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# Post-traumatic Stress Disorder and Depression during COVID-19 Pandemic among Students: Study at Universitas Negeri Semarang

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**Abstract**

The high COVID-19 death rate has an impact on mental disorders. Based an online self-survey on mental health, found a percentage of 63%, 66% and 80% on anxiety, depression and stress, respectively. We aimed to determine factors related to students' mental health during pandemic. A cross-sectional study was conducted yielding 407 students selected consecutively. Data was collected using a questionnaire on google form. Data were analyzed by logistic regression. The results showed that there was a significant relationship between age and stress symptoms (p= 0,038) and depression (p= 0,017), resilience with stress symptoms (p= 0,040) and depression (p<0,001) sleep duration with stress symptoms (p=0,005) and social support with depression (p<0,001) in student at State University of Semarang. The variable that is most strongly associated with symptoms of stress and depression is resilience. Based on this research, the government and universities must provide psychological services and interventions regularly to identify students who have mental health problems.

## Introduction

The world is currently facing the Covid-19 pandemic. Starting from the emergence of the coronavirus acute respiratory syndrome disease in China at the end of 2019, it has now caused a large global outbreak. On January 30, 2020, WHO declared Covid-19 as the sixth public health emergency of international concern (Lai et al., 2020). The government has implemented public health measures such as lock-down policies, social distancing campaigns, use of face masks, and frequent hand washing with soap; however, the incidence of Covid-19 infection is still increasing. Reports of possible reinfection in Covid-19 patients were also reported and occurred in 14.8% of patients (Azam et al., 2020). Massive transmission and high mortality rate cause physical health problems including mental health disorders. This situation is exacerbated by the implementation of restrictive policies that must be carried out by the community, such as isolation, social and physical distancing to large-scale social restrictions or known as PSBB. The policy limits the community to social interaction. Previous research, most respondents (89.6%) agreed that it is better for people to stay at home to face the Covid-19 outbreak (Prajoko, Supit and Azam, 2021).

The education sector is one of those affected by the restriction policy. The Universitas Negeri Semarang is one of the campuses in Indonesia that responds swiftly to the instructions of the Ministry of Education and Culture, by issuing a circular on preventing the spread of Covid-19 infection and an appeal to conduct teaching and learning activities remotely (online learning). This condition makes students forced to adapt in order to understand the material. In the short term this does not seem to be a problem, but in the long term it will make students bored and depressed, so that it causes students to have mental health

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problems, ranging from anxiety to depression (Komala, Choirunnisa and Syamsiah, 2020).

The current literature shows that people affected by COVID-19 may have a high rate of mental health disorders. Psychological exposure to the Covid-19 outbreak differs from individual traumatic events in terms of the temporal nature of the exposure, where the Covid-19 outbreak has been an ongoing exposure for every member of society. Stressful events such as natural disasters have been known to have a significant impact on mental health and can result in conditions such as post-traumatic stress disorder (post-traumatic stress disorders=PTSD) and depression (Tang et al., 2020). Several factors related to mental health disorders in Covid 19, including age, gender, marital status, education, occupation, income, place of residence, close contact with people with Covid 19, accompanying physical and mental health problems, exposure to news and social media. related to Covid 19, coping styles, stigma, psychosocial support, health communication, health care beliefs, personal protective measures, risk of contracting Covid 19, and chances of survival (Hossain et al., 2020)(Xiong et al., 2020) (Tang et al., 2020) (Cao et al., 2020)(Juliane and Machmud, 2020; Luceño-Moreno et al., 2020)

The Association of Indonesian Mental Medicine Specialists (PDSKJI) conducted a survey on mental health through an online self-examination. The examination includes three mental health disorders, namely anxiety, depression and trauma. The survey results for 5 months of the Covid 19 pandemic obtained 4,010 respondents, 64.8% of respondents experienced mental health disorders due to the Covid 19 pandemic. Based on the survey results until April 23, 2020, respondents experienced anxiety and depression were 63% and 66% due to the Covid 19 pandemic. Furthermore, as many as 80% of respondents have PTSD symptoms due to experiencing or witnessing unpleasant events related to Covid 19. Severe, moderate, and mild PTSD symptoms are 46%, 33% and 2% of respondents, while 19% have no symptoms (Specialist Doctors Association of Indonesian Mental Health, 2020).

Iqbal & Rizqulloh (2020) previously conducted research on mental health in students at the State University of Semarang. The research sample came from 44 students. These students are all members of the Unnes Sex Care Community (UKM) Universitas Negeri Semarang for the 2019-2020 period. There were 63.6% of respondents indicated that they had mental health disorders. The conditions or problems that most often arise are 59% (45% - 73%) feel tense, anxious or worried, 50% (42% - 58%) find it difficult to sleep, 50% (42% - 58%) feel tired, 9% (1% - 17%) of the total respondents had thoughts of ending their life in the last 30 days (Iqbal and Rizqulloh, 2020). This study aims to determine the mental health status and the factors associated with it after the Covid-19 pandemic in students at the Universitas Negeri Semarang.

**Method**

The type of research used is analytic observational with a cross-sectional study design. This research was conducted from June to July 2021. The population in this study was 31,022 active undergraduate students at the State University of Semarang. Questionnaires were distributed through the social media platforms of the State University of Semarang internal groups, such as Facebook, WhatsApp, Instagram, Twitter, including sharing links from friends to friends. The inclusion criteria in this study were students from the class of 2017 to 2020 (2nd to 8th semesters) and responded to the questionnaire and were willing to become respondents after reading the informed consent provided on the form. Exclusion criteria are respondents who are incomplete or unable to fill out the questionnaire to completion. The minimum sample size required in this study is 348 students. Samples were taken using a consecutive sampling technique on all college students of the State University of Semarang in 8 faculties who responded completely.

The research instrument used to obtain the required data is a questionnaire. This section of the psychosocial questionnaire contains demographic data consisting of name, gender, age, semester level, history of previous chronic diseases (asthma, diabetes mellitus, hypertension, heart disease, kidney disease, immune disorders and other respiratory diseases), residence status, exposure to social

media and sources of information related to Covid 19 and family income, occupation, parental dependents and sleep duration. The measuring instrument used to measure social support in this study is the Multidimensional Scale of Perceived Social Support (MSPSS); self-resistance was measured using the The Brief Resilience Scale (BRS) questionnaire. The Impact of Event Scale: Revised (IES-R) was used to measure the severity of PTSD symptoms in the past seven days. Depression was measured using the DASS-21 questionnaire (Depression Anxiety Stress Scale-21).

The data collection technique used a survey method with an online questionnaire distribution approach which was published in the form of a google form which was distributed through social media consisting of college students from Universitas Negeri Semarang. After filling out the questionnaire, the student is expected to share the link with other students. Based on the questionnaires that have been distributed, a total of 409 respondents who filled out the questionnaires, of which 2 respondents did not fill out the questionnaire completely while 407 respondents filled out the questionnaire completely and were included in the final analysis. Data processing is carried out using the application of SPSS for Windows version 24. Data analysis used chi square test with cell pooling and logistic regression. The research procedure has been approved and received ethical clearance Number: 104/KEPK/EC/2021 by the Health Research Ethics Commission, Department of Public Health, Faculty of Sports Science, State University of Semarang and each respondent received an online explanation through the provision of information before filling out the questionnaire, stating that they agreed by clicking the agree button to fill out the questionnaire.

**Results and Discussion**

Universitas Negeri Semarang has eight faculties consisting of the Faculty of Education, Faculty of Languages and Arts, Faculty of Social Sciences, Faculty of Mathematics and Natural Sciences, Faculty of Engineering, Faculty of Sports Science, Faculty of Economics and Faculty of Law. Students of the Universitas Negeri Semarang come from various parts of Indonesia. The Covid-19 pandemic has had an impact on people's lives, one of which is the education sector. Distance learning is an option for the Universitas Negeri Semarang during the Covid 19 pandemic and has been implemented for 1 year.

Table 1. Frequency Distribution of Respondents Characteristics

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Female | 339 | 83,3 |
| Male | 68 | 16,7 |
| **Age** | | |
| 15 – 20 years old | 209 | 51,4 |
| 21 – 25 years old | 198 | 48,6 |
| **Semester Level** | | |
| Semester 2 | 97 | 23,8 |
| Semester 4 | 81 | 19,9 |
| Semester 6 | 134 | 32,9 |
| Semester 8 | 95 | 23,3 |
| **Previous Chronic Disease History** | | |
| Any | 46 | 11,3 |
| None | 361 | 88,7 |
| **Residential Area** | | |
| City | 133 | 32,7 |
| Village | 274 | 67,3 |
| **Residence Status** | | |
| Boarding house or rent house | 63 | 15,5 |

| | | |
|---|---|---|
| Living with parents | 344 | 84,5 |
| **Parent's Job** | | |
| Not working | 10 | 2,5 |
| Entrepreneur/farmer/labor/fisherman | 238 | 58,5 |
| Private employees | 73 | 17,9 |
| Indonesian Civil Servant/Police/ARMY | 65 | 16,0 |
| Retired | 21 | 5,2 |
| **Parental Dependence** | | |
| 1 child | 123 | 30,2 |
| 2 children | 180 | 44,2 |
| 3 children | 78 | 19,2 |
| ≥ 4 children | 26 | 6,40 |
| **Parents' Income** | | |
| Less than IDR 1.500.000,00 | 115 | 28,3 |
| IDR 1.500.000,00 - IDR 2.500.000,00 | 104 | 25,6 |
| IDR 2.500.000,00 - IDR 3.500.000,00 | 87 | 21,4 |
| More than IDR 3.500.000,00 | 101 | 24,8 |
| **Family Economy Status** | | |
| Low | 215 | 52,8 |
| High | 192 | 47,2 |
| **Media Exposure and Information Related to Covid-19** | | |
| <15 minutes/day | 270 | 66,3 |
| 15-29 minutes/day | 87 | 21,4 |
| 30-59 minutes/day | 22 | 5,4 |
| 60-119 minutes/day | 6 | 1,5 |
| ≥ 120 minutes/day | 22 | 5,4 |
| **Sleep Duration** | | |
| <5hours/night | 61 | 15,0 |
| ≥5 - <7 hours/night | 217 | 53,3 |
| ≥ 7 - 8 hours/night | 115 | 28,3 |
| ≥ 8 hours/night | 14 | 3,4 |
| <5hours/night | 61 | 15,0 |
| **Social Support** | | |
| Low | 31 | 7,6 |
| Medium | 162 | 39,8 |
| High | 214 | 52,6 |
| **Self-Restraint** | | |
| Low | 112 | 27,5 |
| Normal | 277 | 68,1 |
| High | 18 | 4,4 |
| **PTSD Symptoms** | | |
| Low | 133 | 32,7 |
| High | 274 | 67,3 |
| **Depression Level** | | |
| Normal | 178 | 43,7 |
| Minor | 42 | 10,3 |
| Medium | 69 | 17,0 |
| Severe | 46 | 11,3 |
| Very Severe | 72 | 17,7 |

Souces: Primary Data 2021

Most of the respondents in this study were female (83.3%), aged 15 – 20 years (51.4%), 6th semester students (32.9%), had no previous history of chronic disease (88.7%). ), lives in rural areas (67.3%), lives with parents (84.5%), works as entrepreneurs, farmers, laborers or fishermen (58.5%), parents have 2 dependent children (44.2% ), parents' income is less than Rp. 1,500,000 (28.3%), low family economic status (52.8%), length of exposure to media and information related to covid-19 <15 minutes/ day (66.3% ), the average sleep duration in one month 5 - <7 hours/night (53.3%), high social support (52.6%), and normal self-restraint (68,1%).

Based on the results of the study, it is known that respondents who have PTSD symptoms are at high risk (52.8%), while respondents who have PTSD symptoms are at low risk (32.7%). Depression is divided into several levels of depression, namely mild depression (10.3%), moderate depression (17.0%), major depression (17.7%), and very severe depression (17.7%). While respondents who are normal or not depressed (43.7%).

Table 2. Bivariate Analysis of PTSD Symptoms

| Variable Name | PTSD Symptoms | | | | PR | 95% CI | P value* |
|---|---|---|---|---|---|---|---|
| | High | | Low | | | | |
| | N | % | N | % | | | |
| **Gender** | | | | | | | |
| Female | 228 | 67,3 | 111 | 32,7 | 1,01 | 0,58-1,77 | 1,000 |
| Male | 46 | 67,6 | 22 | 32,4 | | | |
| **Age** | | | | | | | |
| 15-20 years old | 151 | 72,2 | 58 | 27,8 | 1,59 | 1,05-2,41 | 0,038 |
| 21-25 years old | 123 | 62,1 | 75 | 37,9 | | | |
| **Semester Level** | | | | | | | |
| Semester 2 | 71 | 73,2 | 26 | 26,8 | 0,69 | 0,41-1,15 | 0,197 |
| Not Semester 2 | 203 | 65,5 | 107 | 34,5 | | | |
| **Status of residence** | | | | | | | |
| Boarding house or rent house | 39 | 61,9 | 24 | 38,1 | 1,32 | 0,76-2,31 | 0,395 |
| Living with parents | 235 | 68,3 | 109 | 31,7 | | | |
| **Family Economy Status** | | | | | | | |
| Low | 145 | 67,4 | 70 | 32,6 | 0,98 | 0,65-1,49 | 1,000 |
| High | 129 | 67,2 | 63 | 32,8 | | | |
| **Exposure to Covid 19 information** | | | | | | | |
| ≥ 15 minutes/day | 99 | 72,3 | 38 | 27,7 | 1,41 | 0,90-2,21 | 0,161 |
| < 15 minutes/day | 175 | 64,8 | 95 | 35,2 | | | |
| **Sleep Duration** | | | | | | | |
| <7 hours/night | 200 | 71,9 | 78 | 28,1 | 1,91 | 0,33-0,81 | 0,005 |
| ≥7 hours/night | 74 | 57,4 | 55 | 42,6 | | | |
| **Social Support** | | | | | | | |
| Low | 129 | 66,8 | 64 | 33,2 | 1,04 | 0,68-1,57 | 0,927 |
| High | 145 | 67,8 | 69 | 32,2 | | | |
| **Self-restraint** | | | | | | | |
| Low | 61 | 54,5 | 51 | 45,5 | 0,24 | 0,66-0,87 | 0,040 |
| Normal | 198 | 71,5 | 79 | 28,5 | 0,50 | 0,14-1,77 | 0,414 |
| High | 15 | 83,3 | 3 | 16,7 | | Comparator | |

* Chi-square test

Souces: Primary Data 2021

Table 2 presents a cross tabulation that describes the relationship between characteristics and risk factors associated with the appearance of PTSD symptoms in respondents. The table shows a significant relationship with PTSD symptoms according to the Chi-square test on the variables of age, sleep duration and self-resistance. While the variables of gender, semester level status, residence status, family economic status, exposure to information about COVID-19, and social support did not show a significant relationship with the emergence of PTSD symptoms. Ones Age 15-20 years old who have PTSD symptoms have a higher proportion than those aged 21-25 years, as well as sleep duration of less than 7 hours a day and low self-esteem has a higher proportion than the comparison group.

Table 3. Bivariate Analysis of Depression

| Variable Name | Depression | | | | PR | 95% CI | P value* |
|---|---|---|---|---|---|---|---|
| | Depression | | Normal | | | | |
| | N | % | N | % | | | |
| **Gender** | | | | | | | |
| Female | 191 | 56,3 | 148 | 43,7 | 0,98 | 0,58-1,65 | 1,000 |
| Male | 38 | 55,9 | 30 | 44,1 | | | |
| **Age** | | | | | | | |
| 15-20 years old | 130 | 62,2 | 79 | 37,8 | 0,60 | 0,41-0,90 | 0,017 |
| 21-25 years old | 99 | 50,0 | 99 | 50% | | | |
| **Semester Level** | | | | | | | |
| Semester 2 | 60 | 61,9 | 37 | 38,1 | 0,73 | 0,46-1,17 | 0,248 |
| Not Semester 2 | 169 | 54,5 | 141 | 45,5 | | | |
| **Residence Status** | | | | | | | |
| Boarding house or rent house | 32 | 50,8 | 31 | 49,2 | 1,28 | 0,75-2,22 | 0,416 |
| Living with parents | 197 | 57,3 | 147 | 42,7 | | | |
| **Family Economy Status** | | | | | | | |
| Low | 130 | 60,5 | 85 | 39,5 | 0,69 | 0,47-1,03 | 0,088 |
| High | 99 | 51,6 | 93 | 48,4 | | | |
| **Exposure to Covid 19 information** | | | | | | | |
| < 15 minutes/day | 150 | 55,6 | 120 | 44,4 | 1,09 | 0,71-1,65 | 0,765 |
| ≥ 15 minutes/day | 79 | 57,7 | 58 | 42,3 | | | |
| **Sleep Duration** | | | | | | | |
| <7 hours/night | 161 | 57,9 | 117 | 42,1 | 0.81 | 0,53-1,23 | 0,381 |
| ≥7 hours/night | 68 | 52,7 | 61 | 47,3 | | | |
| **Social Support** | | | | | | | |
| Low | 136 | 70,5 | 57 | 29,5 | 0,32 | 0,21-0,48 | 0,001 |
| High | 93 | 43,5 | 121 | 56,5 | | | |
| **Self-restraint** | | | | | | | |
| Low | 39 | 34,8 | 73 | 65,2 | 9,35 | 2,55-34,31 | 0,001 |
| Normal | 175 | 63,2 | 102 | 36,8 | 2,91 | 0,82-10,30 | 0,140 |
| High | 15 | 83,3 | 3 | 16,7 | | Comparator | |

* Chi-square test

Souces: Primary Data 2021

Table 3 presents a cross-tabulation of characteristics and risk factors according to depressive symptoms. The table shows a significant relationship with depressive symptoms from the results of the Chi-square test on the variables of age, social support, and self-restraint. While the variables of gender, semester level status, residence status, family

economy status, and exposure to information about COVID-19 did not show a significant relationship with the emergence of depressive symptoms. Based on the results of the study, it was found that there was a significant relationship between age and symptoms of PTSD (p= 0.038) and depression (p= 0.017) in college students at Universitas Negeri Semarang. These results are in line with research (Cao et al., 2020) who stated that the risk factor for mental health disorders was higher i.e., the younger the age group, they were more likely to develop psychological distress. College students are in the transition period of late adolescence and early adulthood. In their teens, they have to adapt to many things. The pandemic situation shows that teenagers face many problems at home and outside the home that must be overcome. Likewise, the demands for obligations as a student are high. If many problems are not resolved, it is likely that teenagers will be disappointed, have no respect for themselves, and consider themselves a failure. If this situation continues, it will cause health problems (Cao et al., 2020).

The increased negative impact on mental health can be attributed to sudden lifestyle changes and impaired social activity. Other stressors include changing face-to-face classes to online, and changes in living arrangements. According to Notoatmodjo (2012), sufficient age will affect maturity in thinking so that individuals are also mature in acting under any conditions. As they get older, students are less likely to experience mental health problems, this is because the older they are, the more experiences they have, and students' social adaptability and psychological resilience increase.

Students are in the transition period of late adolescence and early adulthood. In their teens, they have to adapt to many things. The pandemic situation shows that teenagers face many problems at home and outside the home that must be overcome. Likewise, the demands for obligations as students are high. If many problems are not resolved, it is likely that teenagers will be disappointed, have no respect for themselves, and consider themselves a failure. If this situation continues, it will cause health problems. Based on the results of the study, it was found that there was a significant relationship between self-restraint with PTSD symptoms ($p = 0.040$) and depression ($p < 0.001$) in State University students of Semarang. This research is supported by research conducted previously by Chi et al. (2020) lower levels of resilience reported significantly higher levels of anxiety, depression, and PTSD.

Resilience is an individual's ability to overcome difficulties and solve problems with positive emotions. It can increase an individual's understanding of happiness and improve psychological health. In the current situation, individuals with high resilience show "mental immunity", which allows them to resist the psychosocial influences of major events. Resilience should be promoted in students because it can reduce their psychological symptoms (Chi et al., 2020). Resilience can be seen as a measure of the ability to cope with stress so that it can be an indicator in dealing with anxiety, depression, and stress reactions (Connor and Davidson, 2003). Resilience is presented as a possible protective factor against symptoms of posttraumatic stress disorder, anxiety and depression. Basically every individual has the ability to face every difficulty in his life. Because every individual must experience difficulties and there is no one who lives in the world without a problem or difficulty. The ability to face adversity will further strengthen him. Someone who has strong reselience will survive during this pandemic (Grothberg, 1999).

The results showed that there was a significant relationship between sleep duration and PTSD symptoms (p=0.005) in college students at Universitas Negeri Semarang. While the results of statistical analysis on the depression variable showed no significant relationship between sleep duration and depression ($p = 0.381$) in college students at the State University of Semarang. These results are in line with previous studies which found that short sleep duration was found to have a strong relationship with PTSD, but contradicted the results of depression where in Tang's study it was found that short sleep duration also had a strong relationship with depression (Tang et al., 2020). The strong association between short sleep duration and PTSD in this study, however,

is in agreement with previous studies in veterans (Swinkels et al., 2013). As it is assumed that sleep duration mediates mental health problems, severe exposure can worsen sleep duration, which in turn can lead to depression or PTSD (Tang et al., 2020). Another study found that nighttime sleep duration was not associated with mental health on any of the scales relevant to reports of anxiety, depression, or somatic complaints (Milojevich and Lukowski, 2016). Given the demonstrated association between sleep duration and mental health problems in this study, in which sleep duration was associated with PTSD but not depression, other specific sleep-related behaviors not analyzed in this study may also have an effect.

The results showed that there was a significant relationship between social support and depression ($p<0.001$) in students at Universitas Negeri Semarang. The results of the analysis on PTSD symptoms ($p = 0.927$) showed that there was no significant relationship between social support and PTSD symptoms in college students at the State University of Semarang. Low perceived social support was significantly associated with an increased risk of anxiety and depressive symptoms. People with low perceived social support are at high risk of experiencing psychological distress, whereas high perceived social support has a positive effect during the COVID-19 epidemic (Cao et al., 2020).

Research of Swinkels et al., (2013), conducted before the pandemic, the results showed that there was a significant relationship caused by social support that was both protective and curative to depression. When individuals feel the burden due to pressure from outside or inside, for example the burden of college, value demands can affect the mood of the individual, if the individual cannot handle this problem it will cause acute stress and can become depressed if there is no treatment for the individual. Social support plays a role in external support that comes from parents, friends and special people. Social support can provide a feeling of security, comfort for the individual's psychology, if this is well received by individuals who are experiencing problems; the possibility of depression is small (Swinkels et al., 2013).

Theoretically, the social support received tends to describe the individual's ability to cope with problems both mentally and physically by refuting stress triggers. The social support normally associated with coping with mental problems may not be sufficient to protect a person from PTSD symptoms in a worldwide pandemic with no predictable endpoint, and the effects of a pandemic cannot be controlled by a single individual. In addition, the pandemic simultaneously impacts multiple areas (financial, relational, and health) with this stress potentially exacerbating PTSD symptoms.

The results showed that there was no relationship between gender and symptoms of PTSD and depression in college students at the State University of Semarang. This research is in line with research conducted by Zhang and Ma (2020) found no significant difference in IES scores between female and male (Zhang and Ma, 2020). Likewise, according to Chen et al (2020), gender did not affect anxiety and depression. This difference indicates that male and female college students experience the same mental health disorders and negative emotions as a result of the epidemic.

Different from research of Tee et al. (2020) which said that mental health disorders tend to be more common in women than men. This is due to biological factors, especially hormonal, making them more susceptible (Tee et al., 2020). According to research by Liu et al. (2020), female gender has been identified as the strongest predictor of post-traumatic stress disorder symptoms after the pandemic. Other studies have shown that the negative impact of the COVID-19 pandemic and rates of depression are higher in female than male (Sønderskov et al., 2020).

Seligman and Roshanhan (1989), described several reasons for the differences in depression between male and female, who were the first female to be more expressive about telling male about depression symptoms. The second reason is biological activity of chemical enzymes, biological factors, and every month there is prementress depression that affects women's emotional condition. The third reason is related to hopelessness that causes depression, women feel hopeless more easily than male, so

depression is more common in female. The last reason, female think more rigidly than male, so female worry more and explain the bad things that are happening in their lives, while male take more action and think less of rigid things.

The results showed that there was no significant relationship between semester level and symptoms of PTSD and depression in college students at the State University of Semarang. The results found in the literature review show that first-year students have higher levels of psychological symptoms compared to senior students (Ratunuman, David and Opod, 2021). First-year students may experience mental health disorders due to lack of parental support related to the chosen major, as well as a transition period between high school and college and adaptation to online learning methods and the surrounding environment, relationships and changing lifestyles. Students who have psychological disorders are not able to follow the learning process optimally. Several problems arise related to the online lecture system, such as readiness, mastery of technology, signals, and other obstacles. This happens not only for first semester students who have adjustment problems in learning, changes in environmental conditions, plus the presence of stressors that can cause depression. However, 4th, 6th and 8th semester students also have the same problem coupled with the higher the semester level, the more it affects the learning materials that must be mastered and understood.

Based on the results of the study, second semester students were the respondents with the highest mental health disorders. Several problems arise related to the online lecture system, such as readiness, mastery of technology, signals, and other obstacles. Studying from home results in several important things, namely 1) lack of sleep due to many tasks; 2) too much time in front of a cellphone or laptop which causes a lack of quality interaction with family, 3) increased laziness and motivation to learn; 4) difficulty to concentrate and lose focus during learning; 5) Feeling tired quickly; and 6) Less able to divide the time. In addition, almost all respondents stated that the internet network is often an obstacle in the learning system at home (Fatimah, S., and Mahmudah, 2020).

The results showed that there was no significant relationship between residence status with symptoms of PTSD and depression in college students at Universitas Negeri Semarang. These results are in accordance with research conducted by Sutjiato et al. (2015), a significance value of 1,000, then there is no relationship between residence and students' mental disorders (Sutjiato, Kandou and Tucunan, 2015). The results of this study indicate that respondents who live in boarding houses are not necessarily more prone to mental health problems than those who live with their families. This is because in the boarding house there are many peers who have a sense of the same fate and think that friends understand their desires more so that they help each other and share. Likewise, respondents who live with their families do not necessarily have mental health problems. It could be that at home, they experience a lot of pressure from parents who are too demanding. In addition, the environment around the house is not supportive during the online lecture period.

Students who live with their parents even though they have family support as a source of strength for students in dealing with the pressures and heavy burdens they face. On the other hand, this can also be caused by the possibility that students who live with their families are actually forced, pressured, or demanded to get good grades and even the highest grades during the lecture process. This is what causes the level of depression in students who live with their parents to be quite high. This result is different from previous research which showed that not living with family was associated with a higher likelihood of experiencing mental health problems (living alone: OR, 1.12; 95% CI, 1.06-1.18; P <0.001; living together with roommates: OR, 1,23; 95% CI, 1,13-1,35; P < .001) (Wathelet et al., 2020).

The results showed that there was no significant relationship between family economic status with symptoms of PTSD (p=1,000) and depression (p= 0.088) in college students at the State University of Semarang. The results of this study are supported by research which states that there is no significant relationship between financial condition and the level of depressive symptoms (Ni et al.,

2020). The family economy status is not a guarantee that the higher the economic level, the less mental health problems. According to Diržytė, Rakauskienė, dan Servetkienė (2017), groups with low economic status are believed to be able to overcome the difficulties encountered due to economic factors with the help of resilience.

The economic changes that have occurred due to the COVID-19 pandemic cannot be accepted by all families. There are families who do not have enough savings to deal with emergencies. The unemployment rate is rising, and to stay in the economy, the government must step in by increasing government spending, to increase consumer demand and investment. However, estimating the economic costs of global disease is now ambiguous as pandemics have a spiraling effect on both national and global economies meaning any economic shock to one country quickly spreads to other countries through the increased trade and financial relations associated with globalization.

The results of the study found that there was no significant relationship between exposure to social media and sources of information related to Covid 19 with PTSD symptoms and depression in college students at State University of Semarang. The null relationship between time spent watching television and mental health suggests that social media may have a special role in adverse mental health during epidemics. Ni and colleagues found that spending more than 2 hours per day on Covid 19 related news via social media was associated with anxiety and depression among community-based adults (Ni et al., 2020). The same result was obtained by Wathelet et al. (2020), that satisfaction with the information received is significantly associated with high levels of distress, stress, anxiety, and depression. The more time students spend reading the news, the more likely they are to have mental health disorder.

The internet is used to simplify daily routines such as doing online learning, remote work and sports. Social media is an inseparable component of human life in this modern era. Many of them can spend hours on social media platforms such as Facebook, Twitter, Instagram, Tiktok, and other social media. However, caution is needed in spending excessive time looking for Covid 19 news on social media given the infodemic and emotional transmission through online social networks (Kramer, Guillory and Hancock, 2014). According to the perception of respondents, 61% have the perception that the sources accessed provide up-to-date and accurate information based on evidence. A total of 38% doubt the accuracy of the information, and 1% perceives that the sources accessed do not provide current and accurate information that is based on evidence. Being wise in sorting and choosing Covid-19 information on social media is considered capable of preventing or anticipating the occurrence of hoax news in the community.

The impact of social media on a person is different. Many factors affect the size of the impact of social media on the person, such as the length of time in using social media, a person's emotional level, mood and physical health. The less time people spend on social media, the more people will feel happier and calmer than people who spend a lot of time on social media. Not only disturbing mental health, uncontrolled use of social media also causes illness and even insomnia.

According to Özdin & Bayrak Özdin (2020), in his research not following new news about Covid 19 can be considered as avoidance behavior. Many Turkish television channels present news broadcasts and programs about the pandemic. At the same time, there is more content about the pandemic on social media (Özdin and Bayrak Özdin, 2020).

Table 4. Multivariate Analysis Factors associated with PTSD symptoms

| Variable | B | Wald | P value | PR | (95% CI) |
|---|---|---|---|---|---|
| Resilience | -1,430 | 4,693 | 0,030 | 0,239 | (0,066– 0,873) |
| Constant | 1,609 | 6,476 | 0,011 | 5,000 | |

Based on Table 4, it is known that the variable that has the strongest contribution to predicting high-risk PTSD symptoms is self-resilience, the value of p=0.030 (p<0.05) which states that there is a significant relationship between resilience and PTSD symptoms in college students at the State University of Semarang. The PR score is 5,000, which means that students who have low resilience tend to have a risk of experiencing PTSD symptoms 5,000 times compared to respondents who have high Self-resilience.

Table 5. Multivariate Analysis Factors Associated with Depression

| Variable | B | Wald | P value | PR | (95% CI) |
|---|---|---|---|---|---|
| Social support | 1,225 | 9,194 | 0,002 | 3,404 | (1,542-7,514) |
| Self-resilience | -2,472 | 12,777 | <0,001 | 0,084 | (0,022-0,327) |
| Constant | 1,185 | 3,287 | 0,070 | 3,272 | |

Based on the results of multivariate analysis (Table 4.39) it is known that there are 2 remaining variables, namely social support and self-resilience. The results of the logistic regression test on the variables of social support and self-defense respectively showed p values, namely p=0.002 and p<0.001 (p<0.05), which stated that there was a significant relationship between social support and self-resilience with depression in college students at Universitas Negeri Semarang. The Wald value of the social support and self-resistance variables are 9,194 and 12,777, respectively. Of the two variables, the variable that has the strongest contribution to predict depression is resilience. This is because social support has the smallest p-value (p<0.01) or the largest Wald value (12,777). The PR value is 0.084, which means that students who have high resilience have a risk of experiencing depression 0.084 times compared to respondents who have low resilience. Resilience is a protective factor that affects the level of depressive symptoms in college students at the State University of Semarang.

The Covid-19 outbreak has had an impact on students. Students can adapt to these difficulties, because these students have resilience. Self-resilience can be used to deal with bad situations, uncertain conditions, and the challenge of drastic changes in new habits due to the Covid-19 pandemic so that it does not cause problems that lead to negative (Subair et al.,2015). Humans who are more capable of coping with extreme events are slightly more vulnerable to risk. The more vulnerable a system is, the lower the individual's ability to adapt and shape change (Subair et al.,2015).

Every human being needs self-restraint to be able to rise from the difficulties or failures faced in life. Usually difficulties or failures will indeed make people feel down to mental disorders, but with the ability of resilience in humans, people will see the meaning of these difficulties or failures and avoid mental disorders. (Nasution, 2011). Resilience is needed to be able to overcome the pressures of the Covid-19 pandemic and recover to a normal level of function. Self-resilience is very important to face today's challenges together at the community level, including in the field of education (Vinkers et al., 2020). In other words, resilience is needed by students to be able to adapt to difficult and stressful situations in the academic environment by trying to show and develop their potential for the better, including during the pandemic. The obstacle and weakness of this research is that filling out the questionnaire is done online. So the data is based on self-reports that rely on the honesty and sincerity of the respondents which can lead to information bias in the study and non-strict random sampling can reduce the representativeness and reliability of the results.

**Conclusion**

The study concluded that the incidence of PTSD symptoms in respondents was 67.3% while moderate-severe depressive symptoms were 46%. Symptoms of PTSD are related to age, sleep duration and resilience while depression is associated with age, social support and self-resilience. The variable that has the strongest contribution to predicting PTSD and depression symptoms is resilience.

So it is recommended that the government and educational institutions should collaborate to solve this problem by providing psychological services of good quality and on time to students. Students are also expected to take full advantage of online counseling facilities provided by universities or the government.

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# Psychosocial Distress in Chronic Disease Patients in Salatiga

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**Abstract**

Patients of hypertension (HT), diabetes mellitus (DM), and mixed (DM-HT) have a vulnerability to stress due to illness and psychosocial responses. Research aimed to identify psychosocial distress, the components, and their relationship to levels of GDP, systole/diastole, and cholesterol in three groups. The quantitative survey research was designed for 42 people, with purposive sampling at the Manunggal Clinic. The collection of psychosocial distress data was by a standard questionnaire. While systole/diastole, GDP, and cholesterol levels with an examination in the laboratory, in April-May 2018. Analysis with ANOVA and Pearson test, $\alpha<0.05$. Shows sufferers have low distress, moderate distress, and high distress. The average score of emotional component (3.2), chronic disease management difficulties (3.2), difficulties with doctors (3.0), and difficulties with friends/people around (2.6). ANOVA test showed no significant difference in psychosocial distress scores (p=0,079). The Pearson test showed a weak correlation between psychosocial distress and systole; diastole; GDP and cholesterol. Conclusion: Psychosocial distress of chronic disease sufferers in Salatiga is included in the category of moderate and high. The highest score on the emotional burden component and the difficulty of chronic disease management. There were no significant differences in psychosocial distress scores, blood pressure, blood sugar levels, and cholesterol in the three groups.

## Introduction

The bidirectional association between chronic physical diseases and psychopathological factors might lead to an exacerbation of both conditions. It is possible to intervene both with medical and psychological science to improve the quality of life. Therefore, physical symptoms. In the history of the patient's illness, the weight of psychological variables plays a fundamental and non-negligible role when the doctor's interest is that of treating the patient from a long-term perspective (Conversano, 2019). The most common chronic physical diseases (namely cardiovascular disease, asthma, arthritis, and osteoporosis) are often complicated by psychiatric symptoms or emotional/psychological subjective suffering. Subjects with diabetes and/or hypertension have a higher proportion of psychological distress compared to healthy subjects (Balajee et al., 2017).

The number of patients with diabetes mellitus, especially type 2, keeps increasing throughout the year. World Health Organization predicted that the number of diabetes mellitus patients in Indonesia will increase to 21.3 million in 2030, while International Diabetes Federation (IDF) envisaged that it will increase by 12 million in 2030 (PERKENI, 2011). Diabetes Mellitus (DM) is a metabolic disease indicated by hyperglycemia caused by the damaged pancreas in producing insulin, function of insulin, or both. Insulin resistance and dysfunction of the pancreatic beta-cell are the main factors that can cause DM. DM complication damages all body organs, both on human patients (PERKENI, 2011) and experiment rats (Navaro, 2010).

The rise of fasting blood sugar levels

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above the normal range or hyperglycemia shows chronic DM. It can cause serious micro and macrovascular complications in the various body organ system. Part of the excess glucose had an enzymatic and non-enzymatic reaction with protein or matters existing in the circulation or system that could accelerate the glycation process. Glucose experiences auto-oxidation that causes overproduction of mitochondrial reactive oxygen species (ROS), antioxidant decrease, and inadequate ROS disposal. In addition, it will also cause a decrease in capillary permeability and will disrupt nutrition intake. Oxidative stress also plays important role in hastening DM complication (Giacco and Brownlee, 2010).

Patients with DM have psychological vulnerability due to uncontrollable blood sugar profile and the period of suffering from DM. In patients with chronic disease management, one will need good management of personal emotional burden, family, other people, medical staff, and management for diabetes mellitus therapy. The existence of these aspects maintains the stability of psychological dynamics of patients with DM and it could affect their blood sugar level and blood pressure. However, these aspects are often overlooked and ignored in DM treatment and management.

Therefore, several efforts to identify the psychosocial aspects of patients with DM, including personal emotional burden, difficulty with family members/other people, difficulty with medical staff, and difficulty in managing DM therapy, need to be done. These aspects will be studied and measured on the amount of role and influence and its specific management so that it will not harm fasting blood sugar profile and blood pressure4. The research aims to identify the psychosocial distress category and its components and its correlation with fasting blood sugar profile, systole/diastole, and cholesterol in patients with HT, DM, and HT-DM.

## Method

The research used a quantitative survey design at Klinik Manunggal Salatiga. The identification of psychosocial distress aspects on patients with DM and HT included personal emotional burden, difficulty with family members/other people, difficulty with medical staff, and difficulty in managing diabetes mellitus therapy. The data were collected through a purposive sampling method with a total sample of 42 respondents. The research participants were required to fill informed consent before completing the questionnaire. The data collection was done through a standard questionnaire mainly about psychosocial distress4. The recapitulation result of this questionnaire was in the form of tabulation of psychosocial distress profile in number proportion and its correlation to diabetes parameter. The research participants were categorized into low, medium, and high distress (Arifin, 2016). Fasting blood sugar profile, systole/diastole, and cholesterol serve as the main parameters. The collection of fasting blood sugar data was after the patients fasted for 8-9 hours with arteriole blood examination from the fingertips (fasting blood sugar, Nesco tool method) and through vena vein (blood sugar two hours after eating, Microlab method). Systole/diastole was examined using sphygmomanometer mercury (Nova Riester). The analysis was done by One Way Anova test and Pearson correlation test with SPSS version 20, and $\alpha<0.05$

## Results and Discussion

The data acquired from 42 participants, after being analyzed with statistics, showed homogenous data ($p>0.05$) and normal spread ($p>0.05$). Homogeneity test data on blood sugar, systole blood pressure, diastole, cholesterol level, and distress score showed a range of p 0.071 - 0.743. The normality test ranges from 0.055 - 0.346. Thus, the data distribution is homogeneous and normal. According to Table 1, the research participants were categorized into three distress categories: low distress, medium distress, and high distress, according to the qualification of score categorization. It was considered as low if the score was< 2; medium if the score was 2 – 3, and considered as high distress if the score was > 3 (Arifin, 2016).

Table 1. Classification of Psychosocial Distress on All Group

| Classification | Numbers | Proportion (%) |
|---|---|---|
| Low Distress | 12 | 0.285714286 |
| Medium Distress | 12 | 0.285714286 |
| High Distress | 18 | 0.428571429 |
| Total | 42 | 1 |

source: secondary data statistical test)

Out of all participants, 42.8 % of respondents had high psychosocial distress, and more than half of them (60 %) had blood sugar levels and cholesterol levels (16.6%) above the normal range. This was supported by the research results that 55.6% of participants with poor blood sugar profiles. There was a correlation between stress level and fasting blood sugar level in patients with DM with a correlation score of 0.477 on medium level (Irvan dan Wibowo, 2015). Furthermore, there was also a correlation between the duration of illness and stress levels in patients with DM (p=0.001) (Sharp & Theiler, 2018). On patients with DM, obtained there is a significant difference between blood glucose levels before and after progressive muscle relaxation therapy (Karokaro dan Riduan, 2019).

Table 2 showed the mean score of psychosocial distress aspects such as emotional burden (3.2), difficulty in managing chronic disease (3.2), difficulty with the doctor (3.0) as high if compared to another aspect such as difficulty with friends and other people (2.6) that were considered as a medium.

Table 2. Average of Psychosocial Distress Aspects on All Group

| Aspect | Score Total | Average |
|---|---|---|
| Emotional burden | 133.5 | 3,2 |
| Difficulty with doctor | 126.25 | 3,0 |
| Difficulty in managing chronic disease | 132.4 | 3,2 |
| Difficulty with friends and other people | 109 | 2,6 |

source: secondary data statistical test

Table 3 showed ANOVA test on the scores of distress, fasting blood sugar, systole, diastole, and cholesterol level that did not show significant different between patients with HT, DM, and HT-DM.

Table 3. One Way ANOVA test of psychosocial distress score

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Distress Score | Between Groups | 8.483 | 2 | 4.242 | 2.861 | .079 |
| | Within Groups | 32.611 | 22 | 1.482 | | |
| | Total | 41.094 | 24 | | | |
| tran_age | Between Groups | .205 | 2 | .102 | .607 | .552 |
| | Within Groups | 4.717 | 28 | .168 | | |
| GD2 | Total | 4.922 | 30 | | | |
| | Between Groups | 234.737 | 2 | 117.368 | .291 | .750 |
| Systole | Within Groups | 11715.732 | 29 | 403.991 | | |
| | Total | 11950.469 | 31 | | | |
| | Between Groups | 42.011 | 2 | 21.005 | .165 | .849 |
| Diastole | Within Groups | 3695.489 | 29 | 127.431 | | |
| | Total | 3737.500 | 31 | | | |
| | Between Groups | 988.927 | 2 | 494.464 | .304 | .741 |
| Cholesterol | Within Groups | 37420.457 | 23 | 1626.976 | | |
| | Total | 38409.385 | 25 | | | |

source: secondary data statistical test

Table 4 displayed the LSD test specifically for psychosocial distress score between groups and showed significant difference (p=0.038) between patients with HT and patients with DM. However, there was no significant difference (p=0.079) between patients with DM and patients with HT-DM (p=0.826).

Table 4. LSD Multiple Comparison Test of Psychosocial Distress Score

| (I) kelp peny | (J) kelp peny | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| 1.00 | 2.00 | 1.26797* | .57394 | .038 | .0777 | 2.4582 |
| | 3.00 | 1.13165 | .61357 | .079 | -.1408 | 2.4041 |
| 2.00 | 1.00 | -1.26797* | .57394 | .038 | -2.4582 | -.0777 |
| | 3.00 | -.13632 | .61357 | .826 | -1.4088 | 1.1361 |
| 3.00 | 1.00 | -1.13165 | .61357 | .079 | -2.4041 | .1408 |
| | 2.00 | .13632 | .61357 | .826 | -1.1361 | 1.4088 |

*. The mean difference is significant at the 0.05 level.

source: secondary data statistical test

A significance value of p=0.017 on the relationship between knowledge and beliefs with self-efficacy on Diabetic Foot Ulcers of the patient. Necessary to study psychosocial factors in patients with Diabetic Foot Ulcers associated with self-efficacy (Rias, 2016). A minor correlation of intelligence/emotional burden with stress level on patients with DM (Gong & Fone, 2016; Bacchi & Licinio, 2017.). Patients with DM could experience difficulty in self-management or self-efficacy, which became an important focus for patients with chronic disease, especially DM (Wagner, Tenner and Osborn, 2010).

Table 5 presented the Pearson correlation test between the scores for the psychosocial distress variable and fasting blood sugar level, systole, diastole, and cholesterol variable. Between these variable groups, there was no significant difference with minor correlation.

Tabel 5. Pearson Correlation Test

| | | Tran_age GD2 | Cholesterol | Diastole | Systole | Distress Score |
|---|---|---|---|---|---|---|
| Distress Score | Pearson Corr. | .106 | .185 | .189 | .014 | 1 |
| | Sig. (2-tailed) | .614 | .375 | .365 | .948 | |
| | N | 25 | 25 | 25 | 25 | 25 |

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

source: secondary data statistical test

Information support about diabetes could also influence one's stress level. There was a correlation between information support and stress level (p=0.000), the correlation between emotional support and stress level (p=0.000), the correlation between assessment support and stress level (p=0.000), and the correlation between instrumental support and stress level (p=0.000) on patients with DM (Arvidsdotter et al., 2015). In addition to stress, family support and self-management also influenced patients with DM who had diabetic ulcer complications. There was an influence on stress (p=0.000), family support (p=0.007), and self-management (p= 0.000) on patients with DM who had diabetic ulcer complications. The most influential variable on patients with DM who had diabetic ulcer complications was high stress with OR 7.757, CI 95% (2.590-22.151) (Molly & Crossman, 2016). The other research on the paired t-test showed that p = 0.001 in the treatment group which means that there is an effect on self-efficacy before and after self-instructional training is given. There is the effect of giving self-instructional training to self-efficacy in people with diabetes mellitus in the treatment group after being given self-instructional training. Self-instructional

training can be used especially for people with DM as self-instruction that can normalize blood sugar (Eskin et al., 2016; Bougie et al., 2016).

The correlation value of Rank Spearman 0.605, p = 0.0001 on self-efficacy and social support 0.648, p = 0.0001 shows there is a strong relationship to the self-care management of patients with type 2 diabetes mellitus in Sembiran Village, Tejakaula District. It is expected that good social support and self-efficacy can improve self-care management in patients suffering from type II DM (Sass et al, 2017.). Patients with more severe psychiatric and/or medical comorbidity are no less likely to benefit from a PPI compared to those with higher levels of health, even though these programs do not directly target psychological distress. PPIs may be widely applicable to medical patients, with lower psychological wellbeing a potential predictor of increased benefit (Feig et al., 2019).

Similarly, there was a significant effect of Diabetes Self-Management Education and Support towards the decline of distress on patients with DM. Paired t-test showed there was a significant difference of distress between pre-test and post-test both in the intervention group (p=0.001) and control group (p=0,046). Similarly, on an independent t-test, it showed a significant difference on intervention group and control group (p=0.001) (Nurkamilah, Rondhianto dan Widayati, 2018).

## Conclusion

On chronic DM, patients had a higher risk of psychosocial distress on components such as emotional burden, difficulty in managing chronic disease, and difficulty with the doctor. On the other hand, difficulty with other people was on a medium level. However, there was no significant difference in psychosocial distress, blood sugar levels, systole and diastole blood pressure, and cholesterol level in patients with hypertension, DM, or HT-DM. There was a minor correlation between psychosocial distress, systole, diastole, blood sugar level, and cholesterol.

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# Intrinsic and Extrinsic Factors Related to the Incident of Toddler Pneumonia

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**Abstract**

According to the Regional Task Unit of Banda Raya Public Health Service, Banda Aceh City, there was an increase in Pneumonia Toddlers from 62 patients in 2017 to 135 patients in 2018. This study aims to determine the intrinsic and extrinsic risk factors related to the incidence of toddlers pneumonia in the work area of the Regional Task Unit of Banda Raya Public Health Service, Banda Aceh City, in 2019. Spatial analysis was used to analyze and describe the results of toddler pneumonia distribution and to see the relationship between intrinsic and extrinsic factors to the incidence of toddlers pneumonia using a Case-Control Study or Retrospective Study design. This study uses a total population sample of 142 people, consisting of 71 cases and 71 controls using a 1:1 ratio. The results showed that the variables associated with pneumonia were education (OR=2.47; 95% CI=1.51-5.32; p value=0.049), vitamin A administration (OR=4.56; 95% CI=1.81-11.49; p value=0.001), and exclusive breastfeeding (OR=0.35; 95% CI=0.11-1.09; p value=0.072). Intrinsic factors related to the incidence of pneumonia are vitamin A administration and exclusive breastfeeding. Then the Extrinsic factor related is education. The recommendation is to improve MCH management, such as complete basic immunization, vitamin A administration, and others.

## Introduction

Pneumonia is the most killer of toddlers worldwide, more than AIDS, malaria, and measles. Based on the World Health Organization (WHO) estimation, more than 2 million toddlers in the world die from pneumonia (1 toddler/20 seconds) out of 9 million total under-five deaths. Every year more than 95% of new pneumonia cases occur in developing countries, and more than 50% of pneumonia cases occur in Southeast Asia and Sub-Saharan Africa. In 2008 there were 8.8 million child deaths in the world. Of which 1.6 million deaths were caused by pneumonia. Pneumonia cases in Indonesia reached 6 million people. So that Indonesia was ranked 6th in the world for pneumonia cases (WHO, 2008).

Based on the Indonesian Health Profile, pneumonia is the cause of 15% of under-five deaths, which is estimated at 922,000 toddlers in 2015. In Indonesia, under-five mortality due to Pneumonia in 2017 was 0.34%. It is higher than in 2015, which was 0.22%. In the infant, the mortality rate was slightly higher at 0.56% than the 1-4 year age group, namely 0.23% (Dinkes Banda Aceh, 2016). The pneumonia incidence and prevalence in Indonesia are 1.8% and 4.5%. The five highest case provinces, namely East Nusa Tenggara, Papua, Central Sulawesi, West Sulawesi, and South Sulawesi. The 2013 Basic Health Research Report (Riskesdas) also shows that pneumonia is the most cause of infant mortality (0-11 months) by 23.80% and as the second cause of under-five mortality (1–4 years), which is 15.50%. It ranks second after diarrhea out of the top 10 death. On average, every 83 toddlers die every day due to pneumonia. It shows that it is a disease

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that is among the most public health problem contributing to the high infant mortality rate in Indonesia (Dinkes Banda Aceh, 2016).

In Aceh Province, Pneumonia is the second rank of all under-five deaths. The estimated number of pneumonia sufferers is 10 percent of the toddlers in the same area and period. Pneumonia in toddlers in Banda Aceh City in 2016 was estimated to be 2,378 sufferers, with a gender distribution of 1,224 boys and 1,154 girls. Meanwhile, in 2017 there were 2,157 patients, with a distribution of 574 children aged less than one year and 1,583 children aged 1-4 years (Dinkes Banda Aceh, 2016).

According to the latest report, the number of toddlers with pneumonia increased from the previous year, which was 212 sufferers. Most of them were found in the Regional Task Unit of Banda Raya Public Health Service, with the details of 135 cases. Then 23 cases in Jaya Baru, 15 cases in Kuta Alam, 9 cases in Jeulingke, 7 cases in Ulee Kareung, 6 cases in Kopelma Darussalam, 6 cases in Baiturrahman, and 1 case in Meuraxa (Dinkes Banda Aceh, 2016).

Based on the Regional Task Unit of Banda Raya Public Health Service in Banda Aceh City, there is an increase in cases of Pneumonia Toddlers from 62 patients in 2017 to 135 in 2018. This study aims to analyze the intrinsic risk factors, namely Nutritional Status, History of LBW, Exclusive Breastfeeding, Vitamin A administration, Basic Immunization Completeness, and Complementary Breastfeeding. And extrinsic risk factors, namely Mother's Education, Family Income, Smoking Habits at Home, Types of Walls, and Types of Floors. Those factors are associated with the incidence of Pneumonia in toddlers. This study also uses spatial analysis to see the point coordinator of pneumonia cases in toddlers at the Regional Task Unit of Banda Raya Public Health Service, Banda Aceh City, in 2019.

## Method

This study used a Case-Control Study design. The dependent variable is the incidence of pneumonia in toddlers. The Independent Variables were Toddler Age, Gender, Nutritional Status, History of LBW, Exclusive Breastfeeding, Vitamin A, Basic Immunization Completeness, Weaning Food, Mother's Education, Mother's Knowledge, Family Income, Home Ventilation, Smoking Habit in the House, Wall Type, Floor Type, House Occupancy Density, and Residential Density. This study also uses spatial analysis to see the coordinates of pneumonia cases in toddlers. The research took place in the working area of the Banda Raya Public Health Service. The selection of the object and location is due to it has many cases of pneumonia in toddlers. The population in this study were all toddlers aged 12–59 months who were diagnosed with pneumonia at the Regional Task Unit of Banda Raya Public Health Service, Banda Aceh City, based on the MCH registration from January to June 2019. The sampling technique in this study was total sampling. So the sample in this study consisted of 71 cases and 71 controls. The control uses a simple random sampling technique, taken from toddlers who have a house close to those with pneumonia.

## Result and Discussion

Table 1. Respondent Characteristic

| Variable | Mean | Standard Deviation | Min | Max |
|---|---|---|---|---|
| Mother Age | 32.16 (tahun) | 5.89 | 22 | 50 |
| Family Income | 2.313.169 (Juta) | 1.666.300 | 0 | 12.000.000 |
| Birth Weight | 3.034 (Gram) | 703.37 | 1.500 | 8.800 |
| BW/A | -1.07 | 0.64 | -2.9 | 0.89 |
| Body Weight | 11.65 (Kg) | 2.34 | 8 | 18 |
| Body Height | 86.44 (Cm) | 10.71 | 68 | 112 |

Source: Primary Data, 2019

Based on the numerical data above, it shows that the average age of the mother is 32 years or more, the average family income is 2,313,169 million. Then the average birth weight is 3,034 grams, the average weight based on age is -1.07 SD, the average weight for toddlers is 11.65 kg, the average height for toddlers is 86.44 cm.

Table 2. Relationship of Instrinsic dan Extrinsic Factor Related to Pneumonia Incident in Toddlers

| **Independent Variables** | **Pneumonia** | | | | | | **OR** | **CI95%** | **P value** |
|---|---|---|---|---|---|---|---|---|---|
| | **Control** | | **Case** | | **Total** | | | | |
| | **n** | **%** | **n** | **%** | **n** | **%** | | | |
| Education | | | | | | | | | |
| High | 19 | 26.76 | 19 | 26.76 | 38 | 26.76 | | | |
| Middle | 49 | 69.01 | 43 | 60.56 | 92 | 64.79 | 0.87 | 0.41-1.86 | 0.735 |
| Low | 3 | 4.23 | 9 | 12.68 | 12 | 8.45 | 3 | 0.70-12.82 | |
| Occupation | | | | | | | | | |
| Civil Servant/Military/Police | 5 | 7.04 | 5 | 7.04 | 10 | 7.04 | | | |
| Private Sector/Entrepreneur | 6 | 8.45 | 5 | 7.04 | 11 | 7.75 | 0.83 | 0.14-4.63 | 0.83 |
| Housewife | 60 | 84.51 | 61 | 85.92 | 121 | 85.21 | 1.07 | 0.27-3.69 | 0.98 |
| Family Income | | | | | | | | | |
| High | 24 | 33.80 | 17 | 23.94 | 41 | 28.87 | | | |
| Low | 47 | 66.20 | 54 | 76.06 | 101 | 71.13 | 1.62 | 0.77-3.37 | 0.197 |
| Toddler Nutritional Status | | | | | | | | | |
| Well-Nourished | 71 | 100 | 68 | 95.77 | 139 | 97.89 | | | |
| Malnourished | 0 | 0 | 3 | 4.23 | 3 | 2.11 | 1 | (Omitted) | - |
| Low Birth Weight (LBW) | | | | | | | | | |
| No | 65 | 91.55 | 60 | 84.51 | 125 | 88.03 | | | |
| Yes | 6 | 8.45 | 11 | 15.49 | 17 | 11.97 | | | |
| Exclusive Breast Feeding | | | | | | | | | |
| Yes | 33 | 46.48 | 18 | 25.35 | 51 | 35.92 | | | |
| No | 38 | 53.52 | 53 | 74.65 | 91 | 64.08 | 0.43 | 0.17-1.09 | 0.078 |
| Vit A Administration | | | | | | | | | |
| Complete | 33 | 46.48 | 18 | 25.35 | 51 | 35.92 | | | |
| Incomplete | 38 | 53.52 | 53 | 74.65 | 91 | 64.08 | 2.55 | 1.25-5.19 | 0.010 |
| Basic Immunization | | | | | | | | | |
| Complete | 14 | 19.72 | 11 | 15.49 | 25 | 17.61 | | | |
| Incomplete | 57 | 80.28 | 60 | 84.51 | 117 | 82.39 | 1.33 | 0.56-3.19 | 0.509 |
| Weaning Food | | | | | | | | | |
| No | 23 | 32.39 | 27 | 38.03 | 50 | 35.21 | | | |
| Yes | 48 | 67.61 | 44 | 61.97 | 92 | 64.79 | 0.78 | 0.39-1.55 | 0.483 |
| Smoking Habit in the House | | | | | | | | | |
| No | 42 | 59.15 | 31 | 43.66 | 73 | 51.41 | | | |
| Yes | 29 | 40.85 | 40 | 56.34 | 69 | 48.59 | 1.86 | 0.95-3.63 | 0.066 |
| House Wall | | | | | | | | | |
| Sufficient | 58 | 81.69 | 55 | 77.46 | 113 | 79.58 | | | |
| Insufficient | 13 | 18.31 | 16 | 22.54 | 29 | 20.42 | 1.29 | 0.57-2.94 | 0.533 |
| House Floor | | | | | | | | | |
| Water Proof | 70 | 98.59 | 69 | 97.18 | 139 | 97.89 | | | |
| Not Water Proof | 1 | 1.41 | 2 | 2.82 | 3 | 2.11 | 2.02 | 0.17-22.89 | 0.567 |
| Total | 71 | 100 | 71 | 100 | 142 | 100 | | | |

Source: Primary Data, 2019

The proportion of respondents who gave exclusive breastfeeding and suffered from pneumonia was 25.35% lower than respondents who gave exclusive breastfeeding who did not suffer from pneumonia of 46.48%, while the proportion of respondents who did not give exclusive breastfeeding and suffered from pneumonia was 74.65% higher than respondents who did not give exclusive breastfeeding and did not suffer from pneumonia by 53.52%. The statistical tests found that respondents who did not give exclusive breastfeeding had a risk of preventing pneumonia by 43% compared to respondents who gave exclusive breastfeeding with a p-value of 0.078, which means that there is no significant relationship between exclusive breastfeeding and the incidence of pneumonia.

The proportion of respondents who gave complete vitamin A and suffered from pneumonia was 25.35% lower than that of complete vitamin A and did not suffer from pneumonia by 46.48% while the proportion of respondents who gave incomplete vitamin A and suffered from pneumonia was 74.65% higher than the respondents who had incomplete administration of vitamin A and not suffering from pneumonia by 53.52%. The statistical tests showed that respondents who did not provide complete vitamin A had a 2.55 times risk of suffering from pneumonia compared to respondents who gave complete vitamin A with a p-value of 0.010, which means that there is a significant relationship between the administration of vitamin A and the incidence of pneumonia.

The proportion of respondents who do not smoke at home and suffer from pneumonia is 43.66% lower than respondents who do not smoke at home and do not suffer from pneumonia by 59.15%, while respondents who smoke in their homes and suffer from pneumonia is 56.34% higher than respondents who smoke in their home and do not suffer from pneumonia by 40.85%. The results of statistical tests showed that respondents who smoked at home had a 1.86 times risk of suffering from pneumonia compared to respondents who did not smoke at home with a p-value of 0.066, which means that there is no significant relationship between smoking habits in the

Table 3 Initial Model of Instrinsic dan Extrinsic Risk Factor Related to Pneumonia Incident in Toddlers

| **Pneumonia** | **OR** | **CI 95 %** | **P value** |
|---|---|---|---|
| Middle Education | 1.12 | 0.34-3.712 | 0.844 |
| Low Mother Education | 10.08 | 1.62-80.11 | 0.029 |
| Private sectors/Enterpreneur | 1.52 | 0.16-14.33 | 0.712 |
| Housewife | 1.36 | 0.19-9.50 | 0.756 |
| Low Income | 1.26 | 0.43-3.68 | 0.672 |
| Malnourishment | 1 | - | - |
| LBW | 1.18 | 0.314-4.458 | 0.803 |
| Without Exclusive Breast Feeding | 0.37 | 0.109-1.298 | 0.122 |
| Incomplete Vitamin A Administration | 6.60 | 2.159-20.225 | 0.001 |
| Incomplete Basic Immunization | 1.09 | 0.340-3.534 | 0.878 |
| With Weaning Food | 0.81 | 0.339-1.980 | 0.658 |
| Smoking Habit In The House | 1.49 | 0.601-3.711 | 0.386 |
| Insufficient House Wall | 1.36 | 0.403-4.654 | 0.614 |
| House Floor is not Water Proof | 4.00 | 0.133-119.889 | 0.424 |

*Source: Primary Data, 2019*

The table above shows that not all intrinsic and extrinsic risk factors affect the incidence of pneumonia. The low respondent education risk 10.08 times having pneumonia with an OR = 10.08 and a p-value of 0.029. The most influential risk factor for the incidence of pneumonia was the incomplete administration of vitamin A with OR = 6.60. It means they had a risk of 6.60 times suffering from pneumonia with a p-value = 0.001.

Table 4. Final Model of Instrinsic dan Extrinsic Risk Factor Related to Pneumonia Incident in Toddlers

| Pneumonia | OR | CI 95 % | P-value |
|---|---|---|---|
| Incomplete Vitamin A Administration | 4.56 | 1.81-11.49 | 0.001 |
| Low Mother Education | 2.47 | 1.15-5.32 | 0.049 |
| Without Exclusive Breast Feeding | 0.35 | 0.11-1.09 | 0.072 |

*Source: Primary Data, 2019*

The results of the multivariate analysis showed that the most influential factor was the incomplete administration of vitamin A with OR=4.56, which means it has a 4.56 times greater risk of suffering from pneumonia. From the table above, there are also factors related to the incidence of pneumonia, namely low mother education with a p-value of 0.049 and incomplete exclusive breastfeeding with a p-value of 0.072.

Table 5. Instrinsic dan Extrinsic Risk Factor Related to Pneumonia Incident in Toddlers by Group

| Group | OR Unadjusted SES | OR Adjusted SES |
|---|---|---|
| **Host** | | |
| Nutritional Status | 1 | 1 |
| LBW History | 1.18 | 1.52 |
| Incomplete Breast Feeding | 0.37 | 0.32 |
| Incomplete Vitamin A Adminstration | 6.60 | 3.85 |
| Incomplete Basic Immunization | 1.09 | 0.74 |
| With Weaning Food | 0.81 | 0.81 |
| **Physical Environment** | | |
| Smoking Habit in the House | 1.49 | 1.57 |
| Insufficient House Wall | 1.36 | 1.07 |
| House Floor is not Water Proof | 4.00 | 1.89 |
| **Social Economic Factors (SEF)** | | |
| Middle Mother Education | 1.12 | |
| Low Mother Education | 10.08 | |
| Low Family Income | 1.26 | |

*Source: Primary Data, 2019*

Above tables shows there is no significant difference of OR Unadjusted after the Social Economic Factors (SEF) variables is excluded to become SEF OR Adjusted.

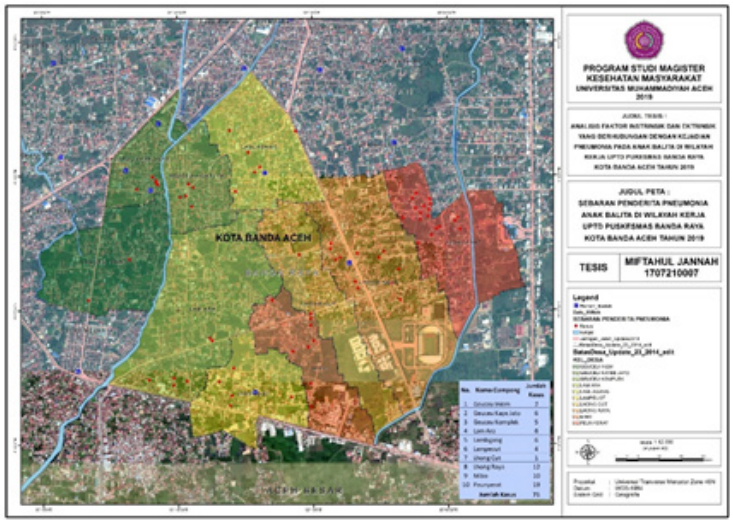


Image 1. Distribution Map of Pneumonia Toddlers in Work Area of Regional Task Unit of Banda Raya Public Health Service, Banda Aceh City, 2019

The map indicates that the toddlers pneumonia incident in Banda Raya District was most found in Peunyerat Village, namely 19 cases and the least is in Lhong Cut Village with only one case.

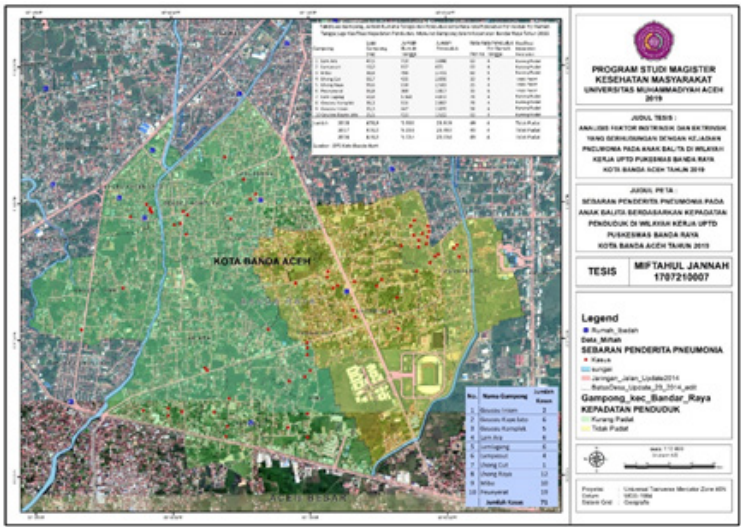


Image 2. Distribution Map of Pneumonia Toddlers by Population Density in Work Area of Regional Task Unit of Banda Raya Public Health Service, Banda Aceh City, 2019

Based on the map above, 71 pneumonia toddlers spread over ten villages in Banda Raya District. Pneumonia sufferers at most are 19 patients, and the least is one patient, both in non-populated areas. However, from the population density point of view, most pneumonia toddlers cases are in Peunyeurat village. As many as 19 pneumonia toddlers. While on the vacant area, there are no cases. In areas that are not densely populated, we found only one pneumonia toddler in Lhong cut village. In this study, exclusive breastfeeding became the independent variable. The exclusive breastfeeding category is 83.10% higher than not giving exclusive breastfeeding by 16.90%. The statistical tests found that respondents who did not give exclusive breastfeeding had a risk of preventing pneumonia by 43% compared to those who gave exclusive breastfeeding with a p-value of 0.078. It means that there is no significant relationship between exclusive breastfeeding and the incidence of pneumonia.

The multivariate analysis explained that after being combined with other risk variables, the without exclusive breastfeeding variable has an OR value of 0.37, meaning that respondents who do not give exclusively breastfeeding are at risk of experiencing pneumonia by 37% compared to those who do exclusive breastfeeding. Then after stepwise (0.25), the exclusive breastfeeding variable entered the final model because it had a p-value of 0.072. It means that there was no relationship between exclusive breastfeeding and pneumonia with OR value = 0.35. It means respondents without exclusively breastfeeding had a 35% risk of experiencing pneumonia than those with exclusive breastfeeding.

This study is not in line with the research of Prina & Torres (2015), using a Case-Control design. They proved a significant relationship between an exclusive breastfeeding history and the incidence of pneumonia (OR = 8,953, 95% CI: 2,843–28,232). It means that toddlers who are exclusively breastfed for less than six months are 8.953 times more likely to suffer from pneumonia than those who are exclusively breastfed for more than or equal to 6 months. The researcher assumes that exclusive breastfeeding can also prevent pneumonia because it is the main food source for infants aged 0-6 months. Breast milk contains many nutrients that support the toddler's growth without the need to provide other additional foods (Wei & Cui, 2020; Jain et al, 2020; Mani, 2018).

In this study, vitamin A became the independent variable. The complete vitamin

A administration category is lower by 35.92%. While the incomplete was 64.08%. The results of statistical tests showed that respondents who do not follow complete vitamin A administration had a 2.55 times risk of suffering from pneumonia than those who follow complete vitamin A administration with a p-value of 0.010, which means that there is a significant relationship between the administration of vitamin A and the incidence of pneumonia (Giuliano & Quinn, 2018; Grief & Loza, 2018).

The multivariate analysis explained that after being combined with other risk variables, the without vitamin A administration variable has an OR value of 6.6, meaning that toddlers without vitamin A administration had a risk of experiencing pneumonia by 6.6 times than those with vitamin A administration. Then after stepwise (0.25), we include the vitamin A administration variable in the final model because it had a p-value of 0.001. It means there is a relationship between the vitamin A administration variable and Pneumonia, and obtained an OR value = 4.56. It means, the toddlers with incomplete vitamin A administration has a risk of Pneumonia 4.56 times higher than those with complete vitamin A administration category.

This study is in line with Adawiyah & Duarsa (2012), finding the toddlers' proportion without Vit A administration in the case group was 38.5%, while the control group was 18.5%. From the bivariate analysis, the p-value = 0.020 ($p < 0.05$), indicating a statistically significant effect between the administration of Vitamin A to toddlers and the incidence of pneumonia in toddlers at the Susunan Baru Public Health Service in Bandar Lampung City. Researchers assume that the administration of vitamin A has a relationship with the incidence of pneumonia. If vitamin A is not given it will be at risk of developing pneumonia. Vitamin A is useful for increasing immunity and protecting the respiratory tract from bacterial infections. If there is a lack of vitamin A, the body can experience respiratory problems. It is supported by research by Mandell & Niederman (2019), which states that Vitamin A functions to stabilize the structure and function of the mucosal surface and is also involved in the immune response (especially T-cell function) and mucus production. In infants with mild vitamin A deficiency, there is a twofold increase in the incidence of respiratory tract disease and a 4-12 times increase in childhood mortality (Stephen et al., 2019; Ramirez et al., 2017).

In this study, smoking habits in the house became the independent variable. The category of not smoking in the house is 51.41%, approaching the percentage of smoking in the house, 48.59%. The statistical tests showed that respondents who smoke in the house had a 1.86 times risk of toddler pneumonia than those who don't, with a p-value of 0.066. It means that there is no significant relationship between smoking habits in the house and the incidence of pneumonia. The multivariate analysis explained that after being combined with other risk variables, the smoking habit in the house variable had an OR value of 1.49. It means that smoking habit in the house has a risk of experiencing pneumonia by 1.49 times than those who do not. After stepwise (0.25), we do not include it in the final model because it has a p-value > 0.25, meaning no relationship between the smoking habit at home variable and Pneumonia.

This study is not in line with the research of Fatichaturrachma, Suhartono, and Dharminto (2016). It obtained a p-value of 0.039 which means there is a relationship between smoking in the house and the incidence of pneumonia in toddlers. Then the value of OR = 2.949. It indicates that toddlers who live with a smoker in the house have a 2.9 times greater risk of developing pneumonia than those who live at home without smokers in the house (Gattinoni et al., 2020; DiBardino & Wunderink, 2015). The researcher assumes that the presence of smokers in the house is a risk factor for pneumonia in toddlers. If toddlers have weak antibodies, they will be at risk for diseases including pneumonia (Chou et al., 2019; Restrepo & Reyes, 2018). Based on the study, most toddlers were exposed to cigarette smoke in both cases and controls. Cigarette smoke contains harmful substances that can interfere with the human respiratory system, and cigarette smoke is one of the risk factors for pneumonia in toddlers (Koo et al., 2018; Zhu et al., 2019).

## Conclusion

Based on the results of research and discussion on the Analysis of Intrinsic and Extrinsic Factors related to the Incidence of Pneumonia in Toddlers in the Regional Task Unit Work Area of the Banda Raya Public Health Service Banda Aceh City in 2019, after multivariate analysis (stepwise <25%/<0.25), the researcher can draw the following conclusions: Intrinsic factors related to the incidence of pneumonia are the administration of vitamin A (OR=4.56; 95% CI=1.81-11.49; p value=0.001) and exclusive breastfeeding (OR=0.35; 95% CI=0.11-1.09; p value=0.072); The related extrinsic factor was education (OR=2.47; 95% CI=1.51-5.32; p value=0.020). The most influential risk factors for the incidence of pneumonia were the administration of vitamin A (OR=4.56; 95% CI=1.81-11.49; p value=0.001); Spatial Analysis the incidence of toddlers pneumonia cases in Banda Raya District was mostly found in Peunyerat village with 19 cases, and the least in Lhong Cut with 1 case.

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# Belimbing Wuluh (*Averrhoa bilimbi* Linn.) Leaf Powder as the Natural Repellent Against Meat Fly (*Genus Sarcopaga*)

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**Abstract**

Efforts are often made to control meat flies with chemical insecticides, but they harm humans, the environment, and other organisms. We use belimbing wuluh leaf as a natural repellent in controlling meat flies. The purpose of this study is to determine the effect of belimbing wuluh leaf powder as a natural repellent and the number of effective doses against meat fly. Using 15 samples at each dose of 1 gr, 2 gr, 3 gr, 4 gr, 5 gr, negative control without powder, positive control with Top Killer powder, performed four repetitions every 10 minutes of observation for 60 minutes. Kolmograv-Smirnov normality test, P-value 0.200> 0.05 means that the data for each group is normally distributed. Variant test, P-value 0.066> 0.05, so there was a group that had homogeneous data variants, an ANOVA test resulted in a Sign value of 0.001. There is an effect of the belimbing wuluh leaf powder dose as the repellent of meat flies. The 5-gram dose is the most effective as a natural repellent of meat flies. (*Genus Sarcopaga*)

## Introduction

Vector-borne diseases are one of the public health problems in Indonesia, one of which is fly vector-borne diseases. Flies are one of the vectors of disease intermediaries whose populations are found around the community. Flies are major public and domestic health pests that spoil food, cause irritation, and are vectors of many infectious disease pathogens of medical and veterinary importance (Baana et al., 2018).

Flies are a type of Arthropoda belonging to the Order Diptera. Several species of flies have the most role in public health problems, namely as vectors of disease transmission. As a cosmopolitan pest, flies will cause a disturbance, irritation, spoil food, and are vectors for many pathogenic organisms that attack humans and livestock (Kumar et al., 2012). As a mechanical vector, flies transfer pathogens through their hairy body parts, eating way, and regurgitation of their feces (Baana et al., 2018). Flies usually eat and reproduce in feces, animal waste, carrion, and other decaying organic matter. They live in close contact with various microorganisms including human pathogens, which may attach to the fly's body surface. The continuous movement of flies between breeding sites and human habitation can lead to the transmission of pathogens to humans and animals (Khamesipour et al., 2018). Flies transmit more than 100 human and non-human diseases including bacterial infections such as salmonellosis, anthrax, shigellosis, typhoid fever, tuberculosis, cholera, diarrhea, and protozoan infections such as amoebic dysentery. In addition, it is also responsible for transmitting the pathogens that cause trachoma and conjunctiva, both of which are estimated to cause approximately 6 million cases of childhood blindness each year worldwide. There are also indications that flies have the potential to be carriers of avian influenza viruses that threaten humans (Baana et al., 2018; Wanaratana et al., 2011; Wanaratana et al., 2013).

Several types of flies that have received

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attention in the health sector are house fly, meat fly, green fly, and fruit fly. Disease agents that can be transmitted mechanically are intestinal bacteria, intestinal worm eggs, and intestinal protozoa (Ryani et al., 2017). In this study, researchers chose meat fly, because of some harm caused, especially for human health, like transmitting various diseases such as typhoid, dysentery, cholera, diarrhea, and can also cause myiasis (fly infestations in humans body tissues) (Mathison & Pritt, 2014). It transmits worm eggs such as pinworms, roundworms, hookworms, and tapeworms. The fly also transmits viral infections, rickettsial infections, and in some cases, life-threatening *Escherichia coli* (Baana et al., 2018). In addition, there is a report that the stomach contains worm eggs of *Ascaris lumbricoides* and *Trichuris trichiura* that can transmit helminthiasis (Sucipto, 2011).

A meat fly is a fly that includes ectoparasites found in meat and animal carcasses and is one type of fly that can transmit disease. This fly belongs to the *Genus Sarcophaga* which means that it eats meat. The fly is very detrimental to the community because it causes accelerated spoilage, an unpleasant odor, causing the presence of the maggot on the media that is infested, poor appearance, and unpleasant odors on media such as meat. The fly is detrimental to the community because they cause accelerated decay (Dewi et al., 2017).

The body of the meat fly is gray with a chessboard-like pattern on the abdomen and three dark stripes on the dorsal thorax. In its life cycle, it is vivifar and releases live larvae in its breeding sites. Like meat, carrion, feces, and rotting vegetables. The life cycle of this fly lasts 2-4 days. Meat fly is generally found in open markets, stalls, meat, garbage, and dirt (Sucipto, 2011). A market is a place that supports the survival of flies, including meat fly, because there are various kinds of sales such as necessities, meat, fish, chicken, fruits, and vegetables. So the market has the potential for the presence of excessive flies (Ryani et al., 2017).

Control of flies has been carried out both chemically and non-chemically. Non-chemical control for adult flies by repelling and trapping flies such as fly adhesive, lamp traps that can kill flies with electricity. Chemical control is carried out by larvicides, surface spraying, room spraying, baiting, and fly repellants (Sucipto, 2011). Long-term application and extensive use of synthetic insecticides have resulted in the accumulation of residues in food, milk, water, soil and caused adverse health effects for humans and ecosystems (Mossa et al., 2018). Insecticide residues contained in the food chain can harm humans, causing poisoning and even death. In addition, various studies have shown that pesticides/insecticides can have long-term effects, namely causing cancer, male and female reproductive health problems, neurological disorders, and damaging the immune system (Mossa et al., 2018). The insect control, including meat fly (*Genus Sarcophaga*) by chemical insecticides, to control parasitic organisms whose mobility is high like flies can cause problems. The problems are the effects of pesticides that are detrimental to health and the environment, the risk of developing insect resistance, and bioaccumulation through the food chain, emphasizing the need to find environmentally friendly alternatives (Baana et al., 2018).

To reduce synthetic insecticides usage, it is necessary to develop biological control by utilizing plants that exist in nature. One that can be as a vector insect repellent, especially meat fly, safe for the environment and society. Plant extracts have long been proposed as attractive alternatives to synthetic insecticides for pest management because they are environmentally friendly, economical, usually target-specific, and biodegradable (Sisay et al., 2019).

Belimbing wuluh (*Averrhoa bilimbi Linn.*) is a plant that is often used for medicine and its fruit as an ingredient for cooking. As a medicinal plant, *A. bilimbi* is used in diabetes mellitus and hypertension treatment. Also as an antimicrobial agent (Alhassan & Ahmed, 2016). Several previous studies stated that the plant contains bioactive compounds. According to Suluvoy, the bioactive compounds contained in the belimbing wuluh fruit are flavonoids, tannins, alkaloids, phenols, and saponins (Suluvoy & Berlin, 2017). Ahmed et al, in the phytochemical test in his research, found the leaf extract contains alkaloids, flavonoids, saponins, terpenoids, triterpenes, and phenolics (Ahmed et al., 2018). The compounds that function as

insecticidal and larvicidal activities are saponins and terpenoids (Rohmah et al., 2020). Almost all parts of belimbing wuluh, including leaf, can and is often used. The leaf is used in medicines as antimicrobial, antioxidant, anticancer, wound healing, antidiabetic, antihypertensive, and toxicity (Alhassan & Ahmed, 2016)

Saponins are stomach poisons that can inhibit the feeding activity of larvae (Wahyuni et al., 2018). Flavonoids, as respiratory and contact poisons, are absorbed and enter the body cavity, which will inhibit metabolic processes (Wahyuni et al., 2019). The same thing, according to Wahyuni, is that the content of flavonoids can enter through the mouth and respiratory tract (spiracles) can cause nervous disorders so that the body withers and causes death (Wahyuni & Yulianto, 2018).

Several studies have been conducted on belimbing wuluh in general. Mostly for medicine, but some also for insect control. Research conducted on "Larvicidal Activity and Histopathological Effect of *Averrhoa bilimbi* Fruit Extract on *Aedes aegypti* from Surabaya, Indonesia" found that the extract of the fruit was effective to kill *A. aegypti* larvae with the most effective concentration of 2000 mg/kg. L with larval mortality 100% of the total test larvae with LC50 value is 1061.275 ppm, and LC90 value is 1461.255 ppm (Rohmah et al., 2020).

In this study, researchers used belimbing wuluh leaf powder to repel meat fly, which in some previous studies used the leaf as medicines and vegetable insecticides. Therefore, researchers tried to use belimbing wuluh leaf as vegetable repellents on flies, especially meat fly. It is reinforced by the opinion of Alhassan et al, stating belimbing wuluh leaf can be used as medicine (Alhassan & Ahmed, 2016). Besides, it can also be used as an ingredient to keep insects away (antifeedant) from food sources (Suluvoy & Berlin, 2017), (Rohmah et al., 2020). Based on the information above, researchers are interested in researching "The Effect of Belimbing Wuluh Leaf Powder (*Averrhoa bilimbi Linn.*) As a Natural Repellent Against Meat Flies (*Genus Sarcophaga*)". This study aims to determine the effect of belimbing wuluh leaf powder as a natural repellent against meat fly and to determine the most effective amount of belimbing wuluh leaf powder as a natural repellent against meat flies.

**Method**

The research was conducted at the Pekanbaru Health Polytechnic Research Laboratory in June-August 2019. The test insects in this study were meat flies obtained from catching at Rumbai Market, Pekanbaru. The belimbing wuluh leaves used in this test were obtained at Tampan Permai Panam Housing, Pekanbaru. This study examines the effectiveness of belimbing wuluh leaf powder as a vegetable repellent on meat fly without ignoring the factors that affect their lives. Namely temperature, humidity, as well as available food. The research design used a Completely Randomized Design Method (CRD) with five dosage levels. Namely 1 gram, 2 grams, 3 grams, 4 grams, 5 grams, negative control without using the leaf powder, and positive control using chemical insecticides (top killer powder) which was repeated four times.

Preparation of test animals is done by inviting meat flies to come by placing pieces of dead fish meat and rotting chicken meat in fly traps. Furthermore, meat flies that have been trapped are kept for one day and then selected flies for test animals that are healthy and actively moving/flying. The test sample for each number of doses (weight), positive control, and negative control consisted of 15 flies with four repetitions so that the total sample amounted to 360 meat flies.

Image 1. Meat fly (Sarcophaga)

The stages of making belimbing wuluh leaf powder are as follows the leaves are collected approximately 500 grams, washed with water, then cut into small pieces. Furthermore, they were dried at room temperature. After they dry, they are mashed using a blender so that they become powder. The cage for testing consisted of 2 kinds of boxes, the first box measuring W: 50 x W: 50 x H: 50 cm as a large cage and the second box measuring W: 25 x W: 25 x H: 25 cm as a small cage. For large cages and small cages, the surroundings are covered with mosquito netting. However, when doing the test, each side of the small box is covered with plastic. But in the middle of one side is made a circle that is not covered with plastic for the air ventilation so the meat flies can breathe. In some corners of the small cages, there were holes as the passages for flies to the large cage during testing.

Image 2. Test Cage

The test was carried out by inserting 15 meat flies into each small cage that had been filled with various doses of belimbing wuluh leaf powder, as well as for negative control and positive control, and was carried out four times. Belimbing wuluh was put in a large cage. Then observed the behavior of meat flies during the study, every 10 minutes for 60 minutes of observation, and counted the number of meat flies that came out of the small cage to the large. The same thing in the second, third, and fourth repetitions. Data analysis using statistical tests of variance analysis with RAL followed by the One Way ANOVA test.

## Result and Discussion

Based on the results of research, flies that come out of small cages into large cages with various doses given, namely 1 gram, 2 grams, 3 grams, 4 grams, 5 grams, Top Killer positive control, and 0 grams negative control (without belimbing wuluh leaf powder). The calculation and observation of the number of meat flies that came out of the small cage to the large cage were observed at 10-minute intervals for 60 minutes with four repetitions. In the negative control (without powder), no flies were seen leaving the small cage to the large at each repetition. However, the positive control showed a significant change. Within a not too long time, the flies panicked and flew irregularly. The flies tried to find holes in the corners of the cage walls. And soon, the meat flies came out of the small cage into the large. In this positive control, all flies went out to the large cage on each repetition.

In the amount of 1 gram and 2 grams of the leaf powder, the meat fly behavior and condition began to appear to be affected by the content of bioactive compounds. Some flies tried to fly away from the powder. It can be seen from the average number of flies leaving the small cage to the large, respectively, as much as 18.% and 26.6% for 60 minutes of observation. At a dose of 3 grams of belimbing wuluh leaf powder, the behavior and condition of the meat fly was a lot of restlessness flying here and there trying to find a way to get out of the small cage into the large. It can be seen from the average number of flies that came out of the small cage to the large on 56.6% treatment for 60 minutes of observation. Furthermore, in the amount of 4 grams and 5 grams of the leaf powder, the behavior of meat flies is more aggressive, flying here and there, even hitting the box walls and getting more aggressive to avoid the leaf powder because it contains more bioactive compounds. It can be seen from the average number of meat flies that leave the small cage to the large of 93.3% and 98.3% for 60 minutes of observation.

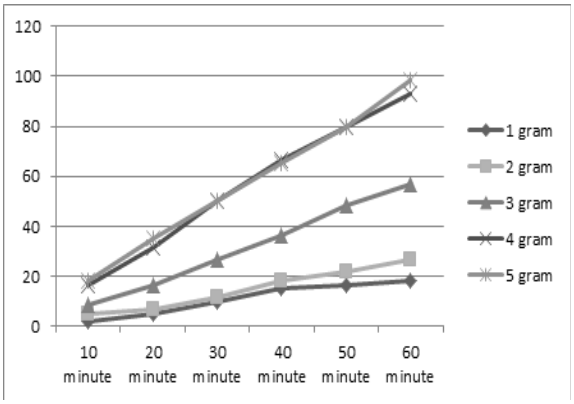


Image 3. Percentage of Meat Fly Coming Out from The Small Cage to The Large in Each Treatment (Primary Data, 2019)

In Image 3 above, the difference in the belimbing wuluh leaf powder amount has a different effect on meat fly. The number of meat flies coming out of the small cage into the large increased along with the increase of doses given to each treatment. It means, the higher the doses, the higher the content of bioactive compounds contained in belimbing wuluh leaf powder, and the number of flies coming out from the small cage to the large. It showed the potential of belimbing wuluh leaf powder as a natural repellent against meat flies.

From the results of the Kolmograv-Smirnov Normality Test Statistical Test, it was obtained a P-value of 0.200 from 5 treatment groups, which means large (>) 0.05. It means that the distribution of data from each group is normally distributed. The results of the Variance test obtained a P-value of 0.066 is large (>) of 0.05, so some groups have homogeneous data variants. Based on the results of the second statistical test above, the results obtained to meet the requirements for the ANOVA test because the data distribution is normally distributed and the data variance is homogeneous. In the One-way ANOVA test, a Sign value of 0.001 was obtained. There is an effect of the amount (weight) of belimbing wuluh leaf powder (*Averrhoa bilimbi*) against meat fly (*Genus Sarcophaga*).

From the observations' results, the number of meat fly coming out of the small cage to the large cage increased along with the number of treatment doses. Based on Image 3, there was an increase in the number of flies that ran along with the increasing number of belimbing wuluh leaf powder. It is caused by the higher doses of belimbing wuluh leaf powder. The more toxic compounds inhaled by the respiratory system of meat fly in the form of respiratory poisons will be accumulatively faster, more effective, and ultimately drives the meat fly away.

From the results of this study, the level of toxicity gave the effect of repulsion of belimbing wuluh leaf powder increased with increasing concentration. In addition, the length of time exposed to belimbing wuluh leaf powder will also increase the toxicity of insecticides (repellents) from belimbing wuluh leaf. Because the more it absorbs toxic compounds, it will affect the body's metabolism and cause the meat flies to stay away. Time exposed to insecticides will also increase the toxicity. Because the more it absorbs toxic compounds, it will affect the body's metabolism and cause meat flies to stay away. It is aligned with research (Wahyuni & Yulianto, 2018), on plant-based insecticides of basil leaf extract against the death of *A. aegypti* mosquitoes. The more *A. aegypti* mosquitoes absorb the compounds contained in the toxic basil leaf extract, the more mosquitoes die. In addition, the longer exposure to basil leaf extract compounds will increase the level of toxicity. Because the more it absorbs toxic compounds, it will affect the body's metabolism and cause *A. aegypti* mosquito mortality. Likewise, Kosini's research on the *Gnidia kaussiana* extracts effect (*Thymeleaceae*) on *Callosobruchus maculatus (Coleoptera Chrysomelidae)* absorbs more toxic compounds. It will slow down development, cause the death of larvae, and melanization of the cuticle. It results in disruption of the endocrine system that controls growth and development. Larval molting is caused by several secondary metabolites such as terpenoids, alkaloids, and flavonoids (Kosini & Nukenine, 2017).

From the results of observations of meat fly after giving belimbing wuluh leaf powder, with different doses, in the amount of 1 and 2 grams, it appears that the behavior of meat fly moves away from the leaf powder looking for gaps to get out of the small box into the big box. In the amount of 4 and 5 grams, the meat fly was more aggressive in flying and even hit the box wall. From various books and journals

about belimbing wuluh, the effectiveness of the belimbing wuluh plant is strengthened by its moderate sticky sap containing a source of active compounds with various biological activities, namely flavonoid compounds, saponins, and tannins. As explained by Sina, et al that the presence of phenols, flavonoids, and tannins in plants is most likely responsible for the observed free radical scavenging effects. Flavonoids and tannins are phenolic compounds. Plant phenolics are the main compound that acts as primary antioxidants or free radical binders (Sina et al., 2016). These chemical compounds are toxic to insects, vectors and are not liked by insects. From this information, belimbing wuluh leaf contains bioactive compounds, namely flavonoids, saponins, and tannins, that can affect meat fly. They are toxic so that one of them can act as meat fly repellent.

Flavonoids are one of the largest groups of phenolic compounds that can modulate the expression and activity of several enzymes in signaling and cell metabolism (Santos Felix et al., 2018). Flavonoid compounds have specific characteristics such as planar and aromatic rings (Fernandes et al., 2019). Flavonoids play a vital role in plant protection against plant-eating insects and herbivores (Acheuk & Doumandji-Mitiche, 2013). The content of flavonoids as bioactive compounds contained in belimbing wuluh leaves can enter through the mouth and the respiratory tract and spiracles found on the skin surface. It can cause nervous disorders so that the flies move very aggressively, flying here and there until they hit the wall of the box.

This study is in line with the research of Gautam et al. (2013), on *Anopheles* and *A. aegypti* larvae after administration of *Vitex negundo* plant extract containing flavonoids. It showed integument disintegration with loss of the chitin layer and abnormal stretching of the larval body. It is due to the neurotoxic effect of the *Vitex negundo* plant extract containing flavonoids. Wahyuni explained that the flavonoid as a bioactive compound in basil leaf extract contains alcohol that enters through the mouth and the respiratory tract and through spiracles found on the skin surface which can cause nervous disorders so that the mosquito wings wither, stiffen, and are unable to fly anymore (Wahyuni & Yulianto, 2018).

The flavonoids in belimbing wuluh leaf also interfere with the respiratory system, so meat fly finds it difficult to breathe and try to find their way from the experimental cage. Wahyuni's research, regarding garlic extract (*Allium sativum*) as a vegetable larvicide in the control of green fly (*Calliphoridae*) explained that flavonoids are respiratory poisons and contact poisons. Which, if it is absorbed and entered the body cavity of the fly in excess will cause dizziness and even cause death (Wahyuni et al., 2019). Utami, and Cahyati, in their research on the potential of frangipani leaf extract as an insecticide against *A. aegypti* mosquito, explained that flavonoids function as respiratory poisons or respiratory inhibitors. Flavonoids will enter along with the air (O2) through the respiratory system and will inhibit the respiratory system in the body of the *A. aegypti* mosquito (Utami & Cahyati, 2017). According to Yi, *Rotenone* is known as a respiratory chain inhibitor, preventing the transport of electrons from NADH to CoQ. *Azadirachtin* has behavioral regulation properties as an antifeedant and deterrent for many insects, and also interferes with insect growth, although it acts slowly (Yi et al., 2012). Wahyuni's research on bintaro leaf extract (*Carbera manghas*) as a larvicide in the control of *A. aegypti* mosquitoes explained that the larvae that died looked stiff, causing the loss of the chitin layer and abnormal stretching of the larva's body, which entered through the mouth and respiratory tract/spiracles so that *A. aegypti* larvae have difficulty breathing this is due to the presence of flavonoids (Wahyuni et al., 2018).

In addition, the cause of meat fly trying to stay away from belimbing wuluh leaf powder is due to the presence of saponin compound present in it. The compound has a bitter taste. It is not liked by insects, especially meat fly so that they stay away from the powder. So the saponins contained in belimbing wuluh leaf powder have insect repellent activity so that meat flies try to get out of the experimental cage.

Saponins are a class of triterpenoid compounds that can be used as insecticides. According to Kosini and Nukeinine, alkaloid compounds in fresh fruit will taste bitter on the tongue. It also toxic secondary metabolites that can block ion channels, inhibit enzymes,

or interfere with nerve transmission, loss of coordination, and death (Kosini & Nukenine, 2017). Saponin is found in plants. Both fruit and leaves. When is eaten by insects, could reduce the activity of digestive enzymes and food absorption so that saponins act as stomach poisons (Aditama & Yosep, 2019). In his research, Rohmah explained that the larvicidal compound contained in A. bilimbi fruit extracts is saponin. Saponin has potential as a larvicide and works as gastric poison in Ae. aegypti by lowering the surface tension of the mucous membranes in the digestive tract, making them more susceptible to damage. Damage mainly occurs in the middle of the larval intestine because various functions occur in this place, such as digestion, absorption of nutrients, ion transport, and osmoregulation (Rohmah et al., 2020; Chaieb, 2017; Chaieb & Protection, 2017). Saponin compounds as insecticides are to change the eating behavior of insects by inhibiting (uptake) food in the digestive tract. Saponin can also inhibit the growth of the larval stage by interfering with the larval molting stage (Chaieb, 2017).

Likewise, the tannin compounds contained in belimbing wuluh leaf can cause hyper dose and have a bitter taste so that meat fly is not strong enough to approach the powder so that meat flies try to escape from small cages to large cages. In Wahyuni's research, it was explained that tannins interfere with the digestive system of larvae in the absorption of food ingredients (Wahyuni et al., 2018). Tannins and pellitorine mainly affect the epithelium of the midgut and gastric septum and malpighian tubules in larvae of *C. pipiens* and *A. aegypti* (Kim & Ahn, 2017).

Based on the results of the analysis above, meat fly that inhaled belimbing wuluh leaf powder will mean that there are differences in the number that fly out from small cage to large cage due to differences in the number of doses of belimbing wuluh leaf. In other words, there is an effect of the amount of belimbing wuluh leaf powder on the rejection of meat flies. The effect of insecticides on insects is very dependent on the form, the way it enters the insect's body, the type of substance contained, the concentration dose, and the length of exposure (Sucipto, 2011). In the results of this study, it can be seen in Image 3, that giving belimbing wuluh leaf powder for 60 minutes in a dose of 5 grams can repel 15 meat flies, and the average number of flies that run at that amount within 60 minutes of observation is 98, 3% meat flies. This amount is the largest and fastest in repelling meat fly when compared to other doses. Thus, it is known that the higher the amount of belimbing wuluh leaf powder, the stronger the effect as a vegetable repellent so that it can apply to meat fly. The higher the amount of belimbing wuluh leaf powder given, the higher the effectiveness of the insecticide against meat fly.

Based on the research, the most effective dose is 5 grams. In this dose, almost all flies go away, which is 98.3% in 4 repetitions. Positive control treatment (Top Killer) was carried out to compare the quality of the amount of belimbing wuluh leaf powder whether or not it was the same as the positive control sold in the market. The negative control treatment was carried out to compare its effectiveness with belimbing wuluh leaf powder. The results obtained were no meat fly left after 60 minutes of observation. Overall, we can conclude that the active substances contained in the belimbing wuluh leaf powder (*Averrhoa bilimbi*) can repel meat fly (*Sarcophaga*). Since the more active substance molecules from the belimbing wuluh leaf powder exposed to meat fly, the greater the effect. Therefore, belimbing wuluh leaves have the potential as an alternative insecticide, namely vegetable repellent, because the source is easy to obtain and does not cause residues in nature. Several previous studies support this opinion on the need to use vegetable insecticides as alternative insecticides.

According to Chang's 2014 research, the use of inappropriate doses of insecticides will make insects easy to adapt by carrying out a series of "metabolite detoxification" processes or the removal of residual toxins (chemical insecticides) very quickly. In addition, the use of inappropriate doses will also make the insects adaptable to increase the survival rate of "survival" with sublethal doses called incentivization. Both will affect the synchronization power of the insect's immune system and ultimately be passed on to the next generation. Therefore, it is necessary to develop alternative insecticides, larvacides,

and repellents that are safer and more effective. In this regard, Chang explained that natural insecticides are needed to suppress the dangers of insecticides that cause resistance and will slow down the process of genetic adaptation in vectors. In addition to the occurrence of resistance, it turns out that there are still other problems, namely the toxic effects of insecticides that occur not only on insects, humans but also on the environment and even the balance of the ecosystem (Chang et al., 2014). Similarly, Hikal et al in their research explained that plant-based insecticides only affect target insects, do not destroy beneficial natural enemies, and provide residue-free food and a safe environment. Therefore, Hikal et al recommend the use of plant-based insecticides as an integrated insect management program that can highly reduce the use of synthetic insecticide (Hikal et al., 2017). Based on this, natural repellents are necessary for vector control because they are more environmentally friendly, effective, and low-cost with wide availability in nature, as stated in the research conducted by Rohmah et al. (Rohmah et al., 2020).

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## Conclusion

From the One-way ANOVA test, the Sign value was 0.001, there was an effect of the amount (weight) of belimbing wuluh leaf powder (*Averrhoa bilimbi*) on the rejection of meat flies (*Genus Sarcophaga*). The total dose of 5 grams is the most influential as a natural repellent for meat fly. Belimbing wuluh leaf powder has the potential to be used by the community as a natural repellent from environmentally friendly plants, especially in controlling meat fly. This natural repellent is relatively easy to make with simple materials and technology and leaves no residue in the environment, so it is relatively safer than chemical insecticides.

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# Potential Self-contamination: Improper Hygiene Procedure of Using Masks

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**Abstract**

Using masks has become popular as an effort to prevent COVID-19. This increased the public consumption of masks. But in practice, this effort might cause other problems. The survey arranged to observe the potential contamination form from using masks. Specifically, it is a procedure when using and removing an inappropriate mask This descriptive study is a cross-sectional study. Data collection was carried out using a questionnaire filled in by 152 respondents aged ≥15-years-old who lived in the Jabodetabek area through a link shared online on various social media. Workingat the healthcare facility was the exclusion criteria for the participants. Fabric masks were the most commonly used. The majority replaced mask with the new or clean one once a day. Touched outer side of masks was the habit of most participants with lack of hand-hygiene practice. Potential self-contamination from inhaling pathogens, direct or indirect, released by the infected person when coughing, sneezing, even when talking, sourced themselves or others. Environmental contamination could occur due to lack of hand hygiene practice before wear masks, and after-touch while in use and after-remove it. Hence, educate the community for proper procedure use of masks and hand hygiene practice is necessary to prevent contamination and spread of diseases.

## Introduction

The COVID-19 pandemic first emerged in December 2019 in Wuhan City, Hubei Province, China. Furthermore, this disease began to spread almost throughout the world until on January 30, 2020 the World Health Organization (WHO) designated this case as a Public Health Emergency of International Concern. The first case in Indonesia was found in early March 2020 in Depok City. Until August 2020, all provinces in Indonesia have reported the discovery of positive cases with a total of more than 170,000 cases and tens of thousands of others who have symptoms are designated as People Under Monitoring (ODP) and Patients Under Monitoring (PDP). The Center for Disease Control and Prevention (CDC) explained that the transmission medium for COVID-19 is in the form of droplets containing viruses that are released by patients when coughing, sneezing, or even talking, so that transmission of this disease is easy. The rapid and widespread mobility of the world's population makes it difficult to prevent its spread throughout the world. This condition is exacerbated by the fact that not all infected people have symptoms, so it is not easy to detect sufferers to prevent transmission (CDC, 2020a). This new type of coronavirus can even survive on solid surfaces for a certain time, allowing transmission through touch (Chin et al., 2020).

One of the efforts that will have a major impact on reducing the number of COVID-19 cases is to prevent transmission. Efforts that can be made are to implement social and physical distancing by staying at home and maintaining a minimum distance of 1 meter from other people, maintaining hand hygiene, covering mouth and nose when coughing and sneezing,

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using mouth and nose covers when close to other people to prevent exposure to viruses, and do not touch the nose, mouth and eye area. Efforts to cover the mouth and nose by using a mask are one of the efforts that contribute to reducing exposure to respiratory droplets of sufferers (Cheng et al., 2020). However, this effort has certain procedures that must be implemented to be effective. Wash hands before wearing, removing or touching masks, immediately replace masks with new and clean ones if they are dirty and handling used masks in a sanitary manner must be done to prevent transmission of Coronavirus or other pathogens to yourself and others.

The potential exposure of infected people during the pre-symptomatic period can be reduced by the use of masks by healthy people in the community. However, other risks also arise such as the risk of self-contamination that can occur by touching and reusing a mask contaminated with pathogens, the possibility of difficulty breathing depending on the type of mask used, as well as the thought that wearing a mask is sufficient to prevent infection, thus ignoring prevention efforts. others such as physical distancing and hand hygiene (WHO, 2020). Information regarding the proper and sanitary use and handling of masks is not yet known to everyone. In fact, masks can be a transmission medium for transmission of various pathogens released by the respiratory system, not only COVID-19. Meanwhile, the increase in the use of masks during the COVID-19 pandemic is very significant. Therefore, the researcher intends to find out the potential for contamination due to the use of masks during the COVID-19 pandemic.

## Method

This study is a descriptive study with a quantitative approach. The study design used was cross-sectional to describe the potential for contamination due to the use of masks during the COVID-19 pandemic. Data collection was carried out in May 2020 with 152 research respondents aged > 15 years living in the Greater Jakarta area. (DKI Jakarta Province, Bogor City, Bogor Regency, Depok City, Bekasi City, Bekasi Regency, Tangerang City, Tangerang Regency, and South Tangerang City). A previous study related to the presence of pathogens on masks found that there was pathogen contamination on the outside of the masks used by 10.1% of the 148 participants who were health workers in hospitals (Chughtai et al., 2019). Based on the calculation of the sample with this proportion, the sample needed in this study amounted to 138 people with a 95% confidence level and an absolute precision of 5%.

Data collection was carried out online, and although measures to prevent data incompleteness had been implemented at the time of making the questionnaire, to prevent the possibility of data that could not be used and had to be discarded, the researchers added 10% of the total sample, bringing the total sample to 152 people. The selection of research samples will be carried out randomly (simple random sampling) by distributing online questionnaire links. People who work in hospitals, health centers, laboratories, doctors' practices and midwives are excluded in this study to avoid information bias. This is because the people who work in these places generally have SOPs for the use and handling of masks. The ethical clearance of this research was agreed by the Research Ethics Commission of the University of Respati Indonesia based on SK Number: 024/SK.KEPK/UNR/V/2020. All research respondents gave consent to the data collection procedure through informed consent which was given before the questionnaire was displayed.

## Result and Discussion

Respondents who participated in this study amounted to 152 people. Characteristics of respondents are quite varied and are shown in Table 1 and Figure 1.

Table 1. Characteristics of Respondents

| Characteristics of Respondents | n | % |
|---|---|---|
| **Gender** | | |
| Female | 107 | 70,4 |
| Male | 45 | 29,6 |
| **Area of residence** | | |
| Province of DKI Jakarta | 69 | 45,4 |
| Bogor City | 2 | 1,3 |
| Bogor Regency | 5 | 3,3 |
| Depok City | 19 | 12,5 |
| Tangerang City | 11 | 7,2 |
| Tangerang Regency | 3 | 2,0 |
| South Tangerang City | 4 | 2,6 |
| Bekasi City | 34 | 22,4 |
| Bekasi Regency | 5 | 3,3 |
| **Education status** | | |
| Graduated from Elementery school | 1 | 0,7 |
| Graduated from Junior high school | 2 | 1,3 |
| Graduated from Senior high school | 45 | 29,6 |
| Graduated from higher education (D1/D2/D3/D4/S1/S2/S3) | 104 | 68,4 |
| **Educational background** | | |
| Health | 40 | 26,3 |
| Non Health | 112 | 73,7 |

Source: Primary Data, 2020

Most of the participants are domiciled in the Province of DKI Jakarta (45.4%, 69/152). However, the entire Jabodetabek area has a representative participant in this study. The majority of participants are female (70,4%, 107/152). Respondents aged 15 – 70 years with a mean = 28 and std. deviation = 8.426. The educational status of the respondents consisted of Graduated from Elementary school, Graduated from Junior high school, Graduated from Senior high school and graduated from college which was then categorized as having high school education and above (98%, 149/152) and education below high school (2%, 3/152). Based on educational background, thre are 73.7% of participants (112/152) had non-health education background.

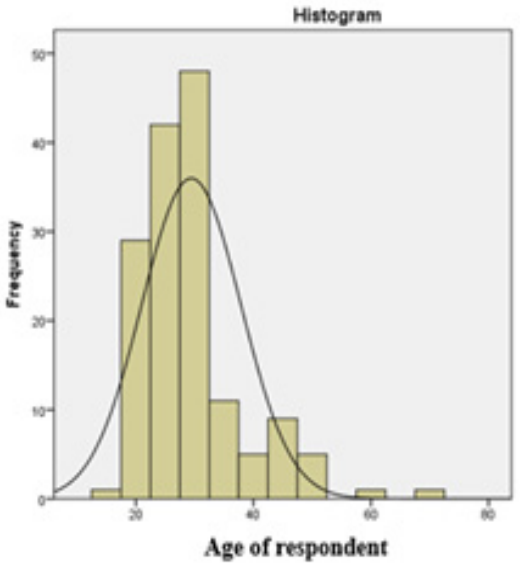


Figure 1. Frequency Distribution of Respondents Age
Source: Primary Data, 2020

Regarding the use of masks, the most frequently used type of mask was cloth masks (80.3%, 122/152). The effectiveness of the use of masks made of cloth, classified as non-medical masks, in the community has not yet been assessed. There is not enough evidence to recommend or prohibit the use of this type of mask. However, to prevent the scarcity of medical masks needed by health workers in riskier environments, healthy people should use this type of mask by considering several criteria such as the number of layers of cloth, the material used allows air to enter and exit, is impermeable to water, shape, and the suitability of the mask (WHO, 2020).

Studies on cloth masks made of cotton, silk, chiffon, flannel, various synthetics with a single layer have an efficiency of 5-80% to filter particles <300nm in size and 5-95% for particles>300nm in size (Konda et al., 2020). The level of risk of infection with diseases such

as influenza in cloth masks made of cotton or polyester cotton with 2 layers is higher than medical masks (Maclntyre et al., 2020). Laboratory test results confirmed a higher risk of viral infection in cloth masks (RR=6.64) compared to medical masks (RR=1.72) (MacIntyre et al., 2015). The poor efficiency of cloth masks is caused by long-term use, frequency of use, and how to wash or clean masks. If not cleaned before use, the cloth can become dirty and contaminated, creating a risk of infection and self-contamination. Ideally, a cloth mask should consist of a waterproof layer, at least consisting of 3 layers, according to the shape of the face and able to filter air well (Maclntyre et al., 2020). Efficiency can also be increased by the use of multiple layers and the use of a combination of materials (Konda et al., 2020).

All respondents had used masks during the COVID-19 pandemic. The frequency of wearing masks was categorized into always (88.2%, 134/152) and sometimes (11.8%, 18/152). Participants used masks when doing activities outside the home (99.3%, 151/152) and when they thought they had COVID-19 symptoms, one of which was coughing (13.2%, 20/152). Most of the participants lived with other people (69.1%, 105/152), 29 of them lived at home with people who had experienced one or more symptoms of COVID-19 (29/152), and a total of 3 participants wore masks when take care of them.

The use of masks plays a role in reducing the risk of infection in several studies related to Coronavirus (aOR = 0,15) (Chu et al., 2020). Another study identified Coronavirus, influenza virus, and rhinovirus released when ARI sufferers (adults and children) breathe and cough. The use of medical masks significantly prevents the transmission of these pathogenic germs from the patient to the environment (Leung et al., 2020). The use of masks is required for all people who come into contact with sick people, not limited to medical personnel. The mask will keep respiratory droplets from reaching other people. Masks should also be used by people caring for patients, although the efficiency of masks (cloth and surgical masks) to protect healthy people from inhaling the virus varies. (CDC, 2020a).

Not all respondents immediately dispose of or wash masks after use (39.5%, 60/152). Some respondents reused masks that had been removed from their faces and stored (51.3%, 78/152) or hung them around their necks (9.2%, 14/152). The average respondent keeps the mask on the table, in the cupboard, or hanging it somewhere open. When removed from the face and stored or hung on the neck, contamination can also occur, considering that 23.1% (18/78) of respondents immediately put the mask into the storage area without folding it first, or left it open on a table or other surface (28, 2%, 22/78). While some others store masks by rolling them up with mask straps (48.7%, 38/78). Improper method of storing the mask can cause the inside of the mask to open outwards thereby allowing contamination of the inside of the mask which will come into direct contact with the face, especially the nose, when the mask is reused.

A total of 5.3% (9/152) of participants who used surgical masks had washed the masks again for reuse. Unlike cloth masks, which are allowed to be washed before reuse by observing the appropriate protocol by using disinfectants and the recommended drying method, surgical masks cannot be reused (WHO, 2020)). However, given the limited number of personal protective equipment, including medical masks (especially respiratory filtering facepieces), there are several strategies that can be used. Disinfection using several methods, namely hydrogen peroxide vapor, ultraviolet radiation, moist heat, dry heat and ozone is a promising method for reusing disposable masks. The best recommendation is to use hydrogen peroxide vapor. However, some of these methods require special technology or resources which make the decontamination process expensive. In addition, there is a limited frequency of reuse and side effects, such as reduced elasticity or moisture accumulation with a consequent increased risk of virus exposure and self-infection. (Rubio-Romero et al., 2020).

Per day, on average, participants wore masks for 1-6 hours (61.2%, 93/152). Although the number who wore masks for more than 6 hours was also quite large (28.9%, 44/152), the rest used masks for less than 1 hour (9.9%, 15/152). The majority of masks were replaced

with new/clean ones per day (64.5%, 98/152), only 19.7% changed masks after being used for 6 hours (30/152) and 15.8% after masks were dirty, smelly or wet (24/152). The mask is recommended to be replaced after 6 hours of use. However, if conditions are not possible, as a precaution, the mask should be replaced with a new one if the mask is wet, dirty, or when used makes it difficult to breathe, is exposed to chemicals, infectious substances, or body fluids, is removed from the face for any reason, or if touched by hand. Even people with COVID-19 symptoms should use medical masks as much as possible, or if conditions do not allow masks to be changed at least once a day (WHO, 2020). The use of medical masks by health workers without removing them for more than 6 hours can increase the contamination of masks by COVID-19 and other pathogens. Wearing a mask for a long time also increases the chance of accidentally touching the mask. Therefore, hands must be cleaned regularly. The duration of use will also result in the filtration media on the medical mask being closed, resulting in obstructed breathing and the risk of inhaling ambient air that has not been filtered from the side of the mask.

A study on 148 doctors and nurses at 3 hospitals in Beijing showed the presence of respiratory virus contamination on the outer surface of medical masks used in 1 shift that lasted 6-8 hours. The pathogen was found on the outside of the masks of 15 participants. The types of viruses found were adenovirus, bocavirus, respiratory syncytial virus and influenza virus. The presence of pathogens on the outer surface of the mask may cause self-contamination for the wearer (Chughtai et al., 2019). Self-contamination can occur by touching and reusing a contaminated mask. For each type of mask, proper use and disposal is important to ensure its effectiveness and prevent potential transmission (WHO, 2020). The high risk is directly proportional to the duration of wearing the mask (> 6 hours) and with a high level of clinical contact. The study also mentions the possibility of contamination on other parts of the mask besides the outer part of the mask (Chughtai et al., 2019).

The findings indicate the possibility of contamination with pathogenic bacteria originating from used masks. The general public can also be at risk of being transmitted by the same transmission media, considering that the health protocol in place to prevent the transmission of COVID-19 requires everyone to wear a mask when doing activities outside the home, in addition to keeping a distance from other people and avoiding crowds. The use of masks during the day and their use which may not be in accordance with procedures due to lack of information, can also pose a health risk. There will be differences in the potential for contamination of infectious agents in health care facilities compared to air quality elsewhere, given the higher number of sources of infection. However, another factor that needs to be considered is the prevalence of cases of acute respiratory infections (ARI) in Indonesia of 4.4% based on the 2018 National Basic Health Research Report. This figure is based on a doctor's diagnosis, not including patients who experience symptoms but do not seek medical attention to health services and other respiratory system-related diseases such as pneumonia or tuberculosis.

The results of the interview showed that 64.5% (98/152) of the participants had coughed or sneezed while wearing a mask. In addition, more than half of the participants had been around someone who was coughing or sneezing while wearing a mask (55.1%, 99/152). A study found respiratory droplets expelled when coughing or sneezing can be thrown more than 2 meters, even up to 8 meters (horizontally). (Bahl et al., 2020). These droplets can be directly inhaled into the lungs of people in the vicinity or attached to the surface of objects. Coughing and sneezing is one of the body's mechanisms to remove disease agents from the host's body. The upper respiratory tract is the initial site of replication for many respiratory viruses that are inhaled or transferred by contact with the nasal mucosa. Symptoms of viral infection of the upper respiratory system, including cough, reflect loss of cellular tight junctions, leakage of blood vessels, edema, increased mucus production, apoptosis, necrosis, and shedding of epithelial cells. The recruitment of neutrophils and mononuclear cells to the

upper respiratory tract will increase swelling and mucus hypersecretion, worsen nasal congestion, and cause sneezing and coughing in patients. (Newton et al., 2016).

Surveys related to viral respiratory infections found the infective form of respiratory viruses and different genetic structures of viruses, unique entry receptors, replication modes, causing similar clinical symptoms and sequelae. Several types of viruses, such as Rhinovirus, Coronavirus, Adenovirus, Seasonal Influenza, RSV, Enterovirus D68, Pandemic Influenza, SARS-CoV, and MERS-CoV, cause general clinical symptoms in the form of coughing (Newton et al., 2016). A study of 45 healthy people found that the diameter of the droplets expelled when coughing was 0.1 – 900 .µm, with 97% of participants expelling droplets under 1 µm (Zayas et al., 2012).

The sneezing reflex can be caused by various factors, one of which is stimulation by chemical or physical irritants in the nasal mucosa which will cause stimulation of the eyes closed, inhale deeply, then exhale forcibly, and increase the pressure in the lungs. The sudden dilation causes the release of large amounts of air through the mouth and nose thereby expelling all irritants and impurities present in the mucosa. The number of particles expelled when sneezing, with a size of 0.5 – 5 µm, estimated up to 40.000, with estimated speed up to150 – 1.045 km/hour (Songu & Cingi, 2009). Not only coughing or sneezing, an observation with laser beams on participants with an average sound intensity of 59dBa showed the emission of droplets of various diameters emitted when speaking. In fact, droplets have the potential to survive for 8-14 minutes in the air in a closed room. These droplets can contain pathogens such as the influenza virus, Mycobacterium tuberculosis, measles, or COVID-19 bacteria (Stadnytskyia et al., 2020).

Table 2. Procedures for Using Masks and Personal Hygiene of Respondents

| | n | % |
|---|---|---|
| Touching the front of the mask while wearing a mask | | |
| Always | 15 | 9,9 |
| Sometimes | 100 | 65,8 |
| Never | 37 | 24,3 |
| Touching the front of the mask when removing the mask | | |
| Always | 12 | 7,9 |
| Sometimes | 72 | 47,4 |
| Never | 68 | 44,7 |
| Cleaning your hands before using and after touching the mask | | |
| Never | 5 | 3,3 |
| Sometimes | 44 | 28,9 |
| Always | 103 | 67,8 |

Source: Primary Data, 2020

The habit of touching the front of the mask while it is being used is carried out by most of the participants. However, the frequency of touching it varies from person to person (sometimes 65.8% and always 9.9%). Touching the mask when taking it off is also done by 55.3% of respondents (sometimes 47.4% and always 7.9%). In fact, 32.2% of respondents stated that they did not clean their hands (3.3% never, 28.9% sometimes) using soap and water or hand sanitizer before using the mask and after touching the front of the mask (when in use or when removing it). ). This situation has the potential to become a medium for transmitting disease to others through hands contaminated with pathogenic germs released by the mask wearer himself. Self-contamination can also occur due to contact between hands and pathogenic germs released into the environment by other people and sticking to the masks that the wearer touches without applying hand hygiene.

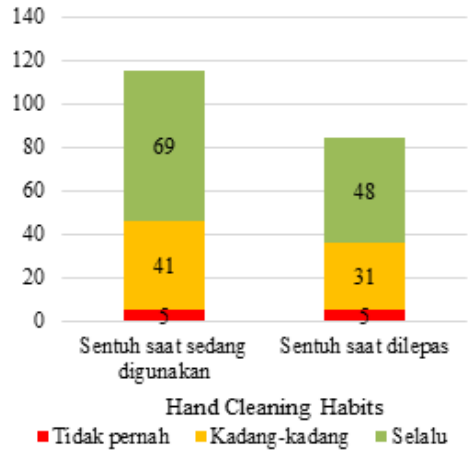


Figure 2. Comparison of Respondents' Habits of Cleaning Hands and Touching Masks
Source: Primary Data, 2020

The habit of touching the front of the mask while it is being worn or when it is removed without cleaning the hands afterwards is quite risky for causing potential transmission for mask users and other people because pathogenic germs can stick to the surface of the mask when the cough or sneeze reflex occurs. Some respondents have coughed/sneezed while wearing a mask, so hands touching the mask can be a medium for transmitting disease to others. Others have the potential to experience self-contamination because they have a habit of touching masks and have been around people who cough/sneeze when wearing a mask especially if afterwards the person touches the nose, mouth, and eyes area without cleaning his hands. An overview of these potential risks can be seen in Table 3 dan Table 4.

Table 3. Cough/Sneezing Reflexes and Hand-Cleaning Habits Based on Respondents' Behavior of Touching the Front of the Mask While Wearing

| | | **The habit of cleaning hands after touching or removing the mask** | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Never** | | **Sometimes** | | **Always** | |
| | | n | % | n | % | n | % |
| Have ever coughed or sneezed while wearing a mask | Ever | 3 | 3,8 | 31 | 39,2 | 45 | 57,0 |
| | Never | 2 | 5,6 | 10 | 27,7 | 24 | 66,7 |
| Have ever been around someone who is coughing or sneezing while wearing a mask | Ever | 3 | 3,8 | 32 | 40,0 | 45 | 56,2 |
| | Never | 2 | 5,7 | 9 | 25,7 | 24 | 68,6 |

Source: Primary Data, 2020

Based on Table 3, it can be seen that about 3.8% of the respondents, who touched the outer part of the mask when it was being used, had coughed/sneezed or were around people who were coughing/sneezing while wearing a mask and never cleaned their hands afterwards, either by wash hands with soap and water or hand sanitizer. The same thing happened to respondents who touched the front of the mask while it was being removed (Table 4). About 5% of respondents who touched the front of the mask while it was being removed had coughed/sneezed or been around people who cough/sneeze while wearing a mask and never cleaned their hands. The potential risk of contamination for respondents who do not regularly (sometimes) clean their hands must also receive attention because the percentage is quite high.

Table 4. Cough/Sneezing Reflexes and Hand-Cleaning Habits Based on Respondents Touching the Front of the Mask While Taking It Off

| | | Cleaning hands after touching or removing the mask | | | | | |
|---|---|---|---|---|---|---|---|
| | | Never | | Sometimes | | Always | |
| | | n | % | n | % | n | % |
| Have ever coughed or sneezed while wearing a mask? | Ever | 3 | 5,2 | 23 | 39,7 | 32 | 55,2 |
| | Never | 2 | 7,7 | 8 | 30,8 | 16 | 61,5 |
| Have ever been around someone who is coughing or sneezing while wearing a mask | Ever | 3 | 5,1 | 25 | 42,4 | 31 | 52,5 |
| | Never | 2 | 8,0 | 6 | 24,0 | 17 | 68,0 |

Source: Primary Data, 2020

SARS-CoV-2, as the cause of COVID-19, is transmitted from person to person through respiratory droplets and close contact with sufferers. This fact explains the importance of the practice of using personal protective equipment (especially respiratory system protection) and hand hygiene (Lotfinejada et al., 2020). Regular hand hygiene, along with wearing a mask, has been shown to contribute to preventing influenza infection (Saunders-Hastingsa et al., 2017). Mask users are required to clean their hands, by washing their hands with soap and water or using a hand sanitizer that contains alcohol, before wearing and after touching/removing the mask (WHO, 2020). These efforts are made to prevent the transfer of pathogens from and to masks through the hands that touch them. This is also the basis for the recommendation not to touch the mask while it is in use and the procedure for removing the mask from behind and being careful not to touch the outer part of the mask. The risk of transmission to a healthy person may increase as a result of inappropriate mask removal procedures, handling contaminated masks or from touching the face while wearing a mask (European Centre for Disease Prevention and Control, 2020).

The main sources of transmission of COVID-19 are respiratory system droplets and direct contact. Everyone who has direct contact with the patient will be at risk for exposure to potentially infective droplets. Droplets can also stick to the surface of objects and survive for a certain period of time. Thus, the immediate environment of an infected person can be a source of transmission (WHO, 2020). A study shows the possibility that SARS-CoV-2 (the cause of COVID-19) can survive for approximately 30 minutes on paper and tissue surfaces, on cloth for about 1 day, 4 days on stainless steel surfaces, 7 days on exterior surfaces of medical mask. Virus resistance on the surface of an object can vary depending on the temperature and humidity of the environment (Chin et al., 2020).

Novel Coronavirus (SARS-CoV-2) survives on surfaces for the same length of time as SARS-CoV-1 (the cause of SARS). Under certain conditions SARS-CoV-2 can survive in aerosols for up to 3 hours. The virus is more stable on plastic and stainless steel, than on copper and whiteboard, and live virus is still detectable up to 72 hours after application to surfaces (Van Doremalen et al., 2020). Other studies have shown that Coronavirus (SARS, MERS or HCoV) can survive on inanimate surfaces, such as metal, glass, or plastic for up to 9 days (Kampf et al., 2020). The resistance depends on the type of surface, temperature, relative humidity, and the strain of the virus. The same study found viruses can be inactivated within 1 minute by using a disinfectant, such as 70% ethanol or 0.1% sodium hypochlorite (WHO, 2020). An important effort that can be done to prevent pathogen contamination on the surface of objects is to carry out hand hygiene practices at the right time and technique (with soap and water or hand sanitizer made from 60%-80% alcohol) (WHO, 2020). Efforts in hand hygiene include washing hands with soap and water or using an alcohol-based hand rub. Wash hands with soap and water when hands are visibly dirty. Hand hygiene is also required when

using and especially when removing Personal Protective Equipment (PPE), including masks (CDC, 2020a).

A study proved a significant protective effect of hand hygiene as a protective device against influenza infection (OR = 0.62) (Saunders-Hastingsa et al., 2017). Hand washing can prevent the spread of respiratory and digestive infections. Germs can spread from other people or surfaces when we touch our eyes, nose and mouth, prepare food and drink with unwashed hands, touch contaminated objects or surfaces, blow our nose, cough or sneeze into our hands and then touch other people's hands or objects. . The steps for proper hand washing are by wetting your hands with clean running water, using soap, then rubbing all parts of your hands (including the back of your hands, between your fingers and nails) for at least 20 seconds, then wash your hands with clean running water then dry hands (CDC, 2020b).

If soap and water are not available, cleaning your hands can be done with a hand sanitizer that contains at least 60% alcohol. The product should be applied to the entire surface of the palms and fingers in an appropriate amount and allowed to dry for about 20 seconds. The downside is that hand sanitizers cannot remove all types of germs, are not very effective if hands are visibly dirty and may not be able to remove harmful chemicals, such as pesticides and heavy metals, from hands (CDC, 2020b). Another method that can be done is to use a wet towel containing soap or sodium hypochlorite. This method is proven to be able to eliminate most of the viruses on the hands. Water containing 1% soap is also effective at killing viruses, and is safe for skin and clothes (Qing et al., 2020).

To support this, it is necessary to increase access to hand hygiene facilities and take an approach to encourage hand washing habits. All health care facilities should have programs in place to promote proper hand hygiene practices and ensure the availability of the required infrastructure (WHO, 2020). Not only limited to health care facilities, but also in places where disease transmission has the potential to occur, especially in places where many people congregate. A study conducted in 2017 in normal situations found that all participants (with an age range of 18 – 75 years) did not apply the correct techniques and steps in wearing masks. More than 90% of respondents did not clean their hands before putting on, removing, and disposing of masks. This is different from previous studies, which obtained results that the picture of hand washing habits when using masks was quite good during the epidemic. So that it is suspected that repeated epidemic situations cause fatigue in the community to follow the recommended health protocols. Therefore, efforts to increase community awareness to implement the practice of using masks and hand hygiene are highly important (Lee et al., 2020).

The behavior of washing hands and wearing masks is not only mandatory for adults. Children must also adopt the same habits and responsible adults are obliged to supervise so that preventive measures to prevent the transmission of this disease are carried out according to procedures. In children, the habit of washing hands and using masks is influenced by the education of their parents and friends in their environment. Therefore, publications related to personal hygiene behavior are urgently needed (Chen et al., 2020). The COVID-19 pandemic has discovered the importance of education and information regarding hand washing and the application of correct techniques when washing hands, both for workers in the health sector, as well as for the general public. Short images and videos that are spread through mobile phones, social media, television, radio, print media, and billboards can be a medium for health promotion, an effective method of hand washing and very crucial to stop the spread of COVID-19. Such information can be conveyed by public figures or many others to raise public awareness to wash hands (Alzyood et al., 2020).

## Conclusion

Masks can be a place of attachment for pathogens released by the wearer or sourced from other people. Thus, it has the potential to cause contamination to the environment if the mask wearer touches the mask without cleaning his hands afterward. Proper mask use procedures, including hand hygiene practices, are key to program effectiveness and

can be improved by educating the public. It is recommended to recommend the instructions for use and the maximum duration of continuous use of masks, especially for those who have a high level of contact with risky environments, such as crowded public places. The use of masks will only be effective when used in combination with routine hand cleaning before putting on and after touching/removing the mask with soap and water or an alcohol-based hand sanitizer.

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# Determinants of the Incident of Pneumonia in Toddlers in Bengkulu City in 2020

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**Abstract**

The number of pneumonia cases in toddlers in Bengkulu City in 2018 reached 3,411. In 2017 there were 3,437 cases. In 2016 there were 31 people. The increase in pneumonia cases will affect the health status of infants and children in the future. This study aims to analyze the determinants of the incidence of pneumonia in children under five in Bengkulu City. The research method was cross-sectional, located in 4 health centers (Sukamerindu, Betungan, Telaga Dewa, and Kuala Lemembu). The sample in this study was 90 people. Data collection using a questionnaire. Data analysis by univariate and bivariate. Results, There is a relationship between immunization status (P-Value 0.000), exclusive breastfeeding (P-Value 0.004), history of ARI (P-Value 0.000), and residential density (p-value 0.004) with the incidence of pneumonia in children under five in Bengkulu City. The study concluded the significant relation between immunization status, exclusive breastfeeding, history of ARI, and residential density with the incidence of pneumonia in children under five in Bengkulu City. The most influential variable was exclusive breastfeeding.

## Introduction

In Indonesia, pneumonia is the second leading cause of death in children under five after diarrhea. Basic Health Research Data (2018) shows the highest prevalence of pneumonia affects toddlers aged 12-23 years. The percentage reaches 1.6 percent in 2013 and increasing by 2.0 in 2018 (Riskesdas, 2018). Of the five provinces in Indonesia having the highest incidence of pneumonia, Bengkulu Province ranks second after Papua, followed by West Papua and West Java. The incidence rate in Papua is 3.6%, Bengkulu is 3.4%, West Papua is 2.9%, and West Java is 2.6% (Riskesdas, 2018).

Bengkulu City Health Profile (2018) showed that in 2018 the number of pneumonia cases in children under five in Bengkulu reached 3,411, for the number of cases handled as many as 876 (25.68%). In 2017 there were 3,437 patients, including 1,679 men and 1,758 women. The number of cases found and handled was 111 people (3.23%). It shows a high increase trend when compared to last year in 2016. There were 31 people (0.95%) when compared to the previous five years. The incidence of pneumonia in toddlers is fluctuating. It can be seen from the number of patients found and treated every year. The number of cases every year in 2016 there were 31 cases. In 2015 there were 125 cases. In 2014 there were 35 cases. In 2013 26 cases. In 2012 46 cases (Dinkes Kota Bengkulu, 2018). From the City Health Office's data we found four puskesmas (public health center) areas in Bengkulu with high incidence rates. They are Sukamerindu, Betungan, Telaga Dewa, and Kuala Lemrubuk. So it needs to be investigated to find out what factors causing the high case numbers of pneumonia in toddlers in Bengkulu City. Based on the above background, the purpose of this study was to see the determinants of the incidence of pneumonia in toddlers in Bengkulu City.

## Method

This study uses a quantitative approach. This type of research is an observational study

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with a cross-sectional approach. This research took place in the working area of the Public Health Center with a high number of pneumonia cases, namely 4 (four) Sukamerindu, Betungan, Telaga Dewa, and Kuala Lempemberu. The population in this study were all mothers who had toddlers. The sample in this quantitative study was taken using the simple random sampling method. The calculation results in the minimum number of samples obtained is 90 people. The independent variables included mother's education, exclusive breastfeeding, immunization status, history of ARI, and residential density, while the dependent variable is the incidence of pneumonia in toddlers. Data was collected by distributing questionnaires. Furthermore, the data collected was analyzed by univariate, bivariate, and multivariate analysis.

## Result and Discussion

From the results of univariate data analysis, data on the frequency distribution of the determinants of the incidence of pneumonia in Toddlers in Bengkulu City in 2020 were as follows:

Table 1. Frequency Distribution Of The Determinants Of The Incidence Of Pneumonia in Toddlers in Bengkulu City In 2020

| **Pneumonia Incident** | **N** | **%** |
|---|---|---|
| Pneumonia | 52 | 57.8 |
| Not Pneumonia | 38 | 42.2 |
| Education | | |
| Low | 13 | 14.4 |
| High | 77 | 85.6 |
| Exclusive Breast Feeding | | |
| No | 36 | 40.0 |
| Yes | 54 | 60.0 |
| Immunization Status | | |
| Incomplete | 58 | 64.4 |
| Complete | 32 | 35.6 |
| ARI History | | |
| Yes | 47 | 52.2 |
| No | 43 | 47.8 |
| Residential Density | | |
| Dense | 35 | 38.9 |
| Not Dense | 55 | 61.1 |

*Source : Primary Data, 2020*

Table 1 above shows the incidence of pneumonia in toddlers from 90 respondents. There are 52 children under five (57.8%) suffering from pneumonia and 38 (42.2%) not suffering from pneumonia. On average, there are 77 mothers of children under five with high education (85.6%). There are still mothers of toddlers who do not give exclusive breastfeeding as many as 36 people (40%). The average immunization status of toddlers was 58 children (64.4%) and had a history of ARI as many as 47 (52.2%). There are still houses with a dense residential of 35 houses (38.9%). The results of bivariate data analysis are as follows:

Table 2. Determinants of Pneumonia Incidence in Toddlers in Bengkulu City in 2020

| | Pneumonia Incident | | | | Total | | p-value | POR (95% CI) |
|---|---|---|---|---|---|---|---|---|
| | Yes | % | No | % | n | % | | |
| **Education** | | | | | | | | |
| Low | 9 | 69,2 | 4 | 30,8 | 13 | 100 | 0,548 | 1,779 (0,504 – 6,277) |
| High | 43 | 55,8 | 34 | 44,2 | 77 | 100 | | |
| **Exclusive Breast Feeding** | | | | | | | | |
| No | 28 | 77,8 | 8 | 22,2 | 36 | 100 | 0,004 | 4,375 (1,689 – 11,330) |
| Yes | 24 | 44,4 | 30 | 55,6 | 54 | 100 | | |
| **Immunization Status** | | | | | | | | |
| Incomplete | 44 | 75,9 | 14 | 24,1 | 58 | 100 | 0,000 | 9,429 (3,465 – 25,654) |
| Complete | 8 | 25 | 24 | 75 | 32 | 100 | | |
| **ARI History** | | | | | | | | |
| Yes | 40 | 75,5 | 13 | 24,5 | 53 | 100 | 0,000 | 6,410 (2,259 – 16,250) |
| No | 12 | 32,4 | 25 | 67,6 | 37 | 100 | | |
| **Residential Density** | | | | | | | | |
| Dense | 32 | 74,4 | 11 | 25,6 | 43 | 100 | 0,004 | 3,927 (1,602 – 9,625) |
| Not Dense | 20 | 42,6 | 27 | 57,4 | 47 | 100 | | |
| Total | 52 | 100 | 38 | 100 | 90 | 100 | | |

*Source : Primary Data, 2020*

Table 3. Final Model of Multivariate Analysis

| Variable | B | P-Value | Exp(B) OR | 95,0% C.I.for EXP(B) Lower | Upper |
|---|---|---|---|---|---|
| Exclusive Breast Feeding | 1.338 | 0,027 | 3.810 | 1.160 | 12.509 |
| Immunization Status | 1.241 | 0,066 | 3.459 | 0.923 | 12.955 |
| ARI History | 1.683 | 0,005 | 5.382 | 1.640 | 17.661 |
| Constant | -3.727 | 0,000 | .024 | 0.024 | |

*Source : Primary Data, 2020*

Based on the results of multivariate analysis with logistic regression test, the equation for the risk of contracting Pneumonia in Toddlers in Bengkulu City, with the following equation model:

$$y = \alpha + ß_1X_1 + ß_2X_2 + ß_3X_3$$

$$y = -3,727 + 1,338(X_1) + 1,241(X_2) + 1,683(X_3)$$

Remark =
$\alpha$ = Constant (-3,727)
$ß_1$ = Exclusive Breast Feeding Coefficient (1,338)
$ß_2$ = Immunization Status Coefficient (1,241)
$ß_3$ = ARI History Coefficient (1,683)
$X_1$ = Exclusive Breast Feeding Independent Variable ( 1 or 2)
$X_2$ = Immunization Status Independent Variable (0 or 1)
$X_3$ = ARI History Independent Variable ( 1 or 2)

In table 2, from 13 mothers with low education, there were nine (69.2%) who suffered from pneumonia with a p-value = 0.548 > 0.005. So, there was no significant relationship between mother's education and the incidence of pneumonia in toddlers in Bengkulu City. The POR value was 1.779 (0.504 – 6.277), which means that mothers with low education have a 1.779 times risk of their children suffering from pneumonia compared to those with higher education. Mother's education is one of the factors that can indirectly affect the incidence of pneumonia in infants and toddlers. Higher formal education of a mother can receive better knowledge or information than a mother with lower education so that mothers with higher education can take better care of their children (Sonego et al., 2015). The study result showed that from mothers with low education, there were nine toddlers (69.2%) who suffered from

pneumonia. With a p-value = 0.548> 0.005. So there was no significant relationship between the mother's education and the incidence of pneumonia in toddlers in Bengkulu City. A Mother with low education has a risk of 1.779 times for their children to suffer from pneumonia compared to those with higher education.

The result is not in line with other studies mentioning a significant relationship between the mother's education and the incidence of pneumonia in toddlers. The mothers with low education have twice the risk of their toddlers suffering from pneumonia compared to mothers with high education with a p-value (0.001) (Mondal & Paul, 2020). However, the result is in line with a study stating there was no relationship between mother's education and the incidence of pneumonia in toddlers at the Semowo Health Center with a p-value (0.299) (Astuti & Koesyanto, 2011). According to (Abbey et al., 2016), lack of awareness and introduction of pneumonia can cause children to get pneumonia. It may be due to the lack of education of caregivers so that their knowledge about prevention and treatment measures about pneumonia is also inadequate.

Of the 90 research respondents, mothers who did not give exclusive breastfeeding to their children, 28 toddlers (77.8%) suffering from pneumonia, with p-value = 0.004 <0.05, so there was a significant relationship between exclusive breastfeeding and the incidence of pneumonia in toddlers in Bengkulu City. The POR value was 4.375 (1.689 – 11.330), which means that mothers who do not give exclusive breastfeeding have a 4.375 times risk of their children suffering from pneumonia compared to those who give. The results of the multivariate analysis of variables that have an Exp (B) value, namely the Exclusive Breastfeeding variable with an Exp (B) value of 3.810 (1.160 – 12.509), means that exclusive breastfeeding to infants has an effect of 3.810 times on the incidence of pneumonia in toddlers in Bengkulu City. Exclusive breastfeeding is breastfeeding only to infants until six months without providing other food or fluids. The content in the breast milk that babies drink is sufficient and essential to the baby's health. Even newborns who receive only a low amount of the first milk (colostrum) do not need additional fluids because babies are born with enough fluids in their bodies (Mustikarani et al., 2019). Breast milk contains immune substances against infections, including proteins, lactoferrin, immunoglobulins. It also contains antibodies against bacteria, viruses, fungi, and others. Therefore, exclusive breastfeeding reduces infant mortality rates due to various common diseases that afflict children, such as pneumonia, pulmonary inflammation, speeding up recovery when sick, and helping to space births (Bham et al., 2016).

Previous researchers supported this result who stated that suboptimal breastfeeding increases the risk of pneumonia morbidity and mortality in all age groups. In particular, mortality from pneumonia was higher in infants who do not get breast milk than exclusively breastfed infants aged 0-5 months (RR: 14.97; 95% CI: 0.67-332.74) and in infants who do not get breast milk compared to infants and young children aged 6-23 months (RR: 1.92; 95% CI: 0.79-4.68) (Lamberti et al., 2013). In addition, exclusive breastfeeding at six weeks of age significantly reduces the likelihood of hospitalization for suspected pneumonia in rural Vietnam (Odds Ratio (OR) 0.39, 95% Confidence Interval (CI) 0.20 to 0.75) (Hanieh et al., 2015).

Of 90 respondents with incomplete immunization status, 44 toddlers (75.9%) suffered from pneumonia, with p-value = 0.000, so there was a significant relationship between immunization status and the incidence of pneumonia in toddlers in Bengkulu City. The POR value was 9,429 (3,465 – 25,654), which means that toddlers who are not fully immunized have a 9.429 times risk of suffering from pneumonia compared to those who get full immunization. From the multivariate results, the immunization status had an influence on the incidence of pneumonia in toddlers with an Exp (B) value of 3.459 (95% CI = 0.923 - 12.955), which means that immunization status in toddlers had an effect on 3.459 times on the incidence of pneumonia in Bengkulu City.

Immunizations help prevent babies from developing infections that directly cause pneumonia, such as Haemophilus influenza type B (Hib). It can also prevent infections causing pneumonia as a complication of the

disease (eg, measles and pertussis). DPT immunization is one of the effective immunizations to reduce factors that increase mortality from pneumonia (Azab et al., 2014). Pneumonia remains the top cause of morbidity and mortality. Risk factors include young age, malnutrition, immunosuppression, tobacco smoke, or exposure to air pollution. The better methods, for specimen collection and molecular diagnostics, have improved microbiological diagnosis showing that pneumonia is caused by several interacting organisms, so immunization is urgently needed to prevent this disease (Marangu & Zar, 2019). These results are relevant with previous studies stating a very low incidence of pneumonia in the Pune and Sangli districts of Maharashtra. Partial immunization emerged as the most influenced risk factor. The low incidence and lack of association of pneumonia with known risk factors may be due to better literacy rates among mothers and better immunization coverage (Gothankar et al., 2018).

The results of this study are in line with (Zhang et al., 2013), showing that toddlers who do not receive immunizations have the opportunity to experience pneumonia. Subsequent research stated a significant relationship between immunization status and the incidence of pneumonia in children under five (Vignari, 2020). According to (Almirall et al., 2015), prevention strategies promoting effective vaccines or identify and act on modifiable risk factors are very important in reducing pneumonia-related deaths in children under five.

Of the 90 research respondents, 40 children (75.5%) had pneumonia, with a p-value = 0.000, so there was a significant relationship between a history of ARI and the incidence of pneumonia in children under five in Bengkulu City. The POR value is 6.410 (2.259 – 16.250), which means that toddlers with a history of ARI have a 6.410 times risk of suffering from pneumonia compared to those without an ARI history. From the results of the multivariate analysis, the history of ARI affected the incidence of pneumonia in toddlers. It has an effect of 5,382 times on the incidence of pneumonia in toddlers in Bengkulu City.

Acute Respiratory Infection (ARI), especially pneumonia, is still the most cause of morbidity and mortality in infants and toddlers. Pneumonia is an acute infection that affects the lung tissue (alveoli) and has cough symptoms, shortness of breath, rales, and infiltrates on X-rays. The occurrence of pneumonia in children often coincides with an acute infectious process in the bronchi, which is often called bronchopneumonia (Saha et al., 2016). The results are in line with previous studies stating the presence of concomitant disease or ARI (OR = 1.902; 95% CI, 1.043–3.469; P = 0.036). Then there is a significant relationship with the incidence of pneumonia in toddlers, so it is necessary to develop an intervention to reduce the burden of pneumonia in toddlers in Egypt (Fadl et al., 2020). Another opinion states that co-residents with upper respiratory tract infections (ARI) also influence the occurrence of pneumonia in toddlers (Bekele et al., 2017).

Of the 90 respondents, 32 people (74.4%) who lived in dense residential areas had pneumonia, with a p-value = 0.004, so there was a significant relationship between a history of ARI and the incidence of pneumonia in toddlers in Bengkulu City. The POR value is 3.927 (1.602 – 9.625), which means that toddlers who live in dense residential have a 3.927 times risk of suffering from pneumonia compared to those who are not. The density of the house occupancy is closely related to the air ventilation of the house. Residential conditions that are too dense and lack air ventilation can increase the air temperature in the house so that the house feels hotter because of the water vapor produced by the body's metabolism and objects in the room. The more residents gather in a room, the more likely the risk of disease transmission will be, especially for babies who are relatively susceptible to disease transmission. The theory is in line with the study showing that Toddlers who lived in dense residential, 32 people (74.4%) suffering from pneumonia, with a p-value = 0.004. So there was a significant relationship between residential density and the incidence of pneumonia in toddlers in Bengkulu City and have a risk of 3,927 times of suffering from pneumonia compared to those who are not dense. The results of this study are in line with research finding a significant relationship between residential density and

the incidence of pneumonia (p-value 0.000). Children who live in densely populated homes have 3.6 times the chance compared to those living in non-dense houses.

This study is supported by (Almirall et al., 2015), stating a relationship between housing density and the incidence of pneumonia for toddlers aged 12 - 59 months with 3.77 times greater risk of occurring in toddlers who live with dense housing than those who live in less dense housing. A house is considered dense when it is not only occupied by one family, but can be two to three families. It can affect the level of residential density even though the house has a large building area. Density is a prerequisite for the disease transmission process. The denser it is, the easier and faster the transfer of disease, especially airborne diseases. Therefore, the residential density is a variable playing a role in the incidence of pneumonia in toddlers. This study is in line with research (Pramudiyani & Prameswari, 2011), finding a relationship between room occupancy density and the incidence of pneumonia in toddlers with p = 0.001.

## Conclussion

There is a relationship between exclusive breastfeeding (p-value = 0.004), immunization status (p-value = 0.000), history of ARI (p-value = 0.000) and occupancy density (p-value = 0.004) with the incidence of pneumonia in toddlers in Bengkulu City in 2020. The mother's education variable has no significant relationship with the incidence of pneumonia in toddlers in Bengkulu City in 2020. From the results of multivariate analysis, the most influential variable on the incidence of pneumonia in toddlers is the history of ARI with the largest Exp(B) value of 5,382. (1,640 – 17,661). It means that a history of ARI in toddlers risks 5,382 times on the incidence of pneumonia in toddlers in Bengkulu City. From the results of multivariate analysis, the most dominant variable influencing the incidence of pneumonia in toddlers was exclusive breastfeeding with an OR value of 3.810 (1.160 – 12.509).

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# The Effect of Community Based Total Sanitation with Diarrhea Among Toddlers

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**Abstract**

The high rate of diarrhea Associated with hygiene and environment. Prevalence of diarrhea still high in Indonesia although community total sanitation program (STBM) has done. Proportion of diarrhea balita in Samosir regency more than 40 % in 2019.The objective of the research was to analyze community based total sanitation with child diarrhea among toddlers. This was an analytic study design, based on its time used cross-sectional study design. The data was collected by observation and interviews. The sample selection was done by purposive sampling with 200 samples, which responden is the mother who have toddlers arround 3 district in Samosir regency. Data analysis used chi square test and multiple-logistic regressions. This result showed that stop open defecation (p value 0.001), hand washing (p value = 0.039), water and household food management, household waste management, and household liquid waste significantly affected diarrhea among toddlers. Hand washing with soap with Exp B=6 and waste disposal management more effect with diarhea, therefore its sugested for all stake holder to increase campaign of hand washing and household waste management in community.

## Introduction

Diarrhea in toddlers in the world is still the most common cause of death, although there has been a decline in cases of diarrheal deaths from 2005-2015 by 20 percent. Every year there are 1.7 billion cases of diarrhea in children in the world, where as many as 525,000 cases of death occur in toddlers. Diarrhea in the toddler group is the most vulnerable group and has the potential to cause death and is not treated seriously. The highest incidence of diarrhea cases occurs in the first two years of life and will decrease with increasing age (Troeger C et. al, 2017)

According to Adane M et.al (2017) Diarrhea cases in toddlers are more common in developing countries than in developed countries. This is caused by several factors, including the lack of drinking water that is suitable for consumption, lack of awareness of hygiene and sanitation and poor nutritional status and public health status. It is estimated that around 2.5 billion people still have poor sanitation facilities and 1 billion people do not have access to safe drinking water. Diarrhea in Indonesia is still an endemic disease and is still a potential outbreak disease (KLB) accompanied by death. The results of Riskesdas in 2018 stated that the prevalence of diarrhea in toddlers in Indonesia based on the diagnosis of health workers increased from 2.4 percent in 2013 to 11 percent in 2018..

Based on data from the Indonesian Health Profile (2018), it was found that the number of children with diarrhea under five in North Sumatra in 2018 was 255,909 cases with a service coverage of 16.73 percent. The highest cases of diarrhea in toddlers were found in West Java province as many as 732,324 cases, while the lowest cases of diarrhea in toddlers

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were in the province of North Kalimantan with 12,551 cases. In 2017, the number of cases of diarrhea in toddlers in Samosir was the highest in addition to the Kepulauan Nias.

Diarrhea disease is still included in the 10 (ten) most cases of disease in Samosir Regency, where diarrhea occupies the 6th (six) most position of the ten largest diseases in Samosir Regency in 2018 and 2019. In 2018 the number of detection targets cases of diarrhea from all ages was 3,397 cases. Most diarrhea sufferers are in the toddler age group with a proportion of 43 percent. The number of diarrhea cases found and treated was 3,124 cases (92%). The highest findings were in Tuktuk Siadong Health Center (251.8%) and Lottung Health Center (219.3%). The lowest number of cases was at the Onan Runggu Health Center (36.6%).

Study Results of Environmental Health Risk Assessment (EHRA) or Health Risk Assessment Study in the Samosir Regency Environment in 2014 showed that the population behaved in open defecation by 37.3 percent. In general, people defecated in Samosir Regency in 2014 using private latrines (69.1%), public toilets (2.1%), dug holes (0.5%) and helicopter toilets (0.5%). 1%). There are still households that do not use defecation facilities so that they practice open defecation, which is 35.3 percent. This shows that the population who has access to proper sanitation or healthy latrines has increased every year which has an effect on decreasing the incidence of diarrhea (Mosler H-J, Mosch S & Harter M, 2018)

One of the government's strategies in reducing diarrhea cases is the Community-Based Total Sanitation strategy (STBM) as stated in the Minister of Health Regulation No. 3 of 2014. The results of the research by Nyambe S, Angestik & Yamauchi (2020) stated that the success of STBM is not only in increasing access to sanitation but also aspects of behavior change and community hygiene. In addition, a good economic aspect of the community also improves sanitation facilities so that it can reduce the incidence of diarrhea (Sumampouw et.al, 2019).

This study aims to analyze the effect of the Community-Based Total Sanitation program on the incidence of diarrhea in toddlers in Samosir Regency.

## Methods and Materials

This type of research is an analytical survey using a cross sectional research design, which is a study that studies the dynamics of the correlation between risk factors and effects, by approaching, observing or collecting data all at once (point time approach). The time of the research was carried out starting from the initial Research Survey in August 2019 until June 2020.

Population is a collection of all subjects that have certain characteristics. The population in this study is mothers who have toddlers who live in the work area of the Samosir Regency Health Office, where there are 1893 toddlers in 12 (twelve) health centers in Samosir Regency. The sample is the object under study and is considered to represent the entire population. The samples in this study were some mothers who had toddlers and were in the working area of the Samosir Public Health Center.

The samples in this study were obtained from 4 Health Center areas in Samosir Regency, namely Tuktuk Siadong Health Center, Lottung Health Center, Buhit Health Center, and Onan Runggu Health Center. Purposive sampling by making inclusion and exclusion criteria. The inclusion criteria for mothers of toddlers who were used as samples in this study were: 1) Registered at the integrated service post in the Health Center areas and have settled in the working area of the Lottung Health Center, Tuktuk Health Center, Buhit Health Center, and Onan Runggu Health Center for at least the last one year, 2) Mothers of toddlers who are willing to be respondents and have good communication. Exclusion criteria for mothers of toddlers, namely: 1) Mothers of toddlers who are not willing to sign the informed consent, 2) Mothers of toddlers who experience mental illness/disorders.

The sample size in this study was obtained from the ISSAC and MICHAEL tables based on the total population in the four working areas of the Samosir District Health Center with an error degree of 10% (ten percent). Based on the table obtained a sample of 200 people. The sample size of 200 mothers of toddlers is believed to have been representative of the population in Samosir Regency. Sources of data in this study are primary and secondary

data. Primary data is data obtained directly from the results of interviews and observations using a questionnaire regarding defecation behavior (stop devecate), habit of washing hands with soap (ctps), drinking water and household food management (pammrt), household waste management (psrt), household liquid waste management (plcrt). Secondary data is data obtained from the Health Office, Health Center, books, internet, and other references. The data that has been obtained were analyzed by chis square and multiple logistic-regression using SPSS software.

## Results and Discussion

The majority of the education of mothers of toddlers is Senior High School (SMA) by 61.5% or as many as 123 people and the lowest education is not graduating from Elementary School (SD) or completing Elementary School by 2.5% or 5 people. The highest income for mothers of toddlers is below the Regional Minimum Wage of Samosir Regency. Samosir's Regional Minimum Wage (UMR) in 2019 was 2 million/month. The income of mothers under the UMR is 75%, while the income above the Regional Minimum Wage is 25%.

The age category of toddlers based on the results obtained was at the age of 1 to 2 years as many as 62% or totaling 124 toddlers while the age category of toddlers at the age of more than 2 years to 5 years was 38% or amounted to 76 people. Diarrhea in toddlers is 25.5% or 51 toddlers while toddlers who do not experience diarrhea are 75.5% or 149 toddlers. The characteristics of respondents and toddlers are presented in table 1 as follows.

Table 1. Characteristics of Respondents and Toddlers

| Characteristics | Number | % |
|---|---|---|
| **Mother's Education** | | |
| Did not finish Elementary | | 2.5 |
| School and finished **Elementary School** | 5 | 24 |
| Junior High School | 48 | 61.5 |
| Senior High School | 123 | 12 |
| Academy and College | | 24 |
| **Mother's Income** | | |
| UMR below | 149 | 25 |
| Bigger than UMR | 51 | 75 |
| **Toddler Age** | | |
| 1 – 2 years old | 124 | 62 |
| > 2 – 5years old | 76 | 38 |
| **Diarrhea Status** | | |
| Diarrhea | 51 | 25.5 |
| Not Diarrhea | 149 | 74.5 |
| **Total** | 200 | 100 |

Source: Primary Data, 2020

Bivariate analysis was conducted to determine the relationship between each variable STBM and sociodemography with the variable incidence of diarrhea in children under five. This analysis uses the chis square statistical test at the 95% confidence level. The variables that will enter the multivariate model are variables that have a p-value <0.25 as the initial stage of multivariate analysis. The results of the bivariate test are listed in table 2 below.

Table 2. Relationship between Sociodemography and STBM with the Incidence of Diarrhea in Toddlers

| Variable | Diarrhea | | No Diarrhea | | Total | | PR | P |
|---|---|---|---|---|---|---|---|---|
| | F | % | F | % | f | % | | |
| **Mother's Education** | | | | | | | | |
| Low | 31 | 28.2 | 79 | 71.8 | 110 | 100 | 1.26 | 0.424 |
| High | 20 | 22.2 | 70 | 77.8 | 90 | 100 | | |
| **Income** | | | | | | | | |
| < UMR | 32 | 26.7 | 88 | 73.3 | 120 | 100 | 1.12 | 0.76 |
| > UMR | 1 | 23.8 | 61 | 76.2 | 80 | 100 | | |
| **Age of toddlers** | | | | | | | | |
| 1 – 2 years old | 28 | 23 | 94 | 77 | 124 | 100 | 0.77 | 0.385 |
| > 2 – 5 years old | 23 | 30 | 55 | 70 | 76 | 100 | | |
| **Stop Devecate** | | | | | | | | |
| Not Safe yet | 26 | 46 | 30 | 54 | 56 | 100 | 2.67 | 0.001 |
| Safe | 25 | 17 | 119 | 83 | 144 | 100 | | |
| **CTPS** | | | | | | | | |
| Poor | 49 | 30 | 115 | 70 | 164 | 100 | 5.37 | 0.005 |
| Good | 2 | 6 | 34 | 94 | 36 | 100 | | |
| **PAMMRT** | | | | | | | | |
| Not Safe yet | 27 | 35.5 | 49 | 64.5 | 76 | 100 | 1.83 | 0.017 |
| Safe | 24 | 19.4 | 100 | 80.6 | 149 | 100 | | |
| **PSRT** | | | | | | | | |
| Not Safe yet | 43 | 28 | 112 | 72 | 155 | 100 | 1.56 | 0.248 |
| Safe | 8 | 18 | 37 | 82 | 45 | 100 | | |
| **PLCRT** | | | | | | | | |
| Poor | 44 | 24 | 143 | 76 | 187 | 100 | 0.43 | 0.023 |
| Good | 7 | 54 | 6 | 46 | 13 | 100 | | |

Source: Primary Data, 2020

Based on Table 1 above, it can be seen that the socio-demographic variable has no relationship with the incidence of diarrhea in toddlers with p value > 0.05. There is a relationship between stop devecate and the incidence of diarrhea in toddlers where p value 0.000 < from alpha (0.05) where the prevalence ratio (PR) is 2.67 which means that mothers who have not stopped devecate have a 2.67 times risk of developing diarrhea in toddlers than mothers who have stopped devecate. There is a relationship between hand washing with soap (ctps) and the incidence of diarrhea in toddlers where p value is 0.005 < from alpha (0.05). The prevalence ratio is 5.37, which means that poor CTPS have five times the chance of getting diarrhea than mothers who do CTPS well.

There is a relationship between PAMMRT and the incidence of diarrhea in toddlers where p value (0.01) < 0.05. The prevalence ratio is 1.08, which means that PAMMRT is still neutral where mothers who are not good at managing food and beverages have a 1.08 times risk of getting diarrhea in toddlers than mothers who have poor food and beverage safety. Multivariate analysis used logistic regression to determine the most dominant variable influencing the incidence of diarrhea in toddlers by selecting variables that could potentially be included in the model, namely variables that had a value p < 0,25 on bivariate analysis. Based on the results of statistical tests on variables, the variables included in the multivariate analysis are Stop open defecation, wash hands with soap, food and beverage management, household waste security, and household liquid waste security. The method used in this test is Backward as shown in table 3 below.

Table 3. Stages of Multiple Logistic Regression Test for Diarrhea in Toddlers in Samosir Regency

| | B | | | 95% CI for EXP (B) | |
|---|---|---|---|---|---|
| | | Sig. | Exp(B) | Lower | Upper |
| Step 1[a] | Ctps | 1.777 | .021 | 5.915 | 1.315 | 26.604 |
| | Stop devecate | 1.234 | .001 | 3.434 | 1.641 | 7.185 |
| | Psrt | 1.413 | .015 | 4.109 | .805 | 3.387 |
| | Plcrt | -2.119 | .009 | .120 | 1.318 | 12.813 |
| | Pamrt | .502 | .171 | 1.651 | .025 | .584 |
| | Constant | -2.468 | .014 | .085 | | |
| Step 2[a] | Ctps | 1.840 | .016 | 6.298 | 1.411 | 28.118 |
| | Stop devecate | 1.325 | .000 | 3.761 | 1.820 | 7.772 |
| | Psrt | 1.423 | .014 | 4.151 | 1.342 | 12.841 |
| | Plcrt | -2.074 | .009 | .126 | .026 | .599 |
| | Constant | -2.389 | .016 | .092 | | |

Source: Primary Data, 2020

Based on the results of the logistic regression test, it is known that the variables that have the greatest influence on the incidence of diarrhea in toddlers are washing hands with soap and securing household waste to prevent diarrhea in toddlers. The multiple logistic regression equation models that are formed are as follows: If the CTPS and PSRT variables are bad (1), then the probability for the occurrence of diarrhea can be projected as follows.

$$P(y) = \frac{1}{1 + e^{-(-2.389+1.840(X1)+1.325(X2)+1.423(X3)-2.074(X4)}}$$

Description:

P (y) : Probability of diarrhea in toddlers
X1 : CTPS, regression coefficient 1.840
X2 : PSRT, regression coefficient 1.325
X3 : Stop devecate, regression coefficient 1.423
X4 : PLCRT, regression coefficient -2.074
a : Constant -2.389
e : Natural number 2,7

Based on the probability calculation from the multiple logistic-equation, the probability of diarrhea occurring if the STBM program is not carried out is 53 percent, while if the STBM program is carried out the probability of diarrhea in toddlers is only 8 percent. This shows that mothers of toddlers who do not wash their hands with soap properly have a 53 percent risk, while 47 percent are determined by other influences not included in this study. The comparison or risk group of mothers of toddlers who do not practice CTPS with mothers of toddlers who do CTPS well is 6 times for the occurrence of diarrhea in toddlers in Samosir Regency.

Based on the results of the study, it was found that there were 144 mothers of toddlers who had stopped devecating or 72 percent, while 56 percent of mothers of toddlers who had not stopped devecate or 28 percent. Stop devecate is a condition where people have safe and healthy habits in defecating, where there are no more people who defecate not in sanitary latrines. This study is in line with the results of Ayawale (2018). About environmental risk assessment factors on the incidence of diarrhea in toddlers in Dangla District, eastern Ethiopia which states that environmental factors such as ownership of healthy latrines have a significant influence in reducing the incidence of diarrhea. Total sanitation also increases ownership of healthy latrines which reduces the incidence of diarrhea in toddlers with OR=2.48 (Tessema, 2017). Areas with Open defecation free (ODF) or Stop devecate have the percentage of bacteria e. coli which is less than the area that has not stopped devecate (Babb, et al., 2018).

The results showed that the prevalence

ratio (RP) of stop devecate tends to affect 2.67 times for diarrhea compared to families who have not stopped devecate. This study is in accordance with the study of Troeger C et al (2017), which stated that there was a significant relationship between the application of stop devecate and a decrease in the incidence of diarrhea in toddlers. Increasing access to healthy latrines must be accompanied by increasing public knowledge so that increased access to sanitation is also in line with the reduction in the incidence of diarrhea in the community.

The increase in the STBM program, the first pillar of stop devecate in Samosir Regency, is increasing over time, where 85 percent of the population's homes already have sanitary latrines, so it is believed to have an effect on reducing diarrhea cases in children under five in Samosir Regency. This is the commitment of the stakeholders, especially the central and local governments in order to improve sanitation facilities and infrastructure, especially the ownership of latrines in supporting health and tourism progress in Samosir Regency. The improvement of sanitary latrine facilities in Samosir has shown the commitment of the local government to stop open defecation. This study is in line with research results of Harter,et.al (2019) and Modern, et.al (2020), that Community-Based Total Sanitation can affect family sanitary latrine ownership which has an impact on reducing diarrhea cases in toddlers.

The results showed that the habit of washing hands with soap for mothers of toddlers in Samosir Regency obtained data that as many as 164 mothers of toddlers or 78 percent had not done CTPS well while mothers of toddlers who did CTPS well were 36 people or 22 percent. Research of Briceno B et al (2017) in Tanzania which states that there is an effect of hand washing with soap with a decrease in diarrhea cases. Several research results show that the promotion of hand washing behavior, improvement of clean water quality and environmental sanitation have been shown to reduce the incidence of gastrointestinal and respiratory diseases. The action of maintaining hand washing habits needs to be maintained by evaluating whether hand washing is still being carried out. Structural constraints (providing clean water facilities) can affect hand washing behavior. The mass media have an important role in the promotion of personal hygiene, including hand washing, so it needs to be used properly in the current era of sophisticated technology (Tidwell JB et.al, 2020).

Based on the results of the multivariate test, washing hands with soap is the most influential variable on the incidence of diarrhea in toddlers where mothers who do not get used to washing their hands with soap have the possibility of diarrhea in toddlers 6 times compared to mothers who get used to washing their hands with soap Oloruntoba (2014), stated that mothers of toddlers who do not wash their hands with soap have 3 times the risk of developing diarrhea in their toddlers (OR=3). Based on the results of observations, most of the mothers of toddlers have managed food and drinks well, namely already boiling drinking water before consumption, placing food ingredients in closed places or cooking food immediately after purchase, consuming food that is still fresh and not moldy or rotting and always cover the food served with a serving hood. So the possibility of fly vectors or other vectors to land on food is quite small. Mothers of toddlers who manage food and beverages safely are 124 people, while mothers of toddlers who do not manage food and beverages safely are 76 people.

In this study, multivariate results showed that the processing of food and beverages in Samosir did not show any effect on the incidence of diarrhea in toddlers. This shows that the food and beverage security of the community is quite good. This research is in line with Suriadi (2016), which states that there is no influence of hygiene and sanitation of drinking water depots with an increase in e coli which is one of the causes of diarrhea.

The decrease in the prevalence of diarrhea can occur by managing safe drinking water in the household. Families who use drinking water by boiling, chemical processing or filtering are known to have a lower chance of suffering from diarrhea than children whose families do not treat water. The stored water can be contaminated during the collection, transportation and storage processes which in turn can increase the risk of diarrhea

(Wanzahun & Mengiste, 2013). This is also in line with research of (Soboksa, Garl, Hallu, & Alemu, 2020) which states that drinking water treatment reduces the incidence of diarrhea in toddlers in Ethiopia. Unprotected drinks and food result in an increase in bacterial contamination so that there is a risk of causing diarrhea (Kapwata, Mathee, Roux, & Wright, 2018). This happens vulnerable to the condition of families or communities living in rural areas. Households that do not have safe drinking water sources are at a higher risk of having diarrhea (Patunru, 2015).

Safe household waste security from the research results obtained in Samosir Regency there were 22 percent or 45 people while 78 percent did not secure household waste. The number of trash bins close to people's homes is one of the risk factors for diarrhea where garbage close to homes contains lots of germs and brings in fly vectors. Household waste security that is already good only focuses on the district center in Pangururan, not evenly distributed in other areas in the Samosir Regency.

There is an influence between households disposing of waste in a place that has been provided in the form of a closed trash can (TPS) with a decrease in the incidence of diarrhea in toddlers. Households that throw garbage in any place can cause unpleasant odors and cause aesthetic problems and can be a breeding ground for insects (flies), rodents (rats), and other animals that transmit germs which in turn live on food, enter the body of toddlers fecal-orally, resulting in the incidence of diarrhea. This is in line with studies of Harter (2019), Modern (2020), and Melese (2019), stated that poor waste disposal has the potential to cause diarrhea in toddlers 3 times.

Based on the results of observations, most of the mothers of toddlers already have sewerage and it runs smoothly so that there is no stagnant wastewater, but the waste water is not managed properly, that is, it does not drain waste into infiltration wells or is channeled into public sewerage. Most households still channel their house liquid waste water into a ditch that will lead to Danau Toba without a temporary sewage pond. The results of the chi square test show that there is a relationship between household wastewater treatment and the incidence of diarrhea in toddlers ($p = 0.036$) < alpha (5%), but the prevalence ratio shows that the liquid waste factor does not indicate a possible risk where $PR = 0.43 < 1$. The results of this study are in accordance with the research Ramanathan (2019), on improving access to sanitation including household waste water to reduce the incidence of diarrhea in toddlers. There is a synergy between access to total sanitation with a decrease in the prevalence of diarrhea in toddlers in India.

## Conclusion

Community-based total sanitation has an effect on the incidence of diarrhea in toddlers, namely hand washing with soap, stop devecate, household food and beverage processing, household waste security, and household wastewater treatment. The multivariate modeling obtained shows that hand washing with soap, Stop devecate, poor food and beverage management and household waste processing have a 53 percent risk for the occurrence of diarrhea in toddlers. Mothers of toddlers who do not wash their hands with soap well have 6 times the chance of having diarrhea in their toddlers than mothers of toddlers who do CTPS well. Cooperation from all cross-sectors from the government, religious leaders, community leaders, community participation, and the private sector can improve sanitation facilities and the habit of washing hands with soap.

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# Worker Health Monitoring Through Whole Body Counter Examination for Safety and Radiation Protection (2017-2019 Data)

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**Abstract**

Radiation protection is an action or effort taken to reduce the effects of damaging radiation exposure. Therefore, it is necessary to routinely monitor the condition of workers, among others, with a whole-body counter (WBC) either for daily activities or in a radiation emergency. In this research 78 male and female workers with an average age of 44.51 years old who have been worked for 1 up to more than 30 years at the Center for Technology of Radiation Safety and Metrology (PTKMR) - BATAN in 2018-2019 have been determined with standard procedures. The results showed that the average K-40 count for the year 2018 was 3767.35 ± 975.33 Bq. Among the 80 participants tested, internal radio-isotopic contamination with Cs-137 was detected in one person, but the levels were marginal and just exceeded the detection limit (250 Bq/body). This average value was lower than that of the previous year (2017) i.e. 4274.74 ± 740.85 Bq for 43 respondents. There is no positive correlation between radioactivity with the bodyweight of respondents but correlated positively with body mass index. It is concluded that the radio-activities of the workers of PTKMR are still within a normal range.

## Introduction

Currently, the use of nuclear energy and technology is very broad, covering almost all aspects of human life, for example the fields of health, industry, space, agriculture, and energy generation (Brook, et al., 2014; Bielecki, 2020). The application of radiation in these various fields is certainly accompanied by health risks for its workers. Various radiation effects, both deterministic and stochastic, are well known. To prevent and reduce the effects of radiation, protection measures must be made in every radiation application, including monitoring the health of radiation workers (Wunderle, 2015). The main objective of radiation worker health surveillance is to assess the fitness of the worker at baseline and during work related to radiation sources (Ko, 2017).

Radiation safety and protection is a branch of science related to medical engineering, namely the protection that needs to be given to a person or group of people against the possible negative effects of ionizing radiation, while the activities required to use ionizing radiation sources are still being carried out (Desouky & Ding, 2015). Currently for this purpose monitoring tools and methods have been used such as physical dosimeter satisfactory (Watanabe, 2017). This is supported, among other things, by implementing a dose limit value (NBD). NBD is the largest dose permitted by the supervisory agency (Nuclear Energy Supervisory Agency, BAPETEN) which can be received by radiation workers and members of the public within a certain period of time without causing significant genetic and somatic effects due to the use of nuclear energy (Desouky & Ding, 2015). However, radiation workers have the potential to receive unwanted radiation exposure either exceeding or not exceeding the permitted NBD, as a result of an accident or due to incorrect work procedures.

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Immediately after exposure to excess radiation, management should carry out investigations to determine the dose received by workers. If the dose is known, the damage or contamination will occur, then it must be informed to the occupational health service. If an excessive dose of irradiation is suspected to have the potential to have a negative impact on the health of radiation workers, additional health checks are necessary (Vaiserman, 2018).

To reduce health threats and avoid unwanted radiation exposure, accurate assessment of the radiation exposure of workplace workers or residents living in radioisotope contaminated areas is necessary (Yasumura, Hosoya, & Yamashita, 2012). Ionizing radiation which affects living systems can produce a range of biological outcomes including inflammation, tissue injury, carcinogenesis and death (Reisz, 2014; Nakamura, 2013). Although radiation accidents are highly rare these days, the situation that arises will be very serious. Various ways can be done to monitor the health of workers, including Thermo Luminescence Dosimeter (TLD) for external exposure (Botwe, 2015), blood chromosome examination (Perumal, et al., 2015; Bi, 2019), examination through urine analysis (bioassay) (Yoo, et al., 2016), whole body counter (WBC) (Shimmura, 2015), etc. with their respective advantages.

Whole Body Counter (WBC) is a device for measuring radioactivity in the human body. This technique is primarily intended for radioactive materials that emit gamma rays. Alpha particle decay can also be detected indirectly by the coincidence of gamma rays. Under certain circumstances, beta yields can also be measured, but with less sensitivity (Shimmura, 2015). In nuclear facilities, these counters are used to measure radioactivity in the human body, that is to say, for the measurement of internal contamination. Full-body counters are highly sensitive devices and are therefore often surrounded by a large amount of lead shielding to reduce background radiation. The full body counter consists of, for example, a standing booth stand with two large area NaI scintillation detectors (Hosokawa, 2017). Whole body counting has been directed towards two uses, firstly, with regard to detection and measurement of trace amounts of radioactivity naturally or inadvertently in the body (accident), and second, with regard to the absorption and retention of radionuclides administered for diagnostic or therapeutic purposes (Yonekura, et al., 2019). Currently health physicists in many laboratories use a total body count (WBC) to estimate the body burden of radioactive material. Direct external measurement with WBC is in most cases with more convenient and accurate method than estimating body load from excretion data. The purpose of this study was to estimate the body load of radionuclides in a number of workers at PTKMR in 2017-2019.

## Methods

This research was conducted at the Center for Safety Technology and Radiation Metrology, BATAN Pasar Jum'at, South Jakarta. The research was started in August - November 2017 and 2018. The equipment used was Horizontal Bed Whole Body Counter Model 2260, ACCUSCAN brand, product of CANBERRA Industries at PTKMR. This equipment is a full-body counting system, equipped with a turn-key. This system identifies and measures radioactivity in the human body in a matter of five to eight minutes. The enumeration is done after the WBC is calibrated, which includes energy calibration, FWHM (Full Width Half Maximum) calibration and efficiency of calibration. After the equipment has been calibrated, a respondent census is carried out where the instructor provides a brief explanation to the respondent about the implementation of the measurement. Respondents are expected to position themselves on the bed on the WBC device lying on their back, and be calm and not move much during the examination, namely census for 10 minutes. The spectrum of the census results is stored in a file and then analyzed to calculate the sample activity in two ways, namely program (software) and manually. For the calculation of activity with software, the spectrum of the sample or respondent count results is analyzed using 3 calibration equations that have been done previously, namely energy calibration, FWHM and efficiency. After the program processes the data, the results will be obtained in the form of: the type of radionuclide, energy

and activity of the sample or respondent being enumerated.

For manual counting, the area of the peaks is determined from the spectrum of the existing peaks, then the count per second (cps) is determined by dividing the area by the length of the count in second units. With equation [I], the activity of the chopped sample can be calculated. The detection efficiency values used in manual calculations are the same as those used in software calculations. Next is the spectrum analysis of the census results and recording the results on the Radiation / Nuclear Accident Examination Form.

## Results and Discussions

The results of the calculation using software and manual are shown in Figure 1. From the figure, it can be seen that the activity resulting from the calculation of the software is always greater than the activity of the enumerated sample; this is due to an error in the parameters in the software used to analyze the spectrum of the census results so that improvements are still needed. The accuracy of the tool is also greater according to the increase in energy of the chopped sample. For whole body chopping with standard sample Cs-137, the accuracy level is 83.95%.

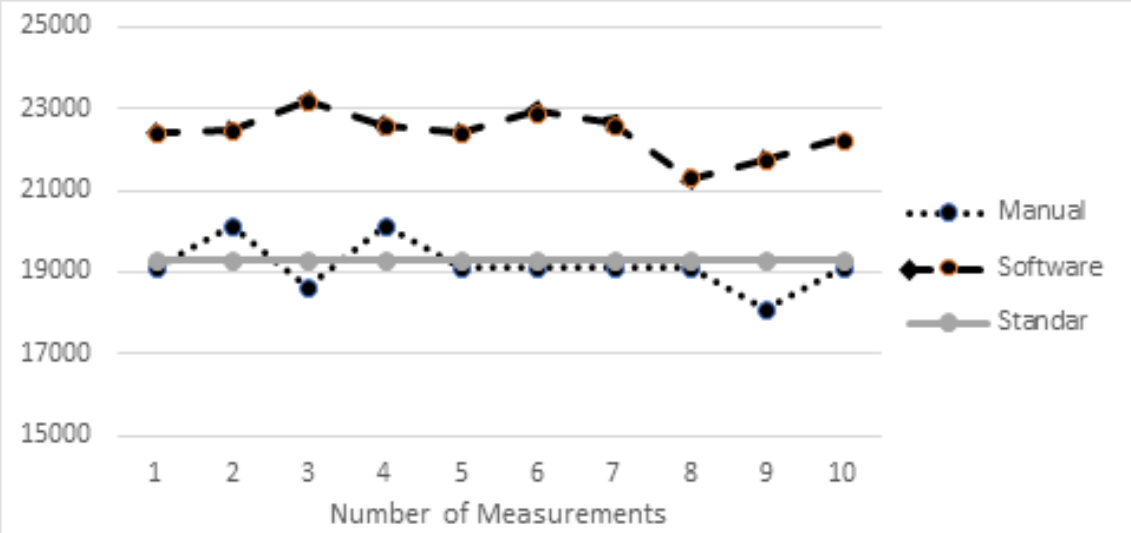


Figure 1. Software and Manual Calculation Activities for Whole Body Counting were Compared with Standard Source Cs-137 = 19,300 Bq

The measurement results show that the average count of K-40 radionuclides from 78 respondents for 2018 is 3768.64 ± 973.55 Bq. This result is still in the normal category or is still below the specified limit. Among the participants tested, one worker had detected radioisotope Cs-137 contamination, but the level was still within safe limits and only slightly exceeded the detection limit (250 Bq/body). The average value of this measurement is lower than the results of the previous years monitoring (2017), namely 4274.74 ± 740.85 Bq for 43 respondents (Table 1). There was no positive correlation between body weight and K-40 activity for each respondent. An example of the counting results of a respondent showing the measured isotope peaks is presented in Figure 2.

Table 1. The Average Value of K-40 (Bq) Radioactivity Measurements with WBC for PTKMR Respondents in 2017 and 2018

| Year | Number of Respondents | Male/Female | Age | Activity of K40 (Bq) |
|---|---|---|---|---|
| 2017 | 43 | 23/20 | 46.51 ± 9.82 (25 - 60) | 4274.74 ± 740.85 (2550 – 5510) |
| 2018 | 78 | 42/36 | 44.39 ± 12.67 (22 – 60) | 3768.64 ± 973.55 (2045 - 6088) |

Source: Primary Data, 2018

Referring to the maximum allowable limit (i.e. 370 Bq/kg) (Darwish et al., 2014), the amount or activity obtained in this study is still far from this limit. For example, for 2017 where the average activity was 4274.74 Bq for 65.97 kg, the activity would be 64.79 Bq/kg, while for 2018 it was 57.26 Bq/kg.

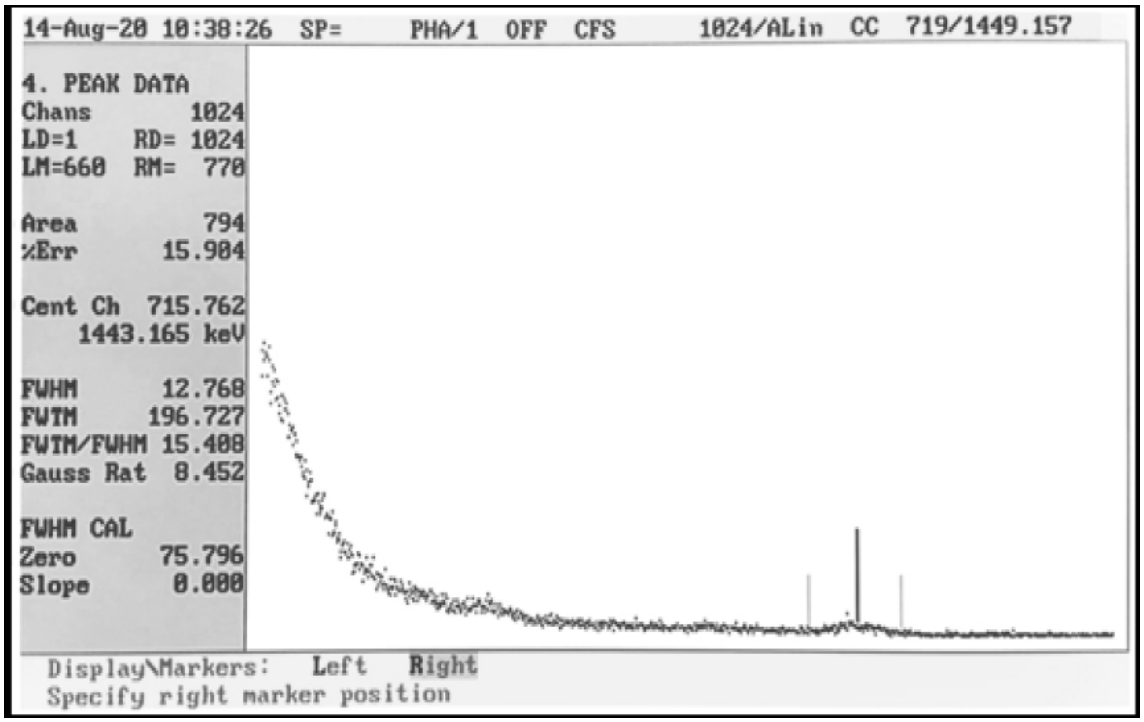


Figure 2. An Example of a Census Result of a Respondent with WBC Showing Isotope Peaks (Especially K-40 at 1400 keV) Measured with the Lowest and Highest Range (ROI).

If all data are combined for 2017 and 2018, it is known that with regression analysis there is no positive correlation between radioactivity and the respondent's age with a relationship of $y = -2.1016x + 4006.5$ with $R^2 = 0.0007$, but there is a positive correlation with body mass index with a relationship of $y = 52.188x + 2584.8$ where $R^2 = 0.0442$ (Figures 3 and 4).

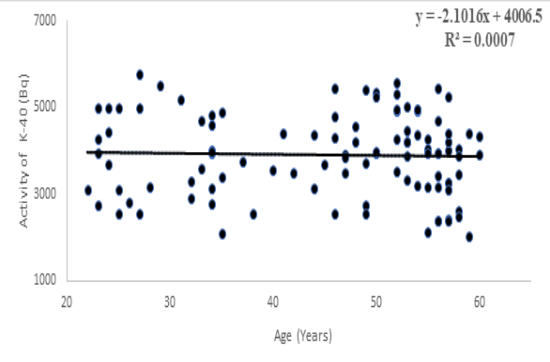


Figure 3. The Results of the Regression-correlation Analysis Between Radioactivity (Bq) and the Age of the Respondent (Years)

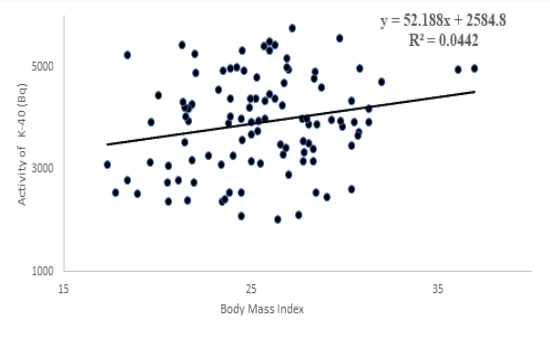


Figure 4. The Results of the Regression-correlation Analysis between Radioactivity (Bq) and the Body Mass Index

In this paper, the measurement of internal radioactivity in the body of a worker has been discussed or investigated. Internal dose measurement is an important part of the WBC monitoring system for monitoring internal dose radiation exposure levels for radiation workers and the public. Workers handling radioactive substances are susceptible to external and internal contamination; hence the need for a radiation protection program that monitors them monthly or annually depending on their needs. Meanwhile, public concerns about contamination arise when an accident occurs at a nuclear facility such as the accident at the nuclear power plant in Fukushima, Japan. For detection and measurement of internal contamination due to fission/ activation products emitting gamma such as Cesium-137, Cobalt-60 and Iodine-131, bed and chair type full-body counter monitoring systems are widely used worldwide. WBC or other radiation counters are used to detect radiation emitted by combined radionuclides during occupational exposure, as well as for response readiness in cases of Radiological Emergencies (Singh I S, 2016; Wada, et al., 2017).

Several WBC devices have been used to monitor internal radioactivity in cases of worker contamination. However, it has been found that external contamination is sometimes thought of as internal contamination in whole-body radioactivity calculations. Therefore, the amount of radioactivity detected can be much higher than the actual radioactivity due to this misclassification of contamination, because the radioisotope stuck to the skin is in close proximity to the WBC detector. Finally, this not only leads to the misjudgment of external contamination as internal contamination, but also an overly conservative estimate of radioactive contamination (Kazzi, 2015).

Whole-body dose calculation, at least in its clinical application, may be a procedure that is not too distinct and separate from previous procedures. The increased use of these procedures is predicted to increase in current and future programs of radiation safety, nuclear medicine, and biomedical research. In this study, the number of isotopes in the respondent's body was determined. The factors that determine the relative radiation hazard of radioisotopes are their quantity, initial body retention, fraction flowing from blood to critical organs, tissue radio-sensitivities, critical organ size, essentiality of an organ, biological half-life, radioactive half-life which is approximately equal to average human lifespan, effective energy per disintegration, and specific ionization (Sinnott, 2010).

In terms of K-40, measurements of the specific activity of the population in the Egyptian Sinai desert were found to range from 940.6 to 1323 Bq/kg with a mean of 1186.4 Bq/kg, which is three times higher than the limit (370 Bq/kg) (Darwish, Abul-Nasra, & El-Khayatt, 2014). Another study by Tolstykh et al. showed that the K-40 activity was 4200 Bq in male and 3000 Bq in women respondents in Russia. Meanwhile, the results of measurements on the general population in Bangladesh showed that the potassium content ranges from 101-196 gK (Patwary, 2013). Another study in the same

country conducted by Rahman et al. found that the K-40 content for men was 2000 Bq/kg and for women was 1700 Bq/kg, averaging 1900 Bq/kg. Meanwhile, the results of measurements of K-40 radioactivity in Russia showed that for respondents aged 20–50 years, it is known that 4200 Bq for men and 3000 Bq for women, where this activity decreases with increasing age (Rahman, 2008; Tolstykh, 2016). These results were consistent with the statement that the amount of radioactive K-40 isotope for a person weighing 70 kg is about 5,000 Bq (Toohey, 1983).

According to the IAEA-TECDOC, all minerals and raw materials contain radionuclides of origin which are highly radioactive up to 4000 Bq/kg (Masok, 2016). In addition, the most important radionuclides for radiation protection purposes are the whole children U-238 and Th-232 as well as K-40. Thus, this research is higly important to be carried out routinely because occupational exposure can lead to the introduction of radionuclides into the body which can occur as a result of various activities, including work related to various stages of the nuclear fuel cycle; use of radioactive sources in medicine, scientific research, agriculture and industry; and work involving exposure to increased concentrations of natural radionuclides (Joyce, 2017).

Radiation exposure that is harmful to the health of workers is not only internal exposure, but also external exposure. Devices that emit radiation will pose a risk of danger to workers who use these tools, for example radiographers, cathlab doctors, X-ray equipment operators, radiologists and so on. This exposure can directly penetrate cells and cause damage to the body at the molecular level. Several previous studies have shown that there is a significant relationship between the dose received and the increase in micronuclei frequency as one of the biomarkers of DNA damage in radiation workers in several government hospitals in Indonesia. The increase in micronuclei frequency reached 16.3 for every 1 mSv increase in exposure dose, whereas for radiotherapy patients, higher micronuclei frequencies were also found than controls. Of course, the cellular DNA damage is not only influenced by the type and dose of exposure, but also individual factors, such as age, sex and smoking habits (Surniyantoro, Lusiyanti, Rahardjo, Nurhayati, & Tetriana, 2018; Surniyantoro, et al., 2019; Surniyantoro, et al., 2018). Exposure to ionizing radiation is also a risk factor for breast and cervical cancer (Sriningsih & Elisa, 2017)

Levels of blood components are also affected by radiation exposure. The number of red blood cells and monocytes in the blood was found to be significantly higher in the radiation worker group than in the control group, while the white blood cell count, hematocrit, mean corpuscular volume and lymphocytes were lower in radiation workers. In correlation-regression, an increase in the number of red blood cells in radiation workers was $0.541 \times 106$ / μL for every 1 mSv increase in the exposure dose. These various possible hazards should be considered and paid deep attention to radiation workers and related stakeholders in any activity that uses nuclear energy so as to create a safe, comfortable and safe work environment (Surniyantoro, et al., 2019).

## Conclusions

It is concluded that the K-40 radioactivity among workers in PTKMR is still within the normal limits which for 2018 is lower than the previous year. There is no positive correlation between respondent body weight and radioactivity.

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# Exploring Media Influence On Contraceptive Use Among Indonesian Couples

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**Abstract**

This paper evaluates whether mass media exposures, specifically television, radio, newspaper/magazine and internet were effective tools for utilizing contraception among Indonesian couples or not. A sample of 8,925 Indonesian couples were selected based on the result of the 2017 Indonesia Demographic and Health Survey. Logistic regression models were used to predict recent media exposure (television, radio, newspaper/magazine and internet) to family planning messages and its association with contraceptive use among Indonesian couples. Internet exposure was found to be significant, and it had a strong effect on the likelihood that the Indonesian couples uses modern contraceptives. Region and number of living children were also found as significant effects on the modern contraceptive use. As such, internet as a promotion tool in campaigning family planning is more effective than television, radio, and newspaper/magazine) in improving contraceptive use among Indonesian couples.

## Introduction

Over the past few decades, the general public relies on the mass media as important sources of health information. Mass media campaigns have been widely utilized as some important efforts to change family planning behaviour. Those campaigns have placed messages in multiple medias which can reach mass populations, most frequently electronic media such as television, radio and internet, but also print media, such as newspapers and magazines (Kabir and Islam, 2000). Information from mass media has the capacity to increase people's awareness, knowledge and lead to positive behavioural change towards family planning. Nevertheless, the mass media campaigns should be delivered regularly because the exposure to such messages is mostly passive (Wakefield et al., 2010). Some recipients need to actively select information related to family planning as needed, for example by reading an article in a newspaper or by clicking on a web link but they need future discussion on it (Islam et al., 2009).

Mass media has been acknowledged as reliable information's sources to make people aware of the benefits of the use of contraception. A study in Nigeria also found that access to family planning media messages may contributed to intention to use contraceptives, contraceptive use, and desire of number of children (Ajaero et al., 2016). Moreover, a study in Bangladesh found that of the respondents who had exposed to favorable information about family planning, 46.9% had used contraception (Kabir and Islam, 2000).

Even though the impact of mass media on one individual may be small, its snowballing effects to the entire population can be huge since it reaches so many people at the same time. Frequent broadcasting via mass media of the same issue over a period of time may influence behaviour, hence, through this procedure one issue may be established as a common truth (Ajaero et al., 2016). Mass media may become a significant instrument to create family planning as an individual decision, a household discourse, and a community value

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of life (Wakefield et al., 2010).

Television provides a dramatic message stimulation than radio, and radio can be more dramatic than printed materials (i.e. newspaper or magazine). Television offers audio and visual effects to stimulate curiosity in acquiring information on family planning. Viewing family planning messages via television increase the odds of using modern contraception for a woman by nearly 8% and 11% in Tajikistan and Kyrgyzstan respectively (Habibov and Zainiddinov, 2015). Hearing the radio program encourage listeners to address misconceptions on contraception and encourage those listeners to become family planning users (Meekers et al., 2007). The exposure of family planning messages through newspaper and magazine had been associated with the increasing awareness of contraception in Bangladesh (Islam et al., 2004). Moreover, couples who were exposed to family planning message through newspaper or magazine tend to have rational decision on their fertility preferences (Kabir and Islam, 2000). Internet has been found as one of crucial family planning information that either sparked further discussions or supplemented information received verbally (Yee and Simon, 2010).

The increasing number of modern contraceptive use in Indonesia is nearly 10 percent and is dominated by the use of shortterm hormonal contraceptives during 1991 to 2017. The contraceptive prevalence rate in Indonesia had increased from about 47.1% in 1991 (Central Bureau of Statistics et al., 1991) to 57% in 2017 (Central Bureau of Statistics et al., 2018). Despite this success, each year about 1.1 million new Indonesian couples marry (Central Bureau of Statistics et al., 2018), requiring family planning information to encourage those couples to communicate fertility desire with their own spouse (Irawaty et al., 2020). The involvement of mass media can spread out information regarding family planning program to reach newlyweds and to achieve the demographic targets (Kabir and Islam, 2000, Knobloch-Westerwick, 2016).

Most of family planning campaign in Indonesia was concentrated in Java-Bali Islands since about 57% of Indonesian population live in those islands (Central Bureau of Statistics et al., 2018). In addition, those couples who already had 3 or more than 3 children had greater probabilities to be exposed to family planning messages through various media than those newlyweds (Ardiansyah, 2016).

Despite growing literature of the effects of media on contraceptive use, there is still a dearth of empirical research into how married couples perceive information regarding contraception from media, especially as knowledge resource, or how media draw upon those married couples and media discourses to express a viewpoint on contraception. Indonesia has been selected as the area of this study since most couples in Indonesia receive various entertainment from the media daily. However, whether those media exposure is directly useful for the decision of married couples to use contraception in Indonesia is unclear. The time of the study was in 2017 since the latest demographic and health survey data available for Indonesia was in 2017. Furthermore, the association between media exposure of family planning message and contraceptive use among Indonesian couples in 2017 is still unclear. Thus, this article contributes to this scarce literature particularly to assess the exposure of Indonesian couples via different mass media (radio, television, newspaper/ magazine and internet) to contraceptive adoption in Indonesia.

## Methods

The data from the 2017 Indonesia Demographic and Health Survey (IDHS) was used into this study. This study was a cross-sectional survey, representing a national outlook. Data of this study derived from the 2017 IDHS datasets particularly individual women and men datasets. Afterwards those datasets were merged to the data of men and women who were married or to be in a union. A couple, as the DHS definition, has been defined as a man and a woman who are legally married or living together in a consensual union (Koffi et al., 2012). Those datasets were sourced from the official website of DHS (dhsprograms.com). The selected sample used in this analysis consists of 8,925 couples in which the wives were aged 15-49 years.

The dependent variable was modern contraceptive use as reported by husbands

and wives. Husbands were asked the following question "What method are you or your partner use?" Wives were also asked using the questions "Are you or your husbands or partners currently using any method to delay or avoid getting pregnant?" If the woman answered "yes ", the interviewer will further ask, "Which method are you using?" Only one method was chosen. Responses to these questions by women and their partners were matched to create couple's current contraceptive. These variables were measured as a dichotomous variable coded as (0) both wives and husbands did not use any contraceptive method and (1) both wives and husbands or either one use of contraceptive methods. Contraceptive use in this study includes intra uterine device (IUD), pill, injectable, implant, female sterilization, male sterilization, male condom, intravag/diaphragms, lactational amenorrhea (LAM), rhythm, withdrawal, and emergency contraceptive. In term of the independent variables, family planning exposures were collected from the wives and husbands responds on whether both of them or either one had exposed on family planning messages through television, radio, newspaper/magazine and internet. These family planning exposures were also measured as dichotomous variables coded as (0) both wives and husbands did not expose family planning messages from questioned media or (1) both wives and husbands or either one had exposed to family planning messages from questioned media.

Region had been selected as one independent variables of this study which coded as (0) outside Java Bali Provinces and (1) Java Bali Provinces. Java Bali Provinces includes Banten, Jakarta, West Java, Central Java, Yogyakarta, East Java and Bali. Outside Java Bali Provinces consist of Aceh, North Sumatera, West Sumatera, Riau, Riau Islands, Jambi, Bengkulu, South Sumatera, Bangka Belitung Islands, Lampung, Bali, West Nusa Tenggara, East Nusa Tenggara, West Kalimantan, South Kalimantan, Central Kalimantan, East Kalimantan, North Kalimantan, Gorontalo, West Sulawesi, South Sulawesi, Central Sulawesi, Southeast Sulawesi, North Sulawesi, Maluku, North Maluku, West Papua and Papua. Moreover, number of living children's variable was derived from wives' respondents due to inconsistent responds between wives and husbands, hence, this study consider wives' answer since they had natural capabilities to be pregnant. The number of living children was divided into two categories (0) 0-2 children and (1) more than 3 children.

Before analyzing of the data, the dataset was weighted to consider for differences due to over sampling and under-sampling as per the survey design. The analyses of this study were based on men's weighted analysis. The univariate analysis was conducted to identify the characteristic of the study population and to recode the grouping when needed. Afterwards, bivariate analysis between selected independent variables and the dependent variable were conducted. Pearson chi-square test correlation was utilized to examine the relationship between each of the mass media exposures on family planning messages and contraceptive use. The regression coefficients of the independent variables was expressed as Odds Ratio (OR). Statistical significance was set at a p-value of less than 0.05. The final model represented the adjusted models of current use of contraceptive methods and all independent variables of region, number of living children, mass media exposures on family planning messages towards contraceptive use in Indonesia. The authors assert that this study has no conflict of interest. The authors declared that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Data and materials of this study can be accessed on https://dhsprogram.com/data/available-datasets.cfm.

## Results and Discussion

The objective of this study is to analyze the various impact of family planning media exposures to contraceptive use among Indonesian couples. Family planning media exposures could have a huge impact on the public's knowledge, beliefs, perceptions, attitudes and behaviours, not only as individuals but also as families, communities and wider society (Maryon-Davis, 2012). As shown in Figure 1, overall, husbands were more likely

to be exposed to a larger number of media sources. More than 90% of wives and husbands saw television regularly. Husbands were reported access radio, newspaper/magazine and internet more frequently than the wives. In 2017, more than 52% of sample husbands were access radio while only more than 37% of the sample wives accessed the same media (see Figure. 1). Newspaper/magazine was accessed by 48.9% of the husbands and 36.3% of the wives. Both husbands and wives had similar pattern in accessing internet 38.8% and 35.1% respectively.

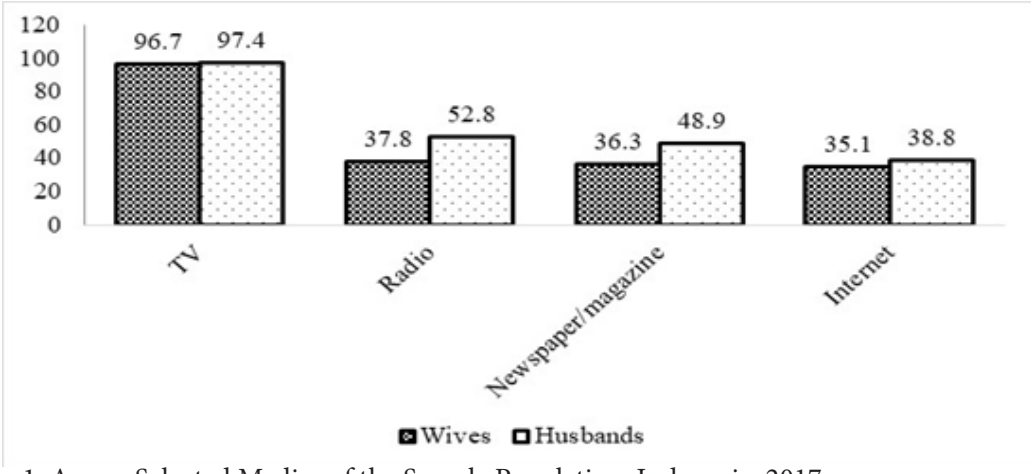


Figure. 1. Access Selected Medias of the Sample Population, Indonesia, 2017

Even though the Indonesian couples accessed mass media (i.e. television, radio, newspaper/magazines and internet) regularly but overall exposure of family planning messages through those media were still rarely. In term of family planning messages' exposures through television, the wives had exposure family planning message more often than the husbands, 57.4% and 52.5% respectively (see Fig. 2). The second media which spread the family planning message intensively was the internet in which 17.9% of the wives and 15.9% of the husbands exposed family planning messages through internet. Family planning messages through newspaper/magazine had been exposed by the husbands (14.5%) more often than the wives (12%). Radio was less popular in accessing family planning messages among the Indonesian couples in which 11.3% of the husbands and 9.2% of the wives had exposed it.

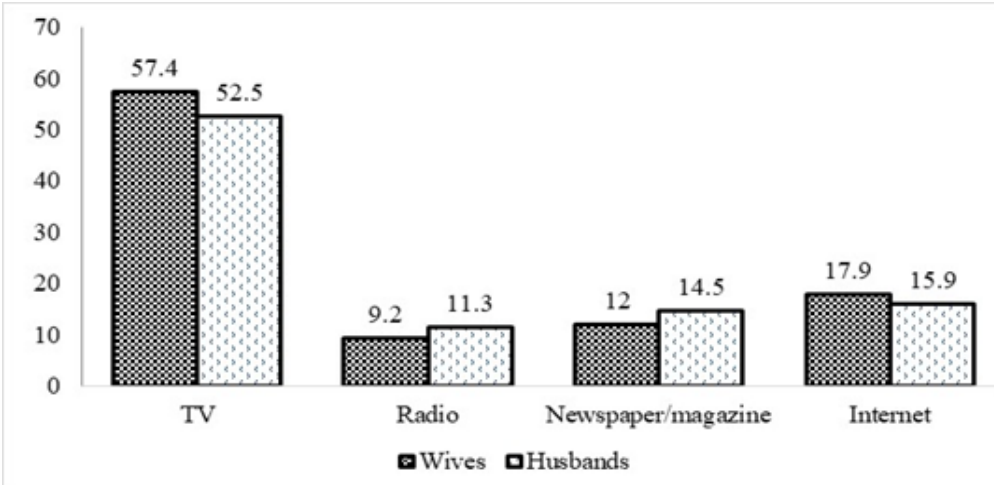


Figure 2. Exposed Family Planning Messages Through Selected Medias, Indonesia, 2017.

The results of univariate analysis revealed that the wives lead in family planning exposure for only two medias, television and internet while the husbands lead for radio and newspaper. Exposures to media among wives and husbands may be vary due to some of the

gender differences in exposure. Married men may travel more often while married women tend to stay at home, therefore, married women have greater probability of being exposed in the media (Hindin et al., 1994).

The contraceptive methods were used by only 72.9% of the selected couples of this study and non-user couples were 27.1%. Table 1 presents selected social-economic-demographic characteristics of the couples together with the couples' exposure of family planning messages on various media (radio, television, newspaper/magazine, and internet). The table revealed that about 60.4% couples had lived in Java Bali Islands while 39.6% couples had lived in outside Java Bali Islands. Couples having three or more children accounted for 30,2% while couples with 0-2 children accounted for 69,8%. Majority couples (76,7%) had been exposed for family planning message through television while the rest of the couples had exposed to family planning message through internet (26,6%); newspaper/magazine (23,3%) and radio (18,5%).

Table 2. revealed the differences impact of family planning messages exposures through various media (radio, television, newspaper/magazine and internet) and contraceptive use. Adjustment revealed that demographic factors that varied among Indonesian couples in 2017 did not have huge differences impact on contraceptive use. As seen in Table 1, couples living in Java-Bali Islands were 1.3 times more likely to use contraception than couples living in outside Java-Bali Islands. Furthermore, the odds for couples who had more than 3 children was 0.49. There were no significant association between the exposure of family planning message through radio and contraceptive use among Indonesian couples. Exposure to the television revealed that couples had a significant level exposure (OR: 0.75, $p<0.05$) for contraceptive use. Couples reported a significant level exposure of family planning message via newspaper/magazine access (OR: 1.16, $p<0.05$). The probability to use contraception on couples who exposed family planning message was 1.2 times than couples who did not exposed.

Table 1. Characteristics of Selected Couples: Indonesia, 2017

| Characteristics | N | % |
|---|---|---|
| **Current contraceptive use** | | |
| Both not using any method | 2,417 | 27.1 |
| Both or either one using contraception | 6,507 | 72.9 |
| **Social-economic-demographic characteristics** | | |
| **Region** | | |
| Outside Java Bali provinces | 3,530 | 39.6 |
| Java Bali provinces | 5,395 | 60.4 |
| **Number of living children** | | |
| More than 3 children | 2,695 | 30.2 |
| 0-2 children | 6,230 | 69.8 |
| **Exposed FP messages: television** | | |
| Never exposed | 2,075 | 23.3 |
| Both exposed or either one | 6,849 | 76.7 |
| **Exposed FP messages: radio** | | |
| Never exposed | 7,278 | 81,5 |
| Both exposed or either one | 1,647 | 18,5 |
| **Exposed FP messages: newspaper/magazine** | | |
| Never exposed | 6,849 | 76.7 |
| Both exposed or either one | 2,075 | 23.3 |
| **Exposed FP messages: internet** | | |
| Never exposed | 6,552 | 73.4 |
| Both exposed or either one | 2,373 | 26.6 |
| N | 8,925 | 100 |

FP stands for family planning.

Table 2. Logistic Regression Analyses of Access to Mass Media Messages and the Modern Contraceptive Use, Indonesia, 2017.

| Characteristics | OR | Sig. | 95% CI |
|---|---|---|---|
| **Region** | | | |
| Outside Java Bali provinces (ref) | 1.00 | | |
| Java Bali provinces | 1.27 | 0.000 | [1.16-1.41] |
| **Living children** | | | |
| More than 3 children (ref) | 1.00 | | |
| 0-2 children | 0.49 | 0.000 | [0.45-0.56] |
| **Exposed FP: Radio** | | | |
| Never exposed (ref) | 1.00 | | |
| Both exposed or either one | 0.98 | 0.798 | [0.86-1.12] |
| **Exposed FP: Television** | | | |
| Never exposed (ref) | 1.00 | | |
| Both exposed or either one | 0.75 | 0.000 | [0.66-0.84] |
| **Exposed FP: Newspaper/ magazine** | | | |
| Never exposed (ref) | 1.00 | | |
| Both exposed or either one | 1.16 | 0.018 | [1.03-1.31] |
| **Exposed FP: Internet** | | | |
| Never exposed (ref) | 1.00 | | |
| Both exposed or either one | 1.19 | 0.004 | [1.06-1.33] |

Notes: Ref = reference category.

The mass media conveys a novel element to family planning delivery care as it offers a medium to be utilized by the married couples in Indonesia to communicate about family planning issues with the possibility of potentially improving modern contraceptive use in Indonesia. The power and reach of the mass media can influence all aspects of people's lives, including health and well-being, and can be harnessed to promote health by informing, motivating and empowering people to change behaviour and by providing a platform for civic action (Maryon-Davis, 2012; Jacobs et al., 2017). Three approaches to using the media to promote family planning are as (1) public information (Kagurusi, 2017; Kim et al., 2019), (2) social marketing (Ahmed and Seid, 2020) and (3) media advocacy (Maryon-Davis, 2012). Media as public information is to provide health information to the public (also referred to as public education) (Maryon-Davis, 2012). Media as social marketing to engage and motivate the public to adopt health behaviors (Maryon-Davis, 2012). Media as media advocacy is to raise broad awareness of an issue to advocate for changes in policy or practice to facilitate or enhance health and well-being (Maryon-Davis, 2012; Hutchinson and Meekers, 2012). These approaches are not mutually exclusive and are often used in combination (Maryon-Davis, 2012). Communicating a broad range of health messages to a wide variety of audiences is challenging and in this context the role of mass media (such as television, radio, newspapers) is fundamental (Foran, 2020; Pires et al., 2019).

Thus, mass media is a powerful instrument, which offers a social interaction mechanism for a range of married couples and family planning health services. Though there are several advantages to the usage of mass media for family planning communication, the information exchanged through media needs to be checked for validity and reliability (Babalola et al., 2017; Beaudoin et al., 2016). In addition, media has indirectly influenced the decision of married couples to their fertility intention and contraceptive use (Lette, 2019). Thus, keep the married couples' contraceptive intention need to be retained by the continuing spread of family planning information through media.

After controlling the socio-demographic factors, this study found that access to through television messages increased the likelihood of respondents making use of modern contraceptive method for both wives and husbands. The result was in line with

the previous study conducted in Indonesia in 2007 and 2012, that television had a statistically significant positive association with contraceptive use (Ardiansyah, 2016). Television was the most used media tool in health promotion and prevention program whereas the computer was the most effective, particularly among adolescents (Quatrin et al. 2015). Television contain a message combining different techniques (text, audio, sill timages, animation, video, or interactivity content forms) seems to be associated with greater success in family planning promotion programs (Quatrin et al. 2015).

Nevertheless, the odds of television exposure to use contraception for both wives and husbands were relatively small. Ardiansyah (2016) had explained that those media exposures still need active information-seeking activities from both wives and husbands. The majority of Indonesian couples would likely to search information related to life-threatening issues such as heart problem or cancer and not for a non-life threatening issues such as family planning (Ardiansyah, 2016). This study found no significant association between family planning message exposure through radio and modern contraceptive method.

This study also revealed that access to information on family planning through newspaper/ magazine and internet were effective in positively influencing people's attitude towards use of family planning particularly for Indonesian women. This results supports earlier findings by other researches who posited that mass media messages through newspaper/magazine and internet on family planning were effective in increasing the use of family planning (Kabir and Islam, 2000; Purdy, 2011; Zakaria and Bhuiyan, 2016). Newspaper or magazine can be kept for future references and they provide illustrations that may guide decision-makers and other couple to use contraception (Kabir and Islam, 2000). Furthermore, one advantage of the internet compared to other media such as television, radio or newspaper/magazine is the ability of the internet to provide detailed information from various websites and also to conduct two–way interaction (Nulhakim and Samosir 2017).

The results of both the logistic regression analyses also showed that increase in socio-economic status leads to a corresponding increase in the use of modern contraceptive method. The region also has significant effect on modern contraceptive use in Indonesia. Couples living in Java-Bali areas are more likely to use modern contraceptive method than their counterparts living in rural areas. This may be due to the availability of health facilities in Java Bali Provinces are more complete than in outside Java Bali areas (Idris 2020; Nulhakim and Samosir 2017).

Number of living children is also having significant association with modern contraceptive use. A previous study conducted in East Nusa Tenggara, Indonesia also showed similar result that number of living children significantly contributed to contraceptive use because those couples have fulfilled their fertility desire (Ruth et al., 2019; Sianturi et al., 2019). There are two limitations of the study. Firstly, because of the cross-sectional nature of the data, this study was unable to determine any causal relationships between the variables examined. Secondly, the Indonesia Demographic and Health Survey data did not provide any information regarding specific information related family planning matters gained by married couples through various medias.

## Conclusions

This study showed that mass media messages significantly increased use of family planning for couples. The regression results showed that access to television messages influences use of family planning use for both individuals more than messages from other mass media. Married women who had exposed with family planning media were more likely to take all contraceptive actions than those who were less exposed or not exposed at all. Married men who had higher levels of exposure of family planning media were more likely to adopt contraception.

Based on the findings, wider coverage area and improved quality of mass media messages on family planning particularly television, newspaper/magazine and internet should be implemented in Indonesia especially in outside Java Bali Islands. After those married couples

exposed with family planning information through multiple media, further face-to-face consultation is also needed as means of making family planning more acceptable to the population. Given the differences between married women and men, it is crucial for policy-makers to address these gender differences and plan to target both women and men in future family planning campaigns in Indonesia.

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# Analysis of Accident and Occupational Diseases with HAZOP Method and The Risk Control of Batik Papringan Workers, Banyumas

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**Abstract**

. An industry that has danger is Batik Papringan, Banyumas. Workers have not implemented Occupational Safety and Health (OSH) at work. It can be seen from the physical environment with poor lighting, workplaces that do not apply Ringkas, Rapi, Resik, Rawat, Rajin (5R), not using Personal Protective Equipment, unergonomic position, and feeling anxious due to decreased demand. Therefore, it is necessary to analyze occupational accidents and diseases and their control. The study took time in August 2020. The population was 200 people. The sample was obtained with the inclusion criteria, namely all Batik workers who were actively working until August 2020, while the exclusion criteria were workers who changed professions so that 190 people were obtained. The research design was cross-sectional with mixed-method analysis. The research was conducted using the HAZOP (Hazards and Operability Studies) sheet instrument. HAZOP sheet consists of job observation, hazard identification, Likelihood, and Consequences scoring, risk categorization, and control. The calculation results show that there is an extreme risk of three hazards (exposure to chemicals from wax, cloth dye, wood dust; bending attitude, static position; not applying 5R). The three extreme risks are respiratory disorders, dermatitis, fatigue, low back pain, Carpal Tunnel Syndrome (CTS), effectiveness, and efficiency of work decrease. The conclusion is that workers are at extreme risk. Employees need to be committed to risk management through disciplined risk control.

## Introduction

Occupational Safety and Health (OSH) is vital for workers. Occupational Safety and Health concerns in protecting the safety, health, and welfare of workers at their workplace by preventing injury or diseases (Khan et al., 2014). Undang-Undang No 13 Tahun 2003 said 86 states that workers have the right to occupational safety and health protection, morality protection, and treatment according to human dignity (UU RI No 13 Tahun 2003, 2003). We can achieve occupational safety and health protection by preventing and reducing the risk of occupational accidents and diseases. The results is the creation of a safe and comfortable work environment that supports a company or organizational goals achievement through effective and efficient work activities (Mock et al., 2018). The use of equipment (machines) and materials in the workplace raises the risk of accidents and occupational diseases because the equipment (machines) and materials have potential hazards (Petrović et al., 2020). According to Heinrich's theory, occupational accidents and diseases are caused by an unsafe act (unsafe behavior) and unsafe conditions (unsafe environment). Unsafe action is an action in working that is not following a predetermined Standard Operating Procedure (SOP). Occupational accidents and diseases caused by unsafe behavior occurred in approximately 88% of cases, 10% by unsafe environments, and 2% by provisions that created humans. Occupational accidents and diseases are caused by potential hazards and risks in the work environment, that is not minimized or controlled. Hazards are all aspects of technology and activities that pose a

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risk. Hazards is a source or situation that can cause injury or health problems, damage to equipment, materials and the environment, or a combination of these. Besides, the risk which is also another aspect of an accident is defined as the likelihood or severity or a combination of the two is causing an occupational accident or disease (Yuebing et al., 2011).

Hazards that can cause accidents and occupational diseases consist of various types, namely physical, chemical, biological, ergonomic, and psychosocial. Physical hazards consist of mechanical, electrical, heat, fire and explosion, radiation, noise and vibration. Chemical hazards consist of dust, metal, chemical, and toxic gases. Biological hazards consisting of bacteria, viruses, and animals. Ergonomic hazards such as position and movement at work. While psychosocial hazards such as relationships and conflicts between workers. The number of hazards and risks in the work environment may consist of more than one hazard and risk. Thus, workers should identify hazards and risks to prevent accidents and occupational diseases (Choi et al., 2020). Indonesia ranks first with the highest number of work accident cases in Southeast Asia. Based on data from the Kementerian Ketenagakerjaan RI in 2006, the number of work accident cases in 2003 was 105,846, in 2004 it was 95,418, in 2005 it was 96,081, and in 2006 it was 70,069. There are about 10.3 million workers in the private sector of Saudi Arabia alone, while the number of injuries and accidents in construction is much higher than any other industry in the country (Emad, 2019).Although there has been a decrease in cases, this figure still tends to be high. Therefore, it is necessary to implement better OSH in various sectors, both formal and informal sectors. One of the informal sectors that are developing and becoming local wisdom in Indonesia is Batik. Batik Banyumas is a batik that has a strong influence from Batik Solo and Yogyakarta. Banyumas batik is also a batik emphasizing more symbolism. It is different from Batik Pekalongan, which has more decorative forms (Sholikhah et al., 2017).

The word 'batik' was derived from the Javanese word meaning wax writing. It was the process of resist, which was known to be an ancient method of applying design to porous surfaces. Parts of the fabrics are covered with melted wax, rice, paste, and some other non-water dissolve substance, and the fabric is later submerged in, or painted with, various colours of dyes (Poon,2017). Based on the preliminary studies conducted by researchers, one of the Banyumas Batik centers is Papringan Village. The majority of Papringan Batik has plant and animal motifs. However, there are also other motives, such as river views. The making of the motif depends on the taste and inspiration of the batik maker. The total number of batik makers in Papringan Village is approximately 200 batik. Some of these batik makers join in group (Kelompok Usaha Bersama / KUB) and some are individuals. However, both KUB and individuals have received guidance for the development of business centers. Coaching is in group management, entrepreneurship, finance, and administration. Apart from that, technical training was also conducted, such as batik production techniques, making motifs, coloring, and the finishing stage. The process of making these products certainly has dangers and risks arising from the work process.

The process of making batik both manually and stamped cannot be separated from the dangers that can cause health problems or work accidents (Hunga, 2014). Health problems were found among batik workers in the form of lung capacity problems 67.5%; decreased visual function 33.8%; dermatitis of the extremities 30%. Distribution of workers with impaired lung capacity, decreased visual function, and dermatitis of the extremities found at the sticking stage of the wax, respectively 64.8%; 48.1%. The process of making hand-written batik using wax has the potential to release CO/carbon monoxide. This is in line with Darmiyanti et al. (2003), that said the Batik workplace has been contaminated with CO and making the risks for health workers. The research showed that the Batik workroom has a higher concentration of CO than the standard. Rahmayanti et al. (2020), said that in Batik coloring using naphthol in their dyes. This dye is a non-biodegradable organic compound, so it is complicated to degrade in nature. So, batik workers need to use Personal Protective Equipment (PPE). PPE helps ensure that individuals are safe from physical hazards that

they may encounter in their work environment. PPE may be used to protect workers from general environmental threats (temperature extremes, noise), specific work-related threats (falling objects, falls from heights), or threats faced in an emergency (hazardous chemical and infectious agents).

The existence of potential hazards and risks in the informal sector Batik Papringan Banyumas causes the need for risk management to prevent or minimize the incidence of occupational accidents and diseases. It can be done in several steps. They are identification of potential hazards and risks, risks assessment, and risks control. The hazard potential identification stage is where are reviewed and identify the potential hazards that can impact workers, other people in the workplace, guests, and the community around the workplace. Then the identification of the risks that may occur by considering the risks that may cause loss to property, society, and the environment. Furthermore, a risk assessment is carried out by calculating the likelihood of the risk and the severity or impact of the risk, whether the risk results in an occupational accident or disease. It can be done by considering the possible duration of exposure, the timing of the accident, avoiding or limiting the hazard. While the identification of the severity or impact can be done by considering the nature of the condition or situation to be protected, its effects on health, and the extent of the possible hazards to be caused. The last stage is risk control so as not to or reduce the possibility of accidents and occupational diseases (International Labor Organization, 2013). Hazard and operability study (HAZOP) is applied to identify the hazards potential and risk in the workplace by determining the score in the workplace from likelihood and consequences score. The HAZOP sheet is the most suitable to know the risks because it suggests a systematic analysis method of operator safety (Choi et al., 2020). Based on the description of the potential hazards and risks in the informal sector workplace environment, Batik Papringan Banyumas led to research on "Analysis of Occupational Accidents and Diseases using the HAZOP Method on Papringan Batik Workers, Banyumas Regency" is important to do.

**Method**

The variables to be studied were the characteristics (age, years of service, and education), the process making, the hazards, the risk of work accidents and occupational diseases, the likelihood, the consequences score, and risk control. This type of research is a mixed method. The research design used a sequential explanatory design by collecting and analyzing qualitative data first and then analyzing the quantitative data obtained based on qualitative data (Bowen et al., 2017). The population in this study were all Kelompok Usaha Bersama and Batik Papringan home industry workers. The population in this research is 200 workers of Batik Papringan. The sample of this research is 190 workers of Batik Papringan. The technique sampling used in this research is a purposive sampling that is determined by inclusion and exclusion criteria. The sample inclusion criteria are Batik Papringan workers who were still actively working when the study is done. The exclusion is workers who switched professions from Batik to another. So, based on purposive sampling (using inclusion and exclusion criteria) is obtained 190 workers as the sample. The research instrument used in this study is HAZOP worksheets. HAZOP consists of many kinds of hazards and risks in the workplace that we observed, Likelihood (L) and Consequences (C) score that determined by the case of a work accident or occupational diseases. The quantitative data that obtained from L and C score is analyzed by univariate analysis. The univariate analysis is done by multiplying the score of L and C in HAZOP worksheets. University of New South Wales (2008) said that HAZOP is an instrument to measure the risk in the workplace by multiplying the score of L and C. The score of L and C is determined by the indicator that described in Tables 1 and 2. After we knew the highest score of multiplication result, we can determine the most priority case of a work accident or occupational diseases to control. There is no validity and reliability analysis because the HAZOP instrument does not consist of some questions. But it consists of guidelines for scoring Likelihood (probability) and Consequences (severity) of a work accident or occupational disease. Table 1 and Table 2 are the description of Likelihood and Consequence to fill HAZOP worksheets.

Table 1. Likelihood (L) Criteria

| Score | Criteria | Description |
|---|---|---|
| 1 | Rarely occurs | <1 time every 10 years |
| 2 | Less likely to occur | 1 time every 10 years |
| 3 | Maybe | once every 5 years or once every year |
| 4 | Most likely every month | once every year or once every month |
| 5 | Almost certain | > 1 time every month. |

Source: University of New South Wales (2008)

Table 2. Consequence Criteria (C)

| Score | Criteria | Description |
|---|---|---|
| 1 | Insignificant | Does not cause lost work days |
| 2 | Small | Can still work on the same shift |
| 3 | moderate | Missing work days <3 days |
| 4 | Weight | Loss work days 3 or more days |
| 5 | Disaster | Lost work days forever |

Source: University of New South Wales (2008)

## Result and Discussion

The people in Papringan District, Banyumas Regency, have long been engaged in batik activities. This batik activity is a hereditary activity from the previous family. Based on the results of interviews conducted by researchers to Batik Papringan workers, both those who are members of Kelompok Usaha Bersama (KUB) or those who do not join the KUB (home industry workers). Based on the research results, it was found that 20 workers entered the KUB and 170 workers in the batik home industry. All Batik Papringan Banyumas workers, both who are members of the KUB and those who are not, are all female workers.

Table 3. Age and Education Distribution of Batik Workers, Papringan, Banyumas who are Members of KUB and Home Industry

| Variabel | Category | Frequency | Percentage (%) |
|---|---|---|---|
| Age | 15-25 | 9 | 4,74 |
| | 26-35 | 23 | 12,11 |
| | 36-45 | 65 | 34,21 |
| | 46-55 | 56 | 29,47 |
| | 56-65 | 23 | 12,11 |
| | 66-75 | 13 | 6,84 |
| | 76-85 | 1 | 0,53 |
| Education | Not graduated of Elementary School | 4 | 2,11 |
| | Elementary School | 140 | 73,68 |
| | Junior High School | 31 | 16,32 |
| | Senior High School | 15 | 7,89 |
| | Bachelor Degree | 0 | 0,00 |
| | Not graduated of Elementary School | 4 | 2,11 |
| Total | | 190 | 100 |

Source: Primary Data Research, 2020

Based on observations made by researchers, the batik made by KUB at the time of the research was written batik. The researcher observes several Pringmas KUB batik makers who loaded the Batik Tulis from beginning to end. The making of written batik at KUB Pringmas consists of several stages. First, draw a pattern on the cloth. The first stage in making Pringmas Batik Tulis is drawing a pattern on the cloth. The pattern is made using a pencil. The batik maker draws a pattern (motif) on the cloth that has been treated. The pattern is made according to the wishes or inspiration of the batik maker. Second, drawing uses canting. This stage is the stage where the batik maker draws (batik) using wax over the pattern that has been drawn on the cloth. The mori cloth is stretched in the gawangan. The cloth is made using a canting containing hot wax. Hot wax heated in a small skillet. The heat source used to heat the candles comes from a gas stove or firewood. Warm up the candle using low heat. The batik process requires a lot of accuracy and time. Third, coloring (bironi). Pencoletan (bironi) is the activity of giving color to the cloth that has been batik using rattan or a brush. The desired color is following the creativity of the batik maker. Fourth, basic coloring. The basic coloring is the coloring on the part that is not covered by wax. The basic color of the fabric is adjusted to the desires of the consumer or the batik. Fifth, drying. After the fabric has been dipped in the base color, let it dry in the sun. The drying is carried out by the batik at KUB in the morning at 08.00 WIB. Sixth, recoloring. The dry cloth is dipped back into color. Seventh, removal of wax from fabric. The next process is to remove wax from the fabric by putting the cloth in a furnace filled with hot water. The process of removing wax is carried out repeatedly according to the complexity of the motif and the number of colors on the fabric. Eight, rining. After the cloth is clean from wax and dry, the batik process is carried out again by making filler. Ninth, spotting. Spotting (pelorotan) aims to remove the wax layer by boiling the cloth in a stove filled with hot water so that the motif is clearly visible. Tenth, washing and drying. After boiling, the cloth is washed in cold water and dried.

Research on workers who are members of the Pringmas KUB was conducted on ten people. The ten batik makers at KUB Pringmas carry out all stages of the batik-making process from start to finish. However, different things are done by batik makers who are not part of the Pringmas KUB or known as home industry batik. Home industry batik is a batik that works on batik in their own homes. Home industry batik makers do their batik directly at the rining stage. They take the cloth from another place that already has a pattern or motif, so the batik only gives filler or dots on the cloth. Then for the next stage, it is sent back to the producer where they took the fabric. Home industry batik get wages from the producers which are calculated per cloth screened. The number of batik home industry who did the screening in this study was 180 people. The rining process carried out by the batik home industry is no different from the rining carried out by the batik makers, who are members of the KUB.

The process of making written batik by batik members who are members of the KUB and batik home industry has potential hazards and risks allowing work-related accidents and diseases. The potential hazards posed by this batik activity include physical, chemical,

Table 4. Risks Arising from The Batik Making Process by Batik Makers Who are Members of KUB And The Home Industry

| Hazards | Kind of Hazards | Risks |
|---|---|---|
| Physics | Less illumination | Eye fatigue (watery eyes, red eyes, headaches, decreased eye acuity (double vision), decreased concentration and thought speed, decreased speed of work |
| | High temperature in room | Dehydration, discomfort, tiredness, lack of focus, stress |
| | High temperature from sunlight | Dehydration, discomfort, fatigue, lack of focus, stress, heat edema (swelling of the hands and feet), heat cramps (spasms of the muscles in the arms, legs or stomach), heat syncope (dizziness that occurs suddenly when changing from a sitting position to standing up), heat exhaustion (anxiety, fainting, excessive sweating), heat stroke (heat buildup characterized by fatigue, pupil dilation, decreased concentration, and confusion) |
| | High humidity in workplace | Increase the growth of fungi, actinomicetes, Streptococcus bacteria and others |
| | Less ventilation | Increases body moisture thereby increasing the risk of bacterial growth in the body |
| | Floor stiil from soil | Increase the risk of pulmonary tuberculosis because it increases the growth of the bacteria Micobacterium tuberculosis |
| Chemical | Exposure to chemicals derived from wax, chemicals from fabric dyes and dust from wood | Pulmonary function disorders, contact dermatitis, vision |
| Biology | Workplace close to pet kennels | Acute Respiratory Infection (ARI), worms, itching |
| | | Attack of wild animals such as snakes and scorpions |
| Ergonomic | A work place that is close to nature | Fatigue, musculoskeletal disorders (low back pain, pain in the arms, neck, waist, thighs, calves, legs and shoulders), Carpal Tunnel Syndrome (CTS) |
| | A bent sitting posture and a static work position | |
| | Workplace don't implement 5R | Decreased work effectiveness and efficiency, poor product quality, increased confusion, decreased work speed, increased fatigue, decreased work comfort, slipped or fell |
| | Not using PPE | Increasing the risk of ARI due to exposure to chemicals from wax and dust due to not wearing masks, increasing the risk of contact dermatitis due to chemical exposure from fabric dyes due to not wearing gloves, wearpacks, red and watery eyes due to exposure to wax smoke and firewood dust the result of not using google safety |
| Psychology | Anxiety about decreased income due to decreased demand for batik products due to the COVID-19 pandemic, saturation, high workloads | Work stress, fatigue, headaches, decreased immunity |

Source: Primary Data Research, 2020

Risk is the possibility of accidents and losses at a particular time (Rudi, 2007). Risks need to be assessed to determine which risks are a priority to control. Tarwaka (2008) states that the risk can be calculated by multiplying the severity level (severity/consequences), denoted by "C" and the level of frequency (likelihood) of the occurrence of the risk, by "L".

Table 5. Frequency, L (Likelihood), C (Severity / Consequences), Risks, and Occupational Accident and Disease Risk Categories of Papringan Batik Workers Joining KUB and Home Industry

| No. | Hazard | Risk | Frequency | L | C | Risk (L*C) | Color | Risk Category |
|---|---|---|---|---|---|---|---|---|
| 1. | Less illumination | Eye fatigue (watery eyes, red eyes, headaches, decreased eye acuity (double vision), decreased concentration and thought speed, decreased speed of work | 160 | 5 | 1 | 5 | Red | High |
| 2. | High temperature in room | Dehydration, discomfort, tiredness, lack of focus, stress | 50 | 5 | 1 | 5 | Red | High |
| 3. | High temperature from sunlight | Dehydration, discomfort, fatigue, lack of focus, stress, heat edema (swelling of the hands and feet), heat cramps (spasms of the muscles in the arms, legs or stomach), heat syncope (dizziness that occurs suddenly when changing from a sitting position to standing up), heat exhaustion (anxiety, fainting, excessive sweating), heat stroke (heat buildup characterized by fatigue, pupil dilation, decreased concentration, and confusion) | 15 | 5 | 1 | 5 | Red | High |
| 4. | High humidity in workplace | Increase the growth of fungi, actinomicetes, Streptococcus bacteria and others | 137 | 5 | 1 | 5 | Red | High |
| 5. | Less ventilation | Increases body moisture thereby increasing the risk of bacterial growth in the body | 76 | 5 | 4 | 5 | Red | High |
| 6. | Floor stiil from soil | Increase the risk of pulmonary tuberculosis because it increases the growth of the bacteria Micobacterium tuberculosis | 17 | 5 | 2 | 10 | Red | High |
| 7. | Exposure to chemicals derived from wax, chemicals from fabric dyes and dust from wood | Pulmonary function disorders, contact dermatitis, vision | 190 | 3 | 4 | 12 | Purple | Extreme |
| 8. | Workplace close to pet kennels | Acute Respiratory Infection (ARI), worms, itching | 17 | 5 | 1 | 5 | Red | High |
| 9. | A work place that is close to nature | Attack of wild animals such as snakes and scorpions | 15 | 1 | 4 | 4 | Red | High |
| 10. | A bent sitting posture and a static work position | Fatigue, musculoskeletal disorders (low back pain, pain in the arms, neck, waist, thighs, calves, legs and shoulders), Carpal Tunnel Syndrome (CTS) | 190 | 5 | 4 | 20 | Purple | Extreme |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 11. | Workplace don't implement 5R | Decreased work effectiveness and efficiency, poor product quality, increased confusion, decreased work speed, increased fatigue, decreased work comfort, slipped or fell | 175 | 5 | 3 | 15 | Purple | Extreme |
| 12. | Not using PPE | Increasing the risk of ARI due to exposure to chemicals from wax and dust due to not wearing masks, increasing the risk of contact dermatitis due to chemical exposure from fabric dyes due to not wearing gloves, wearpacks, red and watery eyes due to exposure to wax smoke and firewood dust the result of not using google safety | 190 | 5 | 2 | 10 | Red | High |
| 13. | Anxiety about decreased income due to decreased demand for batik products due to the COVID-19 pandemic, saturation, high workloads | Work stress, fatigue, headaches, decreased immunity | 190 | 3 | 1 | 3 | Yellow | Low |

Source: Primary Data Research, 2020

Table 5 shows that the risks in the extreme category are the risks caused by three potential hazards in the form of exposure to chemicals from wax, chemicals from cloth dyes and dust from wood, bent sitting posture, and static work positions. It is shown in purple in the UNSW Health and Safety (2008), matrix. In addition, the high risk is caused by nine potential hazards. They are inadequate lighting, high indoor temperature, high temperature due to hot sunlight, humid workplaces, insufficient ventilation, floors that are still from the ground, workplaces that are close to the pet cage, and do not wear Personal Protective Equipment (PPE). The low-risk category is caused by the potential danger in the form of anxiety due to decreased income caused by the COVID-19 pandemic.

The potential hazards giving rise to the most extreme to low risk are known. Therefore, it is necessary to control it. The potential hazards exist around the work environment of Batik Papringan workers, both those who are members of KUB or those who are not affiliated or home industry in their respective homes. Risk control is carried out based on Peraturan Kementerian Tenaga Kerja RI No.5 of 2018 concerning Occupational Safety and Health at the Work Environment. The regulation states that control of the work environment can be done through elimination, substitution, technical engineering, administrative, and Personal Protective Equipment (PPE). Risk control according to Peraturan Kementerian Tenaga Kerja RI No.5 of 2018 concerning Occupational Safety and Health in the Work Environment, is carried out by looking at the types of potential hazards that cause these risks. The following is risk control that can be done for Batik Papringan workers, Banyumas by looking at the potential hazards that exist:

Table 6. Control of Accident and Occupational Disease Risks Based on Potential Hazards in the Work Environment of Batik Papringan Workers, Banyumas

| No. | Hazards | Risk Control |
|---|---|---|
| 1. | Less illumination | Engineering control (using additional lighting or lamps), opening the windows of the workplace |
| 2. | High temperature in room | Engineering control (open vents and windows) |
| 3. | High temperature from sunlight | Engineering control (working in a shaded room where there is no direct sunlight) |
| 4. | High humidity in workplace | Engineering control (opening vents and windows) |
| 5. | Less ventilation | Engineering control (opening the doors of the workplace, creating additional ventilation and windows that let in sunlight) |
| 6. | Floor still made of soil | Substitution (Replacing the floor with ceramics) |
| 7. | Exposure to chemicals derived from wax, chemicals from fabric dyes and dust from wood | Personal Protective Equipment/PPE (Using PPE in the form of masks, gloves, boat safety, safety glasses, and wearpacks) |
| 8. | Workplace close to pet kennels | Engineering control (Positioning the cage in a place away from the workplace) |
| 9. | A work place that is close to nature | Engineering control (Creating a special room for batik) |
| 10. | A bent sitting posture and a static work position | Engineering control (Making an ergonomic chair for batik, stretching muscles every 2 hours) |
| 11. | Workplace don't implement 5R | Engineering control (Making an ergonomic chair for batik, stretching muscles every 2 hours) |
| 12. | Not using PPE | Engineering control (Making an ergonomic chair for batik, stretching muscles every 2 hours) |
| 13. | Anxiety about decreased income due to decreased demand for batik products due to the COVID-19 pandemic, saturation, high workloads | Administrative control (Controlling anxiety by doing hobbies, exercising, socializing with enthusiastic and optimistic people, increasing spirituality, recreation) |

Source: Peraturan Menteri Ketenagakerjaan No. 5 Tahun 2018 (Kementerian Ketenagakerjaan RI, 2018)

The results showed that the Batik Papringan workers, Banyumas had a lot of potential dangers and risks. Risks that arise can be in the form of work accidents or occupational diseases. Work accidents that occur are only caused by not implementing the 5R (Ringkas, Rapi, Resik, Rawat, Rajin) around the work environment. When the research was carried out, it was seen that a lot of unnecessary items in the place (area) used for batik were still scattered and prevented workers from accessing work. Additionally, a slippery workplace runs the risk of causing workers to slip or fall. 5R is learning to manufacture in a clean, sorted, organized, and providing necessary improvement in the workplace (Shaik et al., 2015). The work area is not tidy, there is a puddle of water which causes the floor to be slippery, and the work area has scattered tools, items, or materials that can cause slips or falls. The implementation of 5S (Seiri, Seiton, Seiso, Seiketsu, and Shitsuke) or 5R in Bahasa Indonesia, give the significant difference improvement in small scale casting industry. Batik Papringan workers also said that they almost slipped or fell, especially when soaking the cloth in a stove filled with dye. Therefore, implementing 5R needs to be done in a disciplined manner in the work area of Batik Papringan workers as a form of controlling the risk of work accidents such as slips or falls.

Apart from the risk of work accidents, Batik Papringan workers also have other risks, including occupational diseases. The occupational disease risks for Batik Papringan workers include eye fatigue, watery eyes, headaches, and decreased concentration. It is due to the work area not implementing the 5R. The results showed that 175 workplaces, both in the KUB and home industry area, did not apply the 5R. The work area of Batik Papringan workers still looks scattered, untidy, unclean, and unkempt. It causes workers to

experience a decrease in work effectiveness and efficiency, product quality is not optimal, increase confusion, reduce work speed, increase fatigue, and reduce work comfort. It is in line with (Ghodrati & Zulkifli, 2013), who said that implementing the 5R culture achieves continuous improvement and higher performance. The research shows that in the governmental section, there is an improvement of about 63% and in the private section, of about 51%. The applicable 5R concept is to sort the items that are not needed while working so that the items needed are around the work area. Place them in their containers and label the containers. It will make the items needed easier to find so as not to cause confusion and work faster. Implementing 5R have many advantages such as using workplace better, preventing losing tools, increasing efficiency, saving time in searching things, improving working condition, decreasing machine maintenance, reducing absentees workers, increasing morale and awareness.

The results showed a high temperature in the room, namely as many as 50 work areas for Batik Papringan workers and sun exposure as many as 15 work areas. It causes the Batik Papringan workers to experience dehydration, discomfort, fatigue, lack of focus, and stress. According to Popkin et al. (2010), people must be avoided from excessive room temperature while working to prevent dehydration which can result in headaches, muscle weakness, and digestive disorders (nausea and vomiting). Workers are exposed to high room temperatures due to lack of ventilation or during batik activities using canting or removing wax from cloth. When making batik with canting, workers are exposed to the heat of the fire from the stove and firewood. It also happens when workers remove wax from cloth. It is in line with Pereira et al. (2020), stated that if a work area does not have adequate ventilation, it will cause oxygen levels in the room to decrease and carbon dioxide levels to increase. It causes the humidity and room temperature to increase. Lack of indoor ventilation can also make it easier for bacteria and viruses to grow. Risk control that can be done is by making adequate ventilation. So that air circulation can run properly and the temperature in the room is not high. In addition, workers who are exposed to direct sunlight can hydrate their bodies by consuming enough water when working, especially when drying batik cloth. It is in line with Zhang et al. (2019), said that dehydration has a negative impact, namely reducing memory and concentration and resulting in fatigue. Therefore, control that can be done is rehydration by consuming enough water while working.

The results showed that the work area used for batik was humid for 157 workers. It is caused, among others, by the by the unpiled floor and insufficient lighting and ventilation. The work area also looks dark with little lighting. Humid work areas are at risk of causing various occupational diseases such as upper respiratory infections. It is in line with Kullmann et al. (2008), who states that high humidity, low temperature, and sunshine are associated with the risk of several respiratory diseases.

The results showed exposure to chemicals from wax smoke and dyes used when soaking the batik cloth in a fire stove. It results in exposure to chemical waxes and fabric dyes to the workers' breathing and skin. In addition, exposure to chemicals from dyes or wax is a potential hazard that causes the extreme risk to Batik Papringan workers. Risk control needs to be prioritized. The results showed that all workers (as many as 190 workers) were exposed to chemical wax and fabric dyes because they did not use Personal Protective Equipment (PPE) while working. Whether they were masks, gloves, safety goggles, boat safety, or wear packs. It has the risk of causing occupational diseases such as contact dermatitis and respiratory problems. As many as 67.5% of batik workers in Pekalongan City and 30% of workers had dermatitis. Risk control that can be done according to Peraturan Kementerian Tenaga Kerja RI No. 5/2018 concerning Safety and Health in the Work Environment is to use PPE. PPE can prevent the entry of foreign objects, dust, and chemicals into our bodies provided that the PPE used meets established standards and is used properly, correctly, and continuously.

The results showed a workplace used to make batik close to pet cages or close to nature. A total of 17 batik work areas are close to pet

cages, and as many as 15 batik work areas are close to nature. It is in line with Blum's theory which states that health status is influenced by four factors, namely environment, genetics, behavior, and health services. Good sanitation is an integral part of human-animal housing to prevent and reduce the transmission of diseases from animal to human. The facilities must be clean from animal susceptibility to diseases. Daily cleaning is necessary for cage-free housing (Newburry et al., 2010). Therefore, it is necessary to control risks by positioning the work area away from pet cages and keeping the health protocol. Infectious diseases of animals can enter humans by some processes and transmitted virus, bacteria, or parasite (Atawodi et al., 2013)

The results showed the potential hazards in a bent work attitude and a static position that caused the risk of low back pain to Batik Papringan workers. It is in line with the research of (Suryadi & Rachmawati, 2020), states that there is a relationship between work posture and complaints of lower back pain on partners part of PT X Manufacture Tobacco Product. Therefore, the proper risk control for these potential hazards is the right chair and backrest. Seats should be designed so that they are slightly lordosa at the waist and a little kifosa on the back.

The results showed that all Batik Papringan workers (as many as 190 workers) experienced anxiety due to the decrease in demand for batik. It is due to the COVID-19 pandemic condition. According to Kocalevent et al. (2011), stress is significantly related to subjective fatigue which is characterized by anxiety, tension, discomfort, and not being active at work. Lee et al. (2015), said that job stress, psychosocial stress, and fatigue impact on musculoskeletal symptoms experienced by radiologists. Batik workers in Papringan said they felt sluggish with the state of decline in turnover due to the COVID-19 pandemic causing their income to decline. According to Hawari (2011), sports, worship, recreation, and sleep are some things that can control stress.

## Conclusion

The conclusion from this research is the potential hazards of a bent work attitude and a static work position, exposure to chemicals from wax smoke and batik cloth dyes, and a work environment that does not apply the 5R concept are potential hazards that can pose a hazard risk. Risk control is prioritized for the most part in dealing with the three potential hazards. Then, risk control is prioritized further to potential hazards that pose a high risk, namely insufficient lighting, high indoor temperatures, high temperatures due to hot sunlight, damp workplaces, inadequate ventilation, floors that are still from the ground, workplaces that are close to pet cages and do not wear Personal Protective Equipment (PPE). Suggestion for research is to be able to analyze the condition of the vital capacity of the lungs in workers due to exposure to chemicals from wax smoke and dyes.

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# Homesickness, Anxiety and Depression among Pakistani International Students in Indonesia during Covid-19 Outbreak

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## Abstract

International students are exposed to multiple mental health crisis due to social, environmental and culture shocks in foreign lands but it gets worse in presence of life- threatening disease outbreak. This research was conducted to evaluate the homesickness, anxiety and depression among Pakistani international students in Indonesia during Covid-19 Outbreak. Methods: This study was conducted on 86 random students that are pursuing their studies in different public and private universities in Indonesia. The data were collected by distributing google forms via email and social media groups and the responses from the respondents were recorded and Pearson correlation test was employed to analyze the obtained data and analyzed statistically in the year of 2021. The study findings revealed that there is a correlation between Covid-19 pandemic and the development of various mental health crisis where 33 students (38.37 %) developed homesickness, 11 students (12.79%) developed anxiety and 2 students (2.33 %) manifested low-grade depression. Homesickness was outstandingly observed in females (72.72 %) whereas anxiety was highly reported in males (90.90%). The study findings demonstrated that there is a strong negative correlation between student financial statuses and the development of homesickness (r: -0.977, P: 0.023) and anxiety (r: -0.944, P: 0.056). All in all, the fear to contract coronavirus, lockdowns, financial instability, death toll of citizens and medical professionals, run out of medical facilities and social media hoaxes are significant risk factors of mental health crisis among Pakistani international students in Indonesia.

## Introduction

The global pandemic which is currently threatening human life and causing both social and economic difficulties in both developed and developing countries is attributed to the new type of coronavirus. The coronavirus causes diverse clinical manifestations such as pneumonia, high body temperature and respiratory impairments including difficulty in breathing and infection of the lungs (Adhikari et al., 2020). Although the majority of individuals who work abroad (henceforth referred to as international employees) are unlikely to confront life-threatening conditions, they should be aware of health and safety issues as well as the multiple vulnerabilities they face (De Cieri & Lazarova, 2020). The majority of these viruses are known to highly affect both domestic and wild animals but some of these viruses were also reported to infect humans and cause the disease called zoonotic diseases. According to Joshi et al. (2020), Most universities make an effort to comprehend the strategic and financial consequences of enables students to develop of quality. On 29 December 2019, the World Health Organization (WHO) has temporarily named it 2019 novel coronavirus as the coronavirus that started

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affecting the lower respiratory tract of different patients in Wuhan, China (Thompson, 2020). Later on, WHO officially named it severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) which is the causative agent of Covid-19(Zhu et al., 2020).

Previous research has shown levels of depression increase after sickness, such as anthrax scares and herpes exposure (Abbas, 2020). The lockdown caused by coronavirus disease outbreak is tremendously inconveniencing global citizens in various ways such mental health crisis, fear resulting from the deadliness of the new virus, financial instability, quarantine, contradicting information from different officials in high positions and misinformation from social media. All these factors contribute to the development of depression, homesickness, anxiety and other mental health crises that manifest in citizens but mostly in people who reside far away from their families like students who traveled abroad for further studies (Coughlin, 2012). As global citizens are exposed to the consequences of coronavirus outbreak, mental health stability is considered as the most crucial feature of community health and wellbeing. From that perspective, depression is the highly prevalent mental disorder which doesn't have limit to the time, place, and individual but also it involves all races and ethnicities of people from different demographic regions(Nasir et al., 2010).

Respecting the decision of the government, many higher education institutions (HEIs) started to put their efforts to use technology in support of remote learning, distance education and online learning during the COVID-19 pandemic (Kundu & Bej, 2021). In response to the outbreak, the Pakistani students living in Indonesia are very scared about the virus incubation period and questioning themselves if the asymptomatic people could still buildout the infection. The serious quarantine measures in different major cities of Indonesia and their home countries which confined residents to their homes also aggravate the student's condition by adding mental pressures. Apart from that, the reported insufficient medical protective equipments, few and un-experienced medical staff because SARSCOV-2 is a new virus, shortage of hospital appliances and deaths of medical professionals in Pakistani causes the enormous concerns. Fear of contracting the virus; fear of their loved ones getting the virus; disruption to sleeping patterns; and less social interactions were also found as a result of the adopted social distancing protocol. (Yarrington et al., 2021). In addition to the recent outbreak, the Pakistani students in Indonesia are exposed to psychological tension from the ongoing online classes with massive academic workload, living hand to mouth and financial instability due to the delay of their living allowances from the universities. From the above highlighted reasons, the big number of students are exposed to many environmental and academic pressures that could run them the development of various mental health crisis such as depression of various types (Soltani N, 2016).

Many physiatrists advocated that the lockdown that the states have exercised to control the spread of the virus will have stress-related severe symptoms that are likely to impact people's mental state and overall well-being (Demir et al., 2020). One of the main challenges that Pakistani students experience during their stays in Indonesia is homesickness. It is explained as defined as a motivational and emotional situation which is characterized by the excessive desire and preoccupation of mind with thoughts of going back to the native countries and eventually lead to the absence of reassurance and increase the probability of developing depression and anxiety (Moeini et al., 2018). Depression is a disorder that negatively affects the someone's feeling and characterized by lethargy and the loss of appetite with increased sense of bad thinking and reduced concentration in diverse daily activities, cognitive performances and the development of insomnia (Aziz et al., 2020). The study findings of published researches disclosed that the higher people get exposed to hard-pressing conditions, the lower his/her happiness will be. This was documented as a potential threat which affect people's mental health and lead to homesickness, anxiety and depression of different degrees (Moeini et al., 2018). By giving a great consideration to various published research works from different parts of the world, there are no published

findings discussing about the pervasiveness of homesickness, anxiety and depression among Pakistani international students in Indonesia during Covid-19 outbreak. The pandemic outbreak has had a massive impact on the student fraternity around the world, with the impact being most acute in developing countries, which are grappling with several issues, including online education, which is in a miserable state and has, understandably, suffered a massive loss during the prolonged school closure (Mohamed et al., 2021). So, this current study is intended to light its beams on that research interest and provide primary data which will highly contribute to the continuous enrichment of the academic literatures and help the professionals to find out the effective solutions.

## Methods

This descriptive-analytical research was conducted in the duration of two months (from April to May 2021) on 86 (59 males and 27 females) Pakistani international students pursuing their studies in different public and private universities in Indonesia. Stratified randomization was used as a mean of sampling and collection. In this evaluation, the inclusion criteria were related to the active Pakistani international students in Indonesia who are enrolled in undergraduate, postgraduate and doctoral programs. The researchers limited themselves to 86 participants to conduct the research due to the covid-19 restrictions and also the number of participant's best represent the population. The participants who reside in university hostels and off campus accommodations were all included in the study. As the study was carried with much consideration of the ethical clearance for research, whereby the exclusion criteria were the absence of students' consent to be a part of this study.

The distributed google forms via email and social media groups consisted of both closed- ended and open-ended questions. The forms were intentionally filled by the participants and those who filled in the forms were considered as the research participants through their intentional consents of participation. Questionnaires were employed to collect demographic data from the consented students including their personal identifications such as name, age, gender, marital status and other information like field of study, semester, level of education, living place, number of siblings and their rankings, financial and health statuses, physical exercise experience at home, hobby of reading novels, watching TV habits, the use of internet and laptop- based game playing during the day.

The questionnaires consisted of other supplementary points which examine the repeatedness of homesickness experience and the severity of homesickness. The questionnaire used to assess the depression among Pakistani international students in Indonesia consists of different scales which are lethargy, fear of contract corona, social media pressures with a lot of hoaxes, cognitive-emotion and academic motivation. Students were also asked about their health status to figure out the symptoms of anxiety like fatigue, irritability, trouble of sleeping or staying awake, panic attacks, excessive worrying and restlessness. All the responses from the respondents on each form were evaluated where the low scales indicated the normal states while from the medium to high scores in terms of symptoms were the perfect indications of homesickness, anxiety and depression of different stages. SPSS version 23.0 (SPSS Inc., Chicago, IL, USA) was employed to analyze the obtained data whereby nonparametric test was employed to test the normality and Pearson correlation was used to evaluate the correlation between the variables.

## Results and Discussion

The findings of the current research disclosed that there is a strong positive correlation between Covid-19 pandemic and the development of various mental health crisis among Pakistani students where the analysis of obtained data demonstrated that 40 students (46.51%) were free of any mental health problem, 33 students (38.37 %) developed homesickness, 11 students (12.79%) developed anxiety and 2 students (2.33 %) manifested low-grade depression. Of all 33 students who manifested homesickness, 24 (72.72 %) were females whereas the big number of anxious students were males and they occupied 90.90 %

of all research subjects who presented anxiety. As demonstrated by the results presented in table 1, the high prevalence of homesickness was seen among female participants whilst the anxiety was appeared in males and the equal number of low-grade depressions was observed in both sexes (1:1). In reference to the study findings presented in table 2, the research subjects that are less than 25 years of age were highly susceptible to anxiety, 9 (81.81%) whereas the informants that are aged between 25 and 30 years were vulnerable to homesickness ,19 (57.57%) and the respondents above 30 years of age showed a resistance to anxiety and depression. As shown by the findings recorded in table 3, the students with financial instability (weak) manifested the symptoms of homesickness and anxiety compared to others. The development of mental health crisis in relation to the use of internet and TV watching habits as described in table 4, was highly observed among the students who frequently use internet and watch TV. Of all 33 students who developed homesickness, 18 (54.54%) of them use internet and 12(36.36%) use both internet and watch TV.

Table 1. The Manifestation of Mental Health Crisis in Relation to Gender

| | Negative | Homesickness | Anxiety | Depression | Total |
|---|---|---|---|---|---|
| **Males** | 39(66.10%) | 9(15.25%) | 10(16.94%) | 1(1.69%) | 59 |
| **Females** | 1(3.70%) | 24(88.88%) | 1(3.70%) | 1(3.70%) | 27 |
| **Total** | 40(46.51) | 33(38.37%) | 11(12.79%) | 2(2.32%) | 86 |
| **r** | -1 | 1 | -1 | -1 | |

Primary Data, 2020

Table 2. The Manifestation of Mental Health Crisis in Relation to Age

| | Negative | Homesickness | Anxiety | Depression | Total |
|---|---|---|---|---|---|
| **<25 years** | 22(50%) | 12(27.27%) | 9(20.45%) | 1(2.27%) | 44 |
| **25-30 years** | 10(31.25%) | 19(59.37%) | 2(6.25%) | 1(3.12%) | 32 |
| **>30 years** | 8(80%) | 2(20%) | 0(0.00%) | 0(0.00%) | 10 |
| **Total** | 40(46.51) | 33(38.37%) | 11(12.79%) | 2(2.32%) | 86 |
| **R** | -0.924 | -0.585 | -0.952 | -0.866 | |
| **P value** | 0.249 | 0.602 | 0.198 | 0.333 | |

Primary Data, 2020

Table 3. The Manifestation of Mental Health Crisis in Relation to Financial Statuses

| | Negative | Homesickness | Anxiety | Depression | Total |
|---|---|---|---|---|---|
| **High** | 3(21.42%) | 9(64.28%) | 2(14.28%) | 0(0.00%) | 14 |
| **Good** | 7(43.75%) | 6(37.50%) | 2(12.50%) | 1(6.25%) | 16 |
| **Medium** | 12(60%) | 5(25%) | 3(15%) | 0(0.00%) | 20 |
| **Weak** | 18(50%) | 13(36.11%) | 4(11.11%) | 1(2.77%) | 36 |
| **Total** | 40(46.51) | 33(38.37%) | 11(12.79%) | 2(2.32%) | 86 |
| **R** | 0.996 | -0.977 | -0.944 | 0.447 | |
| **P value** | 0.004 | 0.023 | 0.056 | 0.533 | |

Primary Data, 2020

**Table 4. The Manifestation of Mental Health Crisis in Relation to the Use of Internet and TV as Watching Habits**

| | Negative | Homesickness | Anxiety | Depression | Total |
|---|---|---|---|---|---|
| **Both** | 16(48.48%) | 12(36.36%) | 4(12.12%) | 1(3.03%) | 33 |
| **Internet** | 20(45.45%) | 18(40.90%) | 5(11.36%) | 1(2.27%) | 44 |
| **TV** | 4(44.44%) | 3(33.33%) | 2(22.22%) | 0(0.00%) | 9 |
| **Total** | 40(46.51) | 33(38.37%) | 11(12.79%) | 2(2.32%) | 86 |
| **R** | -0.721 | -0.596 | -0.655 | -0.866 | |
| **P value** | 0.488 | 0.593 | 0.546 | 0.333 | |

Primary Data, 2020

The core results of this evaluation demonstrated that Covid-19 outbreak is highly attributed to the development of various mental health crisis in foreign students due to different environmental pressures such as the increase in number of Covid-19 cases, strict lockdown measures such as strict stay at home directives including home confinement, quarantine, and isolation, conflicting messages from authorities, social media news and other psychological tensions (Betty & Carol., 2020).

The study findings revealed great number of homesickness in studied popula-tion. This result is in agreement with the research results of Moeini who reported that homesickness is common in foreign students due to the fact that they have a desire to return in their home countries and nostalgia for their respective intimate friends and siblings (Moeini et al., 2018). The reported homesickness should also be attributed to the loneliness during lockdowns as well as the incompatibility with the new environments. This result is also supported by the study findings published by Terry which showed the presence of homesickness in non-native students due to diversity of cultures and societal health instability (Terry et al., 2013).

The high prevalence of homesickness observed in females is consistent with past studies that found the vulnerability of females to homesickness in females than males. This statement could be assisted by the results obtained by other researchers who reported the high prevalence of homesickness in girls than boys (Adhikari et al., 2020; Moeini et al., 2018; Stroebe et al., 2002). But, the result of current evaluation is also compromising with the findings of Uchenna who did not find significant gender difference in homesickness (Uchenna, C. Onuoha, Opeyemi & Janet, 2013).

The observed anxiety in this evaluation is in conformity with the study results reported by a Chinese researcher from the study that was conducted on Chinese medical staffs. It should be defined by the fact that Covid-19 pandemic has become a potential stressor, particularly as this is a new viral infection which doesn't have a vaccine or a specific treatment, fear of being infected and the big number of reported deaths globally(Xiao et al., 2020). In this evaluation, the prevalence of depression was equal between males and females. The observed depression in boys is in tandem with the research findings published in previous studies emphasizing that boys due to their concerns about employment and their future that could be more likely to induce depression(Zaid ZA. et al., 2007).

In regard to the obtained results, student's age could be considered as a major predictor of depression. This is in line with the findings from the study of Zaid and friends which disclosed that older people should have better mental health statuses, ability to calm themselves during hard conditions and are not highly developing mental health problems due to self-counselling (Zaid ZA. et al., 2007). Apart from the fact that every individual responds to stress in different ways, the Covid-19 pandemic and the lockdowns has caused a lot of worries, hunger, uncertainty, pending death, confusion and chaos which could drive students crazy and highly inconvenience their psychological stress and mental health(Aziz et al., 2020).

By emphasizing on the observed findings, the correlation between the habits of using both internet and TV watching contributed to the development of mental health crisis. These results are in conformity with the study results. The duration spent on the Internet, web based content, the use of social platforms and watching TV programs or news highly contribute to depression and anxiety (Hökby et al., 2016). The large negative correlation observed between mental disturbance and the use of internet and TV watching is attributed to the fact that social media and various TV stations are broadcasting depressive news and the conflicting messages between government officials and health professionals (Delfanti et al., 2018).

## Conclusion

The conclusion that can be drawn from the results of this research is that the fear to contract coronavirus, lockdowns, financial instability, death toll of citizens and medical professionals, run out of medical facilities and social media hoaxes are significant factors in mental health crisis of Pakistani international students in Indonesia during Covid-19 pandemic. As mental health crises should be mitigated by having positive opinions and

strong feelings of efficacy. From that standpoint, it is recommended to embrace the talking cure with their families, physical exercises and positive thinking to avoid unintended and irreparable consequences.

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# Prevalence of Executive Dysfunction in Type 2 Diabetes Mellitus Patients in Mataram

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## Abstract

Executive dysfunction is a consequence of type 2 diabetes mellitus decreasing the quality of life of the patients. This study aims to investigate the prevalence of executive dysfunction among type 2 diabetes mellitus patients in Mataram. This case-control study involved 106 subjects recruited consecutively from May to September 2020 and divided into two groups, type 2 diabetes subjects (n=53) and healthy subjects (n=53) in the outpatient setting. The statistical analysis was done to investigate the significant difference of the means of age and years of education (independent t-test), mean of TMT-B completion time (Mann-Whitney U test), and proportions of gender and executive function status (chi-square test) between both groups. Binary logistic regression analysis examining the association between demographic and clinical variables and cognitive function status was performed in the type 2 diabetes mellitus subject group. There was a significant difference in the frequency of executive dysfunction between diabetes mellitus and healthy subject groups ($p<0.05$). The prevalence of type 2 diabetes mellitus-associated executive dysfunction was 49.1%. Gender was the only characteristic associated with the prevalence of this executive dysfunction (OR=0.25; 95%CI=0.07-0.88, $p<0.05$). There was a high prevalence of type 2 diabetes mellitus-associated cognitive impairment and it was associated with the female gender.

## Introduction

Diabetes is currently becoming a global health problem in both developed and developing countries. The global prevalence of this disease in 2014 was 8.5% (WHO, 2016) and is estimated to increase to 10.4% in 2040 (Fan, 2017). The global prevalence of diabetes mellitus in Indonesia is still not determined yet, but a study conducted in Jakarta showed that its prevalence in productive age urban population is 4.6% (Mihardja, Soetrisno, & Soegondo, 2014). Type 2 diabetes mellitus is the most common type of diabetes mellitus, which is about 90% of all diabetes mellitus cases (Zheng, Ley, & Hu, 2018). Type 2 diabetes mellitus patients are at higher risk for developing cognitive impairment and dementia (Umegaki, 2014).

Cognitive impairment is the main consequence of diabetes mellitus, particularly type 2 diabetes mellitus, which is currently getting a lot of attention from researchers in recent years. Since the prevalence of type 2 diabetes is becoming higher accompanied by its advanced treatment modalities, the life expectancy of the survivors is increasing. Hence, their risk of experiencing cognitive impairment as a result of diabetes mellitus-related neurodegenerative processes will also increase. Recently, the global prevalence of cognitive impairment related to diabetes mellitus is not available yet, but studies in various countries revealed that its

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prevalence is around 2.2% to 48.5% (Verny, Doucet, Bauduceau, Constans, Mondon, & Le Floch, 2015; Lavielle, et al., 2015; Damanik, et al., 2019). A study conducted in Indonesia showed a higher prevalence. It was related to high serum homocysteine levels, a well-known vascular risk factor for cognitive impairment (Damanik, et al., 2019). The wide range of prevalence of diabetes mellitus-associated cognitive impairment in various countries is influenced by many factors, including the demographic and clinical characteristics of the subjects studied and the study methods used (Kravitz, Schmeidler, & Beeri, 2013; Feinkohl, Price, Strachan, & Frier, 2015).

Type 2 diabetes mellitus-associated cognitive impairment may involve one or more cognitive domains, including attention, memory, language, visuospatial, and executive function (Mahmoud & Gawad, 2018). Executive dysfunction is known as one of the cognitive domains most affected by type 2 diabetes mellitus (Zilliox, Chandrasekaran, Kwan, & Russel, 2016). Individuals with type 2 diabetes mellitus-associated executive dysfunction have difficulty in planning, flexible thinking, and decision making that lead to a decrease in their quality of life and higher dependency on their caregivers (Rucker, McDowd, & Kluding, 2012). A serial process of neuroinflammation, oxidative stress, and glutamate excitotoxicity induced by insulin resistance-associated chronic hyperglycemia. It takes place in the frontal lobe and responsible for the occurrence of executive dysfunction in patients with type 2 diabetes mellitus (Moran, et al., 2013; Kim, 2019). Currently, the prevalence of executive dysfunction associated with diabetes mellitus is remain scarce.

However, early detection of type 2 diabetes mellitus-associated executive dysfunction is beneficial for the patients since it will allow them, to get appropriate treatment. Early diagnosis followed by optimal treatment of type-2 diabetes mellitus-associated executive dysfunction is effective to hamper its progression to a more severe form of cognitive impairment so that they can carry out their daily functional and social activities properly (Sun, et al., 2020). By maintaining proper glycemic control, patients with type 2 diabetes mellitus-associated cognitive impairment, including executive dysfunction have better clinical outcomes compared to those with poor glycemic control (Miranda-Felix, Valles-Ortiz, & Ortiz-Felix, 2016). This study aimed at investigating the prevalence of executive dysfunction and identifying its associated demographic and clinical characteristics.

## Method

This was a case-control study. It both type 2 diabetes mellitus patients and healthy subjects in the outpatient setting of Siti Hajar Islamic Hospital Mataram, West Nusa Tenggara, from May to September 2020. The sample calculation formula for comparing the proportion of two unpaired samples according to Wang and Chow was used to determine the sample size of this study (Wang & Chow, 2007). Since the lowest prevalence of cognitive impairment in patients with type 2 diabetes mellitus (P2) was 2.2% (Lavielle, et al., 2015), the minimum sample size required for each group was 41 using the sample calculation formula mentioned above. However, the number of eligible subjects obtained for each group during the period of this study was 53. The inclusion criteria for the type 2 diabetes mellitus subjects group were: type 2 diabetes mellitus patients aged 40-65 years old, fully conscious, and those with minimum graduation of elementary school. The inclusion criteria for the healthy subjects group were subjects without prior history of diabetes mellitus, aged 18-65 years old, fully conscious, and those with minimum graduation of elementary school. The exclusion criteria for both groups were subjects with significant uncorrected visual and hearing loss, prior history of cognitive impairment, depression, and taking an antidepressant and antianxiety drugs. This study was approved by Komisi Etik Penelitian Kesehatan of Universitas Mataram with Register Number 63/UN18. F7/ETIK/2020. All subjects signed written informed consent before their participation.

Demographic and clinical characteristics collected from both groups were age, gender, years of education, Trail Making Test Part B (TMT-B) completion time, and status of executive function. Demographic and clinical characteristics as categorical variables were

collected only from subjects with type 2 diabetes mellitus. They were age (40-54 years vs 55-65 years), gender, years of education (≤12 years vs>12 years), duration of diabetes mellitus (<5 years vs ≥5 years), treatments (oral antidiabetics, insulin, combination, and no treatment), smoking, hypertension, coronary artery disease, the status of body mass index (BMI) (normo weight vs overweight), and dyslipidemia. Normoweight was defined as BMI <25 kg/m2, while overweight as BMI ≥25 kg/m2 (Indrayana & Harahap, 2020). The status of executive function was assessed using the TMT-B instrument. In TMT-B, the subjects were asked to connect circles containing numbers or letters scattered randomly in a paper in alternate number and letter sequences and its completion time was recorded. The completion time was then categorized into normal (≤180 seconds) and prolonged (>180 seconds). Subjects with normal completion time in TMT-B were considered to have a normal executive function, whereas those with prolonged completion time were considered to have executive dysfunction. This instrument had been validated and used in the previous study (Harahap, Indrayana, & Amalia, 2017).

Statistical analysis used to compare the demographic and clinical characteristics between type 2 diabetes mellitus and healthy subjects were independent t-test, Mann-Whitney U test, and chi-square test. Simple and multiple logistic regression tests were used to examine the association between the characteristics of the subjects and the status of executive function. The analysis was performed using IBM SPSS 22.0 and statistical significance was set at $p<0.05$.

## Results and Discussion

The previous study had shown that type 2 diabetes mellitus was associated with the incident of cognitive impairment ranging from mild to moderate to dementia (Munshi, 2017). Pathophysiologically, chronic dysfunction of pancreatic β-cell and insulin resistance, the hallmark of type 2 diabetes mellitus, will result in the chronic hyperglycemia and the increase of advanced glycation end-products deposition in most of the body tissues, including the brain. In the brain, these conditions will eventually activate a series of pathologic processes, including self-sustaining neuroinflammation, oxidative stress, and glutamate excitotoxicity that lead to neuronal death and neurodegeneration (Kim, 2019). Chronic hyperglycemia-induced oxidative stress found in diabetes mellitus taking place in the population of neurons in brain tissue, especially in the hippocampus, also contributes to increased the production of amyloid-β (Aβ) oligomers and decreased the elimination of them from the neurons. In neurons, the increased production of Aβ oligomers will then provide positive feedback to conditions of oxidative stress, hyperphosphorylation of tau protein, and the formation of neurofibrillary tangles (NFTs), a condition which is characteristic of Alzheimer's disease (Zilliox, Chandrasekaran, Kwan, & Russel, 2016). In type 2 diabetes mellitus, deposition of Aβ oligomers as well as hyperphosphorylation of tau protein, occurred via activation of neuronal glycogen synthase kinase 3 (GSK3) signaling pathway (Seto, Yang, Kiat, Bensoussan, Kwan, & Chang, 2015). These mechanisms support the theory that diabetes mellitus-associated cognitive impairment, including type 2 diabetes mellitus, can have clinical progression towards Alzheimer's dementia. The neurodegenerative process taking place in the particular brain area that serves particular cognitive functions, including attention, memory, language, visuospatial, and executive function will result in dysfunction of these cognitive domains (Palta, Schneider, Biessels, Touradji, & Hill-Briggs, 2014). A study conducted in Cipto Mangunkusumo National General Hospital revealed that the prevalence of cognitive impairment among type 2 diabetes mellitus patients aged <60 years old was 48.5% (Damanik, et al., 2019). This prevalence was higher compared with other studies showing its prevalence ranging from 2.2% to 28.8% (Verny, Doucet, Bauduceau, Constans, Mondon, & Le Floch, 2015; Lavielle, et al., 2015).

Previous article reviews stated that executive function was one of the cognitive domains most affected in type 2 diabetes mellitus (Moheet, Mangia, & Seaquist, 2015; Munshi, 2017). A meta-analysis aimed to obtain the effect size for the most frequently reported neuropsychological test within domains

revealed that the instrument most commonly used for the evaluation of executive function was Trail Making Test Part B (TMT-B) (Palta, Schneider, Biessels, Touradji, & Hill-Briggs, 2014). The present study showed that the prevalence of executive dysfunction in type 2 diabetes mellitus patients is significantly higher (49.1%) compared to healthy subjects with comparable age, gender, and years of education. The mean completion time in TMT-B, an instrument used to evaluate an executive function, in this study also showed significantly higher in type 2 diabetes mellitus patients compared with healthy subjects (Table 1). The prevalence of executive dysfunction revealed in this study was in line with the results of the previous study (Damanik, et al., 2019). Since the brain area serving executive function is located in the prefrontal cortex, the high prevalence of executive dysfunction among type 2 diabetes mellitus patients shown in this study might indicate the occurrence of pathologic processes described above in this brain area. A study using voxel-based morphometry confirmed that type 2 diabetes mellitus was associated with gray matter loss in some brain areas of the patients, including frontal lobes, the brain area that involved executive function (Moran, et al., 2013).

**Table 1.** Demographic and Clinical Characteristics of Type 2 Diabetes Mellitus and Healthy Subjects

| Variables | Mean ± SD, Unless Otherwise Stated | | p-value |
|---|---|---|---|
| | Type 2 DM (n=53) | Healthy Subjects (n=53) | |
| Age in years | 52.75±5.86 | 51.49±6.05 | 0.277[a] |
| Gender, n(%) | | | |
| Male | 23 (45.1) | 28 (54.9) | 0.331[b] |
| Female | 30 (54.5) | 25 (45.5) | |
| Years of education | 12.25±3.93 | 13.45±3.52 | 0.101[a] |
| TMT-B completion time in seconds | 192.34±85.66 | 118.92±49.72 | <0.001[c]* |
| Executive function, n(%) | | | |
| Normal | 27 (50.9) | 47 (88.7) | <0.001[b]* |
| Dysfunction | 26 (49.1) | 6 (11.3) | |

[a]Independent t-test, [b]Chi-square test, [c]Mann-Whitney U test.
*Significant difference (p<0.05)
SD: standard deviation; DM: diabetes mellitus; TMT-B: Trail Making Test Part B

Since the executive function is referred to the ability of subjects in planning, problem-solving, flexible thinking, problem solving, and decision making, dysfunction of this cognitive domain will decrease their functional capacities that lead to loss of productivity and high daily living independence (Rabonivici, Stephens, & Possin, 2015). Type 2 diabetes mellitus is known as an important risk factor for executive dysfunction, either in relation or independent from the existence of demographic characteristics and other vascular risk factors (Rucker, McDowd, & Kluding, 2012). Common vascular risk factors other than diabetes mellitus most commonly identified are cigarette smoking, hypertension, coronary artery disease, overweight, and dyslipidemia (Rosjidi, Isro'in, & Wahyuni, 2017). These vascular risk factors modified the role of diabetes mellitus in the development of cognitive impairment (Kim, 2019). A cohort study also showed that increasing age, good educational level, and female gender were identified demographic factors that increased the risk of diabetes mellitus-associated cognitive impairment, including executive dysfunction (Ganguli, et al., 2014). The present study showed that among demographic and clinical characteristics of patients with type 2 diabetes mellitus, the female gender is the only variable significantly associated with the prevalence of executive dysfunction (Table 2). This is in line with the result of the previous study described above (Ganguli, et al., 2014).

**Table 2.**Association between demographic and clinical characteristics and status of executive function in subjects with type 2 diabetes mellitus

| Variables | Executive function | | Crude OR (95%CI)[a] | p-value | Adjusted OR (95%CI)[b] | p-value |
|---|---|---|---|---|---|---|
| | Normal (n=27) | Dysfunction (n=26) | | | | |
| Age, n(%) | | | | | | |
| 40-54 years | 15 (55.6) | 13 (50.0) | 0.80 (0.27-2.36) | 0.686 | - | |
| 55-65 years | 12 (44.4) | 13 (50.0) | Reference | | | |
| Gender, n(%) | | | | | | |
| Male | 16 (59.3) | 7 (26.9) | 0.25 (0.08-0.81) | 0.020* | 0.25 (0.07-0.88) | 0.030** |
| Female | 11 (40.7) | 19 (73.1) | Reference | | Reference | |
| Years of education, n(%) | | | | | | |
| ≤12 years | 15 (55.6) | 19 (73.1) | 2.17 (0.69-6.87) | 0.187* | 1.24 (0.34-4.54) | 0.744 |
| >12 years | 12 (44.4) | 7 (26.9) | Reference | | Reference | |
| Duration of DM, n(%) | | | | | | |
| <5 years | 12 (44.4) | 6 (23.1) | 0.38 (0.11-1.23) | 0.105* | 0.36 (0.10-1.30) | 0.117 |
| ≥5 years | 15 (55.6) | 20 (76.9) | Reference | | Reference | |
| Treatments, n(%) | | | | | | |
| OAD | 15 (55.6) | 17 (65.5) | 0.76 (0.11-5.15) | 0.775 | - | |
| Insulin | 5 (18.5) | 5 (19.2) | | | | |
| Combination | 5 (18.5) | 1 (3.8) | | | | |
| No treatment | 2 (7.4) | 3 (11.5) | Reference | | | |
| Smoking, n(%) | | | | | | |
| Yes | 6 (22.2) | 4 (15.4) | 0.64 (0.16-2.58) | 0.527 | - | |
| No | 21 (77.8) | 22 (84.6) | Reference | | | |
| Hypertension, n(%) | | | | | | |
| Yes | 20 (74.1) | 22 (84.6) | 1.92 (0.49-7.57) | 0.346 | - | |
| No | 7 (25.9) | 4 (15.4) | Reference | | | |
| CAD, n(%) | | | | | | |
| Yes | 2 (7.4) | 1 (3.8) | 0.50 (0.04-5.87) | 0.581 | - | |
| No | 25 (92.6) | 25 (96.2) | Reference | | | |
| BMI, n(%) | | | | | | |
| Normoweight | 12 (44.4) | 15 (57.7) | 1.70 (0.58-5.06) | 0.336 | - | |
| Overweight | 15 (55.6) | 11 (42.3) | Reference | | | |
| Dyslipidemia, n(%) | | | | | | |
| Yes | 15 (55.6) | 16 (61.5) | 1.28 (0.43-3.83) | 0.659 | - | |
| No | 12 (44.4) | 10 (38.5) | Reference | | | |

[a]Simple logistic regression, [b]Final model of multiple logistic regression
*Eligible for multiple logistic regression analysis (p>0.25), **Significant association (p<0.05)

The existence of other vascular risk factors as the comorbid of type 2 diabetes mellitus, including cigarette smoking, hypertension, dyslipidemia, and overweight contribute to aggravate the endothelial as well as blood-brain barrier dysfunction induced by chronic hyperglycemia-associated systemic inflammation and oxidative stress in patients with type 2 diabetes mellitus (Verma & Despa, 2019). Due to the blood-brain barrier

dysfunction, the brain tissue becomes to be exposed to neurotoxic substances that are translocated from the circulating blood to the brain parenchyma, such as thrombin, fibrin, plasmin, hemoglobin, and iron derived from lysed erythrocyte cells (Biessels & Despa, 2018). Translocation of these neurotoxic substances into brain tissue will cause neuronal and glial cells dysfunction. It leads to neurodegenerative processes and cognitive dysfunction through various mechanisms previously described. A previous study examining the association between vascular risk factors mentioned above and the prevalence of executive dysfunction among type 2 diabetes mellitus patients showed many results. Kim reviewed the characteristics of cognitive impairment in patients with diabetes mellitus and showed that the common vascular risk factors mentioned above were associated with the development of cognitive impairment (Kim, 2019). This review is supported by the results of a study conducted by Ganguli et al. showing these vascular risk factors were associated with the prevalence of cognitive impairment (Ganguli, et al., 2014). However, Xiu et al. investigated the risk factors for cognitive impairment among the older diabetes mellitus population and the results showed that smoking, hypertension, coronary heart disease, overweight, and dyslipidemia were not associated with the prevalence of diabetes mellitus-associated cognitive impairment (Xiu, Liao, Sun, & Chan, 2019). These results are following the results of the present study.

The level of education as an important component of cognitive reserve, in theory, determines the susceptibility of a patient with type 2 diabetes mellitus to suffer from cognitive impairment (Darwish, 2018). Cognitive reserve is the ability of the brain to use neuronal networks efficiently and flexibly in performing unique tasks in the presence of pathology in brain tissue (Stern, 2013). In this case, two subjects, who have relatively similar pathological conditions in the brain, may show different clinical outcomes, i.e. one subject shows intact cognitive function or obtain a significant improvement of cognitive impairment compared to others. Theoretically, a better level of education supports the ability of neurons in the brain to adapt to the existence of type 2 diabetes mellitus-induced pathological, so that they can function optimally. This means that those pathological conditions in brain tissue that lead to type 2 diabetes mellitus-associated neurodegenerative process, can be compensated for by the neuron population. In such a way that they can still carry out their daily functional activities properly. Theoretically, a better level of education induces neuronal activities reflecting the neuronal plasticity that existed in three forms. Namely neurogenesis, production of neurotrophic factors, and regulation of the neurotransmitter system (Vivar, Potter, & van Praag, 2013). However, following vascular risk factors, the present study showed that years of education were not associated with the prevalence of type 2 diabetes mellitus. Nevertheless, many results regarding the level of education, duration of disease, and vascular risk factors in both the previous and the present studies are mostly determined by the population of type 2 diabetes patients studied and the research method and instrument of cognitive assessment used.

This study has a limitation. The baseline data of executive function of the subjects before diabetes mellitus were not available. It is difficult to determine whether the finding of executive dysfunction in this study is merely caused by diabetes mellitus or as a pre-existing condition. Therefore, the information about prior history of cognitive impairment, including executive dysfunction in this study was obtained from the information given by the patients and their relatives. However, due to the scarce data on the prevalence of executive dysfunction among patients with type 2 diabetes mellitus, the results of this study are becoming valuable for the local health authority to make policies regarding the detection and management of executive dysfunction among these patients. The findings of executive dysfunction in this study were not confirmed by brain imaging to identify the anatomical changes in the brain as described in the previous. However, for clinical practice, especially in rural areas, detection of executive dysfunction using simple neuropsychological testing provided in this study is sufficient for the basis of its management.

## Conclusion

This study revealed a high prevalence of executive dysfunction among patients with type 2 diabetes mellitus. Gender was the only characteristics associated with the prevalence of executive dysfunction among these subjects. Being female is at higher risk of suffering from type 2 diabetes mellitus-associated executive dysfunction. Evaluation of the impact of executive dysfunction on the functional and social activities of daily living of patients with type 2 diabetes is recommended in future study.

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# Spatial Analysis and Risk Factors for Diabetes Mellitus Type II in Banjarbaru City

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**Abstract**

The World Health Organization defines diabetes mellitus as a disease characterized by hyperglycemia and disturbances of carbohydrate, fat and protein metabolism associated with absolute or relative deficiency of insulin action and/or secretion. It is estimated that between 2010 and 2030, developed and developing countries will experience a 20% and 69% increase in the number of adults with diabetes, respectively. This research is a quantitative analytic study with a cross sectional design. Utilizing secondary data at the Health Office of Banjarbaru City as of January-March 2020, in particular the five health centers, namely the South Banjarbaru Health Center, the Sei Besar Health Center, the Sei Ulin Health Center, the Liang Anggang Health Center and the Guntung Manggis Health Center. The sampling method is quota sampling and data analysis using chi square. The result is that there is no relationship between gender (p-value=0.742), marital status (p-value=1), employment status (p-value=0.075), education level (p-value=0.646), smoking (p-value = 0.052), BMI (p-value = 0.451), abdominal circumference (p-value = 0.212), and less fruit and vegetable consumption (p-value = 0.586) on the incidence of diabetes mellitus type II. As for the incidence of diabetes mellitus type II is age (p-value = 0.0001). This study also illustrates the mapping of the distribution of the incidence of Diabetes Mellitus Type II using a color gradation with a scale of 1: 211190, namely in South Banjarbaru District as much as 70.4%, then Liang Anggang District which is 20.4% and North Banjarbaru District 9.2%.

## Introduction

Diabetes mellitus Type 2 (DMT2) is a serious public health problem that has a major impact on human life as it affects an individual's functional capacity and quality of life, leading to significant morbidity and premature mortality. Diabetes mellitus is a group of metabolic disorders characterized by chronic hyperglycemic conditions resulting from defects in insulin secretion, insulin action or both (Abdul et al., 2020; Ozougwu et al., 2013). The World Health Organization (WHO) defines diabetes mellitus (DM) as a chronic metabolic disease, a disease characterized by elevated blood glucose levels, which over time causes damage to the heart, blood vessels, eyes, kidneys and nerves (Galicia-Garcia et al., 2020).

It is estimated that between 2010 and 2030, developed and developing countries will experience a 20% and 69% increase in the number of adults with diabetes, respectively. The prevalence of diabetes among those aged 20-79 years could increase to 7.7%, reaching 439 million by 2030 (Al Mansour, 2020). Data from the International Diabetes Federation (IDF) in 2019 stated that DM caused 4.2 million deaths and 463 million people aged between 20-79 years living with DM, this number is likely to increase to 700 million by 2045. Patients with DM have 15 % increased risk of cause of death compared to people without DM (Galicia-Garcia et al., 2020). Diabetes mellitus (DM) is a serious chronic degenerative disease characterized by high blood glucose levels associated with insulin production and/or action. It should be noted that diabetes mellitus

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is a disease that often occurs in the 21st century and it is estimated that by 2030 the number of diabetes mellitus in the world will reach 552 million cases (Muñiz-Ramirez et al., 2021; Nugroho et al., 2020).

Diabetes in Indonesia is considered a major health problem and has been a concern since the early 1980s. Indonesia has a diabetes prevalence rate of 6.2% and is one of the main causes of death. Indonesia is rated as one of the top ten countries in the world by the number of individuals living with diabetes in 2013. Indonesia ranks 7th out of the largest number of diabetes patients worldwide and 3rd out of the top 10 countries with 29.1 million people who have impaired glucose tolerance in 2019 (Kristina et al., 2020; Ligita et al., 2019). The increase in the number of DM patients, mostly DM type 2, is related to several factors. Diabetes mellitus is multifactorial, modifiable risk factors such as body mass index (BMI), physical activity, diet, infection and so on. In addition, non-modifiable risk factors such as age, family history of DM and so on (Majgi et al., 2012).

In general, the prevalence of diabetes mellitus in South Kalimantan Province reaches 1.30%. Meanwhile, the prevalence of Diabetes Mellitus based on doctor's diagnosis at all ages according to the district/city of South Kalimantan Province was highest in Banjarmasin City reaching 2.12%, followed by Banjarbaru City which reached 1.65% and Tapin District 1.57%.(Health Research and Development Agency, 2018). Diabetes mellitus is a concern, especially since this disease is one of the diseases with the highest incidence in South Kalimantan. Thus, researchers want to map the distribution of diabetes mellitus cases spatially, considering that research on the distribution of the disease is still minimal in South Kalimantan. Not only that, this study also examines the relationship between several risk factors such as sociodemography, BMI, abdominal circumference, smoking, fruit and vegetable consumption.

## Research Methods

This research uses quantitative analytical method with cross sectional design. This study also uses secondary data to see the relationship between several factors causing the incidence of type 2 diabetes mellitus. The sample of this study was all people with diabetes mellitus who were treated at the community health center who had cases of type II DM in the work area of the Banjarbaru City Health Office. Of the 10 health centers, there are 5 health centers that have complete data, namely South Banjarbaru Health Center, Sungai Besar Health Center, Sungai Ulin Health Center, Liang Anggang Health Center, and Guntung Manggis Health Center.

The formula used to determine the sample size is as follows:

$$n = \frac{N\, z^2\, p\, q}{d^2\,(N-1) + z^2\, p\, q}$$

Description:
n = sample size
$z^2$ = 1,962=3,814
p = the proportion of a particular case to the usual population in previous studies.
q = 1-p
d = the degree of deviation from the population used, may use 0.05, but 0.02 and 0.01 are prioritized according to WHO recommendations
N = large population, in the productive age of 15-59 years in Banjarbaru City 180,380.

So that,

$$n = \frac{180.380 \times 3{,}8416 \times 0.0165 \times 0.9835}{0.022 \times 180.379 \times 3{,}8416 \times 0.0165 \times 0.9835}$$

n = 155.8
n ≈ 156 sample

The sampling technique in this study is quota sampling, where the number of samples is based on the completeness of the data and the suitability of the variables studied in this study. Secondary data collected is non-communicable disease data from January-March 2020. Bivariate data analysis uses a computer data analysis applicationas for the spatial analysis uses Quantum Gis 3.8.3.

## Results and Discussion

The results of statistical tests using the chi square test (x2) with = 0.05 regarding the relationship between age, gender, marital

status, type of work, education level, smoking, BMI, abdominal circumference and less consumption of fruits and vegetables with the incidence of Diabetes Mellitus Type II in the working area of the Banjarbaru City Health Office, it can be observed in the following table.

Table 1. Relationship of Respondents Characteristics, Smoking, Fruit and Vegetable Consumption, BMI, and Abdominal Circumference with the incidence of DM Type II

| Variable | | DM Type 2 | | | | p-value |
|---|---|---|---|---|---|---|
| | | Yes | % | No | % | |
| Age Group (Years) | < 45 | 10 | 10,2 | 23 | 3,4 | 0,0001 |
| | > 45 | 88 | 89,8 | 35 | 6,9 | |
| Gender | Male | 36 | 36,7 | 19 | 32,8 | 0,742 |
| | Female | 62 | 63,3 | 39 | 67,2 | |
| Marital status | Married | 89 | 90,8 | 52 | 89,7 | 1 |
| | Widow/Widower/ Unmarried | 9 | 9,2 | 6 | 10,3 | |
| Type of work | Worker | 40 | 40,8 | 33 | 56,9 | 0,075 |
| | Non worker | 58 | 59,2 | 25 | 43,1 | |
| Level of education | Low | 49 | 50 | 32 | 55,2 | 0,646 |
| | High | 49 | 50 | 26 | 44,8 | |
| Smoking | Yes | 6 | 6,1 | 10 | 17,2 | 0,052 |
| | No | 92 | 93,9 | 48 | 82,8 | |
| BMI | Normal | 48 | 49 | 24 | 41,4 | 0,451 |
| | Obesity | 50 | 51 | 34 | 58,6 | |
| Belly Circumference | Normal | 36 | 36,7 | 28 | 48,3 | 0,212 |
| | Risky | 62 | 63,6 | 30 | 51,7 | |
| Less Fruit & Vegetable Consumption | Yes | 20 | 20,4 | 14 | 24,1 | 0,586 |
| | No | 78 | 79,6 | 44 | 75,9 | |

Description: α =0,05
Source: Banjarbaru City, Health Center Data 2020

Based on table 1, there is no relationship between gender (p-value = 0.742), marital status (p-value = 1), employment status (p-value = 0.075), education level (p-value = 0.646), smoking ( p-value = 0.052), BMI (p-value = 0.451), abdominal circumference (p-value = 0.212), and less fruit and vegetable consumption (p-value = 0.586) on the incidence of diabetes mellitus type II as for the incidence of diabetes mellitus type II is age (p-value = 0.0001). Based on a study conducted by Sacerdote et al (2012) compared with the highest relative education level, the person with the lowest educational position was associated with a 64% increased risk for DM type II in men and a 90% increased risk in women (adjusted HR: 1.64, 95% CI: 1.51–1.80 and 1.90, 95% CI: 1.75–2.07, respectively). Education level and socioeconomic status in general have no direct biological effect on disease; instead the effect is mediated by other risk factors that may be biologically related to the disease (i.e. smoking status, BMI, physical activity). Whereas higher education levels are associated with health in

different ways: individuals with higher levels of education may be more receptive to prevention messages, have a higher ability to change their health behavior and are more likely to use the health care system better so that the risk of DM type II is lower. (Sacerdote et al., 2012).

Research conducted by Akter et al (2017) found that the risk of DM type II was 38% significantly higher for active smokers compared to nonsmokers. The link between smoking and diabetes is biologically plausible. Smoking causes insulin resistance or inadequate compensatory insulin secretion through a variety of underlying effects, including oxidative stress, inflammation, and endothelial dysfunction. Nicotine in cigarettes can also have a direct toxic effect on beta-cell function. In addition, although smoking tends to lose weight, it leads to central adiposity, which has been linked to inflammation and insulin resistance (Akter et al., 2017).

Compared with nonsmokers, ex-smokers were associated with a 19% higher risk of type II diabetes during the first 5 years of smoking cessation, although the risk did not exceed the risk of type II diabetes among current smokers. This is because smoking cessation usually leads to weight gain, concerns have been raised about the possible increased risk of DM type II after smoking cessation. In fact, mechanical studies show a decline in insulin sensitivity and lipid profile after smoking cessation (Akter et al., 2017).

The results of the study by Wu et al (2020) showed that passive smoking increases the prevalence of impaired glucose tolerance in a time-dependent manner, while no similar relationship was observed in impaired fasting glucose and diabetes mellitus type II. The duration of passive smoking 10 years had no effect on carbohydrate and lipid metabolism and the prevalence of prediabetes and diabetes type II. However, if the duration of secondhand smoke exceeds 10 years, it can worsen carbohydrate and lipid metabolism disorders, and is a risk factor for Diabetes Mellitus type II, moreover, there is a time-dependent relationship between the duration of passive smoking and its effect on IFG, IGT, and diabetes type II. (Wu et al., 2020).

Nicotine and tar are the two main ingredients in tobacco that cause maximum damage to the human body, and these can be harmful components of passive smoke. In addition, the impact of passive smoke on health is related to ventilation, temperature, humidity, depth of breathing, and distance from smokers. After the temperature drops and deposition, some substances in the environment will agglomerate and damage the human body differently compared to active smokers. Nicotine can activate protein kinase α2 AMP-activated adipocytes to enhance adipose tissue lipolysis. Ultimately, nicotine promotes the degradation of insulin receptor-1 (IRS-1) substrate and the loss of insulin-mediated inhibition of lipolysis (Wu et al., 2020).

Based on research conducted by Chizia et al (2017), they do not have formal qualifications that affect the incidence of diabetes, in this case the literacy rate. The literacy rate is directly related to the prevalence of diabetes. Health should be emphasized in education-based policies to ensure that everyone is aware of the components of a healthy lifestyle. Unqualified people may lack the knowledge to make health decisions about the lifestyle to lead. The solution lies not only in policy makers but also in the general public who must adhere to the principles of available knowledge and lead a healthy lifestyle. The school provides information about types of food, diseases and the importance of healthy decision making. However, the acquisition of knowledge is not limited to schools, but is influenced by individual attitudes. It should start in the family and society before and during school and college education (OS. Chizia & D. Bellingham-Young, 2017).

Research conducted by Wang et al (2016) adjusted maximum relative risk for diabetes type 2 for the highest and lowest intakes of 0.91 for total fruits, 0.75 for blueberries, 0.87 for green leafy vegetables, 0. 72 for yellow vegetables, 0.82 for cruciferous vegetables and 0.9 These results suggest that a higher intake of fruit, especially berries, and green leafy vegetables, yellow vegetables, cruciferous vegetables or their fiber is associated with a lower risk of diabetes type 2. (Wang et al., 2016). Fruits and vegetables are rich sources of fiber, flavonoids, and anti-oxidant compounds (carotenoids, vitamins C

and E), folate, and potassium, which may explain the protective effect of fruits and vegetables in diabetes type 2. Dietary fiber is associated with insulin sensitivity, and increased ability to delay carbohydrate absorption and secrete insulin adequately to overcome insulin resistance, resulting in lower postprandial blood glucose and insulin levels. High intake of dietary fiber can increase feelings of fullness and reduce intake of energy-dense foods, resulting in a reduced risk of being overweight/obese, which is a well-established risk factor for diabetes type 2 (Wang et al., 2016).

Based on research by Aravinda (2019) and Mansour (2020) showing obesity is the main risk factor for DM ype II where the proportion of DM Type II Patients who are obese or overweight is eight times higher than non-obese/not overweight patients. The proposed mechanism linking the two is increased adipo-kine/cytokine production, which can lead to insulin resistance and decreased adiponectin levels, ectopic fat deposition, mitochondrial dysfunction which not only decreases insulin sensitivity but also affects cell functionβ (Al Mansour, 2020; Aravinda, 2019). It was also stated that obesity was found to be a common risk factor for diabetes mellitus (Han et al., 2020).

However, this study did not show an association between BMI and the incidence of DM Type II. This is in line with other studies which state that there is no significant relationship between obesity and an increase in blood sugar levels at any time. Research conducted by Rahayu et al. found no relation-ship between obesity status and blood sugar levels. This is because most respondents are obedient in taking drugs so that blood sugar levels can be controlled properly (Rahayu et al., 2018; Sasmita, 2017). Body Mass Index is theoretically correlated with blood glucose levels. However, this is not always the case. A previous study at King Faisal University did not show a significant correlation between blood sugar levels and Body Mass Index. Another study by Karimah revealed that someone who is overweight will not always have high blood glucose levels too, many factors affect a person's high blood glucose levels including food intake and hormones. Carbohydrate intake is the most influential factor on fasting blood sugar levels. The differences that occur in the results of this study with the results of previous studies are the influencing factors such as genes, food, exercise (Awadh et al., 2018; Karimah, 2018).

Regardless of genetics, obesity is rooted primarily in improper diet or physical activity, but in the current study we observed that even in patients who have an active or strenuous lifestyle, the prevalence of obesity is comparable to that of the sedentary group. This may imply that the transition of nutrition, to high saturated fat, sugar, and processed foods as well as transportation facilities and increased stress, especially in urban populations may play an important role (Aravinda, 2019). BMI and belly circumference served as parameters for estimating general or abdominal fat mass, respectively. It is assumed that abdominal fat mass is very important in the development of not only diabetes type 2, but also other chronic diseases, including cardiovascular disease and some forms of cancer. Based on a study by Feller et al (2010) The association between belly circumference and risk of diabetes type 2 was more marked at low BMI than at higher BMI. An increase in belly circumference by a gender-specific standard deviation (9.9 cm for men and 11.2 for women) was associated with a 2.21-fold increased risk of diabetes in men and a 2.31-fold increased risk for women. In individuals with low BMI, belly circumference is a more precise measure of visceral fat, as these individuals have mostly less subcutaneous fat which can affect belly circumference. However, it is the visceral fat that on the other hand greatly increases the risk of diabetes. On the other hand, the biochemistry of subcutaneous fat differs from that of visceral fat (e1-e10) and there is even evidence that subcutaneous fat produces substances that may have a beneficial effect on glucose metabolism. Therefore, it is likely that the amount of subcutaneous fat that causes the negative interaction (Feller et al., 2010).

Based on the results of the study, it was found that nineteen (15.6%) respondents under the age of 40 years and 103 (44.6%) of those who were at least 40 years old suffered from diabetes mellitus ($p < 0.001$). A total of 56 (34.2%) and 66 (34.9%) of men and women had this disease

respectively. Diabetes mellitus rates for both business and private individuals, government employees, housewives, and students were 38.5%, 32%, 10.3%, and 31.9%, respectively. Five (10.4%) of single, 99 (36.3%) married, and 18 (56.3%) divorced or widowed respondents had diabetes mellitus type 2 ($p < 0.001$). Diseases in the low, medium, and high-income groups consisted of 42.4%, 29.0%, and 26.1%. Regular physical activity, smoking tobacco, consuming fatty foods, high LDL, and high blood pressure were not statistically significant factors in diabetic patients. On the other hand, seven (13.2%) of normal or underweight respondents had diabetes mellitus type 2 compared with 115 (42.3%) who were overweight or obese patients ($p <0,001$).

Triglyceride levels were found to be influential, as many as 76 (32.5%) patients with desired or borderline TG had diabetes mellitus Triglyceride levels were found to be influential, as many as 76 (32.5%) patients with desired or borderline TG had diabetes mellitus type 2, compared with 46 (43.4%) patients with high triglyceride levels ($p < 0.004$). 113 (35.9%) patients with desired total cholesterol levels and nine (23.7%) patients with high levels had diabetes mellitus Type II ($p<0.016$). A total of 101 (37.3%) patients with low/mean HDL and 21 (25.6%) patients with HDL had DM Triglyceride levels were found to be influential, as many as 76 (32.5%) patients with desired or borderline TG had type 2 diabetes mellitus, compared with 46 (43.4%) patients with high triglyceride levels ($p < 0.004$). 113 (35.9%) patients with desired total cholesterol levels and nine (23.7%) patients with high levels had Type II diabetes mellitus ($p<0.016$). A total of 101 (37.3%) patients with low/mean HDL and 21 (25.6%) patients with HDL had DM Type II (p (p, compared with 46 (43.4%) patients with high triglyceride levels ($p < 0.004$). 113 (35.9%) patients with desired total cholesterol levels and nine (23.7%) patients with high levels had diabetes mellitus Type II ($p<0.016$). A total of 101 (37.3%) patients with low/mean HDL and 21 (25.6%) patients with HDL had DM Type II ($p < 0,012$).

There is a significant relationship between DM Type II and age. Patients aged forty years or older were more likely to have this disease compared to younger age groups ($p < 0.001$). DM Type II showed a significant relationship with occupation ($p < 0.001$). The prevalence of DM Type II (38.5%) among businesses or the private sector is higher than that of government employees (32%), students (31.9%), and housewives (31.9%). It was also found that the prevalence of DM Type II was higher in married and divorced or widowed respondents compared to single respondents ($p < 0.001$). Then the results of the study also showed that more DM Type II patients were tobacco smokers than nonsmokers, but the relationship was not significant. Furthermore, it was found a significant relationship between obesity and DM Type II.

Lack of physical activity is one of the risk factors for diabetes mellitus reported in this study; However, the relationship between physical activity and diabetes was not significant ($p>0.05$). Tiwari et al. reported similar findings that those who engaged in light activity had diabetes mellitus and the difference was not significant. Shah et al., Ahmad et al., and Mohan et al. found that less physical activity was significantly associated with diabetes mellitus and subjects who did moderate to light physical activity had diabetes mellitus compared to those who did strenuous physical activity (Patil & Gothankar, 2019). The work of housewives shows a higher prevalence of diabetes mellitus than other occupations. This may be because housewives tend to be less active outdoors along with a less active traditional lifestyle which may be responsible for the higher prevalence of diabetes mellitus in them. The highest prevalence is housewives (9.9%) followed by unemployed and retirees (9.6%).

A study says, women are more likely to experience DM than men for reasons of hormonal and metabolic factors. Women who have excess fat in the trunk, especially if it is in the abdomen, are more likely to develop DM, this is because fat in the abdominal organs is easier to process for energy. The results of previous studies regarding the effect of obesity on the incidence of DM in women of childbearing age showed that there was an influence of obesity on the incidence of DM in women of childbearing age with a p

value of 0.009 (<0.05). The results of previous studies regarding the effect of obesity on the incidence of DM in women of childbearing age showed that women of childbearing age had a 3.09-fold risk of obesity compared to women of childbearing age whose BMI was normal (Ardiani et al., 2018; Isnaini & Ratnasari, 2018).

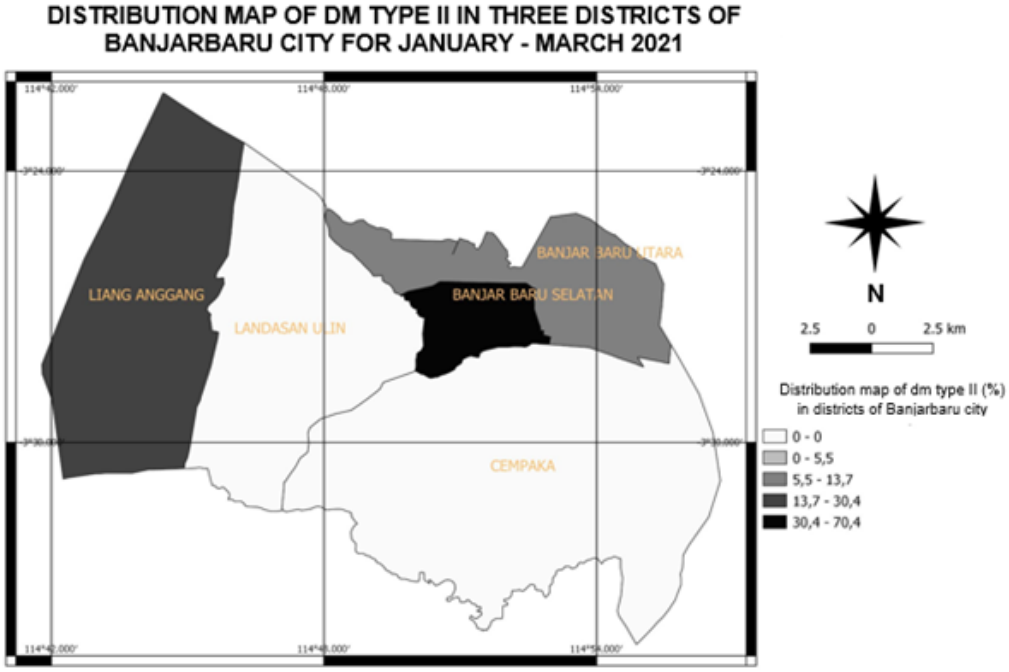


Figure 1. Distribution Map of DM Type II in Three Districts of Banjarbaru City

Based on the map above with a scale of 1: 211190 with color gradient technique, the distribution of the incidence of Diabetes Mellitus Type II in South Banjarbaru District is 70.4%, then Liang Anggang District is 20.4% and North Banjarbaru District is 9.2%.

## Conclusion

There is no relationship between gender, marital status, employment status, education level, smoking, BMI, abdominal circumference, and lack of fruit and vegetable consumption on the incidence of diabetes mellitus type II. As for the incidence of diabetes mellitus type II is age. This study also illustrates the mapping of the distribution of the incidence of Diabetes Mellitus type II with a color gradation with a scale of 1: 211190, namely in South Banjarbaru District where there is a need for further intervention in the community regarding life-style and consumption patterns of vegetables and fruit. Thus, it is hoped that the community can make more efforts to maintain health by preventing the incidence of diabetes mellitus type II.

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# Dynamics of Contraception Use in Indonesia Based on Service Sources at Health Facilities

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**Abstract**

The current use of contraception is dominated by short term methods with a one month drop out rate for contraception pills and injections that contribute 30.6 percent and 46.3 percent, respectively, for women aged 15-49. The high use of short term contraceptives can result in gaps for acceptors to stop using contraception. The analysis aims to investigate switching behaviour among contraceptive users by different source of health facilities both for modern and traditional methods and the analysis also intends to identify sociodemographic factors characterizing switchers. This analysis resulted in four models of sociodemographic factors and their relationship with the possibility of transferring to another contraceptive method which were analyzed using logistic regression in each unit of analysis based on the source of the health facility. Short term contraception is still the favorite, namely injections (50.5 percent) and pills (19.1 percent) are still the main choice for couple of childbearing age. Around 61.2 percent of acceptors who use injectable contraception survive compared to other contraception use in private and community based health facilities. The pattern of family planning use in health facilities in the government sector is at least able to intervene in acceptors in the use of long term contraception which effectively has a lower dropout rate than the dropout rate for short term contraceptives.

## Introduction

Indonesia as one of the countries that agreed on the results of the 1994 World Population and Development Conference (ICPD) in Cairo also implemented population management and development policies that focused on reproductive rights and individual reproductive health. (UNFPA, 2004). This is indicated by the role of the government through the National Population and Family Planning Agency (BKKBN) which always provides guidance by conducting outreach to the community on the importance of maintaining reproductive health through planning the number and interval of pregnancies, preventing the risk of maternal and child morbidity and mortality, preventing pregnancy. unwanted and choose a modern contraception method that suits their needs (Kemenkes, BKKBN, 2018)

The use of modern contraception in Indonesia shows a consistent rate in the last 10 years, even tends to decrease until 2018 which is 57 percent, this is evidenced by the results of the Indonesian Nursing Diagnosis Standards 2002-2003, 2007, 2012, 2017; SKAP 2016, 2017, 2018. Trends in the use of modern contraceptionhave always been dominated by the use of short-term contraception, such as the pill, injections and condoms (see Figure 1). The use of modern contraception is relatively in line with the trend in the average number of children born to every woman aged 15-49 years, when the achievement of contraception use does not show a significant increase, the Total Fertilty Rate (TFR) tends to be relatively consistent.

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Based on the survey results, modern contraception methods that contributed the most were injections at 30.4 percent and pills by 11.5 percent So that, the contribution of 41.9 percent is the contribution of short-term contraception use. The survey results are in accordance with a study conducted by Pasundani & Bantas (2020), that the most widely used contraception method by women of childbearing age in Indonesia in 2017 was the short-term contraception method, which was 78 percent, while the users of the long-term contraception method were 22 percent. The figure for the use of modern contraception is mostly served by the private sector by 24.5 percent, then the government sector at 72.5 percent and the remaining 3 percent of family planning services provided by the community (BKKBN, 2018). The high use of short-term contraception can result in gaps for acceptors to stop using contraception.

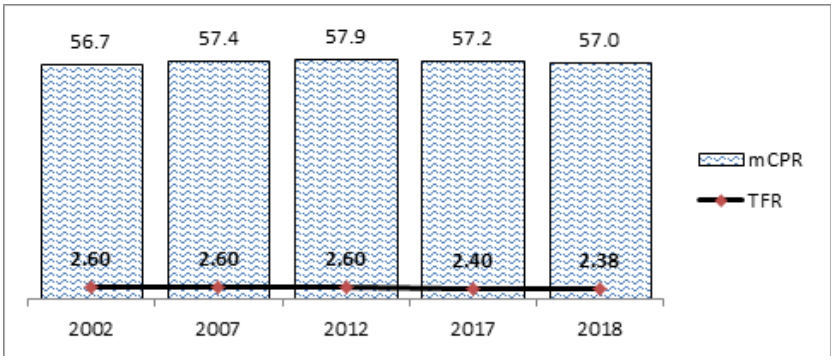


Figure 1. Trends in Use of Modern Contraception and TFR
Source: 2003, Central Bureau of Statistics etc., 2008, Central Bureau of Statistics etc.2013, BKKBN etc., 2018, BKKBN 2019

In Table 1, the results of the 2018 SKAP show that the rate of discontinuation of the use of short-term and traditional contraception is very vulnerable to the continued use of contraception. The results of the 2017 Indonesian Nursing Diagnosis Standards survey and 2018 SKAP strengthen the finding that the dropout rate for all contraception methods is 29 percent and 25 percent, respectively. The highest contribution to the drop-out rate came from 1-month injection contraception (46 percent), condoms (55 percent) and pills (31 percent).

**Table 1.** Stop Use Rate for the First 12 Months

| Method | Number of Episodes of Use (Month) | Subjects | Median Duration of Use (Month) | 12 Months Dis-continuation Rate (%) |
|---|---|---|---|---|
| Implant | 3,377 | 91 | 42 | 17.95 |
| IUD | 2,828 | 67 | 47 | 7.41 |
| 3 month injection | 40,988 | 1,004 | 52 | 17.19 |
| 1 month injection | 4,749 | 205 | 17 | 46.31 |
| Pills | 17,071 | 519 | 34 | 30.66 |
| Male condom | 1,288 | 72 | 12 | 54.72 |
| Female condom | 3 | 2 | 2 | 100 |
| MAL | 10 | 1 | 7 | 100 |
| Abstinence periodically | 2,184 | 52 | 60 | 18.15 |
| Intercourse is interrupted | 2,225 | 66 | 35 | 30.05 |
| Another traditional | 315 | 6 | 61 | 8.78 |
| All methods | 75,038 | 2,085 | 46 | 24.95 |
| Modern method | 70315 | 1962 | 45 | 25.01 |

Source: SKAP, 2018

The fact that the survey results are needed as a strategy for future family planning programs by knowing the dynamics of contraceptive use for couples of childbearing age in using contraception based on the source of service and the main factors that influence the use of contraception. A lot of research has been done on the dynamics of contraception use ((Ekoriano & Novita, 2018; Kiswanto, 2015; Sumini & Abritaningrum, 2015; Wai et al., 2020), the results of these studies show the dynamics, flow, changes, and trends in contraceptionuse. Then the study conducted by Mog and Mondal (2018) and Gebreselassie et al. (2017), explained the trends and dynamics of the use of contraception in modern and traditional methods. However, research related to the dynamics of contraception use based on service sources from health facilities, both modern and traditional contraceptive methods, is still limited. Thus, the purpose of this study was to determine the use of contraception among contraception use from health facilities, both modern and traditional contraceptiion methods. Health facilities include government, private and community based health facilities. This analysis also aims to identify the socio-demographic factors that cause transfer between contraception use.

**Method**

This analysis uses data from the Performance Survey and Government Accountability (SKAP) in 2018 which is conducted annually by the National Population and Family Planning Agency (BKKBN), the survey targets are the population of households, women of childbearing age aged 15-49 years, families and adolescents aged 15-24 years who have not marry. The approach used in this survey is a cluster approach as an enumeration area, while the sample design is stratified multistage random sampling..

Based on the sample calculation conducted by the Central Statistics Agency, the required number of clusters is 1,935 villages spread over 34 provinces and 514 regencies/cities. This village is a cluster which is an enumeration area and has been allocated to each province based on urban and rural strata by considering the wealth index. Each cluster was selected by systematic random sampling of 35 households, so that the number of households that were successfully interviewed was 66,616 households.

The sampling technique in this survey was carried out through several stages. First, selecting a number of villages using Probability Proportionate to Size (PPS) sampling is with the size of the number of households on the list of all villages. The selection of village samples was carried out independently in urban and rural areas in a district/city. Second, the selection of one cluster from each selected village by PPS sampling with the size of the number of households in the selected cluster. Third, selecting 35 households by systematic random sampling based on the results of household listings conducted by door-to-door interviewers in the selected cluster (BKKBN, 2018).

The target respondents are women of childbearing age (WUS) 15-49 years old, head of household/wife/household member, family, unmarried male and female adolescents aged 15-24 years. All WUS aged 15-49 years in 35 selected households in each selected cluster became the sample of WUS respondents. Data collectors use a smart phone as a data collection tool. Four types of questionnaires are available in the application and all of the questionnaires are interrelated, namely household questionnaires, family questionnaires, WUS questionnaires and questionnaires for unmarried adolescents aged 15-24 years.

The unit of analysis used was obtained from the module for women of childbearing age, which amounted to 28,399 couples of childbearing age between the ages of (15-49) years who are currently using contraception. This study explores the dynamics of the use of contraception methods based on the source of health facilities, including 6,330 married women using government health facilities, 19,633 married women using private health facilities, 938 married women choosing community-based health facilities and the rest are other sources. Contraception transfer was measured from the use of a contraception method for the first time or not using any method to current contraception use. This analysis resulted in four models of socio-demographic factors and their

relationship with the possibility of transferring to another contraception method which were analyzed using logistic regression in each unit of analysis based on three types of health facility sources (government, private and community-based health facilities).

**Results and Discussion**

The results show that the selection of short-term contraception is still the main choice of acceptors, the dynamics of the use of contraception nationally, both served by the government, private and other sectors (community-based) so that there is still a possibility for acceptors to discontinue using contraception. Table 2 shows that short-term contraception is still a trend, namely injections (50.5 percent) and pills (19.1 percent) are still the main choice for couples of childbearing age. The highest contraceptive switching came from couples of childbearing age who used intravaginal contraception to IUD contraception (83 percent), emergency contraception switched to injections (74.3 percent) and those who did not use contraception transferred to male condoms (67.3 percent). Meanwhile, in long-term contraception, the majority of contraception uses were implants (8.4 percent), IUD (7.7 percent) and MOW (5.5 percent). This means that massive and sustainable efforts are needed to the community so that the use of long-term contraceptives is increasingly in demand.

**Table 2.** Percentage of Dynamics of Contraception Use (National)

| | | Contraception method being used | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Family Planning Method** | **MOW** | **MOP** | **Implant** | **IUD** | **Pills** | **Emergency Contraception** | **Condom** | **Female condom** | **Intravagina** | **MAL** | **Injection** | **Traditional** | |
| **Previously used contraception methods** | Female sterile (MOW) | 100 | | | | | | | | | | | | 100 |
| | Male sterile (MOP) | | 100 | | | | | | | | | | | 100 |
| | Implant | 6,8 | 0,0 | 45 | 4,7 | 9,5 | | 2,1 | | | | 29,1 | 2,8 | 100 |
| | IUD | 9,2 | 0,0 | 4,3 | 54,5 | 7,3 | | 2,8 | | | 0,1 | 16,4 | 5,4 | 100 |
| | Pills | 5,5 | 0,4 | 7,6 | 5,0 | 39,4 | | 1,9 | 0 | | 0,1 | 37,2 | 2,9 | 100 |
| | Emergency Contraception | | | | | | | 25,7 | | | | 74,3 | | 100 |
| | Female condom | 20 | | | 7,7 | | | | 56,6 | | | 12,7 | 3,0 | 100 |
| | Intravagina | | | | 83,0 | | | | | | | | 17,0 | 100 |
| | MAL | 8,4 | | 0,6 | 3,3 | 5,6 | | 5,7 | | | 6,8 | 41,8 | 27,9 | 100 |
| | Not using contraception | 6,1 | | 1,9 | 9,0 | 0,3 | | 67,3 | 0,3 | | 0,1 | 2,1 | 12,9 | 100 |
| | Injection | 4,4 | 0,2 | 7,1 | 5,3 | 16,0 | 0,1 | 1,9 | 0,0 | 0,0 | 0,2 | 61,0 | 3,9 | 100 |
| | Traditional | 6,5 | 0,2 | 1,7 | 3,9 | 2,1 | | 4,4 | | | 0,0 | 8,9 | 72,2 | 100 |
| | **Total** | **5,5** | **0,2** | **8,4** | **7,7** | **19,1** | **0,0** | **2,8** | **0,0** | **0,0** | **0,2** | **50,5** | **5,6** | **100** |

Source: SKAP, 2018

Acceptors who received family planning services through government health facilities (Table 3) used long-term contraception methods, namely IUD, Implant and MOW, while women who initially used traditional methods mostly decided to switch to using the MOW contraception method (33.8 percent), implants (19.8 percent) and Pills (16.3 percent). This proves that although the majority of family planning services are still dominated by the private sector, family planning services provided by the government sector have attempted to improve long-term family planning services, especially implant contraceptives (24 percent) compared to other sectors of services. The pattern of family planning use in health facilities in the government sector is at least able to intervene in acceptors in the long-term use of family planning which effectively has a lower dropout rate than the short-term contraception dropout rate.

**Table 3.** Percentage Dynamics of contraception use (Public and private health facilities)

| Government Health Facilities | Family Planning Method | Contraception method being used | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MOW | MOP | Implant | IUD | Pills | Condom | Intravagina | MAL | Injection | Traditional | |
| Previously used contraception methods | Female sterile (MOW) | 100 | | | | | | | | | | 100 |
| | Male sterile (MOP) | | 100 | | | | | | | | | 100 |
| | Implant | 11,8 | 0,0 | 65,2 | 4,6 | 4,5 | 0,1 | | | 13,7 | | 100 |
| | IUD | 12,3 | 0,1 | 9,1 | 65,1 | 3,3 | 0,8 | | | 8,3 | 1,0 | 100 |
| | Pil | 12,1 | 1,6 | 22,3 | 9,8 | 28,9 | 0,5 | | | 24,5 | 0,2 | 100 |
| | Female Condom | 66,2 | | | 25,5 | | | | | 8,3 | | 100 |
| | MAL | 27,0 | | 4,1 | 1,8 | 12,0 | 11,6 | | 4,6 | 35,3 | 3,7 | 100 |
| | Not using contraception | 21,4 | | 1,6 | 25,7 | | 39,4 | | | 2,1 | 9,8 | 100 |
| | Injection | 11,1 | 1,0 | 22,4 | 11,3 | 11,0 | 0,3 | 0,0 | 0,2 | 42,4 | 0,4 | 100 |
| | Traditional | 33,8 | | 19,8 | 7,7 | 16,3 | 3,3 | | | 5,0 | 14,2 | 100 |
| | **Total** | **13,0** | **0,9** | **24,1** | **14,2** | **13,2** | **0,6** | **0,0** | **0,1** | **33,2** | **0,5** | **100** |
| **Private Health Facilities** | **Family Planning Method** | **Contraception methods being used** | | | | | | | | | | **Total** |
| | | **MOW** | **MOP** | **Implant** | **IUD** | **Pills** | **Condom** | **Female condom** | **MAL** | **Injection** | **Traditional** | |
| Previously used contraception methods | Female sterile (MOW) | 100 | | | | | | | | | | 100 |
| | Implant | 3,9 | | 32,5 | 4,9 | 12,6 | 3,6 | | | 42,3 | 0,3 | 100 |
| | IUD | 8,1 | | 2,2 | 53,7 | 9,7 | 3,1 | | 0,1 | 21,9 | 1,3 | 100 |
| | Pills | 3,9 | | 3,5 | 4,0 | 40,4 | 2,0 | 0,0 | 0,1 | 45,5 | 0,6 | 100 |
| | Emergency Contraception | | | | | | 25,7 | | | 74,3 | | 100 |
| | female condom | | | | | | | 84,8 | | 15,2 | | 100 |
| | Itravagina | | | | 100,0 | | | | | | | 100 |
| | MAL | 8,4 | | | 5,5 | 7,1 | 7,3 | | 6,0 | 65,7 | | 100 |
| | Not using contraception | 5,4 | | 2,0 | 9,1 | 0,4 | 78,5 | 0,5 | | 2,9 | 1,2 | 100 |
| | Injection | 2,8 | 0,1 | 3,0 | 4,0 | 16,8 | 2,0 | 0,0 | 0,1 | 70,6 | 0,7 | 100 |
| | Tradisional | 15,5 | 0,6 | 1,3 | 11,4 | 3,8 | 10,5 | | | 30,2 | 26,7 | 100 |
| | **Total** | **3,7** | **0,0** | **3,9** | **6,4** | **20,4** | **3,0** | **0,0** | **0,1** | **61,4** | **1,0** | **100** |

Source: SKAP, 2018

The dynamics of contraceptive use based on sources of private health facilities and on a community basis shows a similar pattern, especially between private and community-based health facilities (Table 3 & 4). Most of the acceptors who transfer to other contraception tend to feel comfortable when using the injection method. The majority of private health facilities and community-based facilities provide short-term contraception services. This proves that private health facilities and community bases tend to be more financially profitable because services can be provided in a relatively short period of time with consistent continuity. The interesting thing about family planning services at private and community-based health facilities is that the highest number of acceptors using injection contraception persisted in using the same contraception (61.2 percent) compared to other contraception use.

**Table 4.** Percentage Dynamics of Contraception Use (Community-based Health Facilities)

| | **Family Planning Method** | **Contraception Method Being Used** | | | | | | **Total** |
|---|---|---|---|---|---|---|---|---|
| | | **Implant** | **IUD** | **Pills** | **Condom** | **Injection** | **Traditional** | |
| **Previously Used Contraception Methods** | Implant | 66,5 | | 19,2 | | 14,3 | | 100 |
| | IUD/spiral | 9,1 | 43,6 | 2,3 | 3,7 | 41,3 | | 100 |
| | Pills | 9,7 | 1,0 | 43,4 | 0,4 | 44,6 | 0,9 | 100 |
| | Lactational amenorrhea (MAL) | 38,0 | | | | 62,0 | | 100 |
| | No Family Planning | | 63,3 | | 36,7 | | | 100 |
| | Injection | 11,0 | 3,6 | 24,1 | 0,0 | 61,2 | 0,1 | 100 |
| | Traditional | | | 57,7 | | 6,4 | 35,8 | 100 |
| | **Total** | **13,2** | **4,4** | **27,3** | **0,3** | **54,4** | **0,5** | **100** |

Source: SKAP, 2018

**Table 5.** Logistics Regression Model

| | Model 1 (National) | | | | | Model 2 (Government_FP Services) | | | | | Model 3 (Private_FP Services) | | | | | Model 4 (community based_FP Services) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig. | Exp(B) | 95% C.I.for EXP(B) | | B | Sig. | Exp(B) | 95.0% C.I.for EXP(B) | | B | Sig. | Exp(B) | 95% C.I.for EXP(B) | | B | Sig. | Exp(B) | 95% C.I.for EXP(B) | |
| | | | | Lower | Upper | | | | Lower | Upper | | | | Lower | Upper | | | | Lower | Upper |
| ***Age group [Ref 15-19]*** | | 0,000 | | | | | 0,000 | | | | | 0,000 | | | | | 0,021 | | | |
| Age group [20-24] | 0,652 | 0,000 | 1,919 | 1,420 | 2,593 | 0,963 | 0,006 | 2,619 | 1,325 | 5,180 | 0,791 | 0,000 | 2,205 | 1,492 | 3,258 | 0,816 | 0,201 | 2,262 | 0,648 | 7,897 |
| Age group [25-29] | 0,673 | 0,000 | 1,960 | 1,461 | 2,630 | 1,227 | 0,000 | 3,412 | 1,748 | 6,662 | 0,701 | 0,000 | 2,016 | 1,374 | 2,959 | 0,282 | 0,660 | 1,326 | 0,378 | 4,650 |
| Age group [30-34] | 1,079 | 0,000 | 2,941 | 2,195 | 3,941 | 1,859 | 0,000 | 6,420 | 3,300 | 12,489 | 1,076 | 0,000 | 2,932 | 2,002 | 4,296 | 0,912 | 0,143 | 2,489 | 0,734 | 8,441 |
| Age group [35-39] | 1,176 | 0,000 | 3,242 | 2,419 | 4,346 | 1,831 | 0,000 | 6,241 | 3,208 | 12,142 | 1,251 | 0,000 | 3,495 | 2,384 | 5,123 | 1,052 | 0,093 | 2,863 | 0,840 | 9,755 |
| Age group [40-44] | 1,491 | 0,000 | 4,441 | 3,307 | 5,963 | 1,852 | 0,000 | 6,372 | 3,262 | 12,449 | 1,607 | 0,000 | 4,987 | 3,397 | 7,321 | 0,859 | 0,171 | 2,362 | 0,689 | 8,091 |
| Age group [45-49] | 1,740 | 0,000 | 5,699 | 4,230 | 7,679 | 2,220 | 0,000 | 9,204 | 4,694 | 18,050 | 1,751 | 0,000 | 5,760 | 3,903 | 8,500 | 1,436 | 0,025 | 4,203 | 1,195 | 14,780 |
| ***Ideal number of children [Ref >=3]*** | | | | | | | | | | | | | | | | | | | | |
| Ideal number of children [0-2] | 0,107 | 0,000 | 1,113 | 1,049 | 1,180 | 0,328 | 0,000 | 1,388 | 1,226 | 1,573 | 0,023 | 0,538 | 1,023 | 0,952 | 1,099 | 0,685 | 0,000 | 1,984 | 1,410 | 2,791 |
| ***ALH [Ref 0-2]*** | | | | | | | | | | | | | | | | | | | | |
| ALH [>=3] | 0,403 | 0,000 | 1,497 | 1,404 | 1,597 | 0,422 | 0,000 | 1,526 | 1,332 | 1,747 | 0,309 | 0,000 | 1,362 | 1,258 | 1,475 | 0,149 | 0,423 | 1,161 | 0,806 | 1,673 |
| **Level of education [Ref_under ]** | | 0,000 | | | | | | | | | | 0,000 | | | | | 0,253 | | | |
| Level of education [middle] | 0,160 | 0,000 | 1,173 | 1,095 | 1,258 | 0,121 | 0,102 | 1,129 | 0,976 | 1,306 | 0,131 | 0,003 | 1,140 | 1,047 | 1,242 | -0,184 | 0,343 | 0,832 | 0,568 | 1,217 |
| Level of education [higher] | 0,254 | 0,000 | 1,289 | 1,198 | 1,387 | -0,007 | 0,925 | 0,993 | 0,851 | 1,158 | 0,280 | 0,000 | 1,324 | 1,210 | 1,448 | 0,195 | 0,393 | 1,216 | 0,777 | 1,903 |
| ***Village [Ref]*** | | | | | | | | | | | | | | | | | | | | |
| City | 0,096 | 0,001 | 1,101 | 1,040 | 1,166 | 0,091 | 0,157 | 1,095 | 0,966 | 1,241 | 0,079 | 0,025 | 1,082 | 1,010 | 1,160 | 0,410 | 0,031 | 1,507 | 1,038 | 2,186 |
| **Welfare level [Ref_lowest]** | | 0,000 | | | | | 0,000 | | | | | 0,000 | | | | | 0,001 | | | |
| Welfare level _middle low | 0,136 | 0,002 | 1,145 | 1,050 | 1,249 | 0,182 | 0,026 | 1,200 | 1,022 | 1,410 | 0,095 | 0,099 | 1,100 | 0,982 | 1,231 | -0,299 | 0,141 | 0,741 | 0,498 | 1,105 |
| Welfare level _middle | 0,092 | 0,038 | 1,097 | 1,005 | 1,197 | 0,127 | 0,144 | 1,135 | 0,958 | 1,345 | 0,069 | 0,230 | 1,071 | 0,958 | 1,198 | 0,033 | 0,883 | 1,034 | 0,664 | 1,611 |
| Welfare level _middle high | 0,142 | 0,002 | 1,153 | 1,054 | 1,261 | 0,211 | 0,026 | 1,235 | 1,026 | 1,487 | 0,206 | 0,000 | 1,229 | 1,098 | 1,375 | 0,228 | 0,351 | 1,257 | 0,778 | 2,031 |
| Welfare level _ higher | 0,307 | 0,000 | 1,359 | 1,238 | 1,493 | 0,792 | 0,000 | 2,209 | 1,804 | 2,704 | 0,259 | 0,000 | 1,296 | 1,153 | 1,458 | 1,007 | 0,001 | 2,737 | 1,504 | 4,982 |
| ***Insurance [Ref_No]*** | | | | | | | | | | | | | | | | | | | | |
| Insurance [Yes] | 0,090 | 0,001 | 1,095 | 1,038 | 1,154 | -0,062 | 0,289 | 0,940 | 0,838 | 1,054 | 0,080 | 0,016 | 1,084 | 1,015 | 1,157 | 0,245 | 0,114 | 1,277 | 0,943 | 1,730 |
| ***UKP [Ref_ >=20]*** | | | | | | | | | | | | | | | | | | | | |
| UKP [<20] | 0,224 | 0,000 | 1,251 | 1,179 | 1,329 | 0,218 | 0,001 | 1,244 | 1,097 | 1,410 | 0,245 | 0,000 | 1,277 | 1,187 | 1,375 | 0,075 | 0,656 | 1,078 | 0,774 | 1,502 |
| Constant | -2,069 | 0,000 | 0,126 | | | -2,205 | 0,000 | 0,110 | | | -2,273 | 0,000 | 0,103 | | | -1,996 | 0,002 | 0,136 | | |

Source: SKAP, 2018
Aplha: 0,05; Exp (B); CI = *confidence interval* Sig = significant

The logistic regression model (Table 5) generally shows that women with older age, women with higher parity, living in urban areas, higher education levels, higher welfare levels and women who marry at a younger age tend to have a higher chance of transferring contraception method compared to continuing to use contraception. However, what is different can be seen from the results of the analysis is that family planning services in the government sector that lower secondary education actually have a tendency to change methods to other contraception compared to acceptors with higher education.. This is contrary to the results of the analysis of family planning services provided to the private sector, community-based and nationally. Based on these findings, it is known that family planning services in the government sector are more in demand by the lower secondary education level, while higher education is more likely to be served in the private sector.

Regarding insurance ownership and sources of family planning services in the private, community-based and national sectors, women tend to change contraception compared to women who do not have insurance, while women who have insurance and receive family planning services in the government sector show the opposite result. This result is of course also influenced by the implementation of the National Health Insurance (JKN) program with all citizens guaranteed their health in 2019, so that Family Planning services which are part of health services of course also affect their participation and choice of contraception in health facilities that have not been integrated so far. (Ardiana et al., 2019).

So that of all the variables used in the analysis, the variable that has the greatest influence on women to transfer contraception nationally, the government sector, the private sector and community-based is the age group variable. The number of children born (national and private), the level of welfare (government and community-based communities) are the next variables that have sufficient influence on the community to change their contraception method.

Table 2 shows that the dynamics of the use of injection contraception and the pill are still the main choices for Indonesian women (50.5 percent and 19.1 percent), this result is in accordance with the analysis conducted by Ekoriano, M and Novita, F (2018), who stated that short-term contraception such as injections and pills were still the most popular contraceptives (43.4 percent and 30.5 percent) and most of the shift to injection contraception also came from short-term contraception, namely emergency contraception and the Pill, respectively 74, 3 percent and 34.2 percent. Other studies by Rahardja (2011) and Bekele et al., (2014), stated that about 80 percent more acceptors who use implants for Family Planning and 55 percent of women who use IUD contraception decide to transfer to short-term contraception methods and the majority of women in southeastern Ethiopia also use short-term contraception (injections and pills). They also explained that this was due to women's limited awareness and choice of short-term contraception, especially injection contraception. Meanwhile, for women who did not initially use contraception, the majority switched to using condoms instead of other contraception methods. According to Khraif et al., (2017), those who use contraception methods are very closely related to demographic variables (age, number of marriages, husband's age at first marriage, status of first marriage) and social variables (place of residence, type of family, type of work, level of welfare) as well as rural areas, education level Low also determines the use of contraception. Interventions and promotion of the use of family planning can be done in experienced women to terminate pregnancy (Yussuf et al., 2020).

Based on service sources, survey results show that the majority of family planning services are provided by the private sector compared to the government sector. According to Keesara et al., (2015), This is because women in Kenya believe that private family planning services offer several advantages including convenience (no long waits, polite doctors/ midwives), efficiency and privacy. However, other studies are found to be contradictory in Ugandan women with services carried out by the government sector, but the majority use short-term contraception, namely injections (Alege et al., 2016). Although in general the

dynamics of short-term contraception use are still higher than the long-term, the dynamics of contraception use tend to show better long-term contraception use in the government sector compared to family planning services in the private sector and on the basis of public services. The general pattern of contraceptive use (National, private sector, government and community-based) shows that the majority of contraception use occurs in the short term, so there is a need for fostering a better understanding of contraception through quality family planning services, one of which is through high-quality counseling to increase perceptions so that rational, effective and efficient use of contraception, especially for women who stop using contraception methods (Amran et al., 2019). Follow-up from providers provides opportunities for the poor to provide more choices of contraceptive methods and pay attention to their satisfaction (Hameed et al., 2015). The quality of family planning services in Indonesia in the private sector is still considered better than the government sector and for providers the quality of service is still below the standard, it is necessary to formally emphasize the behavior of health service providers as desired and create a post-service scheme. (Ekoriano & Ardiana, 2020). So it can be concluded that perception among acceptors plays an important role in the pattern or dynamics of contraception use (Amran et al., 2019).

The odds ratio in Table 5 explains how women in the older age group, higher parity, living in urban areas, higher education level, women with higher incomes and women who marry at a younger age tend to have a higher chance of transferring to other contraception methods. However, what is different is that it can be seen from the results of the analysis that family planning services in the government sector show that lower secondary education actually has a tendency to change methods to other contraceptions compared to acceptors with higher education. Several sociodemographic variables that contribute to couples of childbearing age to switch to other contraception in this analysis confirm and complement the previous analysis (UNDIKMA, 2020). The results of this study are also the same as the research conducted by Barden-O'Fallon et al., (2018) who explained that contraception transfer method occurred in the older, educated age group, the number of children (the highest at parity 1-2 children), the middle level of welfare, and the source of services. A study conducted in the city of Jijiga, Eastern Ethiopia, found several other things, namely that woman who had used contraception transfer to other contraception methods due to low quality of counseling, short-term use of contraception, and having many children. The reason they change contraception is due to side effects, they want more effective contraception and the method used at that time is not comfortable (Shiferaw & Mekonen, 2018).

The results of another study related to the analysis of the determinants of contraceptive transfer among women in Sri Lanka, in rural areas found that age and education level were significant for changing contraception methods, while welfare level had no significant effect. (Hamill et al., 1990). More specific studies on adolescent women aged (15-24) in Nepal inform the method of Family Planning by injection which is the highest method of family planning compared to other contraceptions and they will use the contraception method at least after having one child. The reasons for side effects and the absence of husband (long distance) are things that influence the dynamics of contraception use (Kafle, 2018). Other researches by Bekele et al., (2014) explained that the highest contraception transfer occurred from Pills to Injections (49.1 percent) and followed later from Pills to Implants (26.7 percent) with the main reason being the inconvenience of the previous method (52.6 percent). Some differences were found in a longitudinal study conducted in Malawi, transfer methods of contraception was only four percent more likely for younger women than older women. Marital status, education level and number of children are not related in transfering contraception methods (Dasgupta et al., 2015).

**Conclusion**

Most of the couples of childbearing age (PUS) who decide to contraception transfer tend to choose to use the injectable

contraception method compared to other contraceptive methods, but on the other hand, the use of this contraception is faced with a high risk of discontinuation. Contraception use is more likely to be influenced by less effective and efficient counseling to receptors regarding contraceptive use, limited supply of contraception methods, and some programs that are not well targeted. Policy makers need to be aware of this phenomenon, where a third of women who previously used long-term contraception methods have the possibility to change their contraceptive method to an injectable contraception method, especially in health facilities in the private sector and community-based health facilities. The role of the government in fostering the community in choosing effective and efficient contraception in the future is very important in providing reproductive rights and improving the health of Indonesian families. Further analysis is needed to further explore the quality of family planning services at service delivery points to identify and address the factors that influence women's decisions regarding their contraception choice.

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# Evaluation of the Implementation of Exclusive Breastfeeding Policy at Work in the Private Sector

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## Abstract

Giving exclusive breastfeeding in Indonesia, especially in the workplace is still not optimal. Data from Indonesia's Health Profile in 2016 shows that exclusive breastfeeding coverage for 6 months is 54%. Methods of this research used The Important Performance Analysis (IPA) analysis tool is used to determine the stakeholder satisfaction assessment of female worker respondents regarding the implementation of exclusive breastfeeding in the private sector. This research was conducted at selected private companies in the City and District of Semarang. Primary data were obtained from in-depth interviews with company management and filling in questionnaires by female workers. Based on the analysis of Important Performance Analysis (IPA), the assessment of workers' attitudes towards the performance of service corner in companies/private sectors is quite good (ordinary) with a value of 63 (out of a maximum value of 102). This research concludes that the workers want the location of the breastfeeding corner close to where they work and sufficient time to express milk. Women workers also want to prepare basic infrastructure such as pumping equipment, storage bottles and refrigerators to store milking milk.

## Introduction

Breast milk is the first natural food for babies, providing all the energy and nutrients of a baby needs for the first month of life until the second year of life. Breastfeeding plays an important role in contributing to the child's immunological defense system and increasing disease resistance. Breastfeeding helps the baby's sensory and cognitive development and protects against infectious and chronic diseases. Exclusive breast feeding in early infancy reduces the risk of severe illness from diarrhea and suspected pneumonia (Hanieh, 2015). Breastfeeding contributes to reducing the high infant and under-five mortality rate (Walsh et al., 2019). Exclusive breastfeeding is one indicator of the sustainability of family food security (Wong et al., 2019). Prolonged breastfeeding can also provide protection from ovarian cancer and breast cancer (Su et al., 2013 & Scoccianti et al., 2015).

The SDGs target explains that by 2030, all countries are trying to reduce Neonatal Mortality Rates by at least 12 per 1000 live births and Under-five Mortality Rates at least 25 per 1000. This policy includes one of the five targets, namely to increase the level of exclusive breastfeeding in the first six months to a minimum reach 70% coverage and the Ministry of Health is targeting exclusive breastfeeding coverage of 0-6 months in 2020 by 90%. Exclusive breastfeeding in Indonesia is currently still not optimal. The latest results from Riskesdas 2018 found that exclusive breastfeeding coverage for 6 months was 15.3%. Meanwhile, based on data from the

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National Health Survey (Susenas) 2017, only 33.6% of infants in Indonesia are known to have exclusive breastfeeding. On the other hand, the Ministry of Health targets exclusive breastfeeding coverage for 0-6 months in 2020 by 90%. In Central Java Province itself the level of awareness of giving breast milk exclusively included in the low category or only 45.86% in 2011 then in 2012 amounted to 49.96% and in 2013 amounted to 57.67%, and 57.06% at the end year 2014.

In Semarang, the coverage of exclusive breastfeeding in 2007 was 38.44% and in 2008 it decreased to 15.33%. The coverage is still below the Semarang City Health Service (DKK) Minimum Service Standard (SPM) in 2007 which is 40% and still below the national standard which is 80% (Semarang City Health Profile, 2008). Reasons for the failure of exclusive breastfeeding practices vary, such as the culture of giving pralactal food, giving additional formula milk because breast milk does not come out, stopping breastfeeding because the baby or mother is sick, the mother has to work, and the mother wants to try formula milk.

Working women who have babies, have a dual role, in addition to work, they are also obliged to give breastfeeding as the right of the child. It is estimated that 50% of women workers in employment are a group of women of childbearing age and returning to work within one year of the birth of their baby. Only 22% of women workers who work full time give breastfeeding to their babies, while mothers who do not work 35.4% (Libbus and Bullock, 2002). The type of work and working hours also affect breastfeeding in infants. Women workers who work in professional fields will give breastfeeding to their babies longer than those who work in administration (Kurinij et al., 1989). Working mothers face several challenges to breastfeeding such as lack of knowledge about breastfeeding practices, lack of time needed to breastfeed or express breastfeeding, short maternity leave, breastfeeding problems during the first 6 month period, lack of breastfeeding facilities and programs at work, and media impact on formula feeding (Basrowi et al., 2015; Marinelli et al., 2013; Whipps and Honoroff, 2019; Diez-Sampedro et al., 2019)

The implementation of exclusive breastfeeding enhancement policies in the workplace in Indonesia is under a strong and binding legal foundation namely Joint Decree of 3 ministers 48/Men.PP/XII/2008, Per.27/Men/XII/2008, & 1177/Menkes/PB/XII/2008 Regarding the Increased Provision of Breast Milk During Working Time at Workplace. This legal basis should be able to trigger an increase in the scope of exclusive breastfeeding in the workplace, especially in the private sector that has the most female employees or workers of productive age. The purpose of this study consists of three parts, namely: First, to analyze the evaluation of the implementation of exclusive breastfeeding in the private sector; Second, to analyze the response of the assessment of women workers to the exclusive breastfeeding program at the workplace agency; third, to compile appropriate recommendations in implementing exclusive breastfeeding

**Methods**

The locations of the research are Semarang City and Semarang Regency. The research subjects were selected for priv ate companies as the main stakeholders in the process of implementing the exclusive Breastmilk policy. Research activities carried out in July-December 2016. The population of this study is divided into two, first is all companies in Semarang City and Semarang Regency who are eligible. Second, all female workers who work in private companies. Selected companies are companies that have female workers. Case inclusion criteria are company managers who have been in charge of female workers. Exclusion criteria are in company managers who have never been in charge of women workers.

Women workers are women workers who work in private companies. The inclusion criteria of these female workers are female workers who have had experience of breastfeeding in the workplace for the past three years (starting in early 2013). Exclusion criteria were female workers who had no experience of breastfeeding at work. This study uses two analysises. The first analysis uses the Important Performance Analysis (IPA) method which aims to determine the state of each variable from satisfaction factors in terms of importance and

performance. Furthermore, for the assessment of the performance of exclusive breastfeeding in the workplace on variables of satisfaction factors indicated by the letter X, while for the assessment of the factors of interest indicated by the letter Y. Second, content analysis is used to see the consistency of the implementation of the variables observed in this study, in this case the results of the implementation of the Exclusive Breastmilk policy in the private sector workplace which includes: planning in the company; facilities and infrastructure that have been provided; finance; guidance and supervision; and human resource.

**Result and Discussion**

Based on the assessment of workers' attitudes towards the overall performance of the breastfeeding corner service in companies/the private sector (Table 1) is quite good (ordinary) with a value of 63 (out of a maximum value of 102). Attributes of service standards at the Breastmilk corner of the company/private sector are quite good (normal). This can be seen from the results of the evaluation and the trust of respondents/workers towards those that are still below the average and rate normal or moderate.

The product attributes of breastfeeding corners service in companies/private sectors will be divided into four quadrants that reflect the conditions of interest and performance of each of these attributes. The four quadrants consist of: First, quadrant I (top priority) with a high level of importance and low attribute performance. Second, quadrant II (maintain performance) with a high level of importance and performance attributes. Third, quadrant III (low priority) with a low level of importance and performance. Fourth, quadrant IV (excessive) with low importance but high performance.

In Figure 1 we can see the position of each attribute in the Cartesian diagram. The Cartesian diagram is divided into four quadrants with a dividing diameter based on the average total importance (Y) of 2.68 and the average total level of performance (X) of 1.89. The results of a summary of the IPA quadrant position matrix, there are eleven attributes that are the top priority, namely the availability of a special room with a minimum size of 3x4 m2 and/or adjusted to the number of women workers who are breastfeeding; a bag for carrying breast milk (cooler bag); breast milk bottle sterilizer; IEC media about breastfeeding and early breastfeeding initiation consisting of posters, photos, leaflets, booklets and breastfeeding counseling books); tool storage cabinets; air conditioning (AC/fan); increased maternal confidence; increased work productivity; pregnancy delay; advocacy, outreach, and technical guidance for increasing exclusive breastfeeding; and monitoring and evaluation.

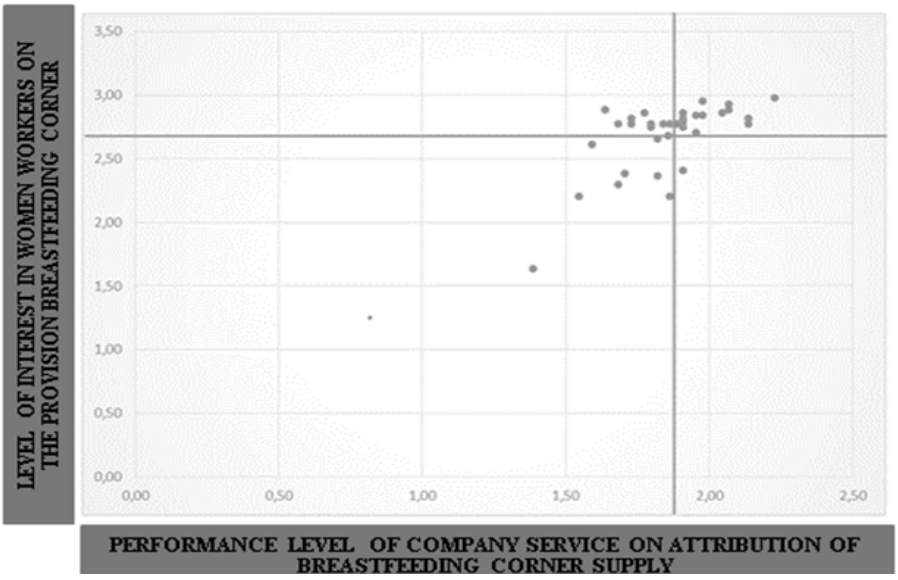


Figure 1 Matrix Position of IPA Quadrant for Breastfeeding Corner Services in Companies (Private Sector)

Table 1 Evaluation Analysis of Workers Attitude toward the Performance of Breastfeeding Corner Service in Companies (Private Sector)

| No | Attribute | Average of Interest (Y) | Average of Performance (X) | Y-X | Quadrant |
|---|---|---|---|---|---|
| **I** | **INFRASTRUCTURE** | | | | |
| **A** | **Breastfeeding Corner Health requirements** | | | | |
| 1 | the availability of a special room with a minimum size of 3x4 m2 and/or adjusted to the number of female workers who are breastfeeding | 2,89 | 1,64 | 1,25 | I |
| 2 | There are doors that can be locked, which are easily opened/ closed | 2,86 | 1,91 | 0,95 | II |
| 3 | ceramic/cement/carpet flooring | 2,82 | 2,14 | 0,68 | II |
| 4 | have adequate ventilation and air circulation | 2,95 | 1,98 | 0,98 | II |
| 5 | free of potential hazards in the workplace including pollution free | 2,93 | 2,07 | 0,86 | II |
| 6 | quite calm environment away from noise | 2,84 | 1,98 | 0,86 | II |
| 7 | indoor lighting is sufficient and not dazzling | 2,84 | 1,95 | 0,89 | II |
| 8 | humidity ranges between 30-50%, maximum 60% | 2,75 | 1,91 | 0,84 | II |
| 9 | available sink with running water to wash hands and equipment | 2,86 | 2,05 | 0,82 | II |
| **B** | **Equipment to store breast milk** | | | | |
| 10 | refrigerator to store breast milk | 2,98 | 2,23 | 0,75 | II |
| 11 | cooling gel (ice pack) | 2,39 | 1,70 | 0,68 | III |
| 12 | bag for carrying breastmilk (cooler bag) | 2,77 | 1,73 | 1,05 | I |
| 13 | Breastmilk bottle sterilizer | 2,77 | 1,86 | 0,91 | I |
| **C** | **Supporting Equipment** | | | | |
| 14 | desk | 2,70 | 1,95 | 0,75 | II |
| 15 | chair with backrest for mother to express milk | 2,89 | 2,07 | 0,82 | II |
| 16 | breastfeeding counseling kit consisting of breast models, dolls, breastmilk drinking cups, 5cc syringes, 10 cc syringes, and 20 cc syringes | 2,61 | 1,59 | 1,02 | III |
| 17 | IEC media about breastfeeding and early breastfeeding initiation consisting of posters, photos, leaflets, booklets and breastfeeding counseling books | 2,77 | 1,68 | 1,09 | I |
| 18 | tool cabinet | 2,77 | 1,84 | 0,93 | I |
| 19 | cold and hot dispenser | 2,20 | 1,55 | 0,66 | III |
| 20 | bottle wash tool | 2,66 | 1,82 | 0,84 | III |
| 21 | trash can and cover | 2,36 | 1,82 | 0,55 | III |
| 22 | Air Conditioning (AC/Fan) | 2,77 | 2,14 | 0,64 | II |
| 23 | nursing apron/perimeter/use krey to express milk | 2,20 | 1,86 | 0,34 | III |
| 24 | washcloth to compress the breast | 2,30 | 1,68 | 0,61 | III |
| 25 | hand wipes | 2,41 | 1,91 | 0,50 | IV |
| 26 | a pillow to support while breastfeeding | 1,64 | 1,39 | 0,25 | III |
| **II** | **MANPOWER** | | | | |
| | **provide nursing counseling** | | | | |
| 1 | improving maternal and child health | 2,82 | 1,91 | 0,91 | II |
| 2 | increasing work productivity | 2,77 | 1,89 | 0,89 | I |
| 3 | increasing maternal confidence | 2,77 | 1,80 | 0,98 | I |
| 4 | economic and hygienic advantages | 2,80 | 1,91 | 0,89 | II |
| 5 | pregnancy delay | 2,75 | 1,80 | 0,95 | |
| **III** | **COACHING & SUPERVISION** | | | | |
| 1 | advocacy, outreach, and technical guidance for increasing exclusive breastfeeding | 2,86 | 1,77 | 1,09 | I |
| 2 | monitoring and evaluation | 2,82 | 1,73 | 1,09 | I |
| | | 2,68 | 1,89 | | |

Source: Analysis Results, 2016

There are thirteen attributes that need to be maintained or are in quadrant II, there are doors that can be locked, which are easily opened/closed; ceramic/cement/carpet flooring; have adequate ventilation and air circulation; free of potential hazards in the workplace including pollution free; quite calm environment away from noise; indoor lighting is sufficient and not dazzling; humidity ranges from 30-50%, maximum 60%; available sink with running water for hand washing and washing equipment; refrigerator for storing breast milk; desk; chair with backrest for mother expressing milk; improving maternal and child health; economic and hygienic advantages.

Quadrant III or low priority consists of eight attributes such as cooling gel (ice pack); breastfeeding counseling kit consisting of breast models, dolls, breastmilk drinking cups, 5cc syringes, 10 cc syringes, and 20 cc syringes; cold and hot dispenser; bottle washer; trash can and cover; nursing apron/perimeter/use krey for blushing; washcloth to compress the breast; a pillow to support while breastfeeding. While there is one attribute that is included in quadrant IV, namely tissue/hand wipes.

Table 2 Summary of Matrix of the Position of the IPA Quadrant for Breastfeeding Corner Services in Companies (Private Sector)

| **Quadrant I (Top Priority)** | **Quadrant II (Maintain Performance)** |
|---|---|
| 1. the availability of a special room with a minimum size of 3x4 m2 and/or adjusted to the number of female workers who are breastfeeding<br>2. a bag for carrying breastmilk<br>3. sterilization of breast milk bottles<br>4. IEC media about breastfeeding and early breastfeeding initiation consisting of posters, photos, leaflets, booklets and breastfeeding counseling books<br>5. tool storage cabinets<br>6. air conditioning (AC/Fan)<br>7. Increase maternal confidence<br>8. Increased work productivity<br>9. postpone pregnancy<br>10. advocacy, outreach, and technical guidance for increasing exclusive breastfeeding assistance<br>11. monitoring and evaluation | 1. there is a door that can be locked, which is easily opened/closed<br>2. ceramic/cement/carpet floors<br>3. has sufficient ventilation and air circulation<br>4. free of potential hazards in the workplace including pollution free<br>5. quite calm environment away from noise<br>6. indoor lighting is sufficient and not dazzling<br>7. humidity ranges from 30-50%, maximum 60%<br>8. a sink with running water is available for hand washing and washing equipment<br>9. refrigerator for storing breast milk<br>10. desk<br>12. chair with backrest for mother expressing milk<br>13. improving maternal and child health<br>14. economic and hygienic advantages |
| **Quadrant III (Low Priority)** | **Quadrant IV (Excessive)** |
| 1. cooling gel (ice pack)<br>2. breastfeeding counseling kit consisting of breast models, dolls, breast milk drinking cups, 5cc syringes, 10 cc syringes, and 20 cc syringes<br>3. cold and hot dispenser<br>4. bottle wash tool<br>5. trashcan and cover<br>6. nursing apron/dividing cloth/use krey to blush<br>7. washcloth to compress the breast<br>8. a pillow to support when breastfeeding | 1. hand wipes |

Source: Analysis Results, 2016

Research shows that countries that have laws supporting breastfeeding correlate with higher rates of breastfeeding. Efforts to encourage breastfeeding in the workplace are divided into three types, including: employers' voluntary initiatives, support services offered by non-profit and other private entities, and government encouragement and requirements. The role of support at work for working mothers is a vital factor that can influence the frequency of breastfeeding working mothers. The legal basis for implementing exclusive breastfeeding at the provincial level related to increasing exclusive breastfeeding at work during work time is Central Java Governor Regulation No. 56 of 2011 concerning increasing breastfeeding in Central Java. The main objective of this regulation is to implement an accelerated increasing participation of the community, government, private sector, and nongovernment organizations in the Government Regulatory Program (Breastfeeding Regulatory) in Central Java Province. The Semarang City Government followed up on the Governor's regulation by preparing Semarang Mayor Regulation No. 7 of 2013 concerning Improvement in the Provision of Breast Milk in the City of Semarang. In this regulation it is explained that each workplace manager is obliged to provide opportunities for working mothers to give exclusive breastfeeding to infants or express milk during work time at work. Relevant agencies need to seek lactation space in all health service facilities, health education units, workplaces, public facilities, and activities in the community. The Semarang Regency Government followed up on this Governor's regulation by preparing Semarang Regency Regulation Number 5 of 2014 concerning Early Breastfeeding Initiation and Exclusive Breastfeeding. One of the objectives of this regulation is to increase the role and support of families, communities, the private sector and the Regional Government in the implementation of the Early Breastfeeding Initiation and the Exclusive Breastfeeding. Social support appears to increase efficacy and help women overcome the various barriers to breastfeeding in the workplace (Schindler-Ruwisch et al., 2019). In addition, community support for exclusive breastfeeding can provide maternal support and the continuation of breastfeeding for children (Quinn, Gallagher and Vries, 2019).

Based on the results of in-depth interviews with eight companies that were respondents of the study, it was stated that 87% of companies had provided ASI corners in the company. Companies that have prepared breastfeeding corners are because they have been given socialization by the Health Office and the Social Service for Manpower and Transmigration, whereas companies that have not prepared ASI corners have not been given this socialization. The role of this socialization is highly important in the success of the Breastfeeding Regulatory program in Semarang City and Semarang Regency. Especially in Semarang Regency, there are local regulations and regent regulations that regulate it, so companies that have not yet prepared will be fined as an form of administrative fine. Lack of support for company management in decision-making and maintenance of breastfeeding is a factor in the cessation of exclusive breastfeeding (Williams et al., 2019). Mills (2009) explained that manager's knowledge about the benefits of breastfeeding is one of important factors in determining the role of companies in supporting breastfeeding.

Through intense socialization, more and more managers/directors of companies are aware of the importance of exclusive breast-feeding at work. By giving women work-ers the opportunity to pump breast milk for their babies, it can improve the health and productivity of their female workers in the future. In addition, if babies today can be given sufficient exclusive breastfeeding, the quality of the next young generation will be better. Lack of company internal regulations that support the breastfeeding program, causes some workplaces to not have facilities for mother to express breast milk provided by management (Nabulsi, 2011). In addition to socialization, there are other factors that have caused some of these companies to have prepared breastfeeding corners, one of which is the demand of buyers (large companies that order their products) which requires each company to prepare breastfeeding corners for women workers who are still actively breastfeeding. Women who work in civil service have a better chance to be

allowed by superiors to express breastfeeding than those who work in private companies (Marinelli et al., 2013).

In practice, companies that have provided breastfeeding corners provide opportunities for women workers to pump breast milk at rest with a variety of additional time, some 15 minutes, some up to 30 minutes. At least the time given by this company is very reasonable because the company is demanded by the results of production targets every day. So if there is only one worker who breaks for a few minutes, the impact will affect the amount of production each day. In addition, in large garment companies, the ASI (breastfeeding) corner is provided at a place relatively far from the production site, making it quite difficult for women workers who will pump breast milk. The company argues that if the breastfeeding corner is close to the production site, there will be a risk of exposure to pollution from the production site such as dust, smoke and other hazardous substances.

The problem of the distance of the location of the breastfeeding corner with the workplace ultimately affects the attitude of workers who are gradually reluctant to pump breast milk in the company because of the limited time to express and the distance to access the breastfeeding corner in the company that takes energy and time. As a result, many breastfeeding corners are not used by women workers. Working mothers face many challenges, such as the inconvenience of the lactation room, its remote location, and the lack of facilities that support mothers to express breast milk (Nabulsi, 2011). Some workers prefer not to express milk because their houses are close to the workplace, so they will choose to go home to breastfeed their children directly. One manager explained that "the difficulty of bringing employees to the breastfeeding corner, many are lazy to come blushing even though an ambulance has been provided to pick up but it is still difficult to come to the base of breastfeeding, they prefer to go home during recess."

In some companies, awareness of female employees is a major obstacle, some workers find it difficult and troublesome to express milk in the company. Actually, the company has permitted to express milk at the workplace, but there are also employees who are less responsible for children, and workers also fear that their work will increase if left to express milk. Support from coworkers is a driving factor in the operation of exclusive breastfeeding for working nursing mothers. Most respondents received support from colleagues who had previously breastfeeded. Support from colleagues is important for some mothers because, during work time, they always meet with them when releasing breast milk (Hirani and Karmaliani, 2013). Working mothers who continue to breastfeed after returning to work need support from company leaders, coworkers and others at work to ensure the provision of space and lactation facilities. Protecting and disseminating information, about the rights of working mothers, can encourage them to continue breastfeeding practice (Basrowi et al., 2015; Hirani & Karmaliani, 2013; Kolinsky, 2009)

Other barriers are company perceptions about the presence of infants at work that can reduce maternal productivity, regulations and other rules that prohibit the presence of children from work, and the lack of daycare centers close to the work environment (Raju, 2006). Likewise, Fein et al., (2008), In their study, compared to the strategy of women who continued breastfeeding while working and found that breastfeeding a baby directly during working hours was related to the long duration of breastfeeding while pumping breast milk during working hours was the second most successful strategy; but not breastfeeding or pumping during working hours is related to the short duration of breastfeeding for the baby. Some mothers report problems arranging their breaks for lunch, prayer and expressing milk. Some even reported that they had to add work hours to replace the break they used to express milk at work. Some mothers report going to work earlier than office hours for expressing milk (Amin, RM et al., 2011). Collaborating with the partner of the exclusive breastfeeding program can ensure continuity of support for breastfeeding mothers in the workplace (Roza et al., 2019).

Working mothers must return to work after they have spent three months on maternity

leave. More than half of respondents (51%) say they leave their children at home with their families during work and go breastfeeding their children when they are resting or family members regularly bring children to work to breastfeed their babies. Furthermore, 30.5% of respondents said they did not have enough time to breastfeed their children and 17.5% said there was no suitable place for them to breastfeed their children in their workplaces. Some mothers who did not have a lactation room in their office, they expressed breast milk in the room, meeting room, and other available space. Each workplace had different standards and facilities to support the practice of expressing breast milk for working mothers. Some workplaces offered complete facilities to support working mothers to express their breast milk but some provide less, so mothers feel less comfortable (Hirani and Karmaliani, 2013).

Some women workers complained about the location for expressing milk far from their workplaces, making it difficult for workers to access the Breastfeeding Corner in the company. This happened to most garment companies in the City and Regency of Semarang. This distance causes workers to need more extra time to be able to pump breast milk at work hour in the workplace. Women often wean early on their babies as a result of an unsupportive work environment. Women often face inflexibility in their work hours and locations and a lack of privacy for breastfeeding or expressing milk, have no place to store expressed breast milk, are unable to find child care facilities at or near the workplace, face fears over job insecurity, and have limited maternity leave benefits (Murtagh and Moulton, 2011). Rest time provisions breastfeeding mothers must breastfeed their babies or pump breast milk regularly to maintain an adequate supply of milk to continue breastfeeding. For female workers, pumping and breastfeeding during work are associated with a longer duration of breastfeeding (Fein et al., 2008). It should be noted that as they get older, women tend to choose to breastfeed exclusively for a long time (Jasny, Amor and Baali, 2019). Existing regulations must ensure that women have the time and freedom to pump or breastfeed at work.

Women workers also want to be prepared with basic infrastructure in the milking process. Such as pumping equipment, storage bottles, and refrigerators to store milking milk. Compared strategies women use to continue breastfeeding while working and found that breastfeeding an infant directly during working hours was associated with the longest duration, and pumping milk during working hours was the second most successful strategy; neither breastfeeding nor pumping during work hours was associated with the shortest duration (Fein et al., 2008). In some countries asking employers to provide such equipment for nursing employees (Murtagh and Moulton, 2011). A number of studies have reported that breastfeeding corner or space to maintain privacy during breastfeeding or expressing breast milk plays an important role in promoting breastfeeding practices in the workplace (Soomro et al., 2016). Public health programs increase mother's knowledge of the importance of exclusive breastfeeding (Littlea et al., 2019). The presence or absence of physical facilities, including breastfeeding corner or room to maintain privacy, can influence a mother's decision to continue or stop breastfeeding. Lack of support for women to maintain breastfeeding after returning to work, and maybe many women have to stop breastfeeding earlier than planned (Danso, 2014). Some of them stopped breastfeeding after returning to work because of heavy workloads and high stress levels. Many mothers say that high stress levels have a negative influence on breast milk secretion (Chen et al., 2019).

**Conclusions**

The Semarang City Manpower and Transmigration Office needs to facilitate the Health Office to enter the company so that it can disseminate communication materials, information and education about increasing breastfeeding. The obstacle for implementation in the private sector is because of the limited time for express breastmilk given by the company, while on the other hand work must continue. Although many buyers now require a room for breastfeeding in the company, it does not just stop there, but it also requires providing reasonable time opportunities for

women workers to express breastmilk at work hours in the workplace and also dispensation in the form of reducing employment targets for women workers who are still actively breastfeeding exclusive breastfeeding for their babies.

Early Breastfeeding Initiation and Exclusive Breastfeeding have no binding sanctions, so they have legal loopholes to be abused. Therefore, it is necessary to revise regional regulations at the provincial and district/ city levels that have strong sanctions and are binding on all stakeholders of Government Regulations related to Breastfeeding (ASI) in Central Java and Semarang Regency/City. Lack of lactation space is one of the most serious obstacles for working mothers to continue breastfeeding. In addition, the problem of heavy traffic in big cities is another obstacle to breastfeeding, making it difficult for mothers to return home during breastfeeding. Having a flexible work schedule and the closeness of the workplace to home seem to be beneficial for breastfeeding practices for mothers who return to their workplaces.

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# Service Implementation Analysis of Adolescent Reproductive Health toward Adolescents' Expectations and Needs

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**Abstract**

Lack of knowledge and information on sexual and reproductive health has led to an increase in reproductive health problems, such as sexual violence and abuse, marriage and teenage pregnancy. There are several government programs related to youth health, but only a few young people can use and take advantage of these programs. This study aims to outline the needs and expectations of adolescents in sexual education and reproductive health. The method used is a qualitative method and an in-depth interview was conducted. Use deliberate sampling techniques to determine samples. The interview results showed that all adolescents had heard of adolescent reproductive health (KRR), but they could not fully explain the definition and scope of KRR. The availability of KRR information and services around the residence is still poor, and although there is no regular schedule and incomplete, most are obtained from the school. The services that young people need include youth-friendly counseling, counseling and health checks. The expected facilities are easy-to-use facilities, affordable costs and flexible service hours. Support from policy makers, plan implementers, schools and youth residential communities are needed to provide youth-friendly and easily accessible KRR services.

## Introduction

Approximately 1.2 billion people, or 1 in 6 of the world's population, are adolescents aged 10 to 19 years and as many as 80% of them come from developing countries. Most are healthy, but there are still many premature deaths, diseases, and injuries among adolescents. Disease can hinder their ability to grow and develop to their full potential. Alcohol or tobacco use, lack of physical activity, unprotected sex and/or exposure to violence can harm not only their current health, but also their health as adults, and even the health of their children in the future (Jarrsa et al., 2017; WHO, 2018).

In 2016, according to the National Labor Force Survey (Sakernas), 62.89% of Indonesian youth aged 15-19 years were still in school. Based on data on the Indonesian Population Projection 2000-2025, the proportion of the population of adolescents aged 10-19 years in 2010 was around 18.3% of the total population or around 43 million people (Puslitbang, 2015). Even though they are a major part of the population, various needs related to sexuality and reproductive health are still not being met through the existing health care system available to adolescents (WHO, 2014).

In Indonesia, adolescent risky behavior begins with sexual initiation from the age of 15-19. This figure is quite high, namely 33.3% for girls and 34.5% for boys. In 2015, it was reported that 8.26% of teenage boys in the cohort, and 4.17% of girls had had premarital sex (Puslitbang, 2015). Premarital sex can lead to an increased risk of contracting sexually transmitted diseases, the most devastating of which is usually HIV-AIDS. In fact, the proportion of HIV infection among those aged 15-24 years continues to increase in Indonesia, from 18.4% in 2014, to 19.3% in 2015, and 21.0% in 2016 (Ditjen PP & PL Ministry of Health of the Republic of Indonesia, 2017).

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This is exacerbated by the existence of inappropriate information and knowledge about reproductive health and HIV/AIDS, therefore teenagers who are in puberty and have a high curiosity can have unsafe sex. Efforts to address adolescent reproductive health problems in Indonesia have existed since 2003 under the name "Adolescent Care Health Services" or known as Pelayanan Kesehatan Peduli Remaja (PKPR). In addition to PKPR, the National Family Planning Coordinating Board (BKKBN) has also established a risk behavior prevention program for adolescents through an organization called the Youth/ Student Information and Counseling Center (PIK R / M). This group trains youth to act as peer educators (UNFPA, 2012).

However, the utilization of adolescent reproductive health services tends to be low. Research in Ethiopia has found that as many as 62.8% of adolescents aged 15-24 years have never used adolescent reproductive health services (Jarssa, 2017). Previous research has also shown that PKPR utilization is still low at <60% (data varies from 12% to 53.7%) below the service coverage standard (Gebreyesus et al., 2019). The low level of utilization of reproductive health services by adolescents is influenced by many factors. Several studies have found that knowledge, individual perceptions such as vulnerability, severity, and seriousness, perceived benefits and barriers, fear of social values, inadequate supervision and information from parents, awareness to use services and failure of services to keep adolescent privacy confidential have an effect on utilization rate (Abajobir & Seme, 2014; Mekonen et al., 2018; Thongmixay et al., 2019; Negash, 2016; Ansha et al., 2017; Hayrumyan et al., 2020; Violita & Hadi, 2019). The government has a responsibility to increase knowledge and understanding of and how to respond to the needs of youth to gain better access to reproductive health services (Chandra-Mouli & Patel, 2017). This study aims to describe the implementation of Adolescent Reproductive Health services to meet the needs of adolescents for sexuality and reproductive health education in schools and health care facilities. The results of this study are expected to be a recommendation for designing and evaluating adolescent reproductive health service programs in Indonesia.

**Method**

This research is a qualitative descriptive study to provide an overview or description of Adolescent Reproductive Health services. Qualitative research models are commonly used in observation and social research, including research on reproductive health services (Forrest Keenan, van Teijlingen, and Pitchforth 2005). Research with a qualitative approach was conducted using in-depth interviews by telephone calls with informants. The aim is to get a deeper picture of the access and use of adolescent to education and Adolescent Reproductive Health (KRR) services and how they feel about their perceived needs and expectations for KRR education and services. Informants in this study consisted of high school students and PIK-R managers in schools. Determination of the sample using purposive sampling based on the considerations of the researcher according to the research objectives. Inclusion criteria are teenagers who are active students and are willing to be respondents.

Qualitative data collection was carried out using in-depth interviews. Data collection was carried out immediately after the ethical review was carried out and the researcher obtained research permission. Interview guidelines in the form of question sheets to obtain information related to the needs and expectations of informants regarding sexual education and reproductive health. Informants were asked to be willing to be part of the research after reading the in-depth interview information sheet which stated that this study did not intend to judge which answers were right or wrong, but rather to emphasize exploring the experience of the informants, having scientific and academic value so that the identity of the informants will be kept confidential. Data from in-depth interviews were analyzed using content analysis methods, namely data collection, data reduction, and verification. Content analysis is done by identifying categories before looking for them in the data. This research has received ethical approval No: 114/EC/KEPK/VI/2020 from the Commission on Ethics for Health Research, Faculty of Health Sciences, Jenderal Soedirman University.

**Results and Discussion**

The results showed that the knowledge of adolescents about their reproductive health was quite good. Even so, teenagers still need a variety of information related to how to maintain the cleanliness and health of their reproductive organs and the impact of sex before marriage. Sex education and reproductive health are clearly still the needs of teenagers in today's modern era. Knowledge of reproductive health, especially with regard to knowledge about sexually transmitted infections, among adolescents is still quite low (Thin Zaw et al., 2020). Support from families and schools is needed to provide education regarding adolescent reproductive health from an early age. Sex education that is given thoroughly from an early age is able to reduce the number of pregnancies in adolescents and is able to delay the desire of teenagers to have sex outside of marriage (Rabbitte & Enriquez, 2019).

Sex education is the delivery of complete information about human sexual anatomy, sexual reproduction and reproductive health. The need for sex education needs to be given, both by parents at home and teachers at school (Maimunah, 2019). Schools play a central role in having a positive and sustainable impact on children's sexual health and well-being (Pareek & Thakur, 2016). This sex education has not been widely applied in the school curriculum as a scientific study material to equip teenagers about reproductive health (Kumar, 2017). The provision of sex education is actually carried out by other parties outside the school through counseling. Adolescents are also not aware of any reproductive health services available at health care facilities.

> "Engga ada, layanan kesehatan reproduksi mungkin ada ka tapi saya kurang tahu" (Z, 17 tahun)
> (No, there may be reproductive health services but I don't know" (Z, 17 years old)
> "Kalo informasi dari puskesmas saya belum pernah, mungkin sih diadakan tapi saya belum penah ikut/dengar." (G, 16 tahun)
> (I have never received information from the public health center, maybe it is held but I have never attended/heard of it." (G, 16 years old)
> "Kalau disekitar rumah si setau saya ngga ada puskesmas ataupun bidan kak, paling deket ya rumah sakit… Kalau di rumah sakit saya belum pernah si kak buat minta konsultasi atau pengecekan kesehatan reproduksi jadi kurang tau. Cuma tau yang di sekolah aja…" (D, 16 tahun)
> (As far as I know, there is no health center or midwife around the house, (Sis), the closest one is the hospital… In the hospital, I have never asked (Sis) for a consultation or reproductive health check, so I don't know. I only know what at school…" (D, 16 years old)

Reproductive health services are widely available in health facilities, especially primary health facilities. This reproductive health service seems to be quite accessible to adolescents with poor quality because the adolescents themselves cannot be fully involved in providing services among other aspects of the quality of KRR services as stated by World Health Organization (WHO) (Ndayishimiye et al., 2020). So that there are still a few teenagers who access reproductive health services because of the lack of information on the existence of services and the lack of adequate media causing teenagers to prefer to access information about their reproductive health through social media.

> "Kalo misalnya tentang menstruasi sih kalo aku sendiri cari-cari di internet sih, kalo misalnya yang selain itu paling dari sekolah… Kalo saya pertama kali mencari menggunakan internet, karena kadang suka, suka apah," (L, 17 tahun)
> (For example, about menstruation, I search the internet myself, for example, other than that, most of them are from school… I used the internet for the first time, because sometimes I like it, what do I like?," (M, 17 years old))
> "Yang pertama itu aku nyarinya gi google, terus kalau sistus nya itu aku carinya yang terpercaya gitu ada dokter maksudnya yang nulis itu dokternya langsung gitu. Atau ngga mungkin kaya tanya tanya di twitter ini gimana gimana gitu. Kalau media cetak jarang si, paling buku biologi hehe" (E, 17 tahun)
> ("The first one I looked for on google, then if the site I was looking for was reliable, there was a doctor, meaning that the doctor wrote it straight away. Or maybe it's like asking questions on Twitter, something like that.

If print media is rare, at least I just find in biology book hehe" (E, 17 years old))
"Sosial media. Karna mudah diakses." (Z, 16 tahun)
("Social media. It's easy to access." (Z, 16 years old))

The limitations of adolescents in accessing KRR services have an impact on adolescents' knowledge of incomplete reproductive health. Lack of knowledge can be caused by lack of education or providing information related to reproductive health (Wijaya et al., 2014). The adolescent phase is part of the human life cycle where in this phase adolescents tend to have delinquency which is closely related to sexuality. The results of the study by Kumalasari et al. (2020) stated that there is a relationship between knowledge and control of adolescent behavior in behaving. Low knowledge and behavioral control tend to encourage teenagers to have sex before marriage (Kumalasari et al., 2019). But on the one hand, teenagers' high curiosity about reproductive health information, encourages them to do something they have never experienced to prove the information they get. As a result, cases of risky sexual behavior in adolescents are increasing (Zainafree, 2015). Media access and contact with information on reproductive health related to risky premarital sexual behavior Unwanted Pregnancy (KTD) which is very vulnerable to lead to unsafe abortion (Azinar, 2013).

The Adolescent Reproductive Health Program is a program that receives special attention from the government in order to meet the needs of adolescents to obtain comprehensive information about their reproductive health. The implementation of the program is carried out differently in each public health, depending on the availability of available resources (Falatansah & Indarjo, 2016). The results showed that the availability of KRR services in the environment around the informants was still very limited. So there are still a few of them who take advantage of KRR services. With regard to the availability of the information needed, the adolescence stated that they had good enough and easily accessible information in online and print media, but it was still incomplete and there were still concerns about false information (hoax). As for the school and around the informant's residence, the availability of information is still lacking and is only given during the commemoration of certain health days.

"Kalau di sekolah, 2 tahun ini mendapatkan hanya 2 kali dari PIKRnya sendiri (kaya tentang pelayanan informasi kesehatan remaja, seperti yang membahas HIV/AIDS, pembulian, kesehatan reproduksi). Namun jarang dilakukan, 1 tahun hanya sekali. Penyedia informasi terkadang dari sekolahan sendiri inisiatif dari ekskul PIKRnya, atau kadang pernah mendatangkan dari luar. Kalau ada agenda itu semua dari kelas 1,2,3 wajib ikut serta kak dikumpulkan di Aula" (G, 16 tahun)

(In school, in the past 2 years, they have only received 2 times from PIKR (such as regarding adolescent health information services, such as those discussing HIV/AIDS, bullying, reproductive health). But rarely done, 1 year only. Information providers sometimes come from the school itself on the initiative of the PIKR extracurricular, or sometimes invite speakers from outside. If there is an agenda, all of those from grades 1,2,3 must participate, Sis, we are collected in the hall" (G, 16 years old))

Most of the informants in this study had never used and sought KRR services and only a small proportion had used online consulting services. Furthermore, most of the informants had discussed KRR with friends and parents because they felt comfortable telling stories with friends and also helped educate their peers. The topics they discussed included HIV, premenstrual syndrome, menstruation, and dating. This is supported by research conducted in Ngesrep Village which shows that adolescents need comprehensive information, including its relation to pregnancy, sexual diseases and HIV/AIDS which is provided at school (Shaluhiyah et al., 2017).

"Engga sih, ga pernah." (Z, 16 tahun)
(No, never." (Z, 16 years old))
"Saya tidak pernah kak kalau sengaja untuk memanfaatkan layanan tentang KRR seperti itu. Paling hanya yang di sekolahan aja yang penyuluhan dari ekskul PIKR itu yang semua siswa wajib ikut." (G, 16 tahun)
(I've never done it on purpose to take

advantage of services about KRR like that. At least only those at school who receive counseling from the PIKR extracurricular activities, which all students must participate in." (G, 16 years old))

"Kalo yang berhubungan dengan kesehatan reproduksi remaja si saya belum pernah kak mendapatkan fasilitas pelayanannya. Untuk yang PIK-R buat bahas masalah kesehatan reproduksi itu juga belum kak" (D, 16 tahun)

(In terms of adolescent reproductive health, I have never received the service facilities. For the PIK-R, they haven't discussed reproductive health issues yet, Sis" (D, 16 years old)

"ngga enak aja gitu kalo mau nanya ke orang tua gitu, takut…Ngga ke guru aaa, ngga mau aja…" (L, 17 tahun)

(It's not good if asking to my parents like that, I am afraid… (doing nothing), I don't want to…" (M, 17 years old))

Most of the informants stated that their obstacles in accessing KRR information and services included unclear explanations, less affordable costs, and less flexible time and lack of confidence in the information conveyed. Another study stated that one of the factors that hindered the use of KRR services was the unaffordable cost of services and the attitude of health workers who were unable to make teenagers comfortable in accessing information (Mutea et al., 2020; Pandey et al., 2019). Adolescents' ignorance of the existence of reproductive health services causes the utilization of services to tend to be low (Elom et al., 2018). These kinds of barriers are often found in areas with low socioeconomic conditions, culture and other structural factors that affect access to KRR services (Maryatun et al., 2020; Mukondwa & Gonah., 2016; Svanemyr et al., 2017). Other obstacles can also be in the form of policies on access to reproductive health services by adolescents, including gender issues, low fulfillment of adolescent rights, poor coordination between institutions and related stakeholders (Elnimeiri et al., 2020).

KRR service program policies and interventions must be able to understand the needs of all adolescent, including adolescent with disabilities and gender-based (Burke et al., 2017). Collaboration between government agencies is needed to be able to design programs that are able to overcome obstacles for youth in accessing information on KRR services (Andajani-Sutjahjo et al., 2016). Policy makers and program implementers need to consider service preferences according to the needs of adolescents and parents to design an adequate KRR service program (Self et al., 2018).

"Aaaa, fifty-fifty 50:50. Setengah-setengah. Karena ya itu tadi sih, kan kaya aaa, misal ini yang aaa, untuk melancarkan haid itu kan makan bayem, makan ini, makan ini, makan ini, terus pas lagi haid juga minum kunyit, tapi tuh kan aaa sempet ada orang yang bilang jangan kebanyaken minum kunyit, nanti gini gini, jadi kan, aah bingung, kaya gitu. Jadikan susah, jadi setengah percaya setengah engga kaya gitu." (L, 17 tahun)

(Aaaa, fifty-fifty 50:50. Because yeah, that was it, like rrrr, for example this is rrrr, to launch menstruation, you eat spinach, eat this, eat this, eat this, then when you are menstruating you also drink turmeric, but there are people who say no to not mostly drink turmeric, then it's like this, so I'm confused, like that. It is difficult, sometimes believe sometimes not, such it." (M, 17 years old))

"Iya kak percaya. Hmm, sebenarnya guru belum tentu benar sih kak. Cuma kalu misalnya udah dapet informasi dari guru nih kak baru searching di online, kalau ternyata beda, nanya lagi ke gurunya. Bu yang benar yang mana hehehe. Iya jadi dicrosscheck dulu. Soalnya takut juga sih gurunya ngga taunya sok tau hehehe." (D, 16 tahun)

(Yes I believe. Hmm, actually the teacher is not necessarily right, sis. It's just that if you get information from the teacher, for example, just searching online, if it turns out to be different, ask the teacher again. Which one is the right one hehehe. Yes, so it was crosschecked first. It's because I'm afraid that the teacher doesn't know, just like want to know everything even it's not their thing, hehehe." (D, 16 years old))

Teenagers first hear information about adolescent-friendly health services from their parents, supervisor, and friends. However, only a few of them have ever visited the facility (Wright et al., 2017). Good location, flexible opening hours, close distance, and a comfortable environment and satisfaction with services are aspects that attract teenagers to

visit health facilities (Abate et al., 2019; Femi-Adebayo et al., 2019; Wright et al., 2017). The availability of seminar rooms and educational materials is also an important aspect for adolescents and reproductive health is the health education topic that is most often chosen by adolescents (Wright et al., 2017). In areas with limited access and contact information, most adolescents even rely on their peers for sexual and reproductive health information. Utilization of KRR services in the community is still low due to the reluctance of youth to visit these services. Apart from confidentiality, negative attitudes of officers and social norms in the community cause adolescents to choose to access information related to their own reproductive health (Kyilleh et al., 2018).

The school environment and positive relationships with teachers and staff play a role in shaping adolescent behavior. The results of a systematic review conducted by Jamal et al. (2013) expressing unhappy feelings, being treated un-fairly, feeling unsafe at school can cause students to seek a source of diversion either by leaving school at lunchtime or by long-term drug use and other risky behaviors. Knowledge of reproductive health can be applied in the primary health care school curriculum and materials in health promotion are expected to increase adolescent awareness of the risks of infertility and the long-term impact of reproductive health problems (Hammarberg et al., 2017).

In addition to teachers, parents have an important role as a source of information for adolescents. Communication on topics related to sex from parents is needed to increase adolescent knowledge of reproductive health issues. Submission of correct information with an open-minded approach will be able to increase the confidence of adolescents in receiving information from parents (Deshmukh & Chaniana, 2020). The results of this study indicate the information needed by adolescents regarding their reproductive health, including nutritional needs, sex education, violence, and menstruation. More specifically, the informant expressed his need for self-control, sexual violence, juvenile delinquency, as well as HIV-AIDS and how to prevent it. As for the services needed, the informants expressed their need for consultation, counseling, and health check services that are friendly and open to teenagers. Furthermore, with regard to the expected facilities, male and female informants both expect facilities that are easy to access, affordable costs, without long queues, and flexible service hours. To facilitate access and flexible service hours, health facilities can design technology-based KRR service programs that make it easier for adolescents to access services anytime and anywhere while maintaining the confidentiality of data and information (Ippoliti & L'Engle, 2017).

> "Resiko dan dampak dari berhubungan secara seksual dengan siapapun itu. Kalau misal remaja udah tau dampak-dampaknya terutama dampak negatifnya harapannya si udah ada inisiatif buet ngehindarin yaa. Sementara untuk kesehatan reproduksinya, saya merasa masih kurang sih kak. Karna selama ini juga dipelajarin di pelajaran biologi cum di permukaan aja belum sampe kesehatan yang mendalam." (D, 16 tahun)
> (The risks and effects of having sex with anyone, If, for example, teenagers already know the impacts, especially the negative impacts, it is hoped that there will be initiatives to avoid them. As for reproductive health, I feel it's still lacking, sis. Because all this time what has been studied in biology lessons has only been on the surface, not yet deep health explanation." (D, 16 years old))
> "Seperti informasi cara merawat dan menjaga reproduksi. Cara bergaul yang baik dan benar dengan lawan jenis khususnya" (G, 16 tahun)
> (It is such as information on how to care for and maintain reproduction. How to get along well and correctly with the opposite sex in particular" (G, 16 years))
> "Ya itu sih, gimana cara kita buat menjaga kesehatannya, cara-caranya tuh gimana, harus ngelakuin apa apa apa gitu. Udah sih paling itu." (L, 17 tahun)
> (Yes, that's it, how do we take care of our health, what are the methods, what should we do. That's all." (M, 17 years old))

School-age youth feel the need to have educational content on sexuality and reproductive health in schools and 33.5% of youth feel that the current related education is inadequate (Jennifer et al., 2012; Sreekumar et al., 2019). Health education sessions in schools

are highly effective in increasing knowledge even though students have a tendency to forget information regarding some aspects that have been obtained over time (Jennifer, et al., 2012). Adolescents expect privacy and confidentiality and the presence of a doctor of the same sex as themselves (Femi-Adebayo et al., 2017; Sreekumar et al., 2019). As for the source of information, several studies mention that teachers are a source of information on sexual and reproductive health in the community, but adolescents prefer to discuss with doctors regarding sexual diseases and feel uncomfortable discussing their doubts about sexual and reproductive health with teachers. However, teenagers do not like government clinics because of the lack of facilities and overcrowding (Jennifer et al., 2012; Sreekumar et al., 2019).

## Conclusion

Adolescents need information about adolescent reproductive health such as HIV-AIDS as well as health in general which is conveyed more broadly and in depth. Adolescents have heard about Adolescent Reproductive Health (KRR), but many teenagers have not been able to explain what is meant by reproductive health and the types of reproductive health services. The KRR services that are currently available are still not able to meet the needs of adolescents for information about their reproductive health. There needs to be support from various parties, ranging from policy makers, program implementers, schools, to the community environment where teenagers live to be able to realize KRR services that are adolescent-friendly and easy to reach. This support can be in the form of comprehensive socialization of KRR services to target adolescent, assistance from the public health as program implementers, training of teachers and parents in assisting adolescents in obtaining information on KRR and curriculum-based sex education in schools. It is hoped that with the collaboration of various parties, KRR services can be carried out optimally to meet the information needs of adolescent reproductive health.

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# Readiness Management in Handling COVID-19 Pandemic and Early Detection in The Referral Hospital in East Nusa Tenggara Province

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**Abstract**

Covid-19 pandemic that is occurring now has rapidly and widely spread throughout the world. Various efforts are made to handle or suppress the number of cases, including readiness management in the emergency department until 7th May 2020. This study aimed to investigate readiness management in handling the Covid-19 pandemic in a referral hospital in Kupang, East Nusa Tenggara Province. This research represented a mix-method study. The samples were 20 emergency nurses at a Covid-19 referral hospital in Kupang. Data were collected using an interview that was distributed to respondents through Google forms. The questionnaire consisted of 12 questions about hospital readiness and 8 questions about early detection of Covid-19. Results showed that 90% of emergency nurses had performed early detection of Covid-19. The hospital readiness management in handling the Covid-19 pandemic was adequately good. Some obstacles were found during its implementation, such as the lack of personal protective equipment and health support tools, as well as patients' dishonesty of traveling and contact history with COVID-19 patients.

## Introduction

Covid-19 is the disease caused by the new coronavirus that attacks the respiratory organs in humans. This virus was first discovered in Wuhan, China at the end of 2019 (Chatterjee et al., 2020) and spread very rapidly among humans through droplets (Mei and Hu, 2020). This rapid rate of outbreak causes more than 100 countries in the world infected within a few weeks (Phillips et al., 2020). Currently, Covid-19 has spreaded to 215 countries with a total incidence of 3,595,662 confirmed cases. In Indonesia, there were 12,438 confirmed cases with a total recovery of 2,317 (Covid-19, 2020). This rate has increased rapidly since the first incident reported on 2 March 2020 in Jakarta. Meanwhile, in East Nusa Tenggara, 11 cases were confirmed (Covid-19, 2020).

Data from the World O Meters showed that, until 7 May 2020, the total death toll in the world is 265,116. The highest rate occurs in the United States with a total number of 74,809 deaths. In Indonesia, 895 deaths are reported so far with zero fatalities in East Nusa Tenggara Province (World O Meter, 2020). This pandemic has strongly affected the health care system in most countries in the world. Italy, which has sophisticated health support system equipment, is reported to be overwhelmed in handling Covid-19 patients. Patients are treated in hospital corridors, while doctors and nurses have increased workload that causes them to work out of their expertise (Phillips et al., 2020). Many nurses and other healthcare workers experienced psychological problems due to high workloads (Lai et al., 2020), as well as people's stigma of the disease. Nurses and doctors had to choose to save patients with a higher level of life following the existing guidelines.

The management of the Covid-19 pandemic should be based on the guidelines

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provided by the government and health agencies (Mahmood et al., 2020). The World Health Organization is one of the world health agencies that issued guidelines for handling the disease. Similarly, the Indonesian Ministry of Health also issued a guideline on handling Covid-19 in the country (Indonesia, 2020). These guidelines were issued to reduce the disease spread and increase readiness. Research showed that 104 (57%) out of 182 countries have a good functional capacity in handling pandemics at both national and sub-national levels. Meanwhile, 32 (18%) countries reported low readiness and are in emergent need of external resources to help deal with the disease (Jacobsen, 2020). Such low readiness can trigger stress and panic in the community, and therefore, the real focus now is on increasing readiness in handling the Covid-19 pandemic (Jacobsen, 2020). This study aimed to investigate the readiness management in handling the Covid-19 pandemic in Kupang City, East Nusa Tenggara Province.

## Method

A mix-method study was utilized to meet the purpose of the study. The study variables included the readiness in handling the Covid-19 pandemic and the early detection of Covid-19 by emergency nurses. The data collection technique used is total sampling. All respondents have filled out informed consent via Google Form to protect the rights as research participants. Data were collected in one of the referral hospitals in East Nusa Tenggara through a questionnaire that was distributed by Google forms to 20 emergency nurses for quantitative data and Interviewed for qualitative data. The questionnaire was adopted from the Covid-19 Handbook by the Indonesian Ministry of Health (Ministry of Health Republic of Indonesia, 2020).

The questionnaire asked for the readiness of nurses and hospitals in handling Covid-19 patients in Indonesia. It consisted of 12 questions about the readiness and 8 questions about the early detection with Yes and No answers. Qualitative data were tested using interpretative analytic phenomenology. The results of the interview were made into a transcript to take keywords. The keywords found were translated using the Indonesian Dictionary to find themes. Then, the quantitative data is tested to find the frequency and percentage. The collected data were processed using the SPSS. This article gets through the ethical test with the number of ethical clearance 120/EC-KEPK-SB/X/2020.

## Result and Discussion

Table 1. Distribution of Respondent Characteristics

| Variable | | f | % |
|---|---|---|---|
| Age | 26-35 years old | 10 | 50 |
| | 36-45 years old | 8 | 40 |
| | 46-55 years old | 2 | 10 |
| Gender | Male | 12 | 60 |
| | Female | 8 | 40 |
| Education | DIII | 12 | 60 |
| | Undergraduate | 8 | 40 |
| Length of work | 0-2 years | 4 | 20 |
| | 3-6 years | 2 | 10 |
| | 6-9 years | 4 | 20 |
| | >10 years | 10 | 50 |
| Clinical Level | PK 1 | 1 | 5 |
| | PK 2 | 15 | 75 |
| | PK 3 | 4 | 20 |

Source: Primary Data, 2021

Based on table 1 it shows the age of respondent most of the respondents who are young adults. Most of the respondents are male. Level of education is mostly a Diploma III nursing with a length of work more than 10 years. Most career paths as nurses are Clinical Nurses II.

East Nusa Tenggara is one of the provinces that has the lowest incidence rate of Covid-19 in Indonesia. Since the first emergence of the case until the present time, the number of human resources in the emergency unit, which included doctors, nurses, and laboratory analysts, had not been increased. In handling the pandemic, China had increased the number of nurses in an intensive care unit until 30 nurses. It is in contrast to the Great Britain which lack of medical staff in one of its hospitals (Gudi and Tiwari, 2020).

One of the reasons is that the number of the incidence is still minimal so that there is no need for additional members for the emergency room. Human resources are urgently needed during the Covid-19 pandemic, especially

laboratory personnel (Lai et al., 2020). When the cases in Italy increased in number, the government urgently requested the addition of 300 doctors and nurses to help provide services in hospitals (Phillips et al., 2020).

This study found that there was no special observation room in the emergency unit. Patients who were suspected of being the ODP (person in monitoring) would be directed to the Covid-19 isolation room. There was a special room for Covid-19 patients. The room has been arranged in such a way to distinguish from the room for ODP, PDP (patient in observation), and patients with Covid-19. There were 10 beds prepared for COVID-19 patients completed with a monitor and oxygen supply. Patients with certain critical conditions would be directed to the ICU.

The number of beds and facilities should be increased especially in the intensive care unit to prevent stress and overcome the overwhelming burden of the hospital staff when there is a significant increase in hospitalized and critical patients (Timmis and Brüssow, 2020). The intensive care unit will only serve patients with severe respiratory failure that requires patients to use mechanical ventilators (Di Gennaro et al., 2020). The triage which was performed in the emergency unit when patients were admitted showed to be very helpful as it helped hospital staff determine which patients had to be taken to the intensive care unit, the isolation room for the Covid-19, or patients that required intubation (Phillips et al., 2020; Ravikumar et al., 2020). Patients infected with the coronavirus should have a special treatment room (Lai et al., 2020).

Covid-19 patients should be provided with a special room for their treatment. Patients with severe infection should be given intensive care. However, to prevent fluctuations in hospitals, some countries determine to manage patients with mild to moderate infections to undergo treatment and isolation at home (Timmis and Brüssow, 2020; Watkins, 2020). Covid-19 patients need a special treatment room to isolate themselves so that they can receive basic medical care and close observations (Timmis and Brüssow, 2020).

Special ambulances for Covid-19 patients were not yet available, but the hospital had turned the regular ambulances for use in handling Covid-19 patients. The number of operating ambulances was insufficient to meet the needs when there is a high increase in the number of cases. This condition can lead to suboptimal management of the patients. Ambulances were a vital means to pick up patients from home to a specified referral hospital. Some countries with increased incidence of Covid-19 showed that asymptomatic patients would do independent isolation at home, and they would receive treatment facilities if they experienced complications in the respiratory tract (Phillips et al., 2020). Ambulances are vital means when patients have experienced complications and require intensive care. A shortage and delay of the ambulance in picking up patients when they are in a critical condition can lead to patient death (Phillips et al., 2020).

Patients and families who came to the hospital were checked for the temperature by using a thermal scanner. Hyperthermia patients would be further examined for their history of traveling to the red zone and signs of severe respiratory infection. If the patients were determined as the people under control or known as ODP, the patients would be taken to the special isolation room. A thermal scanner is a medical tool that can detect body temperature efficiently. This tool is often used to detect patients with Covid-19. However, measurement of temperature alone is not enough to reduce the spread rate of the disease (Lai et al., 2020).

Cross-sectoral communication tools for Covid-19 cases from the emergency unit are not yet available. All information regarding Covid-19 will be carried out by the Covid-19 task force and will be forwarded to the relevant health office. Cross-sectoral tools are needed in handling Covid-19 to help reduce its spread so that collaboration with policymakers is required (Lai et al., 2020). This cross-sectoral collaboration is useful for sharing information and helping each other to solve problems. Besides, cross-sectoral collaboration also helps good coordination in communication, coordination, and implementation of Covid-19 management strategies (Jacobsen, 2020). Cross-sectoral collaboration is urgently needed during the Covid-19 pandemic to prevent the destruction of global health. The government is

obliged to issue rules for social isolation, keeping distance and stopping all activities in and out of the affected areas. Learning from the case in Italy, the government should not only provide lockdown rules but cooperates with other parties including pre-hospital asymptomatic patients and post-hospital patients to continue treatment at home (Phillips et al., 2020).

Life-saving medicines were all available in hospital pharmacies and complementary pharmacies such as Kimia Farma and were easily accessed. Supportive drugs in caring for Covid-19 patients are vital as no vaccine can treat this disease (Jacobsen, 2020). Therefore, the focus of healing is to treat complications or symptoms that appear due to the infection. Pandemic readiness requires drug distribution for prophylactic therapy (Timmis and Brüssow, 2020). Appropriate strategies for medication management can help prevent patients from experiencing critical problems. Supporting drugs needed by patients include Glucocorticoids, Remdesivir, Chloroquine, and Hydroxychloroquine, especially in combination with Azithromycin, Tocilizumab, Lopinavir-ritonavir, Baraticinib, Non-steroidal anti-inflammatory, and Angiotensin-converting enzyme 2 (Di Gennaro et al., 2020). Other adjunctive therapies that can be used include tocilizumab and corticosteroid. Pharmacological treatments in which risks outweigh benefits are Ribavirin With or Without Interferon and Oseltamivir and Baloxavir (McCreary and Pogue, 2020).

Health supporting tools were not adequately available. The number of ventilators was lacking and other respiratory support systems were only available in the intensive care unit. Ventilators are needed to increase the capacity, especially in the intensive care unit (Lai et al., 2020). A country in Africa is reported to have only three ventilators; and this inadequacy is a very serious problem, besides personal protective equipment (Phillips et al., 2020). The machine for swab test analysis was not available yet so that the waiting time in the lab test got longer, indicating that the RT-PCR should be increased (Lai et al., 2020). Adequate diagnostic facilities enable proper management so that a larger number of cases can be handled more effectively (Timmis and Brüssow, 2020). The RT-PCR (reverse transcription-polymerase chain reaction) test showed a sensitivity level of 32%-93%, depending on the source of the clinical specimens (Mossa-Basha et al., 2020). This can help sort out the patients and reduce the incidence rate. Covid-19 patients with severe infection need medical equipment that helps support life, namely ventilators, intubation, and oxygen cylinders (Timmis and Brüssow, 2020).

Personal protective equipment for emergency nurses was still lacking as the current focus was on the Covid-19 isolation room. Personal protective equipment is used to prevent medical personnel from getting infected with virus from patients and spreading the virus to others. WHO standards of personal protective equipment against the Covid-19 are masks (surgery and breathing), gloves, dresses, shoes, headgear, and eye protection (Assadi et al., 2020). Research shows that personal protective equipment in some countries is still lacking, including Indonesia. Some nurses at the beginning of the pandemic even used a raincoat made of plastic. This has become one of the causes of many cases of infections and deaths that occur among nurses and doctors in Indonesia. Some countries have also experienced this incident since the end of January 2020. They are overwhelmed with the best personal protective equipment for health professionals (Timmis and Brüssow, 2020). Thus, there should be an understanding that personal protective equipment is prioritized for medical staff, especially doctors and nurses.

The Indonesian government has ruled all people to use masks. These people are not required to use surgical masks but cloth masks. Surgical masks will be for medical staff and all supporting teams at the hospital. N95 masks are for medical workers, doctors, and nurses who provide direct care in the isolation room. N95 masks are equipped with better protection than ordinary surgical masks, but it is still unclear whether 95% of protection is enough to avoid medical personnel from viral infections (Friese et al., 2020). Gloves are a part of the personal protective equipment, and latex gloves are highly recommended. Latex-based gloves can protect against bacteria and viruses and provide a virus penetration rate of <1%.

Latex gloves are suitable for protecting hands from biological hazards and water-based fluids and can be used for up to 16 hours (Assadi et al., 2020). Other forms of personal protective equipment are robes and masks that can be used for eight hours, as long as they are not removed before eight hours of use. However, the use of personal protective equipment may cause fatigue, difficulties in breathing, speaking difficulty due to breathlessness, and unclear hearing to what is said by peers and patients (Phillips et al., 2020).

Patients with a history of traveling from red zones and did not show any symptoms will undergo independent quarantine at home for 14 days. The patients are asked for their address and telephone number, and this information is documented. Patients will further be directed to the Covid-19 unit and given health education related to the disease. Patients will also be provided with a label or alert card for identification. However, the health alert card is not yet available so it is not used in the hospital. Health alert card functions as a sign to distinguish patients who have a history of traveling from the red zones.

In this study, the procedures in the management of Covid-19 followed the protocols established by the Indonesian Ministry of Health. These protocols become the basis for creating relevant operational standards for patient care management in the hospital. One of the operational standards is related to ethics in determining patients who are eligible to receive a ventilator. These procedures can also help eliminate psychological burdens from nurses after such decision making (Phillips et al., 2020). Standard operational procedures are important components in the readiness management of Covid-19, especially for the hospital management. Standard procedures are developed by focusing on patient safety and minimizing the spread of infection (Mahmood et al., 2020).

Operational standards developed by hospitals should not only focus on Covid-19 management but also other health services, such as the fact that surgical services require SOPs for surgical patients during the Covid-19 pandemic (Bhangu et al., 2020). Other protocols also need to be developed, for example, protocols in critical care in the form of intubation, use of high-flow oxygen, and consultation of infectious diseases and cardiac arrest (Griffin et al., 2020). The protocols are developed by focusing on clinical decisions of intubation, the use of high flow oxygen, consultation of infectious diseases, and cardiac arrest.

In this study, supporting nutrition logistics were not optimally available; most of them were voluntarily provided by social institutions. Additional logistics for nurses on duty were not available. All nurses used their own money to get meals and drink. Nutrition is one of the important things in the treatment of this pandemic. During the pandemic, the government should do proper logistical management, including food stocks, personal protective equipment, and medicines (Jacobsen, 2020). Logistic quality control at the beginning of the crisis is very important to help save lives. Some of the efforts made may include opening hospital facilities and close other supporting facilities, i.e., security, logistics and even closing the research centers (Timmis and Brüssow, 2020).

Communication and education media were always provided to patients and families using leaflets at the hospital and also audiovisual media broadcasted using the televisions in the hospital. The Indonesian government also provides health promotion media and an official health education website at https://www.covid19.go.id. Besides, there is also a contact number linked to the website that can be connected to the WhatsApp application. The information provided by this account includes the present situation of the Covid-19 in Indonesia, definition of Covid-19, the symptoms of Covid-19, how to protect oneself from Covid-19, how to protect others, the use of cloth masks, what is a rapid test, Covid-19 rapid test, how to isolate yourself, how to do physical distancing, and emergency numbers that can be contacted.

The community should keep updated with actual information and knowledge about this pandemic (Timmis and Brüssow, 2020). Current health promotion media should use tele-health to support prevention from Covid-19 (Mahmood et al., 2020). By using

this tele-health, patients can have a better understanding of the symptoms they develop and do the initial treatment at home, as well as know when it is time to get treatment in the hospital (Mahmood et al., 2020). Tele-health will also avoid people from hoaxes that trigger stress and panic.

Table. 2 Covid-19 Early Detection in the Emergency Unit

| No | Variable | f | % |
|---|---|---|---|
| 1 | Patients are assessed for signs of severe upper respiratory tract infection. | 19 | 95 |
| 2 | Patients are also asked about fever, respiratory problems, and the history of traveling to the affected area within the past 14 days | 20 | 100 |
| 3 | Patients were assessed for any contacts with the Covid-19 patients | 19 | 95 |
| 4 | The management is based on the standard operating procedures | 19 | 95 |
| 5 | Report the case if there are signs of Covid-19 | 20 | 100 |
| 6 | Taking specimens | 19 | 95 |
| 7 | Case Reporting | 19 | 100 |
| 8 | The presence of clear communication standards | 18 | 90 |

Source: Primary Data, 2021

Table 2 shows that the early detection of Covid-19 by nurses was around 90-100%. Early detection measures are one of the hospital's permanent procedures during this pandemic. Early detection can help diagnostic by classifying patients based on symptoms or travel history. Early detection is conducted by asking for a contact history with patients who have respiratory symptoms (Aluga, 2020), traveling to an infected area, or having a history of fever and dry cough during the last 14 days.

Based on the guidelines in handling Covid-19 in Indonesia issued by the Indonesian Ministry of Health, patients are categorized into three: (1) people under observation (ODP) who show symptoms of fever, cough/ runny nose/throat pain and have a history of traveling to the affected area in the last 14 days before the symptoms appear; (2) patients under monitoring (PDP) who have symptoms of fever/history of fever, cough / runny nose/sore throat/mild to severe pneumonia according to clinical symptoms and radiological features, as well as having the history of travel to infected areas or exposure or contact with the Covid-19 patients; (3) patients with positive Covid-19, in which patients have shown symptoms and also positive results of the swab test (Indonesia, 2020).

The early detection of patients in hospitals should be performed at the entrance or the emergency unit. Patients will be screened and given a surgical mask to prevent transmission. The specimens for RT-PCR testing during a pandemic should not only be taken from patients with the ODP or PDP categories but also all patients for any reason as an early step of detection (Mossa-Basha et al., 2020). Long and medium-term management in handling Covid-19 is diagnostics (Jee, 2020). Proper diagnostics requires early detection of every patient who comes to the emergency department.

Covid-19 patients with mild symptoms come to the hospital with complaints of flu, coughing or fever, and mild shortness of breath, and about 10% of patients show severe symptoms (Coccolini et al., 2020). Pediatric patients also have similar symptoms of fever, cough, dyspnea, malaise, myalgia, headache, nausea, vomiting and diarrhea, pharyngeal erythema, and tachypnea (Ravikumar et al., 2020). If the results of the early detection at the hospital found that a patient is suspected for Covid-19, the task force of Covid-19 is to do tracking to find out whom this patient is socializing with to identify risk cases to prevent the incidence larger pandemics, such as in Italy (Carinci, 2020). The communication program during this pandemic requires accurate information that can improve human understanding, change behavior, and make decisions during emergencies (Lohiniva et al., 2020). This is an effort to shape the character of society, especially in Indonesia since many incidences of infected doctors and nurses occurred due to patients' dishonesty as a result of their fear and anxiety.

## Conclusion

The hospital readiness in handling the Covid-19 pandemic was still lacking. Supports in the forms of personal protective equipment, supporting medical equipment, and human resources are therefore required. The health promotion media was an excellent effort to help develop community understanding; however, community behaviors were not completely changed as expected. In this study, some other problems might also occur when more cases developed; unfortunately, no significant improvement was made on the facilities and infrastructures, leading to more deaths in future times. The majority of people were apathetic and not honest with their travel history or contact history with infected people. Many people were still gathering without wearing masks and ignoring social distancing.

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# Low Back Pain: Based on Age, Working Period and Work Posture

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**Abstract**

Low back pain is one of the health risks for workers. Age, years of work and work posture that are not ergonomic are associated with complaints of low back pain. This study aims to determine the relationship between age, work period, and work posture on complaints of low back pain in rice mill workers. This study used an analytical observational study, with a cross sectional approach. Samples were taken of 50 respondents using total sampling. Research instrument with a questionnaire to determine data on age, years of service and assessment of complaints of low back pain. The RULA checklist method for measuring body posture. The data analysis technique used the Pearson test and multiple linear regression. The results showed that there was a significant relationship between age, years of service and work posture with complaints of low back pain with a p value <0.05. The conclusion of this study is that there is a relationship between age, years of service and work posture with complaints of low back pain.

## Introduction

Low back pain is a costly and prevalent global health issue (Hartvigsen et al., 2018) . Among the general population, low back pain is a common non-fatal condition with a point prevalence of 9.4 % and a lifetime prevalence of approximately 85 % (Hoy et al., 2014). It was estimated that about one-third of low back pain is attributed to occupation (Driscoll et al., 2014) Manual work is still commonly found in various work activities. Manual work that is done repeatedly or repetitively with monotonous work movements and long working times has the potential to cause work fatigue. Muscles have the ability to contract, relax, expand and contract, allowing for many body movements. Work tools and the physical environment that are not in accordance with the natural abilities of the workforce will cause work results to be not optimal, and even have the potential to cause health complaints and occupational diseases. Low back pain is a common health problem in the workplace and most workers experience low back pain during their work (Hoy et al.,2010)

Low back pain has a huge impact both directly and indirectly on individual workers and their families, industry and government (Haldeman et al., 2012; Lewis & Battglia, 2019). The ILO reports that Musculoskeletal disorders are currently experiencing an increase in cases in many countries. For example, in the Republic of Korea Musculoskeletal disorders have increased by about 4,000 cases in a period of 9 years and in the UK, 40% of cases of occupational diseases are Musculoskeletal disorders.

Musculoskeletal disorders (MSDs) are disorders of the body's structures such as muscles, joints, tendons, ligaments, nerves,

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bones, and the local circulatory system. In addition, back pain is defined as chronic or acute pain, pain or problems in the waist or buttocks area sometimes called the lumbago, or in the upper leg area which is a major work-related disorder in almost any physically demanding job (Meucci et al., 2015) . Rice mill work is a job that has a low back pain risk. The way of working that raises the load to the mill is a risk factor in low back pain. In many studies, various factors associated with low back pain have been identified. Among them; lifting and carrying heavy objects (Yang et al., 2016; Gawde, 2018), awkward posture, psychosocial work demands and job dissatisfaction (Pillastrini et al., 2010; Khalid et al., 2017; Lewis & Battglia, 2019). Repetitive motion, static workload reported as a major risk factor for LBP. The work posture of rice mill workers at Karangrejo Village, Kerjo Subdistrict, Karanganyar is classified as unsafe because there are various insecure attitudes in the form of improper transport, excessive workloads and excessive muscle stretching. Complaints of Low back pain are characterized by physical complaints in the form of low back pain.

**Methods**

This study uses an observational analytic design with a cross-sectional study design that explains the differences between the variables through testing previously formulated hypothesis. This research approach uses a cross sectional approach in which cause / risk and causal / causal variables are measured or collected at the same time and carried out at the same time. The research was conducted in the range of February - September 2020. The sampling technique used a total sampling of 50 workers in all rice mills in Kerjo District, Karanganyar Regency. The independent variables in this study are age, years of service and work posture. The dependent variable in this study is complaints of Low back pain in workers in the rice mill, Kerjo Karanganyar District. Age, years of work and work posture were measured using a questionnaire to respondents, complaints of low back pain were measured using the RULA checklist.

This analysis is used to see the description and characteristics of each independent variable and the dependent variable. The variables of this study were analyzed using the frequency distribution of SPSS version 23 data tendencies to describe the characteristics of each study variable. Bivariate analysis is used on two variables that are thought to have a relationship or mutual correlation. Bivariate analysis uses the Spearman correlation. The strength of the relationship of a variable obtained from the direction of the correlation that has positive (+) and negative (-) values. A positive value (+) means that the greater the value of one variable, the greater the value of other variables. Conversely, for negative values (-), if the greater the value of one variable, the other variables will be smaller. suggests that the correlation strength number (r) is divided into: 1) 0.00 - 0.199: very weak, (2) 0.20 - 0.399: Weak, (3) 0.40 - 0.599: (4) Medium 0.60 - 0.799: (5) Strong 0.80 - 1,000: the significance value of p is as follows: a) If p value <0.05, the test results have a significant correlation. b) If the p value is 0.05, the test results have no significant correlation. and multivariate analysis to find out which variables are the most influential among the variables that have a P-value <0.25 and multivariate analysis using multiple linear regression with the provisions of the p-value <0.25. Multivariate analysis aims to determine the most influential variables and the ability of these independent variables to affect the independent variables.

**Result and Discussion**

The rice mill area in Kerjo Karanganyar District is a home industry that processes rice into rice Kerjo Karanganyar Subdistrict has 25 rice milling units spread across 7 villages, such as Botok Village with 2 rice mills, Karangrejo Village with 10 rice mills, Kutho Village with 1 rice mill, in Tawangsari Village with 4 rice mills, Ganten Village with 6 rice mills, Kwadungan Village with 1 rice mill and Sumberejo Village with 1 rice mill. The production process at 25 rice milling units in Kerjo Karanganyar Subdistrict is carried out indoors for 6 working days, namely Monday to Saturday, where Sundays and holidays are red. This rice mill operates for 8 hours / day from 07.00-16.00 WIB with a rest time of 1 hour from 12.00-13.00 WIB. Judging from the location, this rice

mill is located in the middle of a residential area close to rice fields, making it easier for farmers after harvesting because the distance between the fields and the rice mill is not too far away. All workers in the rice mill are male with a total number of workers in the rice milling area of Kerjo Karanganyar District of 50 people. Every rice mill in Kerjo Karanganyar Subdistrict has less ergonomic workplace conditions and causes workers to experience complaints of low back pain. Complaints of pain are caused by factors of age, years of service, and work posture.

Table 1 describes the characteristics of research respondents which consist of variables of age, years of service, work posture and LBP complaints. Age and work period are categorized based on 5 years, work posture is based on measurement results using the Rula method and LBP complaints based on the Oswestry Disability Index (ODI) Questionnaire. Table 1 shows that the majority of workers are in the age range 46-55 years

Table 1. Characteristics Distribution of Research Respondents

| Variable | Category | n | Max | Min | Rata-rata |
|---|---|---|---|---|---|
| **Age** | 26-35 | 6 | 28 | 57 | 45,66 |
| | 36-45 | 16 | | | |
| | 46-55 | 24 | | | |
| | 56-65 | 4 | | | |
| **Work period** | <5 year | 18 | 2 | 14 | 7,2 |
| | >5 year | 32 | | | |
| **Work Posture** | Low | 10 | | | |
| | Moderate | 21 | | | |
| | High | 19 | | | |
| **LBP** | low Disability | 10 | | | |
| | moderate Disability | 23 | | | |
| | high Disability | 17 | | | |

Source: Primary Data, 2020

Table 2 explains the relationship between the dependent variable and the independent variable. At the age of workers aged 46-55 years, the majority of complaints of LBP in the moderate and severe categories, as well as at work> 5 years and in the work posture, the results of the assessment using the Rula method, the majority are in the moderate risk work posture.

Table 2. About Cross Tabulation Between Dependent and Independent Variables

| Variable Dependent | LBP Complaints | | | *p-value* | *r* |
|---|---|---|---|---|---|
| | *Low Disability* | *Moderate Disability* | *High Disability* | | |
| Age | | | | | |
| 26-35years old | 2 (33.3) | 2 (33.3) | 2 (33.3) | 0.013 | 0.349 |
| 36-45 years old | 5 (31.3) | 8 (50.0) | 3 (18.8) | | |
| 46-55 years old | 3 (12.5) | 12 (50.0) | 9 (37.5) | | |
| 56-65 years old | 0 (0) | 1 (25.0) | 3 (75.0) | | |
| Work Period | | | | | |
| <5 years | 8 (44.4) | 8 (44.4) | 2 (11.1) | 0,000 | 0,481 |
| >5 years | 2 (6.3) | 15 (46.9) | 15 (46.9) | | |
| Work Posture | | | | | |
| Low | 5 (50.0) | 3 (30.0) | 2 (20.0) | 0,000 | 0,496 |
| Moderate | 2 (14.3) | 14 (66.7) | 4 (19.0) | | |
| High | 2 (16.7) | 6 (50.0) | 4 (33.3) | | |

Source: Primary Data, 2020

Based on the results of the multiple linear regression test, it was found that the p-value = 0.000 <0.05, which means that age, years of service, and work posture together have an effect on complaints of low back pain with an adjusted R2 value of 0.305, which means the size of the influence of age, tenure and work posture for complaints of low back pain is 30.5%.

This study involved 50 rice mill workers in Kerjo Karanganyar Subdistrict. The results of this study indicate that 48% of respondents aged 46-55 years of workers in rice mills, Kerjo Karanganyar District experience complaints of moderate low back pain. This indicates that a person's age is one of the factors causing complaints of low back pain which will increase with age (Karwowsky, 2011). Other studies have shown that people over 29 are at risk of low back pain For example, other studies have shown that those over 60 have a prevalence of low back pain> 60% (Ikeda et al., 2019). Respondents who had a service period of <5 years experienced complaints of low back pain in the amount of 36%, while respondents who had a service period of> 5 years experienced complaints of low back pain in the amount of 64%. This shows that there is a significant relationship between work tenure and complaints of low back pain, because the longer the working period the muscles will weaken.

The results of work posture measurements that have been carried out, the average score of work posture is 4.08. A total of 20% of respondents had acceptable work posture scores, 42% of respondents had scores of postures that needed change, and 38% of respondents had unacceptable work posture scores. Based on the results of these measurements, the work posture of rice mill workers is classified as unsafe because there are various insecure attitudes in the form of improper load transport, excessive workload and excessive muscle stretching. (Meucci et al.,2015). In addition, other studies have shown that there is a significant effect between sitting posture and complaints of low back pain (Pillai & Haral, 2018; Bontrup et al., 2019; De Carvalho et al., 2020)

The results of measurements of low back pain that have been carried out, the average score of low back pain experienced by respondents is 32.94. A total of 22% of respondents had a low back pain score with mild disability, 46% of respondents had a moderate low back pain score, and 32% of respondents had a low back pain score with severe disability. This shows that there is a relationship between age, years of service, and work posture on complaints of low back pain. The risk of these complaints will increase if the age is getting older, the long working period and the position of the body further away from the center of gravity are factors that cause low back, research shows that long standing work posture has a higher risk than sitting people. (Goswami et al., 2016; Hasegawa et al., 2018)

There are relationship between age, years (length) of work, and work posture on complaints of low back pain in rice mill workers in Kerjo Karanganyar District. The results of the statistical test of the relationship between age and complaints of low back pain show that there is a significant relationship between age and complaints of low back pain in rice mill workers in Kerjo District that the older person is, the flexibility of the muscles decreases, causing low back pain (Hoy et al., 2012; Asghari et al., 2019). This indicates that a person's age is one of the factors causing complaints of low back pain which will increase with age (Karwowsky, 2011; Blanchette et al., 2016).

The statistical test results of the relationship between working tenure and complaints of low back pain indicate that the tenure with complaints of low back pain in rice mill workers in Kerjo Karanganyar District with moderate correlation strength in a positive direction. The positive direction means that the increasing work period will also increase the score of complaints of low back pain for rice mill workers in Kerjo Karanganyar District. The results of statistical tests of the relationship between work posture and complaints of low back pain in rice mill workers in Kerjo Karanganyar District with moderate correlation strength with a positive direction. The positive direction means that increasing age will also increase the score of complaints of low back pain in rice mill workers in Kerjo Karanganyar District.

The results of multiple linear regression tests, age, years of service, and work posture together have an effect on complaints of low

back pain. This shows that there is a relationship between age, years of service, and work posture on complaints of low back pain. This is due to the increasing age and working period of the workers which means that they are more prone to complaints of low back pain, and poor work posture will also result in complaints of low back pain, especially in the agricultural sector. (Blanchette et al., 2016; Bontrup et al., 2019; De Carvalho et al., 2020). Research on ergonomic interventions for low back pain shows that there is a significant reduction in complaints of low back pain in the age group given the intervention and those not given the intervention. (Pillastrini et al., 2010). Apart from these factors, it is possible that there are socio-economic factors that affect the incidence of low back pain. Workers who are agricultural laborers with continuous and repetitive standing work postures are more at risk of experiencing low back pain (Tissot, Messing and Stock, 2009; Goswami et al., 2016; Pillai and Haral, 2018). As well as research in Japan, shows that there is a significant relationship between socio-economic factors and the incidence of low back pain (Ikeda et al., 2019). There are many other factors that influence low back pain in workers, such as socio-economic conditions, wages received and psychosocial factors. This significantly affects the complaints of low back pain in workers (Yang et al., 2016; Ikeda et al., 2019; Wami et al., 2019).

## Conclusion

The risk factors for workers experiencing complaints of low back pain consist of individual risk factors and factors from work. The results showed that individual risk factors and length of service were associated with low back pain and factors from work such as non-ergonomic work posture were also associated with low back pain.

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