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The Concept of The Epidemiological Triangle in The Workplace

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ABSTRACT

The workplace is a potential source of hazards and risks for workers. Occupational Safety and Health (OSH) is a priority in efforts to reduce these risks through cooperation between employers and employees. Data from the International Labor Organization (ILO) shows a high number of deaths and injuries due to work accidents and work-related diseases. In Indonesia, reports from the Social Security Implementation Agency (BPJS) for employment reveal an increase in cases of work accidents from year to year. Occupational safety and health is an important factor in creating a proper working environment, with the concept of epidemiology helping to understand the host-agent-environment contribution. OHS protection efforts are crucial to reduce risks and improve well-being in the workplace.

Keywords: *Epidemiologic Triangle, Workplace, OHS.*

INTRODUCTION

The workplace is one of the locations that poses many dangers and risks to workers. Occupational Safety and Health (OSH) is a collaborative effort, mutual understanding, and participation between employers and employees within a company to carry out joint tasks and responsibilities in the areas of safety, health, and security at work in order to increase productivity. Through the implementation of OSH, it is hoped that a safe and healthy workplace will be created, encompassing employees, customers, and visitors to a work location, thereby reducing or eliminating workplace accidents and work-related illnesses. The implementation of OSH is based on, among other things, Government Regulation No. 50 of 2012 concerning the Implementation of the Occupational Safety and Health Management System, and OHSAS 18001, the international standard for the implementation of the OSH Management System.

The mortality rate due to workplace accidents and occupational diseases is quite high. According to data from the International Labor Organization, every year around 380,000 workers, or 13.7% of 2.78 million workers, die as a result of accidents at work or occupational diseases. In addition, more than 374 million people suffer injuries, wounds, or illness every year as a result of accidents involving workers (ILO, 2018).

Based on accident data from the Social Security Administration Agency (BPJS) for employment, in Indonesia the number of work accidents reported increased in 2017 to 123,041 cases, while throughout 2018 it reached 173,105 cases. Each year, BPJS handles an average of 130,000 work-related accident cases, ranging from minor cases to fatal accidents (BPJS, 2018).

According to the Ministry of Health (2021), occupational safety and health are important components of decent work. Physical conditions and mental demands in the workplace greatly determine the condition of workers. Work accidents cause enormous human, social, and economic losses, as do occupational diseases and diseases caused by work relationships. Thus, through the concept of epidemiology, it can be understood how host-agent-environment contributes to the workplace environment.

METHODOLOGY

This study uses a descriptive qualitative research method. According to Sukmadinata (2016), this study aims to provide an overview and describe phenomena that occur both naturally and as a result of human engineering, with a focus on the characteristics, quality, and interrelationships between activities. The data source used in this study is secondary data. According to Sugiyono (2018), secondary data is a data source that does not directly provide data to data collectors. Secondary data in this study was obtained from reference books, journal documents, online news, archives, and other literature reviews. The data collection method in this study was carried out through analysis, describing and explaining the conditions of the data in the field based on the research problems being studied.

RESULTS AND DISCUSSION

A. Epidemiological History

1. Historical Figures in Epidemiology

   Epidemiology has been known or introduced in the world of health and medicine for a long time. Some well-known figures who have made important contributions to the development of epidemiology are:

   a. Hipporates (460-377 SM)
      He is considered The First Epidemiologist, the world's first epidemiologist, because he was the first person to propose the concept of rational analysis of disease incidence.
   b. Galen (129-199 SM)
      This Roman military surgeon is often considered the Father of Experimental Physiology. He proposed the concept that health status is related to personality type and lifestyle factors.
   c. Thomas Sydenham (1624-1689 SM)
      This Englishman is often referred to as the English Hippocrates because his statements revived Hippocrates in England and added to the

importance of detailing Hippocrates' concept of environmental factors (atmosphere).

d. Antonie van Leeiwenhoek (1632-1723)
   Leeuwenhoek was an amateur scientist who invented the microscope, discovered bacteria and parasites (1674), and discovered spermatozoa (1677).
e. Robert Koch
   The name Robert Koch is synonymous with tuberculosis. He discovered tuberculosis in 1882 and introduced tuberculin in 1890, which he considered to be a treatment for tuberculosis.

2. Historical Events in Epidemiology

Cholera was a major global scourge in the 19th century, with large-scale epidemics frequently occurring in European cities, especially those originating in the Indian subcontinent. John Snow conducted early investigations into cholera epidemics in England, particularly in London, in 1854. In his research, he showed that contaminated water was the main source of the epidemic. His thorough investigation of the epidemic in London's Soho district led to the conclusion that contaminated water from the Broad Street pump was the source of the disease and, consequently, the removal of the pump handle led to the end of the epidemic.

John Snow studied cholera further in London homes that received water from two water supply systems; one from a section of the Thames contaminated with sewage and the other taking water upstream from an uncontaminated section of the river. The rate of transmission among customers of the distribution system that drew water from the contaminated source far exceeded the rate of infection among customers served by the company that drew water from the upstream section of the river. This demonstration reinforced the goals of the sanitation movement, which developed sewage drainage systems and water purification systems in large and small cities in the following decades, thereby significantly reducing the threat of cholera, typhoid, and many other waterborne diseases (Tulchinsky, 2018).

3. Epidemiology of Safety and Health in the Workplace

According to Fannya (2020), the concept of epidemiology in the workplace is related to the occupational safety and health of workers. This study discusses the effects of workplace exposures on the frequency and distribution of diseases and injuries in a population. Occupational safety and health epidemiology is the study of the health effects caused by exposure factors (hazards) in the work environment. In addition, lifestyle (smoking, drinking alcohol, diet, exercise habits) is a secondary factor that also modifies variables associated with exposure to environmental factors in the workplace.

The objectives of occupational health epidemiology are to determine the exposures that cause occupational diseases or health disorders and

recommend preventive measures, provide data for future projections, conduct standard exposure assessments involving disease induction mechanisms and predict dose-response relationships, and develop Occupational Safety and Health Standards. The benefits of this study include identifying factors that contribute to the risk of workplace accidents and the occurrence of work-related illnesses among workers, providing the data needed for management planning and/or decision-making, assisting in the evaluation of occupational safety and health programs that are being or have been implemented by companies, and developing methodologies to analyze the state of a disease and the risk of workplace accidents in an effort to prevent, overcome, and deal with them.

B. Diseases in the Workplace

Work is a necessity for humans to earn an income to meet their daily needs. However, in the workplace, there are potential risks that can interfere with workers' health, whether from environmental factors, work methods, or the equipment used. Health problems in workers are also related to the duration of exposure to these risks. According to information from the Dr. Iskak Tulungagung Regional General Hospital (2022), the diagnosis of work-related illnesses involves seven steps, including determining the clinical diagnosis, identifying exposure in the workplace, the relationship between exposure and clinical diagnosis, and determining the occupational diagnosis. The causes of work-related illnesses can be grouped into five categories, including physical, chemical, biological, ergonomic, and psychosocial factors. Occupational diagnoses can be made by general practitioners or occupational specialists, as needed. Work-related diseases are diseases that can be triggered, facilitated, or exacerbated by work, and can be caused by various factors such as physical, chemical, biological, and psychosocial factors.

C. Epidemiological Triangle Occupational Safety and Health Aspects

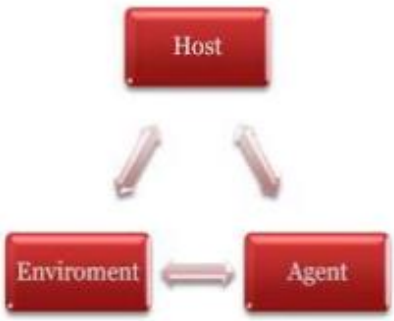

Figure 1. Epidemiological Triangle

In this context, an agent is an essential factor that must be present for a disease to occur. Agents can be various entities, both living things such as metazoans, fungi, protozoa, bacteria, rickettsia, and viruses that are infectious, as well as inanimate objects such as chemicals, physical substances such as temperature, humidity, noise, ionizing radiation, and mechanical force or

impact. In addition, energy, abstract elements, and social conditions can also be agents of disease. In excessive or insufficient amounts, these agents become the main or essential cause of disease. Meanwhile, the host refers to the population or organism that is the subject of research, which is susceptible or exposed to the disease agent.

The host, which is the focus of this study, involves various elements that can influence the response to disease agents. These elements include age, gender, ethnic background, immunity level, individual behavior, and other factors that have the potential to interact between the host and disease-causing agents. Meanwhile, the environment is, in short, the place where the research subjects are located or everything that results from their interaction with all elements, including the atmosphere, hydrosphere, lithosphere, geography (climate, altitude), geology, biosphere, and sociosphere (population size and distribution, socio-politics, education, economic development, etc.). An example is the physical condition of the workplace, such as building design, machine layout, ventilation systems, and other environmental factors that can affect the risk of accidents or illness (Saleh and Yanti, 2021).

D. Occupational Health Surveillance

Occupational health surveillance is the systematic and continuous process of collecting, analyzing, interpreting, and disseminating data for prevention purposes. Occupational health surveillance is designed to detect potential hazards in the workplace before health impacts occur and to provide or obtain data on where, how, and why workers become ill or injured while working (Lele, 2018).

Occupational Health Surveillance is conducted by collecting data related to worker health, which is then identified and focused on ways to address exposure to hazards in the workplace through appropriate prevention activities and hazard control or elimination. Occupational health surveillance programs are carried out by a number of public health programs to identify work-related illnesses and then develop outreach and prevention services. According to Lele (2018), the steps for conducting occupational health surveillance are as follows:

1. Risk assessment, which involves conducting exposure assessments and target organ damage risk assessments. Identify hazardous agents, materials, and processes, find out what the health risks are, review work processes and material toxicity, and prepare a risk matrix. Identify who may be at risk of exposure to these hazards and how, and the health impacts that can be filtered out are those that can be detected at the pre-clinical stage. Intervention at this stage is more beneficial than at later stages of the disease.
2. Selection of objectives and target population, by identifying groups of workers who require monitoring or screening activities, periodic health checks at scheduled intervals.
3. Selection of testing and control procedures, by selecting standardized testing and quality control procedures for each health effect that can be

screened depending on the target organ, such as whether certain workers require special tests, etc.

4. Collection of data to reconfirm the analysis results.

E. Control Strategies

The host-agent-environment control strategy, or epidemiological triangle, in the workplace involves a deep understanding of epidemiology, clinical features, sources, transmission routes, incubation periods, and contagious periods of infection. To prevent and control the spread of infection, steps must be taken to eliminate the source of infection and routes of transmission. Vulnerable workers can be protected by using antibiotics or through immunization. Infection control in the workplace requires comprehensive knowledge of these aspects. Prevention and control measures include controlling the source of infection, routes of transmission, and protection for vulnerable workers. This involves the use of personal protective equipment (PPE), the implementation of standard precautions, and routine immunization for workers at risk (Aw and Blair, 2010).

Other strategies for controlling the epidemiological triangle in the workplace may also include strengthening regulations and harmonization, strengthening occupational health services, controlling health risk factors in the workplace, developing human resources and occupational health professions, integrated data and information, occupational health surveillance, and research development in support of Occupational Safety and Health programs. Management in the workplace must implement health protocols, apply hygiene and sanitation measures, and regulate the workplace, such as the distance between seats, ventilation, and maximum capacity in rooms. Workers or laborers must then implement OSH protocols and health protocols in accordance with workplace regulations (Widyawati, 2021).

F. Overview of the Host-Agent-Environment Concept in the Workplace

Research conducted by Wisudawati and Patradhiani (2020), a case study on a housing development project (PT. Grand Anugerah Wisata). PT. Grand Anugerah Wisata is a housing development company in Palembang, South Sumatra. As a construction project developer, occupational accidents can occur due to two factors, namely humans who do not comply with occupational safety regulations and unsafe environments. The Host-Agent-Environment concept in the workplace context refers to an approach for analyzing factors that influence occupational health and safety.

The main issue in this case is the identification and assessment of risks related to workplace accidents that may occur during the construction process at PT Grand Anugerah Wijaya. The results of the study identified 27 potential risks with varying levels of risk, ranging from low to high. These risks include various hazards such as being buried by soil, tripping, injury from hoes, slipping, dust inhalation, being hit by building walls, falling from ladders, falling materials, being hit by wooden formwork, being hit by hammers, skin irritation from cement, and various other risks related to the construction process. In addition, the main issue is also related to risk control that needs to

be carried out to reduce occupational hazards for construction workers. Recommended mitigation efforts include substitution, administration, and the use of Personal Protective Equipment (PPE) to reduce the risk of workplace accidents.

In the context of this case, the Host-Agent-Environment concept is used to analyze factors that affect occupational health and safety in the construction environment. Host refers to workers or laborers involved in housing construction projects. Agent refers to risk factors, such as chemicals, ergonomics, biology, and psychological factors that can affect workers' health and safety. Meanwhile, Environment refers to the work environment where workers carry out construction activities, including the physical conditions of the workplace, equipment, and work processes.

By understanding the role of each element in the HostAgent-Environment concept, they can identify potential hazards and risks associated with workplace accidents, and plan appropriate risk controls to ensure the health and safety of workers in the construction environment.

CONCLUSION

Potential hazards or exposure to workers can originate from the work environment, work methods, and tools used during work. Health problems for workers are also closely related to the amount of exposure time; the longer the exposure, the greater the risk of health problems for workers. Therefore, Occupational Safety and Health (OSH) is required, which is a collaborative effort and participation between employers and employees to carry out joint duties and obligations in the field of safety, health, and security at work in order to increase productivity. The epidemiological triangle in the workplace involves a deep understanding of epidemiology, clinical features, sources, transmission routes, incubation periods, and contagious periods of infection.

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