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ORIGINAL RESEARCH ARTICLES

REVIEW ARTICLE

Suicide trends during COVID-19 pandemic in Gunungkidul, Indonesia

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ABSTRACT The COVID-19 pandemic had a tremendous impact on psychological burdens and may lead to suicide acts. Suicide is a global mental health problem that happens all over the world. This study was conducted to evaluate the effect of the COVID-19 pandemic on the suicide rates and estimate the category of male-female suicides. This study analyzed suicide data from the Gunungkidul Resort Police from April 2018 to April 2021. Gunungkidul Regency is one area in Indonesia with a high suicide rate. From that time of period, there were about 97 suicide cases as the sample of this study. This article estimated the suicide trend using time series forecasting and Chi-square tests to find potential differences before and after the outbreak. Chi-square analysis showed that there was no difference in the pattern of suicide before and since the COVID-19 pandemic ($X2 = 12.05$; $p > 0.05$), as well as the male rates ($X2 = 20.17$; $p > 0.05$). However, suicide among females has increased since the outbreak ($X2 = 23.43$; $p < 0.05$), especially among the elderly. This article recommended providing a support system, strengthening social networks, and widening the access of women and the elderly to health and psychological services during the pandemic.

1. Introduction

Suicide is a complex phenomenon with various psychosocial dynamics accompanied by experiences of isolation, depression, anxiety, and socio-economic pressures. Suicide has become a global health problem and has experienced a 60% increase in prevalence over the last 45 years. The World Health Organization (WHO) estimates that the prevalence of suicide in Indonesia reaches 3.7%, with a mortality rate of more than 8,900 people every year.[1] Indonesia does not have comprehensive suicide reports, and few areas show these statistics; data about suicide is based solely on police reports.[2,3] The absence of a national suicide registry system makes incidents go unreported and the reporting is considered only superficial.

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COVID-19 has become a global pandemic since March 2020, which has had a tremendous impact on health care systems and massively exacerbated mental health problems.[4] Systematic review has shown that the COVID-19 pandemic has a close relationship with the onset of psychological distress that can lead to mental disorders and pose a threat to the psychological well-being of society.[5] This increase in psychological problems can be associated with increased anxiety about contracting and being infected with the plague, job loss, increased family burden, domestic violence, social isolation, and the development of psychological distress.[6] Mental health problems that are not handled properly can have fatal effects such as depression, traumatic experiences, decreased well-being and quality of life, any of which can encourage suicidal ideation.

The COVID-19 pandemic was expected to lead to some unanticipated increases in the prevalence of suicide, even after this pandemic ends.[7,8] Mental

health issues and suicide are getting less attention during the COVID-19 pandemic. This pandemic has increased the population of vulnerable groups and multiplied their bitter burden. Restricted mobility through work/school from home and stay-at-home policies make people with mental health crises increasingly isolated and disconnected from physical sources of support.[9] The pandemic has also widened the treatment gap; more people are not getting the necessary professional treatment and care and there are strict restrictions on mental health services.[10]

The previous studies have shown a tendency to increase the prevalence of suicide due to prolonged macro crises, such as the uncertainty of political-security, economic recession, and war conflicts.[11-13] However, this situation has varying effects in different countries. Pandemics and health emergencies are reported to have contributed to the increase in the incidence of suicide, such as past experiences when SARS, Influenza, and Ebola outbreaks became pandemics/endemics in several countries.[14] COVID-19 pandemic has also been reported to increase suicide rates among women and young people in Japan, black people, and minorities in the United States.[15,16] In this regard, the impact of the health crisis and pandemics on increasing suicide rates can be understood as a manifestation of psychosocial, health distress and inequality experienced by society. Some parties in Indonesia provide a suicide prevention helpline, such as www.intothelightid.org or movementofrecovery.org, to help people who have suicidal thoughts, depression, and anxiety overcome their mental health problems.

This study covers only suicide cases in Gunungkidul Regency by considering the high number of suicides and the characteristics of local beliefs among the locals. Gunungkidul is one of the areas with a high suicide rate in Indonesia, with an incidence rate of up to 4.3 percent over the last 10 years.[2,3,17] This high suicide incidence is also steeped in local beliefs about *pulung gantung* as the mystical cause of suicide.[18,19] There are also accusations about socio-economic pressures, social isolation, and drought as the leading causes of the high number of suicides in Gunungkidul.[20,21] Andari (2017) analyzed data from the Gunungkidul police resort and

suspected mental health problems as a significant contributor to suicide (52%).

So far, there have been no studies or reports evaluating the impact of the COVID-19 pandemic on the increase in suicide cases in Indonesia, both at the local and national levels. Along with some mobility restriction policies by the authorities and the spread of delta variants, the second wave became very severe.[22] This study aimed to see the impact of the pandemic on the trends of suicide. This study was conducted to evaluate whether the COVID-19 pandemic affected the rate of suicide incidents by comparing the incidence rates before the pandemic. This report is expected to provide an overview of how to strengthen the community's mental health in the context of the COVID-19 pandemic.

2. Method

This research was conducted using a quantitative approach by analyzing secondary data concerning suicide. This study is limited to the trend of suicide cases in Gunungkidul Regency by analyzing suicide data from the local resort police. The data were collected from the official police reports of Gunungkidul from 18 districts (more or less 144 villages). A total of 97 suicide incidents have occurred from April 2018 to April 2021 (see Figure 1).

This study estimates the possible effect of the COVID-19 pandemic on suicide rates using time series forecasting and chi-square analysis. Descriptive quantitative analysis was also applied to compare the percentage of incidents based on existing demographic factors and to see the trend of incident patterns before and during the pandemic. Time series forecasting analysis was used to predict the number of suicide incidents from April 2018 to March 2020. These 24-month data were used to predict suicide incidents since COVID-19 in Gunungkidul in April 2020 to April 2021. Chi-square analysis was used to compare expected numbers and observed numbers at the intersection of the pandemic period. The pandemic period started from April 2020 to April 2021 as observed numbers, while data from April 2018 to March 2020 were calculated as a predictive value using time series forecasting analysis. This prediction produced the expected numbers from
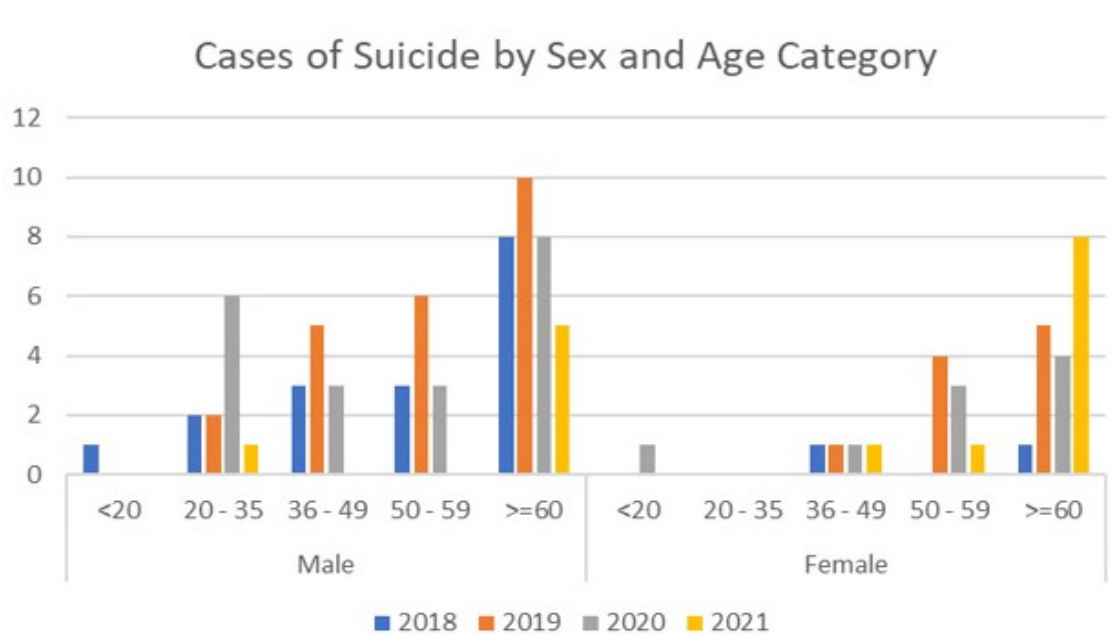
Figure 1. Cases of suicide by sex and age category.
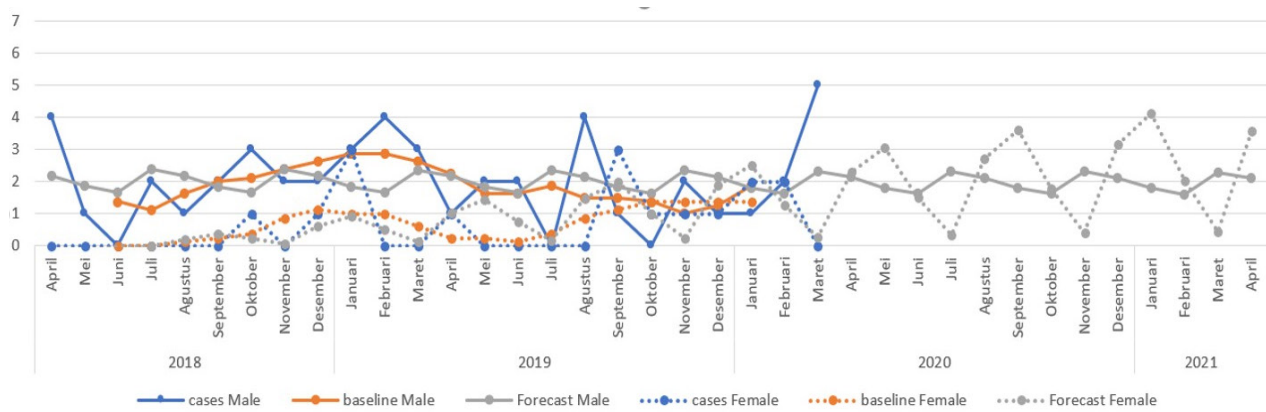
Figure 2. Time series forecasting on suicide cases based on sex.

April 2020 to April 2021. This calculation was done using the Moving Average model. Time series forecasting and chi-square analysis were calculated using the Microsoft Excel program.

Calculations were made on the overall data: both, male and female category data. To generate predictive values from April 2020 to April 2021, the analysis was done by calculating the Moving Average data with a 4-month pattern, namely the average data in month 1 (April 2018) to month 4 (July 2018), and so on. Then the baseline (Centered Moving

Average) was compiled by calculating the average of the results of the first MA(4) data and the second MA(4) data and so on, and counting cases by dividing them into baselines. Furthermore, deseasonalized data were calculated by dividing the case data by the seasonality value. The regression coefficient was formulated based on the trend component. In this case, the forecast value was obtained by multiplying the seasonality value with the trend component. The potential difference between the observed and expected numbers is seen after getting the predicted

values from April 2020 to April 2021.

3. Result

There were 97 cases of suicide from April 2018 to April 2021. During those 37 months, 66 cases (68.04%) were committed by men (M = 57.33 years old, standard deviation [SD] = 20.91) and 31 cases (31.96%) by women (M = 65.45 years old, SD = 17.14). However, throughout 2021 there was a change in trend; cases of suicide were higher in women (62.0%). Based on the age category, suicide cases also were more dominant in the elderly compared to other age groups (see Figure 1). Prior to the pandemic, the elderly women accounted for 5%-15% of the total incidence; and the proportion of suicides in elderly women contributed 50% of the total incidence in that year. In addition, the case of suicide in elderly men is also very high (31.25%) among all male suicides.

Time series analysis for men and women with the Moving Average model obtained predictive results as shown in Figure 1. The time series shows that suicides appeared to be higher in men than women before the pandemic. In addition, the pattern of cases in women looks more volatile and tends to increase. Furthermore, this analysis predicts a pattern of suicide that tends to be static in the men category and an increasing trend in women.

The pattern of forecasting data for men (gray line) shows that the pattern before and during the pandemic is flat enough, which indicated the pattern of the actual and forecasting data controlled by the baseline. Actual data for the men category could not be described. For the women category, the pattern of forecasting data is fluctuated enough (gray line with dot). The actual data for the women category show that there were some suicide cases in some periods, but there are some other periods that have no cases at all.

In general, the pattern of suicide cases seems to tend to decrease from the COVID-19 outbreak (March 2020) to April 2021. Chi-square analysis showed that there was no difference between the observed numbers and the expected numbers in the general trend of suicide (X2 = 12.05; p > 0.05), and

in the trend of suicide in men (X2 = 20.17; p > 0.05). This analysis only shows differences in suicide rates among women (X2 = 23.43; p < 0.05).

4. Discussion

Gunungkidul has attracted researchers attention to draw up a map of how to overcome the high rate of suicide. Although, no efficacious solution has yet been found. Several reports have estimated the prevalence of suicide in Gunungkidul to exceed the national trend.[2,3] Several parties have proposed explanations and factors behind the high number of suicides in Gunungkidul, such as poverty and social change, distortion of meaning applied to the belief of "pulung gantung", mental health issues, and to the absence of adequate resources.[17,18,19,21]

This study was conducted to estimate the effect of the COVID-19 pandemic on suicide patterns. This article underlines no difference in the trend of suicide before and since the COVID-19 pandemic in Gunungkidul, Indonesia. This article reports that the pandemic did not affect the increase in the trends of suicide in Gunungkidul, but there has been a marked increase in women since the pandemic was announced in March 2020. The COVID-19 pandemic has the potential to increase the risk factors for suicide in women and the elderly. Previous studies have shown that the vulnerability of the elderly to commit suicide is related to loneliness, such as the absence of a caregiver and lack of social support, illness, decreased independence in carrying out activities of daily living, depression, and anxiety disorders.[20,23] The increase in suicide in women has been linked to gender inequality associated with psychosocial stressors, such as low social economic status (SES), domestic violence, and economic dependence.[24] Suicide susceptibility in women is associated with women reported as the most affected party, and the increase in domestic violence, health inequality, and a doubled household burden.[25-27]

Decreasing suicide rates during the COVID-19 pandemic can be attributed to strengthening social integration in society as a community coping mechanism in dealing with broad crises, as in the experience of the SARS outbreak or war crisis.[13,14] This strengthening of social integration has increased

community engagement and connectedness, which can be protective factors against suicidal behavior. During a pandemic, people become more open to emotions and internal conditions towards other people. The community has actively made various efforts to provide mutual support, especially vulnerable groups with low SES. This effort has become a collective consciousness as well as a social mechanism to work together and connect with people. Besides that, there are sociocultural factors that can lead to suicide in women, such as childhood adversities, including physical, emotional, and sexual abuse.[24]

The report of this article has a similar pattern to some reports from Saudi Arabia, Argentina, Nepal, and Japan that noted an increase in female suicides during the pandemic. The meta-analysis study also estimated that during the pandemic, women thought more about suicide, attempted self-harm, and attempted suicide.[15,29-32] Social restriction policies by the authorities are associated with the emergence of anxiety, fear, and depression, which can lead to suicidal thoughts; this situation is more commonly reported in women.[33]

This article also suggests potential reporting and data management gaps on attempted suicides. Higher rates of suicide in men are associated with greater capability and choice of fatal method.[34,35] However, women have a higher intensity and make more suicide attempts than men.[1] The increase in suicides in women indicates an increase in the intensity and variety of trials that preceded it. All parties should be aware of this situation, considering that attempted suicide is an "iceberg phenomenon" in suicide reports. On the other hand, there is no national registry mechanism that records and reports attempted suicide attempts, which causes increasing focus on handling and recovering from the pandemic.

It is crucial to strengthen the community, especially women and the elderly, in suicide prevention. Strengthening the domestic economy can be done by providing incentives, social assistance, access to capital, and relaxation of payments. The role of women in the family economy can help overcome the economic difficulties experienced during the COVID-19 pandemic. It is also important for empowering community mental health with supporting policies and infrastructure by strengthening mental health services at the basic service level and collaboration between stakeholders, such as schools, communities, and health centers.

This study acknowledges there are limitations and suggests some practical aspects to anticipate. Suicide data in this study cannot explain whether the suicide perpetrators are people who are directly affected (e.g., patients, family members of COVID-19 patients, and layoffs) or who are indirectly affected by the COVID-19 pandemic. The results of this study are not intended to generalize or be understood causally, considering the act of suicide contains a complexity of factors that cannot only be affected by the COVID-19 pandemic. Although this study found a limited difference in trends, this change may be a manifestation of random patterns as in previous studies.[3] This study also analyzes limited data and also influences the level of sensitivity of predictive patterns. In addition, this article does not reveal whether the decline in the trend of suicide is also accompanied by a decrease in suicidal ideation or the attempts.

5. Conclusion

This study analyzed local suicide data and found that the COVID-19 pandemic did not significantly affect the increase in suicide incidents in Gunungkidul. The trends of suicide before the pandemic did not show a significant difference with the pandemic period. However, gender-level analysis shows that there has been an increase in female suicides since the pandemic. Most of the suicide perpetrators are elderly people, both men and women.

This study proposes evaluating the pandemic's impact on suicide rates longitudinally and using a broader surveillance system. This suicide prevention strategy needs to be implemented by prioritizing women and the elderly. This study also recommends providing support systems, strengthening social networks for women and the elderly during the pandemic, and widening access to health and psychological services. As reported above, the results of this study have the same pattern as some studies that showed women had a higher risk for suicide.

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Decreasing degrees of dyspnea in chronic obstructive pulmonary disease patients through combination of breathing exercises and relaxation

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ABSTRACT Shortness of breath (dyspnea) is a common symptom that accompanies patients with Chronic Obstructive Pulmonary Disease (COPD). Management of dyspnea in patients with COPD is not only using pharmacological therapy but also non-pharmacological therapy. Non-pharmacological therapy for patients with COPD covers three main aspects: breath, mind, and functional processing. Along with the development of complementary therapy in nursing science, nursing interventions that can be done at home begin to be in great demand because of their low cost and time effectiveness. One of the interventions is providing breathing exercises and relaxation for patients with COPD to reduce the dyspnea complaints, increase the strength of breathing muscles and prevent the hospital re-admission due to acute exacerbation. This study aimed to see the effectiveness of the combination of Pursed Lip Breathing (PLB) and Progressive Muscle Relaxation (PMR) on the degree of dyspnea. This quasi-experimental study was conducted with a pre and post-test design approach with 20 respondents in each group. The results showed significant differences in the degree of dyspnea after the combination of PLB and PMR (p < 0.05). The results from this study recommend improving the development of complementary therapy programs in nursing education and services by modifying nursing care standards with the combinations of PLB and PMR for patients with COPD.

1. Introduction

Chronic Obstructive Pulmonary Disease (COPD) contributes significantly to high morbidity and mortality rates. It represents about 6% of all causes of death worldwide, leading to the deaths of 3 million people every year.[1] In 2015, there were an estimated 3.17 million patients worldwide, with COPD making up 5% of them. This trend made COPD the fifth most prevalent disease in the world by 2020.[2,3]

Almost 90% of COPD deaths occur in Lower-Middle-Income Countries (LMICs), with Indonesia being one of the countries included in the category of high risk.[4-6] Socio-economic conditions are the main determinants in determining health status. Thus, there is a strong relationship between socio-economic conditions and the prevalence of COPD, with high rates of morbidity and mortality in LMICs.[7]

COPD has bio-psycho-social-spiritual impacts on sufferers. The main problem that patients with COPD always complain about is shortness of breath or dyspnea, which is commonly encountered in patients with lung disease.[8] Dyspnea was reported by nearly all (98%) of 833 patients with COPD in a web-based survey conducted in 17 countries. The degree of dyspnea in patients with COPD has a significant correlation with survival rates over the next 5 years.[9] The severity of dyspnea also deteriorates as COPD

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worsens, which contributes to the patient's quality of life.[10]

Managing dyspnea in patients with COPD uses not only pharmacological therapy, but also non-pharmacological therapy. There are three main aspects of non-pharmacological therapy for patients with COPD: breath, mind, and functional treatment. These three factors are beneficial in enhancing COPD patients' quality of life.[11,12] Pursed Lip Breathing (PLB) is one type of breathing exercise that can be used to reduce the symptoms of shortness of breath in patients with COPD. Relaxation techniques are another non-pharmacological treatment option for patients with COPD. Mind-body therapy is used in this technique, which targets the sympathetic and parasympathetic nervous systems. Progressive Muscle Relaxation (PMR), diaphragmatic breathing, attention-focusing exercises, and behavioral relaxation training are the four major types of relaxation.[13]

Along with the development of complementary therapy in nursing science, nursing interventions that can be done at home begin to be in great demand because of the low cost and time effectiveness. One of the interventions is providing breathing exercises and relaxation for patients with COPD to reduce the dyspnea complaints, increase the strength of breathing muscles and prevent the hospital re-admission due to acute exacerbation. This study aimed to see the effectiveness of the combination of PLB and PMR on the degree of dyspnea.[2]

2. Method

2.1 Design and participants

This quasi-experimental study was conducted in two major public hospitals in Jakarta and Bandung, from July 2019 to November 2019. A total of 40 respondents diagnosed with COPD grades I-II were chosen using consecutive sampling techniques and assigned into two intervention groups. The researchers included respondents from Bandung in the first group, and respondents from Jakarta in the second group. The approach split up the groups based on the situation and conditions in the field where the research approval from the hospital in Jakarta was given, and the procedure in the Bandung

hospital was done on more than half of the target respondents.

Before beginning the study, all participants were given a thorough explanation of the technical implementation of the research, as well as the potential benefits and drawbacks they might encounter. Participants who agreed to participate in the study signed an informed consent form following the explanation. The Faculty of Nursing Universitas Indonesia and both hospitals provided ethical approval for the study.

2.2. Measures

The Modified Medical Research Council (mMRC) Dyspnea Scale was used in this study to assess pre- and post-intervention dyspnea. The mMRC Dyspnea Scale is a 5-point (0 – 4) scale based on the severity of dyspnea. For seven days, the group I was given a combination of PLB and PMR for ten minutes twice a day. Similarly, for seven days, group II received PLB for ten minutes twice a day. The severity of dyspnea was assessed before and after the intervention.

2.3. Data collection

Medical records were used to collect the patient's gender, age, length of suffering COPD, smoking habits, previous history of exposure to substance irritant, lung infection, and using pulmonary drugs, nutritional, and socio-economic status. Before beginning the study, the researchers explained the objectives and methods. All participants were fully included in the study with personal consent, were free to leave at any time, and the data collected were kept confidential, so the participants' names were not listed in the results.

2.4. Intervention

The researchers assessed the respondent's degree of dyspnea at the first meeting using the mMRC instrument Questionnaire Dyspnea Scale. Respondents and their families were given educational leaflets and explanation sheets of the self-report exercises by the researcher. The researchers demonstrated the exercises to the respondents using a video tool. Furthermore, the researchers assessed

Table 1. Correlation between respondents' characteristics and degree of dyspnea

Variable	Group 1					Group 2				
	Degree of dyspnea		Total		p-value	Degree of dyspnea		Total		p-value
	Severe	Mild	n	Total		Severe	Mild	n	Total	
1 Sex										
Male	2	16	18	90		8	8	16	80	
Female	0	2	2	10	1.000	1	3	4	20	0.91
Total	2	8	20	100		9	11	20	100	
2 Smoking habits										
Smoking	2	16	18	90		7	9	16	80	
Never	0	2	2	10	1.000	2	2	4	20	1.000
Total	2	18	20	100		9	11	20	100	
3 History of exposure to substance irritants/pollutants										
Ever	2	15	17	85		8	2	10	50	
Never	0	3	3	15	1.000	1	9	10	50	0.005
Total	2	18	20	100		9	11	20	100	
4 History of lung infection										
Ever	2	11	13	65		7	9	16	80	
Never	0	7	7	35	0.521	2	2	4	20	1.000
Total	2	18	20	100		9	11	20	100	
5 Comorbidities										
Yes	1	11	12	60		3	3	6	30	
None	1	7	8	40	1.000	6	8	14	70	1.000
Total	2	18	20	100		9	11	20	100	
6 Use of pharmacological therapy										
Use	1	10	11	55		7	3	10	50	
Not use	1	8	9	45	1.000	2	8	10	50	0.70
Total	2	18	20	100		9	11	20	100	
7 Nutritional status										
Poor	2	10	12	60		6	3	9	45	
Good	0	8	8	40	0.495	3	8	11	55	0.175
Total	2	18	20	100		9	11	20	100	
8 Socio-economic status										
Low	2	16	18	90		9	9	18	90	
High	0	2	2	10	1.000	0	2	2	10	0.479
Total	2	18	20	100		9	11	20	100	

Fisher's Exact Test, significant p > 0.05.

the respondent's psychomotor abilities by having the respondent independently perform the exercises. As a guide for the respondents when doing the exercise, the researchers/research assistants distributed a soft copy of the video of the stages of the exercise to the respondent and the accompanying family. During the study period, the researchers/research assistants attempted to ensure that there were no other interventions involving the respondents.

For seven days, the exercises were performed for 10 minutes, twice a day (morning and evening) before the participants ate. From the second to the seventh meeting, the respondents were accompanied by the researchers and a family member or caregiver while performing the exercise procedure. Following the exercise procedure, the respondents completed a self-reporting form as evaluation material. On the last day of the study, this self-reporting form was returned to the researchers.

Table 2. Degree of dyspnea before and after intervention

Degree of dyspnea	Group 1					Group 2				
	Before		After		p-value	Before		After		p-value
	n	%	n	%		n	%	n	%	
Severe	15	75	2	10		10	50	9	45	
Mild	5	25	18	90	0.000	10	50	11	55	1.000
Total	20	100	20	100		20	100	20	100	

Mc Nemar Test, significant p > 0.05.

Table 3. Difference in degree of dyspnea after intervention

Degree of dyspnea	Group 1		Group 2		p-value
	n	%	n	%	
Severe	2	10	9	45	
Mild	18	90	11	55	0.034
Total	20	100	20	100	

Chi-square test, significant *p* > 0.05.

If the respondent was allowed to leave the hospital before completing the 7-day intervention, one of the researchers made a home visit in the morning or evening, as agreed upon with the respondent, to aid and evaluate the implementation. If the researcher made a home visit in the morning, the researcher performed follow-up care in the afternoon by contacting the respondent or family via telephone or video call to ensure that the respondent had independently performed the exercises. After seven days of exercise, the researcher used the mMRC Dyspnea Scale to assess the degree of dyspnea.

2.5. Statistical analysis

The data were analyzed using SPSS version 22.0 software (IBM Corp., Armonk, NY), as well as descriptive and inferential statistical methods. The association between confounding variables and degree of dyspnea were confirmed by the Fisher's exact test and independent *t*-test. Furthermore, the statistical significance level was set at *p* < 0.05.

3. Result

As many as 85% of the respondents in this study were male; 85% of respondents are active smokers and ex-smokers; 82.5% of respondents are frequently exposed to irritants/pollutants; 57.5% of COPD respondents had a lung infection; 55% of COPD respondents had no comorbid disease; 52.5% of COPD respondents used pharmacological therapy to treat complaints of shortness of breath; 52.5% of respondents fall into the category of poor nutrition, and 90% of respondents have low income. The overall mean age of the patients was 55.55 ± 14.254 years and the mean length of suffering COPD was 2.53 ± 2.195 years.

Tables 1-3 show the bivariate analysis between the respondents' characteristic and the degree of dyspnea. Further analysis showed that most of the respondents' characteristics did not have a significant relationship with the degree of dyspnea (*p* > 0.05); except history of exposure to irritants/pollutants in the group II (*p* < 0.05).

The differences in dyspnea severity between the two intervention groups are shown in Tables 2–3. Further investigation revealed a significant difference in the degree of dyspnea in patients with COPD before and after a combination of PLB and PMR (*p* < 0.05; Table 2). In this study, however, there was no significant difference in the degree of dyspnea before and after PLB (*p* < 0.05; Table 2). The degree of dyspnea after exercise differed significantly

between the two groups, according to the results of the analysis ($p < 0.05$; Table 3).

4.   Discussion

The combination of physical exercises in the form of breathing and relaxation significantly improves the patient's ability to regulate breathing patterns, which helps to reduce the severity of dyspnea. There was a significant difference in dyspnea severity between the group that received only PLB training and the group that received both PLB and PMR. The results of this study support the hypothesis that the combination of PLB and PMR has a differential effect on the severity of dyspnea in patients with COPD. In addition, the combination of PLB and PMR administered to COPD patients significantly altered their dyspnea levels.

Men and women have different phenotypes in response to cigarette smoke exposure. Males are more resistant to the emphysematous phenotype, whereas females are more vulnerable to the airway phenotype. The differences in sexual responses to disease are thought to be caused by the body's immune response based on sexual dimorphism. As a result, it is recognizable why men and women respond differently to illness.[14] Patients with COPD in this study included not only elderly people but also young adults. The youngest respondent who was diagnosed with COPD in this study was 20 years old and had a history of smoking since the age of seven. Smoking at a young age has caused a shift in this phenomenon.

This study did not find a significant relationship between duration of COPD and degree of dyspnea. The patients have not felt the severity of respiratory symptoms due to decreased lung function in COPD degree I. The clinical diagnosis of chronic bronchitis, which is one of the clinical features of COPD, is established if the patient has had a cough for at least 3 months in 2 consecutive years.[8] However, in the elderly who experience symptoms of chronic cough and often come for treatment at health facilities, it is often not detected that they have COPD.[15] This causes differences in the length of time experiencing COPD in published studies.

As many as 42% of patients reported having COPD for 2-5 years or more. The length of time a patient suffers from COPD is directly proportional to the degree of obstruction suffered; thus, the longer the patient suffers from COPD, the worse the patient's quality of life will be.[16] Exacerbations of COPD, on the other hand, have the potential to worsen the patient's quality of life regardless of how long the patient has had COPD.[17]

Most previous studies have found a link between smoking and COPD. As many as 90% of patients with COPD are current or former smokers.[18] The high rate of cigarette consumption in Indonesia is closely related to the ease with which tobacco products can be obtained in public places. In addition to having easy access to cigarettes, the low selling price of cigarettes allows people with low-income to purchase them.[19]

Statistically, there was no significant relationship between the history of lung infection and the degree of dyspnea in this study. In 2019, GOLD reported that bacterial infections cause more than half of all COPD exacerbations.[8] The lack of a significant relationship between a history of pulmonary infection and the degree of dyspnea in this study could be related to how the study criteria were determined. Patients with COPD with degrees of obstruction I-II, indicating early-stage COPD, were one of the inclusion criteria in this study. As a result, the impact of lung damage has been minimal.

Metabolic disease is a significant comorbidity in COPD. This high metabolic comorbidity is due to all respondents having the same cardiometabolic risk factor, namely smoking. COPD alone can increase the risk of vascular damage by two times in patients with coronary heart disease, 3.9 times in patients with heart failure, 2.4 times in patients with arrhythmia, and 1.5 times in stroke patients.[20] Comorbidities can predict mortality in patients with COPD using the COPD Specific Comorbidity Test index, but their role as predictors of acute exacerbations in COPD is still being debated.[21] In this study, 45% of the subjects had no comorbid disease. But since 40% of respondents in this study had been diagnosed with COPD for less than a year, they did not have systemic COPD side effects.

Hanania and O'Donnell found that using bronchodilators in combination with long-term-agonist receptors significantly increased dyspnea symptoms as measured by the St. George Respiratory Questionnaire (SGRQ).[22] The Food and Drug Administration (FDA) does not recommend dual bronchodilators as a therapy to reduce dyspnea complaints based on this assessment.[22-26] This study is not in line with the research of Lee et al. on 102 patients with stable COPD taking pharmacotherapy to reduce dyspnea symptoms. Treatment response was evaluated after three months of drug use. Based on the mMRC Dyspnea Scale and COPD Assessment Test assessment (CAT), it was found that there was a decrease in the degree of dyspnea after three months of using pharmacotherapy.

Mete et al. discovered a link between high dyspnea scores and low body mass index (BMI) scores. Their study included 105 COPD inpatients using a nutritional assessment instrument with a 24-hour recall for three consecutive days.[27] Furthermore, Baig et al. discovered a significant relationship between BMI and upper arm circumference on the degree of dyspnea and severity of COPD in 138 hospitalized patients with COPD. The findings of this study did not show a relation between nutritional status and the degree of dyspnea in patients with COPD.[28] The researchers analyzed this based on the respondents' smoking habits. Patients have a tendency to continue smoking in order to control their body weight.[29] As a result, the respondent's nutritional status has no significant bearing on his or her decision to smoke.

Borné at al. conducted a study on 118,134 subjects with COPD ranging in age from 40 to 89 years in Sweden. Borné stated that there was no statistically significant relationship between socioeconomic status and the incidence of COPD in nonsmokers. Borné argued that a smoker's socioeconomic status is closely related to the risk of COPD.[30] Kanervisto et al., who also discovered a link between respiratory tract obstruction disease with low socioeconomic status, as defined by low levels of education and income.[31] Patients with COPD with low income are 2.1 times more likely to have acute COPD exacerbations.[32] Furthermore, the rate of mortality in COPD patients with low incomes is 2.5 times higher than in COPD patients with high incomes.[33] People with low socioeconomic status are more likely to engage in unhealthy behaviors such as smoking, lack of physical activity, and poor dietary intake.[34]

People with lower socioeconomic status are more vulnerable to disease. A person with high socioeconomic status can live a healthier lifestyle by receiving regular medical treatment and check-ups, living in a clean environment with low pollution levels, purchasing healthy and nutritious food, participating in sports groups such as Zumba or yoga, and being able to pay for smoking cessation therapy. The findings of this study revealed that there was no significant relationship between socio-economic status and the degree of dyspnea. The researchers analyzed this in terms of the respondents' smoking habits, with 85% of the respondents in this study being smokers or ex-smokers. Tobacco use has evolved into a physiological, psychological, and social dependency trait. Dependence on nicotine in cigarettes is a behavioral disorder.[29]

PLB exercises are designed to improve oxygen transport, train expiratory muscle strength, increase airway pressure during expiration, decrease airway obstruction, and prevent lung collapse. Other studies have demonstrated that PLB can temporarily reduce the sensation of dyspnea, allowing individuals to control their breathing independently and in accordance with their body's tolerance. The process of pursed lips will lengthen the duration of expiration, thus decreasing the dead space in the airway. The manipulation of breathing patterns can be advantageous for cardiovascular and respiratory control in physiological and pathological conditions. Increased venous return, for instance, can aid in maintaining stable blood pressure during rest periods in critical illness.[35]

The pursed-lip maneuver is utilized frequently in respiratory rehabilitation programs. The purpose of pursed lips is to increase respiratory efficiency and provide better control during periods of dyspnea by increasing resistance during expiration and thereby decreasing the respiratory rate. Pursed lips facilitate breathing with a longer expiration duration and reduced lung volume at the end of exhalation.[35,36] In addition, PLB increases vagal modulation, which may

be associated with a reduction in respiratory rate.[37] PLB can decrease respiratory rate and raise SpO2 levels. This breathing exercise is also recommended to reduce dyspnea symptoms, boost self-esteem, and alleviate night-time anxiety. Due to the mechanism of increased airflow during the expiration process, PLB results in a decrease in respiratory frequency.[38] While the use of accessory muscles during respiration results in an increase in tidal volume, an improvement in the exchange process, and adequate breathing, the use of accessory muscles does not affect tidal volume.[36]

The Randomized Clinical Trial (RCT) research conducted by Seyedi Chegeni et al. demonstrated that eight weeks of home-based PMR successfully reduced fatigue and improved certain components of sleep quality in COPD patients with obstructive degrees III to IV at Shohada Teaching Hospital, Iran.[39] Similarly, Volpato, Banfi, Nicolini, and Pagnini conducted an RCT study on patients with COPD at the Don Gnocchi Hospital in Milan. The research indicated that relaxation exercises have the potential to improve the functioning of the heart and lungs, as well as make people feel better and less anxious.[40]

In this study, the researchers did not conduct an inter-rater reliability test on the research assistants in the second group. Therefore, researchers cannot be certain of the perceptions held in common by the researchers and research assistants regarding PLB training. However, the research assistants recruited for this study already possess research experience, having worked in the respiratory field for more than five years and possess a Bachelor of Science in Nursing degree. Consequently, the research assistants have been generally considered acceptable enough to provide PLB training in terms of competence.

This study's findings can be used to improve COPD patients' ability to self-manage their disease and reduce the frequency of acute exacerbations. For therapy to be effective, nursing personnel who are competent in providing this combination of breathing exercises and relaxation techniques are required. This combination of exercises is applicable for both inpatient and outpatient COPD patients. The findings of this study can also be used to create a comprehensive Standard Operating Procedure that enables nurses to independently care for patients using a combination of PLB and PMR.

5. Conclusion

This study's findings show that there is a significant difference in the degree of dyspnea after performing a combination of PLB and PMR. Thus, combining PLB and PMR has an indirect effect on improving lung function, as evidenced by a reduction in dyspnea after seven days of intervention. Except for the degree of dyspnea, improvements in lung function and functional capacity in patients with COPD can also be assessed using sputum production, spirometry values, and the number of exacerbations. As a result, this study can serve as a reference and provide preliminary data for future research for patients with COPD by investigating the relationship between the combination of PLB and PMR and other indicators of disease severity.

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Conflict of interests

The authors declared no conflict of interest.

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Kakak tumbuh kembang (KUMBANG): Engaging medical students for screening and detecting growth and developmental delays in children

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ABSTRACT The current COVID-19 situation has disrupted routine growth and developmental screening programs for children delivered by the Community Health Centers (Puskesmas). The KUMBANG project aims to provide a 'new normal' alternative in screening for children's growth and development by involving medical students and using online platforms. This study aimed to assess the project's reach in screening growth and developmental delays while also exploring the project's effectiveness through parents' perspectives. Collaborating with the Center for Indonesian Medical Students' Activities (CIMSA) Universitas Gadjah Mada, we recruited and trained 33 volunteers. Volunteers screen for children's development through an online platform, while the community volunteer cadres measure children's growth through COVID-safe offline appointments. We analyzed children's growth using the WHO Anthro Survey Analyzer and children's development according to the Kuesioner Pra Skrining Perkembangan guidelines. Parents' perspective on this project was assessed through a survey. A total of 92 under-five years old children from four Posyandu in Puskesmas Gondokusuman participated in the project. Around 29% (27/92) of the children had nutritional problems, either underweight, stunted, wasted, or a combination. Meanwhile, 34% (29/84) of children were at risk of developmental delays, of which five were suspected to have developmental delays, while 24 had dubious results. Parents reported that this method is sufficiently effective in screening for children's development and were comfortable with the online screening, since it is more COVID-safe. Parents also felt comfortable communicating with volunteers and believed that the medical students could provide valid and reliable information. In conclusion, KUMBANG project offers a good alternative for screening children's growth and development during the current disrupted routine screening. Involving medical students could help in service delivery, since health professionals are relatively occupied with COVID-19 management. The online method used in this project should be considered as a prospective option for routine screening.

1. Introduction

Growth and developmental delays have been an issue affecting millions of children around the world. These problems affect not only the children but also the caregivers and families, causing an overall decreased quality of life for all parties involved. Furthermore, the impacts also last for short- and long-term, contributing to lower human capacities in the future.[1–3]

In regard to those concerns, the integrated health service post (Pos pelayanan terpadu/Posyandu) has been the mainstay approach by the Indonesian government to address growth and developmental delay issues. Through Posyandu, health cadres would conduct routine screening at the community

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level while also delivering public health programs such as offering free health consultations. In terms of growth and development, one of the tools is a screening book given to pregnant mothers. This book consists of charts that could help mothers and health cadres screen for growth and developmental delays in children aged 0 - 6 years old.[4] However, it was found that health cadres only focus on filling-out the growth chart, often causing children at risk for developmental delays to be undetected and miss the opportunity for a better outcome through earlier intervention.[5]

The current ongoing Coronavirus Disease 2019 (COVID-19) pandemic has severely disrupted lives and people's way of living globally since 2020, especially for health service deliveries. One of the most affected services has been Posyandu, specifically the Indonesian integrated health and nutrition services on the community level that mainly target maternal and child health. Since the implementation of physical distancing measures in 2020, many Posyandu routine checkups have been cancelled up until today. This disrupts some of the essential services for child health: routine growth and development screening and monitoring.[6,7] This disruption could hinder the achievement of one of the health priorities set by the Indonesian government, which is the eradication of stunting. Therefore, we introduced the KUMBANG Project, a portmanteau of Kakak Tumbuh Kembang, which means 'older siblings' of growth and development. This program aims to help mitigate Posyandu disruption by providing additional screening and educational seminars involving medical students using a COVID-safe approach. This program consists of two phases: recruiting and training medical student volunteers to screen growth and developmental delays in children and performing screening, education, and follow-ups to parents and children through online delivery.

A previous study in the same field conducted in 2007 found that around 36% of the children screened were at the moderate or high risk of developmental delays.[8] Health cadres were also found to be less aware when it comes to developmental landmarks compared to growth landmarks.[5] Therefore, to rectify this discrepancy, screenings are done to help raise awareness of parents and health cadres and detect children at risk of developmental delays. Medical students are introduced to perform the screening and communicate with parents to work on growth and developmental delay issues. In addition to the benefits for the community, this form of community outreach has proven successful to retain knowledge, skill, and communicating in the sociocultural context that would help with the medical students' future careers.[9]

Yogyakarta is one of the major cities in Indonesia, mainly known as the city of education. However, despite this endearing title, Yogyakarta is also the city with the highest social inequality in Indonesia based on the Gini ratio.[10] This raised the concern regarding its already low developmental index score compared to the average of Indonesia that the number might be even lower in areas with low socioeconomic status.[11] On top of that, a sociocultural stigma might lead to denial of children's developmental growth issues, such as believing that when children walk first, they will talk later and vice versa, which is a common misperception. This causes the normalization of early signs of developmental delays, which is a concerning issue.

This study aimed to assess the project reach in detecting children with nutritional problems and at risk of developmental delay and exploring the project effectiveness through parents' perspectives. Furthermore, the study results will help us better understand the applicability of the project and advocate relevant stakeholders regarding alternative approaches to Posyandu during this pandemic situation.

2. Method

2.1. Project design

A collaboration between the Center for Indonesian Medical Students' Activities Universitas Gadjah Mada (CIMSA-UGM) and Capella Project Foundation, a non-governmental organization focusing on children's growth and development, was conducted prior to the project planning. The roles of the students in the project were vital since they were expected to be the volunteers in organizing and conducting the project. A total of 33 medical students signed up for

Table 1. Sample characteristics

Characteristics	n	Percentages
Age in months		
6 to 12	13	14.1%
13 to 24	20	21.7%
25 to 36	28	30.4%
37 to 48	22	23.9%
49 to 59	9	9.8%
Sex		
Male	41	
Female	51	
Posyandu		
Manisjangan 18	20	21.7%
Manisjangan 20	30	32.6%
Sere 11	20	21.7%
Handilem 13	22	23.9%
	92	100%

the volunteer role and participated in the volunteers' briefing and training and the project execution phase. Volunteers were expected to be actively engaged throughout the project under the supervision of the project steering committee, including a representative from CIMSA-UGM, Project Officer of KUMBANG, and an advisor from the University of Melbourne as the funder of the project.

Prior to the project execution, all volunteers were trained by pediatricians in the form of a two-days seminar and two-hours workshop and they took part in pre-and-posttest sessions. Training material included children's growth and development and early detection of delay in children's growth and development. Volunteers were grouped in a pair of two and responsible to interview five to six parents. To accommodate volunteers' and parents' schedule, volunteers were asked to contact parents and organize the interview in their own flexible time. All consumables spent by the volunteers were reimbursed by the project committee.

2.2. Study setting, study population, and sample

This study used a cross-sectional design and was conducted in March-April 2021 in four Posyandu under the working area of Gondokusuman Primary Health Center (Pusat Kesehatan Masyarakat/Puskesmas), Yogyakarta City. The study population included parents of under-five years old children living in the City. The selection of study location (Puskesmas) was

based on convenience sampling and assisted by the Department of Health, Yogyakarta. All parents living in the four working areas of the selected Posyandu were eligible to participate in the study. Inclusion criteria consisted of children aged 0-59 months living in the study area and had no apparent illness, assessed by history taking. Exclusion criteria were: parents who did not agree to participate and who disagreed to sign the informed consent form.

Children of parents who agreed to participate underwent demographic assessment, anthropometric measurement, and developmental screening. Anthropometric measurement was performed offline by community cadres, either one-on-one in the children's home or in a COVID-safe protocol appointment in the Posyandu area, depending on the cadres and local leaders' decision. This measurement assessed the children's weight and length or height. Children's weight and length were measured using an Onemed OD 231B Baby Scale, while children's height was measured using a stadiometer. In addition, developmental status was screened using the prescreening developmental questionnaire (Kuesioner Pra Skrining Perkembangan/KPSP) as cited in the national guideline to stimulate, detect, and intervene for children's growth and developmental aspects (Stimulasi, Deteksi, dan Intervensi Dini Tumbuh Kembang Anak/SDIDTK) guideline.[12]

Developmental aspects were screened online by volunteers, using either the WhatsApp video call, voice call, or chats. This screening was performed in separate sessions from the anthropometric measurements, since volunteers were expected to have the children's nutritional status data already and be able to explain to the parents about the interpretation during the interactive session. Lastly, an online survey was conducted to gather parents' perspectives on the effectiveness of the project. A self-reported and straightforward questionnaire using a Likert scale (1 to 5) was constructed specifically for the study and distributed among the participants.

2.3. Variables

Children's growth variables include weight-for-
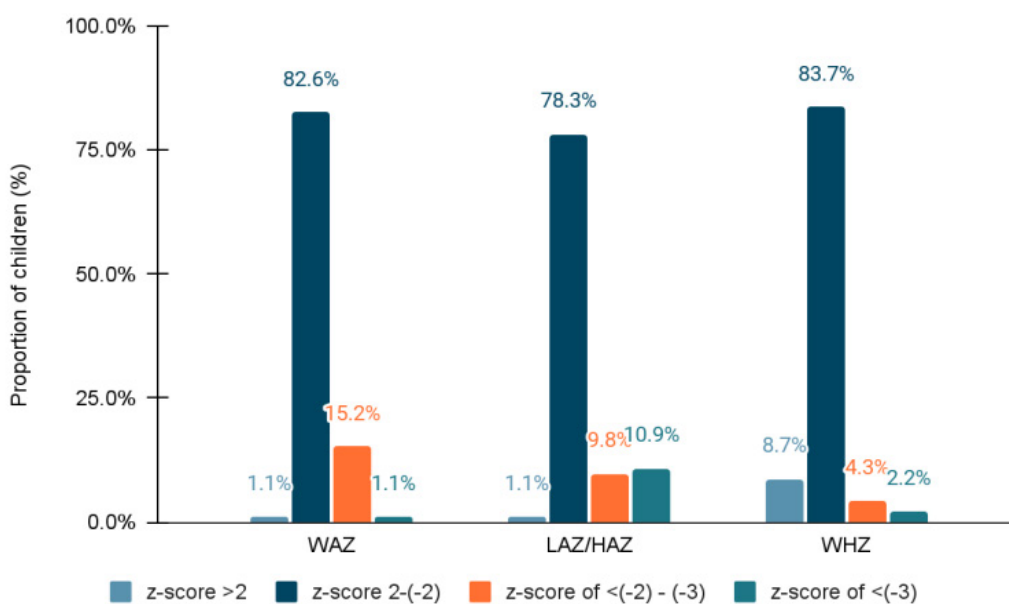
Figure 1. Prevalence of children according to their nutritional status z-score.
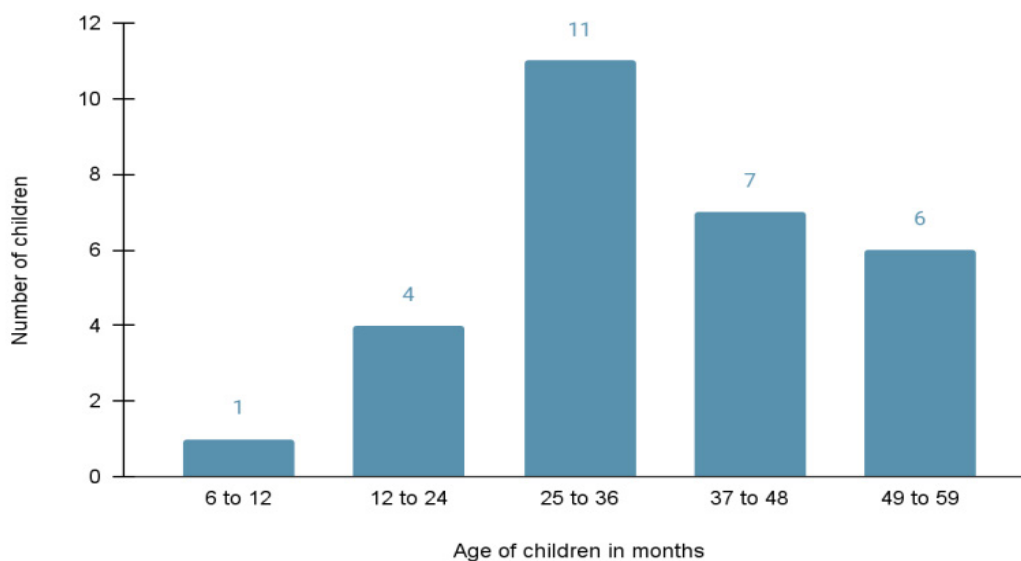
Figure 2. The distribution of children who were at risk of developmental delay according to their age groups.

age z-score (WAZ), height/length-for-age z-score (HAZ/LAZ), and weight-for-height/length z-score (WHZ). For each of the variables, the z-score was then categorized according to the World Health Organization (WHO) interpretation of nutritional status.[13] Z-scores that were in the range of -2 to 2 were considered normal, while z-scores which were less than -2 and -3 were called underweight for WAZ, stunted for HAZ/LAZ, and wasted for WHZ. Meanwhile, if z-scores were less than -3, the child

Table 2. Parents perspectives in the project

Statements	Agree (%)	Neutral (%)	Disagree (%)
Developmental screening through an online platform is sufficiently effective in determining the development status of my child.	88%	4%	8%
Developmental screening through online platform makes me feel safe and comfortable because I can still understand the development status of my child without having to go to the Puskesmas/Posyandu.	41 51		
I feel that the volunteers who interviewed me have asked the questions in a kind and polite manner.	100%	0	0
I feel that the volunteers interviewing me can provide valid and reliable information about my child's development.	96%	4%	0%
I feel that in the future, screening for child development should only be done through online media instead of face-to-face sessions (e.g. Posyandu).	44%	24%	32%

would be considered severely underweight for WAZ, severely stunted for HAZ/LAZ, and severely wasted for WHZ. For developmental status, the range of the results score would be in 0-10 and categorized into 'in accordance with age' if the score was 9-10, 'dubious result' if the score was 7-8, and 'suspected of having developmental delay' if the score was less than and equal to 6.[12] Parents' perspectives were examined according to the questionnaire results. Responses of 1 and 2 were considered 'disagree', while responses of 3 to 5 were considered 'neutral' and 'agree', respectively.

2.4. Analysis

The data were analyzed using descriptive statistics. Growth data were analyzed using an open-access survey analyzer developed by the WHO, called the WHO Anthro Survey Analyzer. This tool was used to assist in transforming growth data into the respective z-scores for each of the anthropometric indicators (WAZ, LAZ, and WHZ) for all participants. Meanwhile, the developmental results and parents' perspectives were analyzed using Microsoft Excel.

3. Result

A total of 92 under-five years old children participated in this project. The majority of the children were in the age group 25 to 36 months (30.4%), followed by 37 to 48 months (23.9%), and 13 to 24 months

(21.7%). The proportion of children according to the sex was approximately equal, with the percentages of male and female children being 44.6% and 55.4%, respectively. Around one-third of the participants came from Posyandu Manisjangan 20, while the remaining equally came from other Posyandu. The summary of the sample characteristics can be found in Table 1.

Among 92 participants, there was a total of 27 children who had problems in their nutritional status, either being underweight, stunted, wasted or the combination of those problems. In detail, there were 16.3% of children who were underweight, 20.7% of children who were stunted, and 6.5% of children who were wasted. This summary is presented in Figure 1.

Only 84 children could be screened for their development status, while the remaining parents of the eight children could not be contacted. The proportion of children who were at risk of developmental delays were 29/84 children (34.6%), of which five were suspected to have developmental delays (KPSP score of less than or equal to six), while 24 had dubious results (KPSP score of 7-8). According to their age, most of the children at risk of developmental delays were in the age group 25 to 36 months, 37 to 48 months, and 49 to 59 months, as seen in Figure 2.

According to the parent's responses to the questionnaire, the majority of parents reported that developmental screening conducted through online

media platform was sufficiently effective (88%), they felt more COVID-safe since they did not need to go outside (80%), perceived that volunteers could ask kindly and politely (100%), and perceived that volunteers could provide reliable information (96%). However, only 44% of parents showed interest in online methods as the only method to perform developmental screening in the future. The summary of the parents' perspectives can be seen in Table 2.

4. Discussion

The prevalence of children who have nutritional and developmental problems during the screening in our study are relatively high. Approximately one-third of children in the study area had either nutritional problems or developmental delays. These cases could be undiagnosed, since the routine Posyandu sessions are currently disrupted. Implementing a community empowerment program as executed in the KUMBANG project could be an alternative to the usual Posyandu and potentially answer the issues mentioned above.

The United Nations International Children's Emergency Fund (UNICEF) reported that due to the current COVID-19 pandemic, around 84% of Posyandu in Indonesia are disrupted/postponed, and some are substituted by parents self-reporting to the community cadre regarding their children's last nutritional status.[14] In addition, children's developmental status is commonly omitted from screening by parents and not reported by the current screening method. It is important to note that parents' self-reports of their children's nutritional status are highly prone to bias, since they are more likely to not use standardized technique and measurement tools. Parents also reported that it is inconvenient for them to measure their children's anthropometric parameters by themselves because not all parents have the measurement tools or understand how to assess their children's growth and developmental status.[15]

By involving medical students as volunteers in the screening process, the work burden among health professionals who are currently occupied with COVID-19 management could be relieved. Because medical students are considered as

trained laypeople, it is expected that screening performed by the volunteers was done in a more standardized manner than the parent's self-reported measurement. In addition, they could also provide other relevant information needed by parents during the online interactive screening.

Our project's offline and online approach also minimizes the possibility of COVID-19 transmission by ensuring that the contact time was done efficiently. Parents' perspective on this project supports the prospective plan of implementing the KUMBANG project, since they report that KUMBANG has been sufficiently effective in screening for children's status. In addition, the acceptance response reflected in the survey also implies an excellent promise to use KUMBANG as an alternative option to the existing Posyandu method.

As a response to the current pandemic situation, the role of distant medical health service delivery, or commonly called telehealth, is receiving more attention than ever.[16] A telehealth which is specifically designed to improve child health, has also been invented in many developing countries to connect many parents with child and family health nurses without meeting in person. For instance, Conti et al. has developed a remote surveillance protocol to detect and intervene in autism spectrum disorder through online interviews and parent-child play videos.[17] TeleHealth Kids, an internet-based program for children with developmental disabilities in an Ohio rural area, showed high parental satisfaction after using telemedicine since it reduced travel cost and time lost from work.[18] Another study on developmental disorder in the Philippines showed promising results in teletherapy. Parents' satisfaction was positively associated with family participation and effective communication during teletherapy, increasing parents' empowerment and making them more aware of their children's needs. Some challenges include time constraints and instructions that were hard to follow.[19] Similar to our KUMBANG project, the Communicating Healthy Beginnings Advice by Telephone (CHAT) project in Australia targets the marginalized and low-income population from pregnancy to two years of age. The approach is potentially beneficial to build rapport with the

provider meeting community needs despite its limitations on physical examination.[16]

Multiple factors contribute to the parents' decision of whether they will seek services to assess their children's nutritional and developmental status during the COVID-19 pandemic, including existing predisposing factors: attitude, belief, and sociodemographic characteristics; enabling factors: health information accessibility, health systems, affordability, and self-efficacy; and need-for-care factors: health status, perceived risk, and perceived severity.[20] Moreover, health services remodeling and proactive execution could increase telehealth implementation and buy-ins from providers.[21] Therefore, during the planning phase of the KUMBANG project, a stakeholder engagement was performed, in order to ensure that the project can run smoothly. Nonetheless, long-term continuous engagement is important to keep the project going; thus, integrating the project into the existing health systems and medical curriculum can further improve the program's sustainability and increase medical students' awareness of child growth and development.[16,21]

The reach of the KUMBANG project in detecting children with nutritional problems and developmental problems can be evaluated by comparing with previous literature. The current data on children's nutritional status in Yogyakarta city in 2019 showed lower proportions of children with nutritional problems in all growth parameters than our study. For underweight and stunted, our study reported twice the proportion for the same parameters in 2019, which are 16.3% (city report was 8.5%) for underweight and 20.7% (city report was 11.3%) for stunted.[22] Meanwhile, the prevalence of wasted children in our study was not broadly different to the one shown in the city report, of which we found a 5.1% proportion, while the city report also showed a 5.1% proportion for wasted children in Yogyakarta.[22]

In addition to that, our study further showed a considerably higher proportion of children at risk of developmental delays compared to the national basic health report (Riset Kesehatan Dasar/Riskesdas). Riskesdas reported that approximately 13% of children aged 36-59 months were developmentally

delayed in Yogyakarta province.[11] This is significantly lower than the prevalence that we found, showing that approximately a third (34%) of under five years old children in the study area were at risk of developmental delays. The different findings between the national survey and our study might be due to different tools (KPSP vs Multiple Indicator Cluster Survey (MICS) as well as different survey population (Riskesdas did not perform developmental surveillance for children under 36 months).

When compared to a study that used the same screening tool (KPSP), we found that the prevalence is relatively similar, of which the authors found that 36% of the children screened were at risk of developmental delays (KPSP score of less than or equal to 8).[8] Even though the prevalence is relatively high, screening for developmental status still does not receive much attention compared to growth screening. This was reflected in the 2018 Riskesdas, which showed that only 37.2% of children in Yogyakarta city were monitored for their developmental milestones, which is lower than the national average surveillance for developmental screening, with 45.6%.[23]

To the best of our understanding, this was the first study that assessed the applicability of a mixed intervention of an online and offline child' growth and development screening, in terms of the project reach and how parents perceive the effectiveness. The KUMBANG project also poses as an innovative way to bridge the disrupted child health services during this pandemic time. However, there are some limitations on this study. Firstly, it is worth noting that this study was conducted in a short period and was limited to parents with access to Internet services in urban areas in Yogyakarta. This might bias the real situation where parents might have different socioeconomic status or limited access to gadgets. Therefore, it would be beneficial to expand the study to a more general population to have a broader understanding of the project. Secondly, there might be social desirability bias where parents tend to overrate their children's ability. This might lead to information bias that influences the results of the study and eventually alters the real prevalence of developmental delays in the area. Thirdly, the KPSP is actually designed to be

used in an offline setting; thus, further research and adjustments need to be conducted to make the KPSP suitable for online screening. Lastly, this quantitative cross-sectional study was not able to analyze why 12% of the respondents felt online screening was not effective enough or why more than half of the respondents preferred face-to-face sessions. Hence, future qualitative study may help address the remaining questions.

5. Conclusion

Our study found that involving medical students in routine growth and developmental screening could help health professionals and potentially be embedded in routine children monitoring. The KUMBANG project also has shown a good reach in detecting children with nutritional problems and at risk of developmental delays. This project further received a good acceptance response from parents and has the potential to be embedded as routine care for children. Furthermore, medical students also provide a valid and reliable source of information to parents, making it more comfortable for parents to talk about their children' condition. Lastly, the online screening method could minimize the potential risks of COVID-19 transmission and should be considered as a prospective option for routine screening during the pandemic.

Acknowledgements

Conflict of interests

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Development and expert-evaluation of FORENSICA-android application for estimating post-mortem interval

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ABSTRACT Death registration is very important and has civil and legal impact on the deceased person and their family. Validity of a death certificate is influenced by the time accuracy of death estimation. Calculation of the post-mortem interval has a central role in the estimation of the time of death, especially for death cases in the community, without prior medical observation. This study aimed to develop a smartphone application for counting the estimated time of death based on android features, to help doctors establish a more accurate time of death and provide a learning facility for doctors and medical student. This action research consisted of 4 cycles: 1) Planning, 2) Action, 3) Observation, and 4) Reflection. The final result of this study is an android application named Forensica 3rd version. This application was developed in Bahasa Indonesia. This application has a menu for recording the patient identity, instructions for post-mortem changes examination, record examination results, time of death calculation and its interpretation. This 3rd version of the application is the latest version after undergoing two revisions. The Forensica application provides an easy way for doctors and medical students to establish the time of death estimation and it is user-friendly.

1. Introduction

Time of death estimation is an important part of forensic medicine. Although this issue is important, some doctors forget how to calculate it and get confused when facing a case of death in the community setting. The researchers tried to fix this problem by developing a smartphone application to guide the doctors in performing post-mortem examinations and calculating the results. It is important because the validity of a death certificate is also influenced by the accuracy of the time of death estimation. Post-mortem interval calculation has a central role in estimating the time of death, especially in the community setting.

By helping doctors to calculate the post-mortem interval faster, we hope that doctors can issue death certificates faster and ultimately help the family to have easier access to all of their rights. Use of technology, by developing a smartphone application, is chosen to help establish the time of death estimation faster. Also, the doctors can access the application anywhere and anytime they need.

We found only two studies that focused on the usage of the mobile phone for postmortem interval estimation, although the scope is different between the two. The first study[1] used a smart-phone with a special optical contraption in addition to estimate the postmortem interval by analyzing the cornea of the corpse. Another study[2] used the phone, mainly through the short messaging service (SMS), to build a reporting system in Pakistan. While this study

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focuses on the general reporting system, we also found that the reporting topic is forensic-related (neonatal, infant, and maternal death). Systematic reviews that are related to mobile-phone usage in the medical field mostly focused on other topics such as obesity treatment,[3] hypertension treatment,[4] mental disorders treatment[5] and health behavior changes.[6] The usage of mobile phone applications for postmortem interval estimation is yet to be found in the literature.

This study aimed to develop a smartphone android-based application to calculate the interval of death estimation, to help doctors to establish the time of death and also to provide a learning facility for doctors and medical students.

2. Method

The method used is action research that includes four cycle of procedures such as planning, action, observation, and reflection. The flow chart is attached and must be fully and clearly done. The method was chosen to generate a shift in the understanding and contextualization of the role of academic professionals in both higher education and the larger environment.[7] These grounding concepts of medical doctors' experiences and problems in community create the backdrop for interpreting social reality and subsequently advising concrete actions to solve pertinent problems.[8] The action research involved all participants to contribute more in the research and solve the problems faced by their colleagues in social reality.[9]

2.1. Planning

This procedure was preceded by collecting criteria of post-mortem changes and constructing the formula for counting the estimation of the time of death.

2.2. Action

This procedure involved developing a smartphone application for time of death estimation calculation. The development is based on an android system, named Forensica 1st version. Peer review was done after this step, and the application was

Figure 1. Action research.

revised. The result of this action procedure is a revised version of the application that is named Forensica 2nd version.

2.3. Observation

This step in the procedure aimed to put the application into trial. A total of 12 forensic experts were involved from the Department of Forensic and Medicolegal FKKMK UGM. The sampling method was done by the total sampling method. All experts joined a group review and were invited to focus group discussions. All experts tried the smartphone application called Forensica 2nd version and gave evaluations about it on three aspects: system, user, and interaction aspects. To develop the questions, we adapted the USE questionnaire.[10] It consists of 13 questions with a 5-point Likert scale. We removed two questions about payment and security because this application is free and does not collect confidential data.

In addition, the experts have also conducted reviews related to the content of Forensica. The literature search was done after the review process. The references used are international references that have been agreed to be the reference sources. One was an agreement on the determination of livor mortis. Livor mortis persists more than 8 hours after death. This was previously debated because there was a difference in cut-off points (6 and 8 hours).

Table 1. Post-mortem interval based on post-mortem changes

No	Sign	Postmortem interval	Postmortem changes	Confounding factors
1	Livor mortis	30 minutes 8 hours	Start observed Settled	-Skin color -Oxygenation status -Status oxygenation -Hemolysis -Temperature -Decomposition -Movement of body position -Intoxication
2	Rigor mortis	2 hours 12 hours 24 hours	Start observed All muscles, maximum rigidity, settled Maximum rigidity starts to release	-Muscle mass -Surrounding temperature -Muscle activity before death -Disease or toxin which influence nerve and muscle activity. -Chronical illness that impacts muscle mass -Decomposition
3	Decomposition	1-3 days	Greenish on the abdominal wall observed	-Body size -Body size -Temperature -Humidity -Oxygen access -Cloths and cover -Embalming -Open or close environment -Immersed -Buried -Bacterial infection -Maggots infestation -Predator
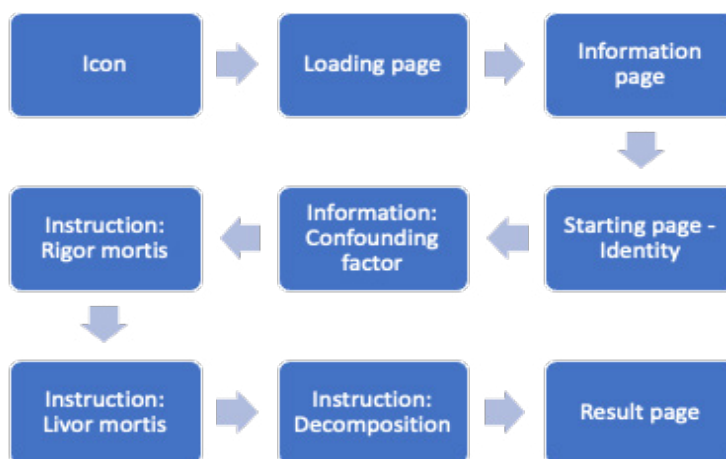
Figure 2. Forensica overall operational process.

2.4. Reflections

This step in the procedure revalidated the instruments. There were also pretest and post-tests to review the efficacy of the application. The data were analyzed by using Python (this includes pandas, numpy, pyplot, seaborn, and scipy modules) to find descriptive statistics, comparison between pretest and posttest, and generate the charts. We did data collection and cleaning prior to the analyses. The

Figure 3. The icon of FORENSICA application.

third revision was done next, and the result of this action research was named Forensica 3rd version. This study was approved by the Medical and Health Research Ethics Committee of the Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada, Yogyakarta, Indonesia (Ref. No. KE/FK/0567/EC/2021).

3. Result

The results of this study are presented according to the four-cycle procedures which were performed in this study.

3.1. Planning

The planning step of this research was done by collecting criteria of post-mortem changes. These criteria then were used to construct the formula that would be used to calculate the time of death estimation. There are many methods in which someone can estimate the time of death, with distinct advantages and disadvantages. After a comprehensive literature study[11-30] was done, it was concluded that there are several criteria that can be used. Livor mortis, body temperature, rigor mortis, decomposition, mummification, and the biochemical process can be used as the criteria.

Body temperature was not used as criteria for this research due to its complex interaction with the environment. It can be used for a specific computational model, including the models for hypothermia and hyperthermia.[1,3] But for this specific application, it was deemed too varied. Another criteria that was not used is mummification.

This is due to Indonesia's climate that has high humidity and warm temperatures, which do not support the process of mummification to occur and instead support decomposition to occur faster. Another of the criteria that is not used is the post-mortem biochemical process which is a relatively new approach that needs more practical effort to do.[32]

The researchers conclude that the remaining three criteria are used in this application: livor mortis, rigor mortis, and decomposition as presented below in Table 1.

3.2. Action

The next step is action. The action step was done by developing the android application named Forensica 1st version. After initial peer-review, the application was then revised into Forensica 2nd version. The application is shown below.

The icon for the application (Figure 3) was designed on the wall of the smart phone after installation. The operational process is started by clicking the icon. The user goes to the loading page that includes the title "Forensica" and the tagline "Easier learning, good understanding". Then it proceeds to the next pages, which are the information pages to better introduce the application being used by the users. The next page is the starting page in which the user is asked for the patient's name and their identity number. Then the next page shows information on confounding factors. The next pages are the instructions on doing rigor mortis, livor mortis, and decomposition examinations. The last page in the process is the results page.

3.3. Observation

The observation step of this study was done by putting the application into trial. Doctors were invited to a focus group discussion in which they tried the 2nd version of the application. The doctors agreed that the 2nd version was easily operated in three main aspects (system, user, and interaction aspect). There were 11 questions that were asked in Bahasa Indonesia using the Likert scale. The English translation is below each question.

Table 2. Observation result.

No	Question	Result
1	*Apakah tampilan antarmuka aplikasi FORENSICA mudah dikenali?* Is the interface of Forensica easy to recognise?	4.625
2	*Apakah aplikasi FORENSICA mudah dioperasikan?* Is Forensica easy to operate?	4.8125
3	*Apakah tampilan warna pada aplikasi FORENSICA nyaman dilihat dan tidak membosankan?* Is the color theme of the application easy on the eye?	4.25
4	*Apakah tampilan menu dalam aplikasi FORENSICA mudah dikenali?* Is the menu interface in the application easy to navigate?	4.5
5	*Apakah informasi dalam aplikasi FORENSICA mudah dicari?* Is the informations available on the application easy to search?	4.5625
6	*Apakah tulisan yang ada dalam aplikasi FORENSICA mudah dibaca?* Is the writing readable?	4.4375
7	*Apakah aplikasi FORENSICA mudah di-download?* Is the application easy to download?	4.625
8	*Apakah simbol, ikon, dan gambar dalam aplikasi FORENSICA mudah dipahami?* Are the symbols, icons, and pictures in the application easy to understand?	4.5625
9	*Apakah mudah mengakses informasi yang ditawarkan dalam aplikasi FORENSICA?* Is the information available on the application easy to access?	4.625
10	*Apakah fungsi yang ditawarkan sesuai dengan tujuan dalam aplikasi FORENSICA?* Is the function of the application in accordance with the goal?	4.625
11	*Apakah menu dalam aplikasi FORENSICA mudah diingat?* Is the menu on the application easy to remember?	4.625

(1 = "strongly disagree", 2 = "disagree", 3 = "in doubt", 4 = "agree", 5 = "strongly agree")
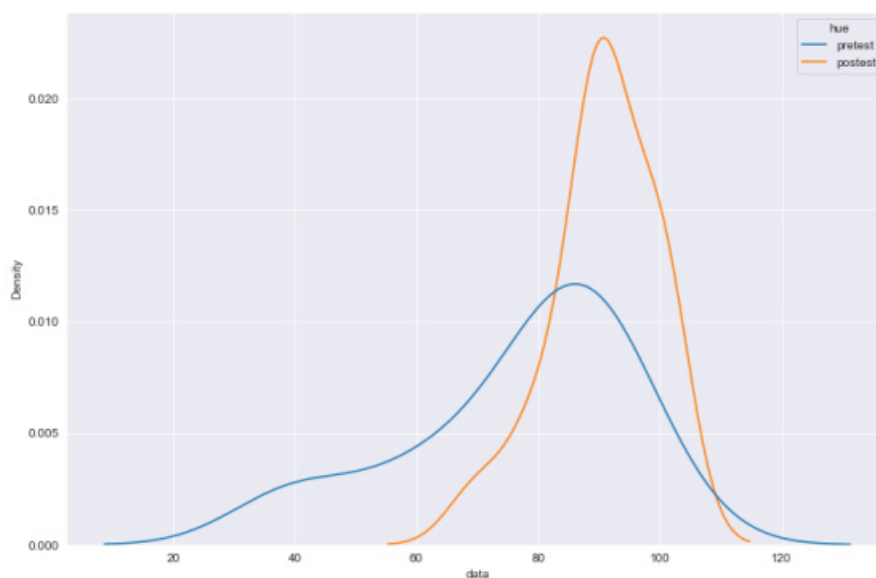
Figure 4. Kernel Density Estimate (KDE) plot showing difference of distributions between pretest results (shown in blue) and post-test results (shown in orange).

There were also suggestions on the application's layout, interface, and the availability of the application in the PlayStore. The first one was the layout of the confounding factors which were slightly confusing, so the developers rearranged the layout to be fully top-down. The second one was the chosen gray color
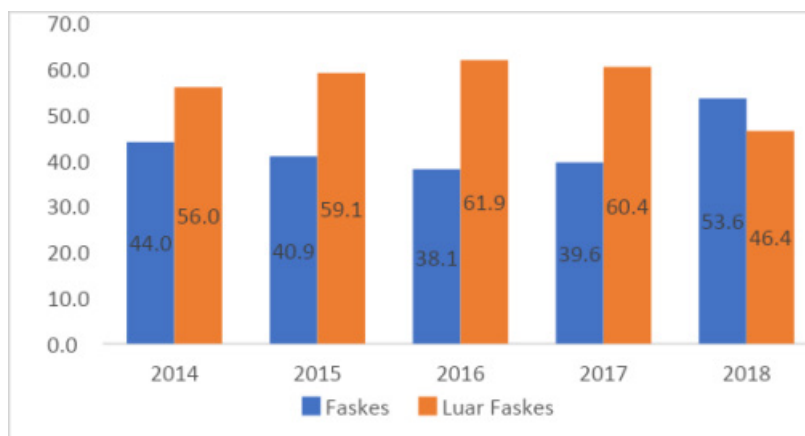
Figure 5. Place of death. Blue shows the intra health facilities mortality while the orange shows the mortality outside health facilities.
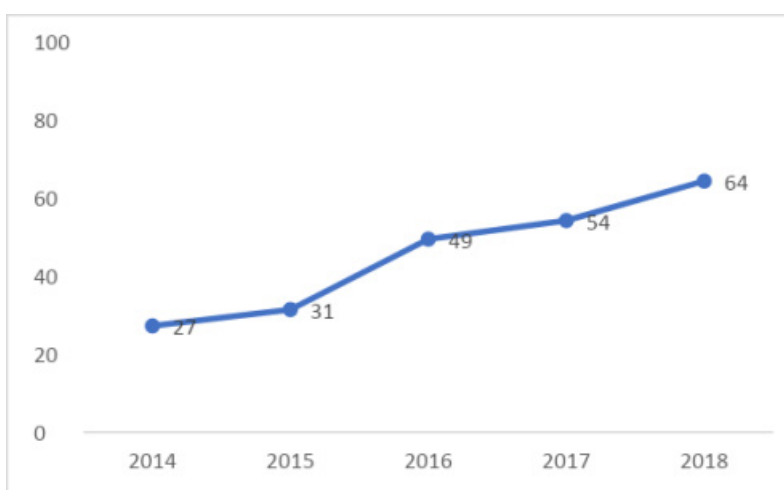
Figure 6. Death registration according to death certificate issued.

for the writing which was sometimes hard to read, then it was changed to black. The last one was that the application was not yet available on PlayStore, so it was uploaded after the research was done.

3.4. Reflections

In the last step of this research, a revalidation process was done to the instrument. Slight readjustment on the formula to adjust to the specific climate in Indonesia were done. We adjusted the formula of the time of death estimation based on the current literature that conforms with our setting. We also modified the application's display based on the responses in the questionnaires. Pre- and post-

tests showed significant differences with a p-value of 0.011 (Mann-Whitney test). After the third and fourth step, the application was once again revised into Forensica 3rd version.

4.　Discussion

The issuance of the death certificate is a document which plays many roles in the socio-economic area. It is mandatory to be issued in any death case. Legal and civil impacts of the death certificate will influence people's well-being, such as legacy, pension, insurance claim, banking business, testament of marriage, spouse's next marriage, and other important issues. The Health and Demographic Surveillance System
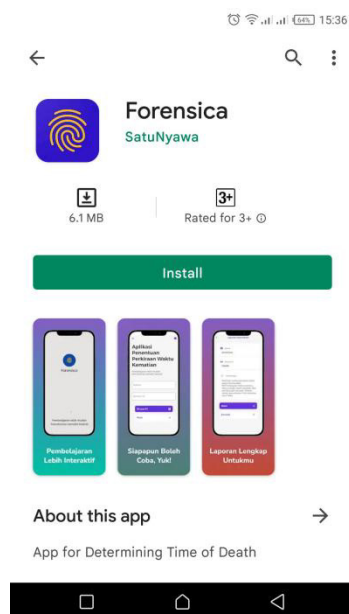
Figure 7. Forensics application in PlayStore.

(HDSS) data in Sleman 2016-2018 showed that death cases in community are more numerous than death cases intra health facilities (Figure 4).

HDSS Sleman data also show that not all death cases are registered and get death certificates. There is improvement in the amount of death cases being reported, although it is still below what is expected (Figure 5). According to the regulations, all death cases must be registered and get a death certificate. Included in a death certificate are data of identity, place of death, and time of death. Medical doctors have the duty to issue the death certificate after examination. Complicated subjects in the medical education program and the development of science in medical issues push medical doctors to become quick adapted learners. Medical doctors' responsibility leads them to improve their knowledge and skills, provide high standard service, and this includes the validity of the death certificate in each component.

The COVID-19 pandemic also plays an important role when regarding the death cases. Ever since the start of the pandemic, per 2nd of September 2021, there were 133,676 cases of death due to COVID-19 alone.[33] Some of them were treated in hospitals and some others were self-quarantined at home.

Per 7th of August 2021, there were 3,013 cases of death that occurred within the self-quarantined patients' community, specifically those who were quarantining outside hospitals.[34] The recent rise of COVID-19 self-quarantined patients death necessitates a faster and safer way to estimate the time of death.

Smartphone users in Indonesia are more than 100 billion in 2018.[35] Internet penetrations reach the same rate in 2018, with an average access for internet of 3.5 hours per day in Indonesia using smartphones.[36] Medical doctors are a part of that population. Doctors have the obligation to improve their knowledge and skills, and also have opportunity to use smartphones as a tool. Continuing medical education using android applications that is developed and dedicated to help doctors in their duty is a challenge for improving health services.

Smartphone application implementation in health settings are usually about health intervention. Implementations widely used include weight monitoring and calorie calculator, such as in the study conducted by Wang and colleagues.[37] Another implementation is for mental health treatment[38] and hypertension treatment.[39] One research studied an application for health behavior changes, encompassing different fields of interventions.[40] Smartphone applications used in the context of reporting and estimation of the time of death are rare in the literature. We found two researches that use mobile phone for estimation and reporting. One study is conducted in Pakistan, while not necessarily using a smartphone, it was using SMS via mobile phones to report death.[41] Another study resembles this study, that is using an application to estimate postmortem interval. Although the goal of the study is the same with this study, there are significant differences between the studies: the method used and the need (or lack of need) of additional contraptions.[42] The application uses images of the cornea to estimate the time of death. As images can vary between shots, especially using smartphone, the application is used in combination with a special contraption that provides lighting and thus minimizes the differences between shots.

All these facts add to the urgency of the

development of the Forensica application. By developing Forensica, death outside health facilities can be examined and estimated faster. This would improve the overall registered death number and ultimately give better services to the family by getting them the rights they deserve faster.

Based on this research, the Forensica application can be implemented in daily practice, which is proven by all items in the questionnaire getting more than 4 marks of the maximum 5-point Likert scale. The Forensica application is already available in PlayStore (Figure 7) and also recorded in Intellectual Property Right certificate no: EC00202183651. This study is limited by the fact that the experts involved come from only one center. For further studies, more experts from more diverse centers can be involved.

5. Conclusion

The Forensica application is a smartphone application based on the android system, developed for guiding doctors and medical students to examine post-mortem changes and calculate estimation of the time of death. The Forensica application provides an easy way for doctors and medical students to establish the time of death estimation and it is user friendly.

Acknowledgements

Conflict of interests

There is no conflict of interest in this study.

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Evaluation of the implementation of COVID-19 prevention and control in the work area of Kalibaru Kulon health center

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ABSTRACT In early 2020, the COVID-19 pandemic spread rapidly to all countries, including Indonesia. This problem prompted the government to immediately make efforts to suppress the spread of COVID-19. Public Health Centers are at the front line in breaking the chain of transmission of COVID-19 because they are located in every sub-district and have a regional concept. This research is a participatory observational study and was conducted from July 6 – 31, 2020. Researchers at the same time as volunteers coordinated with the Public Health Centers and evaluated the implementation of COVID-19 Prevention and Control in the Work Area of Kalibaru Kulon Health Center. The evaluation was done based on the guidelines for the Prevention and Control of COVID-19 by analyzing and interpreting the data and developing a descriptive narrative. The results of the evaluation have shown the suitability of the guidelines with the implementation of the rapid test program, screening COVID-19 at check point posts, and 'Sekolah Tangguh & Pondok Tangguh'. But, there are still some indicators that are not following the guidelines, especially in the implementation of rapid test program and 'Sekolah Tangguh & Pondok Tangguh'. The conclusion from the evaluation of the implementation of Kalibaru Kulon Health Center program in making efforts to prevent and control COVID-19 is that the implementation of the program has not been optimal when compared to existing guidelines so that more efforts need to be made such as increasing the role of the government as the developer of policies, which is supported by public awareness to realize community independence in the health sector.

1. Introduction

The World Health Organization (WHO) since January 2020 has declared COVID-19 a Public Health Emergency of International Concern (PHEIC), and on 11 March 2020, officially declared it as a pandemic. This is a follow-up to the report of the WHO China Country Office in Wuhan City, Hubei Province, China in 2019, on the finding of a pneumonia case of unknown etiology which was identified as a new type of coronavirus.[1]

In response to the WHO's determination of the PHEIC, the Indonesian Ministry of Health has issued the Ministry of Health Decree Number HK.01.07/ MENKES/104/2020 concerning the Determination of Novel Coronavirus Infections (2019-nCoV Infection) as Types of Diseases that Can Cause Outbreaks and Countermeasures. In addition to these rules, Indonesia already has regulations regarding the control of infectious disease outbreaks, such as Law (UU) Number 4 of 1984 concerning Outbreaks of Infectious Diseases, Government Regulation (PP) Number 40 of 1991 concerning Overcoming Outbreaks of Infectious Diseases, and Regulation of the Minister of Health (Permenkes) Number 1501/ Menkes/Per/X/2010 concerning Certain Types of Infectious Diseases that Can Cause Outbreaks and Control Efforts.

The high population mobilization in the world, especially Indonesia, and variants have caused

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several spikes in COVID-19 cases in the world to be increasingly out of control. On March 2, 2020, Indonesia reported the first case of COVID-19, and it quickly spread to several areas in Indonesia.[1] As of August 28, 2022, there have been 6,343,076 confirmed cases of COVID-19 with 157,493 deaths.[2]

The COVID-19 vaccination program has been accomplished throughout Indonesia, but the risk of transmission is still high. Less than one year from the initial case, active cases on a national scale as of December 17, 2021, found 4,833 active cases, and for the East Java region there were 139 active cases, and among these active cases, some were from Banyuwangi Regency. Under certain conditions, the spread of COVID-19 after the implementation of a national-scale vaccination program, can create a wave or surge of the spread of COVID-19 that threatens the health of the people of Indonesia.

Epidemiological and virological studies prove that COVID-19 is highly contagious, and its transmission by symptomatic people to people around them is typically by droplets, which are water-filled particles with a diameter of >5-10 m. Droplet transmission occurs when a person is at a close distance (within 1 meter) with someone who has respiratory symptoms (e.g., coughing or sneezing) so that droplets are a risk of transmission through mucosa (mouth and nose) or conjunctiva (eyes). Transmission can also occur through objects and surfaces contaminated with droplets around an infected person. Therefore, there are several scenarios for stopping the transmission of COVID-19, one of which is preventing the virus from spreading.[3]

In addition, the airborne transmission may be possible in special circumstances where aerosol-generating supportive procedures or treatments such as endotracheal intubation, bronchoscopy, open suction, administration of nebulized medication, manual ventilation before intubation, turning the patient to the prone position, disconnecting the ventilator, positive pressure ventilation non-invasive, tracheostomy, and cardiopulmonary resuscitation. Further research is needed on airborne transmission.[1]

Based on the HL BLUM theory, health status is influenced by four main interrelated factors which are: the environment (40%), health behavior (30%),

health services (20%) and genetics (10%).[4] Of the four factors, the behavior and environment have considerable influence. These factors are strongly influenced by the behavior of the community itself, therefore the implementation of the Healthy Living Community Movement (Germas) in promoting a culture of healthy living and cross-sectoral involvement need to be emphasized. This can be done by local governments starting from the RT/RW to the central level. Referring to this theory, the institutionalization of the performance of controlling the spread of COVID-19 is very important for an organized and systematic response.

At the grassroots level of RT/RW, the existence of the Public Health Center as a form of institutionalization for controlling the spread of COVID-19 is very relevant. According to the Ministry of Health, the scope of Public Health Center services during the COVID-19 pandemic includes Public Health Center management, Community Health Efforts, Individual Health Efforts, and Infection Prevention and Control.[1] As a result, the roles of the Public Health Center in carrying out prevention, detection and responses are implemented in an integrated manner in providing health services to others during the COVID-19 pandemic.

The existence of the Public Health Center is very important in realizing community independence through community empowerment in changing behavior and the environment which is in line with HL Blum's theory, that people need to have awareness, willingness and ability to live healthily and live in a healthy environment.

Community independence needs to be realized through community empowerment to change behavior patterns and the environment. The community in the working area of the Kalibaru Kulon Health Center is expected to be able to have healthy lifestyle behaviors and have the awareness, willingness and ability to live healthily and live in a healthy environment. Therefore, the authors participated in volunteer activities in Community Health Efforts. This is in line with what Syafrida said, that awareness of the joint task of community elements is an effort to prevent the spread of COVID-19.[5]

This study aimed to evaluate the implementation of prevention and control of COVID-19 at Kalibaru Kulon Health Center, Kalibaru District, Banyuwangi Regency.

2. Method

Researchers used a descriptive method, with primary data sources interviews and observations based on the involvement of researchers in volunteer activities within the period July 16–31, 2020 conducted in the work area of the Kalibaru Kulon Health Center, Kalibaru District, Banyuwangi Regency. The technique of collecting primary data was by interview with Mr. Sonika and Mr. Edo as the implementing team for Community Health Efforts (UKM), while gathering observational data was done by optimizing the ability of researchers in terms of identifying motives, beliefs, attention, unconscious behavior, habits, etc.

The evaluation of activities was done by comparing primary data with secondary data, such as reviewing data and documents related to health protocols, guidelines and standard operating procedures (SOPs), which include: Kalibaru Kulon Health Center Profile Documents, COVID-19 Case Documents in Provinces and Districts, Health Protocol Documents for Public Health Center Services in Pandemic Era (Banyuwangi District Health Office), SOP Document for Homecoming Health Services at Checkpoints in Preventing the Spread of COVID-19 (COVID-19 Screening) Banyuwangi District Health Office, Banyuwangi District Health Education Protocol Document (Banyuwangi District Health Office), and Guidelines for the Prevention and Control of Corona Virus Disease 2019 (COVID-19) of the Indonesian Ministry of Health. Data analysis was done as the next phase of this study involving interpretation techniques on the data that were collected, then generating narratives to clarify the description of the data presented.

3. Result

The results of the study concerned the evaluation of the implementation of the prevention and control of COVID-19 in the work area of the Kalibaru Kulon Health Center: first, the results of the evaluation of the rapid test at the Kalibaru Kulon Health Center included seven evaluation variables referring to the Guidelines for Prevention and Control of COVID-19 in Health Service Facilities. The implementation of rapid test at the Public Health Center has been running according to standard guidelines based on four evaluation variables, which are the implementation of the use of Personal Protective Equipment (PPE), installation of special markers to maintain distance, installation of physical barriers, and health monitoring for workers at the Public Health Center. However, there are still three evaluation variables that have not been done according to standard guidelines. They are the implementation of hand hygiene, regular disinfection of the Public Health Center area, and temperature measurement for Public Health Center visitors.

Second, the results of the evaluation of the implementation of the COVID-19 screening at the Check Point Post include three evaluation variables referring to the COVID-19 Prevention and Control Guidelines which include the variables of prevention (prevent), case-finding efforts (detect), elements of fast and effective handling (respond), and four variables that refer to the Guidelines for Health Services for Homecoming Flows at Check Point Command Posts in Preventing the Spread of COVID-19. The implementation of the COVID-19 screening activity at the Check Point Post has been running following the COVID-19 Prevention and Control Guidelines.

Third, teaching and learning in schools and Islamic boarding schools (Sekolah Tangguh & Pondok Tangguh) have conducted activities following standard guidelines/SOP[6] on installation of signs/boards, implementing social distancing, separate student and teacher desks, providing sufficient space for movement, providing seats for each student, implementing rooms with windows that can be opened and closed, and not installing air conditioning (AC) in the room. But, there are still some variables that have not been done according to standard guidelines, which are the implementation of reminder signs on the floor or posters on the walls, disinfecting the school areas, providing handwashing facilities with soap (CTPS), providing a special room for students with symptoms of COVID-19, and the installation of electric fans.

4. Discussion

Factors causing the implementation discrepancy with the official recommendation document to prevent the spread of COVID-19 in the work area of the Kalibaru Kulon Health Center, Banyuwangi, start from the difficulty in implementing of the rapid test at the Kalibaru Kulon Health Center, which eventually had an impact on the implementation of standard guideline. Three evaluation variables have not been done according to standard guidelines. They are the implementation of hand hygiene, regular disinfection of the Public Health Center area, and temperature measurement for Public Health Center visitors.

The implementation of hand hygiene is not following standard guidelines based on observations, indicated in 40% of Public Health Center visitors who have not underwent hand hygiene and are not following the COVID-19 Prevention and Control Guidelines. Indecision among visitors to wash their hands before entering the Public Health Center area is a factor, so that patients do not wash their hands before doing medical check-ups which will increase the risk of transmitting COVID-19. A study conducted by Nakoe stated that hand hygiene is very important to maintain because human hands are often contaminated with microbes, so hands can be an intermediary for the entry of microbes into the body. Hand washing activities will kill the microbes on the hands so that the application of hand hygiene can reduce the risk of transmitting COVID-19.[7]

The procedure for cleaning and disinfection is routinely done every day around the environment by wiping the entire surface of the room environment and mopping the floor of the room using a liquid detergent, cleaning with clean water, and then using 0.05% chlorine.[1] Cleaning the Public Health Center area by mopping the floor is done routinely, but disinfection of the surfaces of the room environment in the Public Health Center area has not been carried out according to the procedure, based on the results of interviews with officers during volunteer activities, disinfection is carried out approximately 1-2 months before the interviews were conducted. The lack of discipline from officers in carrying out disinfection of the Public Health Center area is a factor that causes the implementation of the environmental disinfection of the Public Health Center to not follow the standard guidelines, which can increase the risk of transmitting COVID-19 through media and facilities contaminated with the virus.

Temperature measurement using a Thermal Gun for visitors who enter the Public Health Center area is not done according to standard guidelines, so that visitors can enter the Public Health Center area without checking their body temperature first. Inadequate human resources to take temperature measurements for visitors who come there are a factor that causes body temperature measurements not to be conducted. Measurement of body temperature is one of the efforts to prevent the transmission of COVID-19 through symptoms of fever/high body temperature so that the failure to measure body temperature can increase the risk of transmission of COVID-19 in the Public Health Center environment.

The next evaluation of the implementation of the COVID-19 screening was done at the Check Point Command Post. First, Health promotion activities (promote) are done through socialization, education, and the use of various information media, have been implemented at the screening post locations through printed media installed at the location such as how to wash hands and efforts to prevent COVID-19. The media at the Check Point Command Post location are posters and banners installed in the Check Point Command Post area.

Second, protection activities (protect) have been implemented through several efforts: (1) providing facilities for hand-washing with soap that are easily accessible and according to standards, or provision of hand sanitizers; (2) efforts to screen the health of people who will enter public places and facilities; (3) regulation of social distancing; (4) disinfection of surfaces, rooms, facilities and equipment regularly; and (5) increase discipline on community behavior for people that are at risk of transmitting and contracting COVID-19 (crowding, not wearing masks, smoking in public places and facilities, etc.).[1]

In addition, the effectiveness of COVID-19 prevention measures is highly dependent on the

strength of surface disinfection, hand hygiene, and the use of appropriate materials for PPE.[8] Several types of PPE are considered to work optimally to prevent the transmission of COVID-19, which include masks, face shields, and gloves whose main purpose is to prevent exposure to the virus into the body or transmit the virus to others.[9]

Third, case finding efforts (detect) consist of early detection and monitoring of health conditions. Early detection to anticipate the spread of COVID-19 can be done by all elements and community groups through coordination with the local health office or health care facilities.[1] The checkpoint post has conducted early detection efforts by collaborating between the health service and cross-sector such as the Police, Indonesian National Army (TNI), Department of Transportation and community organizations in Kalibaru District. That is, early detection is a basic strategy for effective efforts to break the chain of transmission of infectious diseases.[10,11] Early detection must be done considering that COVID-19 has a strong transmission capacity and there is a very vulnerable population base, so it is possible to spread on a larger scale if early detection is not done correctly and regularly.[10]

Fourth, the element of handling quickly and effectively (respond) consists of physical and social restrictions and the application of coughing and sneezing etiquette. Physical restrictions are physical distancing activities between individuals[1] that have been implemented for volunteers and people who enter sanitized waiting areas. Volunteers are placed at their respective locations on duty by implementing social distancing between them. The application of coughing and sneezing etiquette is applied by providing education to the public through printed media at the checkpoint location, there is education on the importance of using masks. Not using masks can cause exposure or contamination of bacteria that are transmitted if coughing occurs carelessly.[12-14] In addition, there is the education to not travel far during a pandemic, except in urgent conditions, as an effort and government programs to stop the spread of COVID-19, even involving complete lock-down in various countries of the world.[15]

The last evaluation is the evaluation of the implementation of Sekolah Tangguh & Pondok Tangguh in Kalibaru District which includes twelve evaluation variables referring to the Health Protocol of the Banyuwangi Regency Educational Order, where seven variables have been running according to standard guidelines, which are the implementation of installing signs/boards containing prohibitions, implement social distancing, separate the teacher's desk from the student desk, provide sufficient space for movement, students have their seats, the windows of the room can be opened and closed, and not installing AC. There are five evaluation variables that have not been done according to standard guidelines are the implementation of placing reminder signs on the floor/posters, disinfecting the school environment, providing hand washing facilities with soap (CTPS), providing special rooms for symptomatic students, and installing electric fans.

Based on the results of the researchers' observations, the occurrence of discrepancies in the implementation of Sekolah Tangguh & Pondok Tangguh is caused by three factors: first, structural factors influenced by the environment that give rise to disciplinary attitudes, and awareness of health care; second, institutional factors due to the limitations of educational institutions in terms of infrastructure; and third, the factor of coordination of educational institutions with agencies that have the authority in the health sector, so that they interfere with other learning activities and the importance of maintaining health, especially understanding of the dangers of infectious diseases.

Therefore, in order to build public health independence in facing the health crisis due to COVID-19, there are several recommendations for implementing COVID-19 prevention and control based on the work area of Public Health Center throughout Indonesia, including the Kalibaru Kulon Health Center, as follows: first, the Government and stakeholders policies need to evaluate and increase human resources for health workers, especially at the grassroots level to maximize performance and effectiveness in stopping the spread of COVID-19; second, regional-based institutional specifications are needed for handling the spread of COVID-19 under the Public Health Center institution; third, improving

socialization and health education is important through health education units in each region in order to provide understanding and implementation of health independence; and fourth, incorporating health education should be done in an independent education curriculum as a subject or integrative in certain subjects in order to build awareness of health care through activities to protect case-finding efforts, and to respond quickly and effectively (respond) to support sustainable health independence. This is in line with the results of recent research which states that educational interventions on health greatly affect people's awareness of healthy living.[16]

5.   Conclusion

Based on the results and discussions related to the evaluation of the implementation of COVID-19 prevention and control in the work area of the Kalibaru Kulon Health Center, it can be concluded that community independence in the health sector is rooted in all lines of national and regional life. The government as the developer of health policy must be supported by public awareness to ensure the widest possible health coverage for the people of Indonesia, and the community has health care initiatives to realize community independence which can be started from community empowerment to change behavior and environmental patterns, as well as sustainable health education.

The health centers are at the front line in breaking the chain of transmission of COVID-19 because it is located in every sub-district and has a regional concept, including the Kalibaru Kulon Health Center, it is necessary to make various efforts in handling prevention and control of infection transmission. The efforts carried out by the Kalibaru Kulon Health Center include rapid test program, screening COVID-19 at check point post, and Sekolah Tangguh & Pondok Tangguh.

Conflict of interests

There is no conflict of interest in this study.

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Differences in obesity between the groups consuming snacks and breakfast habits in Universitas Islam Negeri Sumatera Utara Medan

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ABSTRACT Overweight and obesity are increasing in Indonesia, and these conditions pose a growing threat to people with non-communicable diseases. This study aimed to show the difference in obesity among respondents who consume snacks compared to respondents who have the habit of eating breakfast with three choices to select from: always, sometimes, or never. This comparison was done to analyze the relationship between breakfast habits and snack consumption. This cross-sectional study collected data using a survey on 26 – 27 November 2021. The sample population included the entire academic community of the Universitas Islam Negeri Sumatera Utara, Medan. The sample was determined by an accidental sampling technique. Research instruments were used in the form of questionnaires, microtoise and weight scales to measure the anthropometrics of height and weight. Descriptive data analysis used normality tests and because the data were not normally distributed, the Kendall and Kruskal Wallis tests were done. The results of this study indicated that 38 respondents have overweight status (17.9%), 36 respondents (17.0%) obesity I, 18 respondents (8.5%) obesity II, and 26 respondents (12.3%) underweight. There was no significant difference in obesity among respondents who have the habit of eating breakfast always, sometimes, and never, with p-value of 0.793. There was a significant difference in obesity among respondents who have the habit of eating snacks never, sometimes, and always with a p-value of 0.014. Although snacking can sometimes lead to obesity, generally the fatting types of snacks consumed are cakes and fried foods. In conclusion, limiting snack foods such as cakes and fried foods can reduce obesity. It is recommended to replace the consumption of these snacks with fruits and vegetables.

1. Introduction

Indonesia is not only facing the threat of infectious diseases, the threat of non-communicable diseases (NCDs) is also an alarming cause of death. One of the risk factors for the threat of NCDs is obesity. A survey of 1,000 residents in Mongolia found high prevalences of NCDs, including hypertension cases at 27.5%, obesity at 56.8%, alcohol use at 15.5%, and smoking at 24.8%.[1] Basic health research data in 2018 showed that the prevalence of NCDs in Indonesia were also

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high, such as high blood pressure was 34.1%, obesity prevalence was 21.8% and smoking prevalence was 9.1%.[2]

Obesity occupies the largest cause of NCDs that result in death. The World Health Organization (WHO) stated that 71% of deaths in the world are caused by NCDs.[3] The same concern was conveyed by Allen in 2018, indicating most of the global deaths in the world due to NCDs are experienced in low-income countries.[4] Demographically, the NCDs are high in Bangladesh in low and middle socioeconomic status groups.[5,6]

Control of NCDs is different for each country. For example, the State of Myanmar restricts smoking to control NCDs,[7] while India emphasizes controlling

hypertension.[8] Limiting the consumption of foods high in sugar content is done to suppress the increase in NCDs-related obesity and diabetes mellitus.[9] For another example, Mexico prioritizes physical activity and preventing obesity.[10] Research has shown that obesity can reduce intelligence, activity, and creativity.[11]

Changes in behavior, lifestyle, and diet are associated with the risk of NCDs.[12] Relevant to other studies, the quality of food and diet are associated with the increasing prevalence of NCDs.[13] Obesity is related to the consumption of fast food and energy-dense snacks.[5]

In contrast to previous studies, this study analyzes the relationship between snack consumption and breakfast habits and found significant differences between respondents who eat snacks and obesity based on the frequency of always, sometimes, and never which has not been done by previous researchers.

The purpose of the study aimed to find any difference in obesity among respondents who have the habit of eating breakfast compared to the respondents who have the habit of eating snacks always, sometimes, and never. By analyzing the relationship between breakfast habits and snack consumption, this research is useful to provide information and show the importance of limiting the consumption of snacks to avoid obesity.

2. Method

2.1. Research type and design

This research is a type of field research using a survey. The survey method involves data collection that is done directly among respondents to obtain population characteristics.[14] This cross-sectional study was conducted at the Universitas Islam Negeri Sumatera Utara in November 2021.

2.2. Population and sample

The research population involved lecturers, education staff, and students. Activities during work and study tend to be in a static position (sitting) for 6-8 hours, and it is assumed to increase the number of lecturers, education staff, and students experiencing

obesity. Therefore, it is necessary to conduct a study to prove this assumption. It is estimated that the total population in the study area is 400-450 respondents. Calculation of sample size based on population size used the Issac and Michel formula applied in research conducted by Hikmawati.[15] The sample size at the 5% error level is 212 people: students, lecturers, and education staff. The tendency for the sample to be biased toward more students, is considering the ratio of the number of students, lecturers, and education staff which is: 20: 1.6: 1 The sample is determined by the incidental sampling technique.

2.3. Data collection and analysis

Data were collected using surveys at three research locations, namely Campus 1 IAIN Street No. 1 Medan, Campus 2 Willem Iskandar Street Pasar V Medan Estate, and Campus 4 Durian Jagak Street, Deli Serdang Regency. The research instrument used was a questionnaire to measure the variables of snack eating habits and obesity.

Anthropometric measurements used a microtoise, weight scales, and writing instruments. The classification of body mass index (BMI) refers to the Ministry of Health of the Republic of Indonesia,[3,16] namely: 1). underweight (< 18.5). 2). normal weight (18.5 − 22.5). 3). Excess body weight (23 − 24.5). 4) obesity I (25 − 29.9). and 5) Obesity II (> 30).

Data analysis was done using the non-parametric Kendall test (to test the relationship between breakfast habits and snack consumption), and a different test for three groups. However, before conducting parametric analysis, the data normality test was conducted first. The results of the data analysis were not normally distributed, so Kruskal Wallis analysis was used (for the three groups testing). The data were then displayed in frequency distribution tables, diagrams, cross-tabulations, and NPar-Test tables.

3.   Result

The data from the measurements in the field were then analyzed to produce the necessary information according to the research objectives. The characteristics of the respondents are displayed

Table 1. Characteristics age, gender, and employment status.

Characteristic	Frequency	Percentage
Age (year)		
< 26	180	84.9
26 – 37	13	6.1
38 – 49	13	6.1
50 – 61	6	2.8
Gender		
Man	57	26.9
Woman	155	73.1
Status		
Student	175	82.5
Lecturer and staff	37	17.5

Table 2. Breakfast habits, and snack food consumption.

Habit	Frequency	Percentage
Breakfast		
Always	112	52.8
Sometimes	94	44.3
Never	6	2.8
Snack consumption		
Always	4	1.9
Sometimes	135	63.7
Never	73	34.4

Table 3. Kruskal Wallis difference test results.

	Mean	Std. Deviation	N	p-value
Breakfast habits	1.50	0.555	212	0.953*
Obesity	2.65	1.152	212	
Snack	2.33	0.152	212	0.014*
Obesity	2.65	0.508	212	

*Sig p <0.05

based on the frequency distribution analysis in Table 1.

The majority of respondents in the age category < 26 years were 180 people (84.9%) and the minority in the 50 - 61 years age category were 6 people (2.8%). The majority of participants are women amounting to 155 people (73.1%). The majority of respondents are 175 students (82.5%) with the ratio of student: lecturer: education staff, equaling 20 : 1.6 : 1.

Table 2 shows that the majority of respondents have the habit of having breakfast in the yes category with 112 people (52.8%), sometimes 94 people (44.35%), and never 6 people (2.8%). The

consumption of snack foods in the category of occasional was as many as 135 people (63.7%). The results of the univariate analysis of the BMI variable are shown in Figure 1.

The figure 2 shows that the BMI of the majority of participants were in the normal category (18.5 – 22.9) amounting to 94 participants: 76 women and 18 men, with 20 women and 6 men underweight, 29 women and 9 men normoweight, 19 women and 17 men obesity I, and 11 women and 7 men obesity II. After conducting a univariate analysis using frequency distribution, the analysis continued with the relationship between snack consumption and breakfast habits to prove the hypothesis (Ha1). The results of the analysis with p-value of 0.793 means that Ha1 is rejected and accepts the null hypothesis. It is concluded that there is no significant relationship between snack consumption and breakfast habits. Next, a one-way ANOVA test was conducted to assess the differences in obesity of respondents who consumed snacks always, sometimes, and never. This test was conducted to prove the research hypothesis.

Based on the Kruskal – Wallis test (Table 3), it is known that the mean rank of respondents who never eat snacks is 174.0. Respondents who occasionally eat snacks have a mean rank of 99.97. Respondents who always eat snacks have a mean rank of 114.88. It was concluded that there was a significant difference in obesity among the groups of respondents who ate snacks always, sometimes, and never.

In addition, the mean value of breakfast habits is 1.50 and the mean obesity is 2.65. The p-value of 0.953 is greater than 0.05. It was concluded that there was no significant difference between obese respondents based on their breakfast habits.

The results of the Kruskal-Wallis test show that the mean value of obesity is 2.65 and the mean snack consumption is 2.33 (Table 3). The p-value of 0.014 is smaller than 0.05. It was concluded that there was a significant difference between obese respondents based on their habit of consuming snack foods.

4.   Discussion

The majority age category <26 years is the majority group from the results of the study which is a young age. This result is reached by the status of the
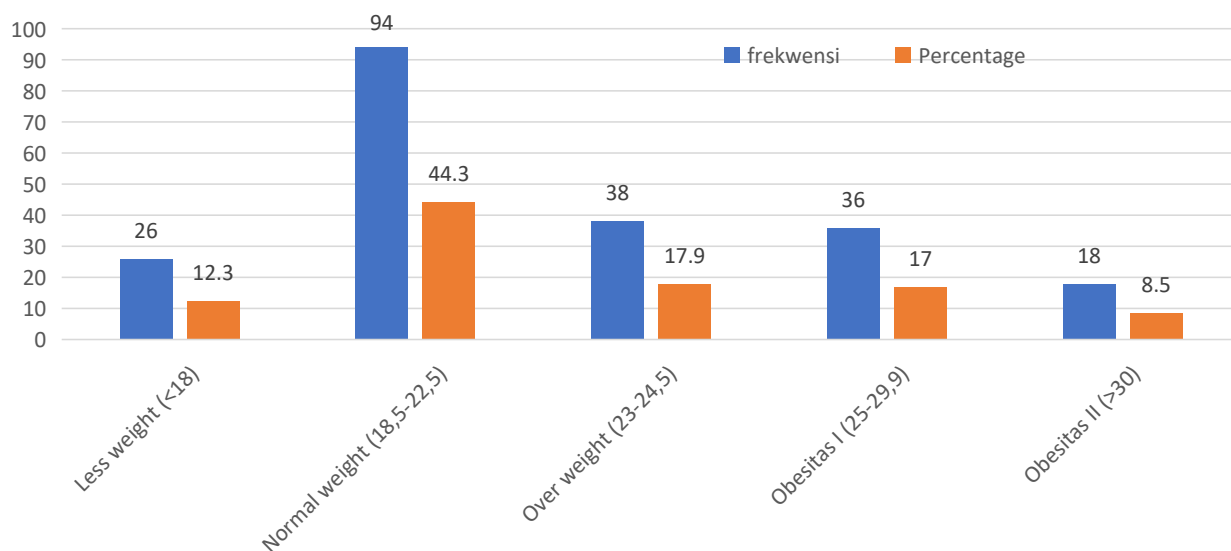
Figure 1. The comparison of body mass index based on the frequency and the percentage.
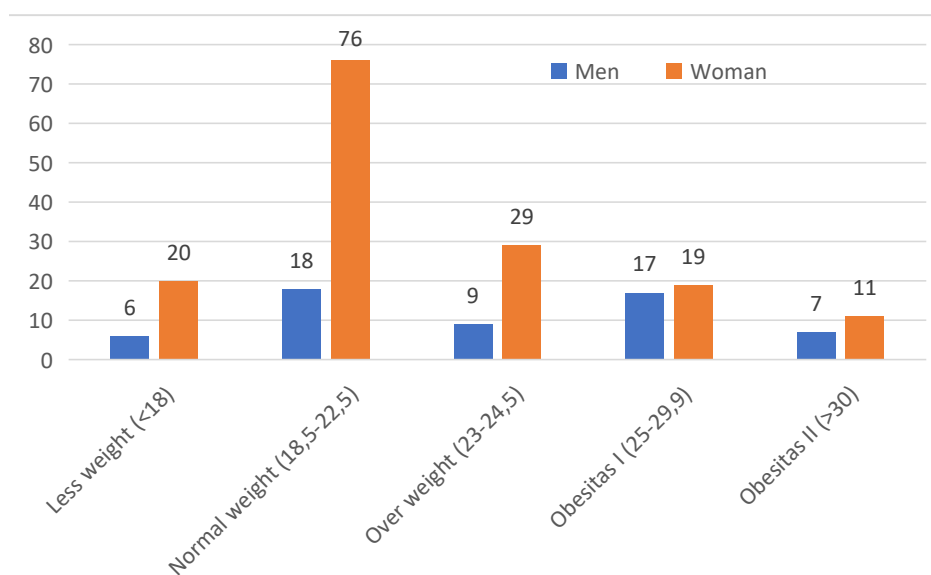
Figure 2. The average of body mass index of women and men.

majority of respondents are students with a total of 175 respondents (82.5%). Research respondents consist of students, lecturers, and education staff, with the ratio of the number of students, lecturers, and education staff of 20: 1,6: 1, so the majority of research respondents are students, creating a potential bias in the research results.

Dyussenbayev et al. (2017) [17] divided the period

of human life into 10 periods of life. The period of youth aged 13-25 years physiologically and psychologically is a period of mental development and the formation of the emotional environment. It is considered the right period for respondents to study in college.[17] The proportion of the female sex is greater than the proportion of men. International Labor Organization statistical data stated that the

global gender gap is higher for female workers than male workers as well as in the service sector, public services, and global companies which are more dominated by female workers than male workers.[18,19]

It is known that the mean rank is 174 for respondents who never eat snacks, shown by the proportions with the 4 respondents who are all male, lecturer status and BMI category between 23.9 – 32.3 overweight category, obesity I, and obesity II so that it has the highest rating of the others. Because the average value of all respondents is obese, the mean rank is the highest compared to other groups. Women's consumption of snacks is higher than men's, especially when women have NCD problems, in contrast to men's. One study in Canada stated that the consumption of snacks occurs most often 2-3 times per day in adult women is higher than in adult men.[20] The weakness of the study was that several factors that influence obesity were not studied, such as family history, and smoking habits, whereas the researchers' considerations were the research objectives to prove snack consumption, breakfast habits, and obesity.

The survey results found that most of the respondents were overweight, obese I, and obesity II. This refers to the weight classification for Asian countries including Indonesia, according to the WHO classification based on a BMI of more than 23.[21] Dobner (2018) described a person's weight-related risk factors for metabolic, endocrine, and immune disorders. Being overweight is a risk for NCDs, and being underweight is a risk for infectious diseases.[22,23] Examining the analysis of the relationship between snack consumption and breakfast habits, there is no positive relationship and value. The majority of respondents have breakfast habits and the majority of respondents consume snacks sometimes, so even though they have breakfast, they also eat snacks. This finding is relevant to previous researchers explaining that respondents in the category of excess nutritional status have the habit of breakfast and have the habit of consuming snacks in the frequent category between the time after breakfast and lunch.[24]

The world health survey results reported cases of NCDs from 48 countries including 25 middle-income countries and 23 other low-income countries. People with higher education tend to be physically inactive, consume less fruits and vegetables, and have an active smoking habit every day.[4] Low socioeconomic groups consume high alcohol and cigarettes, but have low consumption of vegetables and fruits compared to higher socioeconomic status.

Based on the survey results 212 respondents were underweight, overweight, obesity I, and obesity II. This phenomenon needs attention and control efforts to prevent the risk of NCDs through a healthy campus program. The Ministry of Health of the Republic of Indonesia collaborates with universities to implement healthy smoking habits and control obesity on campus to reduce the risk of NCDs due to obesity in academics.[25]

The Myanmar government has implemented tobacco restrictions nationwide to control the problem of NCDs since five years ago. The prevalence of overweight and obesity after tobacco restriction decreased significantly, supported by increased physical activity and improved diet.[7] A study of sociodemographic factors in Nepal found that the prevalence of NCDs in adolescents was 6 times higher in adolescents who smoked.[26] Other researchers stated that one of the factors that support obesity is smoking.[27,28] Smoking habits have an impact on decreasing High-Density Lipoprotein (HDL) levels and low HDL levels are one of the criteria for metabolic syndrome.[29] Indirectly smoking is associated with metabolic disorders, decreased body sensitivity to insulin, which results in weight gain, obesity, diabetes mellitus, cardiovascular disorders, and other health problems.

It was found that there was a significant difference in obesity between the groups of respondents who ate snacks: always, sometimes, and never. Consumption of snacks increases the intake of protein, carbohydrates, or fat so that there is an accumulation of body fat mass. This study did not examine physical activity and types of snack foods, but the habit of eating snacks, breakfast habits, and obesity. The results showed that there was no relationship between snack consumption and breakfast habits. Consumption of fried snacks is associated with obesity.[30] This type of food is high in carbohydrates and fat. Even though the respondent

has breakfast, eating snacks remains an unhealthy habit so it increases the number of carbohydrates and fat in the body. Wrong eating habits and changes in physical activity contribute greatly to obesity.

Relevant to previous research, the frequency of snack consumption is high due to the habit of watching and using gadgets in their spare time. Snacks increase the number of calories and cholesterol intake every day. It was also found that the higher the education, the higher the risk of obesity.30 Economic development and ease of access to food increase snack-eating behavior. Remarkably, identical adolescents experience changes in health due to eating behavior.[31,32] Teenagers who eat snacks while studying, reading, and watching, eating disorders are associated with anxiety and adolescent mood.[33,13]

This research provides benefits for institutions to control overweight and obesity in academics on campus. In the future, it is necessary to conduct periodic health checks such as checking blood pressure, blood sugar levels, cholesterol, and other efforts so that they are not only limited to anthropometric measurements and questionnaires. Education about dietary regulation can include limiting high-sugar diets, replacing snacks with fruit, and increasing physical activity. Obesity education in the community is oriented toward the application of a healthy diet, which is low in fat and sugar.[11,34]

This program can be done in the form of seminars, training, or empowerment of the campus community. Healthy campus promotion programs aim to tackle NCDs on campus.[35] It is also necessary to identify the types of snacks consumed so that they can be replaced with healthy foods that are low in carbohydrates and fats. According to Fottrell (2018), NCDs prevention strategies in Bangladesh improve detection and treatment.[36]

5. Conclusion

The majority of respondents have breakfast habits and the habit of eating snacks in the occasional category. There is no relationship between breakfast habits and snack consumption. The majority of respondents have breakfast habits and the majority of respondents consume snacks sometimes, which indicates even though they have breakfast, they

also eat snacks. Breakfast habits and snacking needs are different. Consumption of snacks is done simultaneously with activities such as working, watching movies, using gadgets, or doing additional work. This type of eating snacks such as cakes and fried foods increases the intake of calories, fat and stored in the body.

There is a significant difference in obesity among the groups of respondents who eat snacks always, sometimes, and never. Consumption of snacks increases the intake of protein, carbohydrates, or fat so that there is an accumulation of body fat mass. Obesity can lead to non-communicable diseases. Therefore, it is necessary to screen health examinations for all academic community members to prevent the increase in the prevalence of obesity and the risk of NCDs . On the other hand, snack consumption can be replaced with fruits and vegetables. Further studies need to be carried out related to physical activity so that early non-communicable diseases can be prevented in the academic community Universitas Islam Negeri Sumatera Utara, Medan.

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Conflict of interests

The author entirely declares that there is no conflict of interest between the authors.

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"EmosiAn": An android-based application for handling students with mild depression in MAN 1 Yogyakarta

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ABSTRACT Stressors from school and inappropriate friendships could lead to depression among teenagers, and possibly to attempts at suicide if not treated properly. To meet this need, there is a peer counsellor service, which is an extracurricular activity at school, called the Centre for Youth Information and Counseling / Pusat Informasi dan Konseling Remaja (PIK-R) Exalta. However, only a few students have used this service. This was due to a situational barrier that happened in direct counselling. This study aimed to detect mild depression and evaluate the implementation of the EmosiAn application (app) in handling mild depression among students. This study used secondary data from Program Kreativitas Mahasiswa Pengabdian Masyarakat (PKM-M)/ Student Creativity Program-Community Services conducted from Augustus to October 2020 at MAN 1 Yogyakarta. A total of 126 students voluntarily filled out the Patient Health Questionnaire-9 (PHQ-9), and 47 (37.3%) showed mild depression. Among 27 students and 5 peer counsellors then agreed to participate. The EmosiAn app was designed based on their problems, and had two interfaces for the administrator (peer counsellor) and the user (student). The app contained a diagnosis of depression using PHQ-9, daily journal, chat and reading the relevant articles. Before using the app, both peer counsellors and students attended zoom-online training. There was an increase in peer counsellors' knowledge (p=0.000) and students (p= 0.002) before and after the webinar. All participants could use the EmosiAn app and felt its benefits after two weeks of implementation. There were 40% of students who experienced a reduction of their depression level. Problems encountered during its usage could be resolved by fixing and refining the app. EmosiAn is a user-friendly application used by PIK-R Exalta to detect and care for students with mild depression. Further development is needed for wider used in the future.

1. Introduction

Depression is one of the psychosocial problems faced by adolescents. Data from Riskesdas 2018 showed that the prevalence of depression among adolescents aged 15-24 years reaches 6.2% in Indonesia, while in Yogyakarta, it reaches 5.5%.[1] Symptoms of a teenager experiencing depression include loss of interest, lack of energy, and decreased activity. Depression is a condition where a person experiences constant sadness and loses interest in what they usually do for at least two weeks.[2] Depression can be caused by stressors from school and social interactions. One of the causes of depression is bullying.[3] This bullying can be mocking, isolating, and calling names, which are often done by teenagers and can slowly lead to depression.

Depression in adolescents can result in impaired learning achievement, and if not handled properly,

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it can lead to attempts at suicide.[4] Therefore, early detection of depression and appropriate treatment can prevent more severe and life-threatening conditions. One of the ways to treat depression in adolescents is the peer counsellor program. A pilot study in Leipzig found that peer-counsellor played an essential role in handling inpatient depression.[5]

Madrasah Aliyah Negeri (MAN) - a government-owned Islamic Senior High School - 1 Yogyakarta has an extracurricular activity called the Centre for Youth Information and Counseling / Pusat Informasi dan Konseling Remaja (PIK-R) Exalta. The PIK-R Exalta provided a peer-counselling forum for the student in the school environment. Based on information obtained from the chief officer of the PIK-R Exalta 2019/2020 period, several problems were found because of bullying. However, only a few students (11 people a year) take advantage of the counselling. This gap was because face-to-face counselling meetings have not been very popular for various reasons. Based on preexisting research by Kessler et al. (2001), a person suffering from depression does not seek immediate treatment or help because there are situational obstacles. These situational barriers include discomfort, long treatment times, and worry about the stigma of others.[6]

In order to overcome those problems, PIK-R Exalta planned to use web-based online consultation. However, lack of human resources became the main obstacle; consequently, the program has not been launched yet. Based on the identification of these problems, the Program Kreativitas Mahasiswa Pengabdian Masyarakat (PKM-M)/ Student Creativity Program-Community Services team took the initiative to form an Android-based application that aims to facilitate PIK-R Exalta in early detection of mild depression, online counselling tools, and monitoring of depression that occurs in students of MAN 1 Yogyakarta. This internet-based intervention is one way to offer a series of practical counselling and efforts to reduce existing situational barriers. A previous study showed an internet and application-based gratitude intervention in reducing rapidly negative thinking (RNT) and other mental health outcomes, such as anxiety, depression and insomnia, both short- and long-term.[7]

This application is named EmosiAn, a user-friendly display with various features needed by PIK-R and students based on their needs. The available features include a depression screening feature using the Patient Health Questionnaire (PHQ) - 9, a chat feature that was used for online communication and counselling with PIK-R Exalta, a daily journal column for students to express their feelings and causes, and an article reading column to add insights into depression. Accordingly, the PKM-M team conducted community service activities in MAN 1 Yogyakarta using the EmosiAn application to handle mild depression. Using the EmosiAn application could facilitate peer-counsellor and students of MAN 1 Yogyakarta in early detection of mild depression and provide online care for those that needed it. Therefore, this study aimed to detect mild depression among high school students using EmosiAn application and evaluate the implementation of EmosiAn application in handling mild depression among high school students.

2. Methods

This study used secondary data from Program Kreativitas Mahasiswa-Pengabdian Masyarakat (PKM-M) that was conducted from August 2020-October 2020 in MAN 1 Yogyakarta. This PKM-M program enrolled 27 students with mild depression and five peer counsellors to use the EmosiAn application in two weeks of implementation.

This activity started with a screening of depression among students using the PHQ-9 questionnaire. The level of depression was categorized as normal/minimal (0-4), mild depression (5-9), moderate depression (10-14), moderately severe depression (15-19), and severe depression (20-27). This study only included students who expressed mild symptoms that a peer counsellor could manage. At the same time, people experiencing moderate to severe depression should seek help from professionals.

Due to the COVID-19 pandemic situation, all activities were done online. A total of 126 students of class X and XI of MAN 1 Yogyakarta volunteered to participate in depression screening using the PHQ-9 questionnaire. Based on the screening result,
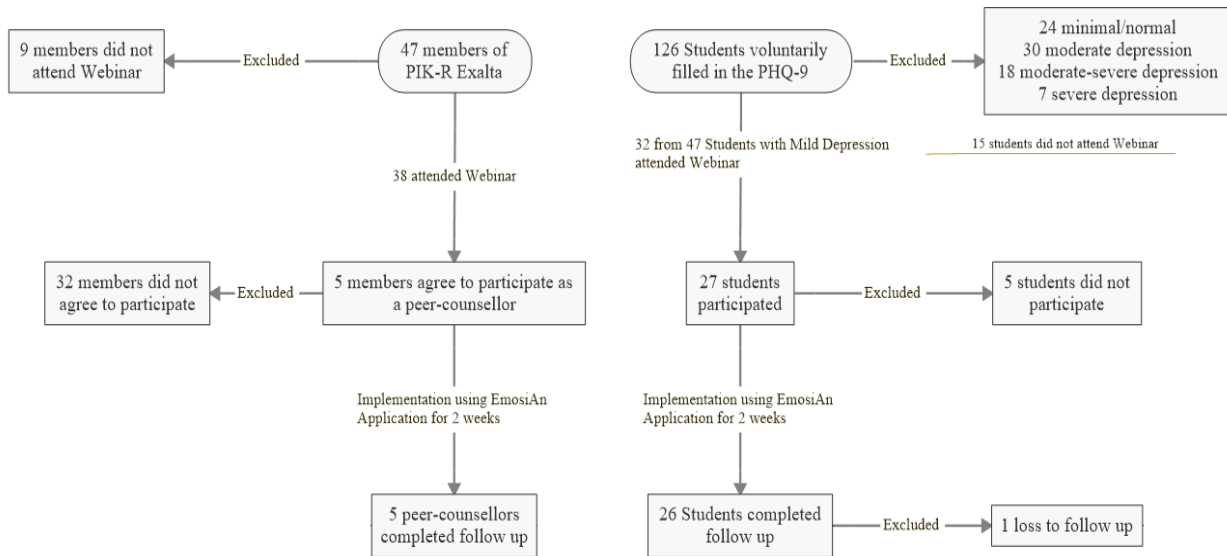
Figure 1. Subject that participated in this study flowchart.
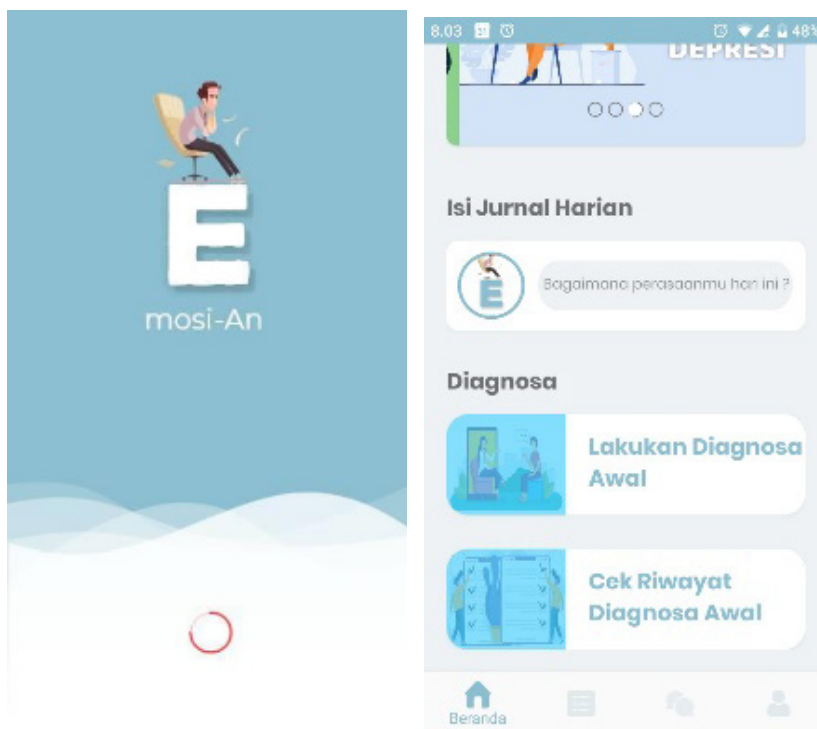
Figure 2. Start screen and home application.

students categorized with mild depression offered to participate in this activity. In addition, 32 students took part in a Webinar explaining depression and the use of EmosiAn applications; furthermore, 27 students were willing to participate in the implementation of EmosiAn for two weeks (Figure 1).

On the other hand, 38 of 47 members of the PIKR Exalta attended the webinar. Only five people in PIK-R Exalta were willing to become peer counsellors and participated for two weeks of implementation.
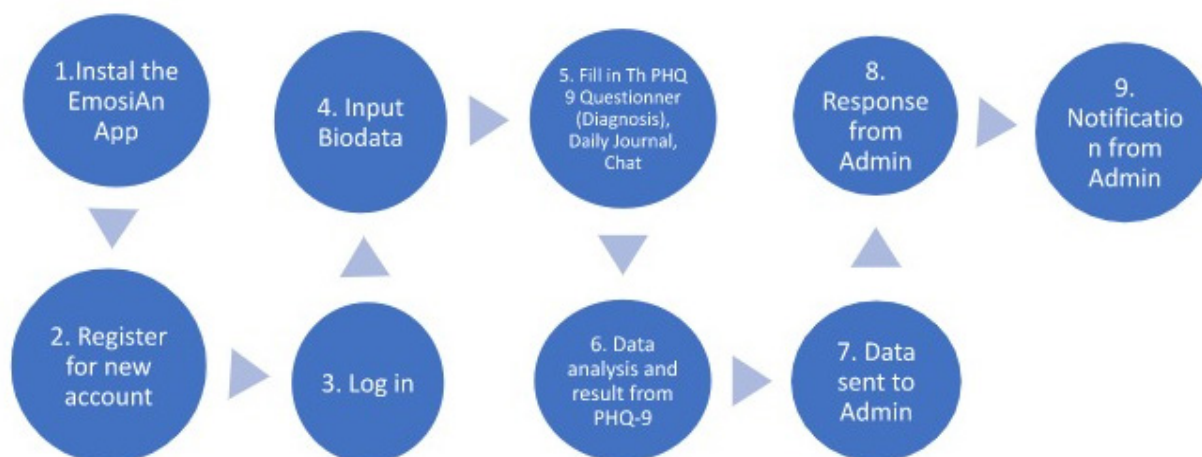
Figure 3. Application workflow.

The Webinar training for counsellors included an introduction to depression, how to handle it and how to use the EmosiAn application as a peer-counsellor. The Peer-counsellor who monitored the Emosi-An application used by students, reminded the students those had lower engagement, evaluated the level of depressive using PHQ-9, responded to daily journal and gave consultation via chat platform.

For two weeks, both students and peer counsellors used the EmosiAn application. Students filled in what they felt in the daily journal every day, filled out the PHQ-9 questionnaire on the diagnosis feature, and conducted online counselling via the chat feature. There was also an article reading feature to add insight and could be developed as needed. Likewise, the peer counsellor read the daily journal and responded to the student counselling in the chat feature.

EmosiAn is an android-based application for detecting and caring for depression among students in MAN 1 Yogyakarta. In the EmosiAn application, there are two sides of the user interface, namely administrators and participants. Participants in this program were students with a screening result of mild depression symptoms, while the administrator was a peer counsellor (member of the PIK-R Exalta). There were several features in EmosiAn application (Figure 2), i.e., the feature of diagnosis (using PHQ-

9 to detect depression), the feature of the chat (for online counselling with PIK-R Exalta), the feature of participant daily journal to express their feeling and the related cause, and the feature of article reading to give additional insight about depression and its preventive. The application design and workflow shown in figure 3.

The primary outputs of this activity were identifying students who suffered from mild depression using PHQ-9 and evaluating the benefits of EmosiAn in reducing depression levels among students. This study also assessed the differences in knowledge before and after the webinar online using a Google Form quiz. In addition, the paired t-test / Wilcoxon signed-rank analysis was employed. Moreover, a phone-based and direct interview were done to evaluate the implementation, detect some obstacles to solve and willingness to use the application. This data were recorded, transcribed verbatim, and analyzed with an open code.

This study was ethically approved by the Committee of Ethics for Health Research, Faculty of Medicine Universitas Islam Indonesia No 38/Ka.Kom. Et/70/KE/XII/2020.

3. Result

The study found that the use of the Emosi-An app could detect mild depression among students and

Table 1. PHQ-9 Depression score among students at baseline and after two weeks of implementation.

PHQ-9 depression score	Baseline	Two weeks
Minimal/normal	-	11
Mild	27	9
Moderate	-	6
Loss to follow up	-	1
Total	27	27

those with good engagement had a better reduction in depressive symptoms. The initial survey using the PHQ-9 questionnaire that involved 126 students from MAN 1 found the depression level of the students, as shown in Figure 4. There were only 20% students of students who had no/minimal depression, while the rest had depression from mild to severe.

A total of 32 students who showed mild depression from PHQ-9 screening attended the online seminar, and 27 among them voluntarily joined this activity. The online seminar using Zoom Cloud meeting (Webinar) was conducted separately for students and members of PIK-R Exalta. This online seminar informed students about depression and the use of the app. At the same time, similar topics were adjusted to peer counsellors, including how to do counselling. Figure 5 shows the pre and post-test results between students and the member of the PIK-R Exalta. Based on Figure 5, the knowledge level of both student and peer increased at post-test (after webinar session). The mean differences for student and peer groups were significant with $p=0.002$ and $p=0.000$, respectively.

After two weeks of using the application, the 27 participants who had mild depressive symptoms at baseline had changed their depressive level. There were 11 (40,7%) participants who experienced a decrease in minimal depression, while the rest remained at the same level and increased to a moderate level. This information can be found in Table 1.

Other findings showed that the students could use all features in the application independently. For example, they used the diagnostic feature to examine their depressive conditions; Students wrote what they felt and worried about in daily journal;

and Students consulted their problem with PIKR-R Exalta as their peer in chat feature as well, as they had valuable insight from several articles provided.

Students and peer counsellors experienced the benefit of EmosiAn. Based on videocall interviewed student expressed their feeling while using EmosiAn :

" ..I am delighted to use it, I can chat to a counsellor" (Student 1).

" … it is good when we feel insecure, we can communicate and ask help from chat feature.." (Student 2).

The peer counsellor /PIK-R Exalta will make this application their program next year.

"I am very grateful with this application. PIK-R Exalta will be a home for a student to tell their story".

Several obstacles arose during the implementation, such as time constraints of counsellors to respond to student chats, the lack of interest in some students for counselling, and the confusion of some students to express their feelings. However, after having the evaluation meeting between PIK-R Exalta and PKM-M team, there were several possible solutions to solve the problems, such as sharing the counsellor's burden per student, inviting and reminding students to be more active in expressing their complaints in the application, and increasing the choice of emotions in the application so that it is more varied than before.

4. Discussion

From the initial survey taken before the program launched, it was found that most students (80%) had depressive symptoms, varied from mild to severe. Similar findings were found from a previous study of 709 university students in Indonesia during pandemic COVID-19, where 72% were found to have symptoms of mild depression.[8] A study that included 450 healthcare students from Jordan found 33.8% had borderline depression and 26.2% had abnormal depression.[9] This result was relatively high compared to a previous study that assessed the mental health of 1,027 medical students at any stage of education, fresh graduate, and internship doctor in Indonesia
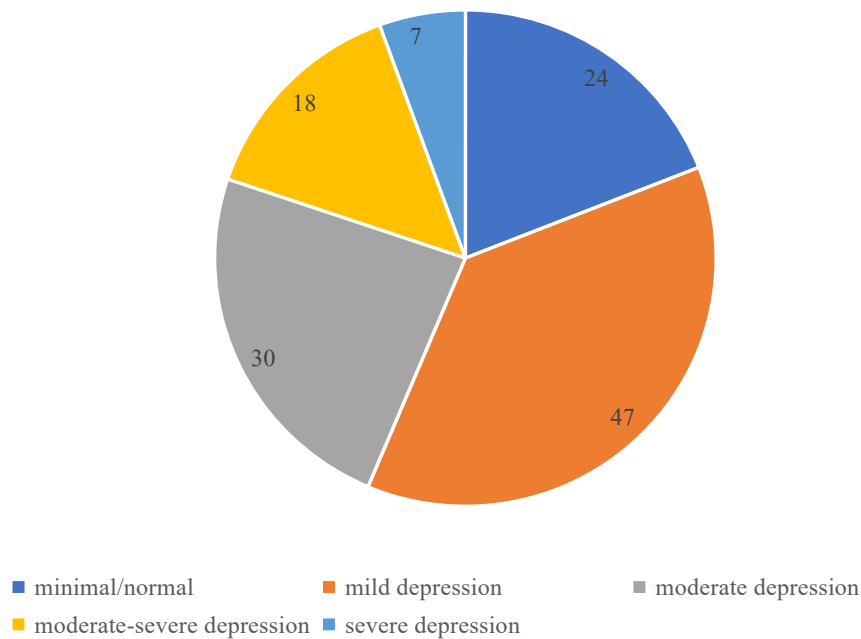
Figure 4. Depression level of the student at the initial survey.
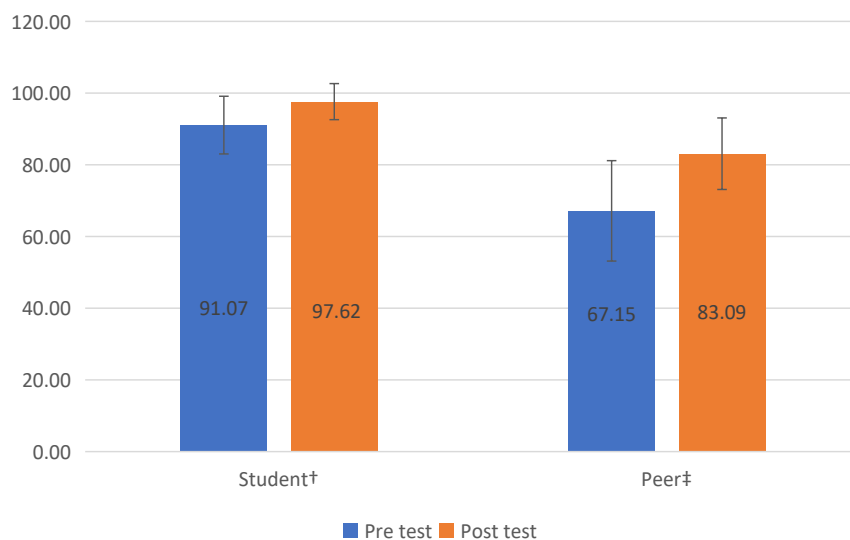
Note: Error bars indicated standard deviation
†Wilcoxon signed-rank test, p=0.002
‡Paired t-test, p=0.000.

Figure 5. Knowledge of student and peer counsellors before and after the online seminar.

during the COVID-19 pandemic and found 16.8% had depression.[10] A previous study showed three major impacts of the COVID-19 pandemic to sub-urban society Yogyakarta, i.e. psychological, social, and economical. The psychological impact included negative emotions that arise due to psychosomatic symptoms, fear of losing loved ones, stereotypes and anxiety concerning contracting COVID-19 infection, limited social interaction in the community, and strict travel restrictions. Individual coping and family support were needed in the current situation.[11] Since the pandemic emerged there are several mental

problems that are more common, and it is necessary to identify the depressive symptoms among the students, so that proper treatment/intervention can be done early.

Based on the pre and post-test results, there was an increase in the mean knowledge of participants about depression. Online education was adequate for increasing the students' learning, especially during the pandemic condition. Almost all students (96%) and peer counsellors (100%) joined the activity until the end of the program. During online sessions, which needed to be attractive and interactive, these pre and post-test methods effectively increased student engagement and helped in evaluating the programs.

Peers played an essential role in detecting and giving consultation.[5] However, even before the COVID-19 pandemic, very few students came to face-to-face consultation. In this study, the EmosiAn application could help students and peer counsellors communicate in an android-based application. Both students and peers expressed their convenience when using the EmosiAn application. A previous study using the Smartteen, a computer app based on Cognitive Behavioral Therapy (CBT), effectively reduced depressive symptoms in Indian adolecents.[12] Similar findings from randomized controlled trials showed that transdiagnostic internet-CBT, mindfulness-enhanced internet-CBT and online mindfulness were more efficacious than usual care in reducing symptoms of anxiety and depression.[13] In addition, gratitude interventions using Internet applications could reduce anxiety and depression.[7] These results were associated with functional impairment at post-treatment[13] and reducing risk factor (repetitive negative thinking).[7] Interestingly, the results could be maintained at 3-months follow-up[7,13] and 6-months follow up.[7] This Internet-based application also had several advantages such as increased resources and more time-efficient intervention for therapists.[7,12]

This study found that 40% of students with mild depression could reduce their level to normal. However, this effect varied and seemed to have a relationship with the frequency of using the app. Students who remained in mild depression or moderate depression have more rare application usage than those who became minimal/normal. Therefore, the admin /peer counsellor could give feedback for the student to fill in the EmosiAn routinely when they needed it. A previous study about the feasibility of an Internet-based mental-health intervention at the Universitas Gadjah Mada students required well educated and fast Internet with enough bandwith.[14] Several obstacles during the implementation should be solved within the peer counsellor and feedback from students/users. Thus, routine monitoring and evaluation were needed to manage these programs. It was essential to pay more attention to the unresponsive students as they might face more problems due to no Internet or more developed depressive symptoms. This application could give such information; thus, peers, teachers or parents could give proper intervention.

To the best of our knowledge, this was one of the limited studies that revealed the use of mobile app to deal with mild depression among students during the pandemic. This study encourages the role of peer counselor and the importance of daily interactions with students while using the app. Students were at risk for depression, especially during online learning due to the pandemic. Since there were many obstacles in conducting face-to-face consultations, therefore the use of the EmosiAn app must be more socialized and expanded.

This study had several limitations since depressive symptoms among students were only defined from PHQ-9 rather than a professional examination by faculty in psychiatry. However, as shown in the previous studies, PHQ-9 was appropriate for detecting and monitoring depression in diverse populations (African American, Chinese American, Latino, and non-Hispanic), and populations with good literacy levels.[15,16] The PHQ-9 seemed to be similarly sensitive but might be less specific for younger patients than older patients; a cut-off score of 10 or above could be used regardless of age.[17] A preexisting study said there was a 20% inconsistency between the SRQ20 and PHQ-9[18]; however, another study revealed PHQ-9 was a reliable and valid measure of depression severity.[19] Therefore, this study used PHQ-9 in the EmosiAn app to screen and monitor depressive symptoms of the students.

As discussed in the earlier study, regarding the Internet / online based interventions, there was a possibility of self-referral and only highly-motivated students participated in the study.[14] Thus, it might not represent the actual situation.

Despite its benefits and ease to use, the EmosiAn app needed to be upgraded following several conditions and more users engaged for better experiences and giving feedback. Hopefully, this app could be implemented widely both for students as well as a peer counsellor.

5. Conclusion

EmosiAn app was useful to detect mild depression among high school students and had advantages for the peer-counselor to help the students with mild depression symptoms. Likewise, for students, this app can be used to share complaints and measure depression independently. This application has been successfully used by PIK-R Exalta and 27 students of MAN 1 Yogyakarta found it helpful for early detection and management of mild depression in students of MAN 1 Yogyakarta.

Several obstacles arose during the implementation, such as time constraints of counsellors to respond to student chats, the lack of interest in some students for counselling, and the confusion of some students to express their feelings. Therefore, better app development is needed to support its distribution if it is to be implemented in all schools in Yogyakarta. In addition, PIK-R Exalta can apply peer counsellor working hours to be more optimal and publish apps continuously in the environment of MAN 1 Yogyakarta.

Acknowledgement

Conflict of interests

The authors have no conflicts of interest associated with the material presented in this paper.

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Implementation of household-scale clean water treatment technology for the mountain farming community, Jajar village, Gandusari district, Trenggalek

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ABSTRACT Currently, the need for clean water which is a vital source for people's lives has not been fully met for all Indonesians, including the mountain farming community, Jajar Village, Gandusari District, Trenggalek Regency. So far, the mountain farming community members of Jajar Village have used mountain water for household needs where cloudy and unstable water conditions are a problem that must be faced. If this problem continues, it will lead to serious health problems and social conflicts in the community. Therefore, through community service activities, we made a practical clean water treatment tool, with easily obtained materials, that can be implemented in hilly areas such as in Jajar Village, Gandusari District, Trenggalek Regency. The filtration system used is an upflow and downflow system where the water undergoes a filtration process twice in the material that has been selected and arranged in a systematic way. The materials used are available and easy to obtain in Jajar Village, so that people can discover easily about the benefits of these materials. After making a water filtration system with the community, then physical testing is conducted on the quality of the water produced. From the test results of the effectiveness of the implementation of clean water treatment technology applied to mountain farmers in Jajar Village, it shows that in general the filtered water has met the physical requirements for the level of turbidity, taste, and smell, as well as the quantity and continuity of water are always available when needed.

1.Introduction

Water is an important element in human life that must be fulfilled, even water can show a wider role in maintaining life and social unity.[1,2] The World Health Organization (WHO) estimates that 1 billion people in the world do not have access to safe drinking water and 3.4 million people die each year from water-related diseases. In meeting the daily needs, the average human needs a minimum of 3-5 liters of clean water per day for drinking and 50 liters of water for cooking, bathing, and sanitation.[3] Clean water in a settlement must be readily-available in terms of the availability of water in sufficient quantities to meet daily needs, water quality must meet standards, and continuity in the sense that water is always available when needed.[4,5]

According to data from the Kimpraswil Department in the National Action Plan Study for the Clean Water Sector, 61% of Indonesians do not have access to clean water. Jajar Village is a village that is included in Gandusari District, Trenggalek Regency, East Java, Indonesia.[6] Jajar Village, especially Dukuh Ngasinan is an area that has hilly contours and rocky soil, which makes it difficult for people in Jajar Village to drill groundwater as a source of clean water for residents. As a result, residents only rely on water sourced from the mountains with cloudy water quality and the discharge is always
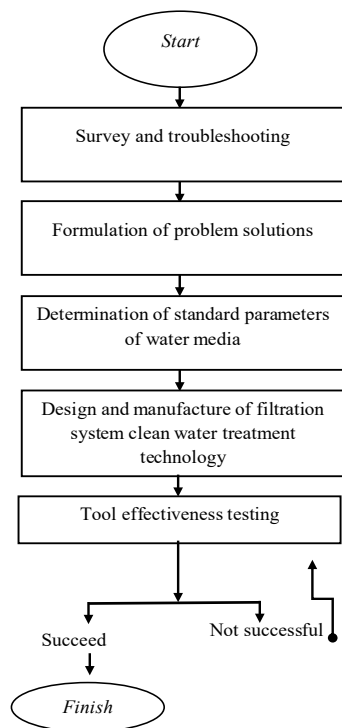
Figure 1. Research flow chart.

changing depending on the season. Based on the requirements for the provision of clean water, the water used by the community in Jajar Village does not meet the standards in terms of quality, quantity, nor continuity.[7,8] If the problem is allowed to continue, there will be serious health problems and social conflicts in the community. Therefore, through community service activities, we had the goal of making a practical clean water treatment tool and assessing how effective the tool's testing results. The test was done by taking into account the physical requirements in accordance with the Regulation of the Minister of Health of the Republic of Indonesia Number 32 of 2017, with parameters such as the level of turbidity, taste, and odor.

2.Methods

The research location was conducted in Jajar Village, Gandusari District, Trenggalek Regency, East Java with a time of seven months of research. The research method started with a survey and identification of problems, formulating problem solutions, determining standard parameters of water

media standards, making clean water processing technology with filtration systems, and testing the tool's effectiveness. The research flow chart can be seen in Figure 1.

The first stage began with a survey and problem exploration. At this stage, the problems experienced by mountain farmers in Jajar Village were explored. Then from all the problems found in the early stages, priority problems experienced by residents were considered and raised and then the solution was formulated. The next step was to determine the standard parameters of the water media, referring to the Regulation of the Minister of Health of the Republic of Indonesia Number 32 of 2017, with parameters such as the level of turbidity, taste, and smell. In addition, the standards of quantity and continuity of the water produced were also a consideration in conducting this research. The determination process was done by categorizing the 5 water quality parameters with the Likert scale such as: SS (Strongly agree), S (Agree), R (doubtful), TS (disagree), and STS (Strongly disagree). Moreover, water quality parameters in testing the tool effectiveness are including: 1) The quality of the resulting water clarity is very good; 2) The filtered water is odorless; 3) The filtered water is tasteless; 4) The water quantity is sufficient to meet the needs of the residents; and 5) Water continuity available when needed.

After determining the standard parameters of the water media, the next step was to design and manufacture the technology for processing clean water filtration systems.[9] The design results used can be seen in Figure 2. The clean water treatment technology of this filtration system uses filter media such as bricks, large stones, medium stones, small stones, gravel, and sand.

The filtration system uses an upflow (flow direction from bottom to top) and a downflow (flow direction from top to bottom) filtration system. Based on Figure 2, in the first reservoir the filtration system used is an upflow filtration system with filter media in the form of bricks, large stones, medium stones, small stones, gravel, and sand. The second reservoir uses a downflow filtration system with filter media in the form of bricks, large stones, medium stones,
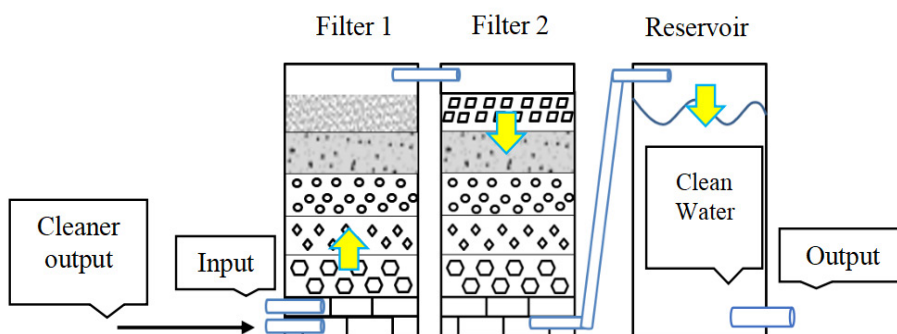
Figure 2. Design of clean water treatment technology filtration system.

Figure 3. The results of the installation of the filtration system clean water treatment technology.

small stones, gravel, and charcoal. The third reservoir is a container for water that has been filtered in clear conditions and is ready to be distributed to the desired place. After the manufacturing process is complete, then we proceeded with installation in a predetermined place as shown in Figure 3.

The last stage was to test the tool effectiveness. Testing the tool effectiveness was done using a sampling technique (probability sampling), where every community member in Jajar Village was randomly selected to be a respondent in the sampling process.[10] In calculating the number of samples, the following data are used: the population in Jajar Village is 2,959 people, the bound of error or the highest sampling error is not more than 5%, and the confidence level used was 95%. By using Equation 1,

it can be calculated for the number of samples taken as many as 353 samples.

$$n = \frac{N \, x \, P \, x \, Q}{(N-1) \, x \, D + P \, x \, Q}$$

Calculation of the number of samples:

N = 2959

B = 5% = 0.05

P = Q 0.5 (Moderate estimate of proportion, if population proportion is unknown)

D = B2/4 (to estimate the percentage at the 95% confidence level)

 = (0,052 / 4) = 0,000625

(a)

(b)

Figure 4. Comparison of water yield before and after filtration using clean water treatment technology.
(4.a) The water before filtration. (4.b) The water after filtration.

Table 1. Water quality parameters in testing the tool effectiveness (%).

No	Parameter	SS	S	R	TS	STS
1	The quality of the resulting water clarity is very good	96	4	0	0	0
2	The filtered water is odorless	98	2	0	0	0
3	The filtered water is tasteless	97	3	0	0	0
4	The water quantity is sufficient to meet the needs of the residents	98	2	0	0	0
5	Water continuity available when needed	96	4	0	0	0

Table 2. The level of public understanding of the criteria for clean water and how to treat clean water before consumption.

Description	Knowing about clean water criteria			Knowing how to treat clean water well before consumption		
	Yes	No	No Answer	Yes	No	No Answer
Respondent (soul)	347	6	0	0	353	0
Percentage (%)	98	2	0	0	100	0

3. Results

3.1 Tool effectiveness

The effectiveness level of the test results of clean water treatment equipment in this study was measured based on five assessment parameters. The study results are shown in Table 1, and the comparison results of water before and after filtration are shown in Figure 4.

Table 3. The level of public understanding of the consequences caused by consuming water that is not/less appropriate.

Description	Knowing the Consequences Caused by Consuming Inappropriate/Inadequate Water		
	Yes	No	No Answer
Respondent (soul)	349	4	0
Percentage (%)	99	1	0

3.2 The level of understanding about clean water

The level of community understanding in Jajar Village about clean water in this study was measured based on three assessment parameters. The study results are shown in Tables 2 and 3.

4. Discussion

The provision of clean water infrastructure is very important in supporting the sustainability of the community in a settlement. Clean water is no longer an item that is available in abundance and freely used, but has become a scarce economic commodity that requires proper management.[11, 12] Based on the effectiveness results of testing clean water treatment equipment, it found that 96% of respondents strongly agreed that the quality of the water clarity produced was very good, while 4% of respondents agreed that the water quality was good.

Then, based on other parameters, 98% of respondents stated that the filtered water was odorless and 97% of respondents stated that the filtered water had no taste. In general, the filtered water obtained shows good quality that meets the physical requirements for the level of turbidity, taste, and odor in accordance with the Regulation of the Minister of Health of the Republic of Indonesia Number 32 of 2017. By fulfilling these physical quality requirements, it shows that the quality of the filtered water can prevent the emergence of suspended solids such as fine sediment, clay, and organic matter which are potential sources of particulates and pose health risks.[13]

Furthermore, as many as 98% of respondents strongly agree that the water quantity produced is sufficient for the needs of the residents, and 96% of respondents strongly agree that the continuity of water is always available when needed, so that the use of clean water for the daily needs of the mountain farmers of Jajar Village can be maintained and fulfilled.

Based on the understanding level of the community in Jajar Village about clean water, the results showed as many as 347 respondents or 98% of respondents knew about what is meant by clean water based on the criteria of "knowing" if one considers: odorless-tasteless-colorless or "don't know" if unable to mention one of the criteria for clean water. Meanwhile, only 6 respondents or 2% of respondents answered that they did not know about the criteria for clean water. Furthermore, to find out the community's understanding of how to treat clean water well before consumption, the results showed that 100% of respondents did not know about how to treat clean water before consumption, based on the criteria of "knowing" if one considers: filtered and deposited using filter media such as stone brick, large stone, medium size stone, small stone, gravel, and sand and use upflow and downflow filtration systems.

Based on these data, the level of public understanding of the criteria for clean water is quite good, but it is necessary to better understand how to treat water properly before consumption.[14,15] Subsequent research was conducted to find out about the level of public understanding of the consequences caused by consuming water that is not / less feasible. Based on the study results as many as 349 respondents or 99% of respondents answered "know" the consequences and as many as 4 respondents or 1% of respondents answered "don't know". The criterion of "knowing" is if the respondent can mention: the occurrence of skin diseases, dysentery, diarrhea, and others in humans who consume the water that is not properly treated.

5. Conclusions

The implementation effectiveness level of the clean water treatment technology applied to mountain farmers in Jajar Village, Gandusari District shows that in general the filtered water has met the physical requirements for the level of turbidity, taste, and smell. By fulfilling these physical quality requirements, it shows that the filtered water quality can prevent the emergence of suspended solids such as fine sediment, clay, and organic matter which are potential sources of particulates and pose health risks. Then, as a result, the water quantity produced in general is sufficient for the needs of the residents and continuity of water is always available when needed.

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Conflict of interests

No potential conflict of interest was reported by the authors.

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Realizing healthy culinary tourism through education in the 'Angkringan' street vendor community of Yogyakarta city during the COVID-19 pandemic

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ABSTRACT Angkringan is included in the culinary options of Java, although it involves a simple food stall on the roadside using a wheelbarrow and covered with a plastic tarpaulin as the roof. However, food safety is one of the main factors that influence tourists in choosing Angkringan culinary spots. Therefore, it is necessary to monitor the quality of food management by paying attention to health requirements including hygiene and sanitation procedures. This study aimed to analyze the differences in the food safety scores of Angkringan street vendors in Yogyakarta City before and after an intervention. We conducted a quantitative study with an experimental design from March to May 2021. We intervened with health education through pocketbooks in 49 communities of Angkringan street vendors in Yogyakarta tourism locations with a duration of one month. Data collection was conducted through the Food Safety Score Questionnaire while data analysis used Wilcoxon signed-rank tests. The majority of Angkringan street vendors had a category of Food Safety Score that was vulnerable but safe to consume before and after the pocketbook intervention. However, the influence of the intervention showed significant differences in research results (p-value < 0.05). This study concluded that health education interventions with pocketbooks among the Angkringan street vendors could positively affect food safety scores. We recommend that the government foster food hygiene education and monitoring of Angkringan street vendors, especially during the COVID-19 pandemic.

1. Introduction

TYogyakarta city is one of the favorite tourist destinations in Indonesia. This student city is a tourist attraction because it has cultural attractions, art-filled museums, and tourist villages. Although the city of Yogyakarta experienced a decrease in tourist visits from 2014 to 2018 and the length of stay of tourists in 2018 did not reach the target, the development of shopping and culinary tourism makes tourists comfortable when visiting the city of Yogyakarta.[1,2]

In the culinary tourism sector, Yogyakarta has its specialties, namely Angkringan, which serves cheap dishes with long carrying poles or charts. The family atmosphere between sellers and buyers in Angkringan makes this culinary option very popular. As a cultural-based tourist city, Angkringan street vendors can be found easily on every corner of Yogyakarta.[3]

One of the main factors that tourists pay attention to in choosing Angkringan culinary spots is cleanliness or hygiene.[4] Food sanitation hygiene is an effort to control food factors, people, places, and equipment that can cause diseases or health problems. Sanitary hygiene requirements are technical provisions set out for restaurants and restaurant products, and their equipment includes bacteriological, chemical, and physical requirements.[5-7]

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By looking at the potential of Angkringan food and the high level of insecurity, it is necessary to supervise the quality of snack food management by paying attention to the rules for safe hygiene and sanitation, and health requirements. Pathogenic bacteria cause about 80% of foodborne diseases. Some types of bacteria that often cause disease include Salmonella, Staphylococcus, E. coli, Vibrio, Clostridium, Shigella, and Pseudomonas cocovenenous.[8,9] The COVID-19 pandemic was easily transmitted from animals to humans and humans to humans through the contact of objects and food. There are few previous studies on food safety among Angkringan street vendors. Therefore, an intervention is required in the form of education by measuring food safety scores as the output. The research-based community aimed to analyze the differences in the food safety score of Angkringan street vendors in Yogyakarta before and after an intervention.

2. Method

This quantitative research was conducted with the design of pre-test and post-test experiments. The researchers conducted community-based interventions on groups of street vendors in the Malioboro tourist area, in Yogyakarta City from March to May 2021. The intervention provided education on food hygiene through pocketbooks, especially during the COVID-19 pandemic. The determination of samples was done through purposive and simple random sampling of as many as 49 communities of Angkringan street vendors. The sample was determined based on Angkringan data from the Kemantren Office in accordance with the inclusion criteria, which were Angkringan traders who sell and cook on site. Next, we randomly selected the data. Figure 1 shows the pocketbook used for community education. The respondents were asked to fill out the pocketbook on food hygiene and safety among Angkringan food vendors during the COVID-19 pandemic.

The researchers had obtained an ethical clearance letter before collecting the data. The data collection used food safety score questionnaires, which measure the selection and storage of foodstuffs, cooking hygiene, food processing, and

food distribution.[10] The questionnaire had been standardized and filled by enumerators. Educational interventions using pocketbooks were conducted when collecting pre-test data directly and privately by paying attention to the COVID-19 health protocols. The duration of the intervention was one month. Next, the researchers took post-test data with the same questionnaire. The researchers conducted univariate and bivariate data analysis using the Wilcoxon sign rank test with results with p<0.05 considered significant.

3. Result

The characteristics of 49 respondents of Angkringan street vendors are explained in Table 1. The average age of respondents was 44.7 years, and most had received higher education. However, most have never received counseling on Food Safety Score (FSS), so they mostly had FSS in the category of vulnerable but safe to consume, with self-cooked food and open deposit and presentation. Most of the respondents have been selling Angkringan for more than ten years, have been licensed, owned their cart, and made it their main job with an average daily income of Rp 184,590.

During the COVID-19 pandemic, most street vendors already had handwashing or hand sanitizer. Nevertheless, not all have imposed restrictions on the number of buyers or seating distance; there was an absence of body temperature checks; and not all traders and buyers use masks or face shields. Therefore, the researchers conducted the socialization of food hygiene pocketbooks, especially since the research was conducted in the "new normal" era. However, based on Table 2, there were no significant differences with a p-value of > 0.05.

Figure 2 showed that some Angkringan street vendors had conducted COVID-19 health protocol. Although not all efforts have been made, at least the vendors in Angkringan provided a place to wash hands and the use of masks between sellers and buyers.

Based on Table 3, there was a significant difference (p-value < 0.05) in the food safety score between Angkringan street vendors before and after being given pocketbook intervention of Angkringan

Figure 1. The pocketbook of food hygiene and safety among Angkringan in the "new normal".

Figure 2. The implementation of 'new normal' condition in Angkringan street vendors.

street vendors face to face or directly (Figure 3). Significant differences were in the selection and storage of foodstuffs, as well as the processing of foodstuffs. Meanwhile, there was no significant difference in the category of hygiene cooks and food distribution (p-value > 0.05).

Table 4 explained the description of the Food Safety Score (FSS) of all respondents of Angkringan

Table 1. The characteristic of respondents.

Characteristics	Min	Max	Mean±SD	SE	N (%)
Age	17.00	65.00	44.70±11.22	1.44	
Daily income (Rp)	20,000	1,500,000	184,590±286,926	36,737	
Education level					
High					28 (57.2)
Low					21 (42.8)
Length of work					
≤ 1 year					10 (20.4)
1-5 year					10 (20.4)
>5-10 year					10 (20.4)
>10 year					19 (38.8)
Food safety knowledge					
High					16 (32.7)
Low					33 (67.3)
Food sales					
Self-cooked					5 (10.2)
Third party food supplier					3 (6.1)
Both of them					41 (83.7)

Table 2. The adaptation of new habits in Angkringan street vendors.

Characteristics	Pre-test		Post-test		p-value
	n	%	n	%	
Providing hand wash/hand sanitizer					0.335
Yes	33	67.3	35	71.4	
No	16	32.7	14	28.6	
Restriction on the number of buyers/seat distances					0.801
Yes	17	34.7	19	38.8	
No	32	65.3	30	61.2	
Wearing mask					0.181
Yes	23	46.9	27	14.3	
No	26	53.1	22	85.7	
Body temperature checks					0.199
Yes	4	8.2	7	14.3	
No	45	91.8	42	85.7	
Covered food					0.321
Yes	23	46.9	24	49.0	
No	26	53.1	25	51.0	
Total	49	100	49	100	

street vendors before and after being given pocketbook intervention. Based on post-test data, 42.9% of Angkringan street vendors still have FSS category vulnerable but safe to consume, while those with excellent and moderate categories were 28.6% in each food safety score.

4. Discussion

The study results mentioned that age, education, prior knowledge, and experience influence the hygiene behavior of Angkringan traders in selling food products. The previous research mentioned that traders' knowledge will impact how they process and serve food to their customers. Therefore, someone who has good knowledge and understanding will improve the quality of food for their customers.[11] This tendency to improve the quality of sales services has to do with the desire to increase revenue.[4]

During the COVID-19 pandemic, several Angkringan street vendors have equipped facilities in

Table 3. Food safety score in Angkringan street vendors.

Food safety score	Min	Max	Mean±SD	p-value
Selection and storage of foodstuffs				0.026
Pre-test	0.00	0.16	0.1304±0.0420	
Post-test	0.07	0.16	0.1449±0.0261	
Cooking hygiene				0.455
Pre-test	0.06	0.15	0.1190±0.0189	
Post-test	0.06	0.15	0.1222±0.0253	
Food processing				0.028
Pre-test	0.00	0.59	0.4824±0.1332	
Post-test	0.37	0,59	0.5267±0.0575	
Food distribution				0.584
Pre-test	0.05	0.13	0.1092±0.0171	
Post-test	0.07	0.14	0.1073±0.0202	
Total				0.019
Pre-test	0.19	0.99	0.8366±0.1773	
Post-test	0.65	1.04	0.9012±0.1059	

Table 4. Food safety score category in Angkringan street vendors.

Characteristics	Pre-test		Post-test		p-value
	n	%	n	%	
Good	3	6.1	14	28.6	
Moderate	11	22.4	14	28.6	0,041
Prone but safe to consume	32	65.3	21	42.9	
Prone and not safe to consume	3	6.1	0	0	
Total	49	100.0	49	100.0	

the sales location with handwashing, hand sanitizer, wearing masks when selling, as well as restrictions on the number of buyers. This is done to increase buyers' confidence in potential vulnerabilities in the era of the COVID-19 pandemic. Previous research explained that the location, facilities, and quality of service influence consumers' decision to choose Angkringan stalls.[4]

Food safety is an essential prerequisite of food.[9] We did the measurement of food quality of the Angkringan street vendors using a food safety score questionnaire. This questionnaire is valid and contains four measurement categories: the selection and storage of foodstuffs, cooking hygiene, food processing, and food distribution.[10] The absence of any significant difference can occur because not all food sold in Angkringan street vendors is cooked alone or is a food deposit. At the same time, the study did not provide interventions to distributors or the suppliers of food. There is also the absence of uniformity of Angkringan food suppliers, so the

quality standards of the food cannot be known.

Maintaining the quality of street food services requires a community-based educational intervention.[7] We provided education on food hygiene and safety, ranging from selecting and storing foodstuffs, cooking hygiene, food processing, and food distribution.[10] In other research, the good knowledge and practice of food safety demonstrated by the respondents corroborated the negligible prevalence of Salmonella, reiterating the importance of vendor meat safety knowledge.[12] The use of pocket books as a medium of health education, has practical value for street vendors. However, interventions can use a variety of practical media, such as pocketbooks or videos. These interventions should be done by monitoring and evaluating to get optimal results. Based on post-test data, most Angkringan street vendors still have FSS category that is vulnerable but safe to consume. Therefore, a relatively short intervention (4 weeks) was not enough to change Angkringan street vendors in maintaining food

hygiene.

The limitation of this study is that it only uses quantitative studies to measure community education interventions. Some conditions do not allow qualitative data retrieval. Therefore, further research is needed to explore the barriers to the intervention so that the implications can be used for further evaluation. The national government and Yogyakarta city have issued policies on food sanitation hygiene requirements and sanitation hygiene for food management.[13,14] Enforcement of the regulations to control for unhealthy foods and beverages is urgently needed.[15] The review of the policy needs to be done by adjusting the conditions to the COVID-19 pandemic. This research can be the basis for creating policy briefs as the basis of program implementation policy. Although it has some limitations, the results of this study have implications for public health interventions. Health education efforts using pocketbooks can be an alternative to providing information in the COVID-19 pandemic to adjust the characteristics of street vendors.

5. Conclusion

This study concluded that health education interventions with pocketbooks in the Angkringan street vendors affect food safety scores, especially for selecting and storing foodstuffs and food processing. Most Angkringan street vendors in Yogyakarta have a food safety score that is vulnerable but safe to consume before and after the intervention. The majority of Angkringan vendors have implemented COVID-19 health protocol, especially using masks and providing hand sanitizer facilities. We recommend that the government can foster food hygiene education and monitoring of Angkringan street vendors, especially during the COVID-19 pandemic.

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Conflict of interests

On this project, there is no conflict of interest. The Government of Yogyakarta Municipality's funding was not involved in the program's technical planning, implementation, and follow-up.

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Applications of smartphone-based in improving self-management of non-communicable disease: Literature review

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ABSTRACT Non-communicable diseases (NCDs) are one of the leading health problems that occur in the adult people. One strategy to improve self-management of NCDs during the COVID-19 pandemic is to use a smartphone-based application. This literature review is structured to describe applications smartphone-based to improve self-management of NCDs. The databases in e-resources included Wiley Online, ScienceDirect, and Cambridge Core from 2010-2021. A literature search resulted in 15 articles that focused on using applications as a medium for improving self-management of NCDs. Various studies have shown the benefits of the use of smartphone-based applications to improve self-management strategies, including (1) the application to count the physical activity score; (2) the self-management application to manage nutritional diets; (3) the application of pain evaluation; (4) the application of weight management, and (5) the application of self-disease management record. The existence of a smartphone-based application can reduce the limitations in the process of implementing and evaluating self-management of non-communicable diseases.

1.Introduction

The global problem of NCDs is one of the main causes of death with a reasonably high prevalence in the adult and elderly group. In 2016, an estimated 71% of patients worldwide died from NCDs.[1] The Southeast Asian region has a 25% chance of death in the population aged 30-70 years.[2] If NCDS are not stopped by prevention and treatment, it can affect the level of productivity and quality of life. The COVID-19 pandemic has caused health services to experience delays in intervention in patients with NCDS.[3,4] One of the intervention strategies is self-management. Self-management is treatment given to improve the patient's ability to manage signs and symptoms, treatment, physical and psychosocial consequences, and lifestyle changes due to chronic

illness.[5] Self-management interventions focus on orientation in overcoming problems by planning educational approaches and cognitive and behavioral changes.[6]

Various studies show that self-management interventions have good results but also include some problems and difficulties, such as the limitations of health workers in introducing self-management and evaluating the interventions provided.[7-9] The condition of the COVID-19 pandemic has made it increasingly difficult for health workers to supervise the patient's self-management process. One way to overcome this limitation is to utilize new technology to manage self-care to overcome chronic disease problems.[10,11] The use of smartphone applications in health interventions to date has been widely carried out. It is used to improve health by providing information, advice, and support in monitoring or recording forms of chronic disease self-management.[10] One of the reviews describes smartphone applications facilitating clients/patients in setting goals for self-

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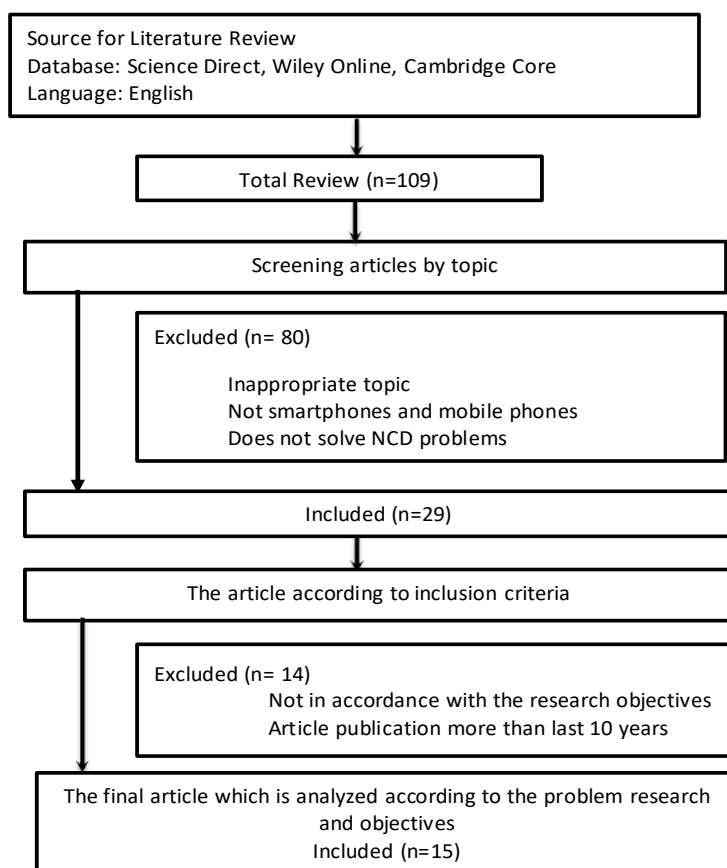
Figure 1. The process of article identification.

Table 1. List of question in applications.

Question	Point
1. How active are you in physical activity today (during the day)?	
More sitting	1.55
Sit/stand/walk	1.65
More standing/walking	1.85
Lots of work	2.2
2. How active are you in your free time/evening physical activity?	
More sitting	+ 0
Walk for 30 minutes	+ 0.06
Cycling 30 minutes	+0.15
Cycling 60 minutes	+0.29

management strategies.[12] Since the beginning of the pandemic, telemedicine and other digital tools have increased.[13] This literature review aimed to describe research results using various types of smartphone applications in managing self-management of NCDs.

2. Methods

This study conducted a literature review in two stages, such as searching for literature from several databases and selecting literature according to inclusion criteria. The inclusion criteria in this study were full-text articles, articles focusing on information technology in the management of NCDs, and the publication of articles from 2011-2021. The research question is "what are the types of smartphone applications that can be used for self-management of NCDs?". The sources and tools used

Table 2. Studies of application for improving self-management of non-communicable disease.

No.	Researchers	Title	Journal	Method	Result
1.	Bexelius, C., Sandin, S., Lagerros, Y. T., Litton, J. E., & Löf, M. (2011).	Estimation of physical activity levels using cell phone questionnaires: A comparison with accelerometry for evaluation of between-subject and within-subject variations.	Arthritis and Rheumatology	Quasi	This study describes a comparative study of physical activity motivational interventions with smartphone applications and interventions using accelerometers.
2.	Allen, J. K., Stephens, J., Dennison Himmelfarb, C. R., Stewart, K. J., & Hauck, S. (2013).	Randomized controlled pilot study testing use of smartphone technology for obesity treatment.	Journal of Obesity	Pilot study	This study describes the feasibility evaluation of a smartphone-based behavior change intervention.
3.	Bromberg, M. H., Connelly, M., Anthony, K. K., Gil, K. M., & Schanberg, L. E. (2014).	Self-reported pain and disease symptoms persist in juvenile idiopathic arthritis despite treatment advances: An electronic diary study.	Arthritis and Rheumatology	Quasi	This study describes electronic diaries as a medium for reporting patient progress in the implementation of self-management
4.	Shinohara, A., Ito, T., Ura, T., Nishiguchi, S., Ito, H., Yamada, M., … Aoyama, T. (2013).	Development of lifelog sharing system for rheumatoid arthritis patients using smartphone.	IEEE Engineering in Medicine and Biology Society, EMBS	Pilot study	This study describes a pilot study to test the feasibility of this application as a consulting media.
5.	Carter, M. C., Burley, V. J., Nykjaer, C., & Cade, J. E. (2013).	Adherence to a smartphone application for weight loss compared to website and paper diary: Pilot randomized controlled trial.	Journal of Medical Internet Research	Quasi	This study describes the feasibility evaluation of a weight management intervention using a smartphone.
6.	Kristjánsdóttir, Ó. B., Fors, E. A., Eide, E., Finset, A., Stensrud, T. L., Van Dulmen, S., … Eide, H. (2013).	A smartphone-based intervention with diaries and therapist feedback to reduce catastrophizing and increase functioning in women with chronic widespread pain. part 2: 11-Month follow-up results of a randomized trial.	Journal of Medical Internet Research	Quasi	This study describes electronic diaries as a medium for reporting patient progress in implementing pain management.
7.	Azevedo, A. R. P., de Sousa, H. M. L., Monteiro, J. A. F., & Lima, A. R. N. P. (2015).	Future perspectives of Smartphone applications for rheumatic diseases self-management.	Rheumatology International	Systematic review	This study describes a systematic review of perspectives related to smartphone-based applications in overcoming rheumatic problems.
8.	Choi, W., Zheng, H., Franklin, P., & Tulu, B. (2019).	mHealth technologies for osteoarthritis self-management and treatment: A systematic review	Health Informatics Journal	Systematic review	This study describes a systematic review of the benefits of m-health application.
9.	Monaco, A., Palmer, K., et.al (2021).	Digital health tolls for managing non-communicable disease during and after the COVID-19 pandemic: Perspectives of patients and caregivers.	J Med Internet Res	Pilot study	This study describes the management perspective of caregivers in utilizing digital applications to manage a non-communicable disease.
10.	Portelli, P., & Eldred, C. (2016).	A quality review of smartphone applications for the management of pain.	British Journal of Pain	Literature review	This study describes pain management with a smartphone-based approach.
11.	Bartholdy, C., Bliddal, H., & Henriksen, M. (2019).	Effectiveness of text messages for decreasing inactive behavior in patients with knee osteoarthritis: a pilot randomized.	BMC Health Service	Quasi	This study evaluates the feasibility of short messages in health behavior.

No.	Researchers	Title	Journal	Method	Result
12.	Anthony, Bokolo. (2020)	Use of Telemedicine and Virtual Care for Remote Treatment in Response to COVID-19 Pandemic.	Journal of Medical Systems	Literature review	This study describes the results of several studies in utilizing telemedicine in the era of the COVID-19 pandemic
13.	Orr, J. A., & King, R. J. (2015).	Mobile phone SMS messages can enhance healthy behavior: a meta-analysis of randomized controlled trials.	Health Psychology Review	RCT	This study evaluates the feasibility of instant messaging in behavior change.
14.	Fikky Aprico, Arif, M. S., Muriyatmoko, D., Musthafa, A., Ramadhan, A., Phuspa, S. M., & Ratih Andhika Akbar Rahma. (2019).	Kerja Sehat : Aplikasi Mobile Untuk Mengurangi Resiko Musculoskeletal.	Jurnal Rekayasa Sistem Dan Teknologi Informasi	Pilot study	This study tested its application in reducing the risk of musculoskeletal problems
15.	Eccleston, Christopher. et al (2020).	Managing patients with chronic pain during the COVID-19 outbreak: considerations for the rapid introduction of remotely supported (eHealth) pain management services	Pain	Literature review	This study describes chronic pain management using eHealth during the COVID-19 pandemic

included Science Direct (74), Wiley Online (9), and Cambridge Core (26) databases.

The keywords used to compile the literature review are "smartphone," "technology," "non-communicable disease," and "mobile phone." The literature search results found fifteen articles that matched the criteria. The process of identifying the articles followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram (Figure1). The inappropriate article was eliminated because it met the exclusion criteria.

3. Results and Discussion

Several smartphone applications that have been created as self-management of NCDs, namely physical activity calculators, self-management applications in lifestyle changes to manage nutritional diet, pain evaluation, weight management, and chronic disease self-management records.

3.1. Physical activity score calculator app

The physical activity levels calculator (Physical activity levels calculator) developed by Bexelius et al. uses a telephone device to evaluate the physical activity of a person who is undertaking a weight management program.[14]

The study conducted by Baxelius et al. also uses a comparative method of measuring physical activity with an accelerometer. This method of measuring physical activity using a telephone device focuses on assessing a person's level of physical activity with a questionnaire compiled on a smartphone device. The questions compiled consist of two questions that should be completed by someone committed to weight management. The person must fill out these two short questions every day at 9 pm as a form of evaluation of the physical activity carried out on that day (Table 1).

The study of Bexelius et al. showed that the evaluation instrument using a smartphone device is in line with the increase in the level of physical activity that is assessed also using an accelerometer. Therefore, the physical activity evaluation instrument using a smartphone device is a promising method for assessing physical activity level (PAL) in epidemiological studies.[14] However, the research conducted by Bexelius et al. has limitations on the number of samples involved in this study (Table 2).

Table 3. Public acceptance of household cloth masks

	Smartphone	Paper Diary	Website	p
Weight				
Baseline	96.8	97.9	96.4	
6 months	92.2	95.0	95.1	
Body Mass Index	33.7	34.5	34.5	
Baseline	32.1	33.4	34.0	
6 months				

Respondents involved in this study were female, so this harmonious research should be carried out again with male respondents. The research should be varied to give more valid measurement results in measuring the level of physical activity using smartphone media on various respondents with any gender characteristics. In addition, this study was also conducted on female respondents who have health characteristics in good indicators. The results of this study should also be carried out on the elderly or less healthy groups of respondents.[14]

Self-management of the implementation of physical activity is also done by using text messages as a form of education.[15] The research of Bartholdy et al. involves patients with a diagnosis of osteoarthritis. Every three times/per week for six weeks, patients are given messages via text messages. The message contains the patient's motivation to perform regular physical activity. After six weeks of being given a message via a smartphone-based short message, they were then monitoring the level of physical activity using an accelerometer for three days. During giving educational messages through these short messages, patients were not given feedback by health workers. Therefore, the results of this pilot study did not show any significant difference between the intervention group and the control group regarding physical activity self-management.[15]

The results differ from the Orr and King study, which showed that short messages were effective in behavior change.[16,17] Short messages are used as a supporting medium in the intervention. This short message results in an estimate of affordable service costs because health workers can provide education easily and quickly to patients.

3.2. Self-management application lifestyle changes in managing nutrition diet

A self-management study using smartphone media conducted by Allen et al. is a method used to support the effectiveness of weight management counselling.[18] Respondents who participated in this intervention were the group with a BMI of 28-42 kg/m^2 with ages between 21-65 years. This study was conducted in the overweight group and the group with a history of coronary heart disease, diabetes, cancer treatment, orthopedic-related diseases, and arthritis pain. The preliminary study conducted on this intervention focused on counselling given by nutritionists every week. Respondents were given counselling that focused on reducing calories and recommending a healthy diet by increasing vegetables and fruits. The problem that often occurs in counselling sessions is the lack of commitment to the presence of the intervention group in the diet management treatment. Therefore, to overcome this, the application was also developed using a smartphone device to provide nutrition management counselling and training materials.

This application focuses on management promotion by utilizing smartphone devices in counselling facilities in real-time. The respondent fills in the initial data regarding weight, height, age, gender, and the target weight to be achieved in this application. After the respondent fills in the initial data, the system will calculate the number of calories needed by the respondent every day. This calorie calculation is based on the Mifflin system, which is generally used to calculate the number of calories based on body weight.

In addition to respondents getting information related to the number of calories needed, users of this application can also record food consumption every day (food intake). Application users can view recorded progress of food intake and physical activity in graphs and diagrams. The appearance of these graphs and diagrams can make it easier for respondents to see the progress of self-management being done to improve nutrient management and physical activity.[18]

This study showed no significant difference between before and after the counselling

intervention and the use of self-management smartphone applications. Although there was no statistical difference, the study results showed a change before and after the intervention, for example, a decrease in the mean BMI of 0.7 kg/m^2. This study also explains that the use of smartphone-based application devices in self-management will further increase effectiveness if it is collaborated with direct counselling methods. The result is indicated by the decrease in the average BMI of 1.8 kg/m^2 if a person uses counselling methods and smartphone applications to implement self-management. This smartphone-based application affects the effectiveness of the costs incurred by patients because there is no need to spend money on a transportation budget for counselling to health workers.[18] The use of digital applications improves communication between healthcare workers and patients during a pandemic.[4]

3.3. Pain evaluation app

A study conducted by Bromberg et al. involved the commitment of application users to report the pain scale they felt due to arthritis problems.[19] Respondents involved in this study were children aged 8-18 years with a diagnosis of arthritis. Respondents involved were committed to filling in the pain scale, stiffness scale, and level of fatigue felt for three times (morning, afternoon, and evening) in one day for one month. Self-evaluation or self-monitoring is done by filling out notes or diaries as self-reported on a smartphone application device. The recording of this pain evaluation was not only carried out by the study of Bromberg et al., but Shinora et al. had also performed this pain diary intervention in patients with osteoarthritis. The pain felt by application users is recorded in a smartphone application device, then health workers see the results of patient self-monitoring and provide recommendations.[20]

This study involved children as respondents in a self-reported intervention model using a telephone device. However, the researchers explained that the results of this study could be adopted as monitoring the effectiveness of cognitive-behavioral therapy. Smartphone devices are a technology that is often used to support interventions, one of which is

self-management of pain problems in the COVID-19 pandemic era. Self-monitoring with smartphone devices can facilitate the documentation of pain scales, stiffness scales, and fatigue levels. The application makes it easier for health workers to get symptom responses and behavioral changes (psychosocial) due to pain problems experienced by application users. In addition, self-monitoring using a smartphone device can also assess the reactions raised by patients after treatment. Notes written by application users in their diaries on the device will be sent directly to health workers. If the message has been sent, health workers can quickly provide feedback and recommendations to patients to reduce the symptoms reported in the application device. This technology-based application is effectively used in the pandemic era, which makes it difficult for patients to consult and conduct examinations directly at health facilities.[13]

The study results in Bromberg et al. did not show the effectiveness of reducing the pain scale felt by application users. However, the records reported by users of the application in monitoring their pain scale showed a decrease in the average stiffness and fatigue levels between the time in the morning, afternoon, and evening. The results show that records written using smartphone devices make it easier for health workers to be responsive in providing recommendations on the scores reported by patients/application users. Therefore, recording pain scales with smartphone media can be an alternative to ease communication between health workers and patients in providing coping strategies to deal with pain, especially in the era of the COVID-19 pandemic. The behavioral component of self-management using digital technology can help manage pain and reduce emotional stress during the COVID-19 pandemic.[21]

3.4. Weight Management App

Weight loss programs are generally conducted in a self-management strategy. In a study conducted by Carter et al., weight loss management strategies were done using a smartphone-based application device.[22] The study was conducted through comparative weight loss self-management using smartphones, paper

diaries, and websites (Table 3). The smartphone-based application in this study is quite different from other applications. The application in this study is relatively mature and has provided choices for application users regarding recommendations that patients should make to change their healthy lifestyles. As a first step, the application user fills in the patient's current weight, and then the application automatically displays the ideal number of calories for the patient and menu recommendations that the patient can consume. This application has been prepared more sophisticated and in-depth because it is done without using a counselling system by health workers. Application users receive various options in planning their management. Patients can use this application in self-monitoring related to the calorie target they want to consume per day, nutrition management, and the implementation of physical activity.

This study indicates that there is a statistically significant difference between the use of smartphones, diary papers, and websites in the implementation of self-monitoring for six months. The use of smartphone applications has a higher median value (Me=82) than other devices (diary papers and websites) by patients to support self-monitoring. In addition, the results of the study also showed that there was a more significant reduction in body weight and BMI among respondents who used smartphones, diary papers, and websites as self-monitoring media for six months. The study results shown in this study indicate that the use of smartphone-based applications supports the implementation of self-monitoring interventions in changing nutrition management behavior and physical activity as a strategy to overcome NCDs, especially during the COVID-19 pandemic.

3.5. Chronic illness self-management notes app

The use of smartphone application devices to manage non-communicable diseases was also done by Kristjansdottir et al. The focus of the use of the application is used for self-monitoring of pain.[23] In general, the use of the application is consistent with other studies, but this study adds a short audio material on the practice of positive thinking (mindfulness).

This application offers various interventions, namely smartphone-based diaries, direct recommendations from health workers, and audio files. The researcher realized that this application was a supporting medium in the self-management intervention done by the patient during the intervention period (11 months). Therefore, the researchers continue to provide counselling interventions as monitoring the patient's health management.

The choice of audio files was also done in a study conducted by Aprico et al., namely by providing educational menu options to prevent complications of joint disease.[24] Application users can choose a menu that provides various education-related to prevent complications from NCDs' problems. One example of education provided by this application includes education on knowledge of Musculoskeletal Disorders (MSDS) and education on correct body posture images.

The study by Aprico et al. showed no significant difference in the level of functional and symptom scoring of the disease between the intervention and control groups.[24] However, the results of this study showed a positive impact and did not show a negative impact related to the level of function and symptoms, fatigue, and emotional distress. The researchers in this study realized that the results of the research were still ambiguous. This happened because there was no significant difference between the two groups regarding function scoring and disease symptoms after the intervention. However, when referring to the initial stage, changes in function and symptoms occur in application users after smartphone-based self-management interventions are carried out. Therefore, smartphone-based applications can be used as a supporting medium for the self-management of NCDs.

This literature review has limitations in reaching the results of previous studies using smartphone applications for self-management during the COVID-19 pandemic. The implications of this research are expected to provide basic information in reviewing experimental research. This literature review can be used as the basis for determining smartphone applications for self-management of chronic diseases during the COVID-19 pandemic.

4.Conclusion

Non-communicable diseases (NCDs) are a serious health problem that has been prioritized by the WHO. The COVID-19 pandemic has limited self-management control of these NCDs. The process of controlling patients with NCDS is an import focus of smartphone-based applications. These beneficial results can be seen in the review of applications for self-management, namely Physical Activity Score Calculator, Self-Management Application Lifestyle Changes in Managing Nutrition Diet, Pain Evaluation App, Weight Management App, and Chronic Illness Self-Management Notes App.

The limited mobilization that occurred in the era of the COVID-19 pandemic made it difficult for this group to conduct direct examinations at health facilities. The existence of smartphones helps groups of sufferers to access various information and conduct counselling safely in the era of the COVID-19 pandemic. Some research results explain that groups of patients with NCDs can use the smartphones. However, it is necessary to pay attention to the accessibility of this group to the use of smartphone devices, such as visual acuity, ability to understand information, and socioeconomic level.

Conflict of interests

The authors declare no conflict of interest.

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