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CARIES AND ORAL HEALTH RELATED QUALITY OF LIFE AMONGS THALASSEMIA MAJOR CHILDREN

Fitri Diah Oktadewi[1], Ryana Budi Purnama[1], Ali Taqwim[1], Dwi Cinthya Financia[1], Nadya Elsa Cahyaningrum[1]

[1] Dental Medicine Study Program, Medical Faculty, Universitas Jenderal Soedirman

Correspondence address: Fitri Diah Oktadewi, email:fitri.oktadewi@unsoed.ac.id,

ABSTRACT

Thalassemia patients typically have high caries rates. Children's daily activities and quality of life may be greatly impacted by dental cavities. Studies on the comparison of caries and oral health-related quality of life between thalassemia children and healthy children provides inconsistent results. The study aimed to compare dental caries and oral health-related quality of life between children with thalassemia major and healthy children. This study was a cross-sectional study involving 17 children with thalassemia mayor and 22 healthy children selected by purposive sampling in Banyumas, Central Java. Caries was assessed using the caries index through digital panoramic radiographs and clinical photographs of the oral cavity. Oral health-related quality of life was evaluated using the Indonesian version of the *Child Oral Health Impact Profile-SF 19* questionnaire. Caries scores in thalassemia major children and healthy children were 2.64 ± 2.06 and 2.23 ± 1.38, respectively. Oral health related quality of life scores in thalassemia major and healthy children were 56.82 ± 10.35 and 56.73 ± 7.70, respectively. There was no significant difference between caries scores and oral health-related quality of life scores between thalassemia major children and healthy children ($p=0.663$ and $p=0.974$, respectively). Nevertheless, oral health in children with thalassemia should be improved.

Keywords: caries, children, thalassemia, quality of life

INTRODUCTION

Thalassemia is a hereditary condition of decreased or missing hemoglobin α, β, or other hemoglobin-forming chains in red blood cells (Rujito, 2019). Based on its severity, thalassemia can be divided into 3, namely thalassemia minor, thalassemia intermedia and thalassemia major. Thalassemia major is a type of thalassemia that has the most severe symptoms and requires treatment in the form of regular blood transfusions (Karayilmaz et al., 2019).

The Indonesian Minister of Health stated that Indonesia is a country with a high number of thalassemia carriers, ranging from 3-10%. The prevalence of thalassemia in Banyumas reached 44 patients in 2008 and increased by 32.3% to 65 patients (Rejeki, 2012; Rodiani & Anggoro, 2017). It was reported that the incidence of thalassemia continued to increase throughout the years, until finally in 2020 there were reportedly 200 thalassemia patients in Banyumas. Oral manifestations of thalassemia include class II malocclusion, gingivitis, and dental caries (Helmi et

al., 2017). Another study reported that thalassemia has an impact on burning and numbness of the oral mucosa, lingual varicosity, dry mouth, anthropic glossitis (Wang et al., 2013)

Dental caries affects people at all societal levels in most of Indonesian population (Nbaia et al., 2018). Dental caries is one of the oral cavity diseases that are frequently found in patients with thalassemia major. Caries in thalassemia major patients occurs due to xerostomia disorder, which causes a decrease in the amount of saliva as one of the natural agents to prevent caries (Akcalı et al., 2019). It was also found that caries in thalassemia patients occurs due to a decrease in the level of immunoglobulin A (IgA) in saliva (Mikael & Al-Allawi, 2018). Caries causes throbbing pain and affects oral function, thus affecting quality of life (Nurwati et al., 2019). Oral health-related quality of life (OHRQoL) is a multidimensional construct used to assess a person's perceptions and feelings about the impact of diseases or abnormalities in the oral cavity. Dental caries can affect oral health-related quality of life in terms of

physical, social, and psychological aspects. Caries in children can cause discomfort when eating, sleeping, smiling, brushing teeth and learning (Souza *et al.*, 2018).

Previous research has shown that children with thalassemia have higher rates of tooth decay than healthy control children. Dental caries will affect the quality of life of thalassemia major patients. Persistent caries will make it difficult for a person to sleep and eat, unable to perform activities, unable to attend school, and require high costs if the caries that occurs is severe (Rozylo dan Orhan, 2020). However, there is still a research gap or contradiction between the comparison of caries rates in thalassemia children and healthy children. The previous study states that there is no significant difference between caries in thalassemia and healthy children (Ali & Al-naimi, 2019; Arora et al., 2014) but the other study (Nabi et al., 2022) actually reports that there is a significant difference between caries in thalassemia children and healthy children. This research gap requires further research to identify caries in thalassemia children and its impact on

oral health related quality of life. The aim of this study was to compare the caries and oral health related quality of life between thalassemia major and healthy children.

METHODS

This cross-sectional study included 39 participants: 17 children with thalassemia major being treated at RSUD Banyumas and 22 healthy children. The respondents were chosen using a purposive sampling technique, with the following criteria: children aged 9-17 years who have been diagnosed with thalassemia major by a doctor, are willing to become respondents, and are actively receiving transfusions at Banyumas Regional Hospital, as well as healthy children aged 9-17 years who are willing to become research participants. Exclusion criteria included pediatric patients who had other chronic systemic diseases other than thalassemia major, and who were not willing and/or did not have parental consent. This study was conducted in August 2022 after obtaining ethical approval from the Health Research Ethics Committee of

RSUD Banyumas no: 167/KEPK-RSUDBMS/V/2022.

The DMFT index was used to measure caries in this study. Every tooth element's radiographic image on a digital panoramic radiograph is examined in order to determine the DMF-t index. (Oteri et al., 2013). The DMF-t index is reported with the following information: D = Decayed, M = Missing, F = Filled. This study was conducted when restrictions on activities and oral examinations were still limited due to the Covid 19 pandemic, which influenced the consideration of caries measurement methods. Caries detection in this study was performed on digital panoramic radiographs (Fig.1) and clinical photographs of the oral cavity (Fig.2). Digital panoramic radiography was performed in the RSGMP Unsoed radiology laboratory, and respondents independently took clinical images of their dental cavities under the researchers' supervision. The use of radiographic images in caries detection has more accuracy, especially in the detection of interproximal caries. In addition, panoramic radiography is an extraoral radiograph that is suitable for examining the general condition of the teeth during the COVID-19 pandemic with a very low risk of exposure (Hervina, 2020). A decayed tooth is characterized by a radiolucent image with indistinct borders on radiographs indicating a decrease in the amount of minerals in the tooth. In contrast, in a filled tooth, the filling is seen as a more radiopaque image with a firm border on the tooth. The number of teeth with caries is counted to determine DMF-t (WHO, 2013).

The assessment of oral health-related quality of life in children with thalassemia major was conducted using the Indonesian version of the Child Oral Health Impact Profile - Short Form (COHIP SF 19) questionnaire. This questionnaire describes the situation in the last 3 months felt by children with thalassemia major. There are 5 items on the oral health subscale, 4 items on the functional well-being subscale, and 10 items on the socio-emotional subscale. There are 2 positive question items that are reverse scored. Each question is answered almost always, fairly often, sometimes, rarely, and never. Scoring for each

questionnaire item will be on a scale of 0-4 with total score of 76. The higher scores indicating better quality of life (S. Nuraini et al., 2021). The results of the data normality and homogeneity test showed that the OHRQoL score is normally distributed, so the data analysis used was independent t-tests. In contrast, the DMFT score is not normally distributed so the data analysis used is the Mann-Whitney test.
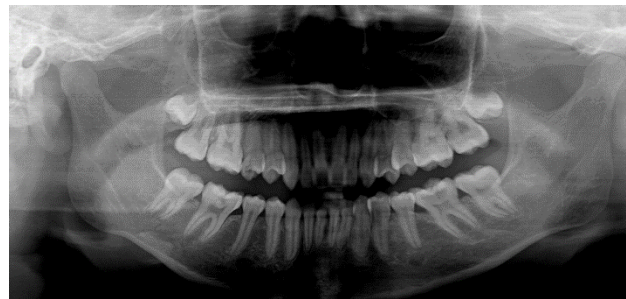
Figure 1. Digital panoramic radiograph samples of respondents

Figure 2. Sample clinical photos of respondents' oral cavity

RESULT

The characteristic of respondents were shown in Table 1.

Table 1. Characteristics of Respondents

Characteristics	Thalassemia Children n (%)	Healthy Children n (%)
Sex		
Boy	7 (41,1)	9 (40,9)
Girl	10 (58,9)	13 (59,1)
Age		
9-13 years old	9 (52,9)	11 (50)
14-17 years old	8 (47,1)	11 (50)

Description: n, number of respondents

Table 1 shows that the majority of respondents from both groups were female (58.9% and (59.1%), respectively). The age range of respondents from both groups was fairly balanced.

Independent t-test was used to determine the comparison of DMFT scores and oral health-related quality of life scores between thalassemia major and healthy children. The results of the bivariate analysis are shown in Table 2

Table 2. Comparison of caries and OHRQOL scores between groups

Variable	Group	Mean ± SD	p
deft/DMFT score	Thalassemia Children	2,64 ± 2,06	0,663
	Healthy children	2,23 ± 1,38	
OHRQoL score	Thalassemia Children	56,82 ± 10,35	0,974
	Healthy Children	56,73 ± 7,70	

Description: deft/DMFT, decayed, missed, filled tooth; OHRQoL, oral health related quality of life; SD, standard of deviation; p, significance at the level <0,05;

Table 2 shows that there is no significant difference between the deft/DMFT score in the thalassemia respondent group and the control group with a p value>0.05 (p=0.663). Similarly, the OHRQoL score between the thalassemia respondents

and the control group showed no significant difference (p=0.974).

DISCUSSION

This study was conducted to assess dental caries and oral health-related quality of life in thalassemia major children. Patients with thalassemia are at increased risk for dental caries due to poor oral hygiene, reduced salivary flow, frequent sugar intake, and neglected oral health. (Hattab, 2017) Blood transfusions in patients with beta thalassemia major can also lead to iron accumulation in the salivary glands, which can trigger the formation of non-cavitated carious lesions (P. Nuraini et al., 2022) . There are still inconsistencies in research findings regarding the relationship between caries and thalassemia. Therefore, in-depth research is needed to explain this condition(Arora et al., 2014). The results of this study showed that there was no difference between Deft/DMFT scores in the thalassemia and control groups. This is supported by previous studies that reported the same results (Moosazadeh et al., 2020; Shooriabi et al., 2016)

Dental caries in children with thalassemia can be explained by the fact that parents pay more attention to general physical health. Oral health care is provided only when there are dental complaints (Arora et al., 2014). Oral health is not a priority for children with disabilities or systemic diseases. No difference in mean DMFT scores can be attributed to differences in study sample size, age range, and method used to determine caries prevalence. Small sample size may negatively affect the reliability of survey results. The panoramic radiographs used in this study have weaknesses in thoroughly detecting caries (Kweon et al., 2018). Although panoramic radiographs can be used as an effective tool to diagnose oclussal caries with 100% specificity, the sensitivity in detecting proximal caries is still low (Bui et al., 2021)

Previous research states that dental caries is an oral manifestation that is commonly found in thalassemia patients and has an impact on oral health-related quality of life (Amirabadi et al., 2019; Fadel et al., 2020; Phrai-in et al., 2017). The results of this study indicate that there is no difference between the oral

health-related quality of life of thalassemia children and healthy children. This condition may occur because the caries rate is not too significant in both groups, which continuously affects the value of quality of life related to oral health. However, the oral health of children with disabilities such as thalassemia requires special attention. Parents of children with disabilities generally do not make oral health a priority due to lack of knowledge and awareness, focusing more on general health needs. Other factors may also be caused by the difficulty of the parents to access adequate dental health services and to be able to take care of the special needs of their children. Physical changes associated with thalassemia such as stunted growth may affect a child's confidence and self-esteem, which can impact their overall quality of life (Shafie et al., 2020). Untreated oral conditions in thalassemia children can lead to more serious problems and affect their quality of life.

Completing an oral health-related quality of life questionnaire provides a subjective picture of individual opinions about the impact of oral health on daily life. This often leads to social desirability or to respondents tending to answer inappropriate questions. Qualitative studies are needed to further explore this variable. Limitations of this study are: the method of measuring caries through panoramic radiographs and clinical photographs of the oral cavity is very limited and is feared to affect the validity of the data obtained, as well as the limitations of online data collection. The cross-sectional research design does not allow for in-depth analysis of the causal relationship between variables. This study did not control for other variables that affect oral health-related quality of life.

CONCLUSIONS

This study concluded that there was no significant difference in the average caries scores of children with thalassemia major compared to healthy children. Furthermore, there is no difference in oral health-related quality of life between thalassemia major children and healthy children based on the results of this study. Nevertheless, there is a need for improvement in the prevention and

promotion of oral health in children with thalassemia. It is intended that oral health will continue to be one of the health priorities that will receive special attention. Otherwise, the quality of life of children with thalassemia may be severely compromised.

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CORRELATION OF PHYSICAL ACTIVITY, FAST FOOD CONSUMPTION, AND FAMILY HISTORY WITH PRIMARY DYSMENORRHEA AMONG ADOLESCENT GIRLS

Mellinia Zahra Ramadhanvy[1] , Lu'lu Nafisah[2*] , Bambang Hariyadi[3]

[1,2,3] Public Health Department, Public Health Department, Faculty of Health Sciences, Jenderal Soedirman University, B Building, Jl. Dr.Soeparno, Karangwangkal, Purwokerto 53123, Jawa Tengah, Indonesia.

Correspondence Author: lulunafisah94@unsoed.ac.id

ABSTRACT

Primary dysmenorrhea is often experienced by adolescents with different levels of pain. Primary dysmenorrhea affects daily activities, especially in school-age adolescents, and has an impact on their academics and productivity at school. This study aimed to determine the factors associated with the incidence of primary dysmenorrhea in female students at SMP N 2 Karanglewas. This study used a quantitative approach with a cross-sectional research design, with a total sample of 87 respondents at SMP N 2 Karanglewas using a cluster random sampling technique. Data collection was carried out using a questionnaire. Data were analyzed using the chi-square test. There is a relationship between menarche age (p-value = 0.018); physical activity (p-value = 0.008); consumption of fast food (p-value = 0.009); and family history (p-value = 0.000); with primary dysmenorrhea. There is no relationship between the length of menstruation (p-value = 1,000); nutritional status (p-value = 0.556); and stress level (p-value = 0.798). There is a significant relationship between the age of menarche, physical activity, consumption of fast food, and family history with the incidence of primary dysmenorrhea in female students of SMP N 2 Karanglewas. Adolescents with a healthy lifestyle can reduce the risk factors for primary dysmenorrhea.

Keywords: Primary Dysmenorrhea, Menarche, Physical Activity, Fast Food Consumption, Family History

INTRODUCTION

Menstrual pain or dysmenorrhea is pain that occurs during menstruation, especially in the lower abdomen, but can spread to the lower back, waist, pelvis, upper thighs and calves. This pain is usually accompanied by severe cramps that originate from uterine muscle contractions, which occur intensely when menstrual blood comes out of the uterus. The majority of women who menstruate have experienced cramps or abdominal pain to varying degrees. Dysmenorrhea is a gynecological problem that most commonly attacks adolescent girls. This pain is experienced by teenagers and this is not caused by disease, but is called primary dysmenorrhea (Leon-Larios et al. 2024; Nurwana, Sabilu & Fachlevy 2017; Soesilowati & Annisa 2016).

Dysmenorrhea has some detrimental consequences on the patients' daily activities. It leads to missed work and school time. Patients typically do not ask for help from others in this situation due to cultural issues. Identification of abnormal menstrual patterns during adolescence may permit early prevention of potential health concerns in adulthood (Abd El-Mawgod, Alshaibany & Al-Anazi 2016).

Dysmenorrhea is the most common menstrual problem in adolescent girls. On average, teenagers experience discomfort during menstruation such as stomach cramps, nausea, dizziness, and fainting. These complaints are also the reason why teenagers do not participate in school activities and decide not to do any activities (Indah & Susilowati 2022; Prihatin et al. 2022; Rudatiningtyas, Fitriyani & Rosita 2021). According to WHO, 1,769,425 people (90%) of women experience dysmenorrhea and 10-15% of them experience severe dysmenorrhea. This is supported by research in various countries with astonishing results, where the incidence of primary dysmenorrhea reported in each country reaches more than 50%. The prevalence of primary dysmenorrhea in young women in Indonesia reaches 60-75%.

The results of the 2017 Indonesian Demographic and Health Survey report show that teenagers experience menarche at the age of 12-14 years (76.6%). Someone who has their first menstruation at the age of less than 12 years is 1.6 times more likely to experience primary dysmenorrhea than those aged 12 years and over. Another factor related to dysmenorrhea is nutritional status (BMI), especially overweight. Excessive nutritional status (overweight) tends to experience menstruation earlier compared to other teenagers which is caused by hormones that play a role in the process of maturation of sexual organs (Soesilowati & Annisa 2016). According to another studies, anemia—defined as hemoglobin levels below normal limits (below 12 grams/dl)—may have an impact on dysmenorrhea. Blood cells' hemoglobin is helpful in binding oxygen; this oxygen supply is dispersed throughout the body to lessen ischemia, which can lead to dysmenorrhea. Teenagers who are anemic and inactive during their menstrual cycle may experience worsening pain (primary dysmenorrhea). Moreover, anemic individuals bleed more throughout their periods (Hamdiyah 2020; Kusumawardani & Cholifah 2018).

Based on data from the Karanglewas Community Health Center, anemia checks were carried out on several school-aged teenagers in Karanglewas District in 2022, there were 16.8% of teenagers experiencing anemia. In general, dysmenorrhea can interfere with everyday activities, particularly for adolescents in school. When dysmenorrhea strikes, young women who are participating in class can cause disruptions, lose interest, and struggle to focus, making it difficult for the teacher to present the content effectively. Severe dysmenorrhea in other circumstances can result in fainting and skipping school (Fitri 2020). Dysmenorrhea, which is prevalent in those between the ages of 15 and 17, can have an impact on educational achievement and attendance (BT et al. 2017; Rifati & Sudiarti 2020). Students with dysmenorrhea have disruptions in their academic performance, school attendance, and learning processes. More individuals with severe

dysmenorrhea skip class than those with mild or no dysmenorrhea (Abd El-Mawgod, Alshaibany & Al-Anazi 2016; Horvat et al. 2023).

Based on the results of a preliminary study conducted on several female students at SMP N 2 Karanglewas, dysmenorrhea was reported by five out of the nine girls surveyed. However, each person experiences dysmenorrhea or discomfort to varying degrees. Most people only feel stomach pain, but there are some who feel back pain all the way down to their thighs. SMP N 2 Karanglewas was the study site of choice since dysmenorrhea is an issue that affects adolescents and can develop two to three years following menarche. In addition, the prevalence of dysmenorrhea among teenagers—particularly students—is a concern that can undoubtedly interfere and disrupt learning activities at school.

METHOD

This research uses a quantitative research design with a cross sectional approach. This research was conducted in September-November 2022 at SMP N 2 Karanglewas, Banyumas Regency. The population in this study were all active female students of SMP N 2 Karanglewas in 2022/2023 academic year (324 students). The number of samples was determined using purposive sampling technique and a sample of 87 respondents was obtained. The research sample was determined by applying specific criteria in order to provide a representative sample. Active female students in grades VII–IX who were menstruating and willing to complete a questionnaire were the inclusion criteria. In meanwhile, students who weren't there during the research's conduct were excluded.

The independent variables in this study were age at menarche, length of menstruation, nutritional status, stress level, physical activity, fast food consumption, and family history. The dependent variable in this study is primary dysmenorrhea. Primary dysmenorrhea is determined using the Numeric Rating Scale (NRS) to measure the pain scale in individuals according to the individual's subjectivity, however there are adjustments in this study so that the questionnaire is more relevant and easy to understand by participants.

Age of menarche was categorized as ≥12 years and <12 years. Length of menstruation was classified as normal (3-7 days) and hyper menorrhea if menstruation lasted more than 7 days. Meanwhile, nutritional status is categorized as normal if BMI is 18.5 - 25 and abnormal if BMI ≤18.5 or >25. Stress levels were measured using the Kessler Psychological Distress Scale (KPDS) which consists of 10 questions and aims to measure distress based on questions about anxiety and depressive symptoms experienced in the last month. The result is no stress if the score is less than 20, and stress if the score is above 20.

Meanwhile, physical activity is measured using the Global Physical Activity Questionnaire (GPAQ) to observe individual physical activity to estimate the level of work, travel and sports activity. This questionnaire consists of 16 questions. Light physical activity if the score is <600, moderate if the score is 600<3000 and heavy if the score is ≥3000. Fast food consumption asked about the frequency of consuming fast food in the last month and the results were categorized into rarely with a score of

1-25 and often with a score of 26-50. Family history aims to ask about the history of primary dysmenorrhea during menstruation in the participant's mother or biological sister.

Univariate analysis was used to determine the distribution of respondents' characteristics, numerical univariate analysis to see the average, standard deviation, minimum, and maximum values, and categorical univariate analysis to see the distribution of frequencies and percentages. Bivariate analysis was used to test the correlation between the independent variables (age at menarche, menstruation cycle, nutritional status, stress level, physical activity, fast food consumption and family history) with the dependent variable (the incidence of primary dysmenorrhea).

The researcher obtained ethical clearance from the Ethics Commission of Jenderal Soedirman University's Faculty of Health Sciences with number 912/EC/KEPK/XI/2022 prior to conducting the research. Subjects who agree to participate in the study as respondents will complete and sign

the questionnaire's Informed Consent form.

RESULTS AND DISCUSSION

The results showed that the majority of adolescent girls in this study experienced primary dysmenorrhea (54.02%) with moderate pain (34.48%), menarche at the age of less than 12 years (59.77%), normal nutritional status (62.07 %), normal menstrual duration (82.76%), do not feel stressed (70.11%), do light physical activity (42.53%), often consume fast food (56.32%), and have a family history with primary dysmenorrhea (59.77%). (Table 1)

Table 1. Frequency Distribution of Primary Dysmenorrhea, Age, Age of Menarche, Length of Menstruation, Nutritional Status, Stress Level, Physical Activity, Fast Food Consumption, and Family History among Female Students of SMP N 2 Karanglewas

Variable	Category	Frequency	%
Primary Dysmenorrhea	No	40	45,98%
	Yes	47	54,02%
Degree of pain	No pain	40	45,98%
	Mild	11	12,64%
	Moderate	30	34,48%
	Severe	6	6,90%
Age	12 years old	23	26,44%
	13 years old	27	31,03%
	14 years old	26	29,89%
	15 years old	11	12,64%
Age at Menarche	≥12 years old	35	40,23%
	<12 years old	52	59,77%
Menstruation Cycle	Normal	72	82,76%
	Hypermenorrhea	15	17,24%
Nutritional Status	Normal	54	62,07%
	Deficiency	33	37,93%
Stress Level	No	61	70,11%
	Yes	26	29,89%
Physical Activity	Medium	33	37,93%
	Light	37	42,53%
	Heavy	17	19,54%
Fast Food Consumption	Rarely	38	43,68%
	Frequently	49	56,32 %
Family History	No	35	40,23%
	Yes	52	59,77%

Source: Processed Primary Data 2022

The results of the chi square test showed that age at menarche, physical activity, consumption of fast food, and family history were associated with primary dysmenorrhea. Meanwhile, length of menstruation, nutritional status, and stress levels were not related to

primary dysmenorrhea in female students at SMP N 2 Karanglewas. (Table 2)

Table 2 Factors Affecting Primary Dysmenorrhea

Variable	Category	Primary Dysmenorrhea				p-value
		No		Yes		
		n	%	n	%	
Age at Menarche	≥12 years old	22	62,9	13	37,1	0,018
	<12 years old	18	34,6	34	65,4	
Menstruation Cycle	Normal	33	45,8	39	54,2	1,000
	Hypermenorrhea	7	46,7	8	53,3	
Nutritional Status	Normal	23	42,6	31	57,4	0,556
	Deficiency	17	51,5	16	48,5	
Stress Level	No	27	44,3	34	55,7	0,798
	Yes	13	50,0	13	50,0	
Physical Activity	Medium	10	30,3	20	69,7	0,008
	Light	17	45,9	23	54,1	
	Heavy	13	76,5	4	23,5	
Fast Food Consumption	Rarely	24	63,2	14	36,8	0,009
	Frequently	16	32,7	33	67,3	
Family History	No	26	74,3	5	25,7	0,000
	Yes	14	26,9	38	73,1	

Source: Processed Primary Data 2022

The results of the study showed that the factors associated with primary dysmenorrhea at SMP N 2 Karanglewas were age at menarche, physical activity, consumption of fast food, and family history. The age of menarche is related to primary dysmenorrhea. Previous research reported a relationship between age of menarche and dysmenorrhea among adolescent girls (Aulya, Kundaryanti & Rena 2021; Mouliza 2020; Nurwana, Sabilu & Fachlevy 2017; Shellasih & Ariyanti 2021; Soesilowati & Annisa 2016). Primary

dysmenorrhea is 3.4 times more likely to occur in women who menarche at age 11 or younger than in women who menarche at age over 11 years old (Soesilowati & Annisa 2016). Menstrual pain will occur if menarche happens earlier than usual, when the cervix is still narrowing and the reproductive organs are not yet ready to undergo changes. Menarche can occur between the ages of 10 and 16 years. Nonetheless, if menarche happens between the ages of 12 and 14, it might be considered normal (Grandi et al. 2012). The results of the

IDHS (2017) also show that teenagers experience menarche at the age of 12-14 years. Recent research results report that an age at menarche of less than 12 years is at greater risk for primary dysmenorrhea.(Hu et al. 2020) As age increased, dysmenorrhea incidence decreased by 0.97 times (De Sanctis et al. 2016).

In this study, the menstrual cycle, nutritional status and stress level were not related to primary dysmenorrhea. Previous research reported no relationship was found between dysmenorrhea and stress levels and BMI (Tiwari et al. 2022). It was further reported that coping mechanisms had an insignificant relationship with dysmenorrhea among students (Nani, Ismawati & Girindra 2017). However, other research states that underweight and stress level has an effect on primary dysmenorrhea (Hu et al. 2020; Pundati, Sistiarani & Hariyadi 2016; Rogers et al. 2023).

Physical activity is associated with dysmenorrhea in adolescent girls. It has also been suggested that physical activity helps to lessen primary dysmenorrhea (Kusumaningrum et al. 2019; Matthewman et al. 2018; Rohmawati & Wulandari 2020; Shellasih & Ariyanti 2021). Previous research reported that teenagers who had less physical activity were 7.441 times more likely to experience dysmenorrhea compared to those with good physical activity. Teenagers still need to get health education with a focus on healthy living, sufficient vitamin consumption, mental stress reduction, proper sleep, and frequent exercise. This includes a warning against eating an imbalanced diet (Ardianto & Elisanti 2019). A majority of adolescent girls in this study exhibited low levels of physical activity, contributing to a higher incidence of primary dysmenorrhea. Physical activity among adolescent girls tends to be lower, especially in the current era characterized by sedentary lifestyles involving extensive use of social media, online streaming, and gaming.

Moderate-intensity physical exercise can alleviate dysmenorrhea symptoms by triggering the release of endorphins, natural pain relievers. These endorphins contribute to a sense of well-being and can reduce pain perception. Additionally, regular physical activity helps accelerate the

elimination of prostaglandins, hormones that contribute to menstrual cramps, from the uterine wall. Recent research supports these findings, with an Odds Ratio (OR) of 3.355 indicating a significant association between physical exercise and reduced dysmenorrhea (Nadila & Trisna 2023). Health workers through the UKS program are expected to increase the physical activity of young women through sports as a dysmenorrhea prevention program (Rohmawati & Wulandari 2020).

Fast food consumption is associated with the incidence of dysmenorrhea. Previous research reported an association between fast food consumption and dysmenorrhea (Aulya, Kundaryanti & Rena 2021; Nadila & Trisna 2023). It was further reported that consuming fast food increases a person's risk of experiencing dysmenorrhea (Nadila & Trisna 2023). Previous research reported that consuming sweet foods and drinks had a 4.8 times higher risk of causing primary dysmenorrhea (Ramadhan et al. 2023). Consuming three to four sugar-sweetened beverages daily was found to be substantially associated to an increased risk of dysmenorrhea (van Uden et al. 2023). The results of this study strengthen previous research which shows that there is a significant relationship between fast food consumption and primary dysmenorrhea. Therefore, information and knowledge is needed, especially on reproductive health in adolescents regarding primary dysmenorrhea, so that they can adopt a healthy lifestyle with regular exercise, adequate rest and consume healthy food and avoid fast food (Aulya, Kundaryanti & Rena 2021). Most adolescent girls in this study reported frequent consumption of junk food, primarily due to easy access to unhealthy snacks at school and the convenience of online food delivery. This dietary pattern is linked to nutrient deficiencies, hormonal imbalances, and an increased risk of severe primary dysmenorrhea. Addressing this issue requires collective efforts to encourage healthier eating habits among adolescent girls.

Adolescent girls who regularly consume fast food (food that is high in sugar, fat, calories, salt and has low nutritional content), have a higher

prevalence of dysmenorrhea than adolescent girls who rarely consume fast food. Consuming fast food can interfere with progesterone metabolism because it is rich in saturated fatty acids (Kanti, Verma & Singh 2020). Fast food is food that is low in micronutrients but high in fat and sodium. Fast food is not a healthy choice for daily intake due to its unbalanced nutritional composition. Fast food consumption frequency was found to be associated with menstruation abnormalities, specifically dysmenorrhea, according to a study that was conducted (Pramanik & Dhar 2014). Trans fatty acids, prevalent in fast food, can damage cell membranes, leading to increased prostaglandin production. Excessive prostaglandin levels are associated with primary dysmenorrhea, a condition characterized by painful menstrual cramps. Furthermore, frequent consumption of fast food has been linked to various menstrual irregularities, including oligomenorrhea (abnormally light menstrual bleeding), hypermenorrhea (abnormally heavy menstrual bleeding), and premenstrual

syndrome (PMS) (Jaget Lakkawar et al. 2014). Excessive junk food intake is significantly associated with menstrual disorders. The menstrual cycle is a normal physiological process, but deviation from its regularity can cause several health problems in the future such as polycystic ovary syndrome, obesity, infertility, and hyperlipidemia (Latif et al. 2022).

Family history was another factor associated with dysmenorrhea in this study. This supports other studies that found an association between dysmenorrhea and family history (Mouliza 2020; Shellasih & Ariyanti 2021). Teenagers with a family history of dysmenorrhea are seven times more likely to suffer from the dysmenorrhea than teenagers without a family history (Rifati & Sudiarti 2020). Previous research found that family history was 4.7 times more risky for primary dysmenorrhea (Molla et al. 2022; Ramadhan et al. 2023). According to other research, young women who have mothers who have experienced dysmenorrhea are 2,553 times at risk to suffer from primary dysmenorrhea (Hu et al. 2020).

Researchers have postulated several assumptions regarding the relationship between a family history of dysmenorrhea and primary dysmenorrhea in adolescent girls. A primary assumption is the existence of a genetic component, suggesting that specific genes may predispose individuals to dysmenorrhea. Additionally, hormonal imbalances, particularly involving prostaglandins, are hypothesized to contribute to the condition. Environmental factors such as diet, stress, and physical inactivity are also believed to exacerbate dysmenorrhea in genetically predisposed individuals. Moreover, psychological factors such as anxiety and depression may play a role, as individuals with a family history of dysmenorrhea may have a heightened pain perception. Furthermore, the influence of sociocultural factors and epigenetic mechanisms cannot be overlooked in understanding the complexity of this phenomenon.

Family history is a risk factor that can increase the occurrence of primary dysmenorrhea. Two out of three women who suffer from primary dysmenorrhea have a history of primary dysmenorrhea in their family (mother and/or sister) (Handayani & Rahayu 2014). Individuals with a family history of dysmenorrhea have a heightened risk of experiencing the condition due to genetic factors passed down through generations. These genetic traits are replicated during cell division, potentially increasing the likelihood of transmitting the condition to offspring. However, dysmenorrhea can often be prevented or managed through lifestyle modifications such as maintaining a balanced diet, limiting caffeine intake, engaging in regular physical activity, managing stress, and addressing psychological factors (Sadiman 2017; van Uden et al. 2023). Given the known effect of dysmenorrhea on academic achievement, school administrators might have a personal stake in providing students health education on this subject. The provision of additional services, such as access to painkillers and consultations with the school physician and nurse, must be included to health education (Abd El-Mawgod, Alshaibany & Al-Anazi 2016). Female students should receive appropriate management and

counseling to assist them deal with the difficulties associated with dysmenorrhea. In order to address the reproductive health needs of the female students, parents, school peer leaders, and school administration should also be provided with information, education, and support (De Sanctis et al. 2016).

xxx This study has several limitations, including a small sample size, a cross-sectional design, reliance on self-reported data, and the potential for confounding variables. The small sample size and cross-sectional design limit the generalizability of the findings and the ability to establish causal relationships. Additionally, the use of self-reported data is susceptible to recall bias and social desirability bias. To address these limitations, future research should employ a larger sample size, adopt a longitudinal design, validate the research instruments, conduct multivariate analysis, and combine self-reported data with objective measures

CONCLUSION

Most of the female adolescents experienced primary dysmenorrhea (54.02%) with moderate pain (34.48%), menarche at the age of less than 12 years (59.77%), normal nutritional status (62.07%), long normal menstruation (82.76%), not experiencing stress (70.11%), doing light physical activity (42.53%), frequently consuming fast food (56.32%), and having a family history of primary dysmenorrhea (59.77%). There is a relationship between age at menarche, physical activity, consumption of fast food, and family history with the incidence of primary dysmenorrhea in female students at SMP N 2 Karanglewas. There is no relationship between menstrual duration, nutritional status, and stress levels with the incidence of primary dysmenorrhea in female students at SMP N 2 Karanglewas. Educational institutions are expected to be able to implement the healthy school concept by providing physical activity, providing education, and controlling fast food consumption. Female students are expected to be able to find more information about dysmenorrhea and implement healthy living behavior by actively participating in sports and other

physical activities at school and paying attention to food consumption.

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DEVELOPMENT OF A MODULE BASED ON THE *EMO-DEMO* GAME TO INCREASE THE COMMUNITY'S UNDERSTANDING OF THE CONCEPT OF STUNTING

Sri Wahyuni[1], Ulin Nuha[2], Veronica Diniarti Mulyana Kusuma Wardani[3],

Program Studi Pendidikan IPA FKIP Universitas Jember.

sriwahyuni.fkip@unej.id

ABSTRACT

Modules are a type of printed learning material which is an innovative approach in providing health-related information involving family members as a strategy, especially mothers as the main target in Health Development Efforts. *EMO-DEMO (Emotional-Demonstration)* based games are an option for use in public education. This research aims to develop an *EMO-DEMO* game-based module based on stunting problems. The development model used is the Plomp development model with three stages, namely Premilinary research, Prototyping stage, and Assessment phase. This media development aims to see the effectiveness of the module based on the community's understanding of concepts in Kemiri Village using indicators of concept understanding used by researchers. The development results obtained a validity of 79.8% which is included in the very valid category. The practicality results obtained 92.1% which is included in the very practical criteria. The average N-gain is 0.8 in the high category, supported by the results of the community response of 89.93% which is categorized as high. This shows that the *EMO-DEMO* game-based module has received a positive response from its users.

Keywords: Module, *Emo-Demo*, Concept Understanding, Stunting

INTRODUCTION

A module is defined as a print media format that contains learning units composed of various components used to learning goals independently. So users can control and evaluate abilities independently (Kuswanto, 2019). This module is intended for communities starting from the age range of 16 – 25 years are categorized as early teenagers, 20-25 years are classified as late teenagers and 25 years and older are categorised as adults. (Ghofur & Rachma, 2019). School children belong to the community, but most school children use modules in formal education. While the society (non-formal) does not use the modules, then researchers develop modules for society. (nonformal). The use of modules has an important role for society to improve behavior, this is because the modules have been structured containing material (Wahyuni *et al.,* 2019*).*

Emo-Demo   (Emotional-Demonstration) is an interactive educational tool using games to trigger the emotions of mothers or babysitters to change behavior that needs to be improved by society

(Putri, 2020). *Emo-demo* is one of the approaches in health education by using imaginative and provocative ways to change people's behaviour in health aspects (Putra *et al.,* 2023). So with this method it can change the behavior of the public in the field of health. Stunting is one of the characteristics that indicates a recurring nutritional problem over a long time. Stunting has been influenced by a number of factors, including   mother's   nutritional knowledge and maternal care patterns as well as maternal intake. Mother's intake, especially during pregnancy, is an important factor. (Amalia *et al.,* 2022). An understanding of the concept of stunting is very much needed that involves more than just a definition. Understanding concepts is a key aspect in education and dealing with challenges, both in learning methods and in the context of everyday learning. According to Uno, the ability of an individual to deduce, interpret, translate or reveal a concept in his personal style regarding the information   he   has   received. Rosdianto *et al.,* explained that the ability of an individual to acquire an understanding of a concept and to

define a matter well (Ramadani & Nana, 2020). It is therefore necessary to improve public understanding of the concept of stunting by involving in-depth understanding of stopping, its causes, impacts, and the efforts that society can make to prevent and address stunting. Based on the above explanation, the development of the *Emotional-Demonstration (Emo-Demo)* based module is required to improve the understanding of the concept of the Kemiri Village community in the health area related to stunting. It is supported by research by Khoirudin *et al.,* (2023), that the development of modules can improve the understanding of concepts for its users. Furthermore, in the study of Falaach *et al.,* (2020), it was found that the delivery of material using the *Emotional-Demonstration* module *(Emo-Demo)* related to stunting prevention is said that the public understands the importance of nutritional needs in children. It shows that with the development and implementation of modules for the effective community can increase the understanding and knowledge of the morning users as well as facilitate the community in understanding.

information through Emotional-Demonstration (Emo-Demo). The previous Emo-Demo module did not contain stunting material, it only contained health educational games related to stunting and generally the module was only used in schools. Meanwhile, this module is intended for people starting from the age range of 16 – 25 years are categorized as early teens, ages 20-25 years are categorized as teenagers end, while those aged 25 years and over are categorized as adults (Ghofur & Rachma, 2019). School children are included in the community category, but most children school children use the module in formal education. Whereas (non-formal) communities do not use modules, therefore researchers develop modules for (non-formal) communities. Module usage has an important role for society to improve behavior, this because the module has been structured to contain material (Wahyuni et al., 2019).

METHOD

The type of this research is research and development with the Plomp research design. The development model used in this research onsists of three stages: Preliminary research is a literature study to obtain an initial description of stunting in Kemiri Village. The next step is an analysis by directly observing the data provided by cadres to midwives, so it was found that there was a low understanding of the concept of stunting among the people of Kemiri Village. Therefore researcher developed a game-based module Emo-Demo to increase conceptual understanding of the Kemiri Village community. At the prototyping stage, the researcher designed a module based on the Emo-Demo game through supporting tools like activity plans and sheets of expert validation. This will produce draft I. If draft I is said to be valid, then continue with draft II. However, on the contrary, if the draft I is not valid, then the researcher can revise it again and revalidate it. The third stage is the assessment phase. At this phase, draft II will be tested by the public to increase conceptual understanding of community in stunting. In the community testing process, the module implementation was observed by the observer to assess the practicality of the Emo-Demo game-based module. The community was given a test sheet for conceptual understanding of stunting before and after education to analyze the bnmodule's effectiveness.

The subjects in this research were 10 people from Kemiri Village, especially pregnant women, mothers carrying out pregnancy programs and mothers who have children.
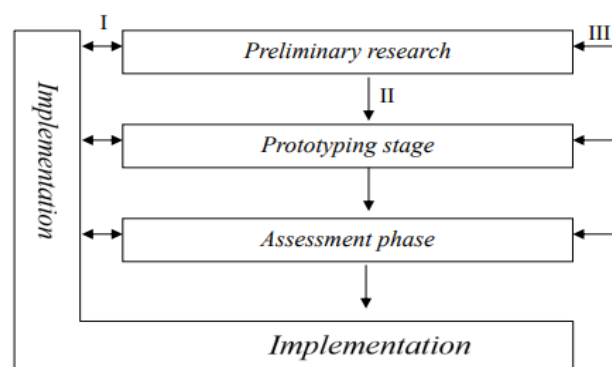
(Figure 1. Plomp expansion model research stream)

The *Emo-Demo* based development module is being tested in Kemiri Village in September-October 2023. The techniques for collecting data in this research are test and nontest. Tests are done to determine the effectiveness of module development. The test uses indicators of concept understanding and nontes, which are validation sheets, practicality and public response.

There are three expert validators in validating the Emo-Demo game-based module, including a Jember University lecturer in the health sector, a Kemiri Village midwife and a community health center nutritionist. The validation formula, according to Septia *et al.,* (2022) would be used to calculate the average of each validation component based on the validator value.

$$V = \frac{summary\ of\ scores\ to\ be\ worked}{maksimum\ number} x\ 100\%$$

Validation values are obtained at the level of interval validation modules based on *Emo-Demo* games on

stunting topics. Table 1 shows the validity criteria of the module submitted Wahyuni *et al.* (2022).

Score	Category
$80 \leq V \leq 100$	Very valid or implementable without modification
$60 \leq V < 40$	Valid or implementable but minor modifications
$40 \leq V < 25$	Less valid, less effective, less stringent, requiring major modifications, recommended not to be implemented
$0 < V \leq 25$	Invalid or unimplementable

(Table 1 Module validity criteria)

The test of practicality can be obtained from the implementation of education applied to mothers. The score is calculated using an average of

the value of each aspect of performance with the number of scores divided by the amount of evaluation criteria.

Implementation (%)	Category
$k \geq 90$	Very Practical
$80 \leq k < 90$	Practical
$70 \leq k < 80$	Quite Practical
$60 \leq k < 70$	Less Practical
$k < 60$	Very Impractical

Table 2 Module practicality criteria

Testing the effectiveness of understanding the concept of stunting mothers can be obtained from the results of the tests and raising the response of the public. Analysis of the pre-test and post-test tests to find out the understanding of the concepts of stunting mothers combined using the N-gain formula.

G score	Interpretation
$g > 0.7$	High
$0,3 < g \leq 0.7$	Currently
$g \leq 0.3$	Low

(Table 3. Concept understanding category scale)

Response (%)	Category
$75 \leq x < 100$	High
$50 \leq x < 75$	Currently
$0 \leq x < 50$	Low

(Table 4. Community response category scale)

This module consist of :

A.   List of contents

B.   Material related to stunting and the Emo-Demo game

C.   Conclusion of the game

D.   Evaluation in the form of answering questions in each game session and material in the module

E.   Answer key, this is needed so that people can learn independently regarding stunting information.

RESULT AND DISSCUSSION

The development module based on the *Emo-Demo* game uses the Plomp design development research, where the design consists of three stages: Preliminary research, Prototyping stage and Assessment phase. The results of the research use the following Plomp model stages. Other information was obtained by conducting direct observation of data provided by the cadre to the maid on Tuesday, July 25, 2023 at the Kemiri Village office, Panti Jember. This observation activity was conducted in order to find out stunting data. The observations indicate that the high number of stunting in the village is due to the high rates of early marriage and high school dropout. In Kemiri Village, it is crucial to provide information about Stunting to ensure that everyone pays close attention to children's nutrition. This is essential to break the chain of stunting in the future. This is demonstrated by data from the Jember 2021 district health department that showed stunting rates in Kemiri village of 29.55%. According to Mawarni research

(2020), this can happen because of minimal knowledge of the surrounding public related to the risk of stunting and early marriage. Child health has always been linked to mother's health and is inseparable. The low nutritional intake of one of the children is due to unhealthy eating behavior. The mother's attitude when feeding the child inappropriately is an important factor causing stunting. With this it takes an effort to improve stunting is to improve the attitude towards the mother, so that it can improve the eating behavior of the child. This shows that the understanding of the concept of stunting activities.in Kemiri Village is still low, so there needs to be public education about stunting by developing modules. In addition, it is acquired that there has never been a stunting education by exploiting and using modules aimed at improving the understanding of the stunting concept of the community. Never used modules in education before.

Prototyping stage (design) the second stage is module design, where researchers carry out module development planning and support device planning as well as planning.

At the support device design researchers compile a plan of stunting educational   While in the design of instruments that are validation sheets, observations sheets implementation education, public response leaflets and questions pre-test and post-test which are leaflet understanding concepts final and initial. The layout of the module can be understood independently with a layout consisting of, 1). User steps; 2). Language material core; 3). User activity sheet; 4). Assessment; 5). Key answers and assessments (Yuliani, 2019). At this stage the module is created using the editing website canva.com. Next, the module is tested on a team of experts or validators for validation of qualifications. The validation test in this study involved 3 validators. As for the results of the validation module based *Emo-Demo* game as follow.

No	Asessment aspect	Score Interval (%)			Persentase (%)	Category
		Validator 1	Validator 2	Validator 3		
1.	Content	62.5	75.0	75.0	70.8	Valid
2.	Presentation	91.6	75.0	91.6	86.1	Verry Valid
3.	Language	87.5	75.0	93.7	85.4	Verry Valid
4.	Graphics	75.0	75.0	81.2	77.0	Valid
	Average	79.1	75.0	85.3	79.8	Valid

Table 1 Result Validity *Emo-Demo* modules based game Based on the validity analysis of *Emo-Demo* modules based on the three expert validators, the average percentage of assessment aspects is 79.8% with valid categories. According to Wahyuni *et al.,* (2022) stated that with a value of $60 \leq V < 40$ modules can be said to be valid so that it can be implemented with minor modifications. It suggests that the *Emo-Demo* game-based module to enhance the understanding of the community's stunting concept deserves to be implemented without any modification. This is supported by criteria of construct validity included model rationality,

theoretical and empirical support at each stage of the model, components of planning and model implementation, learning environment of the model, and assessment and evaluation of the model (Wicaksono et al., 2020).

Assessment phase In this third phase a field test module has been completed developed based on Emo-Demo games, to measure the effectiveness and practicality in the process of educational activities. Can be seen in table 2.

No	Assessment activities	Meeting to- (%)			Percentage	Category
		1	2	3		
1	Access media	100	100	91.6	97.2	Very Practical
2	Understand the material	91.6	100	100	97.2	Very Practical
3	Carry out activities	91.6	83,3	100	91.6	Very Practical
4.	Carry out evaluations	91.6	100	83,3	91.6	Very Practical
5.	Evaluate answers	83.3	83,3	91.6	86.1	Practical
6.	Summing up the results of activities	91.6	91,6	83.3	88.8	Practical
Rata- rata skor					92.1	Very Practical

Table 2. Practical results of Emo-Demo game based modules

Based on the Table 2, the average practicality of the observation sheet on the implementation of educational activities shows the average percentage of 92.1% of those classified as highly practical in three meetings evaluated by three observers. According to Wahyuni et al., (2022) explained that k ≥ 90 can

be categorized very practically. The evaluation activities consisting of six activities in each meeting, including the participant performing the Emo-Demo game according to instructions and explaining the tools and materials used in the emo-demo game obtained an average percentage of activity of 97.2% categorized as very practical.

In the assessment activities guided the participants in the Emo - Demo game and the participants worked the evaluation sheet on the module as well as giving the educational conclusion independently received an average of 91.6% of activity classified as highly practical. Modules can be said to be very practical when the product developed is easy and can be implemented in learning (Nieveen, 1999).

The effectiveness of the module can be seen from the pre-tet and post-test results as well as the public response to the Emo-Demo game-based module that has been used. The pre-test and post-test consists of seven questions according to the concept understanding indicators. While raising the response of the public by looking at the evaluation score. The results of the test to know the understanding of the concept can be seen through Table 3.

Data	Sample	
	Pre-test	*Post-test*
Sample	10	10
Lowest value	7	85
Highest score	71	100
Avergae value	43.3	93.1
Standard deviation	23.19	6.59
N-gain	0.89	
Category	High	

Table 3. Result N-gain

The gain score for concept understanding is 0.89 where according to Wahyuni et al., (2022) stated that the scale of category g > 0.7 can be categorized high.

The response shake consists of three aspects that lead to the module as well as the material. According to Marisa et al., (2020) is the appearance, presentation of material and benefits. First on the aspect of display the percentage obtained 90.83% can be categorized high. Second on the aspects of presentation of material acquired 90.62 percent can be classified high. Third on the benefit aspects gained 88.33 percent may be categorised high. So from these three aspects the average response of the public is 89.93 can be ranked high. According to Wahyuni et al., (2022)

stated that a category scale of 75 ≤ x < 100 can be categorized high. It means that the response of the public, especially the mothers, reached the expected criteria of being very good.

CONCLUSION

The development of the Emo-Demo game based module on the understanding of the stunting concept can be said to be very valid. The practicality of the emo-demo game-based module in stunting educational activities includes very practical. The understanding of stunting concepts after using the Emo-Demo games based modules is increasing and includes a very high category as well as the public response shows a positive response.

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EPIDEMIOLOGY OF MEASLES AND RUBELLA IN YOGYAKARTA CITY 2013-2022

Dwi Ana Sulistyani[1], Sulistyawati Sulistyawati[2], Solikhah Solikhah[3]

1 Master's Program in Public Health, Ahmad Dahlan University, Yogyakarta, Indonesia
2.3 Faculty of Public Health, Ahmad Dahlan University, Yogyakarta

ABSTRACT

Introduction: Measles and Rubella are still a public health problem in Indonesia, including in Yogyakarta. Extraordinary Measles and Rubella Incidents in the City of Yogyakarta are still being reported. In 2022, there will be 2 cases. Nevertheless, measles and Rubella have a high potential for transmission, death and cause more severe complications. This study aims to determine the trend of measles and Rubella cases in Yogyakarta from 2013-2022.

Methods: This study used a descriptive research design. Data on measles and rubella cases were taken from the Yogyakarta City Health Office Case Based Measles Surveillance (CBMS) report for 2013-2022.Results: Measles and Rubella cases tend to decrease in 2018-2021 and increase again in 2022. Of the 2928 suspected measles, the majority were women (50.8%) and aged over 15 years. There were 459 confirmed cases of measles and 468 instances of Rubella. Of the two cases of measles and Rubella, most suffered from children.

Conclusion: Laboratory-confirmed incidences of measles and rubella are found in all areas of the subdistrict and are more prevalent in children. Strengthening the body's resistance and immunity to measles-rubella infection must be done to prevent measles-rubella outbreaks with transmission in the school environment.

Keywords: Measles, Rubella, Surveillance, Yogyakarta City

INTRODUCTION

During 2000–2016, global measles incidence decreased by 87% from 145 to 19 cases per million population. The number of reported cases decreased from 853,479 in 2000 to 132,490 in 2016. However, since 2016 the cases have increased to reach 869,770 cases reported in 2019, with an incidence of 120 cases per million population and an estimated more than 207,500 deaths due to measles.[1] Measles has long-term consequences by predisposing to other infections through prolonged immunosuppressive effects lasting for 2 to 3 years after infection and contributing to malnutrition in children. Rubella also has long-term consequences for the estimated 103,000 babies born with congenital rubella syndrome.[2]

National measles surveillance data for 2021 reported 132 laboratory-confirmed cases of measles, 267 laboratory-confirmed cases of rubella, and 1 report of an Extraordinary Event. In 2022, there will be 2889 laboratory-confirmed measles, 562 laboratory-confirmed Rubella cases, and 62 reports of extraordinary events. This figure shows an increase in cases in 2022 of 22 times for laboratory-confirmed measles, 2 times for laboratory-confirmed rubella, and 7.75 times for extraordinary events (outbreak).[3]

Yogyakarta Province Health Service's 2022 surveillance report for diseases that can be prevented by immunization (PD3I) reports an increasing trend in cases of pertussis, hepatitis B, and measles. In 2021, 117 suspected measles were reported with 62 laboratory-confirmed cases positive for measles and 80 positive for rubella. In 2022, suspected cases will increase 3.7 times to 433 cases.[4]

The 2021 Yogyakarta City Health Service Case Based Measles Surveillance (CBMS) report recorded 29 suspected measles cases 0 laboratory-confirmed measles cases and 2 laboratory-confirmed rubella cases.[5] In 2022 suspected measles cases increased 2.8 times to 82 cases and laboratory confirmed positive 9 cases of measles and 8 positive cases of rubella (an increase of 4 times). In 2021, there were no reported outbreaks of measles or rubella in the Yogyakarta City area, but in 2022 there was 1 incident that met the criteria for an extraordinary event of

measles in the Mantrijeron kemantren area.[6]

Measles is an infectious disease caused by morbillivirus. This disease is very contagious, especially in people who do not have immunity to the virus. Symptoms that appear when infected with the virus that causes measles are fever, maculopapular rash cough, runny nose, or red eyes. A person will show symptoms of measles between 7-18 days with an average of 10 days from the entry of the virus into the body. Measles is dangerous because it can cause complications and even cause death. Complications that often arise are diarrhea and bronchopneumonia. Another disease similar to measles known as Rubella is also caused by a virus, namely the Rubivirus type togavirus. Symptoms include mild fever and maculopapular rash accompanied by enlarged glands behind the ears. The incubation period is around 12-21 days. Rubella is fatal if it attacks pregnant women, especially in the early trimester because it can cause abortion, stillbirth, and congenital defects (Congenital Rubella Syndrome/CRS). Measles and rubella

spread through droplets and airborne transmission.[7] The only reservoir for measles is humans, it is not known that other animals are the reservoir and there are no known asymptomatic carriers. For airborne transmission, the measles virus can survive for up to 2 hours in a closed room even if the sufferer has left the room. Measles often appears in late winter or spring in temperate climates and is endemic.[8]

Areas at high risk of measles are areas that have the potential for measles Extraordinary Events (KLB) to occur, which can be mapped based on immunization coverage, population density, slum areas, nutritionally vulnerable areas, areas that are difficult to reach or far from health services and areas where community groups do not receive immunization.[9] All kemantren areas in Yogyakarta City are densely populated areas. Yogyakarta City is the most populous Regency/City in DIY Province.

Surveillance for measles and rubella is carried out through the Case-Based Measles Surveillance (CBMS) program. CBMS is a measles

surveillance program by records each suspected measles case individually (case line listed) in a report format and carries out laboratory confirmation with the serological examination (IgM) and investigation within 2 x 24 hours after the report is received.[10] In this program, every patient who comes to the Community Health Center or Hospital with symptoms of heat and rash accompanied by one of the symptoms of cough, runny nose, or red eyes will be identified as measles suspect and a measles laboratory examination will be carried out. If the measles IgM result is negative then the Rubella examination will be continued. At the start of CBMS implementation in Yogyakarta City, measles patient data was reported using the monthly hardcopy C1 Measles report format. Furthermore, in 2010-2014 reporting used electronic mail (email) facilities. Since 2017, measles reporting has used SIMPUS while hospitals still use email.

The Yogyakarta City Health Service has implemented CBMS since 2008, carried out by 18 UPT Puskesmas. Health centers in the working area of the Yogyakarta City Health Service consist of Mantrijeron, Kraton, Mergangsan, Umbulharjo 1, Umbulharjo 2, Kotagede 1, Kotagede 2, Gondokusuman 1, Gondokusuman 2, Danurejan 1, Danurejan 2, Pakualaman, Gondomanan, Ngampilan, Wirobrajan, Gedongtengen, Jetis and Tegalrejo Community Health Center. The Puskesmas records every suspected case of measles that comes to the Puskesmas as well as case reports from other health facilities (Hospitals, Clinics, Independent Practicing Doctors) in its work area and takes blood samples and sends them to the Yogyakarta Health and Calibration Laboratory Center (BLKK) for examination. Measles and Rubella serology. Furthermore, the puskesmas will carry out case investigations to look for additional cases and carry out vigilance in the area.

The results of the laboratory examination will be informed by the Yogyakarta BLKK to the Community Health Center. Measles case reports are summarized in the C1 report format and reported to the Yogyakarta City Health Service before the 10th of each month via

email. The C1 Measles report contains individual information on suspected measles cases in the form of case identity (case epid number, name, age, gender, and address), date of onset of symptoms of fever, rash, and other additional symptoms, measles, and rubella immunization status, administration of vitamin A and examination results serological laboratory. Since 2016, the mechanism for reporting suspected measles has been integrated with SIMPUS, so that the Community Health Center does not need to send emails, but the Health Service can see the measles summary in SIMPUS. The C1 Recap data will then be processed by the Yogyakarta City Health Service using the MS application. Excel to find out the trend of cases, see the distribution of cases based on age and gender, immunization status, and laboratory examination results and presented in the form of tables and graphs.

METHOD

This study used a descriptive research design to determine the epidemiological picture of measles and rubella cases in Yogyakarta City.

Data on measles and rubella cases was taken from the individual-based measles surveillance report or Case-Based Measles Surveillance (CBMS) of the Yogyakarta City Health Service for 2013-2022. This research will take suspected measles cases, laboratory-confirmed measles cases, and laboratory-confirmed Rubella cases. Suspected measles are cases with minimal symptoms of fever and maculopapular rash, excluding cases that have been laboratory-confirmed as other cases. Laboratory confirmed measles is a measles suspect who has been laboratory confirmed with a positive result for measles virus (positive measles IgM) and has not received measles-rubella immunization in the last 4-6 weeks before the rash appeared. Meanwhile, laboratory-confirmed rubella is a measles suspect who has been laboratory confirmed with a positive result for rubella virus (positive rubella IgM) and did not receive measles-rubella immunization in the last 4-6 weeks before the rash appeared.[10]

CBMS data in the form of data recaps from 18 Community Health Centers throughout Yogyakarta City is then

processed using Ms. Excel and presented in graphic form to describe annual and monthly case trends, distribution of cases based on outbreaks, distribution by place and distribution of cases based on age and gender.

To determine priority areas, an area map is used to compare the size of the problem between regions. For this purpose, the measles surveillance guidelines recommend using incidence figures. 10 In this study, mapping was created using the QGIS application. The mapping was made based on the Kemantren area (sub-district) by calculating the incidence rate (Incidence Rate/IR) of measles and rubella in each Kemantren area. The city of Yogyakarta is divided into 14 Kemantren areas including Mantrijeron, Kraton, Mergangsan, Umbulharjo, Kotagede, Gondokusuman, Danurejan, Pakualaman, Gondomanan, Ngampilan, Wirobrajan, Gedongtengen, Jetis and Tegalrejo. To analyze it, the IR per kemantren is differentiated based on a gradation of light to dark colors starting with white if the IR is equal to 0 or there are no cases and then the interpretation is

that the higher the IR, the darker the color. Furthermore, the data presented in the form of graphs and area maps is interpreted based on the analysis results and compared with the appropriate literature.

This research protocol has received approval from the Ahmad Dahlan Yogyakarta University Research Ethics Committee. Informed consent was given to all participants and participation was voluntary.

RESULTS AND DISCUSSION

The annual trend during 2013-2022 is quite fluctuating for trends in suspect findings, laboratory-confirmed measles and laboratory-confirmed rubella (Figure 1). Findings of suspected measles increased from 2014 to 2017, and there was a significant decrease in 2018. Although it increased again in 2019, it decreased again in 2020-2021. Findings of suspected measles will increase again in 2022.

Laboratory-confirmed measles and laboratory-confirmed rubella cases had a fluctuating trend from 2013 to 2017 with the opposite pattern between the measles and rubella trends. After 2017, both cases tended

to decline until 2019 and increased again in 2019. During 2013-2017 the number of suspected cases was in the 300-500 range, but in 2018-2022 it was < 200. Laboratory-confirmed measles and rubella also experienced the same trend, in 2013-2017 cases reached above 100 but starting in 2018 they fell to < 50. In 2018 there was a decrease in cases after the rubella measles immunization campaign in August 2017. The government carried out a rubella measles immunization campaign for ages 9 months to < 15 years in 2017 covering 6 provinces on the island. Java (Phase 1). Next, phase II was carried out in 2018 outside Java (28 provinces).[11] Ristiani said that the decline in measles cases in 2014-2019 in Badung Regency, Bali was after the MR immunization campaign was carried out.[12]

In 2020 and 2021, the trend of cases decreased along with the increase in COVID-19 cases in the city of Yogyakarta. At this time, visits from patients other than Covid-19 are relatively down in all Community Health Centers throughout the city of Yogyakarta, possibly because the pandemic conditions are causing people to be afraid to go to Health Facilities for fear of being infected, the high number of Covid cases has also led to prioritization of health facility services for Covid-19, resulting in measles surveillance reports receiving less attention from officers, health protocol policies such as limiting crowds and wearing masks for the public also help reduce the rate of transmission of measles and rubella.
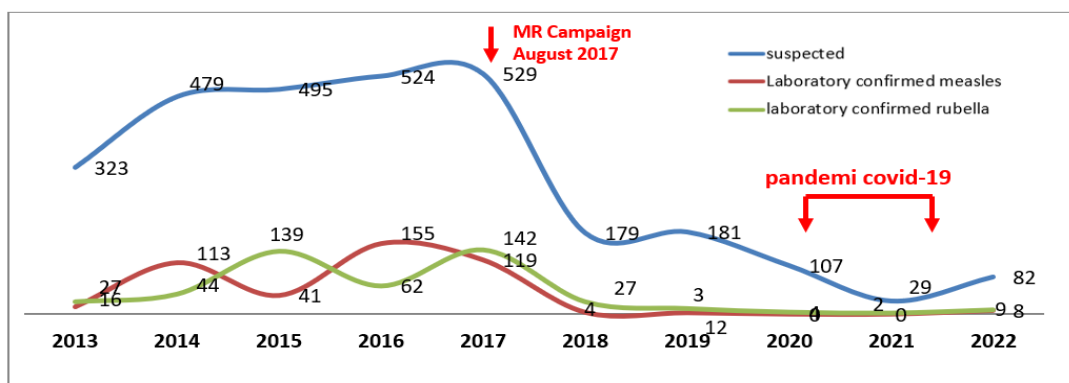

Figure 1. Annual Trend of Suspects, Laboratory Confirmed Measles, and Laboratory Confirmed Rubella in Yogyakarta City 2013-2022
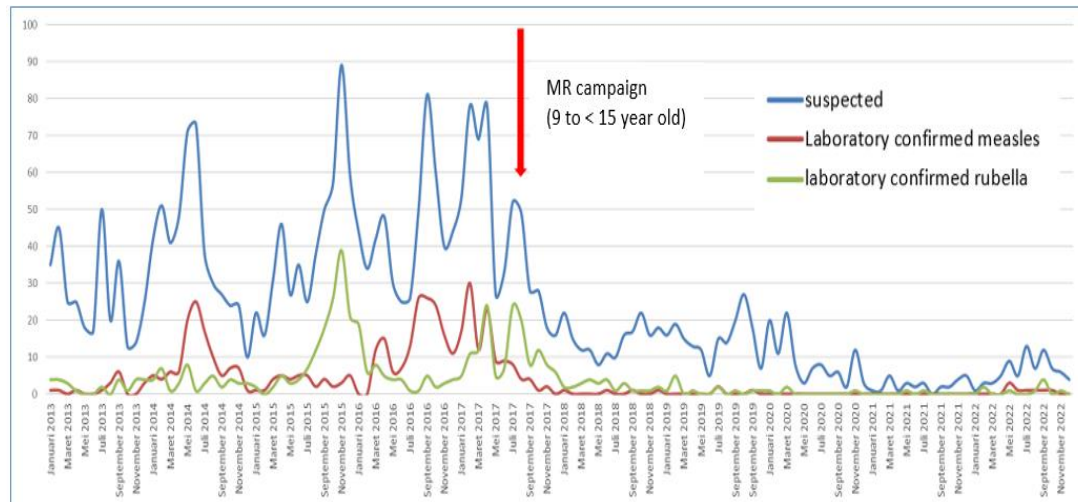
Figure 2. Monthly Trend of Suspects, Laboratory Confirmed Measles, and Laboratory Confirmed Rubella in Yogyakarta City 2013-2022

Monthly Trend of Laboratory Confirmed Measles and laboratory-confirmed Confirmed Rubella each year on average increases in the early and late trimesters, around March April, and September-October (Figure 2). These months coincide with the transition or change of seasons from dry to rainy or vice versa. During this transition period, the weather is unpredictable which causes people to get sick easily.

Laboratory-confirmed cases of Measles and Rubella occurred in all kemantren (sub-district) areas in Yogyakarta City (Figure 4 and Figure 5). The incidence of measles and rubella appears to be evenly high in 2014-2017 because in those years there were outbreaks of measles and rubella (Figure 3). The highest incidence almost every year is in the Kotagede and Umbulharjo kemantren areas. These two kemantren border each other and both also have areas that directly border the Bantul Regency area. The high incidence rate in these two schools was due to the occurrence of extraordinary cases of measles and rubella.
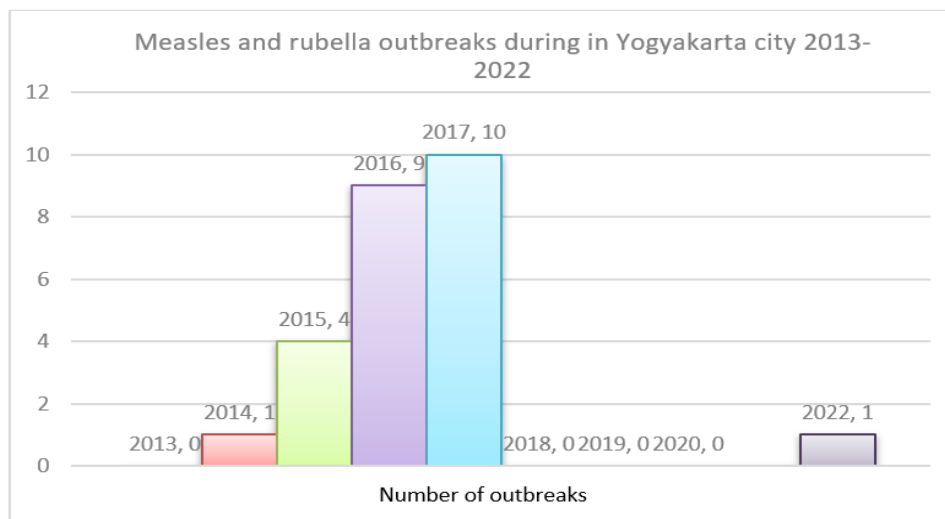
Figure 3. Distribution of Laboratory Confirmed Measles based on subdistrict incidence rates in Yogyakarta City 2013-2022
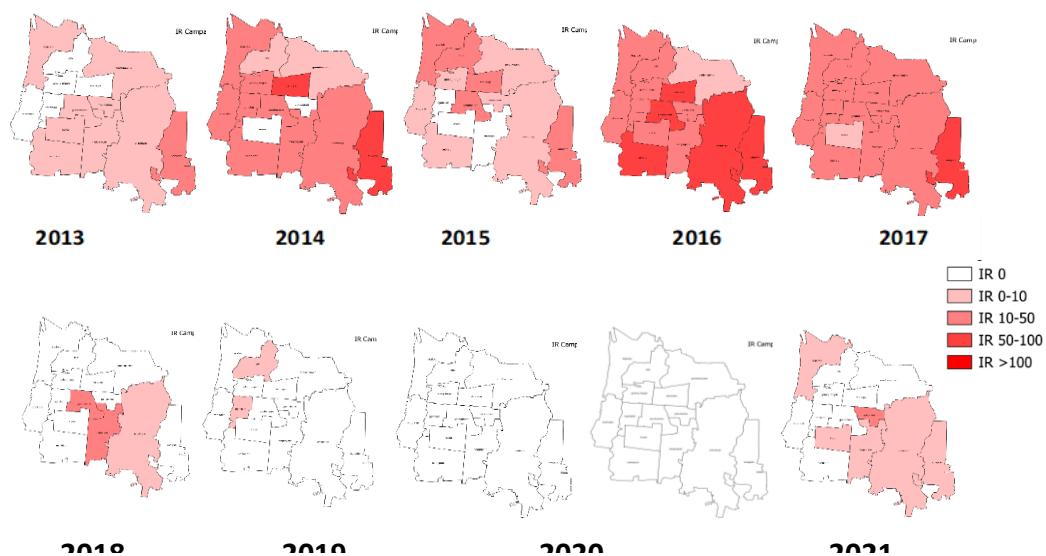

Figure 4. Distribution of Laboratory Confirmed Measles based on subdistrict incidence rates in Yogyakarta City 2013-2022
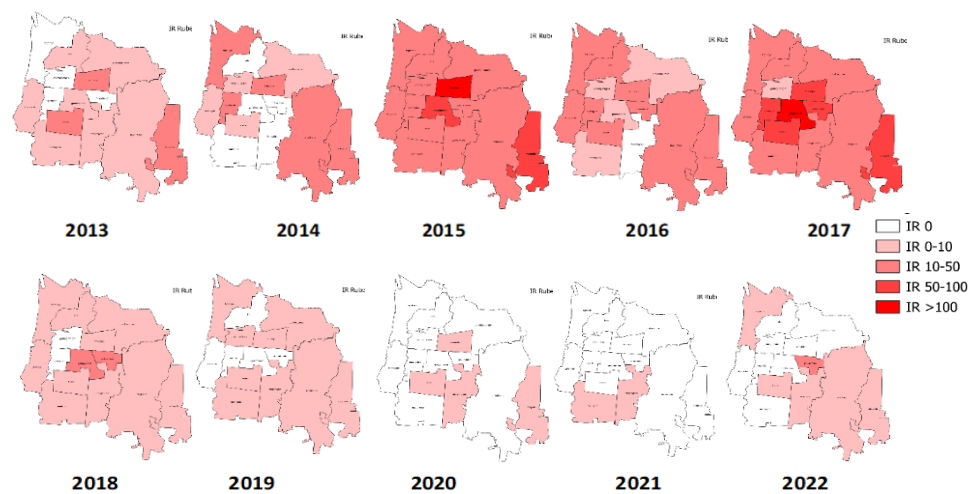
Figure 5. Distribution of Laboratory Confirmed Rubella based on subdistrict incidence rates in Yogyakarta City 2013-2022

The total number of laboratory-confirmed measles cases over 10 years was mostly found in the 1-4 year age group at 27% and the 5-9 year age group (Figure 6). A similar thing happened in 2013-2015. In 2016 the highest was in the 1-4-year age group, in 2017 the highest was in the > 15-year age group. In 2018, it was found evenly distributed in all age groups, except for the 10-14-year-old group, there were no laboratory-confirmed cases of measles. for 2019 it was only found in the age group >15 years. In 2020 and 2021, there were no positive laboratory-confirmed cases of measles or rubella. In 2022, the highest will be in the <1 year age group. This condition is in accordance with the annual measles epidemiology report in Europe which states that the age groups most affected are those aged < 1 year and 1-4 years. In 2022, 80% of them will not have received immunization. 13 Santoso in his research in Karawang City found that the largest age group for positive measles was the 1-4-year-old group, while for rubella-positive cases it was mostly distributed in the 5-9-year-old age group (Figure 7).[14] Utulu in research in Niger also stated that the distribution of measles cases was highest in the 1-4 year age group (41.4%)15, in line with Jamaludin's research at the Kalumata health

center, Ternate stated that the largest age group suffering from measles was age group 0 -5 years. 16 The highest incidence of measles cases in Cirebon City studied by Nurani was in the age group < 5 years. 17 Asriati in Rubella epidemiology in DIY reported that the highest incidence of rubella was in the age group less than 15 years.[18]
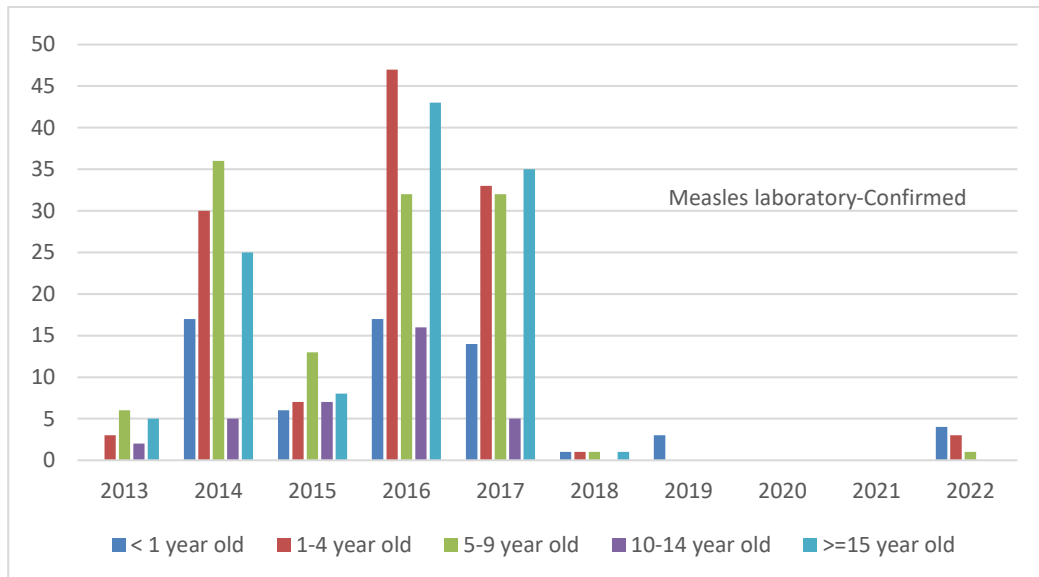

Figure 6. Distribution of laboratory-confirmed measles by age group in Yogyakarta City 2013-2022
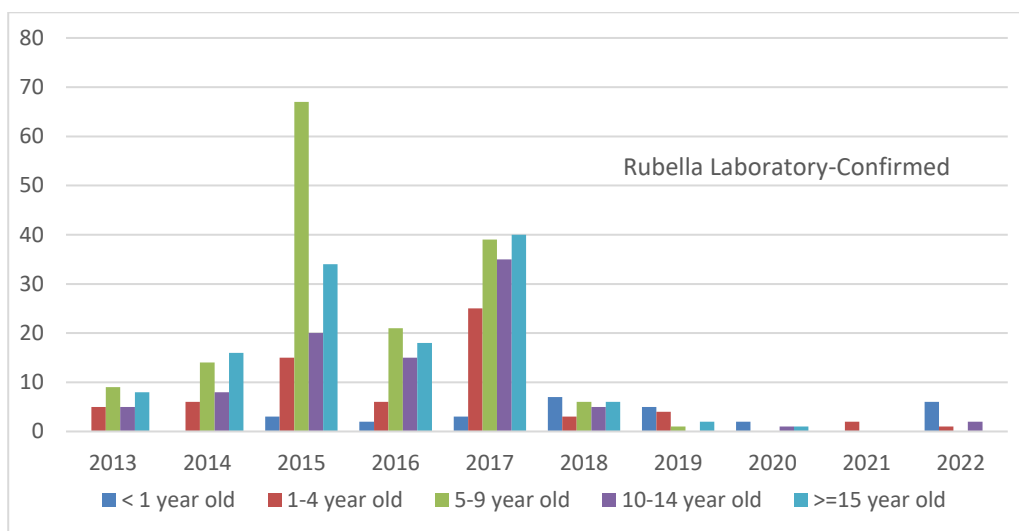

Figure 7. Distribution of laboratory-confirmed Rubella by age group in Yogyakarta City, 2013-2022

The gender proportion of total measles suspects for 1 year 2013-2022 was almost evenly distributed between men and women, with more women (51%) than men (49%). The annual proportion of women was

found to be greater in 2013, 2014, 2015, and 2016. Meanwhile, a greater proportion of men was found in 2016,

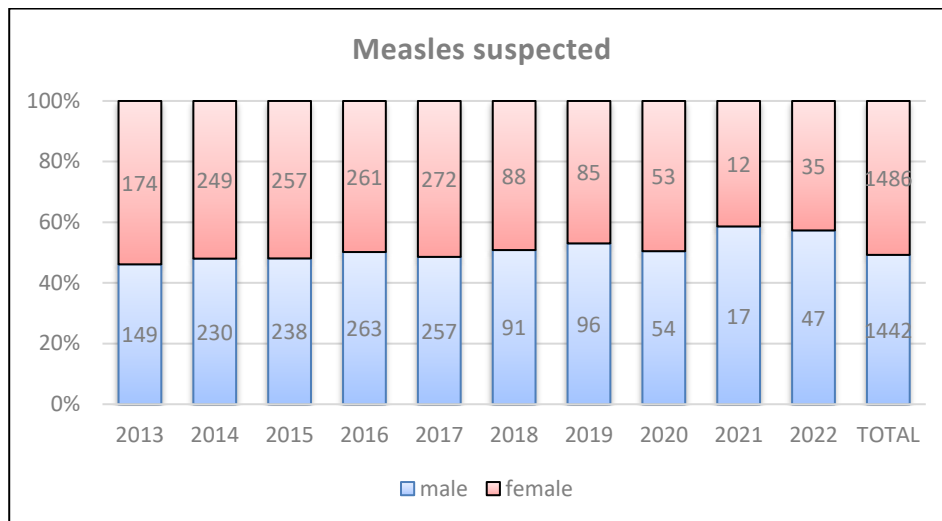2018, 2019, 2020, 2021 and 2022 (Figure 8).

Figure 8. Trend of suspected measles based on gender in Yogyakarta City 2013-2022

In contrast to suspected cases, the gender proportion of laboratory-confirmed measles in 2013-2022 as a whole was more male at 236 cases (52%). Similar proportions occurred in 2013, 2014, 2015, 2017 and 2022. A larger proportion of women occurred in 2016 and 2018. Meanwhile, in 2019-2020 there were no laboratory-confirmed cases of measles (Figure 1).

In contrast to the trend of laboratory-confirmed measles, the gender proportion of laboratory-confirmed rubella cases in 2013-2022 as a whole was more female, with 254 cases (54%). Annual data for the proportion of women occurred more in 2014,

2015, 2016, 2017, and 2018. For the proportion of men, it occurred more in 2013, 2019, 2021, and 2022 (Figure 9).

Utulu's research in Niger reported that there were no significant differences in the gender of confirmed cases of measles. 19 Andriani in research on the relationship between toddler characteristics, age at measles immunization, history of exclusive breastfeeding, and clinical measles in Sidoarjo Regency found that gender had no relationship to the incidence of measles, the immune system of each toddler is more influential in the incidence of measles.[20]
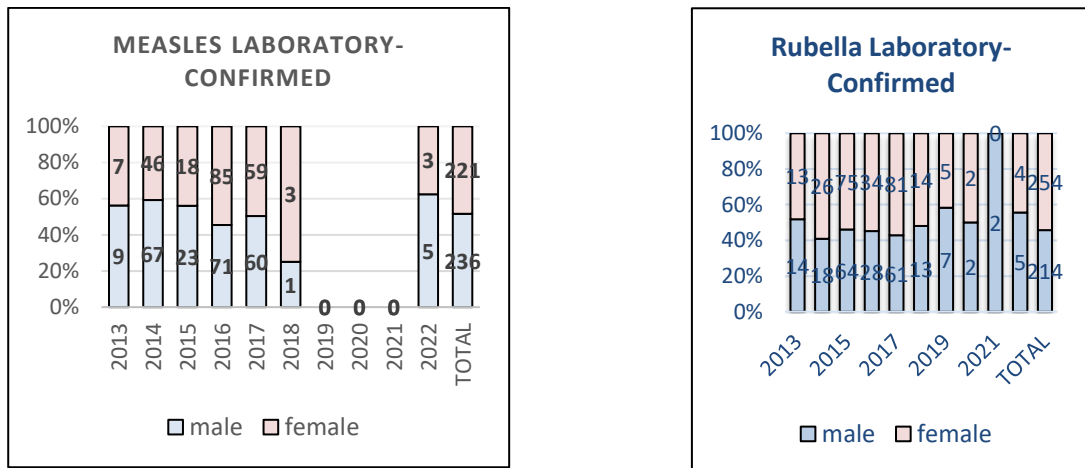
Figure 9. Trend of Laboratory Confirmed Measles Cases and Laboratory Confirmed Ruella by Gender in Yogyakarta City 2013-2022

CONCLUSION

Measles cases in Yogyakarta City tended to decrease from 2013 to 2021 and increased again in 2022. Over the past 10 years, 2928 measles suspects were reported with a greater proportion of cases being women (50.8%) than men (49.2%).) and highest in the age group over 15 years. For laboratory-confirmed positive cases of measles, 459 patients were reported with a higher proportion of males (51.6%) than females (48.4%) and the age group 1-4 years. Meanwhile, there were 468 cases that were laboratory-confirmed positive for Rubella, with a higher proportion of women (54.3%) than men (45.7%) and the age group 5-9 years. The 1-4 year-old age group is classified as an age whose immune system is not yet fully formed, so they need good nutritional intake and receive immunizations to increase their immune system. The 5-9 year age group is a school age group that is very vulnerable to disease transmission in the school environment. Efforts to prevent and break the chain of transmission in the school environment are absolutely necessary for efforts to prevent and control Measles-rubella in the City of Yogyakarta.

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IDENTIFICATION OF POTENTIAL HAZARDS IN OCCUPATIONAL SAFETY AND HEALTH AMONG RICE MILLING WORKERS AT UD. LESTARI

Aerrosa Murenda Mayadilanuari[1]*, Silvia Nurvita[2], Siti Noor Chotimah[3], Viny Natalia Dewi[4], Dhieo Kurniawan[5]

[1234]Health Information Management, Faculty of Science and Technology, National Karangturi University, Semarang
[5]Master of Clinical Pharmacy, Faculty of Pharmacy, Airlangga University, Surabaya

*Corresponding author : aerrosa.murenda@unkartur.ac.id

ABSTRACT

The rice milling industry plays an important role in various industries, making a significant contribution in Indonesia. However, the risk of danger in rice milling work exposes workers to various occupational hazards, which has an impact on their health and safety. This research was conducted qualitatively with observational and quantitative approaches for dust and noise measurements, conducting interviews, observation, and measurements from April to May 2024. The aim of this study was to identify various OHS hazards present in UD. Lestari's rice milling operations. Purposive sampling was used to select 6 informants who had direct experience and expertise relevant to the identified hazards. Descriptive qualitative analysis was employed to systematically analyze and interpret the data gathered from these informants. This research found that all respondents experienced respiratory problems (100%) and 3 people (50%) experienced hearing problems, attributed to inadequate use of Personal Protective Equipment (PPE) and smoking habits. Dust levels inside the production area exceeded permissible limits (8.04 mg/m^3), posing risks of respiratory diseases. Similarly, noise levels surpassed recommended thresholds (93.26 dB), increasing the likelihood of hearing loss. This study contributes valuable insights into enhancing workplace safety and underscores the importance of ongoing efforts to safeguard worker health in informal sector industries. Future research should explore additional factors influencing OHS outcomes to further enhance workplace safety practices and employee well-being.

Keywords: Potential Hazards, Milling Rice Workers, Dust Level, Noise Level

INTRODUCTION

Occupational health and safety (OHS) encompasses all activities aimed at ensuring and protecting the safety and health of workers through efforts to prevent work accidents and occupational diseases (Asiedu et al., 2023). By implementing good OHS practices at the workplace, it is expected to enhance production processes and reduce the risk of work accidents and occupational diseases (Mayadilanuari, 2020). Work accidents and occupational diseases can occur not only in the formal sector but also in the informal sector (Sukismanto et al., 2023).

The percentage of informal sector workers has increased over the past 2 years during the pandemic, comprising approximately 59.97 percent of the total workforce of 135.61 million as of the end of February 2022 (Rohmah et al., 2024). Informal sector workers are the most vulnerable to exposure to various risks associated with workplace hazards, which can lead to occupational diseases and work accidents, and even fatalities (Sriagustini and Supriyani, 2021).

Rice milling is one of the important informal sector industries that contribute to food security in Indonesia (Connor et al., 2021). Like other industries, rice milling activities present various OHS risks for its workers (Santoso, 2023). These risks include respiratory disorders due to dust, hearing impairments caused by machine noise exceeding 85 dB, musculoskeletal disorders, work fatigue, and others (Widodo, 2020). Previous study found that based on the classification of hazard potential in rice milling using the Hazard and Operability Study (HAZOP) method, the distribution was as follows: high 10%, moderate 70%, and low 20% (Ahmad Sobirin and Zaqi Al Faritsy, 2023).

Given these various OHS risks, efforts are needed to prevent work accidents and occupational diseases. To enhance safe and healthy working conditions for workers in the rice milling industry, identifying potential hazards is essential (Putri et al., 2023). Potential hazards encompass anything that could potentially lead to losses, damages, injuries, illnesses, accidents, or even fatalities related to work processes and systems

(Harnawati, 2024). These hazards can result in damage and losses to: 1) humans directly or indirectly involved in the work, 2) property including work equipment and machinery, 3) the environment both within and outside the company, 4) the quality of goods and services produced, and 5) the company's reputation (Ariyanto, 2021).

According to the Industry Rice Milling Data Collection (PIPA) report in 2020, the number of rice milling industries in Indonesia amounted to 169,789 businesses (BPS, 2020). Meanwhile, the number of rice milling industries in Central Java totaled 23,345 (BPS, 2020). With these activities, the number of informal sector workers involved in the rice milling process is quite significant. Therefore, it is important to have a profound understanding of the potential hazards that workers in rice milling may face.

UD. Lestari is an informal sector business unit engaged in rice milling located in Gunungpati Subdistrict, Semarang City. This business unit employs a total of 16 workers, consisting of 14 male and 2 female workers aged between 25 and 50 years. Meanwhile, the average production capacity at UD Lestari is 5-8 tons per day. The rice milling process there includes sun-drying of wet paddy, the first stage of rice milling which involves husking using a husker machine producing brown rice, and the second stage of rice milling which involves polishing using a polisher machine producing polished or white rice. Finally, the white rice is packaged and marketed. Based on the results of initial observations at UD Lestari, it was found that all workers did not use PPE when working, the work environment was dusty and the sound of the rice milling machine was very loud which could increase the risk of OHS for workers. Based on the above, the aim of this research is to identify various OHS hazards present in UD. Lestari's rice milling operations.

METHODS

This research was conducted qualitatively with observational and quantitative approaches for dust and noise measurements It took place at UD Lestari Rice Milling from April to May 2024. Informants for this study were selected through purposive

sampling, totaling 6 individuals, including: a) the business owner, b) a supervisor, c) 2 rice milling workers, d) a rice weighing worker, and e) a rice sorting worker.

The research instruments used include in-depth interview guidelines, observation sheets, noise measurements, and dust content measurements. In-depth interviews were carried out using a semi-structured interview guide aimed at informants where data collection was carried out continuously until no more information was obtained from the informants or the data was saturated (Rutledge and Hogg, 2020).

In this research, data validity was checked using data source triangulation techniques.

Observations were conducted on the environmental conditions and all work processes at UD. Lestari. Dust measurements were conducted using a high volume sampler (HVS) placed inside and outside the production area for 4 hours then the results were later weighed in the laboratory. Meanwhile, noise measurements were taken using a sound level meter for 10 minutes at each of the 7 different points within the production area.

RESULTS AND DISCUSSION

Table 1. Respondent Characteristics

No	Name	Age	Gender	Job Description	Smoking / Not Smoking	Working Period (Years)
1.	SP	50	Male	Owner	Smoking	18
2.	AM	41	Male	Supervisor	Smoking	15
3.	MY	27	Male	Rice sorting worker	Smoking	4
4.	KI	25	Male	Rice weighing worker	Smoking	6
5.	AS	35	Male	Rice milling worker	Smoking	8
6.	JM	31	Male	Rice milling worker	Smoking	12

The main informants in this study were 5 individuals, consisting of a supervisor, 2 rice milling workers, 1 rice sorting worker, and 1 rice weighing worker. Triangulation informants in this study included the

owner of the rice milling business. The average age of the workers was between 25 and 50 years old with a working period of more than 3 years. All informants interviewed were male and smokers. The study did not include female respondents because female workers in rice milling only performed sun-drying tasks and did not operate machinery.

Through observation and interviews, it was found that the workers did not use Personal Protective Equipment (PPE) such as earplugs, masks, gloves, and goggles during their work. This was due to the discomfort and inadequate supply of the PPE at that workplace. Consistent with previous research, it was found that poor-quality PPE could affect workers' willingness to use them (Tamene et al., 2020). Business owners should also provide sufficient quantities of PPE for all their employees. The use of PPE is expected to reduce the risk of work accidents and occupational diseases in the rice milling industry (Dewi et al., 2023). Therefore, the lack of awareness among workers about the importance of using PPE needs to be addressed promptly.

Table 2. Distribution of Dust Levels

Location	Time (Hours)	Result (mg/m^3)	Threshold Value (mg/m^3)
Inside The Production Area	4	8,04	3
Outside The Production Area	4	5,08	3

Dust levels were measured at two points, indoors and outdoors. Each measurement lasted for 4 hours. Table 2 showed that the dust level measured inside the rice milling area was 8.04 mg/m3, while outside area was 5.08 mg/m3. According to Minister of Manpower and Transmigration Regulation No. 13 of 2011 regarding threshold limit values for chemical and physical factors, the permissible exposure limit for dust in the

environment is 3.0 mg/m3 (Permenaker, 2011). Based on this regulation, it is evident that the dust levels measured at UD. Lestari exceeded the applicable threshold limit value in Indonesia.

In line with previous research at the rice milling facility in Gegeran Village, Sukerejo, it was found that the indoor dust measurement yielded 5,9 mg/m3, which exceeded the permissible dust threshold limit in Indonesia (Permenaker, 2011). Failure to control occupational health and safety measures promptly could lead to occupational diseases such as pneumoconiosis (Sahri et al., 2023).

Pneumoconiosis is a disease caused by the accumulation of dust particles after prolonged exposure in the lungs, which can lead to respiratory disorders (Cherian et al., 2023). The onset of this disease was caused by continuous deposition of dust, resulting in fibrotic changes in lung parenchyma, thereby reducing lung elasticity and decreasing lung vital capacity (Lestari et al., 2023). Additionally, rice dust was organic dust that could release substances such as histamine and allergens, leading to respiratory obstruction (Beigoli et al., 2024).

Therefore, efforts were needed to prevent respiratory disorders in workers by using PPE such as masks. The use of masks could reduce the risk of respiratory disorders among workers and other airborne-transmitted diseases (Ramadan et al., 2023).

Table 3. Results of Noise Measurement

Points	Measurements						Results
	1	2	3	4	5	6	
A	87,4	87,3	87,7	87,3	86,8	87,6	94,15
B	94,3	94,7	94,5	95	95,3	95	93,85
C	96,4	96,3	96,4	96,1	96,5	96,3	95,28
D	90,3	90,8	91,5	91,2	90,8	90,8	89,98
E	90,8	90,3	92	90,5	90,6	90,6	90,23
F	92,5	93	92,7	92,7	92,8	92,8	91,70
G	99,1	98,5	98,6	98,5	98,6	98,5	97,63
Average General Noise Measurements : 93.26							

General noise measurements were conducted at seven (7) points inside the area where the rice milling machine is used. Table 3 showed that the general indoor noise level was 93.2 dB. According to Regulation of the Minister of Manpower and Transmigration No. 13 of 2011 regarding the threshold limit values for chemical and physical factors, it is explained that the threshold limit value for noise during an 8-hour workday is 85 dB (Permenaker, 2011). Based on this regulation, it is known that the noise level at UD. Lestari exceeds the threshold limit value set by the Indonesian government.

Previous research found that age (p-value=0.014), length of service (p-value=0.028), and noise intensity (p-value=0.028) had a significant effect on hearing loss in rice mill workers (Putri et al., 2024). Therefore, efforts were needed to reduce the risk of hearing impairments in workers through the use of PPE (Yeşiltepe and Karadağ, 2023). The use of PPE was chosen because eliminating the noise source from machines was not feasible (Adhifa M, 2023). PPE options for noise reduction included earplugs, earmuffs, or a combination of both (Putro et al., 2024). The use of earplugs could reduce noise by up to 30 dB, while the use of earmuffs

could reduce noise by up to 50 dB (Endrianto, 2023).

Table 4. Respiratory and Hearing Disorders Among Workers (by interview)

Type of Disease Disorders	Yes	No
Respiratory disorders	6 (100%)	0
Hearing disorders	3 (50%)	3 (50%)

Based on table 4, it was found that all respondents experienced respiratory disorders (100%). Additionally, the number of workers who experienced hearing disorders was 3 people (50%), comprising 2 workers in the rice milling section and 1 worker in the rice sorting section. These three workers operated in areas where production machines generated extremely loud noise. None of these workers used earplug or earmuff. Conversely, the other 3 workers did not experience hearing disorders because they did not work in the production area. This corresponds with previous research findings that workers exposed to machine noise exceeding 85 dB for more than 8 hours are at risk of permanent hearing impairment (Elshaer et al., 2023).

Subsequently, the respiratory disorders experienced by all respondents were due to their lack of use of PPE such as mask and their smoking habits. All respondents had a smoking habit, which could increase the risk of respiratory disorders (Berlian et al., 2023). Pulmonary function disorders in rice milling workers could be prevented by using masks while working and avoiding smoking. This is consistent with the study by (Nurfitria et al., 2020), where rice milling workers who wore masks while working tended to have normal pulmonary function status.

Previous research conducted by (Pando-Sandoval et al., 2022) showed that individuals who had a smoking habit had a greater chance of suffering from lung diseases compared to non-smokers. Another study indicated that

the smoking habit among rice milling workers was associated with impairments in lung function capacity (Hasibuan et al., 2023).

Based on the above research findings, to prevent respiratory and hearing disorders, efforts can be made to conduct socialization sessions emphasizing the importance of PPE among workers at UD Lestari's rice milling. Previous research has indicated that raising awareness about the use of PPE during work can enhance workers' understanding of the importance of workplace safety and reduce the risk of work-related accidents and diseases (Sumardiyono, 2024).

CONCLUSION

In conclusion, this study highlighted various occupational health and safety (OHS) hazards that were prevalent at UD Lestari. The findings revealed significant risks associated with respiratory and hearing disorders among workers, primarily attributed to inadequate use of Personal Protective Equipment (PPE) and smoking habits. The dust levels inside the production area had exceeded permissible limits, posing risks of respiratory diseases. Similarly, noise levels had surpassed recommended

thresholds, increasing the likelihood of hearing impairments among workers. Furthermore, future research could explore additional factors influencing OHS outcomes in informal sector settings, aiming to foster continuous improvement in occupational safety practices and worker well-being.

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RISK MANAGEMENT ANALYSIS WITH THE AS/NZS 4360:2004 METHOD ON BOILERS AT PT. DHARMAPALA USAHA SUKSES CILACAP

Nita Sofia Rakhmawati[1], Nurussyifa Afiana Zaen[2], Muhammad Fahrezi Al Ghifari[3], Fauzi Achmad[4]

[1] [2] [3] [4] Department of Occupational Safety and Health, STT Migas Cilacap, Indonesia
Correspondence address: rakhmawati.ns@gmail.com [082242083790]

ABSTRAK

Boiler merupakan salah satu alat dengan berbagai potensi bahaya. Potensi bahaya tersebut dapat berasal dari tahapan pengoperasian maupun pada tahapan perawatan. Untuk mencegah terjadinya risiko yang dapat terjadi, di perlukan managemen risiko yang tepat. Salah satu yang dapat digunakan yaitu managemen risiko metode AS/NZS 4360:2004. Tujuan penelitian ini yaitu melakukan analisis risiko dengan metode AS /NZS 4360-2004 pada boiler di PT. Dharmapala Usaha Sukses Cilacap. Penelitian ini merupakan penelitian kualitatif analitik, dengan menggunakan 3 informan antara lain pimpinan, pengawaas dan pekerja. Penelitian di lakukan dengan wawancara dan observasi berpedoman lembar wawancara dan lembar observasi komponen boiler, yang di analisis yaitu pada tahap pengoperasian dan perawatan boiler. Analisis dilakukan dengan metode triangulasi. Hasil penelitian menunjukan terdapat potensi bahaya yang dapat menyebabkan risk level high pada aktivitas pengoperasian yaitu pengisian bahan bakar dan perawatan boiler yaitu aktivitas pengecekan belt conveyor. Risiko yang dapat terjadi adalah kematian akibat kebakaran. Upaya pengendalian yang sudah dilakukan perusahaan di antaranya memasang cyclone, serta dilakukan inspeksi. Peneliti menyarankan perusahaan dapat melakukan pengecekan rutin temperatur batu bara dan memasang safety sign pada area yang berbahaya.

Kata Kunci: AS/NZS 4360:2004, Boiler, Managemen risiko

ABSTRACT

Boiler is one of the tools with various potential hazards. The potential danger can come from the operation stage or the maintenance stage. To prevent the risks that can occur, appropriate risk management is needed. One that can be used is the AS/NZS 4360: 2004 risk management method. The purpose of this study is to conduct a risk analysis using the AS / NZS 4360-2004 method on boilers at PT Dharmapala Usaha Sukses Cilacap. This research is an analytical qualitative research, using 3 informants including leaders, supervisors, and workers. The study was conducted by interview and observation guided by interview sheets and observation sheets of boiler components, which were analysed at the stage of boiler operation and maintenance. The analysis was carried out using the triangulation method. The results showed that there are potential hazards that can cause high-risk levels in operating activities, namely refueling and boiler maintenance, namely checking conveyor belt activities. The risk that can occur is death by fire. Control efforts that the company has made include installing a cyclone, and inspections. Researchers suggest that companies can carry out routine checks of coal temperature and install safety signs in dangerous areas.

Keywords: AS/NZS 4360:2004, Boiler, Risk management

INTRODUCTION

Data from the 2018 International Labour Organization (ILO) shows that every year around 380,000 workers or 13.7% of the 2.78 million workers die from workplace accidents or occupational diseases. More than 374 people are injured, wounded or fall ill every year due to accidents that occur with workers (ILO, 2018).

In Indonesia, according to Fatoni in Zeinda and Hidayat (2019), there are several cases of work accidents especially on boilers. Many cases in Indonesia occur not only caused by small companies, but also large companies. Some cases that occurred in small companies including a krupuk factory in Kaliwates, Jember in May 2001 that killed 4 people, and a tofu factory in Taman, Sidoarjo, in January 2005 that killed 2 people, caused by leakage of holes through which people pass and failure of fire sensors.

Boiler machines are used to support the production process by converting raw materials into finished materials. One industry that uses boiler machines is the sugar-making industry. In the sugar factory, the production process itself is the process of processing raw materials, namely sugar cane into finished materials in the form of sugar crystals. The first sugar-making process is nira extraction, which is the process of milking sugar cane liquid (nira) by grinding. Then it is purified using the sulfitation method to produce a precipitate that will absorb non-sugar ingredients. After purification, evaporation is carried out, then the crystallisation process and sugar drying using hot air (Novianti, Syaukat and Ekayani, 2021). Boiler is a tool that produces steam for various purposes. The type of water and water vapour is greatly influenced by the level of efficiency itself. In boiler machines, the type of water used must be demineralised first to sterilise the water used, so that the application to be used as water vapour can be maximised properly (Rahardja, Mahfud and Bawana, 2021). One of the efforts to eliminate hazards in the boiler is with risk management to avoid work accidents that can cause victims or losses to the company.

Basically, risk management is the application of management functions in risk management, especially the

risks faced by organizations or companies (Prameswari and Aisyah, 2023). Risk management is a procedure involving specific methodologies through which an organization evaluates the risks associated with each operational endeavor in order to meet its strategic objectives. Risk management consists of risk identification, risk assessment, and risk control which means risk management can be used in the process identify, measure and ascertain risks, and develop strategies for managing risks that exist in the workplace (Fathoni, 2020).

PT Dharmapala Usaha Sukses located in Cilacap City is a company engaged in providing crystal sugar or often referred to as granulated sugar. In carrying out its functions many important systems are interconnected. One of the most important parts of the sugar processing system is the boiler. Boiler is one of the tools in the factory department division at PT Dharmapala Usaha Sukses which functions to take sugar cane juice or sap through the procession of milking and boiling water to produce steam which is used as a sap cooking process. In addition, there are risks of

hazards that exist in the boiler area, especially for components or machines that work at high temperatures and pressures that are at risk of failure or experiencing fires and explosions if the temperature reaches >760oC and the valve is not open. Based on a preliminary study by conducting interview with safety officer at PT Dharmapala Usaha Sukses, he said the workers had experienced occupational diseases due to exposure to heat and dust. The majority of the cases are dehydration, blinding, and respiratory problems. The observation results from the preliminary study also found that there are potential hazards in the form of heat and dust exposure due to flue gas emissions from boiler combustion. Previously, in carrying out risk management, PT Dharmapala Usaha Sukses had carried out risk management with a hazard and operability study (Hazop). Therefore, the researcher wants to analyse the AS/NZS 4360: 2004 method in the process of boiler machine tools at PT Dharmapala Usaha Sukses Cilacap.

RESEARCH METHOD

This type of research is analytical qualitative using data collection techniques, namely through in-depth interviews using interview guide, observation using checklist sheet, and document review to complete the required data. Risk analysis was conducted using the AS/NZS 4360:2004 method in the form of a risk analysis matrix which is used to determine the level of risk of hazards in the operation of boiler equipment and maintenance of boiler equipment components. The subjects in this study were 3 informants who were determined by purposive sampling technique. The purposive sampling technique is a technique used to determine the selection of informants based on certain considerations, namely people who are considered to know the most about the data needed in this study and workers who have been working for a long time. Informants consist of supervisors (main informants), work leaders (supporting informants 1), and workers (supporting informants 2). To test the credibility and validity of the data, triangulation of sources, data and methods was used. Source triangulation is carried out by determining several sources such as supervisors, work leaders and workers so that identifying the suitability of one source with another can be done, Data triangulation is carried out by matching interview results with supporting observation method that can inform the validity of the information, and Method triangulation was carried out by re-analyzing using AS/NZS 4360:2004 which previously used the Hazard and Operability Study (Hazop) method.

RESULT AND DISCUSSION

Boiler is one of the most important parts of the sugar processing system at PT Dharmapala Usaha Sukses which functions to take sugar cane juice or sap through the procession of milking and boiling water to produce steam which is used as a sap cooking process. Based on the result of interview in this research, it is known that the boiler operation at PT Dharmapala Usaha Sukses consists of refueling, maintaining water pH, determining the water level in the boiler drum, and starting the boiler. Meanwhile the maintenance of boiler machine components consists of

inspecting conveyor belts, cleaning furnace parts, steam drums, inspecting all wall tubes, cleaning savers, cleaning superheaters, cleaning superheater pipes and fuel nozzles. In addition, based on the results of observations related to the maintenance of boiler components at PT Dharmapala Usaha Sukses Cilacap, it is also known that there is already an SOP document and a preventive maintenance schedule, and monitoring is also carried out through safety patrols to ensure that conditions around the company comply with existing standards.

Risk Identification on Boiler Equipment at PT. Dharmapala Usaha Sukses

Operation of Boiler Equipment

Determining the water level in the boiler drum

The process of determining the water level in the boiler drum at PT Dharmapala Usaha Sukses is by using a water level controller. After the water is appropriate then turn off the feed pump on the feed pump panel. From this process, researcher found potential hazards including noise, heat exposure, and altitude. These

potential hazards can cause the risk of hearing loss, dehydration, stress, fatigue, falls, and injuries.

Feed water pH

Based on the observation of the water analysis report document regarding the pH of the feed water, there is still a water pH that is too low in the boiler water sample which can result in carry over. This can cause scale along the steam line pipe to the turbine and can cause leaks in the pipe.

Checking the force draft fan

In checking the force draft fan, researcher found potential hazards including machine noise in the force draft fan area which is at risk of hearing loss. In addition, there is the potential for tripping over components that can cause the risk of falling to injury.

Coal refueling

Refueling at PT Dharmapala Usaha Sukses uses loader tools so that it does not require a lot of time and effort. At the refueling stage, researcher found an accumulation of coal dust that could pose a risk of fire, respiratory problems and glare.

Start-up boiler

In the boiler start-up operation, there are potential noise and potential

height hazards in the boiler start-up panel area. Noise can result in hearing loss, contact with steam pipes can result in burns and height hazards can risk falling which can result in serious injury or even death. Potential height hazards in the boiler start up panel area can result in the risk of falling and slipping which can result in minor or even severe injuries to workers.

Table 1. Risk Identification Boiler Operation

Boiler operation activities	Hazards	Risks
Determining the water level in the boiler drum.	- Noise - Heat exposure - Altitude	- Hearing impairment - Dehydration, stress, impaired concentration - Falls, injuries
Maintains the pH of the water.	- Water pH too low/high	- Corrosion of the pipe - Scale on the pipe - Leakage in the pipe
Checking the force draft fan.	- Noise - Electric current - Tripping over components	- Hearing loss - Electrocution - Falls, injuries
Refueling.	- Fire - Coal dust exposure	- Material loss - Respiratory distress - Lung damage
Start up boiler	- Noise - Contact with high altitude water vapour pipe	- Hearing loss - Burns - Fall, injury

Maintenance of Boiler Equipment

a.   Checking the conveyor belt

Based on direct observation of the conveyor belt, there is a potential hazard in the form of coal dust accumulation which can cause fires in the conveyor belt area. Exposure to coal dust which can cause respiratory problems and blinding. Pinched conveyor belt machine running.

b.   Cleaning furnace

Based on direct observation in the combustion chamber or furnace section, there are potential hazards in the form of exposure to combustion residue dust which can cause respiratory problems, blinding, tripping over nozzle components that can risk falling and hitting nozzle components or furnace walls and can cause minor or serious injuries to workers.

c.   Cleaning steam drum

Based on direct observation of the steam drum, there are potential hazards in the form of limited space which can result in shortness of breath, bumping, and tripping over components which can result in minor or serious injuries to workers.

d.   Wall tube checking

From the observations obtained, several potential hazards in the boiler wall tube checking area include heat exposure, noise, contact with steam pipes.

e.   Checking the superheater pipe

Based on direct observation of the superheater pipe checking activity, there is potential for tripping over components, heat exposure, and contact with hot pipes.

f.   Cleaning economizer

Based on direct observation of economizer cleaning activities, there are potential hazards in the form of dust exposure which can cause respiratory problems and blinding, tripping over jet pump air hose tools which can cause falls and collisions which can cause minor or serious injuries to workers.

g.   Cleaning air preheater

Based on observations of the preheater air cleaning activity using an air jet pump, there is the potential for slipping due to slippery areas. This can result in falls and can cause minor/serious injuries to workers.

h.   Checking the fuel nozzle

Based on direct observation of checking the nozzle components in the combustion chamber, the potential hazards are tripping over nozzle components which can risk falling and causing injury, exposure to combustion residue dust which can cause respiratory problems, exposure to heat which can cause dehydration, stress and concentration problems.

Table 2. Risk Identification of Boiler Component Maintenance

Boiler Maintenance Activities	Hazards		Risks	
Conveyor belt checking	-	Fire	-	Financial loss.
	-	Dust exposure	-	Death
	-	Engine running	-	Environmental pollution.
	-	Belt breaks	-	Respiratory distress.
			-	Pinched.
Furnace Cleaning	-	Tripping over nozzle components	-	Injury
			-	Falls
	-	Exposure to dust	-	Slipping
			-	Respiratory distress
			-	Lung damage
			-	Dislocation
Steam drum cleaning	-	Limited space	-	Injury
	-	Tripping over components	-	Shortness of breath
	-	Bumped		
Walltube checking	-	Noise	-	Respiratory distress
	-	Contact with steam pipes	-	Burns
			-	Dehydration, work stress, impaired concentration.
	-	Heat exposure		
Checking super heater pipes	-	Tripping over component	-	Injury
			-	Dehydration, work stress, impaired concentration
	-	Heat exposure		
	-	Contact with steam pipes	-	Burns
Cleaning economizer	-	Exposure to dust	-	Respiratory distress
	-	Tripping over a hose	-	Falls
			-	Injury
			-	Dust glare
Cleaning air pre heater	-	Slippery areas	-	Slipping
			-	Falls
			-	Injury
Fuel nozzle checking	-	Tripping over component	-	Falls
			-	Injury
	-	Exposure to dust	-	Respiratory distress
	-	Exposure to heat	-	Dehydration, work stress, impaired concentration

Risk Assessment on boilers at PT. Dharmapala Usaha Sukses

Based on the risk assessment of boiler equipment operation (Table 3) at PT Dharmapala Usaha Sukses Cilacap, it is known that refueling is the highest risk activity compared to other activities because it can cause death, so control is needed to prevent this risk. Besides that, the results of the risk assessment of boiler maintenance at PT Dharmapala Usaha Sukses Cilacap shows that checking the conveyor belt is the highest risk activity compared to other activities because it can also cause death. Meanwhile the activity with the lowest risk is checking the super heater pipe.

Table 3. Risk Assessment on Boiler

Activity	Hazard	Risk	Risk analysis			Risk score	Risk level
			Exposure	Likelihood	consequences		
Operation of Boiler Equipment							
Determining the water level in the boiler drum with the feed pump	- Noise - Heat exposure - Altitude	- Respiratory distress - Dehydration, work stress, impaired concentration - Fall, minor or serious injury	6	3	3	54	*Medium*
Determining the feed water Ph	- Water pH too low/high	- Pipe leaks - Corrosion in pipes - Scale on pipes	0,5	3	15	22,5	*Medium*
Checking the force draft fan	- Height - Noise - Electric current	- Hearing loss - Electrocuted - Fall, minor/serious injury	6	3	3	54	*Medium*
Refueling	- Fire - Dusty area	- Death - Material loss - Production hampered - Environmental pollution - Respiratory disorders - Vision impairment - Flicker	2	3	40	240	*High*
Start-up boiler	Noise Contact with water vapor pipes Height	- Hearing loss - Burns - Fall, minor/serious injury	6	3	3	54	*Medium*
Maintenance of Boiler Equipment							
Checking the belt conveyor	- Running machine - Dusty area - Fire	- Death - Financial losses - Environmental pollution - Respiratory disorders - Visual impairment, blurring. - Stuck	2	3	40	240	*High*
Cleaning furnace	Tripping over nozzle components	- Injury - Fall - Slipped	3	6	3	54	*Medium*

Activity	Hazard	Risk	Risk analysis			Risk score	Risk level
			Exposure	Likelihood	consequences		
	Dusty area	- Respiratory disorders, blink					
Cleaning steam drum	Limited space Tripping over a component Bumped Lack of lighting	- Falls, Injuries - Shortness of breath - Vision impairment	3	6	3	54	Medium
Check all wall tube	Noise Heat exposure Contact with steam pipes	- Hearing loss - Dehydration, work stress, concentration disorders - Burns	2	3	3	18	Acceptable
Checking the super heater pipe	noise Tripping over a component Heat exposure Contact with water vapor pipes	- Hearing loss - Dehydration, work stress, concentration disorders - Burns	1	3	3	9	Acceptable
Cleaning economizer	Dust exposure Tripping over a hose	- Respiratory disorders, blink - Fall, minor/serious injury	3	6	3	54	Medium
Cleaning air preheater	Slippery area Tripping over a hose	- Slipped, fallen, minor/serious injury	3	6	1	18	Acceptable
Checking the fuel nozzle	Tripping over nozzle components Dusty area	- Fall, minor/serious injury - Respiratory disturbances, blink	3	6	3	54	Medium

Risk Control pada Boiler di PT. Dharmapala Usaha Sukses

Tabel 4. Risk Control Boiler

Activity	Hazard	Risk	Risk analysis			Risk score	Risk level	Control	Researcher recommendations
			Exposure	Likelihood	Consequences				
Operation of Boiler Equipment									
Determining the water level in a boiler drum with a feed pump	Noise Heat exposure Height	Hearing loss Dehydration, stress, concentration disorders Fall, minor/serious injury	6	3	3	54	Medium	1. Installing handrails on stairs 2. Prepare SOP 3. Boiler	1. Ensure the ladder and handrails are in safe condition 2. Installing safety signs

Activity	Hazard	Risk	Risk analysis			Risk score	Risk level	Control	Researcher recommendations
			Exposure	Likelihood	Consequences				
								operation inspection 4. Briefing 5. Using PPE (ear plug)	in the workplace 3. Provide drinking water in the workplace 4. Ensure workers are in good health
Determining the Ph of feed water	The PH of the water is too low/high	Corrosion in pipes Scale on pipes Leaks in pipes	0,5	3	15	22,5	Medium	1. Provide manual book standard water boiler 2. Inspection of water samples in the laboratory 3. Briefing	Ensure that the water is in accordance with the standard water boiler
Force draft fan check	Noise Height Electric current	Hearing loss Fall, minor/severe injury Electrocuted	6	3	3	54	Medium	1. Installing hand rails on stairs 2. Installation of interlock systems 3. Prepare SOP 4. Safety patrol 5. Briefing 6. Using PPE (ear plug)	1. Ensure that the ladder and handrails are in safe condition 2. Installing safety signs in the workplace 3. Ensure workers are in good health
Refueling	Fire Dusty area	Death Material loss Production hampered Environmental pollution Respiratory disorders Vision impairment	2	3	40	240	High	1. Installing cyclones 2. Prepare SOP 3. Safety patrol 4. Briefing 5. Use PPE (masks, safety glasses)	1. Installing safety signs in the workplace 2. Routine check of coal temperature 3. Using KN95 masks
Start-up boiler	Noise Contact with water	Hearing loss Burns Fall, minor/severe injury	6	3	3	54	Medium	1. Installing handrails on stairs	1. Ensure ladders and handrails are in safe condition

Activity	Hazard	Risk	Risk analysis			Risk score	Risk level	Control	Researcher recommendations
			Exposure	Likelihood	Consequences				
	vapor pipes Height							2. Prepare SOP 3. Safety patrol 4. Briefing 5. Use PPE (earplug, wearpack)	2. Installing safety signs in the workplace 3. Ensure workers are in good health
Boiler Equipment Maintenance									
Checking the belt conveyor	Fire Dusty display Running machine	Death Financial losses Environmental pollution Respiratory disorders Vision impairment Stuck	2	3	40	240	High	1. Installing cyclones 2. Prepare SOP 3. Briefing 4. Use PPE (masks, safety glasses, gloves)	1. Installing safety signs in the workplace 2. Ensure workers are in good health 3. Using KN95 masks
Cleaning furnace	Tripping over nozzle components Dusty areas	Injury Fall Slipped Respiratory disorders	3	6	3	54	Medium	1. Safety patrol 2. Briefing 3. Use PPE (safety shoes, masks, safety glasses)	1. Installing safety signs in the workplace 2. Ensure workers are in good health 3. Using KN95 masks
Cleaning steam drum	Limited space Tripping over a component Bumped Lack of lighting	Falls, Injuries Shortness of breath Vision impairment	3	6	3	54	Medium	1. Using a flashlight 2. Safety patrol 3. Briefing 4. Using PPE (safety helmet, safety shoes)	1. Ensuring workers are in good health 2. Ensuring workers use PPE that meets standards
Check all wall tube	Noise Heat exposure Contact with steam pipes	Hearing loss Dehydration Burns	2	3	3	18	Acceptable	1. Safety patrol 2. Briefing 3. Using PPE (ear plug, wearpack, safety shoes).	1. Installing safety signs in the workplace 2. Provide drinking water in the workplace 3. Ensuring workers are

Activity	Hazard	Risk	Risk analysis			Risk score	Risk level	Control	Researcher recommendations
			Exposure	Likelihood	Consequences				
									in good health 4. Ensuring workers use PPE that meets standards
Checking the super heater pipe	noise Tripping over a component Heat exposure Contact with water vapor pipes	Hearing loss Dehydration Burns	1	3	3	9	Acceptable	1. Safety patrol 2. Briefing 3. Using PPE (ear plug, safety shoes, wearpack).	1. Installing insulation on pipes 2. Installing safety signs in the workplace 3. Provide drinking water in the workplace 4. Ensuring that the work tools are in accordance with ergonomic principles
Cleaning economizer	Dust exposure Tripping over a hose No ergonomics	Respiratory disorders, dizziness. Falls, minor/serious injuries. Easily tired, spinal and neck disorders.	3	6	3	54	Medium	1. Conducted inspections 2. Safety patrol 3. Briefing 4. Use PPE (masks, glasses, safety shoes)	Ensuring workers are in good health
Cleaning air preheater	Slippery area Tripping over a hose No ergonomics	Slipped, fallen, minor/serious injury Injuries and injuries Easily tired, spinal and neck disorders	3	6	1	18	Acceptable	1. Conducted inspections 2. Safety patrol 3. Briefing 4. Use PPE (masks, safety shoes)	1. Ensure workers are in good health 2. Ensure employees use PPE that complies with standards
Checking the fuel nozzle	Tripping over nozzle components Dusty areas	Falls, minor/serious injuries. Respiratory disorders, dust flickering.	3	6	3	54	Medium	1. Safety patrol 2. Briefing 3. Use PPE (safety shoes, masks, glasses)	1. Ensure workers are in good health 2. Using KN95 masks

Based on the research results (Table 4), several potential hazards were obtained including noise, heat exposure, contact with hot pipes, dust exposure, explosion, electric current and height. Noise can be caused by the activity of determining the water level in the steam drum, boiler start-up activity and force draft fan checking activity. Noise hazards in boiler operations include continuous noise. If the noise with high intensity for a long time can cause hearing loss. Noise that continuously heard by workers will reduce the sharpness and function of the worker's hearing organs especially in timpani membrane and become a decrease in the worker's hearing ability (Putri et al, 2021). In this case, the control actions that carried out are preparing SOP, doing inspection of boiler operation, giving direction or briefing to workers before starting work, and using ear plug when working in boiler operations. This is in line with research conducted by Rimantho and Cahyadi (2015) which states that among the many disorders caused by noise, the most serious disorder is deafness.

Heat exposure comes from the activity of determining the water level in the steam drum. Exposure to heat can cause dehydration because working in a hot environment the body sweats a lot, this is in line with research conducted by Wahyuni, Entianopa and Kurniawati (2020) which states that high environmental temperatures or heat cause the release of body fluids through breathing to increase, resulting in dehydration. The results of the interview the highest air temperature was 30^0C. Contact with hot water vapour pipes can cause burns. This hazard can be caused by boiler start-up activities. Exposure to dust can cause shortness of breath, blinding and lung damage. This is similar to a research conducted by Abidin et al. (2021) which states that exposure to dust can cause lung problems in workers. This is because dust inhaled by workers can irritate the respiratory tract so that respiratory problems can occur in the worker's lungs (Maradjabessy et al, 2021). Dust exposure is caused in the area of boiler refuelling activities with coal. Electric current hazards can cause electric shock. The danger of electric current is found in the activity of

checking the force draft fan. Height hazards come from activities in boilers that use stairs. Height hazards can pose a risk of falling which can cause injury or even death. Leakage hazards come from crusted water pipes when the pH of the water is not in accordance with the standard. Water pipe leakage hazards can cause damage to components, stop production and can threaten the safety of workers.

The results of the risk assessment show that most of the risks in the boiler operation of PT Dharmapala Usaha Sukses are in the medium category, namely hearing loss, dehydration, stress, fatigue, falls, injuries and burns. The risk is classified as medium because it has an important impact on workers and has a fairly high probability of occurrence, this is in line with Bastuti (2021), which states that a potential hazard is declared to be of medium value if it causes serious injury but not permanent disability or for the company to suffer losses. The risk of fire is in the high category, because it is possible to occur and has an impact related to death and minor damage to the environment. This is in line with

Bastuti (2021) which states that the potential danger is considered high because of severe injury and triggers death or triggers a serious impact on the company's business continuity. Fire is one of the most detrimental events because it can disrupt national productivity and reduce community welfare. In various countries, the losses are enormous because they involve high asset values, production processes and employment opportunities (Serani, Lina and Isyatun, 2015).

In boiler maintenance, several potential hazards are obtained including fire, tripping over components, exposure to dust, limited space, lack of lighting, slipping and heat exposure. Fire comes from the accumulation of coal dust in the conveyor belt checking activity area. Fire hazards can cause component damage, burns and stop production. Tripping over components comes from furnace cleaning and nozzle checking activities. Tripping over components can risk falling and bumping which can cause injury. Dust exposure comes from the activities of checking conveyor belts, cleaning furnaces, and cleaning

economizers. Exposure to dust can result in shortness of breath, blinding and lung disorders. Confined space comes from pipe cleaning activities in the boiler drum. Confined space can cause hazards in the form of collisions with components and shortness of breath. This is in line with the research conducted by Nuzuliyah, Sujoso and Hartanti (2014) which states that working in confined spaces has hazards that can result in injury to loss of life, the main danger contained in confined spaces is low oxygen levels.

The results of the risk assessment found that most of the risks in the boiler maintenance of PT Dharmapala Usaha Sukses are in the medium category, namely injuries, falls, slips, respiratory problems, hearing loss, and visual impairment. The risk is classified as medium because based on the risk level >20 which has a serious impact on workers and has a fairly high probability of occurring in the activities of cleaning furnaces, cleaning steam drums, cleaning economizers and checking nozzles. This is in line with the research conducted by Bastuti (2021) which states that a potential hazard is

declared to be of medium value if it causes serious injury but not permanent disability or loss to the company. The risk from the activities of checking the superheater pipe, checking all walltube and cleaning prehearter air is in the acceptable or low category because it has a risk level <20 has a mild impact on workers and does not cause losses to the Company. This is in line with the research of Sabrina and Widharto (2016) which states that the potential danger is declared low value because it only causes minor injuries or does not cause losses to the company. Fire can occur in the conveyor belt checking activity area. Fire is included in the high category, based on the risk level obtained a number >200 because it is possible to occur and has an impact related to death and minor damage to the environment. This is in line with the research of Safitri and Megasukma (2021), which states that the potential danger is declared high because of severe injury and triggers death or a serious impact on the Company's business continuity.

Risk control efforts in boiler operation and maintenance activities

that have been carried out by PT Dharmapala Usaha Sukses include installing cyclones, providing SOP schedule preventive maintenance, installing handrails on stairs, installing interlock systems and providing personal protective equipment.

The risk level that is quite high for workers is fire and exposure to coal dust which can cause fire, shortness of breath and blinding. Risk control carried out by PT Dharmapala Usaha Sukses is installing bag filers or cyclones and providing personal protective equipment, namely masks and safety glasses. These control efforts have gone quite well but some improvements are still needed to maximize control efforts. Recommendations from researchers are to provide health services in the form of general medical check-up periodically to workers. This is useful for initial screening of workers if work-related illnesses occur, install safety signs and routine checking of coal temperature. Installation of safety signs in the workplace serves to inform workers about the occupational safety and health

hazards of a particular activity, area, or work equipment in order to give workers awareness of the importance of occupational safety and health. This is in line with the research of Hamidi et al (2022), which states that the installation of safety signs aims as a sign or message to everyone in the work area to always be careful and stay away from sources of danger. Routine checking of coal temperature is carried out to determine the increase or change in coal temperature that can cause a fire. This is in line with the research of Triono and Ambak (2015) which states that routine checking of coal temperature is one of the prevention of self-burning carried out using a thermometer, if the temperature reaches 50-60^{0}C, spreading, FIFO (first in first out), and stockpile compaction will be carried out.

Noise exposure in the boiler operation and maintenance area is above the noise threshold value which can lead to safety and health problems (Said et al., 2022). In this case, PT Dharmapala Usaha Sukses has provided personal protective equipment in the form of ear plugs, but some improvements are still

needed to maximize control efforts. Control efforts for the potential hazards of noise exposure can be done by conducting provide health services in the form of general medical check-up periodically to workers, and routine measurements of noise intensity in the work area and requiring workers to use ear protection equipment while in the work area. This is in line with the research of Hidayat et al. (2019), efforts that can be made are the measurement of noise intensity carried out periodically, the results of which are used as data as a basis for determining the working period and length of work. So that workers can know how long they have to be in a work environment where the noise intensity does not meet the requirements, the need for the use of PPE, especially APT (ear protective equipment) such as earplugs to reduce noise 8 - 30 dB to minimize the risk of hearing loss.

Workers operating and maintaining boiler equipment at PT Dharmapala Usaha Sukses are at risk of dehydration. This is due to heat exposure in closed work areas or due to hot weather. Therefore, researchers suggest that management needs to provide drinking water in work areas exposed to heat. This is in line with the research of Nofianti and Koesyanto (2019) which states that workers exposed to heat must consume one glass of drinking water (250 ml) every 20 minutes to avoid dehydration.

Boiler is a building with a height of approximately 18 meters. The activities of operating boiler equipment and maintaining boiler components sometimes use stairs. The risk that can be caused by height hazards is falling and slipping which can cause injury to workers. The risk control carried out by PT Dharmapala is to install handrails on the stairs. However, some improvements are still needed to maximize control efforts. Control efforts for potential height hazards can be carried out by ensuring that workers are in good health so that work accidents do not occur because workers find it difficult to concentrate. This is in line with the research of Nofianti and Koesyanto (2019) which states that to maintain the physical condition of employees, regular general health checks are

carried out. This helps in controlling unwanted risks.

CONCLUSION AND SUGGESTION

Based on the results of the research that has been conducted, the researcher can draw the following conclusions:

a. The results of boiler risk identification at PT Dharmapala Usaha Sukses can be summarized as follows:

1) Operation stage

Based on the results of the research that has been carried out, it is known that there are various potential hazards, including acceptable to medium risks such as [1] noise which can be at risk of causing hearing impairment, [2] exposure to heat at risk of dehydration, [3] exposure to dust at risk of respiratory problems, [4] contact with water vapor pipes at risk of burns, to high risk which can cause fatal problems or death such as [1] explosions at risk of component damage, obstruction of production and injury to workers, [2] electric current at risk of electric shock, and [3] height at risk of falling which can cause injury.

2) Maintenance stage

Based on the results of this research, it is known that risk identification can be concluded that the potential hazards contained in boiler maintenance are [1] fire, [2] dust exposure, [3] noise, [4] heat exposure, [5] contact with water pipes, [6] pinched, [7] tripping over components [8] bumped and [9] slippery areas. These potential hazards can cause risks of hazards ranging from acceptable risk to even death if not controlled properly, and can cause losses for the company.

b. The results of the risk assessment on the boiler at PT Dharmapala Usaha Sukses can be summarized as follows:

1) Broiler operation

Based on the results of the research that have been carried out, it is known that the risk assessment on operation can be concluded that most of the risk levels are in the medium category, namely in the activity of determining the water level in the boiler drum with a feed pump, checking the force draft fan, and starting up the boiler. While the refueling activity is in the high category.

2)   Maintenance stage

The results of the risk assessment on boiler maintenance activities at PT Dharmapala Usaha Sukses know that most of the risk levels are in the medium category, namely in the activities of cleaning furnaces, cleaning steam drum, cleaning economizers and checking fuel nozzles. Risk level in the acceptable category is in the activity of checking all wall tube, checking the superheater pipe and cleaning the preheater water while the risk level in the high category is in the activity of checking the conveyor belt.

3)   Risk control that has been carried out by PT Dharmapala Usaha Sukses on boiler operation and maintenance includes safety patrols, briefings, installing cyclones, providing boiler operation SOPs and SOP schedule preventive maintenance, installing handrails on stairs, installing interlock systems and providing personal protective equipment. To maximize control efforts, safety signs are needed, routine checking of coal temperature, routine measurement of noise intensity in the work area, providing water.

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