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Survival Analysis of Tuberculosis Patients Based on Diabetes Mellitus Status in West Sumatra

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Abstract

Tuberculosis (TB) is still one of the main problems in tropical countries, especially in Indonesia. The existence of conditions that cause decreased immune systems, such as Diabetes Mellitus (DM), can lead to an increased risk of death in people with Tuberculosis. This study aimed to analyze the survival of Tuberculosis patients with a history of DM in West Sumatra Province. This research was conducted from April to October 2022. It is a retrospective cohort study with all TB patients recorded in the TB03 SO data register in West Sumatra Province in 2021 (N=8,299). The samples were all candidates who met the research criteria in the data (n=1,125 TB patients). Data analysis was performed using survival analysis. The results showed that 177 TB patients (15.73%) had a history of DM, and 948 (84.27%) did not. The cumulative probability of survival for TB patients based on non-DM cases on day 150 is 0.95. In contrast, the cumulative probability of survival for patients with a history of DM is lower, namely 0.90. The group of TB patients who suffered from DM, male and more than 45 years old, experienced a more significant decrease in survival.

Introduction

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis. This bacterium usually attacks the lungs but does not rule out attacking other organs. Common symptoms of active pulmonary TB are coughing for more than two weeks, accompanied by phlegm (sometimes it bleeds), chest pain, fatigue, loss of appetite, weight loss, fever, and night sweats. Tuberculosis bacteria are transmitted through the air when TB sufferers actively cough, laugh, and sneeze and can die within a few hours in the open air or when exposed to sunlight. TB is included in one of the world's Sustainable Development Goals (SDGs) targets. Until now, Tuberculosis is still one of the world's top ten causes of death. In 2019, 1.4 million people died from Tuberculosis (WHO, 2020).

As many as 44% of TB sufferers come from Southeast Asia, followed by Africa at 25%. Of the 30 countries with the highest TB burden globally, Indonesia ranks second after India (WHO, 2020). In 2019, there were 845,000 TB cases in Indonesia, consisting of 562,000 notified cases and 283,000 unnotified cases. The number of TB sufferers in Indonesia is dominated by men, who are 1.4 times larger than women. As many as 48% of patients are male, 35% are female, and 17% are cases in children (Kemenkes RI, 2019). However, community research in tuberculosis determinants published in various health journals in Indonesia is still limited (Ratnasari & Handayani, 2023).

Based on several studies that have been conducted, it was found that certain conditions and diseases can affect the condition of TB sufferers. The chances of developing TB disease

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are much higher among people affected by risk factors such as malnutrition, diabetes, HIV, smoking, and alcohol consumption (WHO, 2020). Worldwide, it is estimated that there are 9.6 million new patients with active TB each year, and of these, one million experience TB and DM (TB-DM) (Lönnroth *et al*., 2014; WHO, 2020). At one time, the number of patients with comorbid TB-DM was higher than that of patients with TB-HIV worldwide (Ruslami *et al*., 2010).

In 2015, a systematic review study identified 59 studies on DM and TB from 10 countries in the Middle East, showing that the prevalence of TB-DM comorbidities varies widely between studies (Alkabab *et al*., 2015). An observational study conducted in North Semarang found that Diabetes mellitus has a relationship with the incidence of pulmonary TB (Dian Saraswati, 2014). A meta-analysis by Hayashi found that the risk of active TB in people with DM was higher than without DM. The review by Lonnroth *et al*. also found that someone with DM affects a person's risk of getting TB disease three times compared to those who don't (Hayashi & Chandramohan, 2018; Lönnroth *et al*., 2014). West Sumatra is a province with high health problems of Tuberculosis and diabetes mellitus. Based on the 2018 Riskesdas Indonesia data, there were 20,663 people with Tuberculosis (prevalence of 0.31%) and 37,063 people diagnosed with Diabetes Mellitus in all age groups in West Sumatra Province (Kemenkes RI, 2018). So, this research aimed to analyze the survival of Tuberculosis patients with a history of DM in West Sumatra Province.

Methods

This research is an observational analytic study using a retrospective population-based cohort study. It was conducted in West Sumatra Province from April to October 2022. The population for this study was TB patients whose DM status was recorded in the TB03 SO (Drug Sensitive) data register in West Sumatra Province in 2021 (N=8,299). The number of samples used in this study included all candidates who meet the research criteria in the data set, namely 1,125 people. This study was analyzed using survival analysis, where the outcome variable was the time (days) until an event occurred or until the end of the research period (endpoint). The starting point for measuring survival time was the patient's diagnosis date. Survival status was categorized into the event of the patient's death at the end of the study period and the sensor's if the patient was still alive or cured. This study obtained ethics approval from the Faculty of Public Health, Universitas Andalas research ethics committee, with registered number 15/UN16.12/KEP-FKM/2022.

Result and Discussion

The survival of TB patients was obtained from two variables, namely, the survival status of TB patients and the patient's survival time (days). The patient's survival status consists of two categories: event and sensor. An event is a condition in which a patient experiences death from being diagnosed with TB. There were 66 (5.87%) patients experienced an event, and 1,059 (94.13%) did not experience an event (sensor).

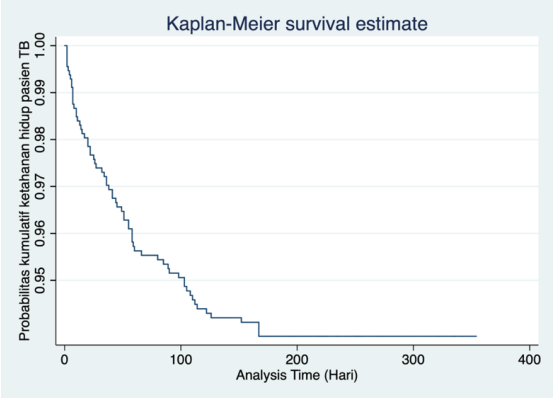

Figure 1. Kaplan Meier Curve of Survival Probability of TB Patients

Based on Figure 1, the survival probability curve for TB patients in West Sumatra in 2021 shows a decline. On day 30, the survival rate for TB patients was 0.97. This means that if there are 100 people with TB, there are 97 people who survive. At day 365, the probability of survival decreased to 0.94. So, if there are 100 TB sufferers, only 94 people will survive. Survival decreased steadily with increasing observation time. Median patient survival cannot be calculated because until the

end of the observation, less than 50% of TB patient deaths have occurred.

Our study shows that the probability of TB patients surviving in West Sumatra in 2021 has decreased over time. It is similar to research in Southern Brazil; most of the deaths occurred within two months after the diagnosis, during the intensive phase of the treatment (Dos Santos *et al.*, 2021). The result of our study also shows that by 12 months, the survival rate declined to 0.94. This finding is in line with survival research in Liberia. The patients were followed up for a mean period of 10 months and showed a decreased survival rate. Of 337 patients, 33 (9.8%) died, resulting in a 90.2% survival rate at 21 months (Carter *et al.*, 2021). Research by Xie *et al.* also shows the 1-year cumulative survival rate of patients with TB decreased to 94.11% (Xie *et al.*, 2020).

Table 1. Cumulative Probability of Survival of TB Patients Based on DM Status

No	Survival Time (days)	Non-DM	DM
1	2	0.9958	0.9944
2	12	0.9863	0.9718
3	30	0.9757	0.9661
4	60	0.9620	0.9322
5	90	0.9578	0.9266
6	120	0.9525	0.9096
7	150	0.9504	0.9040
8	365	0.9483	0.9040

Source: TB03 SO data register in West Sumatra. 2021

In this study, 177 (15.73%) TB patients also had DM, and 948 (84.27%) TB patients did not suffer from DM. The cumulative probability of survival for TB patients based on non-DM cases on day 150 is 0.95, which means that out of 100 TB patients, only 95 survive for one year. Meanwhile, the cumulative survival probability of patients with a history of DM on day 150 is lower, namely 0.90. This means that out of 100 people with TB, only 90 survive on day 150 (Table 1).

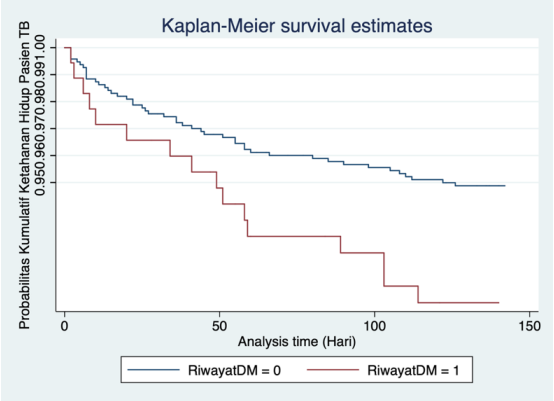

Figure 2. Kaplan Meier Curve Probability of Survival in TB Patients Based on DM Status

In Figure 2, it can be seen that each group has decreased since the first month. The group of TB patients who suffered from DM experienced a more significant reduction compared to the group of TB patients who did not suffer from DM.

Most deaths occurred in male TB patients (6.63%), with a survival probability of 0.93 (Table 2). This is following research in Taiwan that shows patients with male gender had significantly higher mortality. male gender is associated with older age, more co-morbidities, and worse treatment outcomes (Feng *et al.*, 2012). It is consistent with another study that found the risk of death was 1.847 times higher for male patients (Xie *et al.*, 2020). Research in Southern Brazil by Santos *et al.* found that male TB patients had a risk of death that was 6.49 times higher than that of female patients. In the study, sex and age are intercepted, producing different risk effects for death (Dos Santos *et al.*, 2021). Gender disparities in the diagnosis and treatment of pulmonary TB are reflected in elevated disease transmission and reactivation rates and inferior treatment outcomes, particularly among men, that contribute to mortality (Jiménez-Corona *et al.*, 2006).

In terms of age characteristics, our study found that most deaths occur at the age of more than 45 years (9.74%), with a survival probability of 0.90 (Table 2). Using the likelihood ratio chi-square test, research in Ethiopia found that a patient's age, with a p-value less than 0.05, has a relatively strong association with the death of TB patients (Haile *et al.*, 2021). With each year of increase in age, the risk of death

Table 2. Survival of TB Patients Based on Patient Characteristics in 1-Year

No	Variable	Event	Sensor	Total	1-year cumulative probability of survival of a TB patient
		n (%)	n (%)	n (%)	
1	Sex				
	Male	45 (6.63)	634 (93.37)	679 (60.36)	0.93
	Female	21 (4.71)	425 (95.29)	446 (39.64)	0.95
2	Age (years old)				
	<= 18	2 (1.37)	144 (98.63)	146 (12.98)	0.99
	19 – 45	16 (3.29)	470 (96.71)	486 (43.20)	0.97
	> 45	48 (9.74)	445 (90.26)	493 (43.82)	0.90
3	Diabetes Mellitus				
	DM	17 (9.60)	160 (90.40)	177 (15.73)	0.90
	Non-DM	49 (5.17)	899 (94.83)	948 (84.27)	0.95

Source: TB03 SO data register in West Sumatra. 2021

increased by 1.059 times. Advanced age is associated with a higher risk of death, possibly related to low immunity, atypical symptoms, longer onset time, primary diseases, and poor health awareness in elderly patients. Therefore, it is crucial to strengthen TB screening in the elderly population to enable early detection, diagnosis, and treatment (Rahmanian *et al*., 2018; Xie *et al*., 2020). Some researchers also found the same result about older people related to decreased survival of Tuberculosis (Geleso, 2020; Moosazadeh *et al*., 2014; Selvaraju *et al*., 2021; Teketelew *et al*., 2022).

Our study found that most deaths occurred in TB patients with DM, which was 9.6% with a survival probability of 0.9. Whereas in the group of patients who did not have DM, the mortality was 5.17% with a survival probability of 0.95 (Table 2). This is in line with a survival analysis study by Liu *et al.* in China that, within one year of observation, Diabetes Mellitus was significantly associated with death in TB patients (Liu *et al*., 2022). A study of TB patients treated with comorbidities found that DM prolonged culture positivity on examination 2-3 months of TB care. DM also increases the risk of death with an RR of 1.89 (95% CI 1.52 to 2.36) (Baker *et al*., 2011).

Diabetes is a metabolic disease caused by inflammation that results from a complex immunological process. When insulin resistance occurs due to insulin signaling inhibition, it triggers immune responses that worsen the inflammatory state. Many studies have been conducted to determine how diabetes-related mechanisms interfere with the host's defense against pathogens. These mechanisms include cytokine production suppression, phagocytosis defects, immune cell dysfunction, and the inability to eliminate microbes (Berbudi *et al*., 2020). DM potentially contributes to poor control and changes the natural history of TB infection. It also exacerbates the clinical manifestations of TB. Diabetic patients with TB are more likely to complain of physical symptoms, such as dyspnea, fatigue, asthenia, body aches, and headaches. Over time, DM causes functional and structural changes in the circulation of TB development, which causes differences in healing time between TB-DM and TB-non-DM patients. The determinant of the emergence of complications in TB-DM patients is ongoing hyperglycemia, which causes biochemical and structural abnormalities in blood vessels and peripheral nerves. Endothelial damage appears to be a triggering factor for the pathogenesis of microvascular complications associated with symptoms of DM complications in TB patients (Leal *et al*., 2017).

Conclusion

Most deaths occurred in male TB patients who were more than 45 years old. The group of TB patients who suffer from DM experienced a more significant decrease in survival compared to the group of TB patients who do not suffer from DM. TB-DM patients should get more

attention on side effects, symptoms, care, and support from their families and health workers. The joint force for collaboration DM and TB-related activities should be developed more, which has to be reflected in the national or local plans, respectively.

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Nutrition Webinars for Students a nd Health Professionals: Indonesian Study During Covid-19 Pandemic

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Abstract

Recently, there has been an increase in obesity cases among adolescents in Indonesia with a prevalence rate of 19%, which exceeds the national prevalence of 16%. This was caused by the decrease in physical activities and consumption of fruit and vegetables by 95% of the population during the COVID-19 pandemic. This study aimed to foster the development of a Nutrition Education Center (Nutrecent) as a distance learning to promote the consumption of plant-based foods containing polyphenols such as vegetables and fruits. This was a quasi-experiment with three Nutrecent (Nutrition Education Centre) Webinar series and an international webinar. Participants were high school and college students, health workers, and the general public. A total of 654 participants were included in the analysis. The statistical results showed no significant improvement in knowledge due to the Nutrecent webinar series activities, but there was a significant improvement due to the international webinar (p-value < 0.001). Online learning is only effective for students and adults with previous knowledge of the webinar topic. Consequently, there is a need to include the importance of consuming plant-based foods in the school curriculum.

Introduction

The spread of the coronavirus disease 2019 (COVID-19) posed a huge challenge to education systems worldwide, due to lockdown and social distancing recommendations implementations. Various health problems have become a concern in several countries since the implementation of social restrictions due to the COVID-19 pandemic. Furthermore, a study on 4,342 elementary school (SD) and junior high school (SMP) students showed that 24.9% experienced anxiety, depression by 19.7%, stress by 15.2% (Tang *et al*., 2021) socially, and psychologically, yet rigorous investigation into their mental health during this period is still lacking. Methods: A cross-sectional online survey of 4-342 primary and secondary school students from Shanghai, China was conducted during March 13–23, 2020. Besides demographic information, psychological distress (including depression, anxiety, and stress, as well as other eye-related health issues. Meanwhile, another study on 123,535 children aged between 6-13 years discovered that distance learning was associated with an increased prevalence of myopia (Wang *et al*., 2021)Setting, and Participants: A prospective cross-sectional study using school-based photoscreenings in 123535 children aged 6 to 13 years from 10 elementary schools in Feicheng, China, was conducted. The study was performed during 6 consecutive years (2015-2020. Several deaths during the pandemic of COVID-19 due to home learning led to a Joint Decree by the Minister of Education and Culture, Religion, Health, and Home

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Affairs with reference number 03/KB/2021, 384/2021HK.01.08/MENKES/4242/2021, and 440-717/2021 respectively. The decree contained guidelines for the implementation of learning during the COVID-19 pandemic. The government also allowed face-to-face learning due to local government policies and permission from parents.

Consequently, the implementation of home learning led to a change in students' physical activity and food consumption. Furthermore, there was a decrease in physical activities in Indonesia and several countries such as Canada, Saudi Arabia, and Italy (Pietrobelli *et al*., 2020; Radwan *et al*., 2021;such restrictions could precipitate unintended negative consequences on lifestyle behaviors. The main objective of this study was to investigate the prevalence and determinants of unhealthy behavior changes during the COVID-19 lockdown among residents of the United Arab Emirates (UAE Atmadja *et al*., 2020; Moore *et al*., 2020)limiting sedentary behaviours (SB. Over 50% of Indonesians consumed few vegetables and fruits during the COVID-19 pandemic (5), which led to massive weight gain among the people. Poland also experienced a decrease in the consumption of these classes of food, while an increase in consumption of the Mediterranean diet occurred in Italy (Sidor & Rzymski, 2020)which later developed into a pandemic, has forced different countries to implement strict sanitary regimes and social distancing measures. Globally, at least four billion people were under lockdown, working remotely, homeschooling children, and facing challenges coping with quarantine and the stressful events. The present cross-sectional online survey of adult Poles (n = 1097 with no difference in the consumption rate of vegetables and fruit (Pietrobelli *et al*., 2020). Fruit and vegetables are rich in polyphenols which help to increase the body's immunity against various diseases and health problems.

Polyphenols are bioactive components widely distributed in plants such as vegetables, fruit, coffee, and tea (Pérez-Jiménez *et al*., 2010). Several studies have discovered the benefits of consuming polyphenols, which include its anti-inflammatory effects on atherosclerosis, type 2 diabetes mellitus, cancer, and death (Medina-Remón *et al*., 2017; Pounis *et al*., 2018in what we believe to be a novel, holistic approach. Methods: We analyzed 21 302 participants (10 980 women and 10 322 men, aged ≥35 y; Zhang & Tsao, 2016; Little *et al*., 2017; Penczynski *et al*., 2019; Wisnuwardani, De Henauw, Forsner, *et al*., 2020; Wisnuwardani, De Henauw, Ferrari, *et al*., 2020). Also, the consumption of flavonoids from these foods during adolescence is indirectly associated with proinflammatory scores in early adulthood (Penczynski *et al*., 2019), while increased consumption is associated with a low pro/anti-inflammatory biomarkers ratio in European adolescents (Wisnuwardani *et al*., 2020) and weight loss in Europe (Wisnuwardani *et al*., 2020).

East Kalimantan is a province with a Tropical rainforest that contains diverse plants rich in polyphenols such as dragon fruit. Furthermore, a systematic review and meta-analysis of 401 articles concluded that consumption of dragon fruit significantly reduced fasting sugar levels in pre-diabetes patients (Poolsup *et al*., 2017). Also, the fruit has various benefits as a health supplement and it serves as an antimicrobial, anti-hypercholesterolemic, anti-diabetic, and anti-cardiovascular agent (Wahdaningsih *et al*., 2020). The prevalence of obese and very obese conditions among adolescents aged between 13-15 years was 12% and 7.1%, respectively (Kemenkes RI, 2018), which exceeds the national prevalence of 11.2% and 4.8%. Similarly, there was an increase in the prevalence among teenagers between 16 and 18 years due to low consumption of vegetables and fruit by 98% of the population (Kemenkes RI, 2018).

Subsequently, various activities have been introduced for students, parents, teachers, and school canteen providers to promote healthy food consumption (Dewayani & Sukihananto, 2018)consisting of 4th and 5th grade elementary school children and their mothers in SDN Tugu 4, Depok City, Indonesia. Demographic data were also taken for each. The instruments used the Food Frequency Questionnaire and questions about the balanced nutritional guidelines. Statistical analysis conducted a univariate (descriptive. A study in Samarinda concluded that training of

child nutritionists increases the knowledge of healthy and safe food consumption behavior (Iwan *et al.*, 2015). Therefore, it is necessary to introduce diversification of vegetables and fruits in humid tropical forests by educating the parties involved namely students, parents, and teachers for face-to-face learning in schools. Also, efforts are needed to promote the consumption of plant-based foods on digital education platforms such as the Nutrition Education Center (Nutrecent), a digital learning medium established for Indonesian adolescents, especially in East Kalimantan. This study aimed to increase nutritional knowledge, and consumption of plant-based foods, reduce the prevalence of obesity in Indonesia, and increase body immunity in preparation for face-to-face learning in the province during the COVID-19 pandemic.

Methods

This was a quasi-experiment with three Nutrecent (Nutrition Education Centre) Webinar series and an international webinar. Participants of the webinar series were high school students, while participants of the international webinar were college students, health workers, and the general public. The study was conducted between 15 November and 1 December 2021. Participants were recruited via social media (Instagram, YouTube, and TikTok). Ninety-one participants enrolled in the Nutrecent webinar, but only 45 participants were included in the analysis. The dropout participants were due to missing data from pre and post-test questionnaires. For an international webinar, 929 attended participants from Indonesia and other countries such as Malaysia, Thailand, Belgium, and the Netherlands. However, only 654 participants from the Zoom meeting were included in the analysis. As they took the pre and post-tests. Participants who joined the webinar through YouTube did not fill out the pre-test because the pre-test questionnaire was given during webinar registration. Informed consent was obtained and agreed upon by participants and the study proposal was also approved by the Ethical Review Committee at the Faculty of Medicine, Universitas Mulawarman (No. 98/KEPK-FK/XI/2021).

The Nutrecent activities began with creating social media handles such as Instagram, TikTok, and YouTube, which contained information on the benefits of consuming vegetables and fruit, socializing Nutrecent activities, and how to prepare vegetables and fruit dishes. Furthermore, social media was chosen as the medium for enlightenment due to the tendency of high school students to use the platforms. Nutrecent's main activity was a series of webinars themed "Healthy Training during the COVID-19 pandemic," which was held for 3 weekends a month through Zoom meetings. On the first day, the students were educated about balanced nutrition and how to prepare for physical learning during the COVID-19 pandemic. Furthermore, the importance of consuming plant-based foods such as vegetables and fruit was taught on the second day, while the exploration of processed foods from humid tropical forests with examples was taught on the last day.

Subsequently, the webinar series activities for less enthusiastic adolescents were evaluated, and an international webinar was conducted through Zoom. The theme of the meeting was Lifestyle and mental Health. The presenters presented about the association of mental health with lifestyle, and the consumption of fruits and vegetables, which help to reduce the risks of degenerative and mental health diseases. A univariate analysis was carried out to describe the characteristics of the sample population using frequency and percentage distributions, while bivariate analysis was used to determine the increase in knowledge of webinar participants using paired t-tests. The conclusion was drawn with the rule that when Sig (2-sided) <0.05, then H_0 is rejected, and when Sig (2-sided) > 0.05, then H_0 is accepted. The IBM SPSS program version 23 was used for data management and statistical analyses.

Results and Discussion

During the COVID-19 pandemic, the government recommends avoiding gatherings with large crowds, consequently, the Nutrecent training was conducted through Zoom meetings, and information related to the training was disseminated through social media platforms. Furthermore, 70 participants

attended the first webinar, and knowledge improvement was carried out by pre-post-test (Table 1). However, only 28 answered the test questions because it involved 3 hours of independent learning. Based on in-depth interviews with 3 participants, it was discovered that the assignment was burdensome to the students as they expected a vacation from their routine study on Saturdays. Also, the webinar activity was carried out in the morning and students were eager to get up late during the weekend, which led to the low turn-up for the event.

Fifteen participants attended the second webinar, and only 5 answered the post-test. The decline in Nutrecent webinar series participation was due to boredom associated with online learning and this was backed up by interviews with students where they stated that weekly online training was very boring. Students also experienced distance learning at school coupled with many assignments, which also contributed to the low participation in the webinars. Additionally, there were some drawbacks to routine distance learning, which include its boring nature, inability to supervise activities and to provide direct feedback to participants.

The decrease in participants of the second webinar series became evaluation material, leading to the re-socialization during the third webinar. Previously, the webinar was attended by the same participants, but due to a 76% decrease from 70 participants in webinar series 1 to 15 in the second, it was necessary to invite new students. Therefore, re-socialization was carried out by sharing information about the webinar for 1 week on social media such as WhatsApp, TikTok, Instagram, and YouTube. Meanwhile, 26 participants attended the third

Table 1. Characteristics of Participants in Nutrecent.

Characteristics	First webinar		Second webinar		Third webinar	
	n	%	n	%	n	%
Sexes						
Boys	12	17	4	27	5	19
Girls	58	83	11	73	21	81
Class						
X	25	36	4	27	4	16
XI	19	27	7	46	5	19
XII	26	37	4	27	17	65
City						
Bengkulu	4	6	0	0	0	0
Bima	0	0	0	0	1	4
Berau	18	26	2	13	2	8
Bontang	9	13	3	20	6	23
Kutai Barat	0	0	0	0	1	4
Kutai Kartanegara	15	21	2	13	3	12
Kutai Timur	0	0	0	0	2	8
Balikpapan	0	0	0	0	1	4
Samarinda	16	23	8	54	9	35
Nunukan	0	0	0	0	1	4
Sinjai	2	3	0	0	0	0
Total	70	100	15	100	26	100

Data source: primary data in 2021

Figure 1. Webinar series and International Webinar in Nutrition Education Centre in 2021

webinar, but only 12 took the tests. It was also observed that independent learning through assignments was still a problem in the series. Although the task was easier than the previous ones, it was still a barrier that hindered students from taking the post-test. However, all the webinar series activities have been uploaded to Nutrecent's YouTube and Instagram pages.

Although there was a decrease in participants taking the post-test, the available ones were very active in discussing with the presenters, especially regarding daily problems in consuming vegetables and fruit. Furthermore, rewards for active discussion were also given at each webinar series. The participants of series 1 were 70 students, which included 82% female and 37% male. A total of 26% of the students came from Berau, 23% from Samarinda, and 21% came from Kutai Kartanegara. Furthermore, 57% of the participants lacked knowledge about "Healthy Adolescent Tips and Tricks During the COVID-19 Pandemic" before the event started.

Only 28 participants out of 70 took the post-test, which led to the use of only 28 students for the paired t-test. Furthermore, the sample population contained 82% female and 39% Class X students that came from East Kalimantan with 39% from Samarinda, 36% from Berau, 4% from Sinjai and 1% came from Bengkulu. Although there was a knowledge improvement due to the webinar, it was insignificant with a p-value of 0.083 as shown in Figure 2. Meanwhile, the theme of the second webinar was 'Plant-Based Foods during the COVID-19 Pandemic', which was organized for Senior High School students one week after the first edition. The event was attended by the same participants from the first edition, but there was a 79% decrease in participation. Furthermore, most of the students that attended were male, accounting for 53% of the total participants, and 87% showed a good knowledge of the topic. The decrease in participation was due to the conduction of socialization with the same set of students in the previous webinar.

Only 5 participants out of 15 filled out the post-test, and data analysis on knowledge improvement was carried out on only the 5 students. However, there was an increase in the knowledge of the samples after the webinar (p-value = 0.121), but it was not significant

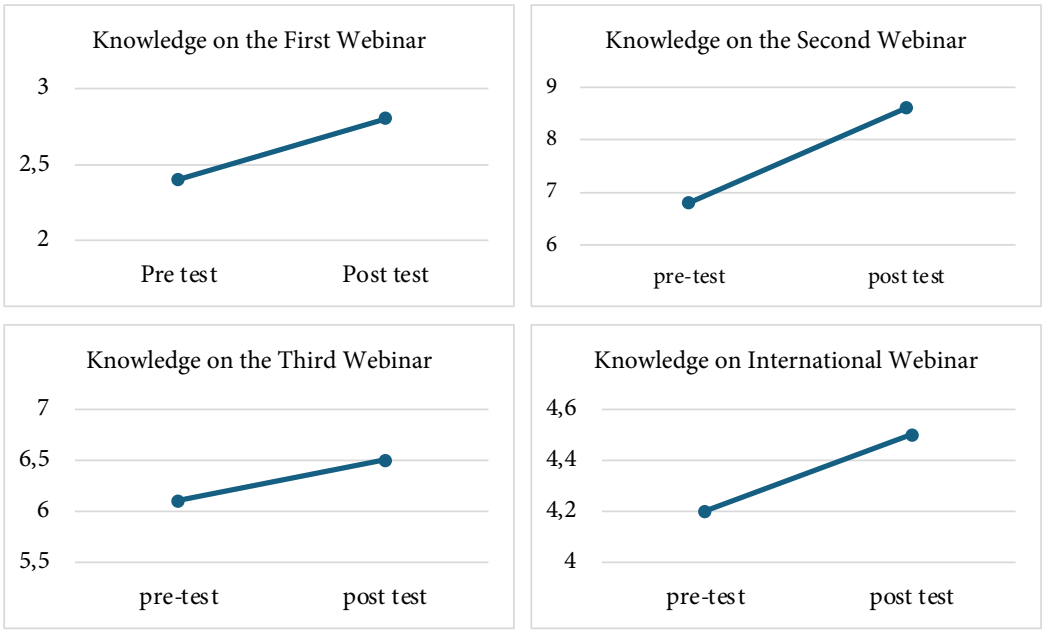

Figure 2. Knowledge Improvement Before and After the Nutrecent Webinar Series (n_1=28; n_2=5; n_3=10) and International Webinar Series (n=591)

as shown in Figure 2. The third series was attended by 26 participants, which included 81% female and 65% class XII from East Kalimantan and beyond. However, they were dominated by East Kalimantan students with 35% from Samarinda and 23% from Bontang, while only 3.8% came from Bima, West Kutai, Balikpapan, and Nunukan. Before the webinar, 65% of the participants had a good knowledge of Processed Food Exploration from Tropical rainforests.

Subsequently, knowledge improvement analysis was carried out on 10 participants (39%) who took the pre-test and post-test. The decrease in participation was due to the assignment's burdensome nature, which involved 3 hours of independent learning. The analysis results showed that all students had a good knowledge improvement, but it was not significant (p-value = 0.081). Meanwhile, before the third webinar, the average knowledge of participants was 6.1 with a standard deviation of 1.7, but after the webinar, the average knowledge increased to 6.5 with a standard deviation of 0.7 as shown in Figure 2.

The Nutrecent Webinar series was conducted three times for senior high school students, and there was no significant knowledge improvement from the three activities (p-value > 0.05). Furthermore, online learning activities were not appropriate for senior high school students when carried out weekly due to boredom, leading to an approximately 79% decrease in participation from 70 students in the first webinar to 15 in the second. Also, giving assignments that involve independent learning after the webinar is burdensome, and this contributed to poor participation. Therefore, it was not advisable to organize webinars during weekends and give assignments in the form of self-study. It was also advisable to include online learning in the school curriculum to increase the student's participation in the lesson because it impacts the final grade. To the researcher's knowledge, this was the first time the Nutrecent webinar series was conducted for senior high school adolescents, hence, it was necessary to design more exciting and interactive learning.

Similarly, the absence of a significant knowledge improvement in webinars also occurred in a previous study targeting senior high school adolescents about online Alzheimer's education in Los Angeles, 2019 (Saif *et al.*, 2020). This is consistent with a previous study on 791 school students in India, concluding that face-to-face learning is more effective than online webinars in health education (Deokar *et*

al., 2021). Therefore, it was advisable to increase the knowledge of senior high school students on the importance of consuming vegetables and fruit through physical classes by following strict health protocols. Distant learning with online media such as Zoom meetings was carried out due to the continuous mutation of COVID-19, consequently, everyone needs to be prepared for variants of the virus. Based on the results, senior high school adolescents were not suitable for online learning. Also, the importance of consuming vegetables and fruit should be included in the school curriculum to increase the student's knowledge.

After evaluating the Nutrecent Webinar Series activities, which had a low turnout from senior high school adolescents, an international webinar was held in collaboration with the Faculty of Public Health, Mulawarman University. The event had 929 participants from Indonesia and other countries such as Malaysia, Thailand, Belgium, and the Netherlands, though, only 654 people from the Zoom meeting took the tests. However, participants who joined the webinar through YouTube did not fill out the pre-test because it was given during webinar registration. The topic of the series was "Lifestyle and Mental Health", which was a current issue during the pandemic.

The speakers came from 2 universities, namely Dr. Nathalie Michels from Ghent University and Ratih Wirapuspita Wisnuwardani, Ph.D., from Mulawarman University. The first speaker spoke about lifestyle and mental health, stating that lifestyle is associated with the consumption of vegetables and fruit and degenerative diseases such as obesity, diabetes mellitus, kidney failure, and others. Meanwhile, the second speaker focused on consuming plant-based foods rich in polyphenols, especially processed foods from the Tropical rainforest in East Kalimantan and its association with the risk of degenerative diseases and mental health problems.

However, there was a 9.6% decrease in participants as only 591 out of the 654 participants filled the post-test. Most people came from Kalimantan, namely 81% from East Kalimantan and 9% from North Kalimantan. Also, there were participants from other countries, and 0.6% attended from Malaysia. There was a significant improvement during the international webinars (p-value < 0.001), where the average knowledge before the activity was 4.2 with a standard deviation of 0.8, and the average knowledge after the activity increased to 4.5 with a standard deviation of 0.8 as shown in Figure 2.

Based on the evaluation of the Nutrecent webinar series, which was unsuitable for senior high school adolescents, another webinar for college students, health workers, and the general public was conducted through a Zoom meeting. Furthermore, the new series presented international speakers and also provided SKP (participation credit unit) to participants as an attraction for this activity, consequently, there was an increase in the number of active participants. A study on college students in Los Angeles also concluded that knowledge improvement in Alzheimer's online learning is more effective for college students than senior high school students (Saif *et al.*, 2020). Furthermore, knowledge improvement in health education for college students also occurred in Australia (Green *et al.*, 2018)exercise physiology (EP, Amherst (USA) (Chung & Chen, 2020), and the UK (Nadama *et al.*, 2019; Cooper *et al.*, 2021). Based on previous studies and the International Nutrecent Webinar, online learning was only effective for college students and adults in the field of expertise. Meanwhile, independent learning was influenced by the readiness of the participant to learn.

Conclusion

The series of Nutrecent webinars for senior high school adolescents did not increase knowledge significantly (p-value > 0.05). In contrast, the international webinar for college students, health workers, and the general public significantly increased knowledge (p-value <0.001). Nuterecent was a digital learning platform for Indonesian adolescents, especially in East Kalimantan used social media such as Instagram, TikTok, and YouTube to promote the importance of consuming plant-based foods containing polyphenols such as vegetables and fruit by diversifying processed foods in Tropical rainforests. This study recommended face-to-face learning to promote vegetable and fruit

consumption in senior high school students to improve knowledge, attitudes, and behavior. Additionally, online webinars during the pandemic were suitable for college students and adults with previous knowledge of the webinar topic, such as health professionals.

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Leveraging Delphi Technique to Develop Breastfeeding Support Modules in East Java, Indonesia

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Abstract

Improving knowledge and skills are crucial factors in increasing the commitment of health facility staff to support exclusive breastfeeding. This study presents the steps to formulate the modules using the Delphi technique and implement those modules in the training. This study used a mixed-methods method consisting of four stages: literature review, qualitative analysis, module validity, and module implementation. The modules were validated by 14 lactation experts to assess reliability, feasibility, and linguistics. The study was conducted from 2020-2021 in 5 regions in East Java Province. A pre-post-test measurement with 493 health workers and non-health workers was conducted to assess the effectiveness of the modules. The first round of Delphi showed agreement proportion between 80-100% on the three aspects. In the second round of Delphi, the strong consensus stated that the modules can be implemented in training was achieved with the percentage of feasibility (79.4%), reliability (44.4%), and linguistics (44.4%). The results of the training using the modules showed a significant improvement in knowledge between 6-26 points in 5 areas (p-value<0.000). In conclusion, three modules have been developed and validated successfully. The modules were effectively used to improve breastfeeding knowledge and practice among health and non-health workers.

Introduction

Malnutrition in those under five remains a major health problem in Indonesia and even the figure rose during Pandemic COVIDS-19 due to a decrease in financial power (Ministry of Health of the Republic of Indonesia [Moh], 2018; Octavia and Rachmalina, 2022). Based on the Indonesian Nutritional Status Survey, the prevalence of stunting in 2021 was 24.4% with a decrease rate in stunting was 2% per year (Kementerian Kesehatan Republik Indonesia, 2021). The prevalence of stunting in Indonesia varies between regions where the malnutrition rate is 2.21 times higher in the Eastern Indonesia region (Papua, Maluku, and Nusa Tenggara Region) than in the Java and Bali region (Ayuningtyas et al., 2022). This is still far from the national target of stunting reduction, which is 14% in 2024, placing Indonesia in 108th place out of 132 countries in the world (Kementerian Kesehatan Republik Indonesia, 2021).

The exclusive breastfeeding practice is one of the main efforts to prevent stunting in 1000 days of first life (Campos, Vilar-Compte and Hawkins, 2020; Hadi et al., 2021). Based on research conducted in Indonesia, pointed out that exclusive breastfeeding for 6 months can reduce the incidence of stunting in poorer households by 20% and reduce the incidence of stunting by 50% in households with better economic levels (Hadi et al., 2021). However, the coverage of exclusive breastfeeding in Indonesia is still low where the figure has decreased from 38% in 2013 to 37.2% in 2018.

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Meanwhile, the prevalence of the practice of Early Initiation of Breastfeeding (EIB) reached 58.2% in 2018 (Ministry of Health of the Republic of Indonesia, 2018). For such a large benefit of exclusive breastfeeding, the practice of breastfeeding needs to be improved (Quesada, Méndez and Martín-Gil, 2020).

To reduce children's morbidity and mortality, WHO recommends mothers breastfeed their babies within one hour after birth and exclusively until the baby is 6 months old (Gavine, McFadden, et al., 2017). Initiation of breastfeeding immediately after birth will increase the chances of successful exclusive breastfeeding practice (Yılmaz et al., 2017; Walsh et al., 2019). To support this recommendation, the breastfeeding practice must be supported by health workers and protected by policies starting from health facilities (Nyondo-Mipando et al., 2021). As a critical place to initiate breastfeeding, health facilities should support mothers to conduct breastfeeding to elevate the chance to achieve 6-months of exclusive breastfeeding and breastfeeding up to two years (Woldeamanuel, 2020; Akello et al., 2021). In the 10 Steps to Breastfeeding Success (10 STSB) initiative launched by WHO, it is stated that to support breastfeeding practices in health facilities, key critical management stages including breastfeeding policies and breastfeeding support training for health facility workers must be carried out to achieve the success of other steps (Gavine, McFadden, et al., 2017; Agampodi et al., 2021).

To support the 10 STSB implementations, the Global Alliance for Improved Nutrition (GAIN) as a National NGO that focuses on improving nutrition has appointed the Centre for Public Health Innovation (CPHI) to conduct an initial assessment of 10 STSB implementations in 242 health facilities in five regions (Bondowoso, Jember, Probolinggo, Trenggalek and Surabaya City) in East Java in 2019. One of the major findings is breastfeeding training was rarely conducted in health facilities due to many reasons. Whereas, as a critical step that must be implemented, breastfeeding support training for health facility workers is a crucial step to improve Early initiation of breastfeeding practice, extend the duration of breastfeeding, and increase mother's trust in health workers (Kowara, 2021).

Many factors were the cause of that issue. Based on the initial study results it was found that the low number of health workers who had attended certified breastfeeding training was because of the high cost to include health workers in the training. Besides that, health facilities also had limited funds to conduct training independently at the health facility level (Pramono et al., 2022). In addition, certified training takes 5 working days so it is difficult for health facilities to allocate funds and time for its health workers to participate in the training. These obstacles have an impact on the lack of commitment of health workers in health facilities to support exclusive breastfeeding for mothers giving birth (Gavine, MacGillivray, et al., 2017). To answer those needs, modified breastfeeding support training has been developed to improve the knowledge and skills of the health non-health workers in health facilities. This article will present step by step to formulate the modules using the Delphi technique and implement those modules in the breastfeeding training in five districts in East Java.

Methods

This is a mixed-methods study which was divided into four stages, namely qualitative study, literature review, module validity, and module implementation. Respondents from this study were health workers and non-health workers in health facilities in 5 districts/cities (Bondowoso, Jember, Probolinggo, Trenggalek, and Surabaya). The study was conducted from 2020-2021. The developed module was adapted based on the 40-hour Breastfeeding Counsellor Module launched by WHO. In the newly developed breastfeeding support module, the material was shortened into 12 sessions with the duration of each session being 1 hour of training. The development stages of the modules were initial study, module writing, formulation of Delphi instruments, module validation using Delphi techniques, and module implementation in training.

The initial study was done to create a module syllabus that accommodate the knowledge needs of health workers and non-health workers. A qualitative study was

conducted with the involvement of lactation experts, and maternity, and health promotion staff. This step aimed to explore knowledge gaps so that an appropriate curriculum could be formulated in the new module. In addition, a literature review was also carried out to enrich the breastfeeding theory support module. The output of this initial stage was to produce a syllabus that outlines the knowledge and practice material sessions needed by health and non-health workers.

The process of writing module material refers to the developed syllabus during the initial study stage. The three modules on breastfeeding support applied for health workers, non-health workers, and breastfeeding champions were compiled based on published literature. Three module drafts were consulted with lactation experts, internationally certified breastfeeding counsellors, and nutritionists to get initial input that was leveraged to improve module quality. The 3 modules developed are presented in Table 1.

The module assessment aspect was developed based on quality indicators, namely reliability and feasibility. This indicator has been widely used to measure the quality of health program implementation (Blas et al., 2016). In addition to those two indicators, linguistics assessment was added. The aspects details of the module assessment are as follows:

1) Reliability: assessment aspect to measure validity and consistency of breastfeeding concepts in the developed modules.
2) Feasibility: assessment aspect to measure the possibility level of breastfeeding theory implementation in the developed modules.
3) Linguistics: assessment aspect to assess the suitability of grammar, sentence structure, and comprehension level of breastfeeding concepts.

The Delphi questionnaire was developed online using a Likert scale, namely "Strongly Disagree", "Disagree", "Agree" and "Strongly Agree". Columns were also provided to write qualitative input in each chapter.

Module validation was carried out using a Delphi survey where this method was proven to be able to measure reliably in developing new concepts and determining future program directions (Chianchana, 2022). There were two rounds of Delphi survey which was conducted during March-April 2020. There were 14 lactation experts as validators such as a breastfeeding counselor from the District Health Office of East Java Province an International Certified Breastfeeding Counsellor, a representative of the midwives' association, an obstetrician, midwives, and a nutritionist. The entire validation process was conducted in several stages, namely:

1) Modules and Online Questionnaire Distribution

The distribution of modules and questionnaires was done one week before the open discussion. The lactation experts received 3 breastfeeding modules and 3 Delphi questionnaire packages that had to be filled out. The results of the data obtained in the questionnaire were analyzed using SPSS and presented at an open discussion meeting.

2) Open Discussion

In this process, results from the Delphi survey were presented to all lactation experts. The open discussion took place in 2 rounds where the first round focused more on exploring inputs and improving the quality of the module while the second round prioritized drawing consensus from lactation experts. A whole discussion process was recorded with informed consent in advance.

3) Drawing Consensus

Consensus was made from agreement among lactation experts. The interpretation of each session assessed was "Strong Consensus" if scores indicated ≥95% agreement in each material session, "Consensus" was reached if 80-94% of lactation experts demonstrated an agreement response, and "No Consensus" was defined if scores indicated <80% agreement. For written mutual agreement, all lactation experts signed the approval agenda which stated the modules passed the three assessment aspects.

After the modules were validated, training was conducted in 493 health facilities and health offices in East Java Province, which are spread across 5 districts/cities, namely Bondowoso, Jember, Probolinggo, Trenggalek, and Surabaya. The number of training

Table 1. Breastfeeding Support Curriculum Modules for Health and Non-Health Workers

Cover	Module Title	Materi Modul	Duration	Participants
	Primary Promotion of Breastfeeding Module for Non-Health Workers in Health Facilities ISBN No. 978 602 294 433 1	Session 1: The Role of Health Promotion Profession in Supporting the 10 STSB and Exclusive Breastfeeding Programs Session 2: Communication Strategy for Non-Health Workers to Promote 10 STSB and Exclusive Breastfeeding Practice Session 3: The Importance of Breast Milk and Breastfeeding Session 4: Basic Knowledge of Breastfeeding Techniques and How to Help Mothers to Breastfeed Session 5: Basic Assistance Practices for Breastfeeding Mothers Session 6: Common Breastfeeding Issues and Providing Basic Referral Information Session 7: Advantages of Breast Milk Compared to Formula Milk Session 8: Emo-Demo Techniques to Support Exclusive Breastfeeding	8 Hours	Health workers and non-health workers such as administrators, customer service, security, cleaning service, etc.
	Management and Breastfeeding Counselling Modules in Health Facilities ISBN No. 978 602 294 432 4	Session 1: The Importance of Breast Milk and Breastfeeding Session 2: Communication Strategies to Improve Mother's confidence to breastfeed Session 3: Emo-Demo Technique to support Exclusive Breastfeeding. Session 4: Exclusive Breastfeeding Education during ANC Session 5: Early Initiation of Breastfeeding Session 6: Latching and Position during Breastfeeding Session 7: Helping mothers in positioning and latching while breastfeeding (Practice Session) Session 8: Signs of Effective Breastfeeding Session 9-10: Common Breastfeeding Problems and Management. Session 11: Alternative Methods of Milking, Giving, and Storing Breastmilk Session 12: Alternative Method of Breastmilk Feeding (Practice Session)	12 Hours	Health workers such as midwives, maternity and child nurses, nursery nurses, nutritionists, health promotion, etc.
	TOT Breastfeeding Champion ISBN No. 978 602 294 444 7	Session 1: Welcome Session Session 2: Becoming a Good Trainer and Classroom Management Session 3: Teaching Skill Techniques Session 4: Theory and Practice of Communication Strategies for Exclusive Breastfeeding Promotion Session 5: Theory and Practice of Emotional Demonstration (Emo-Demo) to support Exclusive Breastfeeding Session 6: Theory and Practice in Positioning and Latching Session 7: Theory and Practice to Help and Observe Early Initiation of Breastfeeding. Session 8: Theory and Practice Common Breastfeeding Problems and Management	8 Hours	Health workers such as midwives, maternity and child nurses, nursery nurses, nutritionists, health promotion, etc.

participants was 493 people of maternal-child nurses, midwives, and health promotion officers. Participants' knowledge was measured before and after the training to find out whether there was a significant knowledge enhancement. Pre and post-test data were analyzed statistically by considering normality data. The different value in knowledge was classified as significant if p-value <0.05.

Results and Discussion

The module development process needs to be done rigorously and conducted in several stages to fulfill the knowledge gap of breastfeeding theory and practice for health and non-health workers (Cianelli et al., 2014). All module development activities involved certified lactation experts in adapting breastfeeding materials from various breastfeeding literature. Thus, these modules showed implications in increasing the knowledge of health and non-health workers regarding breastfeeding support in health facilities. The final stage was the validation process to assess whether the reliability, feasibility, and grammar of the breastfeeding-support interventions were following the science (Alberdi et al., 2018). In the first round of Delphi, all lactation experts provided assessments regarding three aspects of the module, namely reliability, feasibility, and linguistics. In this module, eight material sessions must be assessed by lactation experts. The results of the Delphi Survey on the module Basic Promotion of Breastfeeding for Non-Health Workers in Health Facility are presented in the Table 2.

From the Delphi survey process, it was found that of the 3 modules assessed based on the three assessment aspects, scores were interpreted in the range of "Consensus" and "Strong Consensus" in each session and there was no interpretation of "No Consensus". From the reliability aspect, the lactation experts agreed on the theoretical truth level from breastfeeding concepts and practices developed in modules with a score range between 80-100. It is crucial to develop modules with standardized theoretical concepts so that all staff in the health facility have the same level of knowledge. Thus, the information that has been given to the breastfeeding mothers will be standardized and minimize discomfiture (Mulcahy et al., 2022).

Another assessed aspect was feasibility, which was an assessment related to the possibility of implementing the concept of breastfeeding into practice. The score obtained for the feasibility aspect was in the range of 90-

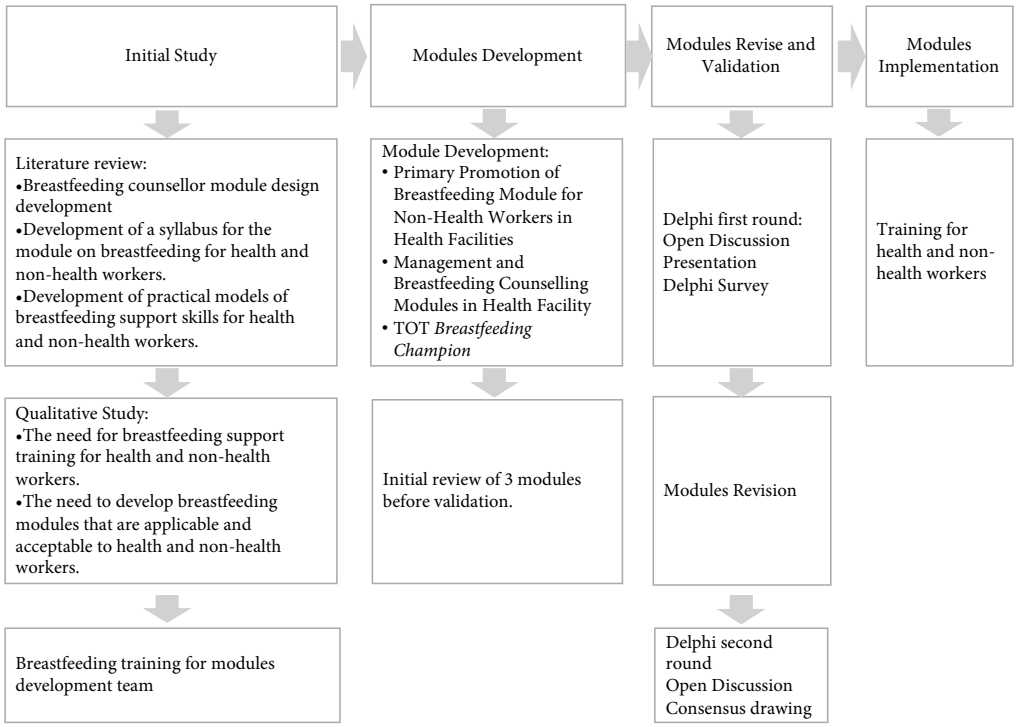

Figure 1. Flowchart of Breastfeeding Modules Development

Table 2. Delphi Survey Results on Three Breastfeeding Support Modules

Module	Session	Reliability		Feasibility		Linguistics		Total Skor
		Agreement proportion	Interpretation	Agreement Proportion	Interpretation	Agreement Proportion	Interpretation	
Primary Promotion of Breastfeeding Module for Non-Health Workers in Health Facilities	Session 1: The Role of Health Promotion Profession in Supporting the 10 STSB and Exclusive Breastfeeding Programs	84.62	Consensus	92.31	Consensus	100	Strong Consensus	133
	Session 2: Communication Strategy for Non-Health Workers to Promote 10 STSB and Exclusive Breastfeeding Practice	84.62	Consensus	92.31	Consensus	84.62	Consensus	126
	Session 3: The Importance of Breast Milk and Breastfeeding	92.31	Consensus	100	Strong Consensus	100	Strong Consensus	142
	Session 4: Basic Knowledge of Breastfeeding Techniques and How to Help Mothers to Breastfeed	100	Strong Consensus	92.31	Consensus	92.31	Consensus	142
	Session 5: Basic Assistance Practices for Breastfeeding Mothers	92.31	Consensus	100	Strong Consensus	84.62	Consensus	139
	Session 6: Common Breastfeeding Issues and Providing Basic Referral Information	84.62	Consensus	92.31	Consensus	100	Strong Consensus	132
	Session 7: Advantages of Breast Milk Compared to Formula Milk	100	Strong Consensus	100	Strong Consensus	92.31	Consensus	149
	Session 8: Emo-Demo Techniques to Support Exclusive Breastfeeding	100	Strong Consensus	100	Strong Consensus	100	Strong Consensus	144
Management and Breastfeeding Counselling Modules in Health Facilities	Session 1: The Importance of Breast Milk and Breastfeeding	92.31	Consensus	100	Strong Consensus	100	Strong Consensus	140
	Session 2: Communication Strategies to Improve Mother's confidence to breastfeed	100	Strong Consensus	100	Strong Consensus	92.31	Consensus	142
	Session 3: Emo-Demo Technique to support Exclusive Breastfeeding.	92.31	Consensus	100	Strong Consensus	100	Strong Consensus	135
	Session 4: Exclusive Breastfeeding Education during ANC	100	Strong Consensus	100	Strong Consensus	100	Strong Consensus	144

	Session 5: Early Initiation of Breastfeeding	100	Strong Consensus	100	Strong Consensus	92.31	Consensus	139
	Session 6: Latching and Position during Breastfeeding	92.31	Consensus	100	Strong Consensus	92.31	Consensus	142
	Session 7: Helping mothers in positioning and latching while breastfeeding (Practice Session)	84.62	Consensus	92.31	Consensus	92.31	Consensus	131
	Session 8: Signs of Effective Breastfeeding	92.31	Consensus	92.31	Consensus	92.31	Consensus	135
	Session 9-10: Common Breastfeeding Problems and Management.	92.31	Consensus	92.31	Consensus	92.31	Consensus	127
	Session 11: Alternative Methods of Milking, Giving, and Storing Breastmilk	92.31	Consensus	100	Strong Consensus	100	Strong Consensus	138
	Session 12: Alternative Method of Breastmilk Feeding (Practice Session)	100	Strong Consensus	100	Strong Consensus	100	Strong Consensus	141
TOT Breastfeeding Champion	Session 1. Welcome Session	92.31	Consensus	100	Strong Consensus	100	Strong Consensus	135
	Session 2: Becoming a Good Trainer and Classroom Management	100	Strong Consensus	100	Strong Consensus	100	Strong Consensus	142
	Session 3: Teaching Skill Techniques	100	Strong Consensus	100	Strong Consensus	100	Strong Consensus	144
	Session 4: Theory and Practice of Communication Strategies for Exclusive Breastfeeding Promotion	100	Strong Consensus	100	Strong Consensus	100	Strong Consensus	149
	Session 5: Theory and Practice of Emotional Demonstration (Emo-Demo) to Support Exclusive Breastfeeding	100	Strong Consensus	100	Strong Consensus	100	Strong Consensus	147
	Session 6: Theory and Practice in Positioning and Latching	100	Strong Consensus	100	Strong Consensus	100	Strong Consensus	144
	Session 7: Theory and Practice to Help and Observe Early Initiation of Breastfeeding	92.31	Consensus	100	Strong Consensus	100	Strong Consensus	141
	Session 8: Theory and Practice Common Breastfeeding Problems and Management	92.31	Consensus	92.31	Consensus	92.31	Consensus	144

100. This score was quite high and indicated agreement among lactation experts that the concepts of breastfeeding in both theoretical and practice modules were feasible to be applied to health facility staff. It was important to assess the feasibility of a concept or program before it was implemented to ensure it was able to increase the knowledge and practice of health facility staff to support breastfeeding mothers (Lok et al., 2021).

Linguistics was the last criterion to be assessed in the breastfeeding modules. It was an additional aspect that had been agreed to be assessed by a lactation expert. The underlying reason was an urgent need to perform modules with non-complex terms, good grammar, and sentence structure. Thus, health facility staff could understand the theory, concept, and practice guidelines comprehensively. Particularly, if there were words that needed to be translated from the foreign language into Bahasa Indonesia (Wambach, 2018). Moreover, there were still parties who thought breastfeeding was an inappropriate practice so it requires consideration of language (Mahurin, 2015). From the first round Delphi survey, the linguistics aspect got a score with a range between 80 to 100.

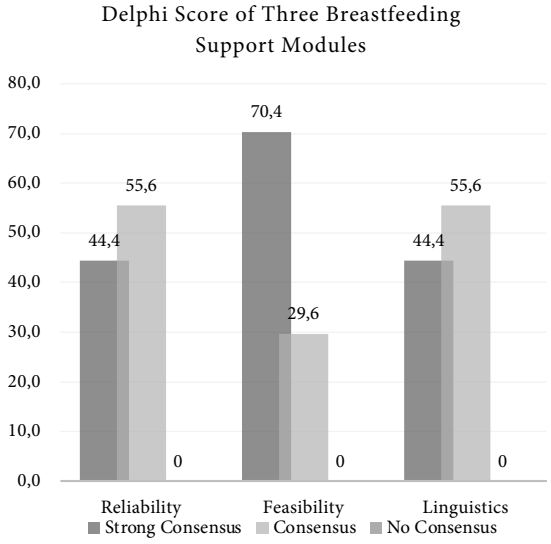

Figure 2. Interpretation of Score Proportions for the Three Breastfeeding Support Modules

The second round of Delphi was held about 2 weeks after the first round. The activity was conducted online by inviting lactation experts. In this forum, discussions were held up to the withdrawal of the consensus modules breastfeeding with an assessment of three aspects. The discussion took place quite intensely until the collective agreement was withdrawn. Based on the results of the Delphi second round, it was found that as many as 44.4% of lactation experts stated a strong consensus on the theoretical truth level from the breastfeeding concepts developed in the modules. This aspect was crucial to be assessed to minimize conceptual error. Thus, the breastfeeding theories that were written in the modules were correct and followed the updated concept (Dolgun et al., 2018).

The second aspect that agreed was feasibility which none of the lactation experts disagreed with the level of implementation of the breastfeeding theories in the modules. All experts agreed on the high possibility of implementing modules to increase knowledge and practice of breastfeeding by considering the characteristics of the target audience (Alberdi et al., 2018). The third aspect agreed upon by lactation experts was linguistics on grammar and the level of understanding possibility of sentences written in breastfeeding theory. The results of the linguistics assessment in the Delphi survey showed that 100% of lactation experts stated strong consensus and consensus on grammatical aspects.

The leveraging of the Delphi survey in the material validation of the breastfeeding support module is an effective way to explore expert opinions and input to reach a consensus among all lactation experts. However, in its implementation which was hampered by the Pandemic of COVID-19, all of the module validation process was carried out entirely online. The online Delphi survey also has a low level of acceptance among lactation experts. This can be seen only by 73.7% of lactation experts who are willing to be involved in this activity. The reason for the high refusal from experts to participate in the online Delphi survey was due to increased busyness during the Pandemic of COVID-19 and a lack of literacy in online technology. Delphi surveys also sometimes lead to pseudo-consensus, where during the discussion process, experts compromise more on the dominant opinion so that it does not

describe reaching a genuine agreement. An experienced moderator was required to manage the discussion room; thus all of the experts showed their opinions, gave some input, and minimized the risk of dominance in the process (Chianchana, 2022).

Implementation of module validation with Delphi which is conducted online needs to consider the readiness of using technology of lactation experts. Some experts were still not used to operating the Zoom meeting application because the validation process was carried out at the beginning of the COVID-19 Pandemic. In addition, the validation process conducted online needs to pay attention to the strength of the internet network and moderators' ability who were able to facilitate online discussion, thus it turns out to be more interactive among participants (Karl, Peluchette and Aghakhani, 2022). Another limitation was the long process of the validation so there was a risk that the expert would decide to resign halfway due to the tightness of their work (Kershaw et al., 2021). A written commitment was required when recruiting experts to follow the validation process until the end.

After the modules had passed the validation process, then it was implemented in breastfeeding training. The training was conducted in 493 health facilities with participants consisting of 326 maternity staff, 150 health promotion officers, and 17 people from the District Health Office. The number of participants who attended was 493 with a participation rate was 100%.

A differential test was conducted to measure the significance of the difference between the pre and post-test values of the training using three breastfeeding support modules. A paired t-test and Wilcoxon test were used in the analysis depending on the normality of the data. If the data is normally distributed, the Paired t-test was used, and if it is not normally distributed, the Wilcoxon test was used for the difference test. There was an increase in knowledge score with a range of 6-26 points in the three trainings. The significance value for three training in five districts showed a p-value<0.05, so it can be concluded that there were significant differences in knowledge before and after attending the training in 5 districts.

The result of the module implementation in the training revealed that the breastfeeding support module could significantly increase the knowledge of health and non-health workers in health facilities. Increasing knowledge had an effect on increasing attitudes and self-efficacy of health workers to perform support for breastfeeding mothers, which was a steppingstone to the Baby Friendly Hospital Designation (Dubik, Yirkyio and Ebenezer, 2021). Actions based on knowledge will be more consistent and sustainable than without sufficient knowledge support (Huang et al., 2019). Having sufficient knowledge related to breastfeeding support could be a strong foundation for health facilities to create a conducive atmosphere for breastfeeding. However, a strong knowledge needs to be

Table 3. Results of Pre-test and Post-test Score of Training Participants Using Three Breastfeeding Support Modules

Module	Intervention District	Pretest Score	Postest Score	P-Value
Primary Promotion of Breastfeeding Module for Non-Health Workers in Health Facilities	Bondowoso	78.8	88.9	0.000[a]
	Jember	71.2	83.0	0.000[a]
	Probolinggo	65.6	82.0	0.000[a]
	Trenggalek	76.8	89.0	0.000[a]
	Surabaya	74.2	83.0	0.000[a]
Management and Breastfeeding Counselling Modules in Health Facilities	Bondowoso	53.8	78.5	0.000[a]
	Jember	51.1	68.6	0.000[a]
	Probolinggo	52.8	69.7	0.000[a]
	Trenggalek	50.8	76.3	0.000[b]
	Surabaya	46.9	67.3	0.000[a]
TOT Breastfeeding Champion	Jawa Timur	75.4	85.7	0.000[a]

Note: [a] Wilcoxon Test; [b] Paired T-Test; α=0.05

maintained in terms of sustainability by monitoring and evaluating breastfeeding outcomes (Araújo et al., 2019).

Conclusion

The results of the Delphi study showed the feasibility of designing breastfeeding modules that were adapted based on the breastfeeding by WHO module. These modules can fill the knowledge and practice gap effectively required by health facility staff, with minimum cost and in a shorter time. Based on validation and implementation results, those modules passed the validation steps on reliability, feasibility, and linguistics aspects. Moreover, those modules also significantly improved health facility's staff knowledge in breastfeeding training conducted in East Java Province. With good performance, health facilities in Indonesia are expected to leverage those three modules in their internal training. So that it can educate more health and non-health workers who can support the breastfeeding initiation process in health facilities. Thus, the number of postpartum mothers who are willing to breastfeed their baby exclusively for 6 months will be increased.

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Pesticide Exposure, Neurobehavioral Symptoms, and Neurobehavioral Performance in Pesticide Applicator in West Java, Indonesia

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Abstract

It was known that pesticide applicators are at risk of experiencing neurotoxicity and neurobehavioral alterations related to occupational pesticide exposure. This study aims to evaluate the association between pesticide exposure and the neurobehavioral performance of pesticide applicators in West Java, Indonesia where chemical pesticides were heavily used. We conducted a cross-sectional study in a vegetable farming center in West Java Province, Indonesia. A total of 88 pesticide applicators were included in the study on November 2022. A structured interviewer-administered questionnaire was used to obtain the participants' characteristics. We performed the German Q18 questionnaire to screen the neurobehavioral symptoms and the WHO Neurobehavioral Core Test Battery (NCTB) for each participant to identify the neurobehavioral performance among pesticide applicators. Data were summarized descriptively and statistical analysis using chi-square and independent sample t-test was performed. We found that the most common neurobehavioral symptoms were symptoms related to memory, concentration, and fatigue. Poor neurobehavioral performance was found in 29.5% of participants and it was found to be associated with those grouped at age ≥ 44 years and categorized as having a high CEL. The pieces of evidence presented here suggest that neurobehavioral performance was associated with pesticide exposure.

Introduction

The agricultural sector in Indonesia is one of the main economic drivers, however, most of the workers are in the small-scale agricultural sector. It is believed that more than any other occupational group, agricultural workers especially those in the small-scale sector are heavily exposed to chemical pesticides (Liem *et al*., 2021). Chemical pesticides are widely used in agriculture, in particular, to control pests including weeds, insects, and plant diseases. Previous studies have shown that pesticide handling among smallholder farmers is generally poor as indicated by more frequent application, higher concentration, use of pesticide mixture, and infrequent use of appropriate personal protective equipment (PPE) (Maden *et al*., 2014.; Liem *et al*., 2021; Yuantari *et al*., 2015). They are less aware that pesticides should be used as part of an integrated approach to pest, weed, and disease control. Accordingly, failure to use pesticides properly can harm people and the environment. The deleterious effects of pesticide exposure arise as a result of the interaction of several factors including pesticide toxicity, dose, length of exposure, route of entry, the work practices or control measures i.e., application method, PPE used, personal hygiene, and spill management, as well as the metabolism in the human body that can be influenced by genetic susceptibility (Liem *et al*., 2022; Damalas and Koutroubas, 2018).

For that reason, it was known that

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farmers and workers in the agricultural sector, especially pesticide applicators, are at risk of experiencing health problems including respiratory disorders, hematological alterations, and endocrine disruptions (De-Assis *et al*., 2021; Liem *et al*., 2023). Not only that, neurotoxicity and neurobehavioral alterations related to occupational pesticide exposure were also reported in several studies (Tiwari *et al*., 2022; Fuhrimann *et al*., 2021). A recent study of farmers in Central Java, Indonesia, showed that most participants were indicated to have been exposed to the acetylcholinesterase inhibitor pesticides, and 59.2% had symptoms of neuropathy (Setyopranoto *et al*., 2020). In another study, chronic low-level exposure to organophosphates has been reported to alter cognitive and psychomotor domains including impaired memory, attention, and alertness, as well as impaired psychological domains such as anxiety, depressed mood, and irritability (Ismail *et al*., 2012). Therefore, our study aims to evaluate the association between neurobehavioral performance and pesticide exposure of pesticide applicators in West Java, Indonesia where chemical pesticides were heavily used.

Method

Our research was a cross-sectional study, conducted in Cibodas Village, West Bandung Regency, West Java Province, Indonesia. The main commodities in this area are romaine lettuce, broccoli, and chilies. The eligible study population was all farmers in the Cibodas area, totaling approximately 500 people. The minimum sample size of our study was 84 participants determined by the Slovin formula using a 10% margin of error. Using a consecutive sampling method, a total of 100 vegetable farmers participated in the recruitment process of our study. Among them, 10 farmers did not apply pesticides, while 2 other farmers did not complete the neurobehavioral test, leaving 88 farmers who actively applied pesticides included in the study. The recruitment process was held in November 2022. Since the farming activities are relatively similar throughout the year, the timing of recruitment does not affect the assessment of the actual exposure situation.

The information on the individual and occupational characteristics of the study participants was identified using a structured interviewer-administered questionnaire. The occupational characteristics primarily consisted of several parameters related to agricultural activities which were then used to calculate the intensity level and cumulative exposure level (CEL). We calculated the intensity level and the CEL of pesticide exposure using a quantitative approach from Dosemeci that has been shown effective in Agricultural Health Study (Dosemeci *et al*., 2002). The intensity level of exposure to pesticides was estimated using parameters of pesticide handling practices which include application-related activities (e.g., mixing, repairing, and/or washing used equipment, mode of application), personal protective equipment utilization, personal hygiene practices, and spill management as explained in the previous study (Dosemeci *et al*., 2002; Liem *et al*., 2021). Furthermore, the CEL was calculated based on the intensity level, the number of days of applying pesticides in a year, and the lifetime of pesticide exposure. Based on the median CEL value, the participants were then categorized into high and low CEL groups (Liem *et al*., 2022).

The 18 questions on the German Q18 questionnaire were used to screen the neurobehavioral symptoms among pesticide applicators. Cut-off points of 5 for men and 6 for women were applied to determine the presence of neurobehavioral symptoms (Ihrig *et al*., 2001). The WHO Neurobehavioral Core Test Battery (NCTB) is intended to identify or screen for the neurological effects of chemical exposure. In this study, we performed the Digit Symbol, Digit Span, Pursuit Aiming, and Trail Making tests for each participant, according to NCTB operational procedures. All testing procedures were well understood and properly implemented by the research team to avoid testing bias. This test was conducted at a comfortable room temperature with sufficient lighting and relatively free from distracting noise to minimize disturbance to participants during the test. The overall neurobehavioral performance was classified into two (2) categories according to the score test. Score tests above 40 were categorized as good (normal), otherwise categorized as poor (abnormal) if

one of the score tests was 40 or less (Anger, 2014; Anger *et al*., 1993).

The analysis was performed using SPSS 20 for Windows. We summarised the study population characteristics as frequency distribution for categorical variables while using mean (SD) or median (minimum-maximum) to describe the continuous variables. An independent sample t-test was used to evaluate the difference in NCTB score according to the presence of neurobehavioral symptoms and CEL groups. The chi-square test was used to analyze the association between neurobehavioral performance and both the individual and occupational characteristics of the study participants. All p-values are two-sided, and $p<0.05$ was considered significant. The Medical and Health Research Ethics Committee of the Faculty of Medicine and Health Sciences Universitas Kristen Krida Wacana (UKRIDA) approved the study protocol on September 28, 2022 (No. SLKE: 1361/SLKE-IM/UKKW/FKIK/KE/IX/2022). We obtain written informed consent from all participants.

Results And Discussion

Our research participants have been farmers for many years and pesticide application methods have been implemented for generations. The characteristics of the pesticide applicators who participated in our study are shown in Table 1. The mean age of our study participants was 44.2 years, most were male and had low levels of education. They had been spraying pesticides for approximately 15 years, with a median frequency of 65 spraying days per year. Almost all farming and pesticide handling activities were done manually. The application equipment and pesticide handling practices in our study are described in Table 2. We found that all of our participants wore long trousers during pesticide application. However, the proportion of goggles and chemical gloves users in our study population was considered small. Therefore, pesticide applicators may experience exposure to pesticides which can occur through skin contact, inhalation, or ingestion. Apart from mixing and spraying pesticides, several agricultural activities, including cleaning used equipment, re-entering sprayed areas, and harvesting crops that may be contaminated with pesticides are the primary sources of occupational pesticide exposure (Gangemi et al., 2016). Not only that, combining multiple pesticides in a single spraying activity was found to be a common practice in our study. Most of our study participants use a minimum of 2 (two) combinations of pesticides in a single spraying activity. Mancozeb, difenoconazole, and emamectin were the most frequently used pesticides as detailed in Table 3.

Table 1. Characteristics of the Study Participants

Characteristics (n =88)	Description
Age ‖	44.2 (10.1) years
Male – n (%)	85 (96.6)
Low level of education – n (%)	66 (75.0)
Obese (Body mass index ≥ 25 kg/m^2) – n (%)	33 (37.5)
Smoking – n (%)	71 (80.7)
Lifetime pesticide exposure #	15 (1 – 40) years
Number of days spraying per year #	65 (13 – 208) days
Intensity level (IL) #	6.5 (0.4 – 62.8)
Cumulative exposure level (x10^3) #	7.7 (0.1 – 98.0)
Daily work duration #	5.5 (2 – 12) hours
Duration of spraying pesticide #	0.43 (0.02 – 2.3) hours/day

‖Mean (SD), # Median (minimum – maximum)

Using the Germany Q18 questionnaire, we identified the neurobehavioral symptoms experienced by our participants. The most common neurobehavioral symptoms were symptoms related to memory, concentration, and fatigue as shown in Table 4. Poor performance on digit symbol, digit span, pursuit aiming, and trail-making tests were 17%, 12.5%, 15.9%, and 4.5%, respectively. Overall, poor neurobehavioral performance was found in 26 (29.5%) participants. We discovered that neurobehavioral symptoms and cumulative exposure level (CEL) were associated with lower scores on the digit symbol and pursuit aiming tests, as well as longer processing time in the trail-making test as shown in Table 5.

Table 2. Distribution of Application Equipment and Pesticide Handling Practices Used by the Study Participants

Parameter	Frequency - n (%)	
	Never / rare	Frequent
Application equipment		
Hat	7 (8.0)	81 (92.0)
Face mask	49 (55.7)	39 (44.3)
Goggles	86 (97.7)	2 (2.3)
Long sleeves	2 (2.3)	86 (97.7)
Long pants	0 (0)	88 (100)
Chemical gloves	72 (81.8)	16 (18.2)
Boots	1 (1.1)	87 (98.9)
Pesticide handling practices		
Read the instruction label before using pesticides	38 (43.2)	50 (56.8)
Combining multiple pesticides in a single spraying activity	5 (5.7)	83 (94.3)
Direct contact with pesticide concentrates	56 (63.6)	32 (36.4)
Being splashed or spilled on pesticides during spraying	48 (54.5)	40 (45.5)
Spraying against the wind	70 (79.5)	18 (20.5)
Re-entering sprayed area	52 (59.1)	36 (40.9)
Wiping sweat with contaminated clothing	63 (71.6)	25 (28.4)
Smoking while spraying pesticides	85 (96.6)	3 (3.4)
Wash hands with water and soap after using pesticides	20 (22.7)	68 (77.3)
Changing clothes after spraying pesticides	12 (13.6)	76 (86.4)

Source: primary data (2022)

Table 3. Types of Pesticides Used by Study Participants

No	Active ingredient	Chemical class	Utilization	Frequency - n (%)
1	Mancozeb	Dithiocarbamate	Fungicide	53 (58.9 %)
2	Difenoconazole	Triazole	Fungicide	44 (48.9 %)
3	Emamectin	Avermectin	Insecticide	26 (28.9 %)
4	Chlorantraniriprole	Diamide	Insecticide	20 (22.2%)
5	Profenofos	Organophosphate	Insecticide	15 (16.7 %)
6	Azoxystrobin	Methoxyacrylate	Fungicide	12 (13.3 %)
7	Abamectin	Avermectin	Insecticide	11 (12.2 %)
8	Cypermethrin	Pyrethroid	Insecticide	10 (11.1 %)
9	Carbendazim	Benzimidazole	Fungicide	9 (10.0%)
10	Chlorotalonil	Chloronitrile	Fungicide	8 (8.9 %)
11	Propineb	Carbamate	Fungicide	7 (7.8 %)
12	Spinetoram	Spinosine	Insecticide	6 (6.7 %)
13	Imidacloprid	Neonicotinoid	Insecticide	4 (4.4 %)
14	Dimethomorph	Morpholine	Fungicide	3 (3.3 %)
15	Beta cyfluthrin	Pyrethroid	Insecticide	2 (2.2 %)
16	Diazinon	Organophosphate	Insecticide	2 (2.2 %)
17	Fipronil	Phenylpyrazole	Insecticide	2 (2.2 %)
18	Hexaconazole	Triazole	Fungicide	2 (2.2 %)
19	Chlorpyrifos	Organophosphate	Insecticide	2 (2.2 %)
20	Maneb	Carbamate	Fungicide	2 (2.2 %)
21	Methomyl	Organophosphate	Insecticide	2 (2.2 %)
22	Thiamethoxam	Neonicotinoid	Insecticide	2 (2.2 %)

No	Active ingredient	Chemical class	Utilization	Frequency - n (%)
23	Amylsubrom	Sulfonamide	Fungicide	1 (1.1 %)
24	Famoxadone	Oxazolidinedione	Fungicide	1 (1.1 %)
25	Fluxametamide	Isoxazoline	Insecticide	1 (1.1 %)
26	Lambda cyhalothrin	Pyrethroid	Insecticide	1 (1.1 %)
27	Oxathiapiprolin	Isoxazoline	Fungicide	1 (1.1 %)
28	Mefenoxam	Fenilamida	Fungicide	1 (1.1 %)

Source: primary data (2022)

Table 4. Neurobehavioral Symptoms Distribution According to the German Q18 Questionnaire

	Questions	Yes -n (%)	No - n (%)
1	Do you have a short memory?	28 (31.8)	60 (68.2)
2	Have your relatives told you that you have a short memory?	35 (39.8)	53 (60.2)
3	Do you often have to make notes about what you must remember?	25 (28.4)	63 (71.6)
4	Do you generally find it hard to get the meaning from reading newspapers and books?	31 (35.2)	57 (64.8)
5	Do you often have problems with concentrating?	33 (37.5)	55 (62.5)
6	Do you often feel irritated without any particular reason?	14 (15.9)	74 (84.1)
7	Do you often feel depressed without any particular reason?	10 (11.4)	78 (88.6)
8	Are you abnormally tired?	34 (38.6)	54 (61.4)
9	Do you have palpitations of the heart even when you don't exert yourself?	18 (20.5)	70 (79.5)
10	Do you sometimes feel an oppression in your chest?	9 (10.2)	79 (89.8)
11	Do you often perspire without any particular reason?	6 (6.8)	82 (93.2)
12	Do you have a headache at least once a week?	28 (31.8)	60 (68.2)
13	Are you less interested in sex than what you think is normal?	26 (29.5)	62 (70.5)
14	Do you often feel sick?	31 (35.2)	57 (64.8)
15	Do you have numb feelings in your hands or feet?	27 (30.7)	61 (69.3)
16	Is there a weak feeling in your arms or legs?	20 (22.7)	68 (77.3)
17	Do your hands tremble?	8 (9.1)	80 (90.9)
18	Does alcohol not agree with you?	78 (88.6)	10 (11.4)

Source: primary data (2022)

The association of neurobehavioral symptoms and the neurobehavioral core test battery score strengthens the notion that there has been a neurobehavioral alteration. Furthermore, as presented in Table 6, poor neurobehavioral performance was associated with those grouped at age ≥ 44 years and categorized as having a high CEL.

Our findings on the association of the cumulative exposure level (CEL) with neurobehavioral performance are in agreement with a recent study in Indonesia that showed a significant association between pesticide spraying frequency, spraying duration, lifetime pesticide exposure, and the utilization of PPE with neurobehavioral performance (Pawestri and Sulistyaningsih, 2021). High CEL scores occur due to high exposure intensity, application frequency, and lifetime years of pesticide exposure. We observed that more than 4 out of 5 pesticide applicators did not use chemical gloves. Since direct skin contact is one of the most significant routes of entry for pesticide exposure, direct contact with pesticides places them at a higher risk of pesticide exposure and health effects. For that reason, those in the high CEL group characterized by less adequate PPE utilization and poorer work practices had poor neurobehavioral performance. This finding aligns with the results of a recent review which stated that insecticide applicators without PPE tended to perform worse on neurobehavioral tests (Antonangeli *et al.*, 2023), and also supporting a previous study that stated most farmers using PPE were categorized in the healthy group (Joko *et al.*, 2020).

Table 5. The Neurobehavioral Core Test Battery Score of Study Participants Grouped by Neurobehavioral Symptoms and Cumulative Exposure Level

Parameter		n	Mean score	Mean difference	p	95% CI
Digit Symbol Test	NB Symptoms					
	Yes	41	46.40	-6.75	0.001	-10.77 ; -2.73
	No	47	53.14			
	CEL					
	High	45	46.78	-6.59	0.002	-10.61 ; -2.56
	Low	43	53.37			
Digit Span Test	NB Symptoms					
	Yes	41	47.31	-5.04	0.015	-9.08 ; -1.00
	No	47	52.35			
	CEL					
	High	45	48.39	-3.29	0.124	-7.49 ; 0.92
	Low	43	51.68			
Pursuit Aiming Test	NB Symptoms					
	Yes	41	46.03	-7.43	< 0.001	-11.40 ; -3.47
	No	47	53.46			
	CEL					
	High	45	46.17	-7.84	< 0.001	-11.76 ; -3.92
	Low	43	54.01			
Trail-Making Test	NB Symptoms					
	Yes	41	53.22	6.03	0.007	1.96 ; 10.10
	No	47	47.19			
	CEL					
	High	45	53.01	6.18	0.003	2.16 ; 10.19
	Low	43	46.84			

NB Symptoms: Neurobehavioral symptoms
CEL: Cumulative exposure level

Table 6. The Association Between Neurobehavioral Performance and Study Participants' Characteristics

Variable	Neurobehavioral performance		p^{cs}
	Poor	Good	
Age			
≥ 44 years	22 (84.6)	22 (35.5)	< 0.001
< 44 years	4 (15.4)	40 (64.5)	
Sex			
Female	0 (0)	3 (4.8)	0.345 (f)
Male	26 (100)	59 (95.2)	
Level of education			
Low (≤ 9 years)	23 (88.5)	43 (69.4)	0.059
High (> 9 years)	3 (11.5)	19 (30.6)	
Smoking			
Smoking	20 (76.9)	51 (82.3)	0.563
Not smoking	6 (23.1)	11 (17.7)	
Body mass index			

Variable	Neurobehavioral performance		p^{cs}
	Poor	Good	
Obese (≥ 25 kg/m^2)	9 (34.6)	24 (38.7)	0.717
Not obese (< 25 kg/m^2)	17 (65.4)	38 (61.3)	
Knapsack sprayer			
Manual pressurized	23 (88.5)	58 (93.5)	0.339 (f)
Motorized	3 (11.5)	4 (6.5)	
Cumulative exposure level			
High	21 (80.8)	24 (38.7)	< 0.001
Low	5 (19.2)	38 (61.3)	

cs: *chi-square*
f: *Fisher exact test*

Furthermore, as the categorization of CEL into high and low-exposure groups serves as a surrogate for chronic exposure among our study participants, our results suggest that the pesticide applicators in our study were chronically exposed to agents with neurotoxic properties. The results were consistent with a previous review that concluded that long-term low-level pesticide exposure was associated with impaired neurobehavioral functions including memory/attention, visuospatial abilities, and psychomotor speed (Ross *et al*., 2013).

The nervous system is susceptible to the effects of pesticides, and for that, there is growing evidence that chronic neurodegenerative conditions are associated with long-term pesticide exposure, including carbamates, pyrethroids, and organophosphates (Baltazar *et al*., 2014). Occupational exposure to pesticides may also result in changes in the level of several neurotransmitters, cause oxidative stress, and finally lead to neurological and behavioral disorders (Kori *et al*., 2018; Monnet-Tschudi *et al*., 2007). The use of these types of pesticides was common among our study participants, and in addition, we observed that most of our study participants use a combination of pesticides in a single application. Under these conditions, complex dose-response interactions are likely to occur as a result of the multiple modes of action involved and the fact that the individual chemicals can interfere with each other (Leemans *et al*., 2019), raising concerns about much more severe effects.

Aging is also linked to nervous system changes, which lead to alterations in various neurological examination findings (Schott, 2017). As expected, most of the applicators with poor neurobehavioral performance in this study were in the older group. This condition is compounded with pesticide exposure that may cause nerve cell alteration and deteriorating neurobehavioral functions. Regarding the nutritional status, there is an opinion that lipid storage may play a significant role in the elimination of OP pesticides. Since higher pesticide concentrations are present in adipose or fat tissues, pesticides that temporarily bind to adipose tissue will gradually be released and undergo biotransformation so that the effects can last longer (Eaton *et al*., 2008), and leads to speculation that individuals with obesity are more susceptible to experiencing the long-term effects of exposure to pesticides. About 38% of our participants were categorized as obese according to their body mass index. However, in our study body mass index was not associated with neurobehavioral performance. Thus, we assume that this result may be due to differences like the types of pesticides and complex mixtures used by our study participants.

More than 80% of our participants are active smokers, however, there is no association found between smoking habits and neurobehavioral performance in our study. A previous study stated that tobacco smoking was considered to alter the physiological transformation and metabolism of xenobiotics, including OP pesticides, although the precise mechanism remains unclear (Lee *et al*., 2010). The nicotine substances in tobacco may also significantly affect brain function and further cause nerve disorders by affecting catecholamine secretion (Kang *et al*., 2015).

We realized that our study had some limitations. The exact amount of pesticides

or the composition of the mixture used is not measured quantitatively. Another limitation is that biological monitoring of exposure was not performed in this study and information regarding agricultural activities was self-reported. This limitation can lead to the misclassification of exposure estimates. Despite the limitations, our findings provide additional evidence of the impact of pesticides on neurobehavioral performance. Therefore, it can be used as a basis for promoting health impact prevention and the implementation of pesticide exposure control.

Conclusion

The pieces of evidence presented here suggest that the neurobehavioral performance of pesticide applicators was associated with pesticide exposure. As pesticide use among farmers seems unavoidable, the results of our study support the notion of the importance of multisectoral collaboration to provide access to safer methods of pest control, an understanding of the potential health implications of pesticide exposure, and comprehensive instruction and support on appropriate pesticides handling practices.

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Breastfeeding Self-Efficacy and COVID-19 Pandemic Anxiety in Post-Partum Mothers

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Abstract

The COVID-19 pandemic has affected people worldwide, and this condition is also prone to postpartum maternal circumstances. This study investigates the impact of COVID-19 on maternal anxiety and breastfeeding confidence during postpartum. This study has a quantitative, cross-sectional design and includes 1018 mothers with children aged 0-24 months (July-September 2021). The instrument used in this study was Self-Efficacy Scale-Short Form (BSES-SF). The bivariate analysis found a significant association between anxiety in COVID-19 and changes in income (p-value 0.008), number of children (p-value 0.09), and age of children (p-value 0.029). According to the findings of multivariate logistic regression, maternal confidence in breastfeeding was associated with the number of children (OR=0.62; 95%CI=0.42-0.91) and early breastfeeding initiation shortly after delivery (OR=1.47; 95%CI=1.11-1.95). Anxiety about the COVID-19 pandemic was associated with the number of children (OR=0.58), changes in income (OR=1.98; 95%CI 1.34-2.95), type of delivery (OR=1.53; 95%CI 1.4-2.24), child age (OR=0.70; 95%CI = 0.49-0.99), and having been diagnosed with COVID-19 (OR=0.65; 95%CI = 0.44-0.97). Breastfeeding confidence is connected to the number of children and the history of Early Breastfeeding Initiation (EBI). The following interventions should include evidence-based practices and minimal birthing measures to reduce maternal anxiety and improve breastfeeding success.

Introduction

Globally, the whole world is experiencing a pandemic caused by the coronavirus (COVID-19). This case began with information from the World Health Organization (WHO) on December 31, 2019, which stated that there was a case of cluster pneumonia with unclear etiology in Wuhan City, Hubei Province, China (Kemenkes RI, 2020). In Indonesia, the first case of COVID-19 was reported on March 2, 2020, with 2 confirmed cases of COVID-19 (Setiawaty *et al.*, 2020). From increasing cases of transmission of COVID-19 in more than half of the world's countries, on March 11, 2020, WHO has declared COVID-19 a global pandemic (World Health Organization, 2020c).

The number of positive cases of COVID-19 in Indonesia with a total number of cases reached 14,749 people. Patients who recovered were 3,063 cases and those who died were 1,007 cases. Most of the positive COVID-19 patients in Indonesia are at productive age, including breastfeeding mothers. Approximately 54% are in the age group of 30 to 59 years (Kemenkes RI, 2020). Cases of COVID-19 in infants have been confirmed to have occurred in newborns, but all infants were infected by mothers who all also tested positive for COVID-19. The youngest babies were declared infected after 30 hours post-birth (Chen *et al.*, 2020). Data on COVID-19 in neonates is still very limited because transmission to neonates is rare. Neonatal cases with COVID-19 have no symptoms, very mild to moderate symptoms

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may be encountered (Procianoy *et al*., 2020). Children with cystic fibrosis or severe asthma increase in severity if they are exposed to COVID-19, so children with comorbidities are included in a vulnerable group that needs special monitoring(Sinha *et al*., 2020). This case also makes mothers more afraid to breastfeed their babies, especially breastfeeding mothers who are affected by COVID-19 and the lack of support makes it worse for mothers psychologically to start breastfeeding again and results in failure of exclusive breastfeeding.

Breastfeeding is the optimal method for feeding and caring for babies (American Dietetic Association, 2009). Thus, the World Health Organization and the American Academy of Pediatrics recommend exclusive breastfeeding for the first 6 months of a baby's life, with continued breastfeeding for at least 1 or 2 years (Lawrence M *et al*., 2005; World Health Organization, 2003). Despite these benefits and recommendations, not all mothers start and continue breastfeeding (Kasmita *et al*., 2023). Breastfeeding self-efficacy is a woman's belief in her ability to breastfeed (Noel-Weiss *et al*., 2006) and is a prominent variable in the initiation and duration of breastfeeding. The impact of COVID-19 has been recognized as the cause of Acute Respiratory Distress Syndrome (ARDS) and the mental health of the population is one of the greatest challenges facing humanity in the twenty-first century (Kamboj *et al*., 2020). Especially for mothers who are breastfeeding, it will have an impact related to the mental health of the mother, mothers who are breastfeeding will also experience anxiety, in dealing with COVID-19. Therefore this study will also explore anxiety in breastfeeding mothers using the COVID-19 anxiety scale (CAS) instrument (Silva *et al*., 2022)

Breastfeeding not only provides optimal nutrition for babies but also has short-term and long-term health benefits for babies and mothers (Richard *et al*., 2018). WHO and UNICEF recommend that mothers start breastfeeding their babies within the first hour after birth, breastfeed exclusively, for six months, and maintain breastfeeding for at least the first two years of life (World Health Organization, 2003). Despite these recommendations, recent studies have found that only 37% of infants under six months in low- and middle-income countries are exclusively breastfeeding (Victora *et al*., 2016), far below the WHO target of 90%. To overcome these problem situations it is necessary to identify breastfeeding behavior problems. International literature shows that breastfeeding self-efficacy (BSE) is one of the most important and modifiable factors that affect breastfeeding behavior in postpartum women (Lau *et al*., 2018; Victora *et al*., 2016).

BSE is a woman's belief in her ability to breastfeed (Noel-Weiss *et al*., 2006) and is a prominent variable in the initiation and duration of breastfeeding (Silva *et al*., 2022). The self-confidence possessed by individuals in something that has not been done and can increase motivation is called *self-efficacy*. *BSE* is a mother's self-confidence in terms of breastfeeding which can predict whether the mother will decide to breastfeed, how much effort is made to breastfeed, whether she has a constructive or destructive mindset, and how to respond to various problems and difficulties during breastfeeding. Research shows that *BSE* is an important factor related to the initiation, duration, and exclusivity of breastfeeding (Mcqueen *et al*., 2011). Within the aim of this study, the researchers wanted to see the level of confidence of breastfeeding mothers during the COVID-19 pandemic and other factors.

Methods

This study was conducted using a cross-sectional design to analyze factors related to breastfeeding self-efficacy and anxiety about the COVID-19 pandemic in post-partum mothers. The population and sample in this study were all breastfeeding mothers in Indonesia in 2021 who had babies aged 0-24 months and internet access to fill out surveys and were willing to be research respondents. The minimum number of samples obtained with a 5% margin of error is 382 respondents. During data collection, the number of samples obtained was 1018, with this number it can reduce the margin of error. Data collection was carried out in collaboration between researchers and non-profit organizations that focused on educating breastfeeding mothers, it is the Indonesian Breastfeeding Mothers Association (AIMI) which was carried out online via WhatsApp,

email, Facebook, and social media in July-September 2021.

The questionnaire consisted of sociodemographic characteristics, type of delivery, completeness of breastfeeding, history of being infected with COVID-19, mother's confidence in breastfeeding using the Self-Efficacy Scale-Short Form (BSES-SF) instrument, and anxiety assessment of the COVID-19 pandemic using the COVID-19 instrument anxiety scale (CAS). The Self-Efficacy Scale-Short Form (BSES-SF) instrument consists of 14 statements (Handayani *et al*., 2013). Both instruments have been tested for validity and reliability on 35 respondents to get rxy values of more than the r-table and Cronbach's α value of more than 0.7.

Statistical analysis consisted of descriptive analytics to explore the sociodemographic characteristics of the participants, type of delivery, completeness of breastfeeding, history of being infected with COVID-19, mother's confidence while breastfeeding, and mother's anxiety in dealing with the COVID-19 pandemic. Bivariate chi-square and independent T-tests were conducted to analyze the relationship between demographic characteristics, type of delivery, completeness of breastfeeding, and history of being infected with COVID-19 with the mother's confidence while breastfeeding, and the mother's anxiety in facing the COVID-19 pandemic. Logistic regression to identify factors that contribute to mothers' confidence when breastfeeding and mothers' anxiety in facing the COVID-19 pandemic. The study has been cleared by the Ethics Committee of the Respati Indonesia University Research and Community Service Institute, Number 196/SK.KEPK/UNR/VII/2021. All participants signed informed consent as their agreement to participate. The authors declare that there is no conflict of interest.

Result and Discussion

The respondents are all breastfeeding mothers in Indonesia in 2021 who had babies aged 0-24 months and internet access to fill out the survey and are willing to be research respondents. The survey was conducted in society, with the number of respondents 1018 participants completed the survey questionnaire. Data collection is through an indirect online questionnaire distributed from July to September 2021. Result demographic characteristics are shown in Table 1.

Table 1. Sociodemographic Descriptive Analysis and Mother Characteristics

Variable	Frequency (n)	Percentage (%)
Age of Respondent		
≤30 year	586	57.6
>30 year	428	42.0
Missing	4	0.4
Educational Background		
Elementary School	2	0.2
Junior High School	16	1.6
Senior High School	159	15.6
University/Collage	841	82.6
Resident Island		
Java	785	77.1
Bali	28	2.8
Sumatera	86	8.4
Kalimantan	63	6.2
Sulawesi	41	4.0
Nusa tenggara & Eastern Indonesia	15	1.5
Residential Area		
Rural	221	21.7
Urban	797	78.3
Job Loss		
yes	175	17.2
No	843	82.8
Income Change		
No Income	25	2.5
Decreased Income	457	44.9
Same Income	480	47.2
Increased Revenue	56	5.5
Total	1018	100

Source: primary data, 2021

It was found that respondents aged ≤30 years were 57.8% and the rest were >30 years 42%. Higher education has the first rank of 82.6%, followed by respondents with high school education at 15.6%. for respondents' residences spread over 6 regions in Indonesia with the most respondents in Java at 77.1%. Respondents who live in urban areas are 78.3%

Table 2. Sociodemographic Relationship and Mother's Characteristics on Anxiety in Facing COVID-19

Variable	Worried about COVID-19 (CAS Instrument)				Total		p-value	OR (95% CI)
	yes		no					
	n	%	n	%	n	%		
Ages of Respondent								
≤30 year	490	83.6	96	16.4	586	100	0.842	-
>30 year	355	82.9	73	17.1	428	100		
Educational Background								
Elemenytary School (SD)	2	100	0	0.0	2	100	0.747	-
Junior Haihj School (SMP)	12	75.0	4	25.0	16	100		
Senior High School (SMA)	133	83.6	26	16.4	159	100		
University/Collage	702	83.5	139	16.3	841	100		
Resident Island								
Jawa	656	83.6	129	16.4	785	100	0.652	-
Bali	25	89.3	3	10.7	28	100		
Sumatera	67	77.9	19	22.1	86	100		
Kalimantan	53	84.1	10	15.9	63	100		
Sulawesi	36	87.8	5	12.2	41	100		
Nusa Tenggara & Indonesia Bag. Timur	12	80.0	3	20.0	15	100		
Residential Area								
Rural	180	81.4	41	18.6	221	100	0.436	-
Urban	669	83.9	128	16.1	797	100		
Job Loss								
Yes	148	84.6	27	15.4	175	100	0.729	-
No	701	83.2	142	16.8	843	100		
income change								
No Income	21	84.0	4	16.0	25	100	0.008	-
Decreased Income	401	87.7	56	12.3	457	100		
Same Income	383	79.8	97	20.2	480	100		
Increased Revenue	44	78.6	12	21.4	56	100		
Total	924	100	94	100	1018	100		

Source: primary data, 2021

and the remaining 21.7% are in rural areas. During the COVID-19 pandemic, 82.8% of the respondents did not lose their jobs and the rest 17.2% lost their jobs. for changes in income that occurred during the COVID-19 pandemic, respondents who said their income was the same and decreased were almost the same, 47.2%, and income decreased by 44.9% (Table 1).

Based on the results of the bivariate analysis in Table 2, it is known that only the variable income changes are related to anxiety in facing COVID-19 with a p-value of 0.008, and for the variables age, education, island of residence, region place of residence and employment status have no effect (table 2).

Based on the results of the analysis of the relationship between the type of delivery, completeness of breastfeeding, history of COVID-19, and anxiety in COVID-19, it is known that the number of children (p-value 0.09), and the age of the child (p-value 0.029)

have a significant relationship to anxiety in COVID-19. 19, and the rest are unrelated (Table 3).

Table 4 explains that there is a difference in the score (p-value <0.05) of Breastfeeding Self-Efficacy in the two age groups of participants, last education, number of children, performing EBI, and breastfeeding. The difference in the range of the highest mean score is in the breastfeeding variable. It is known that the group of mothers who breastfeed their babies has a higher mean score of 6.19 compared to the group of mothers who do not breastfeed their babies. The group of mothers aged >30 years had a higher mean score of 0.56 compared to the group of mothers aged ≤30 years. The group of mothers with a history of recent tertiary education had a higher mean score of 1.52 compared to the group of mothers with a history of high school, junior high, and elementary school education. The group of mothers who had more than two children got a higher mean score of 1.54 compared to the group of mothers who had ≤2 children. The group of mothers who did IMD shortly after giving birth had a higher mean score of 1.80 than the group of mothers who did not do IMD immediately after giving birth.

Logistic regression analysis showed that the mother's confidence in breastfeeding was related to the number of children (OR=0.62; 95%CI=0.42 to 0.91) and to initiate early

Table 3. Relationship between Type of Delivery, Completeness of Breastfeeding, History of COVID-19 and Anxiety in COVID-19

Variable	Worried About COVID-19 (CAS Instrument)				Total		p-value	OR (95% CI)
	yes		no					
	n	%	n	%	n	%		
Number of Children								
>2 child	125	77.6	36	22.4	161	100	**0.039**	**0.633**
≤2 child	724	84.6	132	15.4	161	100		(0.418 – 0.958)
Type of childbirth								
Caesarean section	399	85.8	66	14.2	465	100	0.166	
Assisted delivery (vacuum, etc.)	18	81.8	4	18.2	22	100		
vaginal delivery	432	81.4	99	18.6	531	100		
Performing Early Breastfeeding Initiation								
No	332	83.2	67	16.8	399	100	0.964	
yes	517	83.5	102	16.5	619	100		
Child Age								
≤6 month	257	79.6	66	20.4	323	100	**0.029**	0.673
>6 month	590	85.3	102	14.7	692	100		(0.478 – 0.948)
Give breast milk								
Yes	770	83.3	154	16.7	924	100	0.976	
No	79	84.0	15	16.0	94	100		
History COVID-19								
Yes	179	79.6	46	20.4	225	100	0.098	
No						100		
Total	924	100	94	100	1018	100		

Source: primary data, 2021

Table 4. Analysis of Sociodemographic Differences, Mother Characteristics, Type of Childbirth, Completeness of Breastfeeding and Ever Diagnosed with COVID-19 on the Mother's Confidence Score in Breastfeeding with the BSES (Breastfeeding Self Efficacy) Instrument

Variable	Mean	SD	SE	p-Value	N
Age of Respondent					
≤30 year	44.17	8.228	0.340	0.003	586
>30 year	45.73	8.093	0.391		428
Educational background					
Non-College Education	43.56	8.904	0.669	0.025	177
College Education	45.08	8.027	0.277		841
Residential area					
Rural	44.58	8.614	0.579	0.633	221
Urban	44.88	8.088	0.286		797
Number of children					
>2 child	46.11	9.188	0.724	0.029	161
≤2 child	44.57	7.989	0.273		856
Job Loss					
Yes	44.15	9.702	0.733	0.240	175
No	44.95	7.854	0.271		843
Performing Early Breastfeeding Initiation (EBI)					
No	43.72	8.516	0.426	0.001	399
Yes	45.52	7.920	0.318		619
Child Age					
≤6 month	44.34	8.971	0.499	0.216	323
>6 month	45.02	7.825	0.297		692
Breastfeeding					
No	39.20	11.339	1.170	<0.0001	924
yes	45.39	7.591	0.250		94
Diagnosed with COVID-19					
Yes	44.96	8.069	0.538	0.761	225
No	44.78	8.244	0.293		793
Worried about COVID-19 (CAS Instrument)					
Yes	44.73	8.057	0.277	0.467	849
No	45.24	8.906	0.685		169

Source: primary data, 2021

breastfeeding shortly after delivery (OR=1.47; 95%CI=1.11 to 1.95). Anxiety about the COVID-19 pandemic is related to the number of children (OR=0.58; 95%CI= 0.36 to 0.94), changes in income (OR=1.98; 95%CI 1.34 to 2.95), type of delivery (OR=1.53; 95% CI = 1.4 to 2.24), child's age (OR=0.70; 95% CI = 0.49 to 0.99), and previously diagnosed with COVID-19 (OR=0.65; 95% CI = 0.44 to 0.97). The analysis explained that the mother's confidence in breastfeeding and anxiety about the COVID-19 pandemic had no relationship between the mother's age, last education, island of residence, area of residence, job loss, and exclusive breastfeeding.

A woman's health during pregnancy

affects the health outcomes of their infants. The anxiety can come from a behavioral response to stress or a trigger such as the COVID-19 pandemic (Nicolás-López *et al*., 2022)particularly, for pregnant women and lactating mothers. The alarming infectious risk together with the lockdown period could affect the emotional state of mothers-to-be, as well as breastfeeding rates, mother-baby bonding, or neonatal weight gain. The aim of this study is to describe the impact of this world health emergency in mother-baby pairs right after the first wave of Sars-Cov-2 pandemic (from March to May 2020. Several factors can influence the occurrence of anxiety or psychological distress that have been identified (Lee *et al*., 2021; Lee *et al*., 2021) such as receiving inadequate support during childbirth or feeling unsafe in the hospital, discomfort during childbirth due to issues regarding isolation in patients infected with COVID-19 (Stepowicz *et al*., 2020)as well as to indicate the social and medical factors that could contribute to stress and anxiety. A total of 210 patients were enrolled in the study. Two well-established test-tools were applied: State-Trait Anxiety Inventory (STAI (Mollard & Wittmaack, 2021)885 women were consented and participated in the study; 22.5% of women reported hypertension, 33.8% reported anxiety, 18.6% reported depression, and 1.13% reported testing positive for COVID-19. Of this, 61% of women reported inadequate support for childbirth, and 20.5% reported that they did not feel safe giving birth in the hospital. Women who tested positive for COVID-19 were more likely to be of Asian race, have a cesarean delivery, not have a birth partner present, and discontinue breastfeeding before 6 weeks. Pandemic-related changes to maternity care practices may have impacted birthing women's perceptions of safety and support in the hospital environment and affected symptoms of stress. Health care policy and maternity care practices should promote feelings of safety and control and overall experience for women giving birth in the hospital during a pandemic (Mollard & Wittmaack, 2021). There was elevated prevalence of post-traumatic stress, anxiety and loneliness in pregnant and post-partum women in 64 countries during the COVID-19 pandemic. Feelings of insecurity regarding the safety of hospital services also make it difficult for mothers to early breastfeeding initiate (EBI) (Ceulemans *et al*., 2021). Mothers who are breastfeeding will have an impact related to the mental health of the mother, self-requirement that the mother has in terms of breastfeeding which can predict whether the mother will decide to breastfeed, how much effort is made to breastfeed, whether she has a constructive or destructive mindset and how responding to various problems and difficulties, during the COVID-19 pandemic, mothers who breastfeed experience double worries, mothers will also experience anxiety and anxiety in dealing with COVID-19. Therefore, this study explores the confidence of mothers in breastfeeding and the anxiety experienced by breastfeeding mothers during the COVID-19 pandemic.

Table 5. describes the variables that are predictors of a mother's confidence in breastfeeding. History of EBI is a determinant of the mother's confidence in breastfeeding (OR=1.47; 95% CI=1.11 to 1.95). Mothers who have high breastfeeding self-efficacy have longer and more exclusive breastfeeding durations 1-6 months after delivery and ethnicity affects breastfeeding self-efficacy. Furthermore (Mossman *et al*., 2008) conducted a study that found that mothers with higher prenatal breastfeeding behavior scores had significantly more initiation of breastfeeding. In addition, mothers with high prenatal breastfeeding behavior scores and high breastfeeding confidence scores tend to continue to breastfeed until 4 months after delivery. Social support and mothers' confidence in breastfeeding also become a determinant. Research that Otsuka, (Otsuka *et al*., 2008) showed less than 40% of mothers gave breast milk after 4 weeks postpartum, most mothers used formula milk, and 73% mentioned insufficient milk as the main reason for supplementation or stopping exclusive breastfeeding. Social support and self-confidence are significantly correlated with postpartum depression (Leahy-Warren *et al*., 2012). The number of children is the second predictor that determines a mother's confidence in breastfeeding (OR=0.62; 95% CI=0.42 to 0.91), it is known that mothers who have more than two children are protective and give mothers better confidence in breastfeeding

(Hamid & Zaidi, 2020). This explains that mothers with multiparas have more experience when breastfeeding than first-time mothers. This personal experience is very important in determining the mother's attitude, subjective norms, and the mother's confidence in subsequent breastfeeding behavior (Bartle & Harvey, 2017).

Mothers' confidence in breastfeeding has also been disrupted by the emergence of the COVID-19 pandemic. It is known that there are 5 predictors related to maternal anxiety in dealing with the COVID-19 pandemic. The main predictor of this variable is decreased family income during the COVID-19 pandemic (OR=1.98; 95%CI 1.34 to 2.95). This also determines the confidence of mothers in breastfeeding coupled with the anxiety that arises during the COVID-19 pandemic. It is known that 47.4% of respondents in this study experienced a decrease in income up to loss of income, and 17.2% of respondents lost their jobs. One study explained that a sad experience experienced for more than 6 months is considered a chronic psychological stressor which is associated with the appearance of early signs of illness which is associated with the impact of social isolation, loneliness, and financial pressures that have an impact on mental health during the COVID pandemic. -19 (McDermid *et al*., 2022). Based on research using the Mental Health Inventory, it was explained that during the COVID-19 pandemic, respondents often felt nervous, down, and depressed. Financial stress, which is a psychological concept, is characterized by saving and having consumer debt before the pandemic outbreak, which then increased financial pressure during the COVID-19 pandemic (Basyouni & El Keshky, 2021). Anxiety about finances during the COVID-19 pandemic does not only occur in developing countries but also developed countries (Bareket-Bojmel *et al*., 2021).

The next predictor that is also related to anxiety during the COVID-19 pandemic is mothers who experience caesarean sections during childbirth (OR=1.53; 95% CI= 1.4 to 2.24). This was explained in previous studies regarding the possibility of postpartum anxiety in patients with a history of CS delivery. This study shows that in certain time settings the mother's perspective changes, and found evidence of the emergence of depressive and anxiety symptoms that differ longitudinally. The researchers also explained the severity of the mood to the point of being depressed. The findings of this study also suggest risk prevention and further assessment of the outcomes of CS deliveries as well as services and greater attention to ongoing assessment of psychological well-being among mothers undergoing elective CS deliveries (Kuo *et al*., 2014). Another study also stated that prenatal anxiety, Postpartum Depression (PPD) symptoms that occurred in the early postoperative stages, and pain at 6 weeks postpartum were associated with the incidence of PPD in women undergoing SC (Lin *et al*., 2022).

The predictor of the number of children has a relationship with the anxiety of the mother during the COVID-19 pandemic. It is known that mothers who have more than two children protect against the occurrence of anxiety in mothers during a pandemic by 1.72 times compared to mothers who have less than two children (OR = 0.58; 95% CI = 0.36 to 0.94) this explains that multiparous mothers have more experience in managing stress management when taking care of their children (Bartle & Harvey, 2017; Hamid & Zaidi, 2020) especially when having to breastfeed in a pandemic situation, it is also explained that the variable number of children is a predictor of a mother's confidence in breastfeeding. This contrasts with the results of a randomized control trial study that had been conducted previously, that the number of children was not related to the mother's belief in child feeding patterns (Admasu *et al*., 2022).The next predictor was mothers who had babies ≤ 6 months to protect against anxiety during a pandemic COVID-19 is 1.43 times compared to mothers who have children > 6 months (OR=0.70; 95%CI = 0.49 to 0.99). This is possible because mothers who have babies less than 6 months still have intense and even exclusive breastfeeding activities where the breastfeeding process can reduce postpartum anxiety and depression (Sun *et al*., 2020).

The last predictor is information about having been infected with COVID-19. It is known

that mothers who were previously infected with COVID-19 protected against anxiety during the pandemic 1.67 times compared to mothers who had never been infected with COVID-19 (OR=0.65; 95% CI = 0.44 to 0.97). This is associated with the many symptoms that appear, such as fever, cough, fatigue, shortness of breath, headache, congestion or runny nose, nausea, and vomiting, to shortness of breath, in contrast to mothers who have experienced infection for the first time, if they are infected with COVID-19 returns, the symptoms that arise can become lighter because this creates anxiety about a symptom that has never been experienced before and then becomes severe (Larsen *et al*., 2021).

Conclusion

In conclusion, it is known that the number of children and the age of the children are related to the anxiety of the mother during the COVID-19 period. childbirth also increases the potential for anxiety for post-partum mothers during the COVID-19 period. The implications for suggestions and subsequent practical interventions are that it is very important to carry out EBI and minimally intervention deliveries to reduce maternal anxiety and increase breastfeeding success. Apart from that, protection on the determination of income and family livelihoods is a common factor that can affect this condition.

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History of Falls and The Use of Walking Aids on The Incidence of Depression in The Elderly in Indonesia

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Abstract

Depression is a prevalent concern, especially among the elderly who are at risk of falling and rely on walking aids. This study examines the relationship between falls, walking aid usage, and depression in the elderly using data from the Indonesian Family Life Survey 5 (IFLS-5). Conducted as a cross-sectional study, it included respondents aged ≥ 60 years. Among the 2909 respondents, the majority of respondents were aged below 75 years (13.4%), women (51.6%), and lower level of education (84.1%) with a prevalence of depression of 24,1%. The research revealed that age, education, and a history of falls were significantly associated with the occurrence of depression ($p<0.05$). Age above 75 years old (OR: 0,653; 95% CI: 0,495-0,862) and higher education level (OR: 0,626; 95% CI: 0,483-0,811) was found to be a protective factor, while a history of falls was found to be a predictive factor to depression in elderly (OR: 1,996; 95%CI: 1,393-2,332). However, the use of walking aids showed no correlation with depression. These findings suggest that while age and education act as protective factors, a history of falls serves as a predictive factor for depression in the elderly.

Introduction

Currently, Indonesia has entered the era of an aging population, marked by an increasing number of elderly individuals (Badan Pusat Statistik, 2023). The rising number of elderly poses a particular challenge, especially in the healthcare sector. With advancing age, there is an increased risk of various degenerative issues, non-communicable diseases, and mental health problems, including the risk of depression (Fiske *et al.*, 2009; Weyerer *et al.*, 2013). Studies estimate that 7.2% of the elderly worldwide experience severe depression, and 17.1% experience depression at some point in their lives (Fiske *et al.*, 2009). Factors influencing depression include declining physical function and a history of falls. Declining physical function leading to activity limitations can further exacerbate the decline in muscle tissue function, increasing the risk of falls among the elderly (Iaboni and Flint, 2013; Salari *et al.*, 2022; Satria *et al.*, 2022).

Depression and a history of falls have a significant two-way relationship. Excessive fear of falling is often associated with depression. Fear and anxiety are significant cognitive-affective responses to falling events. Given the close relationship between depression and

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anxiety in the elderly, excessive fear and anxiety of falling are closely related to depression (Iaboni and Flint, 2013; Salari *et al*., 2022; Satria *et al*., 2022). Besides balance training programs aimed at improving the balance of the elderly, the use of walking aids has become common among the elderly with motor function impairment or a history of falls (Widagdo *et al*., 2024). These efforts are expected to reduce excessive fear of falling among the elderly. Modok *et al.*'s research indicates that the percentage of elderly individuals using walking aids reaches 13.5%. However, walking aids for the elderly often cause excessive fear, leading to depression (Modok and Wati, 2019; Anggarani and Djoar, 2020; Thies *et al.*, 2020). However, these studies are still controversial (Horowitz *et al*., 2006; Kvæl *et al*., 2017; Putu Martha and Kurniawan Djoar, 2020).

Previously, research on depression in the elderly using data from the Indonesian Family Life Survey-5 (IFLS-5) has been conducted (Handajani *et al*., 2022; Madyaningrum *et al*., 2019). The Indonesian Family Life Survey-5 is a health survey collected longitudinally with a representative sample from 13 provinces in Indonesia. These data include the health status of the elderly (Strauss *et al*., 2016). However, to the best of the researchers' knowledge, research on the relationship between the history of falls and the use of walking aids with depression in the elderly using IFLS-5 data has never been conducted. This needs to be done considering previous studies indicating that a history of falls and the use of walking aids can lead to depression in the elderly (Salari *et al*., 2022; Thies *et al*., 2020). Therefore, this study focuses on analyzing the correlation between the history of falls and the use of walking aids with depression in the elderly in Indonesia. This research is expected to guide the elderly with a history of falls and the use of walking aids regarding the occurrence of depression.

Methods

This descriptive-analytic study with a cross-sectional approach utilized secondary data from the IFLS-5 (Indonesian Family Life Survey), a continuous community health survey in Indonesia conducted by RAND, Survey Meter, and the Center for Population and Policy Studies at Gadjah Mada University from September 2014 to March 2015 (Strauss *et al*., 2016). The inclusion criteria comprised elderly individuals aged ≥ 60 years who completed questionnaires regarding their history of falls, use of walking aids, and depression (using the Center for Epidemiologic Studies Depression Scale: CESD-10). This questionnaire has been validated as a screening tool for depression risk in the elderly, with a sensitivity of 90% and specificity of 95% (Baron *et al*., 2017; Fu *et al*., 2022). The exclusion criteria for this study included incomplete data.

Statistical analysis in this study employed chi-square and multiple logistic regression using SPSS 26. The significance level for statistical tests was set at $p<0.05$. The chi-square method was used to analyze the relationship between two categorical variables. Multiple logistic regression was employed to evaluate the relationship between one or more dependent variables and independent variables. All independent variables were analyzed without considering the significance of bivariate statistical analysis results because these independent variables were theoretically related to depression. This analysis also calculated odds ratios (OR) and 95% confidence intervals to determine the risk of a variable for depression. If the OR value is greater than one, the independent variable is considered a predictive factor for the dependent variable. However, if the OR value is less than one, the independent variable becomes a protective factor against the dependent variable (Sopiyudin, 2014).

Result And Discussion

This research indicates that the majority of elderly respondents are under 75 years old (86.6%), female (51.6%), and have less than 12 years of education (84.1%), with a depression prevalence of 24.1%. Chi-square tests show that age, education level, and history of falls are significantly associated with depression occurrence in the elderly ($p<0.05$) (Table 1). Multiple logistic regression analysis reveals that variables predictive of depression occurrence include a history of falls, where the elderly with a history of falls are at a 1.996 times higher risk of experiencing depression (OR: 1.996; 95%CI: 1.393-2.332). Meanwhile, protective factors

Table 1. Bivariate Analysis of Independent Variables on the Occurrence of Depression among Research Respondents

Variable	Occurrence of Depression		Total	p
	Yes (%)	No (%)		
Age				
<75 years	628 (21,6)	1890 (65,0)	2518	0,005
≥75 years	72 (2,5)	319 (11,0)	391	
Gender				
Female	380 (13,1)	1120 (38,5)	1501	0,086
Male	319 (11,0)	1089 (37,4)	1408	
Education Level				
< 12 years	617 (21,2)	1830 (62,9)	2446	0,001
≥ 12 years	83 (2,9)	379 (13,0)	463	
History of Falls				
Yes	128 (4,4)	225 (7,7)	353	0,000
No	572 (19,7)	1984 (68,2)	2556	
Use of Walking Aids				
Yes	34 (1,2)	99 (3,4)	133	0,679
No	666 (22,9)	2110 (72,5)	2776	
Total			2909	

Source: IFLS 2014 Data

include age (OR: 0.653; 95% CI: 0.495-0.862) and education level (OR: 0.626; 95% CI: 0.483-0.811), where elderly individuals over 75 years old and those with higher education levels are at a lower risk of experiencing depression (Table 2).

The prevalence of depression in this study is 24.1%. This figure is similar to the findings of a study by Madyaningrum *et al*., which also used data from IFLS-5, at 24.9% (Madyaningrum *et al*., 2019). Meanwhile, another study by Pramesona *et al.* indicates that the prevalence of depression in the elderly ranges from 11% to 46.5% (Idris and Hasri, 2023; Pramesona and Taneepanichskul, 2018). This difference may be due to differences in respondent characteristics, where the studies by Idris *et al.* and Pramesona *et al.* used elderly respondents in urban areas and nursing homes, while this study used elderly respondents living in both urban and rural communities. Elderly individuals living in nursing homes tend to have more limitations in their daily lives, which can be one of the factors contributing to depression (Nugraha and Aprillia, 2020).

Table 2. Multivariate Analysis of Various Factors with the Occurrence of Depression among Research Respondents

Characteristic	P	Depression		
		OR	95% Confidence Interval	
			Lower	Upper
Age	0,003	0,653	0,495	0,862
Gender	0,291	1,098	0,923	1,307
Education Level	0,000	0,626	0,483	0,811
History of Falls	0,000	1,996	1,572	2,533
Use of Walking Aids	0,670	1,093	0,725	1,650

OR=Odds ratio, p<0,05

Regarding age factors, it was found that respondents aged ≥75 years are much smaller compared to the <75 years elderly group in Indonesia. This is in line with Indonesia's population census data for 2022, which shows that the elderly population in Indonesia reaches 9.28%, with the majority in the 65-75 age group (Badan Pusat Statistik, 2023). In this study, the demographic factor of age is significantly associated with depression occurrence. This finding aligns with WHO reports, where the highest prevalence of depression is in the age range of 60-64 years and starts to decrease at ages 65-69, becoming lowest at age >80 years (WHO, n.d.). Based on the results of multivariate analysis, it was found that age over 75 years is a protective factor against depression occurrence in the elderly. This is consistent with a meta-analysis study by Maier *et al*., which states that older age is not a factor that independently increases the risk of depression, but rather age-related physical health decline and disability that lead to depression (Maier *et al*., 2021). However, some studies found conflicting results (Conde-Sala *et al*., 2019; Weyerer *et al*., 2013). This may be due to other factors influencing depression, such as genetic factors, cultural and value differences, and social activities (Madyaningrum *et al*., 2019; Maier *et al*., 2021). A study by Susanti *et al.* (2018) suggests that older individuals who live longer may possess better-coping mechanisms and an enhanced ability to adapt to physical and psychological stress. With effective coping mechanisms, depression can potentially be avoided. According to the concept of psychoneuroimmunology, the acceleration of the aging process is closely linked to cellular damage within the body. Elevated stress levels and insufficient coping mechanisms may lead to increased cortisol hormone levels, contributing to cellular damage. Consequently, the incidence of depression tends to rise among individuals under the age of 75, due to the aging process experienced within this demographic (Lee *et al*., 2019; Susanti *et al*., 2018).

In this study, the majority of respondents were female, which is consistent with data from BPS (Statistics Indonesia), indicating a female population of 15.4 million compared to 14.3 million males (Badan Pusat Statistik, 2022). However, gender was not found to be significantly associated with depression occurrence in the elderly in this study. These findings differ from those of Idris *et al*., who showed that females have a higher risk of experiencing depressive symptoms (Idris and Hasri, 2023). Conversely, another study by Ozer *et al.* involving 641 elderly individuals showed a higher risk of depression among males, but a higher severity level was found among females. Female respondents are more at risk of experiencing more severe depression due to assumed higher vulnerability compared to males (Ozer, 2021). The differences in findings may also be attributed to differences in respondent characteristics, where Idris *et al*. studied respondents living in densely populated areas and Ozer *et al.* studied respondents in tertiary clinics (Ozer, 2021).

The majority of respondents in this study had low levels of education, below 12 years. This is consistent with Indonesia's population census data from BPS, indicating that the majority of the elderly in Indonesia have low educational statuses (Badan Pusat Statistik, 2023). This study indicates that education level significantly influences depression occurrence in the elderly. This aligns with studies by Xu *et al.* and Idris *et al*., which reported that previously pursued education levels play a role in the onset and development of depression in the elderly. Respondents with higher education tend to have a lower risk of experiencing depression (Idris and Hasri, 2023; Xu *et al*., 2023). Mumulati *et al*. in their study involving elderly individuals in one of Indonesia's nursing homes also reported similar findings (Mumulati *et al*., 2020). Richardson *et al*. also reported that individuals with lower education levels tend to have relatively poor coping effects compared to individuals with higher education. The way individuals resolve various life problems is proven to be better in highly educated individuals compared to those with lower education. This study also shows that higher education (above 12 years) is a protective factor against depression in the elderly in this study (Richardson *et al*., 2020).

A history of falls in the elderly is a sign that they have experienced a decline in motor function in terms of balance and muscle

strength. Additionally, the coordination system is also likely to experience dysfunction due to aging processes. This is undoubtedly related to the disabilities experienced by elderly individuals. This study indicates that a history of falls is significantly associated with depression occurrence in the elderly. This aligns with research by Choi *et al*., which reported that elderly individuals with a history of frequent falls are prone to depression, often to a more severe degree than elderly individuals without a history of falls (Choi *et al*., 2019). Based on multivariate analysis in this study, a history of falls is a predictive factor, which is consistent with research by Basharkhah *et al*.. The study showed that a history of falls accompanied by depressive symptoms experienced by subjects tends to increase their fear of falling in the future and demoralization effects, leading to subjects becoming more passive in their daily lives (Basharkhah *et al*., 2020; Van Poelgeest *et al*., 2021).

This study indicates that the use of walking aids is not significantly associated with depression occurrence. The use of walking aids is concrete evidence of disabilities experienced by the elderly population with advancing age. These disabilities may be related to depression occurrence in the elderly. The findings of this study differ from those of Horowitz *et al*., who showed that the use of walking aids in elderly individuals with disabilities is significantly associated with depression occurrence (Horowitz *et al*., 2006). Similarly, another study by Kvael *et al.* found that motor dysfunction, such as balance disturbances requiring the use of walking aids, is significantly associated with the development of depressive symptoms (Kvæl *et al*., 2017). Mobility impairments requiring elderly individuals to use canes or other walking aids cause disruptions in daily activities or mobile social interactions. This undoubtedly leads to continuous emotional changes. The findings of this study are consistent with research by Anggraini *et al*., which showed that an unsupportive environment and difficulties in using walking aids can lead to excessive fear of falling, which can then lead to depression. However, the study also states that the appropriate use of walking aids can assist in the mobilization of the elderly, reducing fear and the risk of depression (Putu Martha and Kurniawan Djoar, 2020).

This study has strengths in utilizing representative data from 13 provinces in Indonesia. However, it also has limitations such as the use of secondary data. Additionally, there is a possibility that data collection was limited to respondents assessed to have relatively good health statuses.

Conclusion

The prevalence of depression among the majority of respondents aged under 75 years, female, and with low education levels is 24.1%. Age, education, and history of falls are significantly associated with depression occurrence, but not the use of walking aids. A history of falls is a predictive factor, while age over 75 years and higher education are protective factors against depression occurrence in the elderly in this study.

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Video-based Training for Health Cadres on Mental Health and Social Support for Pregnant Women

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Abstract

The lack of knowledge of cadres about mental health causes a lack of social support for pregnant women. This study aims to analyze the effectiveness of mental health education for maternal and child health cadres on the knowledge and social support of cadres. This study was conducted with a quasi-experimental pre-test and post-test design with a control group. Sampling was carried out by cluster random sampling in the city of Surakarta. The intervention group consisted of 45 cadres in the Gajahan health center area and the control group consisted of 47 cadres in the Pajang health center area. While educational interventions use short story video media equipped with infographics. Data on knowledge and social support were collected using a questionnaire that had been tested for validity. Data analysis used independent t-tests and paired t-tests because the data were normally distributed. To analyze the data, this research used free statistical software. The results of this study are there were differences in the scores of mental health knowledge and social support between the intervention group and the control group (p-value <0.001). The intervention effectiveness test was carried out on the difference between the two groups' pretest and post-test data. This study concluded that mental health education with video media for maternal and child health cadres is effective in increasing mental health knowledge and cadre social support for pregnant women.

Introduction

The Covid-19 pandemic, which has occurred for two years, has had a significant impact on the mental health of the entire community. Pregnant women are the most vulnerable group for mental health problems, especially anxiety and depression. The COVID-19 pandemic has also caused a reduction in social interaction which can lead to loneliness. Survey results obtained from Groarke's research, that restrictions imposed during Covid-19 in England caused a quarter of respondents to experience loneliness (Groarke et al., 2020). Pregnant and postpartum women are vulnerable to stress related to COVID-19. Women who have had previous mental health problems have higher mental health symptoms. Worry and grief over health issues during a pandemic increase the likelihood of symptoms of mental health disorders (Liu et al., 2021).

Multinational studies have also found high levels of depressive symptoms and general anxiety in pregnant and lactating women during the COVID-19 outbreak. These findings emphasize the importance of monitoring perinatal mental health during pandemics and other social crises to maintain the mental health of mothers and babies (Ceulemans *et al.*, 2021). The results of the meta-analysis also provide evidence that there is a significant

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increase in anxiety scores in pregnant women and the perinatal period during the COVID-19 pandemic compared to before the pandemic (Hessami *et al*., 2020).

The impact of Covid-19, apart from limiting social interactions, can also disrupt the mental health of pregnant women. In Asyanti's research, 9.23% of respondents described the characteristics of a person's mental health as being disturbed, as shown by never smiling and always having dreams all the time. (Asyanti & Karyani, 2018).

Mental health disorders have an impact on declining physical health conditions. Limited access to health services and lack of social support from various parties, as well as concerns about the health of themselves and their babies, if infected with COVID-19 are factors that underlie pregnant women to experience mental health problems (Santi *et al*., 2021). The proportion of anxiety disorders in the global population in 2015 is estimated to be 3.6%. Depression globally in women (4.6%) is higher than in men (2.6%) (Laksono & Wulandari, 2022). Worldwide data about 10% of pregnant women and 13% of women who have just given birth experience mental disorders, especially depression. Data in developing countries is higher, namely 15.6% during pregnancy and 19.8% after the birth of a child (Laksono & Wulandari, 2022).

The prevalence of mental-emotional disorders in Indonesia in 2010, such as anxiety and depression, was 11.6% of the general adult population. In 2013, it became 6% (McGowan *et al*., 2023). Specific data on pregnancy depression in Indonesia are not available, but several studies have shown a prevalence of depression. However, it was found that the prevalence of adolescent pregnant women who were identified as experiencing postpartum depression ranged from 14% to 53% (Syamantha *et al*., 2023). Several studies have identified the causes of postpartum depression as low income, low educational background, primigravida, low birth weight, prematurity, and lack of social support (Andajani Sutjahjo *et al*., 2007). In previous studies, it was found that pregnant women with depressive symptoms in Surakarta City were 25.3% (Kusumawati *et al*., 2022).

One of the factors that is significantly related to pregnancy depression is low social support (Rashid & Mohd, 2017). Research in Turkey showed the absence of family support related to the severity of depressive symptoms during pregnancy (Aktas *et al*., 2015). Systematic review studies and past meta-analyses concluded that pregnant women are more likely to report antenatal depression, have a history of economic hardship, poor marital relations, common mental disorders, poor obstetric history, exposure to violence, and poor social support (Dadi *et al*., 2020).

Social support was a significant predictor of depression and anxiety from mid-pregnancy. Social support is also a protective factor against parenting stress (Milgrom *et al*., 2019). Social support can be in the form of emotional or practical support which may be objective which is what is received or subjective, that is what is considered to have been received from spouses, family members, friends, co-workers, neighbors, and others. Social support is encouragement that is felt and received from family members of the husband/spouse and friends. Previous studies have shown that social support protects all women against postpartum depression (Muzik *et al*., 2017).

Educational interventions based on social support and self-efficacy are effective in increasing maternal care behavior (Izadirad *et al*., 2017). During pregnancy, women experience physical changes, followed by psychological changes which result in unstable emotional conditions. These changes increase susceptibility to anxiety and depression (Biaggi *et al*., 2016). Unstable emotional changes have an impact on fetal development, premature birth, low birth weight babies, and the baby's emotions after birth (Gelaye *et al*., 2016; Ibanez *et al*., 2015; Saeed *et al*., 2016). Pregnant women often do not realize that they have mental disorders, especially depression. Husbands and families sometimes also don't know the psychological condition of unstable pregnant women, so they don't give enough attention and support. Previous meta-analytic studies reported a significant association between low social support and the risk of developing mental health problems [i.e. depression, anxiety, and self-harm] during pregnancy (Bedaso *et al*.,

2021).

The results of previous studies at several public health centers in Surakarta City showed that pregnant women with symptoms of pregnancy depression were 39.3%, and those who had shown a pregnancy depression score of 13.3%. The level of knowledge of pregnant women about mental health and its disorders during pregnancy is in the moderate category of 70% and less category of 10%. Health cadres are one of the closest people to pregnant women in their environment. Cadres have an important role in providing health care and support to pregnant women. However, so far, cadres do not have much knowledge about mental health and the disorders that often occur in pregnant women. Cadres also do not know exactly the mental health problems of pregnant women, so they are sometimes unable to provide social support to pregnant women. This study aims to analyze the effectiveness of mental health education with video media on the knowledge and social support of cadres in pregnant women. The video in this research is a video developed from the results of previous research on mental health education for pregnant women (Kusumawati *et al*., 2023), where this video contains a broadcast of a short story about the importance of family support for pregnant women, played by several characters and there is information in the form of graphic info. The video used in this research has been tested for validity by media experts with valid results and has received a Letter of Creation from the Indonesian Ministry of Human Rights with creation number No. 000181298.

Methods

This research was conducted with a quasi-experimental design, namely the pretest-posttest control group design. The population of this study was maternal and child health (MCH) cadres who provided services at integrated service posts in Surakarta. The sample for this study was MCH cadres in the primary health center (PHC) area who were selected as the sample. The sampling technique used cluster sampling based on the PHC area. The sample for the intervention group was 47 cadres from the Gajahan Health Center and the control group was 45 cadres from the Pajang Health Center. Data collection used a validated questionnaire. Before participating in the study, participants signed their consent by filling out informed consent. The questionnaires were filled in directly by the cadres before the intervention [pretest] and after the intervention (posttest) one week after the intervention. Intervention, namely mental health training using video media and direct debriefing. The video used for this intervention study was developed from the results of previous research in the form of a broadcast video containing short stories and information in the form of infographics. The video has been tested for validity by media experts from Gadjah Mada University's communication science and ISI Bandung's film art experts on the criteria for graphic suitability to the theme, color clarity with messages, readability of message writing, language, video transition effects, story and music suitability, clarity of infographic audio accompaniment and messages. All experts were assessed separately with valid results and obtained a certificate of creation from the Ministry of Law and Human Rights of the Republic of Indonesia with creation number No. 000181298.

For the control group, the material was not given during the research process but was given after the research process ended. Data analysis using paired t-test and independent sample t-test, then analyzed using free statistical software. This study has passed the ethical review by the ethical committee of the Medical Faculty, Universitas Muhammadiyah Surakarta, and granted the ethical clearance letter of No. 4807/B.1/KEPK-FKUMS/III/2023. All the subjects have received informed consent and agree to participate in the study as shown by their signing in the informed consent forms.

Result and Discussion

The characteristics of maternal and child health cadres in the intervention and control groups are shown in Table 1. In Table 1, the average age of cadres in the intervention group was higher than the control group, this shows that the age of cadres in the Gajahan Health Center is more senior than the age of cadres in the Pajang health center group. In both age groups for cadres, the oldest is 75 years old. The

youngest age in the intervention group was 31 years and 34 years in the control group.

Based on the length of time as a cadre, the average period of service as a cadre in the intervention group was longer than that of the control group. This shows that the cadres in the intervention group had a longer working period than the control group. So, it can be concluded that MCH cadres in the two public health centers have had a lot of experience in running health programs in the community. Some of the cadres in the intervention and control groups graduated from high school, but the proportion in the intervention group (73.3%) was higher than that in the control group (55.3%). Based on the occupation of the cadres, most of the MCH cadres in both groups work as housewives. In the control group (88%) more than the intervention group (66.6%). Experience related to mental health training, most of the two groups of MCH cadres have never attended or have not received mental health training. Cadres who had received mental health training were more than one-third in the intervention group (38.8%) higher than the control group (12.8%).

Table 2 shows the results of the analysis of differences in the average knowledge scores before and after mental health education using video media. In the pretest scores between the intervention group and the control group, there was no difference in the average score of maternal and child health cadres' knowledge about mental health in both the intervention group and the control group (p-value 0.409). This shows that before the intervention was given, the initial conditions in both groups showed that the knowledge scores in both groups were homogeneous (comparable]. Likewise, in the social support pretest scores, between the video media intervention group and the control group, there was a difference in the mean social support scores of maternal and child health cadres (MCH). This shows the initial conditions of cadre social support for pregnant women in both homogeneous groups.

Table 1. Characteristics of Maternal and Child Health Cadres [MCH], in the Intervention and Control Groups

Variable	Group		p-value
	Intervention n=45 (%)	Control n=47 (%)	
Age of cadres (years)			
Mean ± SD	56.56 ± 10.32	58.00±10.48	0.68
Minimal	34	31	
Maximal	75	75	
Length of time as a cadre (years)			
Mean ± SD	19.64 ± 10.32	9,85±6.45	0.0001
Minimal	1	1	
Maximal	73	30	
Education			
Graduated from elementary school	0 (0.0)	3 (6.4)	0.266
Graduated from middle school	6 (13.3)	9 (17.0)	
Graduated from high school	33 (73.3)	26 (55.3)	
College graduated	5 (11.1)	9 (19.1)	
No school	1 (2.2)	1 (2.1)	
Occupation			
Housewife	30 (66.6)	38 (80.8)	0.233
Entrepreneur	6 (13.3)	4 (8.5)	
Tailor	8 (17.7)	3 (6.9)	
Doesn't work	1 (2.2)	2 (4.3)	
Mental Health Training			
Never	28 (62.2)	41 (87.2)	0.183
Ever	17 (38.8)	6 (12.8)	

Data resources: Primary data

Table 2. Results of Analysis of Differences in Knowledge and Social Support for Mother and Child (MCH), Cadres in the Intervention and Control Groups in Surakarta City

Variable	Measurement Result		
	Intervention n=45	Control n=47	p-value*
Knowledge Score Pretest			
Mean ±SD	21.1 ± 3.07	20.62 ±2.9	0.409
Median	22	23	
Posttest			
Mean ±SD	22.3 ± 2.47	20.91±2.48	
Median	21	22	
p-value**	0.010	0.104	
Social Support Score Pretest			
Mean ±SD	46.89 ± 12.31	43.55 ± 11.9	0.191
Median	49.57	54	
Posttest			
Mean ±SD	55.87 ± 11.64	44.74 ± 10.3	
Median	57.00	44	
p-value**	0.003	0.000	

**Independent sample t-test*
***paired t-test*

Table 3. Results of Analysis of the Effect of Mental Health Training Interventions on Mother and Child Cadres (MCH], on Knowledge and Social Support in the Intervention and Control Groups in Surakarta City

Variable	Measurement result		
	Intervention n=45	Control n=47	p-value*
Difference (pre-post) Knowledge Score			
Mean ±SD	1.57±3.31	0.29±1.23	0.018
Median	2	0	
Min	-6	-3	
Max	13	3	
Difference (pre-post) Social Support score			
Mean ±SD	8.98±10.78	1.19±3.02	<0.000
Median	0	0	
Min	-8	0	
Max	35	14	

**Independent t-test*

In the educational intervention group with video media, the average knowledge score increased from before the intervention which was 21.1 ± 3.07, to 22.3 ± 2.47 after the intervention, and the results of the analysis showed that there was a significant difference (p-value 0.010). Whereas in the control group, the average score of knowledge did not increase from before the intervention to after the intervention and the results of the analysis showed no significant difference (p-value 0.409). Social support scores in both the intervention and control groups experienced an increase. However, the increase occurred higher in the intervention, namely 8.98 points, while the control group experienced an average increase of 1.19 points. The effect of mental health training interventions on MCH cadres using video media was analyzed based on changes in scores, which were determined by the difference between the pre-test and post-test in each group. Furthermore, the influence of the intervention was analyzed by the difference in score change between groups with the results showing that there was a difference in knowledge scores between the two groups (p-value 0.018], and there was a difference in social support scores between the intervention group and the control group (p-value <0.0001) (Table 3). Thus, it can be concluded that mental health training with video media for MCH cadres influences increasing knowledge and social support.

Educational interventions using video media affected the mental health knowledge of pregnant women among MCH cadres. Although both groups experienced an increase in knowledge scores, the increase was higher in the intervention group. An increase in scores in the control group also occurred, possibly due to participants getting information from another source, and trying to find information through social media after doing the pretest. The results of this study are in line with the research, that audiovisual media in the form of videos can increase the knowledge and behavior of external genital hygiene of pregnant women. Other researchers concluded that video media has proven to be more effective in increasing knowledge and attitudes toward preventing Covid 19 than leaflet media (Lee & Kim, 2021).

Video is an audiovisual medium that can help convey mental health material information through picture and sound messages (Taufik *et al*., 2021). The video used in this study is the development of the results of previous research, with material according to needs regarding the meaning, signs and symptoms, and the impact of pregnancy depressive disorder. The video provides illustrations of mental health problems that often occur in pregnant women with short stories and is equipped with clear infographics with a duration of about 13 minutes. Cadres participating in the training were able to receive and understand well the information conveyed, considering that the intervention group had an average age of cadres who had reached 56.56 years, which was included in the category of senior cadres.

The average length of service as a cadre has reached 19.64 years, which is a time that is quite mature and experienced in helping manage health programs. Cadres are the spearheads who assist midwives in implementing health programs in the community. With mental health training for MCH cadres, it is hoped that the cadres can help midwives accompany pregnant women, and provide support in both informational, instrumentation, emotional, and social support aspects. With good support from cadres, it is hoped that the mental health of pregnant women can be maintained, thereby reducing the risk of depression during pregnancy and postpartum. Following the findings of previous studies that the type of social support received by postpartum mothers can reduce the physical and psychological burden during the postpartum period (Desy Meldawati, 2021)

Most of the MCH cadres, both in the intervention group and the control group, had never received training on pregnant women's mental health. Most of the trainings attended by cadres included Community-Based Total Sanitation, Nutrition, preventing stunting, Eradicating Mosquito Nests, Family Medicinal Plants, Immunization, Exclusive Breastfeeding, Complementary Feeding, Early Breastfeeding Initiation, Introspective Surveys and Village Community Consultations. There are a small number of cadres who have received training on the Assistance Group for pregnant women

and are tasked to assist pregnant women in monitoring the development of the health of pregnant women, preventing anemia and other complications, and leading to healthy deliveries. Some of the cadres who have had mental health training are about assisting people with mental disorders in general, not specifically pregnant women. Assistance for people with mental disorders is clearer because the symptoms and signs are very clear. However, assistance to pregnant women who are likely to experience mental health problems, the symptoms are not very visible, if pregnant women do not convey their complaints and cadres are not very attentive.

This research was conducted to provide education and information to MCH cadres about the mental health of pregnant women and to increase mental health knowledge and social support for pregnant women cadres. Social relationships shown by social support play an important role in maintaining mental health and persons with disabilities (Tough *et al*., 2017), the same as for pregnant women who need special attention because they belong to a vulnerable mental health group. Previous studies have also proven that social support from husbands and families can reduce maternal depressive symptoms in postpartum mothers. This statement is in line with the research conducted by Tania *et al*, that affectional support, self-confidence, involvement of health experts, and the environment are fundamental for postpartum mothers' mental health (Tania *et al*., 2023).

Training for MCH cadres using video media has also been proven to increase social support for pregnant women by cadres. The provision of knowledge about mental health provided in the MCH cadre training can increase the role of cadres in carrying out their duties as companion groups for pregnant women. Because prenatal care groups, prenatal education, and peer support programs have the potential to increase social support (Hetherington *et al*., 2018). Social support must be given to pregnant women because social support can increase the confidence of pregnant women in undergoing pregnancy and childbirth. Social support has an important role in protecting the general population against depression (Wang *et al*., 2018), as well as pregnant women who need attention during pregnancy and childbirth (Milgrom *et al*., 2019).

Social support is a form of one's attention to the condition of other people which includes aspects of instrumental support, emotional support, informational support, and appreciation support. The support that was mostly given to pregnant women was instrumental support, both in the intervention and control groups where cadres never refused to take the time to take pregnant women for check-ups. However, most (79%) cadres also never provide emotional support to pregnant women to draw closer to God when facing problems in both groups, even though it is an easy thing to do. In terms of emotional support, cadres also sometimes help in solving problems faced by pregnant women. The most common emotional support from cadres is always asking about the mother's health condition and reassuring pregnant women when they feel anxious. Almost all cadres always give appreciation for the sacrifice of mothers during their pregnancy (Karuniawati *et al*., 2021)

The cadres also gave praise when pregnant women wanted to take the vitamins given by the midwife. The smallest thing that can be given to pregnant women is emotional support, namely paying attention by asking about health news and giving praise for the good things done. Social support provided by people around such as health workers and relatives can reduce the risk of antenatal depression. Social support factor is a predictor of antenatal depression (Sigalla *et al*., 2017). High levels of social support in early pregnancy are associated with a reduced risk of depression during pregnancy (Friedman *et al*., 2020).

Research at a Xián China hospital found that decreased social support during the COVID-19 pandemic in perinatal women was associated with poorer mental health. Virtual social support and support from friends during the COVID-19 pandemic had a positive effect on the mental health of perinatal mothers (Zhou *et al*., 2021). This shows that the importance of social support that can be provided by friends or the closest people in their environment, such as cadres, can prevent depression and

improve the mental well-being of pregnant and postpartum women. Mental health education and training for cadres can equip cadres to provide appropriate social support according to their abilities. Social support may be a powerful protector against antenatal depressive symptoms, but only that of a partner (Handayani *et al*., 2023). Strengthening support for pregnant women may be a successful strategy to reduce the incidence or severity of maternal mental health problems, to compensate for the lack of social support from partners (Umuziga *et al*., 2022).

The limitations of this study, only providing information on the mental health of pregnant women and the possibility of disturbances occurring, were conveyed to cadres via video media. This training has not yet provided detailed methods for detecting mental disorders, so it is considered very important and urgent to provide pregnancy mental health training to cadres so that the cadre's duties as a support group for pregnant women can be more complete in terms of monitoring mental health. Following the results of previous research, training on themes and technical preparation is needed to develop materials and curricula for detecting maternal mental health problems (Surjaningrum *et al*., 2022), so that cadres can detect mental disorders and provide good social support, to prevent depression in pregnancy and the postpartum.

Conclusion

Mental health education with video media for MCH cadres is effective in increasing mental health knowledge and cadre social support for pregnant women. Programs for assisting pregnant women by health cadres can provide social support to improve the mental health of pregnant women and prevent pregnancy and postpartum depression, especially for pregnant women who do not receive social support from their partners.

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Effect of Avocado Pulp Extract on HbA1c and Fasting Blood Glucose in Diabetes Mellitus Patients

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Abstract

Diabetes mellitus is a complicated necessitates ongoing medical attention and is a serious health problem that has grown to worrisome proportions. The study aimed to assess the avocado pulp extract's glycemic control in individuals with type 2 diabetes mellitus (T2DM) in a clinical setting in 2023. From the Klinik IMAN database, patients >18 years with T2DM who had previously been treated with oral hypoglycemic medications were included. The index date—the first day that avocado pulp extract was consumed—was used to collect baseline data. A laboratory measurements analysis was used to evaluate the change in glycated hemoglobin (HbA1c) and fasting blood glucose levels after a month of consuming avocado pulp extract and placebo. At one month, the percentage of patients who achieved their goal HbA1c and fasting blood glucose levels was determined. Overall, 30 patients were included and had baseline HbA1c and fasting blood glucose levels values available. Added avocado flesh extract not associated with improved HbA1c (0.04 [95% CI: -0.22-0.30], p>0.05) and fasting blood glucose levels values (0.85 [95% CI: - 24.7-26.4], p>0.05) versus baseline at a month. Added avocado flesh extract not associated with improved glycemic control during a month of follow-up in patients with T2DM.

Introduction

Diabetes mellitus is a complicated, chronic condition that necessitates ongoing medical attention as well as multifaceted risk-reduction techniques beyond glucose control. A class of metabolic diseases known as diabetes mellitus is typified by persistently high blood sugar levels brought on by deficiencies in insulin secretion, insulin action, or both. The prevention of acute complications and the mitigation of the risk of long-term problems depend on ongoing diabetes self-management education and assistance. There is substantial evidence in favor of a variety of therapies to improve diabetes outcomes. Diabetes mellitus is a serious health problem that has grown to worrisome proportions. Today, diabetes mellitus affects more than 500 million individuals globally (ElSayed et al., 2023; Lasari et al., 2021; Magliano., 2021). In Indonesia provinces have a higher prevalence of diabetes DKI Jakarta with 3.4 percent, followed by DI Yogyakarta (3.1 percent) and East Kalimantan (3.1 percent). (Oktora & Butar., 2022).

The number of persons with diabetes worldwide is predicted to reach 537 million in 2021, 643 million in 2030, and 783 million in 2045. Additionally, it is anticipated that 541 million individuals will have reduced glucose tolerance by 2021. Over 6.7 million persons between the ages of 20 and 79 are anticipated to pass away in 2021 as a result of diabetes-related diseases. Every year, more kids and teenagers (i.e., those under the age of 19) are diagnosed with diabetes. More than 1.2 million kids and teenagers will have type 1 diabetes in 2021. Diabetes-related direct medical costs have already reached about $1 trillion. IDF predicts

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that by 2045, there will be 152 million diabetics in the South-East Asia (SEA) region, a 68% increase from the current figure. The prevalence of diabetes will rise by 30% to 11.3% throughout the same time frame. At 51.2%, the percentage of undiagnosed diabetes is the third-highest among the IDF Regions. The highest rate of hyperglycemia-affected pregnancies (25.9%) among IDF Regions (Magliano., 2021).

After being identified as a biomarker of glycemic management in the late 1960s, glycated hemoglobin (HbA1c) has gradually increased over the past four decades. Glycated hemoglobin (HbA1c), frequently utilized in diabetes, determines the average plasma glucose concentration. Because hemoglobin and glucose in the blood combine to generate HbA1c, this explains why HbA1c is used to diagnose diabetes rather than just blood glucose levels. Historically, it was believed that HbA1c represented long-term average blood sugar levels. It is restricted to the typical red blood cell lifecycle over 120 days. Since RBCs do not lyse simultaneously, HbA1c is only used as a three-month measurement. Patients are at a higher risk of acquiring diabetes-related problems the higher their HbA1c levels are (Indranila., 2017).

Among the acknowledged risk factors for macro- and microvascular complications in type 2 diabetes are older age and higher glycated hemoglobin (HbA1c) levels (Kaneko *et al*., 2021). A1c has several benefits over FPG and OGTT, including being more convenient (fasting is not necessary), having greater preanalytical stability, and being less susceptible to fluctuations daily due to stress, dietary changes, or sickness (ElSayed *et al*., 2023). According to National Health and Nutrition Examination Survey (NHANES) statistics, only 30% of the diabetes patients identified using A1C, FPG, or 2-h PG are diagnosed using the A1C test, which has a diagnostic threshold of > 6.5% (48 mmol/mol). Despite these drawbacks, the International Expert Committee introduced A1c to the diagnostic standards in 2009 to boost screening (Karnchanasorn *et al*., 2016).

The avocado tree, a member of the Lauraceae family and the genus Perseal, is indigenous to Mexico and Central America (Talavera *et al*., 2023; Weschenfelder *et al*., 2015). Persea and Eriodaphne are the two subgenus that make up this genus. However, there are two major species in horticulture: Persea drymifolia cham, which includes Mexican race avocados and is currently thought to be a botanical variant of Persea Americana, and Persea americana Mill (Galindo *et al*., 2008). The avocado is a fruit with 114 calories per 70 grams, 4.6 grams of fiber, 345 mg of potassium, 19.5 mg of magnesium, 1.3 mg of vitamin E, and 57 mg of phytosterols. It has a caloric density of 1.7 kcal per gram and a half (Dreher & Davenport., 2013).

Methods

This study used retrospective database technology and secondary data from Klinik IMAN. The CDMP club (Chronic Disease Management Program) participants with T2DM and hypertension who routinely attend monthly counseling and health checks are included in the Klinik IMAN database as outpatient administrative data. People having a T2DM diagnosis but no type 1 diabetes diagnosis were deemed eligible for inclusion in the study if they were older than 18 years old. Study participants were excluded if they had blood sugar levels < 50 mg/dL and > 350 mg/dL at the pre-intervention examination. Study participants were divided into two groups. The first group consumed avocado pulp extract, while the second consumed placebo. There were no limitations on taking concurrent anti-diabetic drugs. This research has received ethical approval from the Health Research Ethics Committee Faculty of Medicine University of Muhammadiyah Sumatera Utara No 1011/KEPK/FKUMSU/2023.

The avocado fruit used in this study was butter avocado obtained from Medan, Sumatera Utara. The avocado pulp is separated from the peel and seeds, and then thinly sliced for easy drying. The sliced avocado pulp is weighed and then dried for 4-5 days in a drying cabinet at 40 ± 2^0C, and then grinded using a grinder to produce avocado flesh simplicia powder. The extract was prepared by maceration of dry powder using 70% Food-grade ethanol. As much as 500 grams of simplicia powder was macerated with 5 liters of ethanol 70% FG (1:10) put into a closed vessel. Soak for the first

6 hours with occasional stirring, then let stand for 18 hours at room temperature, protected from sunlight and filtered. The macerate results were evaporated using a rotary evaporator and a thick extract was obtained (Kementrian Kesehatan RI., 2017). Preparation of avocado flesh extract powder by weighing 300 grams of amylum maydis and 200 grams of avocado flesh extract, then mixing until homogeneous. Then the mixture is sieved to speed up drying. The powder or granules are dried in an oven at 60^0C. The dry powder is ready to be filled in capsules using a capsule filler. A creamy, avocado-scented powder. The 500 gram capsule contains a placebo containing 500 mg of amylum maydis. The normality test for differences in HbA1c and fasting blood glucose levels in the experimental group had a normal distribution, so the test used was the paired T-test. The normality test for the difference in HbA1c and fasting blood glucose levels in the control group had an abnormal distribution, so the test used was the Wilcoxon test.

Results and Discussion

Of the 30 patients with T2DM in the Klinik IMAN database were included in the study. 2 participants did not continue the study, so the total who took part was 28 participants, 14 participants for each group. Table 1 displays demographics and baseline characteristics. The mean age (standard deviation [SD]) was 64 (9.3) years, and the baseline T2DM duration was 10.3 (8.7) years on average. An overall history of hypertension was present in 64.3% of the population. Other comorbidities that were noted included a history of dyslipidemia (85.7%) and a body mass index of 25.3 (3.4) kg/m^2. Comorbidities were evenly distributed across the treatment groups, except hypertension and body mass index, which were more prevalent and high in patients who consumed Avocado Pulp Extract (Table 1).

Of the total population, all patients had a baseline HbA1c and fasting blood glucose measurement; the mean (SD) baseline HbA1c was 8 ± 1.6% while the mean (SD) baseline fasting blood glucose was 153 ± 58.4 mg/dl. From the results of this study, there was no decrease in HbA1c levels and fasting blood glucose levels in participants who consumed avocado pulp extract compared to a placebo for one month. From the results of the study, it was found that there was an increase in HbA1c levels in study participants who consumed avocado pulp extract compared to placebo (0.04 [95% CI: -0.22-0.30], p>0.05). It also happened in examining fasting blood glucose levels, where an increase in fasting blood glucose levels was found in study participants who consumed avocado pulp extract compared to placebo (0.85 [95% CI: - 24.7-26.4], p>0.05). Using outpatient administrative data from the Klinik IMAN database, this study provides the first proof of the effects of avocado pulp extract in T2DM patients. Based on the variations between baseline and 1-month data, the study showed that adding avocado pulp extract was not associated with decreases in HbA1c and fasting blood glucose levels in patients with

Table 1. Patient Demographics and Baseline Clinical Characteristics

	Avocado Pulp Extract (n=14)	Placebo (n=14)	Total population (n=28)
Age, mean ± SD (years)	64.6 ± 9.6	63.5 ± 9.3	64.0 ± 9.3
Female, n (%)	10 (71.4)	11 (78.6)	21 (75.0)
BMI, mean ± SD (kg/m^2)	26 ± 2.9	24.7 ± 3.9	25.3 ± 3.4
Duration of T2DM, mean ± SD (years)	8.6 ± 7.7	12 ± 9.5	10.3 ± 8.7
HbA1c pre-test, mean ± SD (%)	7.9 ± 1.9	8.1 ± 1.3	8.0 ± 1.6
HbA1c post-test, mean ± SD (%)	8.0 ± 1.7	8.2 ± 1.6	8.0 ± 1.7
Fasting blood glucose pre-test, mean ± SD (mg/dl)	143.3 ± 56.8	164.2 ± 60.3	153 ± 58.4
Fasting blood glucose post-test, mean ± SD (mg/dl)	144.1 ± 59.0	157.6 ± 69.5	150.8 ± 63.6
History of hypertension, n (%)	10 (71.4)	8 (57,1)	18 (64.3)
History of dyslipidemia, n (%)	12 (85.7)	12 (85.7)	24 (85.7)

BMI body mass index, *SD* standard deviation

T2DM who had previously been treated for blood glucose levels.

In the current study, the mean baseline HbA1c was 8 ± 1.6% and fasting blood glucose was 153 ± 58.4 mg/dl, reflecting the fact that many of the patients in this sample received initial treatment with inadequate glycemic control. Unfortunately, the addition of avocado flesh extract did not cause a decrease in either HbA1c levels or fasting blood glucose levels in the patients participating in this study. This result is not in line with a study where a decrease in blood glucose levels was found in male white rats induced by alloxan. The ethanol extract of avocado flesh at doses of 100 mg/kg body weight and 200 mg/kg body weight had a significant difference with a significance value of 0.024 and 0.026 and a dose of 50 mg/kg body weight had no significant difference with a significance value of 0.275. Both the treat-to-target study design and the fact that the population in the prior study was an animal population, which was anticipated to attain this aim more readily, are likely to be to blame for these disparities. The hemoglobin A1c (HbA1c; also known as glycosylated or glycated hemoglobin) level, which represents the average blood glucose control over about three months, is one approach to blood glucose measuring. HbA1c readings, like any laboratory tests, are subject to fluctuation, which can be exacerbated by factors including race and ethnicity (Sacks *et al*., 2011; Wolffenbuttel *et al*., 2013; Bergenstal *et al*., 2017).

Adults (average baseline age, 53 to 66 years) participating in five large, long-term randomized controlled trials were compared between intense (achieved HbA1c levels, 6.3% to 7.4%) and less intensive (achieved HbA1c levels, 7.3% to 8.4%) treatment target strategies. They discovered that tighter glycemic control mainly reduced the risk for microvascular surrogate events, such as retinopathy identified by ophthalmologic screening or nephropathy determined by the onset or progression of albuminuria, by tiny absolute amounts (Jenkins *et al*., 2015; Hayward *et al*., 2015). Studies have not consistently demonstrated a reduction in clinical microvascular events, such as vision loss or impairment, end-stage renal disease, or painful neuropathy, or a reduction in macrovascular events, such as death, with stringent glycemic management to HbA1c levels below 7%. In one study, overweight persons who took metformin experienced a decline in all-cause and diabetes-related deaths for at least ten years (Taylor *et al*., 2021; Chawla *et al*., 2016). Several things are the weaknesses of this study, which may play a big role in not achieving the objectives of this study. First, the study participants did not consume avocado pulp extract regularly. Even though an attempt was made to contact study participants regularly to remind them about consuming avocado pulp extract regularly, at the end of the study, study participants still found that they had remaining capsule extract.

Second, the short research time. By consuming avocado extract for a month, it may not be possible to achieve changes in HbA1c as expected. As a comparison, the study conducted by Kaneko et.al.; to find changes in HbA1c with the addition of insulin to the therapy that had been carried out previously by study participants was carried out for 12 months (Kaneko *et al*., 2021). Lastly, the small number of study participants will also play a role in the results that are not by previous expectations. For this reason, a follow-up study should add more participants with a longer observation time so that more meaningful results are found.

Conclusions

Glycated hemoglobin (HbA1c) represents long-term average blood sugar levels and is used to diagnose diabetes rather than just blood glucose levels. In this research, an effort was made to reduce HbA1C levels by using avocado extract consumable daily, easily and cheaply. But unfortunately, the research results did not get the results as expected. The research found no decrease in both HbA1c levels and fasting blood glucose levels in participants who consumed avocado pulp extract compared to placebo for a month. We recommend to conduct further research with more samples and a longer research time.

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Community Engagement in Urban Areas of South Tangerang Regency, Indonesia: A Study on COVID-19 Response

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Abstract

In Indonesia, particularly in South Tangerang, Banten Province, high COVID-19 cases are intensified by urban density. A comprehensive study was initiated by 106 students from UIN Syarif Hidayatullah Jakarta. Employing a cross-sectional design with purposive sampling, they surveyed 5,326 households across 13 Community Health Centers. The Chi-Square tested data uncovered that 79% consistently wore masks, 74% practiced hand hygiene, 59% followed social distancing, and 37% regularly disinfected. Intriguingly, there's a substantial correlation between protocol adherence and factors like knowledge, attitude, and proactive community leadership. These factors amplified adherence effectiveness between 2.0 to 3.5 times. The findings highlight the potential of the Community-Based Fighting Initiatives Against COVID-19 (PARC-19) approach, stressing grassroots engagement. Implementing PARC-19 successfully mandates fostering community autonomy in health management. Such autonomy flourishes when forged through a collaboration net comprising academia, government agencies, social organizations, influential community and religious leaders, and business stakeholders. This synergized effort paves the way for a holistic and efficient health management strategy during these pandemic times.

Introduction

COVID-19 is the most frightening disease since the 1918 Spanish flu pandemic, killing 260,000 Spaniards and 50 million people worldwide (Ferguson *et al*., 2020; Short *et al*., 2018; Trilla *et al*., 2008). The Pandemic, officially announced on March 11, 2020, has hit many countries world (World Health Organization, 2020). Until October 4, 2021, in Indonesia, the number of victims who died had reached 142,560, while the number of recorded cases was 422,587. The incident number reached 1,384, and the coverage vaccinated was 53,993,753 people (World Health Organization, 2023). The second wave of the pandemic in India has frightened the world; on April 22, 2021, India reported an additional 273,810 cases per day, with a death toll of around 1,761; the government's occurred with lack of health facilities and facilities for cremation, mainly carried out in the open field (Pandey, 2021).

The escalation of this situation begins with a public disregard for health protocols. Even though the government and non-governmental organizations have been working to prevent the Pandemic, these efforts failed to lower the curve, particularly in Indonesia. Many critics have shouted about Indonesia's postponement in response to this Pandemic (Lindsey and Mann, 2020). China's three-month experience controlling the virus has caught the attention of many experts worldwide. Some experts concluded the success was mainly due to Wuhan's complete lockdown and the state machinery's extreme power. The brilliant method to control the Pandemic is through a network of community-based organizations working with the state (Cheng *et al*., 2020).

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The Chinese government's ability to trust experts and voluntary groups quickly restored public confidence after the initial outbreak of COVID-19 in Wuhan (Li, 2020).

There is a significant effort in flattening the epidemiologic curve, especially in avoiding crowds through social distancing programs that impacted economic activity. The program, which aims to reduce the frequency and social distancing among the community, is implemented by closing public places such as schools, entertainment places, and workplaces, limiting working hours in markets and other places where people gather (Lestari and Dewi, 2022). This regulation is carried out by restricting community groups such as schools and child care centers with a size of 2-5m2 / child, offices with 18 m2 / person, and houses of 35-44m2 / person (Ebrahim *et al*., 2020).

However, the restriction was only successful by limiting working hours, so the "Transitional Social Distancing" was implemented from April 10 to July 30, 2020. The evidence showed that the incidence of COVID-19 had increased compared to strictly social distancing by implementing a local lockdown program at the settlement or village level (Saputra and Salma, 2020). The Transitional Social Distancing program was eventually implemented throughout Indonesia, which resulted in uncontrolled morbidity and mortality. At the beginning of 2021, the Indonesian government started a vaccination program for 181 million people; the nation needed 426 million vaccine doses. The government already has a vaccine stock of 325 million doses, which will soon be distributed to the public (Fitria Chusna, 2021). Even though this program is implemented, the government should also consider supporting this program with promotive and preventive actions at the grassroots level.

Method

In November 2020, we conducted a cross-sectional household survey with a purposive method in South Tangerang. One hundred six trained public health university students distributed simple random method for online and offline questionnaires to be completed by a household member in 13 Public Health Service (PHS) areas proportionally (5,326 households included in this study, with 350 to 420 sample households per Puskesmas). Cadres help students distribute the questionnaires to the households for offline questionnaires. Only one questionnaire per household was requested. The same surveys were identified and removed if the name, address, and phone number were identical. We built the questionnaire and used Green and Kreuter's (2005) theory, where we asked about the characteristics of respondents, predisposing, enabling, reinforcing, and Behaviour of the households about their behaviour in preventing Covid 19 in thirteen public health services (Puskesmas) areas (see Figure 1). We asked about 62 questions, and the average duration of filling out the questionnaire was 30 minutes.

Primary data was obtained from Google Forms and then analyzed with a statistical program. Before the questionnaire was applied, we examined the questionnaire outside of the district with 30 respondents to identify the validity and reliability and see if the respondents understood the question well. We also include data from observations in the field study. In this study, a systematic data analysis was undertaken utilizing univariate and bivariate methods, accompanied by the Chi-Square test, with a significance level set at $p < 0.05$ and a 95% confidence interval. These quantitative techniques provided a robust mechanism for deciphering patterns and relationships embedded within the dataset. To augment the robustness and comprehensiveness of our findings, we meticulously integrated qualitative insights derived from targeted field observations. This eclectic approach, harmonizing quantitative rigor with qualitative depth, offers a multifaceted perspective, engendering a richer, more nuanced understanding of the research problem.

Result and Discussion

The study offered an exhaustive examination of the respondents' adherence to prescribed health protocols. Upon meticulous analysis of the collated data, it was discernible that a significant proportion, albeit not monumental, of participants were compliant with the stipulated health guidelines: precisely,

Figure 1. Conceptual Framework, and the Question of Behavior in Implementing Health protocols in preventing COVID-19

79% were assiduous in donning masks, 74% were meticulous in observing hand hygiene, and a somewhat diminished 59% were diligent in upholding social distancing norms, as illustrated incisively in Figure 2. The scrutiny of adherence levels revealed tangible impediments to the efficacious enforcement of social distancing norms within the community. This situation is also observed in many other parts of the world (Gonzalez *et al.*, 2021; Sadjadi *et al.*, 2021). A salient exacerbator of this quandary emanated from the recurrent congregations associated with religious and cultural ceremonies. These assemblies intrinsically engender intimate social interactions, rendering the implementation of distancing protocols particularly intricate (Sisti *et al.*, 2023; Tan *et al.*, 2021).

Concurrently, 37% of respondents affirmed an unwavering adherence to systematic disinfection practices. This unveils a conspicuous lacuna in the populace's compliance with the stringent health directives promulgated by the government. Such a revelation accentuates the exigency for augmented public awareness initiatives, stringent enforcement mechanisms, and the inculcation of a pervasive culture of health consciousness and communal solidarity in combatting the pathogenic adversary (Hu *et al.*, 2020; Kaushik *et al.*, 2021).

The vital role of regular disinfection in mitigating COVID-19's impact cannot be overstated (Beggs and Avital, 2020; Wang *et al.*, 2020). Yet, a concerning gap exists in public adherence to this and other health protocols, despite ongoing governmental warnings. Local governments' strategies are pivotal in enhancing compliance, necessitating context-specific, adaptive, and responsive approaches (Ayouni *et al.*, 2021; S. Talabis *et al.*, 2021). The varied adherence patterns across communities point to the need for tailored interventions that consider sociocultural, economic, and demographic factors. In this intricate situation, reinforcing the healthcare system through collaboration among policymakers, public awareness campaigns, community engagement, and enforcement is pivotal for a comprehensive and effective response to the pandemic (Haldane *et al.*, 2021; Loewenson *et al.*, 2021). As an illustration, the decision by Chinese authorities to promptly impose a lockdown policy was found to be efficacious in managing the outbreak (Baloch *et al.*, 2020). In stark contrast, the Indonesian government's tactic centered on imposing broad-scale movement restrictions coupled with prioritized vaccinations in regions recording the peak incidences of the COVID-19 pandemic (Thorik, 2020).

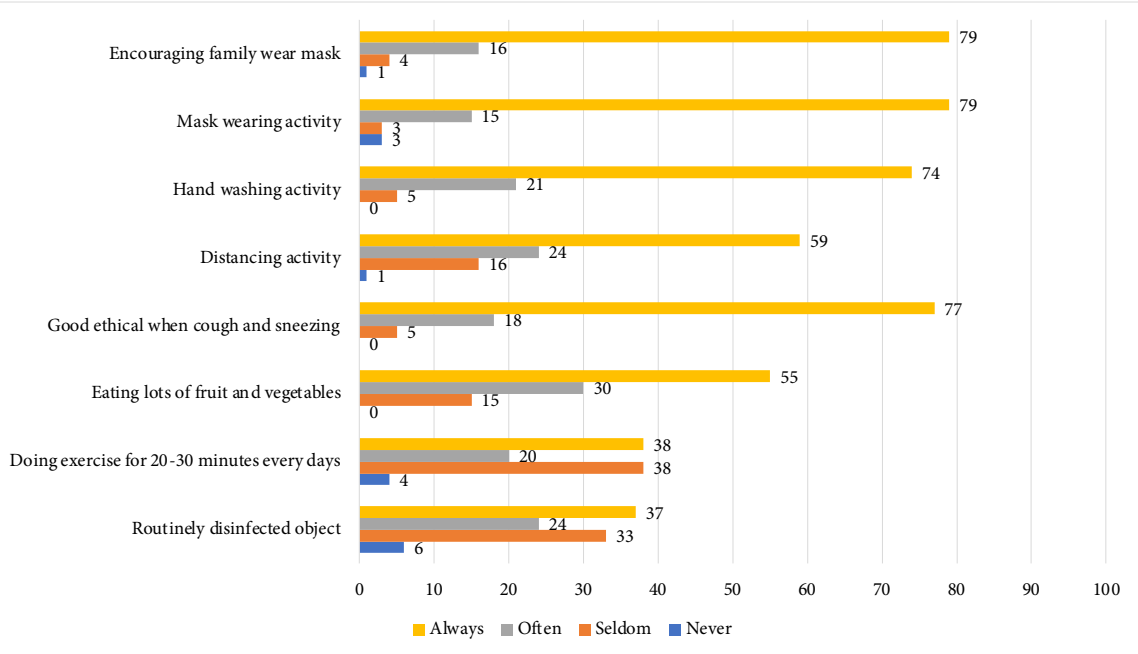

Figure 2. Percentage of Behavior Description of Health Protocols in South Tangerang (n = 5326 respondents)

One of the barriers to the weaknesses of Large-Scale Restrictions (PSBB) and their ineffectiveness is primarily attributed to the ongoing paradigm shift from treating the sick to improving overall health (Boyce *et al*., 2022; Seale *et al*., 2022). Given this ongoing paradigm shift, implementing preventive and promotive measures in the context of the pandemic has proven to be quite challenging. The active and engaged involvement of community guards (Linmas) and local village leaders (Lurah) within the COVID-19 Task Force has played a pivotal role in enhancing the management and coordination of local resources amidst a health crisis. Their participation is vital in not only streamlining the distribution and utilization of these resources but also in ensuring that critical information and directives are effectively communicated and implemented at the grassroots level. This collaborative approach is instrumental in fortifying the community's response to the pandemic, thereby significantly contributing to the overall efficiency and success of the health crisis management efforts (Haim *et al*., 2021). Public disappointment with the success of health promotion becomes evident when a significant portion of the population not only ignores health protocols but also fails to participate in vaccination programs (Feleszko *et al*., 2021; Islam *et al*., 2021).

The current study underscores the influence of knowledge, attitude, enabling, and reinforcing factors on community adherence to health protocols. Nevertheless, the potency of these elements in driving the effective implementation of health protocols is relatively modest, increasing the likelihood by merely 2.0-3.5 times, with a statistically significant p-value of less than 0.05 (as delineated in Table 1). It aligns with multiple research endeavors identifying correlations between these variables and behavioral shifts toward adopting healthier practices (Lee *et al*., 2021; Zhi-Hao Li *et al*., 2020).

Enhancing the effectiveness of behavioral modifications necessitates strategic interventions at the community level, specifically through active community engagement in managing COVID-19 (Miao *et al*., 2021). As exemplified by PARC-19 (Community-Based Fighting Initiatives COVID-19), community-based approaches have emerged as pivotal strategies, encompassing five primary functions in comprehensive and regional public health efforts. These functions, originally developed from the five-level prevention method by Leavell and Clark, include (1) health promotion, (2) specific protection, (3) early diagnosis and immediate treatment, (4) disability limitation, and (5) rehabilitation. In this context, these

Table 1. The relationship between Health Protocols Respondents and Knowledge, Attitude, and Reinforcing

Predisposing, Enabling & Reinforcing	Behavior Toward Health Protocols						P value	OR (95% CI)
	Not Good		Good		Total			
	n	%	n	%	n	%		
Respondent's knowledge about COVID-19								
Poor knowledge	1159	21,8	1233	23,1	2392	44,9		2,008
Good knowledge	936	17,6	1886	37,5	2934	55,1	0,01	(1,796-
Total	2095	39,4	3119	60,6	5326	100		2,245)
Respondent's attitude about COVID-19								
Poor attitudes	1448	27,2	944	17,1	2392	44,9		2,219
Good attitudes	1067	20,2	1867	35,1	2934	55,1	0,01	(1,988-
Total	2515	47,4	2811	52,8	5326	100		2,478)
Respondent's enabling about COVID-19								
Poor enabling	1412	26,5	980	18,4	2392	44,9		2,684
Good enabling	1155	21,7	1778	33,4	2934	55,1	0,01	(2,401-
Total	2567	48,2	2758	51,8	5326	100		3,000)
Respondent's reinforcing about COVID-19								
Poor reinforcing	1678	31,5	714	13,4	2392	44,9		2,917
Good reinforcing	1308	24,6	1625	30,5	2934	55,1	0,01	(2,603-
Total	2986	56,1	2339	43,9	5326	100		3,269)

Source: Primary Data, 2020

five functions are integrated into essential field interventions for COVID-19 mitigation, which entail (a) mobilizing volunteers for the identification and monitoring of COVID-19 patients and individuals closely associated with them, (b) collection of donations and essential supplies to help the patient or suspected COVID 19, and (c) providing critical community services to ensure that those in home-based confinement have access to life-sustaining resources (Siregar *et al*., 2022). Such community health initiatives are pivotal in enhancing resilience during prolonged pandemics (Cheng *et al*., 2020).

The emphasis on community-level health development by Community Health Centers (Puskesmas) necessitates strengthening through the involvement of the Pentahelix network, comprising Government, the Business World, Academics, Media, and Non-Governmental Organizations, in every public health intervention (Ardiansyah *et al*., 2023; Upe *et al*., 2021). This intervention should encompass the five levels of prevention or action, aligning with the Community Health Center framework, and adopting a systemic approach while emphasizing prevention strategies to address the challenges posed by the pandemic (Siregar *et al*., 2022). An important advantage of this comprehensive approach is its potential to expedite community development efforts upstream (Schulz *et al*., 2020). This achievement is realized through the enhancement of government institutions and related stakeholders' capacity to effectively respond to the pandemic situation (Djalante *et al*., 2020).

The interventions carried out during field observations were found to be incomplete due to a lack of coordination between community health centers, sub-districts, and community leaders. This issue became particularly significant when COVID-19 cases were identified in sub-district areas. The unpreparedness of government officials to establish effective communication and community assistance exacerbated the situation. Consequently, the dissemination of information about COVID-19 became biased, and in certain instances, residents even refused to permit COVID-19 patients to reside in their neighborhoods out of fear of contracting the virus. Additionally, there were instances of community groups refusing COVID-19 vaccination.

Therefore, strategic interventions to address the COVID-19 crisis should prioritize a community-level approach (Owoyemi *et al*., 2021), particularly within the jurisdiction of the lowest government units, such as the Puskesmas area. Collaborative efforts involving various stakeholders, including the Police, Babinsa, and volunteers, have been initiated to trace and manage COVID-19 cases. Despite the ongoing efforts, coordination challenges remain a significant hurdle, underscoring the complexities and nuances inherent in multi-agency collaboration. This situation calls for a more nuanced understanding and strategic approach to ensure effective communication and synergy among the various involved parties (Abdeen *et al*., 2021; Coccia and Robertson, 2009). Simultaneously, community-driven initiatives to assist COVID-19 patients in self-isolation at their residences have been commendable, characterized by generous donations that cater to the daily needs of those affected. However, these noble efforts appear to be geographically limited, with operations predominantly concentrated in specific pockets of the village (Isnainy *et al*., 2022; Putri and Rahmah, 2020; Suwandi *et al*., 2022).

Conclusion

Our research findings reveal a clear relationship between knowledge, attitudes, supporting factors, reinforcing elements, and community compliance with established health protocols. However, despite this correlation, it is evident that the influence of these factors in realizing the implementation of strict health protocols is moderately effective, resulting in an increase in compliance rates by only 2.0-3.5 times. These results highlight a concerning trend: people's commitment to health protocols falls short of expectations. Addressing this gap requires critical re-stratification and innovation in our approach. There is a need to prioritize localized strategies within the community environment, particularly within the purview of the Community Health Center. An integrated system involving PARC-19 and utilizing the Pentahelix network model,

which leverages synergies among Government, Business, Academia, Media, and Non-Governmental Organizations, along with a five-level prevention approach, is imperative. This collaborative effort presents a multifaceted and holistic strategy to tackle the challenges of the COVID-19 Pandemic. These community engagement or endeavor methods are designed to enhance community participation, cultivate an understanding of the significance of health protocols, and seamlessly integrate them into daily routines. The objective is to transition from a paradigm of illness to one of health, thereby equipping the community with the capacity to endure the prolonged pandemic, both in the present and future.

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Parent's Knowledge and Attitude as Key Determinants of Completeness Childhood Immunization in Central Java, Indonesia

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Abstract

Incomplete basic immunization in children aged 11-23 months has the potential to increase contracting dangerous diseases risk due to suboptimal immunity. Parents play an important role in ensuring the success of children's immunization. This study's purpose was to analyze the completeness of CBI based on parents' knowledge, attitude, perception, and satisfaction in immunizing their children. It's a quantitative analytic study with a cross-sectional approach. The population was all children with a sample of 685 children taken by purposive sampling technique from 31 districts in Central Java province. Data were collected through interviews and analyzed univariate with frequency distribution, bivariate with Chi-Square test, and multivariate with multiple logistic regression. A total of 38.7% of children were not fully immunized, especially in booster immunization (73.4%), IPV (25.7%), and MR (15.9%). Partially, it was proven that parent's knowledge, attitude, perception, and satisfaction were related to the completeness of basic immunization. Simultaneously knowledge and attitude together affect the completeness of basic immunization in children with an overall effect of 42%. Parents' knowledge and attitudes are key factors for the completeness of basic childhood immunization. Need to improve literacy and strengthen positive attitudes through structured IEC using a personal approach, as well as involving key figures in the community in their support for the immunization program. Utilizing communication technology and social media is an alternative that should be considered.

Introduction

Immunization has proven to be very effective in preventing the transmission of dangerous diseases and its measurable impact on reducing morbidity and mortality of children (Chan, 2014; Efendi *et al*., 2020; Kanchan *et al*., 2018). In addition to providing personal protection from the risk of contracting disease and death, immunization has also been shown to protect the community level or herd immunity However, optimal protection from immunization will only be obtained when children are fully immunized. This is related to the body's immune system and the power generated by each type of antigen given. Several studies have shown that children who are not fully immunized are at risk of poor health status and growth development, including the risk of malnutrition (Ma'alin *et al*., 2016). When routine childhood immunizations are not completed, children become individually and collectively vulnerable, putting them at higher

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risk of vaccine-preventable diseases (WHO, 2022).

Although immunization has been routinely implemented since 1980 in Indonesia and other Southeast Asian countries, cases of immunization-preventable diseases still occur frequently today. In 2019, Philippines reported an outbreak of polio serotypes 1 and 2, followed by Malaysia in 2020 (Snider *et al*., 2022), and spreading throughout Asia (Kemenkes RI, 2020). A total of 16 countries reported an incidence of polio type 2 in 2022 including Indonesia, although in 2014 Indonesia received a polio-free certificate from WHO (Harizon *et al*., 2020; Kemenkes RI, 2020). Measles cases in Malaysia increased significantly from 125 cases (2013) to 1467 cases (2018), including 4 cases of diphtheria and 19 cases of pertussis (Wong *et al*., 2020). The high number of cases of diseases that can be prevented by immunization proves that there are obstacles and problems in immunization program implementation so far.

Referring to the Minister of Health Regulation No. 12 of 2017 concerning the Implementation of Immunization, every child up to 24 months old was entitled to completing basic immunization, namely: HB-0 (1 time); BCG (1 time); Polio drops/OPV (4 times); Polio injection/IPV (1 time); DPT/HB/HiB (3 times); Measles Rubella/MR (1 time); and booster immunization, namely DPT/HB/HiB and MR. Every child gets Complete Basic Immunization (CBI) status when they have received all types of immunization according to the type, frequency, and volume. Based on data from Indonesian Health Profile 2020, there is a downward trend in CBI coverage from 90.6% (2018) to 93.7% (2019) and 83.3% (2020). The Health Basic Research data in 2018 even showed CBI coverage of only 57.9%. The immunization dropout rate with an indicator comparing DPT/HB/HiB-1 coverage with Measles-Rubella (MR) coverage also shows an increasing trend from 2.5% (2018) to 3.1% (2019) and 4.2% (2020). The national coverage of basic immunization in 2021 slightly increased to 84.2% but has not yet reached the strategic plan target of 93.6%. Provincial CBI coverage also varies in the range of 42.7% - 100% with Aceh province having the lowest coverage and the highest in South Sulawesi province. The dropout rate vaccine (DO) of 6.9% also still does not meet the target of <5%. Based on data National Socioeconomic Survey 2020, it is known that only 30.8% of children aged 12-23 months in Sumatra have complete immunization status, and 10.3% of children did not receive basic immunization at all (Setiawan & Wijayanto, 2022).

Low coverage of basic immunization contributes to the increasing number of cases of immunization-preventable diseases in Indonesia. Based on data from the Indonesian Health Profile in 2021, 11 cases of Tetanus Neonatorum (TN) were found with 9 deaths (CFR 82%). A total of 9 children out of 11 TN patients (82%) were not immunized. Although the number of suspected measles cases in 2021 decreased to 2931 cases (compared to 3434 cases in 2020), the distribution map of the area is widening. Only 3 of 34 provinces had suspected measles cases. A total of 259 diphtheria cases were found in 2020 and slightly decreased to 235 cases in 2021, but the case fatality rate (CFR) increased from 5.02% (13 deaths in 2020) to 11% (25 deaths in 2021). A high CFR rate indicates a greater risk of death for the patient. As the third most populous province in Indonesia, Central Java province has also experienced a decrease in CBI coverage. Through data from the Central Java Health Profile in 2021, it could be seen that there has been a downward trend in the last 3 (three) years, namely 98.5% (in 2019), 94.3% (in 2020) and 86.7% (in 2021). The risk of immunization-preventable disease outbreaks is also quite large and spread in various regions in Central Java province. In 2020, 113 cases of paralysis were found, and this increased to 196 cases in 2021. Diphtheria cases also increased to 11 cases (in 2021) although it had decreased to only 1 case (2020) from 9 cases (2019). Although the total number of measles cases has decreased from 1389 cases (2019) to 683 cases (2020) and 507 (2021), the area of distribution has increased in 22 districts/cities (62.9% of all districts/cities in Central Java province).

The main obstacle to immunization programs relates to low utilization which directly contributes to low coverage. Low immunization utilization is mainly due to access barriers related to limited resources and inadequate infrastructure (Bangura *et al*.,

2020), socioeconomic factor barriers (Herliana & Douiri, 2017) related to living conditions, maternal education, maternal employment status, place of delivery, and inequality in the distribution of health facilities (Setiawan & Wijayanto, 2022), and behavioral barriers related to negative perceptions, doubts, and rejection of vaccines (Smith *et al*., 2017). Parents' hesitation to immunize their children is mainly related to concerns about vaccine safety and side effects, poor personal experiences in the past, false beliefs and faith in vaccines, and distrust of the government, health system, and healthcare providers, especially in religious fanatics and ethnic minority communities (Mursinah *et al*., 2020). Access difficulties are mainly the reason for low socioeconomic groups to delay or cancel immunization. Low accessibility not only leads to low coverage but also creates large pockets of unimmunized vulnerable groups at risk of contracting or transmitting diseases (Mallory *et al*., 2018). Studies in India have shown that maternal education and wealth index are confounding factors that affect immunization completeness (Kanchan *et al*., 2018). In Asian countries, especially in Southeast Asia, social elements, culture, traditions, norms, and religion strongly influence health service-seeking behavior including immunization services (Arnault & Woo, 2018).

Parents play a very important role in fulfilling the coverage and completeness of basic immunization in their children. Parents' attitudes and beliefs towards vaccination are important to understand to shape vaccine acceptance and intervention demand (Balgovind & Mohammadnezhad, 2022; Wallace *et al*., 2019). Parental knowledge of immunization is related to the level of literacy and the ability to obtain and understand various health information that ultimately affects every health decision made (Aharon *et al*., 2017). Fear of side effects, concern about multiple injections of immunization, and parents' doubts about vaccine safety are often caused by misinformation and misunderstandings that parents receive about immunization (Crescitelli *et al*., 2020; Joshi *et al*., 2018; Syiroj *et al*., 2019). The satisfaction of immunization services received also influences mothers' decisions to immunize or not immunize their children (Debela *et al*., 2022). Dissatisfaction with the immunization received is related to reluctance, delay, and inaccuracy of immunization time on schedule (Beavis *et al*., 2022; Uwaibi & Omozuwa, 2021). Preliminary studies conducted by the author on several parents showed low literacy related to immunization programs, in addition to wrong attitudes and perceptions about immunization. The purpose of the study was to analyze the completeness of basic immunization of children aged <24 months based on parents' knowledge, attitudes, perceptions, and satisfaction with child immunization.

Method

This is a quantitative analytic study with a cross-sectional approach. Conducted in Central Java province and spread across 31 of the 35 districts/cities in Central Java province. The population was all children aged 11-23 months. Samples were determined using a purposive sampling technique based on the public health center (PHC) that had the lowest CBI coverage from each district. In each PHC, 1 (one) village with the lowest immunization coverage was taken. Each village sampled at least 20 children per village randomly, resulting in a total sample of 685 children. Respondents were parents or caregivers who lived with their children and gave informed consent.

The independent variables of the study include knowledge, attitude, perception, and satisfaction of parents towards immunization, while the dependent variable is the completeness of basic immunization in children. Basic immunization is declared complete when the child has received all types of mandatory immunizations that are part of the government program (including booster immunization), namely HB-0, BCG, oral Polio (OPV) 4x, DPT/HB/HiB (3x), injectable Polio (IPV), Measles Rubella (MR) and booster immunization (2x). Data collection using an interview method using a questionnaire that had been tested for validity and reliability. Observations were also made to collect data on the completeness of immunization status through the Maternal and Child Health Book that each child has had since birth. The research

enumerators were students participating in Universitas Diponegoro Thematic Work Practice on immunization who had been given adequate explanations regarding filling out questionnaires, observation sheets, and field data collection using accidental techniques. The data collected were analyzed univariately with frequency distribution, bivariate using the Chi-Square test because the data form is categorical, and multivariate analyzed using multiple logistic regression tests to see the influence of all variables simultaneously and identify the variable that has the most dominant influence on the completeness of basic immunization. This study has also met ethical standards through a certificate of Ethical Review Pass Number 361/EA/KEPK-FKM/2022 from the Health Research Ethics Commission, Faculty of Public Health, Universitas Diponegoro.

Result and Discussion

Table 1 shows that only 61.3% of children had complete status for basic immunization. The immunizations with the lowest utilization were booster immunizations, namely DPT/HB/HiB_4 (26.6%) and Measles-Rubella_2 (44.1%). Of all types of immunization antigens, IPV coverage was lowest (74.3%), followed by MR (84.1%) and OPV_4 (87.3%). All vaccine types had coverage below the national target (<95%), including BCG which only reached 94.5%.

Table 1. The Immunization Coverage based on Antigen Type

Antigen type	Not N (%)	Yes N (%)
HB-0	70 (10.2%)	615 (89.8%)
BCG	38 (5.5%)	647 (94.5%)
DPT/HB/HiB_3	80 (11.7%)	605 (88.3%)
Polio (OPV)_4	87 (12.7%)	598 (87.3%)
Polio (IPV)	176 (25.7%)	509 (74.3%)
Measles-Rubella	109 (15.9%)	576 (84.1%)
DPT/HB/HiB_4 (*booster*)	503 (73.4%)	182 (26.6%)
MR (*booster*)	383 (55.9%)	302 (44.1%)
CBI status	265 (38.7%)	420 (61.3%)

Table 2 shows the proportion of parents who have low knowledge about immunization is 54.2%, poor attitude (47.1%), poor perception (46.7%), and low satisfaction with immunization (40%). Results of univariate analysis showed that poor maternal knowledge was related to the understanding that booster immunization does not need to be given if the basic immunization status is complete (54.5%), they do not know about immunization program (42.8%), complete immunization if each child is immunized once for each type of antigen (42.6%), the cause of measles and tuberculosis (30.5%) and the obligation of every newborn to get HB-0 vaccine (24.7%). Poor maternal attitudes were mainly related to the understanding that immunization can be given late (51.8%), MR immunization is sufficient only once and does not need to be repeated (42.4%), and giving vitamins and herbs can prevent disease transmission (25.9%). A total of 35.8% of parents agreed that booster immunization does not need to be given (35.8%) and does not affect the health status of children (36.7%).

As many as 36.2% of parents participated in immunization because they only followed government recommendations. Parents' perceptions regarding post-immunization adverse events are still not good (57.5%) and perceptions related to multiple injections are also not good (47.7%). Parents' dissatisfaction was related to unclear information provided by health workers about the benefits, risks, and side effects of immunization (25%), the inconvenience of clinic facilities and services that did not meet the needs of children (37.8%), long waiting times for immunization (34.1%) and the ability of staff to calm children when crying during immunization (31.3%).

Table 2 also shows that among the group of parents who have fully immunized their children, the proportion of those with high knowledge is higher (68.8%) than those with low knowledge (55%), those with good attitudes is also higher (67.8%), those with good perceptions is also higher (65.2%) and those with high satisfaction is also higher (65%). Statistically proven there is a partial relationship between knowledge, attitude, perception, and satisfaction with the completeness of basic immunization with p-value<0.05. Based on the results of multivariate analysis (see Table 3) it is evident that knowledge and attitude together affect the completeness of immunization with

Table 2. Relationship Analysis Between Independent Variables and Completeness of Child Immunization

Variables	Completeness of Immunization		Total N (%)	Sig.
	Not Complete N (%)	Complete N (%)		
Knowledge				
Low	167 (45.0%)	204 (55.0%)	371 (100%)	0.000*
High	98 (31.2%)	216 (68.8%)	314 (100%)	
Attitude				
Poor	148 (46.0%)	174 (54.0%)	322 (100%)	0.000*
Good	117 (32.2%)	246 (67.8%)	363 (100%)	
Perception				
Poor	138 (43.1%)	182 (56.9%)	320 (100%)	0.031*
Good	127 (34.8%)	238 (65.2%)	365 (100%)	
Satisfaction				
Low	121 (44.2%)	153 (55.8%)	274 (100%)	0.020*
High	144 (35.0%)	267 (65.0%)	411 (100%)	

*Significant at p-value<0,05

an overall effect of 42% of the resulting R^2 value. Knowledge and attitude have a dominant influence with Exp(B) values of 1.596 and 1.580. The chance of an increase in the completeness of basic immunization is 1.596 times greater if parental knowledge is improved and 1.580 times greater if parental attitudes are improved.

The results showed that Hepatitis immunization coverage (HB-0) and Bacillus Calmette-Guerin (BCG) had the highest coverage among other antigen types. Programmatically, both vaccines are given when newborns are birth (for HB-0 vaccine) at health facilities and when they are one month old (BCG vaccine). Coverage of two types of booster immunization (DPT/HB/HiB-4 and MR-2) was the lowest among other immunization types, at 26.6% and 44.1%. These figures are still far from the national target of 95%. Repeated immunization (booster) is given to children aged 18 months, with a gap of about 9 months after the child received the first MR vaccine at the age of 9 months. It is suspected that the long waiting time for repeating vaccines causes parents to forget the immunization schedule, especially when they do not have a record of their child's immunization. Forgetfulness is also often the reason for delays in immunizing children. Studies in Malaysia show that in addition to the reasons for forgetting and no time, doubts about the halal-ness of vaccines are also a contributing factor to reluctance and refusal of immunization (N. A. Ahmad *et al*., 2017). The same condition also occurred in Indonesia (Syiroj *et al*., 2019). A study in Uganda showed that 44% of parents answered that they did not know, were not interested, felt lazy and reluctant as reasons for not fully immunizing their children and another 44% answered because they were afraid of side effects (Vonasek *et al*., 2016).

Immunization is complete when a child receives all types of vaccines with a predetermined frequency. Low immunization coverage is caused by internal and external factors. The data from Health Basic Research 2018 shows that basic immunization coverage is only 57.9%, incomplete immunization is 32.9% and no immunization is 9.2%. Reasons for not immunizing children include fear of

Table 3. Result of Multivariate Analysis

Variables	B	SE	Wald	df	Sig.	Exp(B)	95% CI for Exp(B)	
							Lower	Upper
Knowledge	0.467	0.167	7.850	1	0.005*	1.596	1.151	2.213
Attitude	0.458	0.165	7.702	1	0.006*	1.580	1.144	2.183
Constant	0.019	0.123	0.025	1	0.876	1.019	-	-

* Significant at p-value<0,05

side effects (28.8%), family refusal (26.3%), far immunization post (21.9%), busy parents (16.3%), sick child (6.8%) and not knowing the place of service (6.7%). This result shows that the largest proportion of children not immunized or immunized but incomplete is more due to family factors that tend to be afraid, do not trust vaccines, and, also do not want to be bothered. The low level of support from parents, families, and communities indicates that there are obstacles related to their perceptions and attitudes toward immunization. Immunization barriers include three interrelated themes: barriers related to beliefs, vaccine safety concerns, and issues of trust and misinformation received (Syiroj *et al*., 2019). On the other hand, poor staff attitudes, long waiting times, and unpleasant immunization service procedures are also factors that prevent parents from attending the follow-up immunization schedule, including uncomfortable clinic environment conditions (Balgovind & Mohammadnezhad, 2022; Oku *et al*., 2017). Lack of knowledge of vaccine indications and contraindications and lack of counseling skills, as well as the tendency of harsh or even hostile attitudes towards mothers, are also barriers that affect parents' knowledge, attitudes, and perceptions of immunization services (Bangura *et al*., 2020).

When children are not fully immunized, they are at risk of health problems and malnutrition. The emergence of cases of immunization-preventable diseases indicates obstacles in the implementation of immunization programs. Through mathematical analysis, studies in the USA have shown that unvaccinated children are 4-5 times worse off for measles, 2 times worse off for chickenpox, and 5-8 times worse off for rubella (Fefferman & Naumova, 2015). In addition to the risk of contracting dangerous diseases, there is also a risk of poor growth and nutritional status. A study in Ethiopia found that unimmunized children were 2.5 times more likely to be underweight, and the prevalence of stunting was 3.8 times greater in households with large family sizes (Ma'alin *et al*., 2016). Studies in Pakistan also prove that immunization completeness is significantly associated with malnutrition and underweight in children (D. Ahmad *et al*., 2020). A study in Indonesia showed that immunization completeness is a protective factor for not stunting in children under five (<5 years), in addition to LBW, the number of children <3 people and parenting. The prevalence of stunting in children with incomplete immunization was 41.1% higher than in children with complete immunization (32.5%) and the risk was 7 times (Simbolon *et al*., 2019). Studies in Timor Leste also show that the risk of stunting is associated with the completeness of immunization and the history of infectious diseases that children have (Pacheco *et al*., 2017).

Immunization completeness is often associated with delays in service utilization, which can be caused by access and affordability issues, children who are sick during the immunization schedule, and parents' ignorance of the immunization schedule. The absence of home visits, misinformation and misunderstanding, and dissatisfaction are the determining factors for incomplete immunization (Mebrat *et al*., 2021). A study in Temanggung, Central Java province proves that maternal knowledge and perceptions correlate with the completeness of basic immunization (Sriatmi *et al*., 2021). Knowledge, social influence, information, and trust in health workers are associated with vaccination compliance (Smith *et al*., 2017). Completing children's immunization status is done by complying with a predetermined service schedule because the schedule is made according to the age of children and the type of vaccine that must be received. Immunization schedule adherence is related to the timeliness, potent status, and immunity of vaccine given type. The immunization schedule has also been adjusted to the child's level of vulnerability. On the other hand, policy factors also contribute to parents' compliance with vaccinating their children. Studies in the USA show that increasing immunization adverse events that have occurred in recent years are consistently associated with parental refusal of recommended immunizations for children. Empirical studies show an association between the level of non-vaccination behavior and permissive vaccine exemption policies. Exemptions due to religion and belief, as well as vaccinations for school entry prerequisites,

are not constitutionally required. These results suggest that legal reforms and strict regulatory arrangements can encourage higher immunization rates (Weithorn & Reiss, 2018).

The results prove that low parental knowledge, less supportive attitudes, and negative perceptions about immunization are positively correlated with the completeness of basic immunization. These results are in line with a systematic review study that lack of knowledge, distance and access points, lack of partner support and negative attitudes, and distrust of vaccines and immunization programs are barriers to immunization practices (Bangura *et al*., 2020). Parents' knowledge, attitude, and behavior will determine immunization decisions, while decision-making about immunization is a very complex process (Balgovind & Mohammadnezhad, 2022). Better of knowledge, attitude, and perception of parents, the lower the risk of immunization refusal. Through multivariate tests, it is also proven that knowledge and attitudes affect the completeness of immunization. Understanding parents' knowledge and attitudes about immunization is key to a successful immunization program. Theoretically, it is understood that knowledge is the result of curiosity through the sensory process towards certain objects, as well as being an important domain for the formation of behavior. Attitude is a person's closed reaction or response to a stimulus or object that involves opinion and emotional factors. This response is formed based on the experience of cognition, reaction, affection, desire, and past behavior that wants to be raised. Attitudes can be positive (in favor) or negative (against).

Refusal of vaccines and immunization is often caused by erroneous knowledge, attitudes, and perceptions about immunization in the community. Refusal generally begins with doubts and distrust of vaccines, especially regarding the safety and effectiveness of vaccines in protecting children (Syiroj *et al*., 2019). Dube *et al.* explained that vaccine hesitancy or refusal is complex and varies for different types of vaccines, across time and context. The main determinants of a person's acceptance or rejection of immunization are related to perceived risk of disease, concerns about vaccine safety, perceived need, usefulness of the vaccine, experience with health services, emotions, mindset, sources of information, and different levels of social norms (Dubé *et al*., 2021). There is a strong association between vaccination and perceived susceptibility to disease, while a weak association exists between vaccination and perceived severity of disease.

Knowledge about vaccines, social influence, and trust in health workers also contribute to vaccination behavior (Smith *et al*., 2017). A total of 51.1% of respondents had a child card based on a study in Southern Nigeria. Of these, only 76.3% had complete immunization status. Maternal education is a significant factor associated with immunization timeliness (Nalley & Maduka, 2019). The low knowledge and socioeconomic resources are the main barriers to incomplete basic immunization for children in Indonesia too (Siramaneerat & Agushybana, 2021). These results are in line with a Kenyan study which showed that highly educated mothers were 54% more likely to be fully immunized than those with low education, and children born in health facilities were 41% more likely. Children in wealthy households were 43-57 times more likely to be fully immunized than those born into poor families. Also, children born in the order ≤ 6 had a 37% lower chance of being fully immunized (Allan *et al*., 2021). Barriers that arise from parents and communities include lack of knowledge about immunization, difficult distance to access points, financial difficulties, low partner support, and mistrust of vaccines and immunization programs. Meanwhile, barriers at the health system level are related to dimensions of health service providers (supply side), including limited human resources, inadequate infrastructure in maintaining the cold chain, and inadequate management of the vaccine supply (Bangura *et al*., 2020).

It must be recognized that internationally, the phenomenon of parental hesitance is increasing and presents a growing challenge to health professionals (Crescitelli *et al*., 2020). Differences in people's levels of trust in governments and countries also impact vaccination acceptance rates (Handy *et al*., 2017). Navin *et al.* explained that the reasons for vaccine refusal can vary according to

different motivations. Parents who refuse vaccines, because they do not care about immunization-preventable diseases, are more likely to immunize their children if they realize that immunization-preventable diseases are serious diseases with fragile herd immunity. Parents who refuse vaccines because they are not concerned about vaccine-preventable diseases may become more likely to vaccinate if they realize vaccine-preventable diseases are serious, herd immunity is fragile, and international travel makes everyone vulnerable and the interactions between people that occur make them even more vulnerable. Similarly, parents who refuse for vaccine safety reasons should be provided with evidence that the risk of vaccine complications is very low and the ingredients from which vaccines are made are very safe and natural (Navin *et al*., 2019).

Psychologically, the relationship between parents or families with vaccines and immunization gives rise to varied cognitive associations. The Howell *et al*. study proves that a person's cognitive associations correlate with intention, beliefs, and refusal of vaccines and immunization. Cognitive associations about vaccine identity, especially those related to understanding that vaccines protect or vaccines harm, can be a psychological building block that bridges parents' immunization beliefs and behaviors (Howell *et al*., 2022). The better the cognitive associations formed about vaccines and immunization, the higher the chance of utilizing immunization services. There is a relationship between maternal knowledge and perceptions of the completeness of child immunization (Mebrat *et al*., 2021; Navin *et al*., 2019; Sriatmi *et al*., 2021). Smith *et al*'s study proves a strong relationship between the perception that vaccines do not cause side effects, positive attitudes, and recommendations for perceived difficulties in using immunizations, including perceived vulnerability and severity of illness (Smith *et al*., 2017).

Building positive interactions and communication between health workers, parents, and communities regarding immunization is a strategic step in improving attitudes and perceptions while minimizing the rejection that occurs (Aharon *et al*., 2017). Health workers have been considered a trusted source of information about vaccines and immunizations (Balgovind & Mohammadnezhad, 2022). Effective communication with parents is essential for overcoming immunization barriers, overcome hesitancy and increasing immunization coverage (Oku *et al*., 2017). Hesitation and refusal of immunization are mainly caused by misinformation, negative experiences, and the strong influence of anti-vaccine groups through massive mass media (N. A. Ahmad *et al*., 2017; Crescitelli *et al*., 2020; Dubé *et al*., 2021). Increased misinformation through media and anti-vaccine advocacy is an important contributor to hesitance levels in the United States and other developed countries with strong immunization programs (Handy *et al*., 2017; Olson *et al*., 2020). The negative influence of the anti-vaccine movement is often cited as a cause of increased vaccine resistance in society (Dubé *et al*., 2021). Vaccine acceptance is a critical component of sustainable immunization programs, so increased vaccine hesitancy automatically affects their success. The 2017 measles outbreak in Italy is evidence of how vaccine hesitancy and refusal as a result of advances in global internet access has played an important role, as well as evidence of how the anti-vaccine movement has grown (Siani, 2019).

Good communication about vaccination is not only related to the message conveyed, but is also influenced by the environment and attitudes of the sender and receiver of the message themselves. Policymakers and health program managers need to understand these factors so they can implement communication approaches effectively (Oku *et al*., 2017), including health workers as the main source of information (Beavis *et al*., 2022; Debela *et al*., 2022; Sriatmi *et al*., 2021). In addition to staff attitudes, uncomfortable clinic environments and long waiting times are barriers to receiving information (Oku *et al*., 2017). Studies conducted in Botswana, the Dominican Republic, and Greece showed a high dependence on healthcare providers for information and communication about vaccines (Handy *et al*., 2017). Health workers are required to be able to provide information to parents or other caregivers and support them in deciding to

vaccinate their children (Oku *et al*., 2017). On the other hand, trust in the government and healthcare system affects vaccine acceptance differently in each country. This points to the need for countries to have specific data on vaccine acceptance by their populations, and to understand which drivers can be leveraged to improve immunization programs successfully (Handy *et al*., 2017). Effective communication is needed to increase coverage and reduce resistance to the use of existing or new vaccines (Oku *et al*., 2017). Positive communication and interaction also need to be built with key figures in society such as religious leaders, community leaders, and regional officials in supporting immunization programs to be the right choice of action (Syiroj *et al*., 2019). They are generally behavioral role models for their followers and surrounding communities.

Building and strengthening immunization literacy for the community also needs to be done. Vaccine literacy is defined not only as knowledge about vaccines but also the ability to use critical and evaluation skills to seek appropriate information, especially information available in media that tends to increase, especially on the internet and social media (Olson *et al*., 2020). Today the internet and social media are increasingly used to communicate, learn, also to make and reinforce decisions about vaccination. Many studies show that vaccine refusal or delay is more common among people who report the internet as their main source of information about vaccines (Dubé *et al*., 2021). Parents generally also find it difficult to know which sources of information are valid and reliable. They are also confused about where finding information that they think is balanced and impartial. Vaccine literacy is an important factor in reducing the negative effects of exposure to misleading information about vaccination (Olson *et al*., 2020), although it must sometimes be acknowledged that those with high health literacy are less likely to adhere to immunization, especially regarding the perceived reliability of information sources (Aharon *et al*., 2017). Vaccine controversies, mostly spread in traditional media (newspapers, magazines, radio, television) as well as social media, have a tremendous impact on immunization coverage. In the face of current vaccine hesitancy, the internet and social media play a key role (Dubé *et al*., 2021). Studies have shown that increased information about vaccines is associated with coverage, but how these various sources of information affect immunization programs needs further research (Smith *et al*., 2017).

Satisfaction with the information and explanations received about vaccine safety and the risk of adverse effects is also lacking (Beavis *et al*., 2022; Crescitelli *et al*., 2020) Some parents also expressed distrust of the information about vaccines and adverse effects provided by health workers, believing it to be subjective and manipulated. Explanations were also only provided on how to minimize and report vaccine side effects but did not promote and support "open" debate or discussion on vaccine safety (Crescitelli *et al*., 2020). While providers (including health workers) and medical literature are the main sources of information about vaccines, complaints about lack of communication and explanations remain (Handy *et al*., 2017). Parents want vaccine information that is tailored to them and their child's needs (Crescitelli *et al*., 2020). Therefore, all future interventions should ensure that the needs of the target group are well studied and understood, including understanding specific vaccine issues in the community, historical experiences, religious or political affiliations, socioeconomic status, demographic background, and trusted messengers. Vaccine messages, information, and stimuli must be able to evoke different values while appealing to society's values to change their behavior about vaccines and immunization (Olson *et al*., 2020). This can also motivate parents who were previously hesitant or refused vaccines to accept and vaccinate their children (Crescitelli *et al*., 2020).

Conclusion

Complete basic immunization coverage was only 61.3%. All coverage for each antigen type has not reached the minimum target of 95%. Coverage of both repeated immunization (booster) DPT/HB/HiB and MR is the lowest, followed by IPV immunization. Many parents have low knowledge, unfavorable attitudes and perceptions, and also dissatisfaction with

services received.

Parents' knowledge and attitudes are key factors for the completeness of basic childhood immunization. Increasing literacy and strengthening positive attitudes must continue to be pursued through structured IEC with a personal approach, as well as involving society leaders in supporting immunization programs. Improvement of immunization education materials needs to be done using of simple science language, the right choice of words, interesting topics as needed, and using visual aids according to the target audience. Utilization of communication technology and social media is one alternative that should be considered.

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Antecedents of Referring Healthcare-provider Engagement and its Impact on Willingness to Re-refer

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Abstract

Emerging nations' healthcare sectors grow with private hospitals. In this environment, private hospitals must balance quality care with business growth, such as patient growth. Referrals and healthcare providers are attracting more patients. Only a few studies described how healthcare provider engagement (HCPE) affects Willingness to re-refer (WRH) patients to a hospital. This study examined healthcare practitioners' HCPE toward WRH and its variables. A quantitative cross-sectional questionnaire study queried 181 healthcare providers who referred patients to RSKK in the last twelve months was conducted from August to September 2022. Partial least squares structural equation modeling (PLS-SEM) was used to evaluate the data. Out of six antecedents, five were significant (p-value<0.05), and HCPE had a significant connection with WRH (p-value<0.05). Finally, patient-specialist interaction is crucial to HCPE. The link between HCPE and WRH is significant. To promote HCPE, hospital administration must prioritize this. This study's HCPE antecedents are linked to WRH, and this model can be repeated in other hospitals.

Introduction

Rising populations in emerging countries are driving healthcare growth. Private hospitals are growing faster than public ones (Tang *et al*., 2013). It causes competition, like increasing patient numbers. It matters because more patients mean more income (Yi *et al*., 2019). The growing population requires various healthcare services. Healthcare consumers come from and go to different places (Kosasih *et al*., 2022). Patients in Indonesia who can afford healthcare can select between public and private facilities. However, to use insurance or national healthcare security insurance (Jaminan Kesehatan Nasional or JKN), customers must follow specific steps of referral system services (Pisani *et al*., 2017; Wartiningsih *et al*., 2022).

Healthcare uses referral systems in addition to payment. Referrals are made from lower levels of the healthcare system, such as primary healthcare, private practice, midwifery, or private clinics, to higher levels, such as hospitals, private or public, to manage or take over a patient's care (Hensher & Price, 2006; Seyed-Nezhad *et al*., 2021). The referral should be effective for any patient (Seyed-Nezhad *et al*., 2021; Wau & Razella, 2020). Referral systems benefit several parties, making them crucial. A strong referral network improves patient outcomes. Benefits include efficient healthcare facility resource use. Finally, the referral system indicates the health system's performance and how successfully governments control all subsystems and parties involved in the referral process (Harahap *et al*., 2019; Seyed-Nezhad *et al*., 2021). Thus, it must be studied and understood to make the referral system efficient.

Studying the referral system will help explain why patients are referred to higher-level hospitals. It will help doctors make better decisions, treat patients faster, and monitor their

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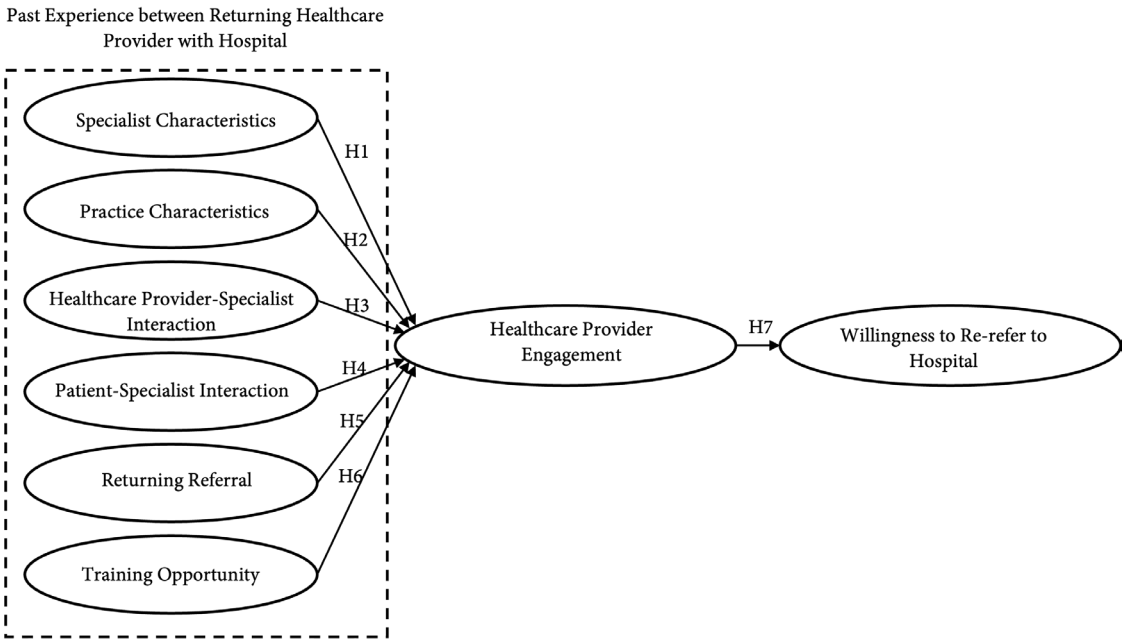

Figure 1. Conceptual Framework

H1: Specialist characteristics (SCH) are positively associated with Healthcare Provider Engagement (HCPE).
H2: Practice characteristics (PCH) are positively associated with HCPE.
H3: Healthcare provider–specialist interaction (HCP) is positively associated with HCPE.
H4: Patient–specialist interaction (PSI) is positively associated with HCPE.
H5: Returning referral (RRL) is positively associated with HCPE.
H6: Training opportunity (TOP) is positively associated with HCPE.
H7: HCPE is positively associated with Willingness to Re-refer to Hospital (WRH)

health, improving patient outcomes (Seyed-Nezhad *et al.*, 2021). Understanding the referral system reduces patient costs and healthcare facility resources. Referral system research can help healthcare practitioners comply with government standards and policies (Hort *et al.*, 2019). Referral system phenomena do occur, especially in private hospitals. Poor referral systems cause diagnosis and treatment delays. This causes patient dissatisfaction and poor care. They will skip primary care and move straight to secondary care (Hort *et al.*, 2019). An integrated referral system involves a complex link between referring healthcare practitioners and referral specialists. Engagement characterized their connection. Two-way social engagement, notably amongst physicians, considers organizational and cultural issues (Kaissi, 2014). Physician engagement is vital to reduce costs while improving effectiveness, patient safety, quality of treatment, physician satisfaction, and retention (Perreira *et al.*, 2018).

Previous research has shown that good communication and engagement are essential for referral system coordination. Successful long-term models of collaborative treatment between referring healthcare practitioners and referral specialists were needed (Forrest *et al.*, 2000). Usually, public hospitals employ referral systems for patients with national healthcare security insurance. In addition to improving patient care, healthcare providers should understand why they recommend patients to a hospital. Whether referring healthcare providers' hospital engagement matters for these reasons is intriguing. There is little research on why healthcare providers recommend individuals to specialists besides their health issues. This study suggests a new research model (Figure 1) based on prior studies on primary care physician specialist choice and factors affecting it (Barnett *et al.*, 2012; Forrest *et al.*, 2000; Kinchen *et al.*, 2004; MohammadAlGhamdi *et al.*, 2015). This study

examines the factors influencing healthcare providers' desire to re-refer patients based on hospital experience. Healthcare providers can also use the important antecedents of engagement to improve their engagement with hospitals that accept patient referrals, which can increase their desire to re-refer to hospitals. Patients will profit from better care, hospitals from higher revenue, and communities from better health systems. The elements of healthcare provider engagement become six independent variables as antecedents: specialist characteristics, practice characteristics, healthcare provider-specialist interaction, patient-specialist interaction, returning referral, and training opportunity.

Materials and Methods

This research uses a quantitative survey method with a cross-sectional study approach to collect the data. This study was conducted in a private hospital, RSKK, in Tangerang district, Banten Province, Indonesia. Data for this study was collected from all healthcare providers (midwives, general practitioners who work at clinics, or general practitioners who work at private practice) who usually refer their patients to RSKK within the last twelve months. After around two months of the survey (August to September 2022), there was a total of 181 responses gathered, which were eligible to be analyzed. The number of samples in this study was determined by power analysis using G-power with f2 0.15; the sample number required was 153 (Memon *et al*., 2020; Sarstedt *et al*., 2022). The sample size aligns with recommendations for partial least squares structural equation modeling (PLS-SEM). The minimum sample required was 160 (Kock & Hadaya, 2018). Therefore, 181 samples in this study are qualified, and the number of respondents met the minimum sample size requirement criteria based on a sample size guideline for analysis with PLS-SEM (Memon *et al*., 2020).

Data was gathered using a self-administered questionnaire. The constructions of the proposed conceptual framework are assessed using a set of indicators in a structured questionnaire to evaluate six independent variables (SCH, PCH, HCP, PSI, RRL, and TOP). These independent variables were used to investigate how the antecedent of HCPE (in the table will be stated as HCE) affected WRH as a dependent variable. The questionnaire used in this research was formed from previous studies and adjusted to fit the purpose of the study. The questionnaire used in this study was adopted from Kinchen (Kinchen *et al*., 2004) and Hollebeek (Hollebeek *et al*., 2014). All questionnaire questions were translated into the local language to confirm all questions were understandable. Before being distributed, the questionnaire was reviewed by professionals from the marketing field. There are six scales ranging from 1 (strongly disagree) to 6 (strongly agree) to answer each question in the questionnaire, which needed to be chosen by the respondents. The respondents who participated responded to all the interview questions voluntarily and anonymously, as all the responses were confidential. The main objectives of the research were explained to subjects to obtain their informed consent. All data collected from August to September 2022.

This study has eight constructs in the conceptual framework, which is later considered a complex research model. Therefore, the PLS-SEM method is preferable to be used to analyze the complex models in this research because the research model is explanatory(Hair *et al*., 2019; Henseler *et al*., 2015). The PLS-SEM analysis used SmartPLS version 3.2.9 (SmartPLS GmbH, Boenningstedt, Germany) to provide a bootstrapping menu to test significance (Memon *et al*., 2021). Two different models, namely measurement and structural models, are the foundation of the PLS-SEM primary procedure. The measuring model was developed to assess the consistency and validity between the model's components and its indicators. The reliability testing phase includes indicator reliability (outer loading) and build reliability (Cronbach's alpha and composite reliability). Construct validity (average variance extracted [AVE]) and discriminant validity are included in the validity testing process (heterotrait–monotrait [HT–MT] ratio) (Henseler *et al*., 2015). It can move on to the next stage if these four items are reliable and legitimate. The structural model determines whether there is a meaningful relationship between

each concept in the research model. This work uses importance-performance map analysis (IPMA), a more sophisticated PLS technique, for more precise management implications (Ringle & Sarstedt, 2016).

Results and Discussion

The demographic data are presented in Table 1. Most of the respondents were female, aged 25 to 44 years old, working as midwives, with most of them referred to the hospital less than a month ago and the frequency of referring more than six times. Outer loading from the reflective model was used to measure the reliability indicator. From the result, all 26 research indicators met the outer loading criteria, with all values more than 0.5. All constructs exceed the value of 0.7 for Cronbach's alpha and composite reliability with an upper threshold ranging from 0.7 to 0.95 as an internal consistency test (Hair *et al*., 2019). Convergent validity was measured using AVE, showing that every construct has AVE ≥ 0.50 as required (Hair *et al*., 2019), which means that all constructs could explain variance in the model for at least 50%. Reliability and validity test results are shown in Table 2.

The measurement model analysis's last stage is to evaluate the discriminant validity using the HT-MT ratio. This method was chosen because it has a value that is known to be more precise (Hair *et al*., 2019; Henseler *et al*., 2015). Regarding Hair *et al.* (Hair *et al*., 2019), which establishes that each construct indicator is conceptually distinct, it is advised that the threshold value for the HT-MT ratio be lower than 0.9. All HT-MT values in Table 2 are significantly below the 0.9 criteria, indicating that all indicators utilized in this study model have sufficient discrimination to measure the various components. This measurement model analysis consecutively passed the reliability and validity test's four criteria. Therefore, it can be said that every indicator in this research model is accurate and dependable for measuring each construct. In this investigation, the model fit indices were determined by standardized root mean square (SRMR), and the value achieved was 0.06, which was lower than the required value of 0.08 and indicated a good model fit (Sarstedt *et al*., 2022). Firstly, multicollinearity issues were investigated using the inner variance inflation factor (VIF) test. According to the results, which revealed that every construct had an inner VIF score below 5, as suggested (Hair *et al*., 2019), this model has no multicollinearity problem. From the result, the R^2 of WRH was 0.417, which was categorized as moderate estimation accuracy (Hair *et al*., 2019). Therefore, the model in this study is capable of estimating the WRH. HCPE has R^2 = 0.640, which indicates the strong accuracy. The HCPE had a large effect size on the WRH with the f^2 value 0.716.

Table 1. Respondents Characteristic

Demographic Variables	Category	Sample (n)	Percentage (%)
Gender	Male	24	13.2
	Female	159	86.8
Age	25–44 years old	126	69
	45–65 years old	57	31
Occupation	Midwife	121	66.2
	General Practitioner works at a clinic	24	13.1
	General Practitioner works at Private practice	38	20.7
Last time referring patient	< 1 month ago	81	44.2
	1–6 months ago	79	43
	6–12 months ago	23	12.8
Frequency of referring patients	1–2 times	35	19.1
	3–4 times	35	19.1
	>6 times	113	61.8

Table 2. Reliability and Validity Analysis

Variables		Indicators	Outer Loading	CA	CR	AVE HCP	Discriminant Validity (HT - MT Ratio)							
							HCE	PSI	PCH	RRL	TOP	HCE	WRH	
HCP	HCP1	I feel I have a good experience with my referring specialist	0.695	0.727	0.847	0.650	-	-	-	-	-	-	-	-
	HCP2	I feel my referring specialist returns the patients to me	0.818	-	-	-	-	-	-	-	-	-	-	-
	HCP3	I feel the referring specialist has a good attitude	0.894	-	-	-	-	-	-	-	-	-	-	-
HCE	HCE1	I consider Hospital XYZ based on the relationship that exists between the hospital and healthcare provider if want to refer patients	0.585	0.872	0.904	0.581	0.804	-	-	-	-	-	-	-
	HCE2	For me, Hospital XYZ has an effective referral system if you want to refer patients to a hospital	0.532	-	-	-	-	-	-	-	-	-	-	-
	HCE3	Generally, I want to get information about the patient I refer to Hospital XYZ	0.803	-	-	-	-	-	-	-	-	-	-	-
	HCE4	For long-term interest, I feel sure when referring patients to Hospital XYZ	0.779	-	-	-	-	-	-	-	-	-	-	-
	HCE5	I feel calm (not worried) when referring patients to Hospital XYZ	0.856	-	-	-	-	-	-	-	-	-	-	-
	HCE6	I usually feel comfortable when referring patients to Hospital XYZ	0.862	-	-	-	-	-	-	-	-	-	-	-
	HCE7	I can feel confident when referring patients to Hospital XYZ	0.846	-	-	-	-	-	-	-	-	-	-	-
PSI	PSI1	Usually, my patient says that she/he is treated well by a specialist	0.872	0.892	0.926	0.757	0.672	0.767						
	PSI2	Generally, patients already have desired specialists who practice in the hospital	0.907	-	-	-	-	-	-	-	-	-	-	-
	PSI3	Generally, hospital XYZ can be reached by patients easily	0.867	-	-	-	-	-	-	-	-	-	-	-
	PSI4	Usually, the referral specialist gives enough time to examine the referred patient	0.831											
PCH	PCH1	I feel the referral specialist has appointment timeliness	0.865	0.831	0.899	0.749	0.774	0.744	0.620	-	-	-	-	-
	PCH2	I feel the referred patients can be protected by insurance	0.923	-	-	-	-	-	-	-	-	-	-	-
	PCH3	The hospital I referred patients to, can upgrade the class of JKN	0.804	-	-	-	-	-	-	-	-	-	-	-
RRL	RRL1	For me, the specialist needs to refer back my patients	0.733	0.800	0.884	0.719	0.770	0.732	0.543	0.726				
	RRL2	It is important for me that the specialist who refers my patient back inform me of the progress of my patient's therapy	0.908	-	-	-	-	-	-	-	-	-	-	-
	RRL3	For me, the specialist needs to provide information about why my patient is not referred back	0.891	-	-	-	-	-	-	-	-	-	-	-
SCH	SCH1	I feel the referral specialist has sufficient medical skills	0.599	0.710	0.845	0.652	0.590	0.594	0.572	0.492	0.587	-	-	-

Variables		Indicators	Outer Loading	CA	CR	AVE HCP	Discriminant Validity (HT - MT Ratio)							
							HCE	PSI	PCH	RRL	TOP	HCE	WRH	
	SCH2	I feel the referral specialist has a board certification	0.891	-	-	-	-	-	-	-	-	-	-	-
	SCH3	I feel the referral specialist has a good reputation	0.896	-	-	-	-	-	-	-	-	-	-	-
TOP	TOP1	For me, it is important to have the opportunity to receive training from Hospital XYZ	0.895	0.899	0.937	0.831	0.703	0.757	0.756	0.719	0.651	0.565		
	TOP2	For me, it is useful to have the opportunity to attend scientific events organized by the Hospital XYZ	0.926	-	-	-	-	-	-	-	-	-	-	-
	TOP3	For me, it is a good opportunity to get an invitation to scientific events from Hospital XYZ that matches my profession	0.914	-	-	-	-	-	-	-	-	-	-	-
WRH	WRH1	I want to refer patients to Hospital XYZ if I get a new case that needs to be referred	0.902	0.844	0.906	0.763	0.581	0.759	0.577	0.677	0.627	0.254	0.641	-
	WRH2	I consider Hospital XYZ more than other hospitals if I want to refer patients to a specialist	0.881	-	-	-	-	-	-	-	-	-	-	-
	WRH3	I recommend Hospital XYZ to my colleagues if they need a referral hospital	0.836	-	-	-	-	-	-	-	-	-	-	-

HCP, Healthcare Provider - Specialist Interaction; HCE, Healthcare Provider Engagement; PSI, Patient - Specialist Interaction; PCH, Practice Characteristics; RRL, Returning Referral; SCH, Specialist Characteristics; TOP, Training Opportunity; WRH, Willingness to Re-refer to hospital, CA, Cronbach's alpha; CR, composite reliability; AVE, average variance extracted; HT–MT, heterotrait–monotrait

The Q2 predictive value is calculated using a blindfolding procedure to assess the PLS path model's predictive relevancy (Hair *et al*., 2019). In contrast, the WRH displayed Q^2 predict= 0.365 and was classified as having a medium predictive value. HCPE has a Q^2 prediction of 0.608. Thus, it can be concluded that HCPE has a large predictive relevance to the PLS-path model. To ascertain the relationships between the model's variables and evaluate whether the study's proposed hypothesis was validated, bootstrapping was used to test hypotheses. The bootstrap method was used to determine the significance of the data analysis in PLS-SEM Memon *et al*., 2020). To ascertain whether a directional hypothesis is significant, the cut-off value of p value>0.05, agreement with confidence intervals (CI) 5%, and CI 95% direction were utilized (Hair *et al*., 2019; Sarstedt *et al*., 2022).

Table 3 demonstrates that six hypotheses with positive direction are supported (p<0.05) with CI between a low threshold of 5% to a high threshold of 95%. Only one hypothesis, H1, was not supported (p>0.05) from Specialist Characteristics to HCPE. PSI has the strongest effect on HCPE, followed by RR and HCP. Finally, HCPE demonstrated/ revealed a strong relation to WRPH with a standardized coefficient of 0.646, categorized as a large effect size (f^2=0.716). In addition, mediation analysis was performed following Nitzl *et al*. (Nitzl *et al*., 2016) advice to ascertain the mediation's importance through the particular indirect effects. Based on the findings of the mediation analysis, the HCPE as the mediator construct investigated had T-statistics above the 1.645 threshold for the supported hypothesis. Therefore, it can be concluded that HCPE proved to be a significant mediator towards WRH. From the importance-performance map, it is essential to pay more attention to indicator PSI4, which discusses the adequacy of time to examine patients with the specialist. PSI4 is an indicator that is considered vital but not performed well. Therefore, this situation needs to be prioritized by the hospital management because it is deemed necessary by the healthcare providers but has not shown enough performance. From the analysis using PLS-SEM, the result of an empirical model can be seen in Figure 3. HCPE and WRH have a moderate relationship. Therefore, this research model can be used to study HCPE and WRH.

This study focuses on enhancing the quality of patient care and the referral system from the perspective of healthcare providers and hospitals, particularly in developing nations where the standard of healthcare must continually be raised. The findings of this study tend to be to the results from earlier studies (Forrest *et al*., 2000; Kipkirui Aruasa

Table 3. Hypothesis Test Result

	Hypothesis	Standardized coefficient	p-value	CI 5.0%	CI 95.0%	Result
H1	Specialist Characteristic -> Healthcare Provider Engagement	0.052	0.117	-0.021	0.125	Hypothesis not supported
H2	Practice Characteristic -> Healthcare Provider Engagement	0.136	0.012	0.043	0.239	Hypothesis supported
H3	Healthcare Provider - Specialist Interaction -> Healthcare Provider Engagement	0.174	0.000	0.091	0.263	Hypothesis supported
H4	Patient - Specialist Interaction -> Healthcare Provider Engagement	0.287	0.000	0.173	0.387	Hypothesis supported
H5	Returning referral -> Healthcare Provider Engagement	0.176	0.001	0.081	0.272	Hypothesis supported
H6	Training Opportunity -> Healthcare Provider Engagement	0.173	0.002	0.080	0.279	Hypothesis supported
H7	Healthcare Provider Engagement -> Willingness to Re-refer Patients to Hospital	0.646	0.000	0.582	0.716	Hypothesis supported

CI, Confidence Interval

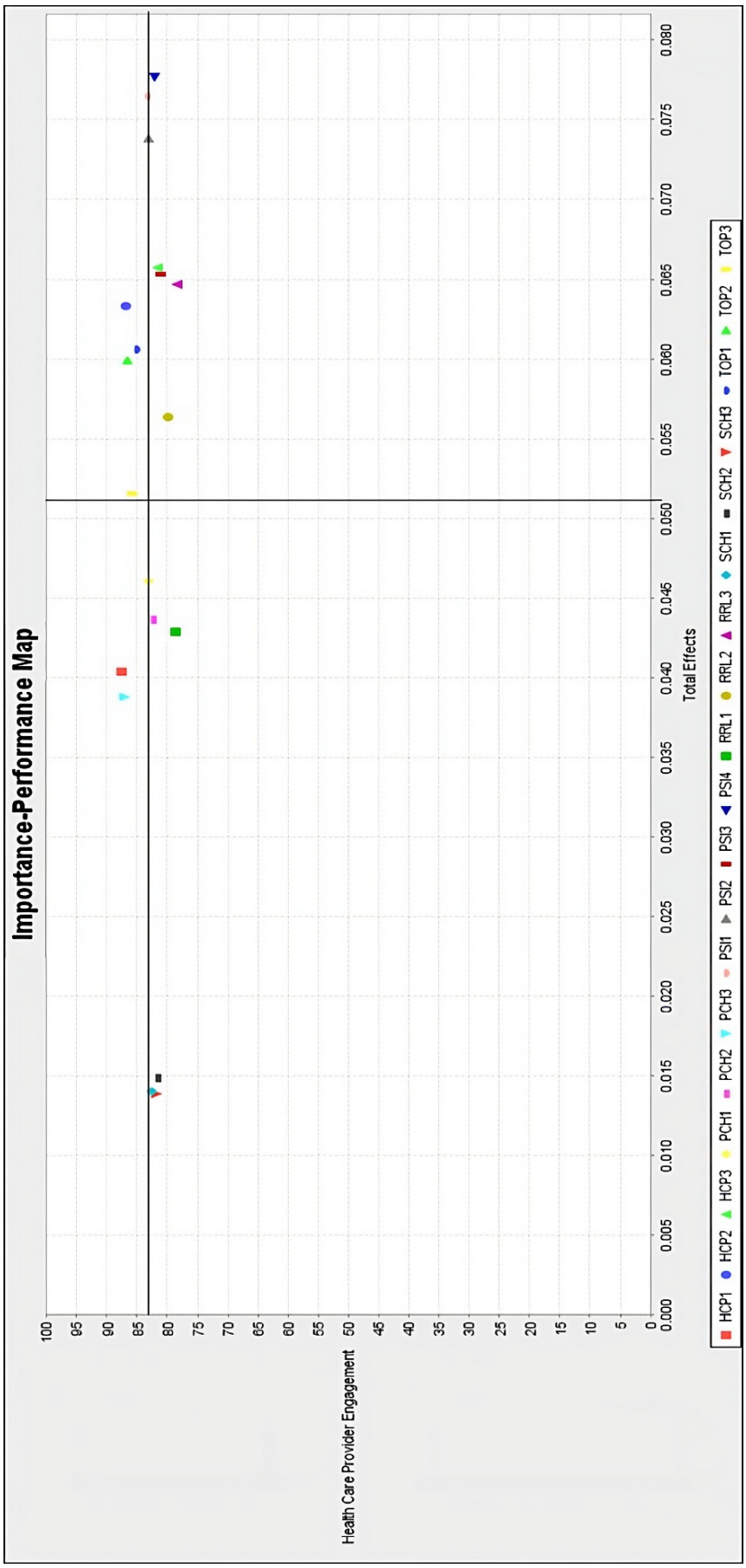

Figure 2. Importance-Performance Map
HCP, Healthcare Provider - Specialist Interaction; PCH, Practice Characteristics; PSI, Patient - Specialist Interaction; RRL, Returning Referral; SCH, Specialist Characteristics; TOP, Training Opportunity

et al., 2019) and demonstrate that healthcare providers' engagement significantly impacts their Willingness to re-refer their patients to the hospital. This study supports prior research (Kinchen *et al.*, 2004), showing that healthcare practitioners' experience is a crucial indicator of patient referral involvement. Five of the six PHCE antecedents in this investigation are significantly linked (Figure 3). The last antecedent, specialist characteristics, had no significant association with PHCE, supporting Kinchen's 2004 study. Even though medical skill, board certification, and reputation are important, the healthcare providers who refer may think all the specialists they refer their patients to have those essential characteristics already, so they stop considering them. Specialist characteristics are significant for referral specialists, even if referring healthcare providers don't think so.

Patient-specialist interaction was the most significant HCPE association (0.287). This suggested that HCPE increased with patient-specialist engagement. Previous research by Barnett (Barnett *et al.*, 2012). supports this patient-specialist interaction connection with HCPE. Healthcare providers referring patients to specialists cited good specialist experience. This finding supports the specialist characteristics explanation above. When specialists' traits are met, a patient-specialist relationship is most crucial. Thus, hospital specialists must increase patient interactions and provide suitable treatment experiences. Second, returning referral antecedent is strongly associated with HCPE. The returning referral antecedent includes providing patient status updates, returning patients to their referring healthcare professionals, or explaining why not. Previous research (Forrest *et al.*, 2000) found that referring physicians were satisfied with referral results. Many referral physicians do not give back information because they feel overwhelmed or useless, and some do not send back patients (MohammadAlGhamdi *et al.*, 2015). The referral experts should give comments to the referring healthcare practitioners by phone or letter (Forrest *et al.*, 2000).

This study's significant link between returning referrals and HCPE shows that primary care providers and private hospitals must collaborate to create a sound referral system. This collaboration can improve patient care and communication, improving patient and hospital outcomes. Figure 3 shows that HCPE became a WRH predictor. If the parameters are modified, the model still predicts according

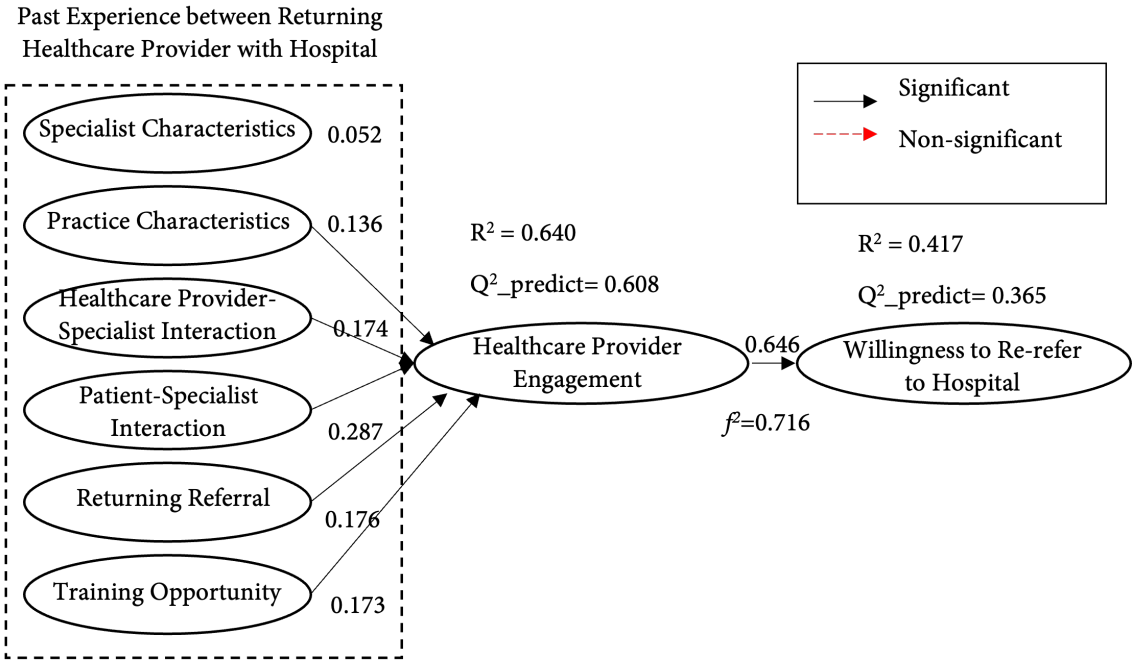

Figure 3. Empirical Model

to Q2, and WRH's R2 suggests moderate explanatory power. This study found a new way to increase the Willingness to re-refer patients to the hospital by boosting healthcare professional engagement, as shown in Figure 3. In conclusion, private hospitals need a sound referral system with healthcare providers to improve healthcare delivery, cost-effectiveness, collaboration, and policy alignment.

This study has limitations that should be considered in future research. This study includes healthcare practitioners who refer to one private hospital. Future research may benefit from selecting participants from multiple hospitals for more reliable results and a more representative sample with objective criteria. This study included doctors and midwives. Most doctors treat any medical condition, while midwives treat obstetrics and gynecology. Thus, these healthcare professionals will encounter specialists differently. Separating participants by occupation is best for the recommendation.

Conclusion

This study concluded that healthcare provider engagement positively relates to Willingness to re-refer to the hospital, while experience between returning healthcare providers with the hospital proven as an antecedent of HCPE. Patient-specialist interaction has a predominant relation with HCPE. The model shows how healthcare providers engage with hospitals will depend on their experience and perception after referring patients to the hospital. Healthcare providers willing to re-refer their patients to the hospital are the ones who engage with it. So, to increase the Willingness to re-refer patients to the hospital, hospital management needs to build engagement with healthcare providers who refer their patients to the hospital, especially regarding patient and specialist interaction.

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Doctor Consultation Duration on Patient Satisfaction at The Internal Medicine Outpatient Clinic

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Abstract

Long waiting times for healthcare services are one of the causes of patient dissatisfaction. The average waiting time for patient services at the Internal Medicine outpatient clinic is 280 minutes with the average duration of a doctor's consultation being only 6 minutes. Nowadays, patients can decide for themselves whether long waiting times for short doctor consultations are worth the effort. This study aimed to determine patient satisfaction based on the duration of the doctor's consultation. This research was conducted at the Internal Medicine Clinic using a quantitative observational analytical research design with a cross-sectional data collection method using a questionnaire. The patient satisfaction questionnaire uses a 1-5 Likert scale, while the doctor consultation duration questionnaire uses actual recording in minutes. The respondents for this study were 139 respondents based on epi-info software calculations with a confidence interval of 95%, and the sampling method used consecutive sampling. The research results were analyzed using SPSS version 21 with the chi-square analysis method. The duration of the doctor consultation, with an average of 6 minutes, does not affect patient satisfaction (p-Value 0.842). There are many other factors that can influence patient satisfaction, not limited to the duration of the doctor consultation.

Introduction

The long waiting time is one of the causes of patient dissatisfaction with healthcare providers. Long waiting time has been a persistent issue from the past to the present and into the future. Long waiting times are primarily due to healthcare providers aiming for a high number of visits but not balancing it with capacity and service capabilities (Lee *et al*., 2020). In theory, waiting time is calculated from when a patient has registered until they receive the desired or recommended healthcare service. The actual time of service is not included in the total waiting time. There is a difference in the perception of waiting time in theory and the way patients understand it. For patients, waiting time is calculated from when they arrive at the healthcare facility until they leave. This definition is quite different from the theoretical concept of waiting time (Alarcon-Ruiz *et al*., 2019).

The duration of waiting time to receive healthcare service is influenced by various factors, including the type of visit (initial or follow-up), punctuality of service (on time or delayed), the type of clinic (internal medicine, dentistry, and others), the duration of doctor's consultations, diagnostic tests (if necessary), and the kind of prescription given (compounded or not). Patients visiting a health care center have different purposes and health issues, which affect the total duration of waiting time they will experience (Biya *et al*., 2022; Li *et al*., 2020). The duration of doctor consultations in providing healthcare services is one of the factors that affect the duration of service waiting times. There is an influence between the duration of doctor consultations and patient satisfaction and safety. Doctor consultations duration should not be too short or too long.

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The duration of doctor's consultations should be appropriate for the health issues and goals desired by the patient. A consultation that is too brief can make patients feel that the service received does not justify the time they spent waiting. On the other hand, a consultation that is too long can result in longer waiting times for service (Galvão *et al*., 2020; Gong *et al*., 2022; Grot *et al*., 2023; Inoue *et al*., 2018; Wang *et al*., 2022)patient arrivals, queuing discipline, and physician consultation times are three key factors influencing work processes. (3.

A study conducted by Jabour (2020) has demonstrated that the duration of doctor's consultations significantly impacts the quality of service and patient satisfaction. Appropriate duration of doctor consultation can lead to high-quality service processes and more accurate diagnoses. The appropriate duration of consultation will also affect treatment outcomes, satisfaction, and perceptions of overall service quality. This study was conducted due to many complaints from patients who waited for too long to see a doctor but received very brief doctor consultations. Patients felt that the time they spent waiting was not on par with the duration of the doctor's consultation they received. The study aims to assess patient satisfaction based on the duration of doctor consultations received by patients. The doctor consultations duration in this study was obtained by tracking patients in real-time from when they entered the doctor consultation room until they left. The results of this study are expected to provide insights into the effect of duration of doctor consultation on patient satisfaction.

Methods

This study used an observational analytics quantitative study design with a cross-sectional data collection method using questionnaires on patients in the internal medicine clinic of the Air Force Hospital Dr. Efram Harsanah Lanud Iswahyudi, Magetan, East Java. The researcher prepared two questionnaires related to doctor's consultation duration and patient satisfaction. The doctor's consultation duration questionnaire was filled out by the researcher based on actual data obtained by following the study respondents from the moment they entered the doctor's consultation room until they left. The patient satisfaction questionnaire used a Likert scale from 1 to 5 and was filled out by the research respondents. This research questionnaire also included notes related to respondents' opinions, feedback, and suggestions regarding the waiting time for the internal medicine clinic service. The validity of the research questionnaire was tested using Pearson correlation analysis with a significance value of < 0.05, and its reliability was assessed using the Cronbach alpha method with a minimum alpha coefficient of >0.6. The validity and reliability tests were conducted on 30 respondents who visited the outpatient clinic of the Air Force Hospital Dr. Efram Harsana Lanud Iswahyudi and met the inclusion criteria for this study but did not visit the Internal Medicine clinic. The validity and reliability testing for the instruments in this study was necessary because the questionnaire used was based on a previous study in English that was subsequently translated into Bahasa Indonesia. The questionnaire in this study was valid and reliable, with a significance value of 0.000 for all eight questions and an alpha value of 0.868.

The sample size in this study consisted of 139 respondents, calculated using epi-info software with a 95% confidence interval and a 5% margin of error. The sampling method employed in this study was consecutive sampling based on the following inclusion criteria: 1. Patients seeking treatment in the internal medicine clinic; 2. Patients aged at least 17 years old; 3. Patients making their first or follow-up visits; 4. Patients with a minimum education level of elementary school; 5. Both male and female patients; 6. Patients using either BPJS (government health insurance) or out-of-pocket payment. This study has been ethically approved based on the Certificate from the Ethical Committee of Health Research of the Faculty of Medicine and Health Sciences of Muhammadiyah University Yogyakarta No. 118/EC-KEPK FKIK Universitas Muhammadiyah Yogyakarta/II/2023. Data analysis was conducted using SPSS Version 21 with the chi-square analysis method to determine the influence of the duration of doctor consultations on patient satisfaction. The study also performed cross-tabulation analysis to specifically determine the number

of respondents with long doctor's consultation durations who expressed dissatisfaction, respondents with long doctor's consultation durations who expressed satisfaction, respondents with short doctor's consultation durations who expressed dissatisfaction, and respondents with short doctor's consultation durations who expressed satisfaction.

Result And Discussion

The Internal Medicine Clinic of the Air Force Hospital Dr. Efram Harsana Lanud Iswahyudi provides services that begin with an automatic queuing machine starting at 06:00 AM. Patients then proceed to the registration desk for registration, which begins at 07:00 AM. After completing the registration process, patients will move to the waiting area of the internal medicine clinic for vital sign measurements while waiting for the internal medicine clinic to commence at 10:00 AM. The internal medicine clinic has two internal medicine specialists who alternate their practice days every week. The patient service flow at the internal medicine clinic is as follows:

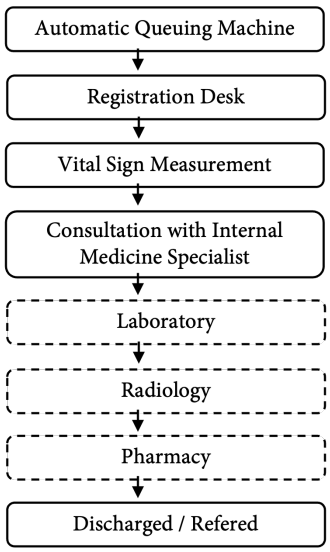

Figure 1. Internal Medicine Clinic Patient Service Flowchart

The study respondents exhibit specific characteristics. Most patients fall into the follow-up group, indicating they have previously visited the internal medicine clinic. Furthermore, most respondents are over 46 years old, which is early elderly. The gender distribution shows a predominance of female respondents. In terms of occupation, a significant portion of the respondents are housewives and regarding their education level, most of them have completed Junior High School.

Table 1. Respondents Characteristics

Criteria	Number	Percentage (%)
Type of Visit		
Follow-up	117	84.2
Initial	22	15.8
Total	139	100
Patient Age		
≥46 years old	128	92.1
<46 years old	11	7.9
Total	139	100
Gender		
Male	57	41
Female	82	59
Total	139	100
Occupation		
Housewife	49	35.3
Retired	5	3.6
Farmer	30	21.6
Civil servant	4	2.9
Army	9	6.5
Entrepreneur	42	30.2
Total	139	100
Educational Level		
Elementary School	43	30.9
Junior High School	47	33.8
High School	36	25.9
University	13	9.4
Total	139	100

Source : Primary Data, 2023

The waiting time for internal medicine specialist appointments is calculated by summing the total waiting time from the registration desk until the patient is called to enter the doctor's examination room. The service time is not included in the waiting time. Researchers followed patients who were willing to be respondents and met the inclusion criteria for this study. The waiting time at the Internal Medicine Clinic is calculated from when the patient leaves the registration queue machine until the patient enters the doctor consultation room.

Table 2. Waiting Time for Doctor Consultation

Categories	Waiting Time (Minute)	
Mean	280	
Longest duration	275	
Shortest duration	38	
Categories	Number (n)	Percentage (%)
Long	71	51.1
Short	68	48.9
Total	139	100

Source : Primary Data, 2023

Based on the data regarding waiting times to meet with a doctor, the mean waiting time for a doctor consultation is 280 minutes, with the longest duration being 275 minutes and the shortest duration being 38 minutes. The researcher categorized waiting times as long or short based on the individual respondents' waiting times compared to the average waiting time for all respondents. If a respondent's waiting time is shorter than the average time for all respondents, it is classified as "short," and if longer, it is classified as "long." Of all the respondents, 68 (48.9%) experienced short waiting times, while 71 (51.1%) experienced long waiting times.

The mean total waiting time for healthcare services at the Internal Medicine Clinic in this study is longer than in the study conducted by Harada et al (2020), which found an average total waiting time for a doctor's consultation of 74 minutes. Sianturi et al (2020) found that of 62 respondents in their study, 59.7% experienced total waiting times of more than 60 minutes only to consult a doctor. The difference in the average waiting time in this study compared to previous studies is because the outpatient service time in this study started at 10:00 AM, while patients started registering at the registration desk at 7:00 AM. There is a significant time gap between the registration desk opening and the start of service in this study location. The extensive time gap theoretically falls within the definition of waiting time. The duration of a doctor consultation was calculated from when the patient entered the consultation room until the patient left the room. During the consultation, the researcher waited outside the examination room to maintain patient privacy.

Table 3. Duration of Doctor Consultation

Categories	Duration of Doctor Consultation (Minute)	
Mean	6	
Longest duration	13	
Shortest duration	3	
Categories	Number (n)	Percentage (%)
Long	49	35.3
Short	90	64.7
Total	139	100

Source : Primary Data, 2023

In this study, the mean duration of consultations was 6 minutes, with the longest one being 13 minutes and the shortest being 3 minutes. The researcher categorized the consultation duration into long and short. Consultation duration was categorized based on each respondent's consultation duration compared to the average consultation duration of all respondents. If a respondent's consultation duration is shorter than the average consultation duration of all respondents, it is considered "short," and if it is longer, it is considered "long." As many as 90 respondents (64.7%) had short consultation durations, while 49 (35.3%) had long consultation durations. Consultation duration has a significant impact on patient satisfaction. Patients highly desire the best service, especially after waiting for an extended period. The acceptable average duration of doctor consultations are 15 minutes. Duration of Doctor's consultation that align with patients' preferences and needs are crucial for enhancing patient satisfaction (Haghgoshayie & Hasanpoor, 2021; Leow & Liew, 2022; Pockros *et al*., 2021; Srinivas & Salah, 2021). Based on the cross-tabulation analysis of duration of the doctor consultation and patient satisfaction, in the group with a long consultation duration, 28 (20.14%) respondents expressed dissatisfaction, while 21 (15.10%) respondents expressed satisfaction. In the group with a short consultation duration, 53 (38.12%) respondents expressed dissatisfaction, while 37 (26.61%) respondents expressed satisfaction.

Table 4. Cross Tab Analysis of Duration of Doctor Consultation on Patient Satisfaction

Categories	Satisfaction Based On Duration of Consultation				Total
	Not Satisfied		Satisfied		
	Number	Percentage (%)	Number	Percentage (%)	
Duration of Consultation					
Long	28	20.14	21	15.13	49
Short	53	38.12	37	26.61	90
Total	81		58		139

Source : Primary Data, 2023

There are other factors that can influence patient satisfaction aside from the duration of doctor consultation. Patients would feel satisfied if their expectations align with what they receive during the healthcare service process (Dwi Lestari *et al*., 2020). Short waiting times significantly impact patient satisfaction, as patients are more satisfied when the waiting time for healthcare services is brief. Conversely, patients are dissatisfied when they experience long waiting times. Every 1% increase in waiting time duration decreases patient satisfaction by 3%. The acceptable total waiting time for patients, from leaving the registration desk to completing their last required service, is ≤ 90 minutes (Abdus-salam *et al*., 2021; Al-Harajin *et al*., 2019; Alarcon-Ruiz *et al*., 2019; Sharma *et al*., 2022).

Several respondents provided reasons to the researcher regarding their satisfaction with short doctor consultation durations. Firstly, some of these respondents were accustomed to and frequently attended monthly check-ups, so they were used to short consultation durations. The frequency of repeat visits can influence patient satisfaction. Patients with repeat visits are more likely to feel satisfied compared to first-time visitors to a healthcare facility. Patients who regularly visit a healthcare facility are familiar with the duration, environment, and service culture at that facility, compared to patients visiting a healthcare facility for the first time (Al-Harajin *et al*., 2019; Davis-Dao *et al*., 2020; Sinyiza *et al*., 2022; Tenforde *et al*., 2020).

Secondly, respondents felt comfortable with the doctor's services, leading to satisfaction with the short duration of doctor consultations they received. The manner of communication, including speech, intonation, attitude, and behavior of the doctor when providing information and education related to the patient's health issues, significantly influences patient satisfaction. Patients can assess and choose which doctor they want to consult to address their health problems, even if they have to wait for an extended period (Borghi *et al*., 2019; Chandra *et al*., 2018; De Waard *et al*., 2018).

The researcher also received explanations from respondents with long consultation durations but feeling dissatisfied. These respondents felt dissatisfied mostly because they have had experiences with treatment in other hospitals with better service quality, leading them to compare the duration of doctor consultations in other hospitals with the one in the study location. The opinions of these respondents in this study align with the studies conducted by Homma (2018) and Qiao *et al* (2019), which found that patients with experience in "doctor shopping" at various healthcare facilities are more likely to feel dissatisfied because they have high expectations for waiting times and the service they will receive when visiting healthcare facilities. The quality of service obtained through the doctor shopping experience has been proven to influence patient satisfaction (Molina Indarwati, 2018).

A chi-square analysis was performed to determine the effect of the duration of a doctor consultation on patient satisfaction and found that doctor consultation duration does not significantly affect patient satisfaction, with a significance value of >0.05, which is 0.842. The absence of an influence of doctor's consultation duration on patient satisfaction is due to the presence of many other factors that can affect patient satisfaction beyond waiting time. These factors can be categorized as internal and external factors. Internal factors include age, gender, education level, social life, and occupation, while external factors encompass

waiting time, the number of repeat visits to the same hospital, service etiquette, cleanliness and the extent of the facility in healthcare services, ease of access to and from healthcare facilities, and low costs (Li *et al*., 2020; Quyen *et al*., 2021). The results of this study align with the studies conducted by (Jabour, 2020) and (Leow & Liew, 2022) which found no influence of consultation duration on patient satisfaction. Patient satisfaction can be influenced by many factors, including age, gender, marital status, occupation, education level, clinic type, the type of disease experienced, and patient expectations before visiting a healthcare facility (Lee *et al*., 2020). Sociodemographic conditions, health status, number of visits to healthcare facilities and comprehensive holistic services can also impact patient satisfaction, extending beyond doctor consultation duration (Leow & Liew, 2022; Wartiningsih *et al*., 2022).

Conclusion

Patient satisfaction is not solely influenced by the duration of doctor consultations. There are other factors that may affect patient satisfaction apart from doctor's consultation duration, encompassing both internal and external factors. This study concludes that a long consultation duration does not necessarily make patients feel satisfied, and a short duration does not necessarily make patients feel dissatisfied. Further studies can be conducted to explore the internal and external factors that influence patient satisfaction and to identify the extent to which each of these factors affects patient satisfaction. This can serve as a reference for developing solutions to enhance patient satisfaction, not limited to doctor consultation duration. The results of further studies, as suggested in this study, are expected to have a positive impact on the healthcare service industry by providing insights into the influence of internal and external factors on patient satisfaction, which is crucial for the sustainability of the business.

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Kidney and Liver Disorders Due to Microplastic Exposure: Chronic Vivo Study in Male White Rats

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Abstract

The increasing use of plastics has caused severe environmental pollution, especially by microplastics with plastic particles of 5 mm or less in diameter. These particles are formed by environmental factors such as weathering and ultraviolet irradiation, thus making environmental pollution worse. This environmental pollution increases human exposure to microplastics through the food chain. Many studies have now reported the adverse effects of exposure to microplastics in food and aquatic organisms. However, relatively few studies have used white rats. the entry of microplastics into white rats can affect two important organs, namely the liver and kidneys, in this study we conducted an in-vivo experimental test of male white rats by giving acute and chronic exposure to pure microplastic PE (polyethylene) for 28 days respectively. repeated with an adjusted dose. Toxicological effects were comprehensively evaluated in white rats by looking at clinical signs, body weight, and kidney and liver activity through examination of blood parameters creatinine, SGOT, SGPT, and further kidney and liver abnormalities were analyzed through histopathological tests. Based on the results of the experiments conducted, it was found that PE-type microplastics had a significant impact on changes in body weight, increased functional activity of the kidneys and livers of white rats, and chronic histopathological abnormalities in male white rats, so it is hoped that this study can clarify that PE type microplastics greatly affect organs for those who consume it in the long term.

Introduction

In recent years, plastic particles with a diameter of <5mm have been increasingly recognized as a global environmental threat and health hazard to the human population (Katsnelson, 2015). Microplastics is a term for plastic particles for which there is no universal definition. In the literature, microplastics are often defined as plastic particles with dimensions up to 5 mm with no specified lower size limit (Leslie *et al*., 2022) Based on their origin, microplastics (MP) are classified into primary and secondary MP (Lee *et al*., 2022). MP primers are made for use in personal care products, cosmetics, toothpaste, detergents, sunscreens, and drug vectors (Chatterjee& Sharma, 2019) which, if discharged into the environment, can undergo UV oxidation,

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light degradation, and physical ablation (Dey *et al*., 2021). The presence of these harmful plastic fragments in ecosystems (terrestrial and aquatic) is due to different anthropogenic activities, which include domestic, industrial, and coastal activities.

The introduction of microplastics in aquatic ecosystems is mainly due to domestic runoff containing microbeads and microplastic fragments (used in cosmetics and other consumer products) and also from fragmentation of large plastic debris (Andrady, 2011). MPs encountered in the environment strongly represent a heterogeneous group, one of which is chemical composition (polypropylene, polyethylene, polystyrene, etc.). Polyethylene is a major source of microplastics and is widely present throughout the environment. Microplastics include plastic materials, such as polyethylene, polystyrene, and polypropylene. Polyethylene is a major source of microplastics and is widely and predominantly present throughout the environment (Uurasjärvi *et al*., 2021). as for the uses according to the type of MP, namely polyethylene (politen; PE) in the form of low density (LDPE; garbage bags, films) and high-density construction (HDPE; shopping bags, bottle caps) or as atetraphthalate (PET; bottles, food trays), polypropylene (PPL; kakubak, straws), polyvinyl chloride (PVC; pipes, door and window frames), and polystyrene, both rigid (PS; food pots, toys) and expanded (EPS; packaging, insulation) (Waring *et al*., 2018). Due to their small size and non-biodegradability, microplastics accumulate within aquatic organisms.

The food chain is the main pathway through which humans are exposed to microplastics (Mercogliano *et al*., 2020) so eventually it not only harms the environment but can easily transfer to marine biota and be consumed by humans through the food chain process (Lee *et al*., 2022). The accumulation of MP tissue can lead to various side effects, such as physical injuries (De Stephanis *et al*., 2013) Reduction of feeding activity, inhibition of growth and development (Yang *et al*., 2021), energy deficiency (Cole *et al*., 2015), immune response (Akhbarizadeh *et al*., 2020) oxidative stress (Kutralam-Muniasamy *et al*., 2020) neurotoxic response (Q. Li *et al*., 2020) and metabolic disorders (Lee *et al*., 2022). It is these releases to the environment that occur continuously and are now a global problem that requires urgent managerial strategies to reduce or avoid potential threats that worsen the survival of organisms, human health, and the aesthetic value of the environment (Barletta *et al*., 2019). These results are important clues to the accumulation and release of microplastics after exposure to the human body. Human feces were previously analyzed by Fourier Transform Infrared (FTIR) spectroscopy, providing evidence that micro-sized plastic particles can be excreted through the gastrointestinal tract (Zhang *et al*., 2021). Plastic particles were also detected in human colectomy specimens by FTIR (Ibrahim *et al*., 2021). Raman microspectroscopy was recently applied to the images and identified three polypropylene particles measuring between 5 and 10 μm in human placental tissue (Ragusa *et al*., 2021).

Despite these reports, studies on mammals concerning the toxicological effects of microplastics are still limited. In particular, rodent toxicity tests to evaluate the risk assessment of microplastics in humans currently lack consideration of their risk or severity. Therefore, the need and interest in in vivo toxicity and accumulation evaluation needs to be carried out in this study. We tested the in vivo effects of polyethylene (PE) microplastics at a size of 5 μm2, the study was conducted by orally administering polyethylene microplastics (MP-PE) at repeated doses chronically for 28 days and evaluating toxicity in male white rats. Evaluation of renal and hepatic impairment was carried out by taking blood before and after exposure to creatinine, SGOT, and SGPT parameters. We also more fully identified whether MP-PE can cause damage to kidney and liver organs through histopathological tests. Our findings provide insight into the in vivo toxicity of MP-PE and its potential bioaccumulation in organs with graded doses for 28 days in a complete manner.

Method

Pure MP-PE particles purchased at local industry provider of pure polyethylene type microplastic raw materials in powder form which is then measured first using light and

transmission electron microscopy at the Animal Laboratory, Faculty of Medicine, Diponegoro University and identified the size of MP-PE which is 5 μg^2 and this MP-PE is sterilized first with aquades liquid and then mixed with 0.5% CMC Na solution so that it is easy to dissolve and orally in white rats, The preparation of 0.5% CMC Na solution is made by weighing 500 mg of CMC Na into 10 ml of hot aquades then left for approximately 15 minutes until clear and shaped like jelly. Next, it is stirred to a homogeneous mass and diluted in a measuring flask with aquades up to a volume of 100 ml. Thirty-six mice were assigned to six groups each: group 1, which was considered a control group; group 2, which gets 200 µg/kg MP-PE, group 3, which gets 400 µg/kg MP-PE; group 4, which gets 600 µg/kg MP-PE, group 5, which gets 800 µg/kg MP-PE; and group 6, who got 1000 µg/kg MP-PE for 28 days.

Animal observations, the presence of near-dead or dead animals, and animal weight measurements were performed once a day, twice a day, and once a week, respectively, for 28-day repeated dose toxicity studies. In addition, food and drinking water consumption was measured daily for repeated dose-toxicity studies over 28 days. For quantitative in vitro determination of creatinine concentration in rats, plasma, or urine in Konelab analyzer using an enzymatic method. All test results are interpreted with a clinical context in mind and examined using Indiko Thermo scientific: Photometer (End point &; Colorimetric) Auto Analyzer. For quantitative determination of alanine aminotransferase in vitro (L-Alanine: Activity of 2-Oxoglutarate Aminotransferase (ALT), EC 2.6.1.2) in serum or human plasma on Konellab analysis. All test results must be interpreted concerning the clinical context and examined using the Indiko Thermo scientific Auto Analyzer: Photometer (End point &; Colorimetric). For in vitro quantitative determination of aspartate aminotransferase (L-Aspartate: 2-Oxoglutarate Aminotransferase (AST) activity, EC 2.6.1.1) in serum or rat plasma on Konelab Analysis. All test results must be interpreted concerning the clinical context and examined using the Indiko Thermo scientific Auto Analyzer: Photometer (End point &; Colorimetric). All hematology, serum biochemistry, weight, and organ data are presented as minimum, maximum, mean ± standard deviation (SD). The abnormally distributed data were analyzed in a nonparametric manner by the unpaired Mann-Whitney test. Comparison of several groups was done using analysis of variance with post-test. According to Bonferroni. A P value of <0.05 is considered statistically significant.

The manufacture of histological preparations of organs begins with the stage of fixation of organs. Organ tissues are put in a 10% neutral formalin-buffered fixation solution for at least 24 hours. Fixation is used to prevent post-mortem degeneration, kill microorganisms that may still be present, and harden tissue so that it is easily cut. The finished fixed organ is cut 5 mm thick and inserted in a tissue cassette. Following the dehydration stage, pieces of tissue in the cassette tissue are put into a stratified concentration of alcohol (70% alcohol, 80% alcohol, 96% alcohol, I absolute alcohol, II absolute alcohol, III absolute alcohol for 30 minutes each) to remove the water content in the tissue. Furthermore, in the clearing stage, pieces of tissue in the cassette tissue are then inserted in xylol solution for 2 x 30 minutes, to remove the alcohol content in the tissue, the goal is that the tissue becomes clearer and transparent so that it can be filled with liquid paraffin. Next to the impregnation stage, pieces of tissue are put into liquid paraffin for 2 x 2 hours. Next to the embedding stage, pieces of tissue in cassette tissue are planted into paraffin which has a melting point of 56-580C, and waited until the paraffin becomes solid. The tissue already embedded in solid paraffin is cut 4 µm thick with a microtome. Pieces of tissue are affixed to glass objects. The tissue on the glass object is heated to a temperature of 56-580C to dilute and remove residual paraffin between the tissues, then rinsed with aquades. Sequentially the tissue on the glass object is inserted in: Xylol for 1 minute, Xylol for 2 minutes, Xylol for 3 minutes, Alcohol 100% for 2 minutes, Alcohol 96% for 2 minutes, Alcohol 70% for 1 minute, Aquades for 1 minute, Alcohol 100% for 2 minutes, Hematoxyllin for 2 minutes, Aquades for 2 minutes, Eosin for 2 minutes, Aquades for 15 seconds, Alcohol 80% for 15 seconds, Alcohol 96% for 30 seconds, Alcohol 100%

for 30 seconds, Xylol for 1 minute, Xylol for 1 minute, Tissue that has been stained on the glass object is covered with a glass cover, which was previously dripped with entellan which is a transparent adhesive. Scoring of disorders in the kidney organs and liver of male white rats was carried out in this study. Animal studies have been reviewed and approved by the Health Research Ethics Committee of the Faculty of Public Health, Universitas Airlangga with No: 57/EA/KEPK/2021.

Result and Discussion

Chronic administration of MP-PE doses with repeated doses here is presented based on differences in rat body weight over time to see at what dose of weight loss based on the graph (figure 1) and also more fully presented the average ± SD to see the value.

In Table 1, it can be seen that most of the rats given exposure to MP-PE doses experienced a decrease in body weight per dose according to the length of exposure time, but the focus here is on the difference in body weight between controls and graded treatment doses, namely doses of 400 mg/kgBW, 600 mg/kgBW; 800 mg/kg to 1000 mg/kgBW where the decrease occurred at a dose of 400 mg/kgBW on day 7 (198.00 ± 9.192) to (178.50 ± 50.205) on day 28; a dose of 600 mg/kgBW on day 7 (207.33 ± 7.202) to (204.50 ± 18.912) and the final dose or the highest dose of 1000 mg/kgBW on day 7 (231.00 ± 9.201) to (223.33 ± 25.580) on day 28 (Table 1). When compared with the control dose, it is very different, not experiencing weight loss but weight gain, because the control was only given food and drink during this chronic exposure study, where the body weight of rats on day 7 (180.00 ± 4.427) becomes (203.50 ± 4.370). Complete body weight tends to decrease when rats are exposed to graded doses starting from a low dose of 200 mg/kgBW to a high dose of 1000 mg/kgBB. If you look at the table presented (Table 1), it can be seen that most rats given exposure to MP-PE doses will experience significant changes based on the length of time the rats are exposed. Looking at the results of the one-way anova analysis conducted between the treatment dose and body weight based on days 7-28, it was found that there was a significant relationship between the dose of MP-PE and the body weight of rats based on the length of exposure, namely on days 7 ($p = 0.000$); day 14 ($p = 0.001$); day 21 ($p = 0.001$) and day 28 ($p = 0.022$). In administering MP-PE doses, we also monitor the value of kidney activity by checking creatinine levels to ensure that the exposure given is also detected in the blood so that it can represent a single cause that can enter the body of mice. The renal function

Table 1. Changes in Body Weight of Male White Rats Given MP-PE Doses at Various Doses

Dosage Group (mg/kgBW)	Mean± std. deviation (day-)			
	7	14	21	28
Control	180.00±4.427	187.00±4.899	194.50±5.010	203.50±4.370
200	188.33±4.412	196.17±6.795	202.67±10.558	206.33±13.967
400	198.00±9.192	184.00±16.823	182.33±25.968	178.50±50.205
600	207.33±7.202	201.40±20.305	206.50±16.783	204.50±18.912
800	209.00±6.595	215.50±5.802	236.25±10.720	236.25±10.720
1000	231.00±9.201	220.50±15.588	223.00±19.053	223.33±25.580
Average±SD	200.41±17.061	200.07±17.125	206.54±20.984	209.96±22.404
Max	231.00	220.00	236.00	236.00
Min	180.00	187.00	182.00	178.00
p-value	0.000*	0.001*	0.001*	0.022*

(*: significant ($p<0.05$)

Note: All groups were treated for 28 days. The data is expressed as the average ± SEM. high dose (KP5) = 1000 mg/kg/day; Medium dose (KP2-KP4) = 400-800 mg/kgBW/day); Low dose (KP2) = 200 mg/kg/day and control (KK) supplemented with rat food pellets.

Table 2. Effect of MP-PE on Kidney (Creatinine Levels) and Liver (SGOT Levels, SGPT) Activity in Male White Rats

Group	Creatinine (mean±SD)		SGOT (mean±SD)		SGPT (mean±SD)	
	Pre	Post	Pre	Post	Pre	Post
Control	0.250±0.0548	0.333±0.0516	179.50±200.839	268.00±97.724	70.50±6.156	116.50±58.092
Dosage 200	0.300±0.0000	0.400±0.0000	294.83±252.166	233.67±119.823	184.33±225.713	297.17±407.604
Dosage 400	0.267±.00516	0.333±0.0816	191.67±84.327	236.83±236.83	90.00±30.013	103.67±18.408
Dosage 600	0.283±0.0408	0.367±0.0516	167.17±53.056	304.33±304.33	88.00±20.159	135.83±11.441
Dosage 800	0.300±0.0000	0.383±0.0753	145.33±43.944	278.17±109.077	84.00±17.123	110.83±11.906
Dosage 1000	0.300±0.0632	0.300±0.0632	203.67±84.282	206.83±79.668	116.83±52.186	112.83±35.997
Ave±SD	0.283±0.0447	0.353±0.0654	197,03±140,964	254,64±91,055	105,61±96,806	146,14±172,389
Max.	0.300	0.400	294.83	278.17	184,33	297,17
Min	0.250	0.333	145,33	206,83	70.50	103,67
P-value	0.000*		0.007*		0.012*	

(*: significant (p<0.05)

Table 3. Analysis of the Value of Damage to Kidney Tissue with Repeated Doses for 28 Days (200, 400, 600, 800, and 1000 mg/kg body weight/day)

Network	Group	Disorders					
		Normal	Swelling	Inflammation	Necrosis	Hyaline cast	Fibrosis
Kidney	Control						
	200		+	+			
	400		++	++			
	600		++	++			
	800		++	++			
	1000		+++	+++		+	

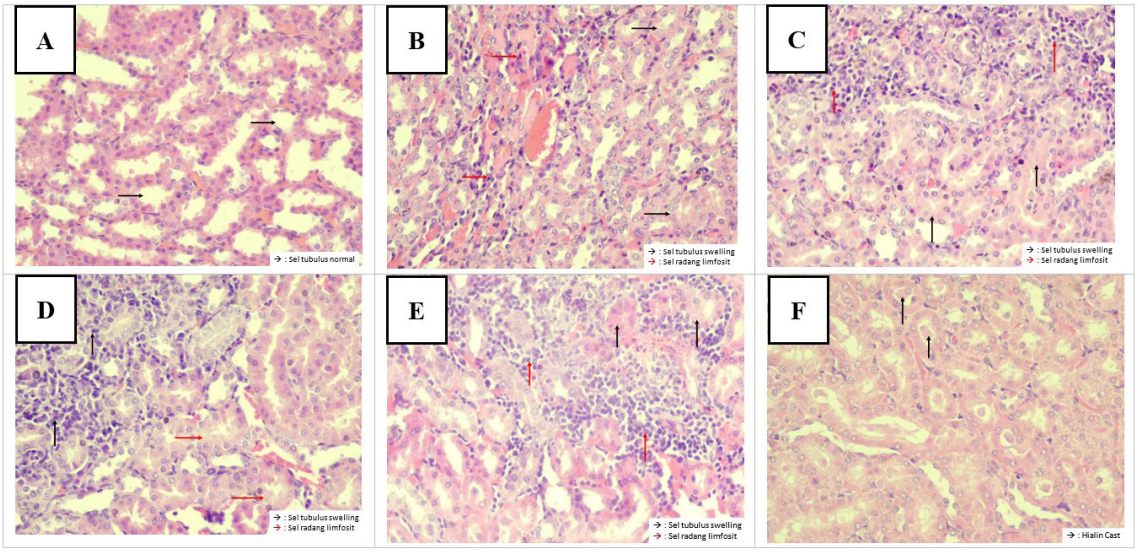

Figure 1. Histopathology in Kidney Tissue A) Control Group (0 mg/kg MP-PE), B) Given with MP-PE Dose (200 mg/kg), C) Given with MP-PE Dose (400 mg/kg), D) Given with MP-PE Dose (600 mg/kg)). E) Given with a Dose of MP-PE (800 mg/kg), F) Given with a Dose of MP-PE (1000 mg/kg). Evaluation of Kidney Tissue Reveals the Normal Structure of Each Dose has Significant Changes, Namely Abnormalities Swelling Tabule Cells, and Lymphocyte Inflammation

activity between before treatment and after treatment at each dose has been presented in the form of average±SD so that quantitative values can be seen in Table 2.

The results of testing kidney function activity through examination of serum creatinine levels in male white rats showed increased activity in each dose given during the sub-chronic period of 28 days, white rat serum stratified concentrations in the MP-PE group doses of 200 mg/kg, 400 mg/kg, 600 mg/kg, 800 mg/kg and 1000 mg/kg compared to the control group, i.e., serum urea levels increased compared to the control group. In addition, there was a significant decrease ($p < 0.05$) which showed a significant difference between serum urea concentrations in normal doses (mean ± SEM) compared to the low-dose group.

It was found that the overall dose showed abnormalities in the kidney and liver organs through several categories of damage observed to cause death, the higher the dose, the higher the damage. In the histopathological picture of rat kidney organs starting with a swelling disorders score of 2 in all groups with the presence of tubule cells that experience degeneration/swelling of the cytoplasm in < 25% of tubule cells, which then also experience inflammatory disorders with a score of 2, namely found a moderate distribution of inflammatory lymphocyte cells/plasma cells in the interstitial area even at the highest dose found Hyaline cast abnormalities with a score of 1 found hyaline cast in the lumen of the tubule, All these findings conclude that microplastics have an impact on the function, activity and also kidney

Table 4. Analysis of the Value of Damage to Liver Tissue with Repeated Doses 28 Days (200, 400, 600, 800, and 1000 mg/kg body weight/day)

Organ	Group	Disorders			
		Normal	Ballooning	Inflammation	Steatosis
Liver	Control				
	200		++	+	
	400		++	++	
	600		++	++	
	800		++	++	
	1000		+++	+++	+

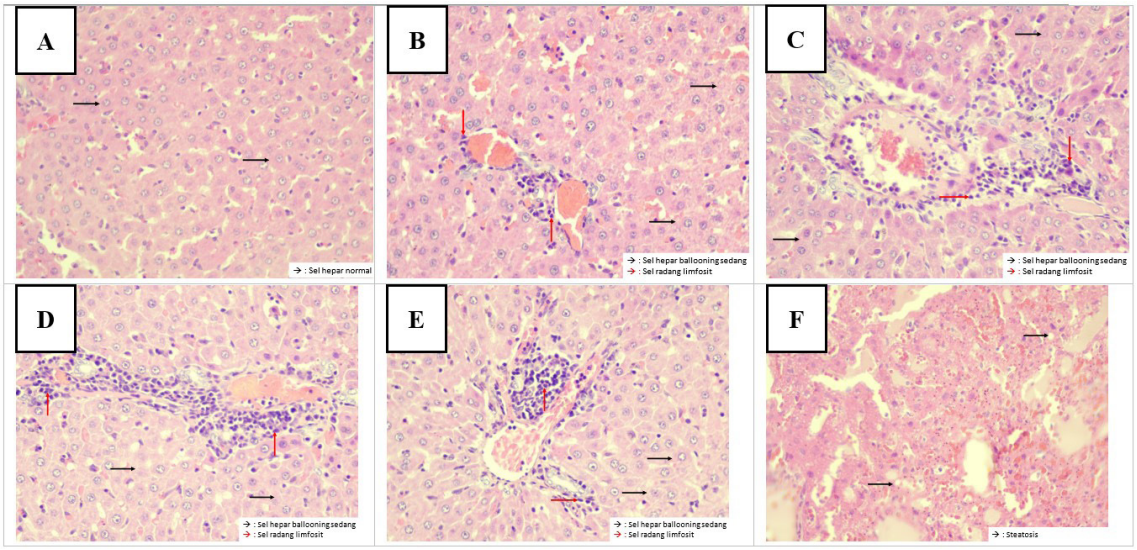

Figure 2. Histopathology in Liver Tissue A) Control Group, B) Given with MP-PE Dose (200 mg/kg), C) Given with MP-PE Dose (400 mg/kg), D) Given MP-PE Dose (600 mg/kg)). E) Given with a Dose of MP-PE (800 mg/kg), F) Given with a Dose of MP-PE (1000 mg/kg). Evaluation of Kidney Tissue Reveals the Normal Structure of Each Dose Has Significant Changes, Namely Abnormalities Namely Sweeling Tabule Cells, and Lymphocyte Inflammation

organ damage of white mice.

Based on histopathological features in the liver, by looking at the activity of SGOT and SGPT in previous rats which increased their activity, then in line with organ damage, ballooning damage was found at each dose with a score value of 2 where the distribution of hepatocyte cells that experienced moderate hydropic degeneration was found and a score of 3 at a high dose of 1000 mg/kg where the distribution of hepatocyte cells that experienced severe hydropic degeneration or hepatocyte cells were found. The necrosis is even worse with steatosis damage at high doses with a score of 1 where hepatocyte cells experience intracellular fat accumulation. If you look at it as a whole, this is very dangerous. Due to sub-chronic stratified exposure, much damage is found to the liver.

As the production of plastic products increases, plastic waste also increases. Microplastics are formed due to weathering and environmental exposures, and plastic waste collects in the oceans. Microplastics, which are environmental pollutants, have recently attracted the attention of the wider community. In marine environments, aquatic organisms can ingest microplastics, leading to human exposure based on the food chain. A study noted the presence and type of microplastics found in human feces (Zhang *et al*., 2021). As a result, there is increasing interest in studying the prevalence and effects of environmental microplastics (Deng *et al*., 2017). The impact of microplastics was evaluated using aquatic (Zhu *et al*., 2020), mouse (Yang *et al*., 2019), and human cells (Schirinzi *et al*., 2017), and there was a significant increase in the negative impact of environmental pollution on human health (Inhorn and Patrizio, 2014).

In this study, using standard toxicity evaluation methods (OECD guidelines 408, 423, and BPOM Indonesia), 5 concentrations of MP-PE (200, 400, 600, 800, 1000, mg/kgBW/day) were administered to male white rats with single and repeated doses for 28 days. In addition, we determined whether the microplastics administered could enter the blood of white rats and affect the condition of kidney and liver organs through histopathological tests. The polyethylene microplastic (PE-MP) used was pure type with an average size of 5.21 μm^2. Many studies are using spheroidal microplastics. (Au *et al*., 2015) consider that this type of microplastic is very common in plastic products discharged into the environment, so it is very risky to degrade in the environment and can enter the human body. Therefore, microplastics reflecting these characteristics were prepared and used in this study.

To confirm the sub-chronic dose that triggers clinical disorders to death from MP-PE, repeated oral dose toxicity studies were conducted by looking at the consequences in the form of clinical symptoms, changes in body weight, mortality or death, and histopathological evaluation in the kidney and liver organs. From the results of the administration of graded doses carried out, significant differences were found in the treatment of graded doses with groups that were not exposed to MP-PE, from the aspect of weight gain, changes were found that showed the greater the dose, the lower the body weight of white rats (Figure 1). From the significance test, it was found that each dose given affected the weight at each week during the treatment period on day 7 ($p=0.000$), day 14 ($p=0.001$), day 21 ($p=0.001$), and day 28 ($p=0.022$). So it can be concluded that as a result of repeated oral doses of PE-MP, we determined that exposure to MP-PE greatly affected the metabolic system of rats so that in graded doses the ability of rats to eat and drink normally was impaired.

Based on previous research that has shown that changes in body weight due to exposure to toxic substances are the most visible indicator and an early indicator of the toxic effects of the test sample given, experimental animals that receive high doses generally lose weight due to physiological changes in rats and decreased food intake and metabolic state (Sireeratawon *et al*., 2010). In another study of a different type of MP-PS conducted on zebrafish animals, it was found that Polystyrene (PS) caused a decrease in body weight, body length, and body mass index as well as an increase in inflammatory cytokine and chemokine gene expression in zebrafish. (B. Li *et al*., 2020), research conducted with polyethylene (PE) exposure given to rats led to the conclusion

that MP-PE affects growth by causing undesirable things namely satiety by inflaming the digestive tract, changing the intestinal barrier, and decreasing lender secretion (B. Li *et al*., 2020), also in other studies, it has been shown that the inclusion of MP (PE-PS) can cause localized effects on the immune system, increase intestinal inflammation, and affect diet resulting in weight loss (Wright and Kelly, 2017).

In addition to MP-PE affecting the body weight of rats, it cannot be denied that MP particles are very small particles that can enter the organs. In this case, based on the identification results, MP-PE entered the body and affected kidney and liver function. Creatinine can be used as a biomarker for kidney disorders and as an indicator of glomerular filtration rate (Lien *et al*., 2006) and enzymes (AST and ALT) are found in the cells of several organs throughout the body and the release of these enzymes and elevated blood levels are signs of cell membrane damage (Lenaerts *et al*., 2005). The results of kidney function activity tests with creatinine level parameters in the serum of male white rats showed that there was increased activity in each dose given during the sub-chronic period of 28 days. The dose of MP-PE 200-1000 mg/kg between pre and post-treatment was found to increase compared to the control group with a mean + SD creatinine value of pre (0.283 ± 0.0447) and post (0.353 ± 0.0654), and for liver activity SGOT and SGPT also found differences between pre and post serum tests, namely pre SGOT (197.03±140.9640); post SGOT (254.64±91.055) and Pre SGPT (105.61±96.806); Post SGPT (146.14±172.389).

When referring to the dose and the increase in SGOT, SGPT, and creatinine activity, it should be noted that the treatment group members with high doses had lower hematrocytes (HT) or red blood cells, and also had high doses of MP. Hemoglobin (Hb) levels were much lower, which is considered an indication of sickle cell disease (anemia) (Magrì *et al*., 2018). Research by Wang *et al*. showed the induction of polystyrene microplastics in rats showed a decrease in rat body weight, an increase in creatinine levels, and an increase in pro-inflammatory mediators such as IL-1β, IL-6, and TNF-α. The study also showed that the occurrence of lesions in the histopathological picture of rat kidneys was due to inflammation caused by microplastics.(Wang *et al*., 2023) Palaniappan also showed the results of their research in vitro on the effect of exposure to polyethylene microplastics on renal epithelial cells, showing that the cells experienced damage characterized by an increase in TNF-α levels, which is a pro-inflammatory mediator so that inflammation occurs (Palaniappan *et al*., 2022).

Based on previous studies, MP-PS can be distributed to the liver, kidney, and gastrointestinal tract and affect energy metabolism, lipid metabolism, oxidative stress, and neurological functions (Deng *et al*., 2017). When viewed further with the ANOVA test, it was found that there was a significant relationship between MP-PS dosing and kidney function activity, namely p=0.000 (p< 0.05) and liver function SGOT and SGPT have a significant relationship, namely p=0.007 (p<0.05) and p=0.012 (p<0.05). Based on the histopathological results, abnormalities were found in the kidney and liver organs (Figures 1 and 2); this followed the high kidney and liver activity found in the serum of rats with creatinine, SGOT, and SGPT parameters (Table 2). If seen in more detail, the damage that appears in the kidneys consists of swelling, inflammation, and even hyaline cast damage.

In Table 4, exposure to microplastics at a low dose of 200 mg/kg found swelling and inflammatory damage with a score of 1, where tubule cells were found to have degeneration or cytoplasmic swelling in 25% of tubule cells. The higher the dose (400, 600, or 800 mg/kg), the more the disorder increases with a score of 2, where a moderate distribution of inflammatory cells (lymphocytes and plasma cells) is found in the interstitial area. A score of 3 occurs at a dose of 1000 mg/kg where a hard or diffuse distribution of inflammatory cells, lymphocytes, and even hyalin cast damage with a score of 1 is found in the area of fibrosis in the kidney parenchyma. Liver damage (Figure 2) shows that ballooning damage is found at each dose with a score of 2 where there is a distribution of hepatocyte cells that experience moderate hydropic degeneration, and at a high dose of 1000 mg/kg, there is increased damage, namely steatosis damage with a score of 1

where there are hepatocyte cells that experience intracellular fat accumulation. When viewed as a whole, this is very dangerous. Due to subchronic graded exposure, a lot of damage is found in the liver. The damage caused by MP-PE exposure is also based on research that found that it is very true that the accumulation of microplastics in rat kidneys is the cause of histopathological damage, increased levels of endoplasmic reticulum stress markers, inflammatory markers, and nephrotoxicity (Kuhlman, 2022). Furthermore, Goodman *et al*.'s research on the effect of microplastics in vitro on embryonic kidney and liver cells showed that microplastics produce toxicity effects on cell metabolism and cell interactions, one of which is a decrease in gene expression of antioxidant enzymes such as superoxide dismutase 2 (SOD2) and catalase (CAT) which reduces the ability of SOD2 and CAT enzymes to detoxify reactive oxygen species (ROS) and cause oxidative stress on cells so that cells are damaged (Goodman *et al*., 2022).

Abdel-Zaher *et al*. mentioned that exposure to microplastics in mice affects the morphology of red blood cells. Red blood cells have a variety of shapes due to exposure to microplastics. This morphological change affects oxygen transportation to organs so that it can affect organ function, one of which is the kidney. The study also showed an increase in creatinine, AST (SGOT), and ALT (SGPT) levels in the group of rats exposed to microplastics compared to the control. AST and ALT enzymes are found in the cells of several organs. High levels of AST and ALT in the blood indicate the presence of damaged cells, so these enzymes that should be in the cells become present in the bloodstream (Abdel-Zaher *et al*., 2023). The accumulation of MP in the liver can be considered as a consequence of chronic liver disease. For example, the possibility of having hypertension (a major cause of clinical complications of liver cirrhosis), causing impaired bowel function (also known as "leaky gut), and allowing MP particles to migrate through the intestinal wall, and be transported to the liver (Camilleri, 2019).

Even in studies with human respondents, the liver identification of MPs was found Overall, this proof-of-concept case series assessed the presence of MPs in human liver tissue. We observed that MPs were found in the livers of individuals with liver cirrhosis, but not in those who did not carry congenital liver disease, and from six microplastics of different sizes Polymers ranging from 4 to 30 μm suggest that chronic liver disease appears to be a major driver in MP accumulation in humans (Horvatits *et al*., 2022). Also, toxicity in mammals is conducted by many studies that show the entry of particles into the lymphatic system occurs in humans (particle size 0.2-150 μm) rodents (30-40 μm), rabbits (0.1-10 μm) and dogs (3-100 μm), via the intestine. For dogs, PVC particles (5-110 μm) were found in the portal vein and were found to reach the liver. Also, toxicity in mammals conducted by many studies showed the entry of particles into the lymphatic system occurred in humans (particle size 0.2-150 μm) rodents (30-40 μm), rabbits (0.1-10 μm), and dogs (3-100 μm), via the gut. For dogs, PVC particles (5-110 μm) are found in the portal vein and are found to reach the liver (Wright and Kelly, 2017).

This study provides new insights to improve our understanding of the toxicity effects of MP-PE and the biological safety of microplastics to male white rats which can be a preclinical depiction of the impact of MP-PE on human health after exposure. In this investigation, we found that the accumulation of MP particles is mainly dose-dependent in the digestive system. Their particle size strongly influenced their distribution and tissue accumulation kinetics, and accumulated in the liver, kidney, and intestine (Deng *et al*., 2017). To overcome some of the limitations of this study, it is necessary to evaluate the toxicity of repeated microplastic administration for more than 28 days. In addition, studies on the mechanism of microplastic toxicity should be conducted simultaneously. Because humans and other organisms are continuously exposed to microplastics through food intake.

Conclusion

In male white rats, polyethylene microplastics produced several toxins and caused impacts on the digestive system, kidney and liver organ abnormalities, and histopathological abnormalities. These

biochemical parameters can cause severe toxic effects on all organs at concentrations ranging from low doses to higher doses and for a long time with repeated exposure. The findings showed that the microplastic dose groups had damaging effects on kidney and liver organ cells, reflecting the harmful impact of these dose groups on human health. The current study may initiate future comprehensive studies to determine the hazardous doses of microplastic exposure, especially the polyethylene type.

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Vitamin B1, B6, Chronotype, and Sleep Duration in Patient with Neurotic, Stress and Somatoform Disorders

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Abstract

Sleep disorders are prevalent among individuals with neurotic, stress, and somatoform disorders. Nonetheless, the essential roles of vitamin B1 and B6 in sleep regulation and the insights provided by chronotype on circadian rhythms, and their interplay remains undiscovered in existing research. This study investigates the relationship between vitamin B1 and B6 levels, chronotype, and sleep duration in patients with neurotic, stress, and somatoform disorders. This study took time from December 2022 to January 2023 and recruited 42 patients diagnosed with neurotic, stress, and somatoform disorders and whoever willingly participated in the research. Vitamin B1 and B6 levels were measured using the Liquid Chromatography tandem-mass spectrometry (LC-MS-MS) method, while Chronotype was assessed using the Morningness Eveningness Questionnaire (MEQ). Sleep duration data were collected through structured interviews. The results found no statistically significant relationship between vitamin B1 and B6 levels, chronotype, and sleep duration. However, bivariate analysis revealed significant associations with monthly income (OR=0.21; 95% CI=0.05-0.94; p=0.042) and duration of diagnosis (OR=3.90; 95% CI=1.06-14.38; p=0.041), though this association did not persist in multivariate analysis.

Introduction

Human health consists of physical and mental health, both of which influence each other (Ohrnberger *et al.*, 2017). Neurosis, stress, and somatoform disorders are a group of diagnoses of mental health disorders that are usually accompanied by symptoms of anxiety, depression, and sleep disorders (Sivertsen *et al.*, 2021; World Health Organization, 2019). Sleep disorders are generally often experienced by sufferers of mental health disorders because sleep disorders are widely involved in the transdiagnosis process of several mental health disorders such as depression, anxiety, and stress through circadian rhythm and neurotransmitter mechanisms (Richards *et al.*, 2020). A study states that in general insomnia is more common among people with mental disorders than healthy people, especially women. This study states that 59% of women who suffered from anxiety disorders experienced insomnia. In addition, 74.2% of men who experience eating disorders also experience insomnia (Sivertsen *et al.*, 2021). A review article stated that the results of previous cohort studies were that the prevalence of people who slept <6 hours reached 22.1 - 53.3% (Matsumoto & Chin, 2019; Matsumoto *et al.*, 2018; Mossavar-Rahmani *et al.*, 2017). Other research also states that 52.6% of the global population affected by the COVID-19 pandemic experiences insomnia (AlRasheed *et al.*, 2022).

Sleep is a necessity for living creatures, including humans, so the brain can work optimally. The benefit of sleep is basically to replenish glycogen in the brain, which

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decreases when awake. After that, energy will be formed and spent at night to maintain body temperature to stay warm amidst cold environmental temperatures. Lack of sleep over a long period can result in severe physical and cognitive disorders or can even lead to death. Sleep duration is one of the parameters that can be used to measure sleep adequacy in a day because it reflects the sleep stage. Sleep stages consist of non-rapid eye movement (NREM) and rapid eye movement (REM) stages. When someone sleeping, he usually goes through the NREM stage for approximately 60-80 minutes and the REM stage for 15-40 minutes. In NREM stages 1 and 2, a person can usually still hear sounds from outside, so it is easy to wake up again. While in NREM stages 3 and 4, a person usually starts to forget or is not aware of their surroundings, and in the REM stage, a person usually enters the dream phase. The REM stage is a sleep stage that is qualitatively different, characterized by high brain activity and a level of physiological activity similar to that of a person who is awake. (Purves *et al*., 2004; Sadock, 2015).

Recommendations for good sleep duration vary depending on a person's age. Newborn babies are said to get enough sleep if they reach 16-17 hours a day, while teenagers are said to get enough sleep if they reach 9 hours a day (Purves *et al*., 2004). Adults can be said to be getting enough sleep if their sleep duration reaches 7-8 hours a day. So if someone sleeps less than the recommended time, this can result in serious physical and cognitive disorders or even death (Sadock, 2015). Previous research states that anxiety symptoms can increase in groups of people with shorter and longer sleep duration (Peng *et al*., 2021). Other research states that lack of sleep duration can increase anxiety symptoms the next day (Bean & Ciesla, 2021).

Vitamins B1 and B6 are nutrients that have an important role in the neuronal system. A study states that vitamin B1 plays an important role in the synthesis of myelin and several neurotransmitters such as acetylcholine, serotonin, and gamma amino butyric acid (GABA) (Calderón-Ospina & Nava-Mesa, 2020; Sharma & Bist, 2018) where acetylcholine is also involved in the production REM stage in the brain (Sadock, 2015) and GABA are involved in the process of circadian rhythm regulation (Ono *et al*., 2018). Other research states that low intake of thiamine (vitamin B1) is associated with longer sleep duration (more than 9 hours a day) (Lee *et al*., 2022). Vitamin B6 is also indirectly involved in the synthesis of the neurohormone melatonin which can stimulate the body to become sleepy (Purves *et al*., 2004). A study states that a combination of melatonin, vitamin B6, and medicinal plants can improve sleep onset latency, sleep quality, and daytime function disabilities ((Lemoine *et al*., 2019). Other research also states that poly-gamma-glutamic acid supplementation and vitamin B6 can increase sleep duration and improve sleep quality (García-García & Baik, 2021). Previous research also states that vitamin B6 levels are negatively related to short sleep duration, while high vitamin B6 levels are often found in groups of people with long duration. sleep normally (Ge *et al*., 2022).

Another factor that influences sleep duration is the circadian rhythm. Circadian rhythms are endogenous oscillations or human biological clocks that run based on the Earth's 24-hour rotation or specifically, based on temperature and light (Waddell *et al*., 2023; Yoshida *et al*., 2023). Circadian rhythms in humans describe several complex phenotypes composed of various genes and form a chronotype, where human chronotypes are categorized into morningness, eveningness, and intermediate chronotypes (Montaruli *et al*., 2021). A study states that people with eveningness chronotypes and tending to eveningness are significantly associated with longer sleep duration than those with morningness chronotypes (Merikanto & Partonen, 2020). Other research states that the chronotype tends to be eveninger, which is directly related to a higher BMI and indirectly related to insufficient sleep duration (Anothaisintawee *et al*., 2018). So far there has been no research that combines the variables of vitamin B1, B6, and chronotype levels and analyzes their relationship with sleep duration, especially in people with mental health disorders, so researchers are interested in analyzing the relationship between vitamin B1 and B6 levels and sleep duration in people with

mental health disorders.

Methods

This research method is quantitative observation with a cross-sectional design. This research was declared ethically appropriate on November 7, 2022, by the ethics committee of the Faculty of Medicine, Sebelas Maret University. This research was conducted for two months, from December 2022 to January 2023, at RSJD Dr. Arif Zainuddin Surakarta. The population of this study was all patients with mental health disorders who underwent outpatient therapy and consultation at the Executive Psychology Building of RSJD Dr. Arif Zainuddin Surakarta. The inclusion criteria in this study were patients who were included in the neurosis, stress, and somatoform diagnosis groups, aged 18-59 years, domiciled in Solo Raya, able to communicate well, and agreeing to take part in the research as proven by signing an informed consent. The independent variables in this study were vitamin B1, B6 levels, and chronotype, while the dependent variable was sleep duration. Data collection on vitamin B1 and B6 levels is carried out by taking blood samples. Then, the samples will be analyzed using the Liquid Chromatography tandem-mass spectrometry (LC-MS-MS) method. Data regarding chronotype was obtained by filling out the Morning Eveningness Questionnaire (MEQ) independently of the respondent, while data regarding sleep duration was collected by interviewing the respondent. Sleep duration was divided into three groups, namely <7 hours, 7-8 hours, and >8 hours. The ordinal logistic regression method was used to analyze the relationship between each respondent's characteristics, vitamin B1 and B6 levels, and chronotype with sleep duration.

Results and Discussion

This research was attended by 42 respondents aged 18-59 years, 67.4% of whom were adults. 66.7% were women, 62.8% were single, 64.3% were high school graduates, 41.9% were students, and 45.2% had an income of IDR 0 - <1 million. Diagnosis and treatment duration for most respondents was less than one year, and the majority's sleep duration was less than 7 hours a day. An overview of the characteristics of respondents is in Table 1.

The results of the analysis of the relationship between respondent characteristics, vitamins B1 and B6 levels, and chronotype with sleep duration using simple ordinal logistic regression are summarized in Table 2.

Table 1. Respondents Characteristics

Respondents Characteristics	Sleep duration category			
	<7 hours (n=18)	hours (n=23)	>8 hours (n=1)	Total (n=42)
Gender, n (%)				
Male	7 (38,9)	7 (30,4)	0 (0,0)	14 (33,3)
Female	11 (61,1)	16 (69,6)	1 (100,0)	28 (66,7)
Age, n (%)				
<20 years	7 (38,89)	6 (26,09)	0 (0,0)	13 (30,95)
20-44 years	8 (44,44)	13 (56,52)	1 (100,0)	22 (52,38)
45-59 years	3 (16,67)	4 (17,39)	0 (0,0	7 (16,67)
Marital Status, n (%)				
Married	4 (22,22)	10 (43,48)	0 (0,0)	14 (33,33)
Single/Divorce	14 (77,78)	13 (56,52)	1 (100)	28 (66,67)
Education, n (%)				
Elementary	2 (11,11)	2 (8,7)	0 (0,0)	4 (9,52)
Junior High	0 (0,0)	1 (4,35)	0 (0,0)	1 (2,38)
Senior High	12 (66,67)	15 (65,22)	0 (0,0)	27 (64,29)
College	4 (22,22)	5 (21,74)	1 (100)	10 (23,81)

Respondents Characteristics	Sleep duration category			
	<7 hours (n=18)	hours (n=23)	>8 hours (n=1)	Total (n=42)
Occupation, n (%)				
Housewife	2 (11,11)	3 (13,04)	0 (0,0)	5 (11,9)
College student	8 (44,44)	11 (47,83)	0 (0,0)	19 (45,24)
Entrepreneur	2 (11,11)	4 (17,39)	0 (0,0)	6 (14,29)
Government Employee	6 (33,33)	4 (17,39)	1 (100)	11 (26,19)
Private Worker	0 (0,0)	1 (4,35)	0 (0,0)	1 (2,38)
Income, n (%)				
Rp 0 - <1 million	5 (27,78)	13 (56,52)	1 (100)	19 (45,24)
Rp 1 - <2 millions	8 (44,44)	5 (21,74)	0 (0,0)	13 (30,95)
Rp 2 - <5 millions	4 (22,22)	4 (17,39)	0 (0,0)	8 (19,05)
Rp 50 - <10 millions	1 (5,56)	1 (4,35)	0 (0,0)	2 (4,76)
Diagnosed period, n (%)				
< 1 year	13 (72,22)	10 (43,48)	0 (0,0)	23 (54,76)
≥ 1 year	5 (27,78)	13 (56,52)	1 (100)	19 (45,24)
Treatment period, n (%)				
< 1 year	12 (66,67)	12 (52,17)	0 (0,0)	24 (57,14)
≥ 1 year	6 (33,33)	11 (47,83)	1 (100)	18 (42,86)
Chronotype, n (%)				
morningness	6 (33,33)	13 (56,52)	0 (0,0)	19 (45,24)
intermediate	9 (50,0)	8 (34,78)	1 (100)	18 (42,86)
eveningness	3 (16,67)	2 (8,70)	0 (0,0)	5 (11,90)
vitamin B1 level (ng/mL)				
Average ± SD	57,3 ± 18,5	65,2 ± 25,0	78,1 ± 0	62,3 ± 22,4
median (IQR)	32,7 (25,6 – 96,8)	39,1 (30,2-119)	0 (78,1-78,1)	32,6 (25,6-119)
vitamin B6 level (ng/mL)				
Average ± SD	35.4 ± 29.2	33,3 ± 24,03	26,6 ± 0	34,07 ± 25,8
median (IQR)	17,8 (9,4– 100)	10,5 (12,1-100)	0 (26,6-26,6)	10,5 (9,4 – 100)

SD, standard deviation; IQR, interquartile range

Table 2 shows that compared to the group of respondents with income below 1 million, the income group of IDR 1 - < 2 million is significantly related to sleep duration (p = 0.042). For a change in income level from Rp. <1 million to Rp 1-2 millions, then the *odds* or chance of sleep duration category > 8 hours compared to category combination of 7 hours and 7-8 hours will be 0,21 time lower, assuming that other variables in the bivariate model remain constant. Likewise, the odds for the IDR 1-2 million income group for the combination of the 7-8 hour and 8 hours sleep duration categories will be 0.21 times compared to the <7 hours category. The cutoff value for changing from the <7 hours category to a combination of the 7-8 hours and >8 hours category is -1.08, while the cutoff value for changing from the combination of the <7 hours and 7-8 hours category to the >8 hours category is 3. 18. Thus, we obtained two empirical models of the relationship between sleep duration and income level as follows:

Sleep duration <7 hours *versus* [7-8 hours + >8 hours]:

Log odds sleep duration = -1,08 +0,21 (income Rp 1-2 million)

Sleep duration [<7 hours and 7-8 hours] *versus* >8 hours:

Log odds sleep duration = 3,18 + 0,21 (income Rp 1-2 millions)

Table 2 also indicates that the duration of being diagnosed with a mental health disorder ≥ 1 year is significantly related to sleep duration (p=0.041). For a diagnosis duration of ≥ 1 year, the odds for the sleep duration category > 8 hours compared to the combination of the categories < 7 hours and 7-8 hours will be 3.9 times greater, provided other variables in the model remain constant. Based on the proportional

Table 2. Relationship between Respondent Characteristics, Vitamins B1 and B6 Levels, and Chronotype with Sleep Duration

Respondents Characteristics	Odds ratio (OR)	IK 95%	p-value
Gender			
Male (reference category)	1		
Female	1.63	0.46 - 5.85	0.450
Age			
<20 years (reference category)	1		
20-44 years	2.19	0.55 - 8.72	0.267
45-59 years	1.52	0.25 - 9.31	0.651
Marital Status			
Married (reference category)	1		
Single/divorce	0.47	0.13 - 1.74	0.259
Education			
Elementary (reference category)	1		
Junior High	8.02	0.06 - 1042.55	0.402
Senior Hig	1.24	0.16 - 9.77	0.841
College	1.89	0.18 - 19.58	0.593
Occupation			
Housewife (reference category)	1		
College Student	0.92	0.13 - 6.46	0.936
Entrepreneur	1.29	0.12 - 13.76	0.831
Government Employee	0.68	0.08 - 5.70	0.725
Private Worker	5.48	0.05 - 654.35	0.485
Income			
< Rp 1 million (reference category)	1		
Rp 1 - <2 millions	0.21	0.05 - 0.94	0.042*
Rp 2 - <5 millions	0.33	0.06 - 1.81	0.202
Rp 5 - 10 millions	0.33	0.02 - 6.104	0.457
Diagnosed period			
<1 year(reference category)	1		
≥ 1 year	3.90	1.06 - 14.38	0.041*
Chronotype			
morningness (reference category)	1		
intermediate	0.55	0.15 - 2.04	0.373
eveningness	0.33	0.05 - 2.47	0.282
vitamin B1 level (ng/mL)	1.02	0.99 - 1.05	0.190
vitamin B6 level (ng/mL)	1.00	0.97 - 1.02	0.739

OR, odds ratio; CI 95%, Convidence Interval 95%.

odds assumption, the same increase of 3.9 times was also found between the categories of sleep duration <7 hours with a combination of 7-8 hours and >8 hours. In the length of diagnosis variable, the cutoff value for changing from the combination of the categories <7 hours and 7-8 hours to the category > 8 hours is 4.54 so that an empirical model of the relationship between sleep duration and time of diagnosis is obtained as follows:

Sleep duration <7 hours *versus* [7-8 hours + >8 hours]:

Log odds sleep duration = 0,28 + 3,90 (diagnosed ≥ 1 a year)

Sleep duration [<7 hours and 7-8 hours] *versus* >8 hours:

Log odds sleep duration = 4,54 + 3,90 (diagnosed ≥ 1 a year)

Multivariate analysis was carried out to find the influence of respondent characteristics that were significant in bivariate analysis on the dependent variable simultaneously, where in this study, the relationship between income level and time of diagnosis was analyzed, together with sleep duration. The results of multivariate analysis with multiple ordinal logistic regression will be presented in Table 3.

Multivariate analysis was carried out to find the influence of respondent characteristics that were significant in bivariate analysis on the dependent variable simultaneously, where in this study, the relationship between income level and time of diagnosis was analyzed, together with sleep duration. The results of multivariate analysis with multiple ordinal logistic regression are in Table 4.

The results of the multivariate analysis showed that the variables income and length of diagnosis together did not have a significant relationship with sleep duration in patients with neurosis, stress, and somatoform disorders. Sleep duration is an important health parameter to pay attention to because it is related to a person's neurocognitive development. If someone experiences a deficiency in sleep duration can result in cognitive and emotional dysfunction (Hehr *et al*., 2023). The results of this study show that income level and time of diagnosis are two variables that are each significantly related to sleep duration in sufferers of neurosis, stress, and somatoform disorders, but no longer show statistical significance when both are analyzed simultaneously. In addition, the results of the study confirmed that the variables of vitamin B1, B6, and chronotype levels were not significantly related to sleep duration. Previous research states that sleep duration can be influenced by several factors such as gender (Wehrmeister *et al*., 2020), age (Cassidy *et al*., 2023; Lu *et al*., 2021; Wang *et al*., 2017), income

Table 3. Results of Analysis of the Influence of Respondent Characteristics on Sleep Duration Simultaneously

Respondents Characteristics	Odds ratio (OR)	CI 95%	p-value
Income			
< Rp 1 million (reference category)	0		
Rp 1 - <2 millions	0,24	0,04 – 1,14	0,074
Rp 2 - <5 millions	0,36	0,06 – 2,12	0,258
Rp 5 - 10 millions	0,15	0,006 – 3,22	0,224
Diagnosed period			
< 1 year (reference category)	0		
≥ 1 year	4,10	0,97 – 17,26	0,054
Cutoff Value	**Coefficient**	**CI 95%**	
7 hours versus [7-8 hours & >8 hours]	-0,48	-1,66 – 0,70	
[7 hours & 7-8 hours] versus >8 hours	4,07	1,79 – 6,35	

OR, odds ratio; CI 95%, Convidence Interval 95%

Table 4. Results of Analysis of the Influence of Respondent Characteristics on Sleep Duration Simultaneously

Respondents Characteristics	Odds ratio (OR)	CI 95%	p-value
Income			
< Rp 1 million (reference category)	0		
Rp 1 - <2 millions	0,24	0,04 – 1,14	0,074
Rp 2 - <5 millions	0,36	0,06 – 2,12	0,258
Rp 5 - 10 millions	0,15	0,006 – 3,22	0,224
Diagnosed period			
< 1 year (reference category)	0		
≥ 1 year	4,10	0,97 – 17,26	0,054
Cutoff Value	**Coefficient**	**CI 95%**	
7 hours *versus* [7-8 hours & >8 hours]	-0,48	-1,66 – 0,70	
[7 hours & 7-8 hours] *versus* >8 hours	4,07	1,79 – 6,35	

OR, odds ratio; CI 95%, Convidence Interval 95%

(Cassidy *et al*., 2023; Wehrmeister *et al*., 2020), marital status (Wang *et al*., 2017), mental health status (Lu *et al*., 2021; Wehrmeister *et al*., 2020), cigarette and alcohol consumption (Gong *et al*., 2017; Lu *et al*., 2021), as well as chronotype (Nowakowska-Domagała *et al*., 2022).

There are not many studies analyzing the relationship between vitamin B1 and sleep duration, especially in people with neurosis, stress, and somatoform disorders. The results of this study are not in line with previous research, which states that there is a significant relationship between vitamin B1 levels and sleep duration and that vitamin B1 levels have a negative relationship with sleep duration, which means that low vitamin B1 levels are associated with longer sleep duration and vice versa (Lee *et al*., 2022). This research differs from previous research in terms of the study population. Previous research involved groups without mental disorders as respondents. Meanwhile, this study involved patients with neurosis, stress, and somatoform disorders who had different exposures to environmental stress as well as disorders of brain structure and chemical compounds (neurotransmitters) (Sadock, 2015). One of the symptoms of anxiety in patients with neurosis, stress, and somatoform disorders is influenced by disorders of neurotransmitters such as serotonin and gamma amino butyric acid (GABA), both of which play an important role in sleep regulation in humans. Serotonin is a precursor to melatonin, a neurohormone that triggers sleepiness (Okoshi *et al*., 2014; Purves *et al*., 2004). Other research suggests that decreasing levels of the neurotransmitter GABA can increase activity in the anterior cingulate cortex or medial prefrontal cortex which can result in insomnia and hyperarousal (Park *et al*., 2020). Apart from that, previous research stated that the influence of vitamin B1 levels on sleep duration was strengthened by the behavior of respondents who had a high tendency to consume alcohol (Lee *et al*., 2022).

This study also found that vitamin B6 did not have a significant relationship with sleep duration, which is in line with previous research which stated that giving vitamin B6 supplements did not have a relevant effect on sleep indicators such as sleep quality, nighttime wakefulness, and feeling tired after waking up. Sleep. The insignificant results in this study were probably because most respondents belonged to a group of people with sufficient vitamin B6 levels (>30 ng/mL). The results might be different if carried out in a group with vitamin B6 deficiency. (Adventure-Heart *et al*., 2018).

This study shows that chronotype does not significantly relate to sleep duration. Previous research shows varying results, one of which states that chronotype modulates sleep duration, sleep quality, and social jet lag (Juda *et al*., 2013). Other research states that there is a tendency for sleep disorders and short sleep duration in the eveningness group, which may not only be influenced by chronotype factors but may also be influenced by symptoms of depression and anxiety (Salfi *et al*., 2022; Zou *et al*., 2022). The results of this study show that the largest distribution of respondents was in the normal sleep duration group, namely 7-8 hours, so the research results could be different when the research was carried out specifically in the group with short sleep duration.

This research shows that the income variable of IDR 1 million per month shows a significant bivariate relationship with sleep duration. The income category of IDR 1 million per month can be said to be low because the Regency/City Minimum Wage (UMK) is IDR 2,174,162. Previous research states that the monthly income variable has a significant effect on sleep duration (Lallukka *et al*., 2012; Nyarko *et al*., 2023; Peng & Wu, 2022). One study states that groups with low incomes are likely to give up their sleep time to obtain more education or training to increase their abilities and income in the future. In addition, it is possible that low-income groups tend to increase their leisure time to compensate for the time spent working (Peng & Wu, 2022).

This research also shows that the variable length of time diagnosed with a mental health disorder has a significant bivariate relationship with sleep duration. This relationship could be mediated by the anxiety symptoms experienced by the respondent. Previous research states that people with anxiety disorders generally experience shorter sleep duration (Albrecht-Bisset *et al*., 2023; Kim *et al*., 2022; Roberts & Duong, 2017). Other research states that a

sleep duration of more than 8.5 hours a day is associated with reduced symptoms of depression and/or anxiety (Ojio *et al*., 2016). Not many studies have analyzed the exact mechanisms underlying the relationship between anxiety disorders and sleep duration, but several studies have stated that anxiety disorders and sleep regulation are both influenced by the work of neurotransmitters and circadian rhythms (Sadock, 2015). The neurotransmitter serotonin acts as a precursor for metonin, a neurohormone that stimulates sleepiness, while the neurotransmitter dopamine works the opposite, namely reducing melatonin levels according to light stimulation (Lee *et al*., 2021; Richards *et al*., 2020). Other research states that the relationship between anxiety disorders and sleep disorders is influenced by genetic factors, social environment, hormones, regulatory systems such as the HPA axis (hypothalamus-pituitary-adrenal), and cognitive processes such as cognitive arousal (Roberts & Duong, 2017).

Previous research stated that the average duration of someone suffering from anxiety disorders was 15.2 months with a range of 6-36 months. Anxiety symptoms generally decrease gradually over time. The length of time a person experiences an anxiety disorder is influenced by factors such as being older, not having a job, having a higher neuroticism score, experiencing physical health problems, and experiencing a decline in physical function (Ten Have *et al*., 2021). Neuroticism is a personality concept related to anxiety, worry, moodiness, and negative emotions (Friedman, 2019). A limitation of this research is that it did not dig deeper into the data regarding respondents' food intake, especially consumption of food sources of vitamin B1. Apart from that, this study also did not analyze in more depth the mediating role of anxiety symptoms in the relationship between length of diagnosis and sleep duration in patients with neurosis, stress, and somatoform disorders.

Conclusion

This study analyzed the relationship between levels of vitamins B1 and B6, and chronotype with sleep duration in patients experiencing neurosis, stress, and somatoform disorders. The results of this research analysis state that there is no significant relationship between levels of vitamins B1 and B6 and chronotype and sleep duration, but there is a significant relationship between monthly income and length of diagnosis and sleep duration in patients with neurosis, stress, and somatoform disorders. This research provides additional insight into the relationship between nutrition and sleep characteristics in individuals who experience certain mental health disorders so that these findings are expected to provide a strong basis for the development of further research in this area and provide useful directions in efforts to prevent and/or treat neurosis disorders, stress, and somatoform

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The Effect of the SAMRY Model (Mahfudzat Adaptation Stress and Guided Imagery) on Nurse Work Stress

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Abstract

Nurses' work stress must be managed well. Work stress can affect nurses' performance, reduce service quality, and cause turnover intention. The 2018 PPNI survey showed that 50.9% of Indonesian nurses experienced work stress. A preliminary study at K.R.M.T Wongsonegoro Hospital Semarang of 10 nurses in special units stated that 90% experienced work stress. The SAMRY (Stress Adaptation and Guided Imagery) model can reduce nurses' work stress. This technique combines the application of the concepts of mahfudzat and guided imagery so that it can create relaxation distractions and increase adaptive coping patterns. This research aims to determine the effect of the SAMRY model on nurses' work stress. The research method uses a pre-experiment with a pre-post-test one-group design. The population is 223 nurses who work in special units. Sample of 35 respondents using a purposive random sampling technique. Data collection was carried out by assessing work stress pre and post-intervention. The research instrument used the Expanded Nursing Stress Scale (ENSS) questionnaire. The results of the study reported an average pre-intervention work stress score of 114 and post-intervention 78.26. Data analysis using the paired sample t-test obtained p-value=0.000 (p<0.05). It can be concluded that there is an influence of the SAMRY model on nurses' work stress.

Introduction

Work stress is a stressful condition that arises due to work demands that exceed a person's ability to cope, giving rise to various physiological, psychological, and behavioral reactions (Kokoroko and Sanda, 2019). A survey conducted by PPNI in 2018 stated that 50.9% of nurses in Indonesia experienced work stress. A study on stress and resilience in the workplace conducted in Australia showed that nurses experienced moderate to high levels of stress (Badu *et al.*, 2020). Research on the prevalence and relationship between work stress and *burnout* conducted in the United States during the Covid-19 pandemic odds of stress and burnout were 49% lower in those who felt valued by their organization (odds ratio 0.60, 95% CI [0.58, 0.63], p<0.001) (Prasad *et al.*, 2021). Nurses aged 30-34 years expressed the highest stress (Chatzigianni *et al.,* 2018).

In a preliminary study by researchers on five executive nurses in the ER and five executive nurses in the IBS K.R.M.T. Wongsonegoro Hospital, Semarang City, we found that 90% of nurses stated they experienced work stress. Adaptation stress model *guided imagery* at KRMT Wongsonegoro Hospital, Semarang City, so far it has never been applied to nurses, but only applied to patients to reduce the pain scale. *Mahfudzat* which has been implemented in the form of the motto "Serve with Sincerity", and the slogan which reads "Religious, Integrity, Professional, Innovative", as well as the employee motto

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BERAKHLAK (Service Oriented, Accountable, Competent, Harmonious, Loyal, Adaptive and Collaborative). The implementation and evaluation of hospital slogans and slogans have not been carried out in a structured and documented manner, so maximum results have not been achieved.

The stress adaptation model uses *mahfudzat* given by means of guided imagination*(guided imagery)* becomes a challenging model to experiment with. *Mahfudzot* are Arabic pearls of wisdom with deep meaning, wise values, ideas, motivation, and solutions, which can stimulate positive energy and *inner power* (Andi, 2019). Guided imagination (*guided imagery*) is a relaxation technique that aims to reduce stress and increase feelings of calm and peace and is a sedative for difficult situations in life (Moriya, 2018). Mc Kinney's research examines the effects of *guided imagery* on mood and cortisol, the results of the study concluded that *guided imagery* can positively influence mood and reduce blood cortisol levels. Mc Kinney's second research shows that guided imagination can stimulate peripheral endorphin levels which stimulate feelings of happiness (Alharbi and Alshehry, 2019). Researchers will conduct research on the implementation of the SAMRY model, namely the stress adaptation model which combines applications*mahfudzat* and guided imagination *(guided imagery),* then look at its effect on nurses' work stress levels.

Method

This research is quantitative, with methods *pre-experiment pre-post test one group design.* The population of this study was all nurses working in the special unit of K.R.M.T Wongsonegoro Hospital, Semarang City in 2023, totaling 223 people. Samples were taken by calculating the hypothesis test against the average of 1 population, resulting in 31 samples with estimates *dropping out* 10% so the total sample is 35. Researchers took samples by*purposive random sampling,* namely by selecting certain strata in the population (Harsono *et al.,* 2017). The inclusion criteria for this study were nurses working at K.R.M.T Wongsonegoro Hospital, Semarang City in 2023, nurses working in special units (Emergency Installation, Intensive Care Unit, Pediatric Intensive Care Unit, Neonatal Intensive Care Unit, Perynatology, Central Surgical Installation, and Anesthesia Unit), nurses with 1-10 years of service, nurses with non-ASN status, nurses aged 25-40 years, nurses who work in shifts, and executive nurses. The exclusion criteria for this study were nurses on leave or sick and nurses who were not willing to be respondents.

The research was conducted at K.R.M.T Wongsonegoro Hospital, Semarang City, for six months (August to January 2023). This research variable consists of the dependent variable, namely nurse work stress, and the independent variable, namely the SAMRY model. The research instrument used a questionnaire *Expanded Nursing Stress Scale* (ENSS) to measure nurses' work stress. ENSS *(Expanded Nursing Stress Scale)* uses a ratio scale to determine nurses' work stress with a total of 57 questions (Fasbender, *et* al., 2019) developed from NSS *(Nursing Stress Scale)* (Mert, Aydin Sayilan and Baydemir, 2021). The Indonesian version of the ENSS has been tested for validity, reliability, and internal stability with satisfactory results. So this instrument can be used to assess work stress in nurses in Indonesia (Harsono *et al.*, 2017). Data collection was carried out by researchers by asking respondents to fill out the ENSS questionnaire at the pre-intervention stage. Then, researchers conducted SAMRY model training followed by independent practice for two weeks. In the post-intervention stage, respondents filled out the ENSS questionnaire again to determine nurses' work stress after the SAMRY model intervention. Researchers compiled a SAMRY model reference book which was reviewed by *experts* and has been published. Then, the reference book is used as the respondents' guide in applying the SAMRY model.

Results and Discussion

Table 1 shows that the respondents used by researchers, according to the inclusion criteria, were aged between 25-40 years, with their average age being 30.6 (*SD* 3.5) years. The gender of respondents was predominantly male (62.9%), while 37.1% were female.

Table 1. Frequency Distribution of Respondent Characteristics at K.R.M.T Wongsonegoro Hospital, Semarang City, 2023 (n=35)

Characteristics	Categories	Amount	%	Min	Max	Mean±SD
Age	Early adulthood (20-40 years)	35	100%	25	34	30,6±3,5
Gender	Man	22	62,9%			
	Woman	13	37,1%			
Marital status	Marry	23	65,7%			
	Not married yet	12	34,3%			
Education	D III	18	51,4%			
	Ners	17	48,6%			
Working time	1-10 years	35	100%	1	10	5,26±2,8
Personality type	Extrovert	12	34,3%			
	Introvert	23	65,7%			

Source : Primary Data (2023)

Table 2. Job Stress Score of Nurses at K.R.M.T Wongsonegoro Hospital Semarang City Pre and PostSAMRY Model Intervention, Year 2023 (n=35)

	n	Score Minimum	Score Maximum	Mean	SD
Pre-intervention	35	47	193	114	37,351
Post-intervention	35	21	181	78,26	37,065

Source : Primary Data (2023)

Respondents' education showed almost the same number, namely D III nursing as much as 51.4%, and nursing education as much as 48.6%. Respondents' work period was between 1-10 years with an average value of 5.26 (*SD* 2.8) years. Characteristics of respondents based on marital status showed that 65.7% were married and 34.3% were unmarried. Respondents were given a personality questionnaire to determine their personality type. The results of the questionnaire assessment showed that 34.3% of respondents had extroverted personalities, and 65.7% had introverted personalities.

Table 2 shows the nurses' work stress assessment scores measured using a questionnaire *Expanded Nursing Stress Scale* (ENSS) at the pre-intervention stage with a minimum score of 47 and a maximum score of 193, an average score of 114 (*SD*=37,351). The assessment at the post-intervention stage resulted in a minimum score of 21 and a maximum score of 181, with an average score of 78.26 (*SD*=37,065). The average pre-intervention and post-intervention scores showed a decrease from 114 to 78.26. The difference in the average score pre and post-intervention was 35.74.

Table 3 shows that the pre-intervention assessment of nurses with normal stress was 1 person (2.86%), mild stress was 12 people (34.29%), moderate stress was 18 people (51.43%) and severe stress was 4 people (11, 43%). The assessment carried out after the intervention showed that there were 12 nurses with normal stress (34.29%), 16 people with mild stress (45.71%), 6 people with moderate

Table 3. Job Stress Categories of Nurses at K.R.M.T Wongsonegoro Hospital Semarang City Pre and Post SAMRY Model Intervention in 2023 (n=35)

	Stress Category			
	Normal (0-57)	Light (58-114)	Medium (115-171)	Heavy (172-228)
Pre-intervention	1 (2,86%)	12 (34,29%)	18 (51,43%)	4 (11,43%)
Post-intervention	12 (34,29%)	16 (45,71%)	6 (17,14%)	1 (2,86%)

Source : Primary Data (2023)

Table 4. Job Stress Categories of Nurses at K.R.M.T Wongsonegoro Hospital Semarang City based on Respondent Characteristics, at the Pre and Post-Intervention Stages of the SAMRY Model in 2023 (n=35)

Characteristics		Pre and Post-Intervention Job Stress Categories (n=35)									
		Normal (0-57)		Light (58-114)		Currently (115-171)		Heavy (172-228)		Total	
		pre	post	pre	post	pre	post	pre	post	pre	post
Age	20-30 th	0	5	5	9	10	3	3	1	18	18
	31-40 th	1	7	9	7	6	3	1	0	17	17
	Total	1	12	14	16	16	6	4	1	35	35
Gender	Man	1	8	10	12	7	1	4	1	22	22
	Woman	0	4	4	4	9	5	0	0	13	13
	Total	1	12	14	16	16	6	4	1	35	35
Marital status	Marry	1	9	9	10	11	4	2	0	23	23
	Not yet	0	3	5	6	5	2	2	1	12	12
	Total	1	12	14	16	16	6	4	1	35	35
Education	D III	1	6	3	7	13	5	1	0	18	18
	Ners	0	6	11	9	3	1	3	1	17	17
	Total	1	12	14	16	16	6	4	1	35	35
Working time	1-5 th	0	4	8	9	8	4	2	1	18	18
	>5-10th	1	8	6	7	8	2	2	0	17	17
	Total	1	12	14	16	16	6	4	1	35	35
Personality type	Introvert	0	7	8	12	12	3	3	1	23	23
	Extrovert	1	5	6	4	4	3	1	0	12	12
	Total	1	12	14	16	16	6	4	1	35	35

Source : Primary Data (2023)

stress (17.14%), and 1 person with severe stress (2, 86%). The average score of the 35 respondents was 114 (*SD*=37.35) at pre-intervention and 78 (*SD*=37.06) at post-intervention.

Statistical test to determine the effect of the SAMRY model intervention on work stress of nurses at K.R.M.T Wongsonegoro Hospital Semarang City using *paired sample t-test,* with a significance value of 0.000 (*p-value*< 0.05), we concluded that there is a significant influence of the SAMRY model intervention on nurses' work stress. The results of research data processing showed that the average pre-intervention nurse work stress value was 114 (SD=37.35). As many as 18 nurses (51.43%) experienced moderate work stress and 4 people (11.43%) experienced severe work stress. These results are supported by previous research where nurses face serious challenges in their work. Nursing is a very demanding and stressful profession (Mohamed *et al.*, 2019)this study showed significantly high level of both blood oxidative biomarkers as both levels of MDA, [Median (3.18. Work stress is a realistic phenomenon and is widespread among nurses throughout the world (Mohamed *et al.*, 2019)this study showed significantly high level of both blood oxidative biomarkers as both levels of MDA, [Median (3.18. Other research that supports this opinion was carried out by Oktovin in several hospitals and health centers in Indonesia reporting the same thing, namely that the majority of nurses experienced mild and moderate levels of work stress (Hendy *et al.*, 2021). Almazan explored the work-related stress of nurses in acute care hospitals in KSA using the PSS-14 (perceived stress) questionnaire, with 164 respondents reporting overall nurses had moderate levels of stress (Almazan, Albougami and Alamri, 2019). Sulistyawati, in her study on stress levels of nurse work with work *shift* In the emergency room at Karangasem Regional Hospital, it was reported that 87.1% of nurses experienced moderate levels of work stress (Sulistyawati, Purnawati and Muliarta, 2019).

Factors that contribute to the occurrence of work stress among nurses include the number of working hours per week, work

fatigue, working in special units (surgical rooms, ICU) and the front line (emergency unit), the ratio of nurses to patients, nurses with a shift work system, nurses with female gender, period of having and caring for children, fear of contracting infection, negative public stigma towards COVID-19, inadequate availability of PPE, lack of hospital attention to nurses, and conflicts with doctors (Lambert *et al.*, 2004). Respondents who underwent the SAMRY model intervention using training, demonstration, and independent practice methods showed a reduction in work stress. Respondents showed changes in coping while applying the SAMRY model, as evidenced by observations from researchers when respondents carried out daily tasks in the hospital. Researchers observed that respondents were more patient in dealing with conflicts that occurred during work, reduced high-pitched and unhelpful remarks, respected co-workers more, and were more communicative. Observations of other respondents showed that nurses carried out additional tasks given by their superiors sincerely and responsibly, did not complain, and did not compare them with their friends' lighter work.

Research supporting this suggests that the implementation of *mahfudzat* in aspects of life will bring many benefits, especially increasing effective coping (Braun-Lewensohn and Mayer, 2020). Applying concepts *mahfudzat*. It cannot be done immediately in a short time, but it requires a process. The formation of human character must be instilled from an early age, religious values are instilled as a foundation, and seeking knowledge is mandatory (Jurado *et al.*, 2019). The Koran views people with knowledge in a high and noble position, therefore enthusiasm and sincerity in seeking knowledge must be firmly built in the heart (Sugirma, 2020). Formal education, especially in Islamic boarding schools, requires every student to memorize Arabic proverbs known as *mahfudzat* as a medium for generating enthusiasm for students (Abdurrahman and Muqorobin, 2018). Strengthening based on character education *golden habits* One of them is done by implementation *mahfudzat*. Sugirma's research (2020) supports this opinion that studying and applying *mahfudzat*it must be accompanied by a balance in life in the afterlife and prioritizing morals so that it can have an effect on improving good coping according to the teachings of the religion one believes in (Sugirma, 2020).

Research that examines the influence *of guided imagery* looks at its effect on final-year students' stress in completing their thesis. Research that examines the influence *of guided imagery* on nurses' work stress has never been done, but theories in various previous studies show strengthening (Pohan & Kustiati, 2021). Anxiety, sleep quality, pain, decreased blood pressure, decreased blood sugar levels, and asthma recurrence are closely related to stress (Marudhar and Josfeena, 2019). Relaxation can reduce stress physiologically (Natsir, Hartiti and Sulisno, 2020). This relaxation will stimulate the brain through imagination, which can directly affect the nervous, endocrine, neuromodulatory, and endorphin systems by reducing the frequency of *heart rate* so that *cardiac output* according to normal rhythm (De Witte *et al.*, 2020). Cortisol plays a central role in metabolism in the body's response to stress, by reducing inflammation, improving analgesia, contributing to immune system function, and maintaining constant blood sugar levels as well as blood pressure (Giordano *et al.*, 2020). Marques' research supports this opinion that there was a significant decrease in blood cortisol after the intervention-guided *imagery* (*p-value* =0.001) (Berridge, 2018). The release of endorphin hormones produces a relaxing, comfortable, and happy feeling (Merakou *et al.*, 2019).

Nurses' coping mechanisms are greatly influenced by beliefs and perspectives. A person's positive perspective in facing life's problems will positively affect their life and vice versa (Lee and Jang, 2020)job stress, and fatigue (explanatory power = 56.7%. Success starts from thinking according to sentences *mahfudzat "man jadda wajada"*, which means whoever is serious will succeed. Strong beliefs provide energy and the strength to find solutions to various problems. The SAMRY model that has been applied by respondents has an influence on increasing the application of hospital mottos, slogans, and slogans, especially in the religious, loyalty, adaptive, and collaborative

aspects. Respondents stated that there had been changes in *mindset* namely complete belief in religious teachings (concept *mahfudzat*) which, if implemented correctly, will bring goodness in this world and the hereafter. Changes in beliefs and relaxation conditions affect nurses' psychology, this results in changes in attitudes and behavior. Nurse loyalty increases along with a sense of gratitude for the blessings received. Nurses accept all of God's decrees with an open heart, resulting in an adaptive and collaborative attitude in carrying out daily tasks (Teixeira *et al.*, 2016).

Previous research on influence *coping training* of coping mechanisms supports this training in coping interventions can help improve *emotion-focused, is family empowerment,* psycho-education, and spiritual programs (Tran *et al.*, 2019). Taylor explains coping as general habits that a person practices to deal with stressful events in certain ways (Prasad *et al.*, 2021). Coping strategies are cognitive and behavioral efforts to regulate internal and external demands that are considered to disturb individual boundaries (Fasbender, Van der Heijden and Grimshaw, 2019). Coping strategies consist of : *emotion focus coping* namely directing emotional control responses in stressful situations and *problem focus coping* namely reducing the demands of a stressful situation or confronting the source of stress (Fasbender *et al.,* 2019). Effective and adaptive coping mechanisms can reduce nurses' work stress. Teixeira's research proves this opinion, problem-focused strategies have been shown to be protective in relation to work stress in hospitals (Rodrigo Garcia Motta, Angélica Link, Viviane Aparecida Bussolaro *et al.*, 2021)Brazil, occurring in 2002-2004, are described. From a total population at risk of 1,359 cattle, 54 1-18-month-old calves from both sexes and several breeds were affected and 50 died spontaneously or were euthanatized while moribund. The highest frequency of cases was in recently weaned calves or calves submitted to other stressing factors. General rates of morbidity, mortality and lethality were respectively 3.97, 3.67 and 92.59%. Clinical courses varied from 3-10 days and included depression, nasal and ocular discharge, grinding of teeth, circling, blindness, fever, nistagmus, trembling, anorexia, dysphagia, drooling, incoordination, head pressing, rough hair coat, tachycardia, tachypnea, abdominal pain, melena, falls, recumbency, opisthotonus, convulsions and paddling. Nineteen calves were necropsied. Necropsy findings were characterized by hyperemia of leptomeninges, swollen rostral portions of the telencephalon, and flattening of frontal lobes gyri; frequently in these frontal areas there were segmental brown-yellow discoloration and softening (malacia. Woo researched problem-focused coping and emotion-focused coping as one of the stress management efforts (Woo and Kim, 2021). The results of Mundung's research and several previous studies reported a significant relationship (*p-value = 0,*001) between coping mechanisms and work stress of nurses (Selbmann *et al.*, 2020)Dothideomycetes, and Eurotiomycetes. The SAMRY model is an effort to increase effective and adaptive coping mechanisms for nurses.

Conclusion

The SAMRY model has a significant influence on reducing work stress for nurses at K.R.M.T Wongsonegoro Hospital, Semarang City, as evidenced by the results of statistical tests *paired sample t-test* with *p-value* = 0.000. The average score for assessing work stress for nurses using the ENSS questionnaire decreased by 35.74 after the SAMRY model intervention was carried out on 35 respondents through training by experts and continued with independent practice for 2 weeks, with a frequency of once every day for 20 minutes.

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Design Laboratory for Developing Students Competencies: Physical Education for Elementary School

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Abstract

Attention to student competence as prospective physical education teachers is very important. Physical education is not only learning about how to maintain health but also how to provide space for students to learn movement skills. Analysis in 2023 shows no laboratory that facilitates a special space for microteaching practice for prospective physical education teacher students at the elementary school level. This research aims to develop a basic physical education movement learning laboratory design for elementary school physical education study program students in 2023. The method used in this research is the research and development method. This type of development research is carried out to produce certain products and test the effectiveness of these products. The results of this research found that the suitability, safety, and usability of the products developed for users received a good response. Five questions addressed to lecturers and students as potential design users showed that on the first question, respondents gave a good response with an average of 72% regarding the placement and use of spatial layout. Next, regarding basic movement coverage, the result was 68.3%. Questions related to the suitability of material outcomes obtained a result of 65.1%. The percentage regarding aspects of ease and safety in use obtained a value of 55%, and regarding the usability and usefulness of the product, a response of 56.5% was obtained. This response concludes that the development product received a good response and support from the lecturers and students of the elementary school physical education study program. Suggestions for further research are the development of a laboratory with the concept of game activities by including elements of tactics and strategy.

INTRODUCTION

The physical education study program is one of the study programs that plays a very important role in improving the physical quality of students and increasing their competence as prospective teachers (Guo, 2020). Talking about physical activity is very important to pay attention to because, through physical activity, we can prevent stress from occurring in children from an early age (Santanu *et al.*, 2023). Apart from that, the important role of physical activity is to reduce the level of obesity that occurs among teenagers (Fauzi *et al.*, 2022). One of the routes that can be used as a place to apply physical activity to teenagers is through educational levels starting from an early age to higher education (Wintle, 2022). A variety of modern techniques and concepts have been applied by higher education to reshape the content and maximize the facilitiesand teaching models of physical education in higher education (Rourke, 2020). The education and skills obtained through physical education students in tertiary institutions are very useful in the future not only for the world of work, but theskills obtained by students during education can also influence user satisfaction (Asún *et al.*, 2020). Physical education in higher education

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can help students build the concept of lifelong education and foster lifelong physical education habits (Indarto *et al*., 2020). Students in physical education colleges continuously improve their physical skills, build scientific awareness of physical education, and rely on college physical education provided by the standardi zation,systematization, and standardization of physical education (Bai & Xia, 2019). Higher education gradually emphasizes the focus on implementing, analyzing, and studying the effectiveness of new educational models based on appropriate competencies to provide to students (Ross *et al*., 2014). Physical education curriculum in higher education generally includes professional knowledge at various levels and directions of learning (Engdahl *et al*., 2023). Physical education study program organizers always facilitate students to be able to maximize professional competence in sports or physical education,and to develop the quality of prospective physical education teachers (Jin, 2018).

Elementary school physical education study program students are certainly required to master professional competencies as physical education teachers (Wilujeng *et al*., 2019). Awareness of innovation must be embedded in them as sports practitioners and education experts. Awareness of innovation is a source of motivation for them as prospective teachers and also for prospective students (Blegur & Lumba, 2022). Physical education study programs in universities will not be effective in capturing the spirit of professional innovation in the field of physical educationand sports without awareness of innovation (Spittle *et al*., 2022). Apart from that, students are also unable to carry out in-depth professional development (Toom *et al*., 2021). The professional innovation abilities of students majoring in physical education must be cultivated to ensure that each student has good work and communication skills, self-awareness, and adaptability (Egan *et al*., 2019). It is very important to ensure that students as prospective physical education teachers have acquired mastery of their general competencies in professional teacher education before they complete their undergraduate education (Yılmaz *et al*., 2020).

The use of innovative teaching approaches is an effective way to provide appropriate educational standards (Qiang *et al*., 2022). Innovative teaching positively influences student performance. It can be created by having a laboratory or space to demonstrate and hone the skills and innovation of prospective physical education teachers (Naz & Murad, 2017). Laboratory experience is a direct interaction with the physical world where scientific tools and research skills are used together with various tools and materials in the development and interpretation of scientific knowledge according to the field (Prabha, 2016). Higher education, as a producer of future generations, is obliged to optimize ideas and improve infrastructure, such as the use of places and sports monitoring in the teaching process (Bayerlein *et al*., 2021).

Elementary School Physical Education is one of the study programs established under the auspices of the Faculty of Sports Science, Semarang State University. Several activities in implementing the lecture process in the study program appear to be in accordance with the curriculum provided. However, if seen in accordance with the theories from previous research results, several points strengthen the identification of problems in the elementary school physical education study program, such as; The Primary School Physical Education Study Program is required to prepare the next generation of prospective physical education teachers for the elementary school level; Students needto be provided with practice space facilities appropriate to their field of science to improve skills and competencies; There is no special practice place for elementary school physical education study programs.

Students are required to be able to master basic scientific materials, in this case physical education, for the elementary school level, which is identical to the variety of basic movement learning for elementary school students, as well as the amount of free space in the actual campus environment will be very useful for students to improve their teaching skills or competence as prospective physical education teachers elementary school. There are many open spaces and areas that can still be utilized as places or study rooms for students.

If the development is carried out, it will be much more useful for the learning activities in elementary school physical education study programs.

Method

This type and design of research is included in development research or Research and Development (R&D). The stages carried out in this research, include; Analysis, Planning (Design), Development, Implementation, and Evaluation. *Analysis*; Researchers do initial observations to study, investigate, and collect information. This step includes needs analysis, review of previous research, initial observations in the field, and identification of existing problems. *Planning*; Researchers create a design plan in the form of an initial product development draft. Several vital aspects in the plan include what the product developed about, the goals and benefits of development, who the product users will be, why it is important to develop the product, where is the location for the development, and what is the development process.

Development; Researchers carry out product designs developed and equipped with product assessment instruments carried out by experts. This development stage is validated by experts regarding the feasibility of the product before the product is implemented in the testing stage in the field. Researchers implement products that have been validated by experts, to potential users of the product to get responses in the form of assessments and suggestions from potential users. The users of this development product are lecturers and students of elementary school physical education study programs. *Implementation;* Researchers disseminate development results after going through the testing and product improvement stages. This implementation is, of course, adjusted to the needs in the field, in this case the elementary school physical education study program. *Evaluation;* Researchers regularly make improvements to products in accordance with developments in the field. The evaluation stage is carried out with the aim of ensuring product development always follows developments in needs in the field.

The research location is in Central Java, within the Universitas Negeri Semarang, with the population in this study being lecturers in the elementary school physical education study program and students in the elementary school physical education study program. The respondents in this study were 30 lecturers who have a scientific field in physical education, and 100 students from elementary school physical education study programs. The sampling technique was carried out using a simple random sampling technique based on the researcher's needs in the field. The instrument in this research uses a validation sheet addressed to open space planning expert and Primary School Physical Education Experts. Each uses five assessment indicators to obtain validation from experts. Green Architecture, Utilization of Open Space, Electrical Energy Savings, Environment friendly, Ease of Maintenance are the five basic questions for space planning experts. Next, physical education experts are given assessment indicators regarding Suitability of Primary School Physical Education Characteristics, Comfort in Use, Conformity with the Study Program Curriculum, Usefulness, Coverage of basic movement learning activities provided.

Apart from the instruments used to obtain assessments from experts, this research also uses a questionnaire sheet containing a range of assessments from product users regarding the design being developed. The contents of the questionnaire are related to five aspects there are; Appearance of the basic movement laboratory layout for elementary school physical education; Coverage of basic movement learning activities; Suitability of laboratory functions with course outcomes taken in the elementary school physical education study program; Ease and safety in laboratory use; and Usefulness for students in supporting microteaching lecture practices. Respondents are given a score range of 1 to 5 to assess the aspect in question, as are experts in the assessment of the suitability of the product. The Research Team carried out a needs analysis in the field by focusing on three problem points, namely: space utilization, increasing student competency, and laboratory innovation specifically for elementary school physical education. The results of the needs analysis were

resolved by formulating a product development design in the form of a basic movement learning laboratory prototype created by utilizing empty space in the campus environment. Next, the research team implemented the product results validated by experts for users, teaching staff, and students. From the test results, an evaluation is carried out on the sustainability of the product so that it can always be useful and can be developed in stages. The data obtained were processed using a Likert scale formula approach to describe the results in the percentages for each aspect used to assess the development product. The percentage scale formula used is:

"Index Formula % = Total Score /Y x 100%"

Apart from using this formula to see the percentage results of product assessments from each aspect formulated by the research team, trend criteria are also used in research to show how each aspect in the criteria ranges from very good to not good. The trend criteria formula used is as follows:

Table 1. Propensity Criteria

No	Formula	Category
1	X > M + 1,5 SD	Very Good
2	M+ 0,5 SD ≤ X< M + 1,5 SD	Good
3	M-0,5 SD ≤ X< M + 0,5 SD	Pretty Good
4	M-1,5 SD ≤X<M-0,5 SD	Not Good
5	X<M - 1,5 SD	Very Not Good

Result and Discussion

Design a practical laboratory specifically for the Primary School Physical Education study program, by providingan open space used as a Microteaching practice space by providing a learning space for elementary schoolphysical education basic movements. The design has been validated by two experts, including experts in open space planning, with 88% of the five indicators assessment product showing that experts give a "very good" category on this product. Another expert from physical education, especially at the elementary school level with mastery of material specifically for children's basic movements gives 84%, which is shown in the "good" category. Based on two validations from experts, the product is ready to be tested. The following is a display of the designs that were assessed and will be tested with comments from respondents:

Figure 1. Design Laboratory for Physical Education Study Program

Questionnaires are needed to obtain comments from lecturers and students of elementary school physical education study programs, as users. The questionnaire sheet contains comments and suggestions from lecturers and students regarding product development in the form of a physical education basic movement learning laboratory design for elementary school level. Contains the same statement between the lecturer and students regarding the usefulness of the development product. The assessment results or responses from the lecturers are as follows:

Table 2. Results of Filling in the Lecturer Questionnaire Sheet (N=30)

Aspect	Evaluation				
	1	2	3	4	5
1. Aspect 1			7	21	2
2. Aspect 2			5	20	5
3. Aspect 3			4	19	7
4. Aspect 4			10	15	5
5. Aspect 5			2	18	10
Total Score			28	93	29

Source: Primary Data

Based on the table 2, it can be seen that the response from 30 users gave good comments, with a percentage of 70% regarding the layout of the basic movement laboratory; 66.6% answered "good" regarding the coverage

of basic movement activities available in the product design being developed; 63.3% was obtained from answering "good" responses regarding the suitability of laboratory functions with study program course outcomes; while the aspects of easy and safety in use were only obtained by 50% who answered "good"; and regarding the usefulness of the product for students, it reached a percentage of 60% with "good" answers. Overall, the assessment results of 30 physical education lecturers obtained a percentage of 62%. This percentage is in the "Good" category.

Table 3. Trends in Product Aspect Criteria Based on Lectures Answer

No	Formula	f	Category
1	X > 28.97	0	Very Good
2	25.92 ≤ X< 28.97	2	Good
3	22.87 ≤ X< 25.92	3	Pretty Good
4	19.83 ≤X< 22.87	0	Not Good
5	X< 19.83	0	Very Not Good

Source: Primary Data

Table 3 shows the five aspects of product assessment. The results obtained showed that the criteria for aspects 1, regarding the layout of the basic movement laboratory, and 2, regarding the coverage of basic movement activities available in the product design developed, are in a good category. Then aspects 3, regarding the suitability of laboratory functions with study program course outcomes. Aspect 4 regarding the ease and safety in use, and aspect 5, regarding the usefulness of the product for students are in the pretty good category. The next table is the assessment results or responses from students as follows:

Table 4. Results of Completing Student Questionnaire Sheets (N=100)

Aspect	Evaluation				
	1	2	3	4	5
1. Aspect 1			12	74	14
2. Aspect 2			17	70	13
3. Aspect 3			10	67	23
4. Aspect 4			34	60	6
5. Aspect 5			7	40	53
Total Score			80	311	109

Source: Primary Data

Table 4 shows the response from 100 users gave "good" comments, with a percentage of 74% regarding the layout of the basic movement laboratory; 70% answered "good" regarding the coverage of basic movement activities available in the product design being developed; 67% was obtained from answering "good" responses regarding the suitability of laboratory functions with the study program course outcomes; while the aspects of ease and safety in use were only obtained by 60% who answered "good"; and regarding the usefulness of the product for students, the percentage reached 53% with "very good" answers. Overall, the assessment results for 100 physical education students obtained a percentage of 62.2%. This percentage is in the "Good" category.

Table 5. Trends in Product Aspect Criteria Based on Students Answer

No	Formula	f	Category
1	X > 100.05	0	Very Good
2	89.35 ≤ X< 100.05	3	Good
3	78.65 ≤ X< 89.35	2	Pretty Good
4	67.95 ≤X< 78.65	0	Not Good
5	X< 67.95	0	Very Not Good

Source: Primary Data

Table 4 shows the criteria for aspects 1, regarding the layout of the basic movement laboratory and 2, regarding the coverage of basic movement activities available in the product design being developed, and aspects 3, regarding the suitability of laboratory functions with study program course outcomes is in a good category. Aspect 4, regarding the ease and safety in use, and aspect 5, regarding the usefulness for students are in pretty good categories. Based on the overall data analysis, we concluded that the five aspects of product assessment carried out by users resulted in the product's suitability being able to be developed and used in the future according to needs.

Based on the results obtained from this research, a discussion can be carried out about how the results of this research match the findings of previous research that has been carried out. Some related research that has been carried out includes: "*Pedagogy for Effective Learning of Clinical Skills: An Integrated*

Laboratory Model", research on this topic focuses on laboratory models that function to teach clinical skills in physical therapy education (Reilly *et al*., 2020). The study explains the importance of the laboratory to the practice of physical therapy. So this research became one of the bases for implementing the idea of designing a laboratory for physical education activities. Motor skills learning laboratories in physical education are very useful in helping students learn skills by paying attention to the student's abilities (Takiyama & Shinya, 2016). Laboratories play a very important role in helping students learn movement skills. The laboratory is a space that provides students with the opportunity to gain hands-on experience and allows students to develop critical thinking and problem-solving skills (Gyarmati, 2022). The laboratory also offers the opportunity to train students to adapt response skills and abilities to existing conditions (Da Silva *et al*., 2022). Based on the results of all this research, it is clear that the existence of a laboratory is very useful as a learningspace. In physical education, it is closely related to how students are able to learn movement skills. Therefore, the design of the movement learning laboratory developed is very much in line with suggestions and input from several previous studies. Moreover, from several existing research results, a special laboratory design has not been found that provides a place for students to learn basic movement skills in physical education.

Conclusion

The design of the movement learning laboratory developed received a good response from users. It is proven by evaluations from several experts which show percentage values of 84% and 88%. Users, including lecturers and students of elementary school physical education study programs, gave good responses with a starting percentageof more than 50% with good criteria. Using five questions addressed to lecturers and students as users of development design, we found that on the first question, respondents gave a good response at an average of72% regarding the placement and utilization of space layout. Furthermore, regarding coverage of basic movement activities, the results were 68.3%. Questions related to suitability for table tennis course outcomes obtained a result of 65.1%. Meanwhile,the aspect of ease and safety in use was only obtained by 55%, and regarding the usefulness of the product, the response was 56.5%. With this percentage, we concluded that user interest in laboratory design is good. Suggestions for further research are the development of a laboratory with the concept of game activities by including elements of strategy in it.

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