assess associated risks, and implement appropriate control measures. The HIRARC method was also used to prioritize tasks and evaluate the extent of SMK3RS implementation. In a 2025 study titled "Effectiveness of HIRARC in OSH Risk Management," Wilson Lee et al. (2025) found that the implementation of SMK3 in the workplace is positively correlated with the application of HIRARC, leading to a reduction in occupational accidents and diseases. This technique was selected due to its fundamental role in SMK3 and its effectiveness in hazard identification, risk evaluation, and control implementation. Previous studies have also extensively utilized risk management approaches, including HIRARC and JSA (Nur, 2023). It is expected that the findings of this study will contribute to the optimal assessment and management of K3 in hospital settings.

To support the delivery of optimal healthcare services, the implementation of a Hospital Occupational Safety and Health Management System (SMK3RS) is essential, particularly at Karsa Husada Regional General Hospital in Batu City. In this context, the study is designed to examine the extent of potential hazard sources that may negatively affect the implementation of SMK3RS, to analyze the level of risk arising from identified hazards, and to determine appropriate corrective actions as part of risk control efforts within the hospital environment. In line with this problem formulation, the objectives of this study are to identify and analyze potential hazard sources related to SMK3RS implementation, assess the level of risk within hospital work units, and formulate corrective actions to strengthen risk control and improve the effectiveness of SMK3RS. The findings of this research are expected to provide both theoretical and practical contributions. Theoretically, this study enriches the body of knowledge in occupational safety and health management, particularly in hospital contexts. Practically, the results are expected to serve as a reference for hospital management in improving hazard control, strengthening compliance with occupational safety regulations, and creating a safer working environment for healthcare workers, patients, visitors, and all parties involved in hospital services.

METHODS

The method used in this study is a case study. The researchers chose the RSUD as a case study because it provides a real environment to investigate and evaluate the implementation process of SMK3RS. The goal of this contextual and thorough case study technique is to investigate complex phenomena in a particular management system. The implementation of SMK3RS in research hospitals is the system that is the focus of this investigation. This method allows researchers to examine hazard identification, risk assessment, and control procedures in the hospital service unit, as well as the compliance of the SMK3RS program with relevant standards and regulations.

This research focuses on three specific parts of the health service installation unit at the Karsa Husada Regional General Hospital (RSUD) Batu City:

1. CSSD and Laundry Installation Unit
2. Unit IPSRS
3. Our laboratory installation unit has four departments: center, pathology, microbiology, as well as database and research systems.

The three service units are health service units that have been determined by the management and K3 team of Karsa Husada Hospital, Batu City, as priority units for the programs and expectations of the management of the hospital until the end of 2025, out of a total of 15 units identified as K3 risk zones based on the Director's Decree Number: 188.4/311.1/102.13/2022, concerning the types of Health Services at Karsa Husada Hospital, Batu City, and the Decree of the Director of Karsa Husada Hospital, number: 100.3.3/102.13/2025 in IV-K regarding risk areas of K3 installation units and safety, there are 15 installation unit areas that are at risk.

1. Laboratory Installation Unit and BDRS
2. Radiology Installation Unit
3. Pharmaceutical Installation Unit
4. Laundry Installation Unit
5. Operating Room Installation Unit
6. Perinatology Installation Unit
7. Solar Chamber
8. Isolation Room (Dahlia Room)
9. Emergency Room Installation Unit (IGD)
10. Intensive Care Unit (ICU)
11. Nutrition Installation Unit
12. Warehouse
13. Wastewater Treatment Plant (WWTP)
14. Generator Room
15. Unit IPSRS

The study included the following research instruments:

1. Researchers use tools such as focus group discussions and interviews to study risks related to management and planning, evaluate those risks, and find ways to mitigate them.
2. The researchers used questionnaires to measure the level of implementation of SMK3RS, identify hazards, classify and assess risks, and mitigate risks, especially from the perspective of implementing officers.
3. Document observation and analysis: specifically, the tools the researcher used to check the extent to which SMK3RS was used, as well as the accuracy of hazard identification, risk assessment, and risk control procedures.

This study used two main data collection methods:

1. The data collection approach used was a questionnaire, which was designed to collect quantitative information from health workers, hospital administrators, and hospital top-level management regarding the implementation of SMK3RS. The questionnaire uses a semi-open-ended format (also known as a mixed questionnaire) and a risk perception format (also known as a risk perception questionnaire).

2. In-depth interviews and FGDs are the main tools to collect qualitative data from hospital specialists involved in the launch of SMK3, such as the K3 Unit management team.

Basic questions regarding the implementation of SMK3RS are included in the survey and interview questions, such as:

Table 1. Key Questions in the Questionnaire

No	SMK3 Dimensions	Purpose	Sample Questions
1	**Aspects of K3 Policy Implementation**	Testing how effectively the K3 policy is implemented by checking how well health workers understand it and how easily the policies and procedures are accessible.	In my workplace, we have strict rules regarding occupational safety. Before any employee or worker starts working, they are always given a safety briefing by the company. Occupational safety rules and standards are prominently displayed throughout the organization. At Karsa Husada Hospital in Batu City, how many years have you been an employee?
2	**Protocol Compliance Aspects**	Ensuring that healthcare staff adhere to safety protocols, including wearing PPE	When performing tasks, I always make sure to adhere to all safety protocols. I usually take extra precautions at work as there are safety protocols in place. Personal protective equipment (PPE) is an important part of my work uniform.
3	**Risk Education Aspects**	Monitor how often and how well healthcare workers participate in occupational safety training	I am one of the participants of the K3 training organized in Batu City by Karsa Husada Hospital. In my opinion, occupational safety training is an excellent way to make the workplace safer for everyone.
4	**Factors Affecting Job Satisfaction and Working Conditions**	A safe and healthy workplace is an important indicator of employee happiness.	. The hospital's efforts in providing a safe workplace have met my expectations. . I feel safe and comfortable working with K3 because there are rules and standards that apply.
5	**Risk of Injury at Work**	Record how often accidents or injuries occur in the workplace in a given time span	. In 2022–2024, I was working as a staff at Karsa Husada Hospital in Batu City when an incident occurred. . I was working at Karsa Husada Hospital in Batu City (2022–2024) when I suffered a minor injury at work. . Is there anything in your area that might put you in harm's way? . Of all the possible risks, which one is the most threatening?

(Source: Referring to Government Regulation No. 50 of 2012 (SMK3) and Permenkes No. 66 of 2016 (SMK3RS))

Meanwhile, based on Article 4 of Permenkes No. 66 of 2016, the five main aspects of SMK3RS are the focus of data collection conducted through interviews and questionnaires. These aspects include:

1. Formulation of K3RS policy
2. K3RS Planning

3. Implementation of K3RS plan
4. Monitoring and evaluation of K3RS performance, and
5. Review and improvement of K3RS performance.

And **the SMK3RS Standards** as stipulated in PERMENKES No. 66 of 2026, include:

a. K3RS risk management
b. Safety and security in hospitals
c. Healthcare
d. Management of hazardous and toxic materials (B3)
e. Fire prevention and control
f. Hospital infrastructure management
g. Medical equipment management
h. Emergency or disaster preparedness

Population and Research Sample

i. People who work at the hospital in the three (3) installation unit locations that are the focus of this study include medical personnel, non-medical personnel, technical personnel, administrative staff, and hospital management.
j. The sample used in this study is representative of the population in terms of skills in each of the three service unit areas that this investigation focuses on. These areas include the hospital workforce.

Based on internal data from Karsa Husada Hospital in Batu City, the following is the total number of hospital workers in the three installation unit areas that are the focus of this study:

Table 2. Population and Number of Workers at Karsa Husada Regional Hospital, Batu City

No.	Installation Area/Unit	Total Kry (Total)	PIC/Chairman	Unit Assignment
1	**Laundry Installation and CSSD** (CSSD: Central Sterile Supply Department)	21 people	Ibu Anggun (Head of CSSD Institute)	Every service provided by the hospital relies on sterile medical equipment managed and provided by the CSSD. Receiving, cleaning, sterilizing, packaging, storing, and distributing medical equipment in accordance with the applicable standard processes is part of its responsibility.
2	**IPSRS**	15 people	Mr. Deni (IPSRS)	Karsa Husada Clinic in Batu City relies on non-medical facilities, infrastructure, and equipment to provide high-quality health services. The mission of IPSRS is to keep these assets in top condition, ensuring their security and readiness for use at all times. To achieve this, the construction, maintenance, and repair of non-medical facilities, such as buildings, air conditioning, and electricity, are carried out on a regular basis.

3	**Laboratory Installations** (Medical Plasma Bank, Vital Laboratory, Microbiology Laboratory, and Diagnostic Laboratory)	34 people	Mrs. Dian/ Mr. Hibah	Located in Batu City, Karsa Husada Hospital Scientific Installation provides laboratory services for support departments.
Total Population		**70**		

Source: Internal Data of Karsa Husada Hospital, Batu City (November 2025)

The following is the procedure for determining the number of samples to be collected using Stratified Random Sampling, also known as random sampling: The sample group is divided into sections according to the requirements of the task or job (e.g., doctors, nurses, laboratory analysts, administrators, other welfare workers, structural, technical, or service sections). Then, using the Slovin formula, the appropriate sample is taken from each section, with a margin of error (e) that is, the tolerable error rate of 5% for research in the fields of organizational systems, K3 administration, and applied research is 5% (0.05) (Sugiyono, 2019):

$$n = \frac{N}{1 + Ne^2}$$

(Formula 3.1)

So, with a total population of 70 workers, the sample size is 59.57 or 60 hospital workers.

Validity and reliability tests are carried out to ensure that research instruments are relevant, scientific, and consistent.

k. To ensure that all questionnaire questions are relevant, accountable, and scientifically valid, the validity of the content is checked in consultation with K3 experts and referring to the laws related to the implementation of SMK3RS. This ensures quantitative validity.

l. Quantitative Reliability: The internal consistency of the research instrument is ensured by measuring the reliability using Cronbach's Alpha. To ensure the questionnaire is consistent and reliable, we use Cronbach's Alpha. According to Ghozali (2021), the instrument is considered to have adequate reliability if the predicted Cronbach's Alpha value is more than 0.7.

RESULTS AND DISCUSSION

Questionnaire Testing

Sixty participants were surveyed during the implementation research phase of SMK3RS. The object of the research was the personnel or employees of the Hospital who were questioned about the main features of SMK3RS and the SMK3RS Standards applied in the Hospital. The questionnaire is designed to collect answers from them. Therefore, statements or questions should be checked individually to ensure their reliability and validity.

Validity Test

To ensure that the survey is relevant, representative, and scientific, it undergoes a validity test. The factors that show the implementation of SMK3RS at Karsa Husada Hospital, Batu City, were tested for validity and the results were as follows:

a. Validity Test on 3 (three) hospital installation units at Karsa Husada Hospital, Batu City

The validity test was carried out on three (3) installation units of the hospital with sixty (60) participants. All questions and statements regarding the implementation of SMK3RS at Karsa Husada Hospital, Batu City, are considered valid because of the value of the correlation coefficient (r calculated > r table, 0.254).

The results of the validity test analysis showed that of the three RSUD installation units (research objects), all indicators in the instrument statement and questionnaire questions were considered valid because the r calculation results were higher than the r table results (r calculated > r table (0.254)) and the significance level was less than 0.05.

b. Validity Test on CSSD and Laundry Installation Units

After conducting a validity test on the CSSD and Laundry Installation Unit of the hospital, with a sample size of 21, we found that all questions and statements regarding the implementation of SMK3RS in these units were considered valid, because the value of the correlation coefficient (r calculated > r table, 0.433) was greater than the critical value (r table).

c. Validity Test in IPSRS Implementation Unit

With 12 participants, the validity test for the IPSRS installation unit of the RSUD resulted in a correlation value of r greater than the critical value of 0.576. Therefore, all questions and statements regarding the implementation of SMK3RS in the IPSRS installation unit are considered valid.

d. Validity Test on Laboratory Installation Units and BDRS

With a total of 27 participants, the validity test for the placement units of CSSD and Laundry Hospital resulted in an r correlation index greater than a critical value of 0.381. As a result, all questions and statements regarding the implementation of SMK3RS in the test facility placement unit and BDRS are considered valid in the questionnaire.

Reliability Test (Reliability Test)

The purpose of the reliability evaluation was to ensure that the answers given by the participants in each of the three configuration units of the hospital were consistent with each other and with the claims of the research questionnaire. According to Cronbach's alpha (Cronbach's Alpha), the threshold of reliability investigation for each factor is spot on. A factor is considered reliable in the research object of the hospital in Batu City if the value of the Cronbach Alpha coefficient is more than 0.70. A reliability level of 0.70 indicates that a factor is reliable.

Reliability Tests at 3 (three) Installation Units of Karsa Husada Regional Hospital, Batu City

Findings from the reliability test of the SMK3RS implementation tool The three aspects of the reliability test carried out on the three hospital installation units used in this study had a value greater than 0.70. For the P12 factor (proof of risk management implementation document), the maximum reliability test result was 0.980, which was obtained at a level of 0.98. Alternately, the factors P05, P07, P08, P09, P16, P17, P22, and P25 had the lowest reliability test value of 0.978. The overall reliability test results fall into the high category. Each statement in this research questionnaire has a high reliability and consistency value, as indicated by the reliability value. A number greater than 0.70 was shown by Cronbach Alpha on the SMK3RS instrument at the hospital. The reliability or consistency of SMK3RS, which has thirteen factors and twenty-six statement items, is indicated by this number.

a. Reliability Test on CSSD and Laundry Installation Units

Findings from the reliability test of the SMK3RS implementation tool This study found that each aspect had a Cronbach's Alpha value above 0.70, which indicates reliability, in the CSSD and Laundry installation units at the hospital.

b. Reliability Test on IPSRS Installation Unit

The findings of the reliability test of the SMK3RS implementation tool showed that all dimensions of the RSUD IPSRS installation unit were reliable (Cronbach's Alpha > 0.70).

c. Reliability Testing on Laboratory Installation Units and BDRS

Findings from the reliability test of the SMK3RS admission device All dimensions in this study had a Cronbach's Alpha value above 0.70, which indicates reliability, according to the Laboratory and BDRS installation units of the hospital.

Hazard *Identification, Risk Analysis, and Risk Control* (HIRARC)

For each potential hazard in the three installation units studied, the HIRARC method was used to determine the level of risk, likelihood and severity. This is done by first identifying the hazards using the JSA method, then by conducting interviews, observations, studies of hospital K3 documents, and focused group discussions with K3 management experts at the hospital. Each hazard that may occur is categorized into three risk levels according to the AS/NZS 4360:2004 Standard: moderate, high risk, and very high/extreme risk.

Based on the findings of data analysis obtained using the HIRARC approach, the risk level (risk level) for each hazard identified in the three installation units studied at the hospital can be calculated as part of the risk assessment process. From this, it can be concluded that:

1. *Risk Assessment* on CSSD and Laundry installation units

There are three steps in the work process of CSSD and laundry assembly units that are considered high risk, with Risk Level values ranging from 10 to 19. The steps are as follows:

a. A high-risk procedure that involves sorting infected and uninfected linen from each patient's room, as well as assisting with the storage and delivery of clean linens.
b. This procedure involves washing and separating linen from solid objects according to the Infectious and Non-Infectious categories, as well as the type and material of linen. There are two potential hazards, each with a value of 12 (High Risk), associated with this operation.
c. High-risk procedures for cleaning and decontaminating linens, with a risk level of 12.

One work process involves administering standard hospital chemicals in controlled doses, and the other involves drying linens; Both of these activities have a risk level value of 9 and are therefore classified as medium risk.

2. Risk Assessment in IPSRS Installation Unit

One work process activity in the IPSRS installation unit is considered very risky, with a risk level of 20. This activity involves repairing and maintaining hospital facilities and infrastructure at heights, especially in areas with sloping floor contours, without the use of seat belts as personal protective equipment (PPE).

In addition, three work process activities within the IPSRS installation unit have been identified as High Risk, with a risk level of 12. These activities include:

m. The officer was exposed to a hazard level of 12 (High Risk) when welding and grinding without using appropriate and required personal protective equipment.
n. Irregular power grids continue during the repair and maintenance process of electrical installations. Repairing the electrical system, which has a risk level of 12 (high risk), without the use of personal protective equipment (PPE).
o. Officers do not wear masks when repairing or cleaning air conditioners or caring for non-medical infrastructure in hospital rooms exposed to viruses and germs, thus putting them at a high risk level 12.

3. Risk Assessment on Laboratory and BDRS installation units

There are two (2) work process activities in the Laboratory and BDRS installation units that are classified as severe risk, with a Risk Level value of 20. These activities include:

a. Hematology Analysts, Blood Gas Analysts, and Spectrophotometers are some of the laboratory instruments used for sample analysis at level 20 (extreme risk), which occurs in central laboratories.
b. Hot steam and pungent odors are generated by heating the disease specimen crushing machine in the pathology laboratory, which is used to destroy laboratory samples. There is a danger of being exposed to vapors containing viruses and experiencing shortness of breath. The danger level for this possibility is 20 (very high).

In addition, there are six (6) work process activities in laboratory installation units and BDRS that are categorized as High Risk, with risk levels ranging from 10 to 19. These activities include:

a. During the examination and analysis of laboratory samples at the central laboratory, there is a potential hazard that can cause short circuits and electric shocks to officers due to the layout of water pipes and electrical systems arranged in one row. The risk level for this unsafe condition is 16, which indicates a high risk.
b. There is a high risk of officers tripping and getting hit in the Central Laboratory work area when handling patient samples due to the narrow design and layout of the laboratory and filled with laboratory analysis equipment. The wiring is also non-standard, adding to the danger.
c. Officers are at risk of being infected with viruses or diseases from patient samples, as well as being exposed to medical, biological, and chemical wastes, when examining and analyzing samples in a laboratory environment that does not adhere to strict protocols regarding the storage, handling, and examination of body fluids, tissues, phlegm, secretions, swabs, pus, and other ecological samples (such as water and food) for microbiology. A risk level of 15 indicates a high risk for the disease.
d. There is a chance that the officer was exposed to medical viruses and bacteria while examining and analyzing samples in the laboratory, as chemicals and testing kits can produce aerosols and droplets. As the specimen is processed, aerosols and droplets are released. A risk level of 15 indicates a high risk for the disease.
e. It is known that the air circulation in the Pathology and Microbiology laboratory is inadequate, which creates a risk of staff being exposed to viruses and bacteria during

laboratory work and experiencing respiratory problems. This condition is classified as high risk, with a risk level of 16.

f. From a holistic point of view of the work process, taking into account ergonomics and psychology, it has been determined that some laboratory workers are given heavy workloads during certain working hours. This increases the likelihood of human error or uploading files containing laboratory analysis results to SIMRS Kanza due to fatigue factors; The risk level associated with this condition is 10 (high risk).

Third, based on the following analysis of work activities, three tasks within the Laboratory unit and the BDRS installation are classified as medium risk:

a. Manual delivery of blood samples increases the risk of spillage or exposure to dust, germs, or viruses because the lid is not always tightly sealed. The risk level for this problem is 8, which is considered a moderate risk.
b. Officers in the Pathology and Microbiology laboratory acted carelessly in the use of fire to preserve microscopic examinations (Direct Smear), thus endangering laboratory workers against the risk of fire and burns. The risk level for this condition is 6, which is categorized as moderate risk.
c. Officers are at risk of needle injuries from blood bags during BDRS installation, particularly during mobilization and removal of bags from external sources (such as PMIs) to units that require them. This condition is classified as moderate risk.

***Failure Mode and Effect Analysis* (FMEA)**

The study uses the Failure and Effect Mode Analysis (FMEA) technique, an organized and systematic approach to risk analysis, to identify potential failure modes in systems, processes, or equipment in , and evaluate how they may affect the reliability, quality, and safety of work. This is done by first conducting JSA and HIRARC analysis, which identify the risks and control them. Furthermore, this study uses this information to determine the priority of addressing these risks.

Risk Priority Number *(RPN)* Indicator

Using the RPN value indicators obtained by summing the indicators of Incidence (O), Severity (S), and Detection (D), the indicators used to identify possible failure modes in the FMEA technique are interpreted in relation to the risk of work accidents. As a result, the mitigation priorities of each potential hazard can be determined using the FMEA approach in this study. The three installation units in this study, namely CSSD and Laundry, IPSRS, and Laboratory and BDRS, have determined frequency (O), severity (S), and detection (D) indicators using the FMEA method.

Hospital management should prioritize this risk score from the analysis using the FMEA method, as shown in table 4.6.1 and graph 4.6.1, and consider the RPN value. This FMEA method, taking into account three more specific aspects of risk assessment (Failure Mode): Event (O), Severity (S), and Detection (D), and combining them, is able to generate RPN values to determine the order of priority of risks that need to be addressed and the issues that need to be adjusted. Specifically, there are 8 (eight) hazard identifications (Failure Mode) with RPN values that fall into the "high hazard" category (with an RPN score of 193 – 1,000), namely:

1. We should prioritize the rapid handling of two types of failures in the CSSD and Laundry units:

a. Linen exposed to body fluids, biological waste, patient feces, and blood are signs of A-03 failure mode (RPN 324).
b. Inpatient or procedure room attendants do not clean or move used linen from infected equipment or non-linen items, so it remains mixed with linen. This is the A-02 failure mode (RPN 240).
2. We must prioritize the immediate handling of two types of failures in the IPSRS installation unit:
a. Code B-03 (RPN 2880) indicates that the power grid is still irregular and officers do not use personal protective equipment (PPE) when repairing electrical installations.
b. Repairing and maintaining non-medical infrastructure in medical rooms exposed to viruses and germs, as well as officers not wearing masks, caused Failure Mode B-04 (RPN 224).
3. There are four failure scenarios in the Laboratory and BDRS installation units that need to be addressed immediately:
a. Code C-04 (RPN 315) indicates that there are samples of body fluids (biopsy, phlegm, secretions, pus, etc.), as well as environmental specimens (water, food) that are not stored in an environment safe for microbiology.
b. Inspection materials and reagents with the failure mode C-05 (RPN 2880) can produce aerosols and droplets.
c. The Laboratory of Pathology and Microbiology experienced a failure mode with the code C-06 (RPN 280). Ventilation in microbiology and pathology laboratories is inadequate.
d. The pathology laboratory experienced a pungent stench and hot steam from the equipment for the destruction of disease samples due to a failure with the C-10 code (RPN 270).

After addressing the risks associated with hazards with a "high hazard" RPN value, the next step is to address the risks associated with hazards with an RPN value in the "medium hazard" category. Of all the hazards identified, 12 (out of a total of 192) fall into this category, namely:

a. The CSSD and laundry installation units experience failure mode A-01 (RPN 108), which manifests as an overloaded linen trolley during manual handling and transport to a linen transport vehicle.
b. The CSSD and laundry installation units are subjected to A-06 failure mode (RPN 96). This mode is caused by indoor air being exposed to hot steam and linen while it is being dried.
c. The CSSD and laundry installation units experienced A-05 failure mode (RPN 72). The linen decontamination procedure exposes the user to the chemicals contained in the soap.
d. It has been observed that the IPSRS installation unit is experiencing a failure mode B-01 (RPN 180). This means that officers do not use PPE seat belts when working at heights in hospital facilities and infrastructure, especially in areas with sloping floor contours.
e. Problems with IPSRS installation devices; the failure mode is B-02 (RPN 96). Officers do not wear appropriate standard personal protective equipment (PPE) when welding or grinding.
f. The laboratory analysis equipment is placed in a very narrow space, and there are wires arranged in an unstandard manner. This is the cause of the C-03 failure mode (RPN 168) in the laboratory installation unit.

g. In the laboratory installation unit, there is a failure mode code C-11 (RPN 140). This mode is related to the installation of BDRS, which is responsible for the collection and delivery of blood bags from external sources (such as PMI) to units that need them.
h. When a laboratory installation unit is in Failure Mode C-08 (RPN 128), the officer has a lot of work to do at certain times of the day.
i. The laboratory installation unit experienced Failure Mode C-09 (RPN 128) due to the careless use of fire by an officer during the fixation phase of microscopic examination (Direct Smear) in the pathology and microbiology laboratory.
j. The laboratory analysis machine was operating when the failure mode C-01 (RPN 126) occurred at the central research facility. Here, the equipment and machines used for blood gas analysis, hematological analysis, blood chemical analysis, etc., are not turned off by the officers.
k. The failure mode of the laboratory installation unit C-07 (RPN 112) occurs when the blood sample is sent manually; The possible cause of this mode is a lid that is not tightly closed.
l. This is the C-02 failure mode (RPN 96) in the laboratory installation unit. The problem lies in the water tap that sits above the electrical installation in the central laboratory layout, which has the water pipe and the installation of the power grid in one row.

Next, we need to address potential hazards with a "low risk" RPN value. Of all the hazards, there is only one with an RPN value of 0–64. This danger is present in CSSD and laundry installation units, where police traffic areas are affected by standing water and slippery floors due to washing and decontamination of linens. Our solution is to implement risk mitigation measures.

Risk Control and Risk Control Recommendations

The hierarchy of hazard control, the basic idea of K3 management and an important part of many occupational safety standards such as ISO 45001:2018 and Government Regulation Number 50 of 2012 concerning SMK3, being the basis of the risk control process, or failure mode, in accordance with OHSA (2016) and NIOSH (2015), there is a five-level system to control risk, called the HoC Approach, which is as follows: elimination, substitution, engineering, administration, and finally, PPE.

CONCLUSION

Based on available data and observations, there were a total of 19 different types of workplace accidents across the three units of the Regional General Hospital in 2025. Of the total number of employees, 27 had experienced a workplace accident—or 39%—while 43 had not. These three RSUD units have a total of 70 personnel, with an incident rate of 27.14% and a frequency rate of 1,131 lost work hours per million work hours and 141 lost workdays per million work hours related to the severity rate. From these three indicators, it is clear that the SMK3RS has not been functioning optimally across all hospital units. A total of 21 potential hazards (hazard identifications) were identified across all hospital units based on the results of the JSA and HIRARC analyses. Of these, 6 were found in the CSSD and Laundry units, 4 in the non-medical IPSRS unit, and 11 in the Laboratory and BDRS locations. 3. Risk level assessments using HIRARC and FMEA indicate that in the CSSD and Laundry units, there are 4 potential hazards with high risk and 2 potential hazards with moderate risk. In the IPSRS unit, there is 1 potential hazard with extreme (very high) risk and 3 potential hazards with high risk. For the Laboratory and BDRS units, there are 2 potential hazards with extreme risk (very high risk), 6 potential hazards with high risk, and 3 potential hazards with moderate risk. Risk level analysis using the FMEA approach with RPN indicators shows that; a) The following two hazards have high RPN values: (a) in the CSSD and Laundry units. Cleaning and separating linens from solid items according to infectious and non-infectious categories (b) involves handling linens that have been exposed to body fluids and biological waste from patients. The RPN value for this procedure is 324. Sorting and washing linens according to infectious and non-infectious categories, as well as the type and material of the linens, is a procedure with an RPN value of 240; b) Two (2) potential hazards with a high RPN risk rating are present in the IPSRS installation unit: (a). Personal protective equipment (PPE) with an RPN value of 280 must not be worn by police officers when performing repairs and maintenance on electrical systems. Officers do not wear masks with an RPN value of 224 while working in non-medical facilities in inpatient rooms exposed to viruses and germs, or while repairing or cleaning air conditioning units; c) There are four (4) potential hazards in unit (a)* with high-risk RPN values in the BDRS laboratory and installation. The following types of samples are collected: environmental samples (water, food, etc.), body samples (cerebrospinal fluid, pleural fluid, etc.), and swabs (blood, urine, feces, biopsy tissue, sputum, secretions), pus, and an RPN value of 315 are not stored in a safe and protected environment for microbiological purposes. Aerosols and saliva droplets pose a threat to examination materials and reagents in the context of patient laboratory sample analysis, with an RPN value of 280, (c). Ventilation in the microbiology and pathology laboratories is inadequate; the RPN value is 280, and (d). As part of the thermal destruction process of laboratory samples, foul odors and clouds of hot steam are released into the Pathology laboratory room, contributing to an RPN score of 270. Given recent developments, the risk management plan for the implementation of SMK3RS at the Regional General Hospital uses the HoC method.

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