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## Hazard Risk Analysis in the Laboratory of Qolbu Insan Mulia (QIM) Hospital Using the Hazard Identification Risk Assessment and Risk Control (HIRARC) Approach

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### ABSTRACT

Activities in hospitals have risks originating from physical, chemical, biological, ergonomic, psychosocial, and waste factors. Qolbu Insan Mulia Hospital is a health service facility where sick and healthy people gather, which allows work-related accidents and occupational diseases to occur. The laboratory of Qolbu Insan Mulia Hospital is part of the medical support services, which provides hematology, serology, immunology, urine, blood chemistry, drugs, endocrinology, faces, blood transfusion, tumor marker, microbiology, and electrolyte testing services. This study aimed to determine K3 risk management using hazard identification risk assessment and risk control (HIRARC). This research is qualitative research. The techniques used in data collection were field observation, document review, and in-depth interviews. The research results show that in the laboratory there are 17 sources of potential danger consisting of physical, chemical, biological, ergonomic, mechanical, electrical, psychosocial, and waste hazards. In conclusion based on a high-level risk level of 71%, medium 23%, and low 6%, while the control efforts are in the form of administration, manipulation, and PPE.

### 1. Introduction

One of the medical support services provided by the Hospital is the laboratory installation. A clinical laboratory is a health clinical laboratory that carries out clinical specimen examination services to obtain information about individual health, especially to support efforts to diagnose disease, cure disease, and restore health. Medical laboratory technicians are an important group of paramedics who contribute greatly to medical, surgical, and other needs and are the population most at risk due to their activities requiring exposure to blood and body fluids. Their job is to handle a number of instruments and materials such as syringes, microscopes, various chemicals, and various electrical equipment every day in their work. Standing for long periods of time, bending the neck,

focusing on microscopes and drip tubes, and being in front of a computer dealing with infectious patients are some of the characteristics of laboratory analyst activities. Occupational safety and health need to be considered in order to protect workers so that they remain safe and healthy while carrying out their activities. This applies to hospitals, where the focus of implementing occupational safety and health in hospitals (K3RS) is to protect medical personnel, non-medical personnel, patients, and visitors from the potential risk of infectious diseases while in the hospital environment.<sup>1-5</sup>

Hazard identification risk assessment and risk control (HIRARC) is a series of processes for identifying hazards that can occur in routine and non-routine activities in a hospital, then carrying out an

assessment of these hazards so that the risk level can be minimized from the highest medium to low. The aim of the HIRARC program is to prevent and reduce the rate of accidents in hospitals. A preliminary study conducted in December 2022, based on the results of an interview with one of the workers at Qolbu Insan Mulia Hospital in the last year, in 2021, workers complained that there were still several cases of work accidents, one of which occurred in the laboratory section, namely injection needles. The results of the observations found a number of potential dangers such as physical (slippery floors), chemical (storage of chemicals), biological (exposure to viruses and bacteria), mechanical (needle pricks), electrical (electrical cables that are not neatly arranged), ergonomics (bending posture when picking up sample), psychosocial (pressure from superiors).<sup>6-9</sup> This study aimed to analyze the risk of hazards at the laboratory of Qolbu Insan Mulia (QIM) Hospital using the HIRARC (hazard identification risk assessment and risk control) approach.

## 2. Methods

This type of research is analytical descriptive research with methods of hazard identification, risk assessment, and risk control (HIRARC). The techniques used in data collection are field observation, document review, and in-depth interviews. There are three important stages in research using the HIRARC method, which is part of the risk management system, consisting of hazard identification, risk analysis, and risk control. Several stages in completing research using the HIRARC method include Data collection from observations and interviews and data processing consisting of Identifying potential risks from hazards that have been obtained from data collection in the field. Risk analysis after obtaining data from activities in the laboratory environment that have the potential to cause danger and risks is then carried out as a risk assessment. Determine risk controls to minimize and handle dangers so they don't happen again.

## 3. Results and Discussion

Based on the results of research that has been carried out and described in the HIRARC table, there are several potential dangers in the laboratory of Qolbu Insan Mulia Hospital, which have potential mechanical, chemical, biological, physical, ergonomic, waste, electrical, and psychosocial hazards. There are several potential dangers:

### Physical

Based on research that has been carried out in the laboratory of Qolbu Insan Mulia Hospital, there are several potential dangers, one of which is physical danger. At the time of data collection, there was a low-risk level result. The processing of patient sample results shows a medium risk level, and washing the equipment after sampling has a moderate risk level (medium), which results in eye fatigue, hearing loss, and slippery floors. Based on parallel research. The potential risk of hearing loss comes from noise resulting from the process of eating work objects and also the sound of operating machines. This can happen due to the use of machines at too high an intensity, lack of care and maintenance on each work machine used, lack of awareness of safety, minimal understanding of how to operate each work process correctly, and minimal use of personal protective equipment in related work processes. For this reason, steps are taken to control potential hazard risks, intended to prevent workers from health problems or illnesses and accidents due to potential work risk hazards. So, controlling the risk of hearing loss is providing education and training to all operators regarding how to operate the machine in question properly and correctly. Making SOPs and using PPE in the form of earplugs is the step that is most effective in preventing potential noise hazards. This is done to reduce noise exposure received by operators so that hearing is not disturbed either temporarily or permanently. Election earplugs must also be an appropriate standard. The minimum available is that it can be used as hearing protection for noise or sound levels in the workplace with a value of 85 dB.<sup>10</sup>

Table 1. HIRARC.

Work activities	Hazard identification		Risk analysis			Risk control
	Potential hazard	Types of potential hazards	Probability	Consequences	Results	
Patient sampling	Mechanical	Needle prick	4	3	H high	Elimination :- Substitution :- Manipulation :- Administration: Work according to SOP, Training PPE: Use appropriate PPE
	Biology	Exposure to viral/bacterial infectious diseases from patients	4	4	H high	Elimination :- Substitution :- Manipulation :- Administration: Giving safety sign, training, work according to SOP PPE: Use appropriate PPE such as hand gloves
	Ergonomics	Bending position when taking samples (awkward posture) back pain	3	3	H high	Elimination :- Substitution :- Manipulation: Changing the sampling position by sitting on a chair Administration: The need for education regarding correct body posture, posters related to ergonomics APD :-
Data collection on patients results in a computer application system	Physical	Computer screen lighting (eye fatigue)	2	2	L low	Elimination :- Substitution :- Manipulation: Mobilization to move around, not always in front of the computer Administration :- APD :-
	Ergonomics	Awkward posture, back pain	3	3	H high	Elimination :- Substitution :- Manipulation: Changing the sampling position by sitting on a chair Administration: the need for education regarding correct body posture, posters related to ergonomics APD :-
	Electrical	Cables not arranged neatly can cause electrical short circuits	3	4	H high	Elimination :- Substitution :- Manipulation: cable rearrangement Administration: danger signs APD :-
	Psychosocial	Increased patient stress	4	3	H high	Elimination :- Substitution :- Manipulation :- Administration: Safety sign poster about work stress APD :-
Processing of patient samples	Physical	Noise from sampling machine 58.03<65DbA (hearing impairment)	3	2	M medium	Elimination :- Substitution :- Manipulation: Mobilizing places, not staying in noisy places Manipulation: Warning signs of engine noise PPE: Use appropriate PPE such as earplugs
		The floor is slippery due to spilled materials	3	2	M medium	Elimination :- Substitution :- Manipulation :- Administration: Signs of

Work activities	Hazard identification		Risk analysis			Risk control
	Potential hazard	Types of potential hazards	Probability	Consequences	Results	
						danger, work according to SOP PPE: use of appropriate PPE
	Biology	Exposure to viruses and bacteria	4	4	H high	Elimination :- Substitution :- Manipulation :- Administration: Providing safety signs, training, working according to SOP PPE: Use appropriate PPE such as gloves
	Chemistry	Exposure to reagents derived from acids and alkaline solvents	3	4	H high	Elimination :- Substitution :- Manipulation :- Administration: Work according to existing SOPs, use of danger signs PPE: Use appropriate PPE
	Mechanical	Affected by smear sparks	3	3	H high	Elimination :- Substitution :- Manipulation :- Administration: Work according to existing SOPs, use of danger signs PPE: Use appropriate PPE
	Electrical	Machine usage errors	3	3	H high	Elimination :- Substitution :- Manipulation :- Administration: Work according to existing SOPs, warning signs APD :-
Washing and cleaning used sample equipment	Physical	The floor is slippery due to water spills	3	2	Medium M	Elimination :- Substitution :- Manipulation :- Administration: Warning signs of engine noise PPE: Use of appropriate PPE
	Biology	Exposure to bacteria and viruses	4	4	H high	Elimination :- Substitution :- Manipulation :- Administration: Providing safety signs, training, working according to SOP PPE: Use appropriate PPE such as gloves
	Mechanical	Hit by shards of beaker glass	3	2	M medium	Elimination :- Substitution :- Manipulation :- Administration: Work according to SOP, Training PPE: Use appropriate PPE
	Waste	Skin irritation contamination	3	4	H high	Elimination :- Substitution :- Manipulation: Providing a special space for B3 infectious waste Administration: Danger signs PPE: use of appropriate PPE

Based on the results of research on physical hazards in interviews and observations, the potential for noise hazards can be stated to exist. The noise comes from several medical tools used in the

laboratory, which, based on the assessment results, are still in the medium category. And based on relevant research, control can be eliminated by creating a special room for tools/machines. Substitution can be

done by replacing the machine with one with minimal noise, administration by providing danger signs and training, and using appropriate personal protective equipment. This research is in line with the results of other research where there are several types of dangers, including physical dangers, namely experiencing respiratory problems, exposure to heat, eye irritation, slipping, being pinched, experiencing minor to severe injuries, and even death. According to researchers, the potential danger that occurs does not have an excessively negative impact on workers because the risk level still only reaches a medium to low level.<sup>11</sup>

### **Chemistry**

Based on research that has been carried out at the laboratory of Qolbu Insan Mulia Hospital, there are several potential dangers, one of which is a chemical danger when processing sample results with a high category level. Based on the results of research on chemical hazards in interviews and observations, potential chemical hazards can be stated to come from reagents that can cause skin irritation. The activities carried out must be in accordance with the SOP, and instructions for carrying out effective activities at work must also be given before carrying out the inspection process. The use of PPE must also be emphasized to all laboratory users. The potential dangers contained in the laboratory of Qolbu Insan Mulia Hospital can have an impact on workers because the risk level of these chemical hazards is in the high category.<sup>12</sup>

### **Biology**

Based on research that has been carried out at the laboratory of Qolbu Insan Mulia Hospital, there are several potential dangers, one of which is a biological danger that occurs when taking samples and processing sample results in the high-risk category as a result of medical equipment used after exposure to a patient. Based on the research results, a very high level of risk was found in the biological dangers of bacteria and viruses in the patient's cough or droplets. This is in accordance with other research, which found

that the anamnesis process for patients and families and when doctors and officers explain the flow of services in hospitals is one of the causes of disease transmission to health workers caused by diseases transmitted from patients. The potential dangers contained in the laboratory of Qolbu Insan Mulia Hospital can have quite a high impact due to the high-risk category, and workers may experience losses.<sup>11</sup>

### **Ergonomic**

Based on research conducted at the laboratory of Qolbu Insan Mulia Hospital, there are several potential dangers, one of which is ergonomic dangers that occur when taking patient samples and when in front of a computer desk in the high-level category. Based on research, the most common ergonomic risk is awkward posture caused by work facilities. On average, existing beds are no longer suitable because their high cannot be adjusted, forcing nurses to bend when performing procedures, such as installing an IV and having to bend more than 90 degrees. The impact is musculoskeletal disorders (MSDS), such as muscle pain and low back pain (LBP). Based on the results of research on ergonomic hazards in interviews and observations, potential ergonomic hazards were stated to originate from workers' body postures that bend when at a computer desk and sit while working on samples, causing back pain. The potential dangers contained in the laboratory of Qolbu Insan Mulia Hospital can have quite a high impact due to the high-risk category, and workers may experience losses.<sup>14</sup>

### **Psychosocial**

Based on research conducted at the laboratory of Qolbu Insan Mulia Hospital, there are several potential dangers, one of which is psychosocial danger in the high-risk category as a result of complaints from patients who can't wait for the results. Based on research that is in line with the psychosocial dangers of patients who are angry at health workers, this danger is also in line with other research, which states that the psychological dangers found in emergency installations include pressure and intimidation from

the patient's family who cannot wait for action. The potential dangers contained in the laboratory of Qolbu Insan Mulia Hospital can impact workers and can cause losses for the agency because they can affect work productivity.<sup>15</sup>

### **Mechanical**

Based on research that has been carried out in the laboratory of Qolbu Insan Mulia Hospital, there are several potential dangers, one of which is mechanical danger, namely being hit by sharp objects, being scratched by sample tools, being hit by sparks, and each of them is in the high-risk level category there are 2, and there is 1 medium. Potential mechanical hazards are dangers originating from equipment or moving objects that can result in accidents, such as being pinched, cut, hit, rolled over, cut, or stabbed by sharp objects. The potential dangers in the laboratory of Qolbu Insan Mulia Hospital could have a huge impact on workers because they could be infected with infectious diseases and workers would lose their jobs.<sup>13</sup>

### **Electrical**

Based on research conducted at the laboratory of Qolbu Insan Mulia Hospital, there are several potential dangers, one of which is an electrical danger when using machines or sampling tools in the high-risk category. Based on research related to occupational safety and health (K3), short circuits (short circuits), electric shocks, and long currents often occur, which cause fires. The potential dangers that exist in the laboratory of Qolbu Insan Mulia Hospital can impact workers and agencies because they can cause huge losses if a short circuit occurs, which results in a fire.<sup>12</sup>

### **Waste**

Based on research conducted at the laboratory of Qolbu Insan Mulia Hospital, there are several potential dangers, one of which is the danger of waste in the high category, which can cause skin irritation. Based on research that is in line with. Based on preliminary data, data was obtained on chemicals from the list of

B3 (toxic hazardous substances) in the Haji General Hospital, South Sulawesi Province which have the potential to cause fires in hospitals because they are easily explosive or combustible in the Haji General Hospital, South Sulawesi Province, such as alcohol, acetic acid, picric acid, acetone, LPG, formalin, methanol, nitroglycerin, and xylene. The potential dangers contained in the laboratory of Qolbu Insan Mulia Hospital can have an impact on workers, agencies, and communities outside the agency because it can have a very high impact if waste control efforts are not available.<sup>15</sup>

### **4. Conclusion**

The results of the hazard identification showed that there were dangers that occurred as a result of work activities. The types of hazards found were 17 types of potential hazards, including those originating from potential physical, chemical, biological, ergonomic, mechanical, electrical, psychosocial, and waste hazards. The results of the risk analysis in the laboratory of QIM Hospital are a high level of 71%, medium 23%, and low 6%. As a result of hazard identification and risk analysis, control efforts can be made, namely engineering control (providing a suitable workplace, providing special B3 storage cupboards), administration (working in accordance with existing SOPs, the need for training, providing danger signs, routine carry out maintenance) and PPE (using appropriate PPE such as gloves, masks, lab coats, rubber sandals).

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