

The impact of behavior change communication on healthy living movement-related knowledge and behavior among adolescents: A mixed-methods study

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DOI: <https://doi.org/10.36685/phi.v9i1.654>

Received: 16 November 2022 | Revised: 6 December 2022 | Accepted: 16 February 2023

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Abstract

Background: Behavior change communication (BCC) is a validated health communication technique for influencing changes in knowledge and behaviors.

Objective: This study aimed to investigate the impact of BCC on the knowledge and practice of the Healthy Living Movement (HLM) or called *Gerakan Masyarakat Hidup Sehat (Germas)*.

Methods: This was a mixed-methods study. A single group pre-posttest design was conducted in Yogyakarta and Central Java, Indonesia, from May to October 2019. Participants are all first-year students from selected schools, as many as 713 persons. The intervention was the BCC strategy, while the outcomes were knowledge and behavior. The BCC intervention was carried out through several stages, from need assessment, designing an educational intervention, the intervention with pre-and post-test, evaluation, and networking. Specifically, the educational intervention was conducted 60 minutes weekly for three weeks. The contents of HLM included a balanced diet, physical activity, and the relationship between health and academic achievement. The knowledge and practice scores were measured using a structured questionnaire before and after the BCC intervention. STATA 13 was used to calculate the mean difference (MD) using a *t*-test. To evaluate the BCC intervention, qualitative in-depth interviews were used, and data were analyzed thematically.

Results: BCC intervention significantly increased knowledge and behavior on a balanced diet, physical activity, and the relationship between health and academic achievement ($p < 0.05$). Internal social norms were carried out through the HLM campaign and declarations, as well as assigning HLM ambassadors, while advocacy by establishing networking between universities, schools, and public health centers strengthened the sustainability program.

Conclusion: BCC intervention improves knowledge and behavior among adolescents. Moreover, the environment is crucial to support and maintaining the program.

Keywords: behavior change communication; BCC; school; healthy living; adolescents

Background

The health status of adolescents and the population are generally influenced by lifestyle and long-term habits. Bad health behavior, an imbalanced diet, and a poor lifestyle will impact the incidence of lifestyle-related diseases and earlier occurrence of non-communicable diseases (NCDs) (Rah et al., 2021). The SDG's third goal includes all these health issues to ensure a healthy life and promote well-being. Adolescents are potential agents of change, and this age is the fixed period to instill good habits and behaviors, making health promotion through BCC appropriate for NCDs prevention (Sparrow et al., 2021). Moreover, several reports showed that changes in lifestyle, technological advances, industry, transportation, food access, economy, and health are closely related to the varying patterns in infectious to non-communicable diseases (Siswati et al., 2022). Habits formed during adolescence are predictors of NCDs in young adults, such as risk markers for cardiovascular diseases (CVD), hypertension, and stroke (Schnermann et al., 2021); hence diabetic children tend to develop Diabetes Mellitus (DM) in adolescents (Maslova et al., 2019).

Currently, teenagers are exposed to a sedentary lifestyle with increased consumption of western food containing high sugar, salt, and fat (Rachmi et al., 2021). In 2020, Indonesia and several countries experienced the COVID-19 pandemic (Siswati et al., 2021) that caused schools and students to switch to online learning, which is associated with less physical activity due to excessive use of androids and laptops, as well as prolonged sitting or to lie down (Zheng et al., 2020). These conditions have an impact on reducing energy expenditure (Newton Jr et al., 2013). The COVID-19 pandemic also caused excessive anxiety (Chaabane et al., 2021) and a tendency to eat more as a coping mechanism (Mason et al., 2021). A sedentary lifestyle and emotional eating increase the risk of weight gain, obesity, and body mass index (BMI), as well as the development of the metabolic syndrome and NCDs (Ferreira Rodrigues et al., 2021). A basic health survey conducted in Indonesia in 2018 showed that the physical activity of the population aged >10 years was 67% while consuming fruit and vegetables for <5 servings a day reached 93% (Kementerian Kesehatan Republik Indonesia, 2018).

The HLM is a movement that encourages people to adopt healthy lifestyles and break their harmful habits and behaviors to establish a culture of healthy living. It is regulated by the Presidential Instruction No. 1 of 2017 to prevent NCDs and create a high degree of health and quality of life for all levels of society at any age group. HLM is pursued through 6 pillars, namely a) increase in physical activity, b) improvement of healthy living behaviors, c) provision of healthy food and acceleration of nutrition improvement, d) improved prevention and early detection of the disease, e) improvement of environmental quality and f) increased education on healthy living (President Republic Indonesia, 2021). Health promotion to support the implementation through literacy and education has been widely carried out. However, deficiencies in reading and education make it difficult to change health behaviors, while the information offered from a public health perspective tends to be ignored. This implies that more efforts are required to encourage changes in health behaviors, specifically through implementing the BCC strategy. Previous studies demonstrated the efficacy of BCC in altering nutrition-related knowledge and behavior in Ghana (Saaka et al., 2021), improving child-feeding practices in Ethiopia (Workicho et al., 2021), healthy living and nutrition in young adults in Australia (Dix et al., 2021), and abortion in women aged 15-49 years old in India (Banerjee et al., 2013). BCC can take numerous forms to affect people's health behaviors, focusing on how communication might promote positive health behaviors to prevent and control disease spread. Therefore, this study aims to investigate the impact of BCC on the knowledge and practice of HLM among Indonesian adolescents. The results will help health promoters, schools, and other observers construct adolescent behavior modification methods for healthy living activities and encourage adolescents to engage in healthier lifestyles.

Methods

Study Design

This was a mixed-method study conducted in five senior high schools in Yogyakarta and Central Java, Indonesia, from May to October 2019.

Participants/Samples

We used different sampling methods to select participants based on the research phases as

follows: First, for need assessment and designing BCC, we purposively recruited two to three participants from each school. With a total of five schools, we gathered ten to fifteen participants for FGD. Second, to select adolescents to participate in the BCC intervention, we used a two-stage stratified random sampling. Initially, two districts in Yogyakarta and Central Java were chosen randomly. After that, we selected senior high schools from each selected district. All the first-class

students were enrolled as our participants. Those absent during the data collection and who did not consent to be participants were excluded. **Figure 1** shows the participants' flow. Lastly, we evaluated the BCC intervention using in-depth interviews. We randomly recruited one school principal or teacher as a key informant from each school. A total of 25 students who completed the intervention were also randomly selected from the five schools.

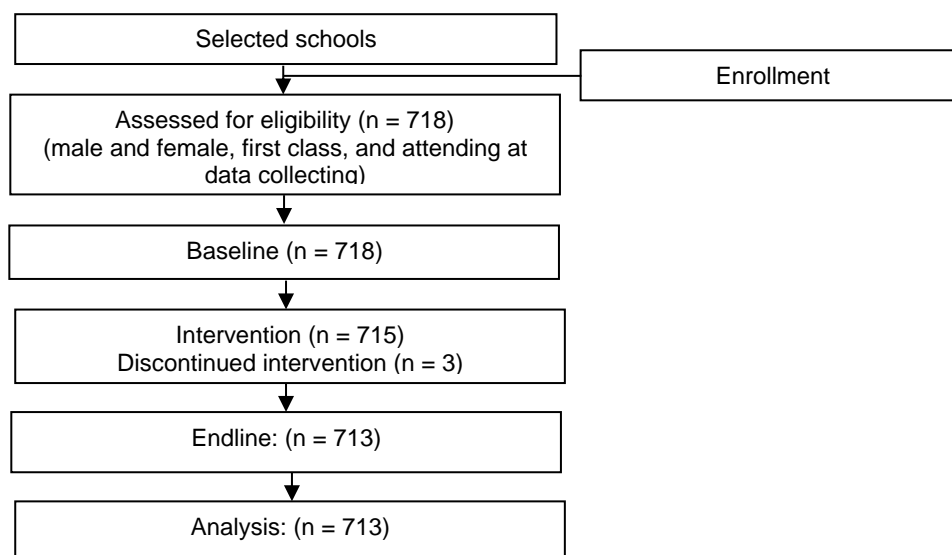


Figure 1 Participant flow chart

Intervention

We employed the BCC intervention using multi-stages, as shown in **Figure 2**. First, a client-need assessment was conducted by Focus Group Discussion (FGD) to investigate the community's health-related requirements and identify existing resources and alternative solutions. Second, we discussed and designed a BCC strategy to formulate models, materials, and intervention procedures with the school stakeholders until reaching an agreement. Third, we conducted a BCC intervention using a single-group quasi-experimental design with pre-and post-test. Fourth, we evaluated the BCC

intervention using in-depth interviews with teachers, staff, and students. Lastly, we networked with related stakeholders to ensure the sustainability of our intervention by creating a conducive atmosphere both internally and externally. The internal environment comprises the declaration of HLM by all school community members and the selection of male and female ambassadors by each school based on the best post-test knowledge and behavior. Meanwhile, the external environment was created through collaboration between schools, universities, and local health clinics.

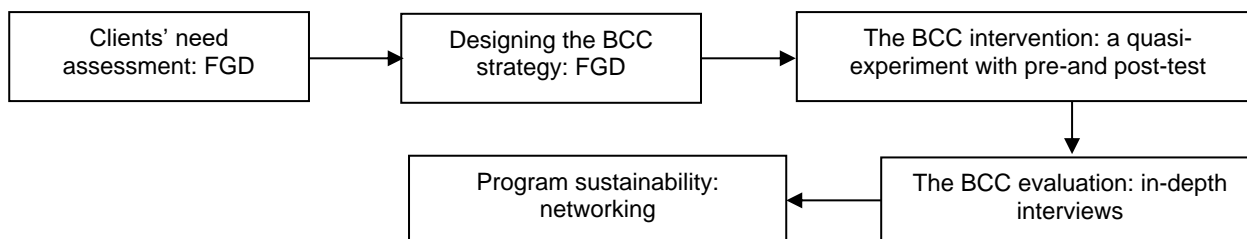


Figure 2 The BCC intervention stages

The BCC intervention comprised educational interventions delivered through face-to-face learning for 60 minutes per week for three weeks. The content covered healthy living movement (HLM), including a balanced diet (Week 1), physical activity (Week 2), and the relationship between health and academic accomplishment (Week 3). The adolescent knowledge and behavior regarding a balanced diet, physical activity, and the relationship between health and academic accomplishment were assessed before and after the intervention using a structured questionnaire and checklist.

Data Collection and Analysis

Quantitative strance

Adolescent knowledge was measured using 30 questions in a structured questionnaire regarding balanced nutrition, physical activity, and health-related learning achievement. Anthropometric data include thin <18.5, normal 18.5-22.9, overweight 23-24.9, and obese >25. Height was measured by a portable microtoice stadiometer with an accuracy of 0.1 cm, while weight was assessed by a Tanita digital body weight scale with an accuracy of 0.1 kg. Furthermore, adolescent behavior was observed using a one-week healthy lifestyle checklist, including breakfast, physical activity, sleep time, sitting time, fruit and vegetable consumption, drinking water, and fried and fast food. Breakfast habits were grouped into often and rarely for ≥ 4 and < 4 times a week, respectively; physical activity was categorized as sufficient for up to 30 minutes per day and five times a week or insufficient when it was lower than the requirement. Sleeping time was considered enough for 7-8 hours per day. Sitting time was good for < 7 hours and poor when it was ≥ 7 hours per day. In addition, fruit and vegetable consumption was enough or poor when it was < 5 servings a day, respectively. The amount of drinking water consumption was sufficient for 8 glasses per day and insufficient for < 8 glasses per day. The consumption of fast food was good for < 3 times per week and not good when it was greater than three times, while the consumption of fried food was good for one to three pieces per day and not good for three pieces per day. Anemia in female adolescents was determined by measuring Hb levels using an easy-touch Hb-meter, stripe code, auto click, blood lancet, gloves, alcohol swabs, and AAA batteries. Anemia was confirmed when Hb was < 12 g/dL and normal at 12 g/dL. Health analysts were recruited to test the hemoglobin levels of female adolescents.

Finally, the knowledge and behavior were assessed before and after the intervention by two assistants with a nutrition background diploma and previous training, while the data were analyzed using the logistic regression

Qualitative strance

We conducted need assessments to explore the following information: 1) issues related to healthy living (e.g., diet, physical activity), 2) the existing interventions that had been done, 3) challenges to implementing such interventions, and 4) expectations towards this BCC intervention. We coded the transcripts and constructed themes and subthemes. Likewise, data from the designing phase using FGD were coded and analyzed using thematic analysis. The themes included methods, materials, media, lesson hours, duration, and aspects of observations. Additionally, the intervention evaluation data were transcribed, coded, and classified into the following themes: obstacles and opportunities for program sustainability.

Ethical Considerations

This study was approved by IRB Poltekkes Ministry of Health Yogyakarta with the No. e-KEPK/Polkesyo /0031/V/2019 date 9th May 2019. The legal guardian of the students signed the informed consent.

Results

The results are reported according to the study flow shown in **Figure 2**.

Need Assessment

The client needs assessment revealed the urgent requirement for a behavior change strategy that actively engages participants to tackle some adolescent health issues, such as skipping breakfast, an imbalanced diet, much fast food, and fried foods, less physical activity, and low consumption of fruits and vegetables.

Designing a Strategy for Intervention

The BCC strategy of HLM provides opportunities for changes in adolescent health practice through adequate knowledge, a healthy lifestyle, and environmental as well as social norms. In addition, educational interventions are felt to be critical in addressing specific adolescent problems, including a) nutrition and a balanced diet, b) physical activity, and c) the relationship between health and learning

achievement. In addition, observations related to the problem of lifestyle, nutritional status, and female anemia were carried out. Supportive social and environmental norms were created through internal support in the form of the campaign and declaration of HLM and setting ambassadors in each school. The external support involves collaboration between schools, universities, and local health centers.

Participants Characteristics

Based on **Table 1**, most of the respondents were female 58.6%, lived in rural areas 58.3%, fathers who worked in the formal sector 56.4%, mothers working in the informal sector 44.4%, fathers and mothers with a university degree as their education background 56.9%, as well as high school 54.3%.

Table 1 Characteristics of participants (N = 713)

Variable	n	%
School area		
Central Java	320	43.8
Yogyakarta	393	56.2
Sex		
Male	300	41.4
Female	413	58.6
Living area		
Urban area	300	41.7
Rural area	413	58.3
Father's occupation		
Work, formal	411	56.4
Work, informal	302	43.6
Mother's occupation		
Work, formal	313	43.3
Work, informal	324	44.4
Not working	76	12.3
Father's level of education		
Low (Junior high school & below)	76	10.2
Intermediate (Senior High school)	234	32.9
High (University)	403	56.9
Mother's level of education		
Lower (Junior high school & below)	129	18.1
Intermediate (Senior High School)	386	54.3
Upper (University)	198	27.6

Impact of Educational Intervention on Knowledge, Lifestyle, BMI, and Anemia

The intervention increased adolescent knowledge by 30 points and was statistically significant ($p = 0.034$), as shown in **Figure 3**. In addition, the educational intervention improved adolescent

lifestyle and nutritional status as well as reduced anemia in adolescent girls. However, a significant increase was found in aspects of breakfast habits, fruit and vegetable consumption, mineral water, and reduced consumption of fried foods with $p < 0.05$, as shown in **Table 2**.

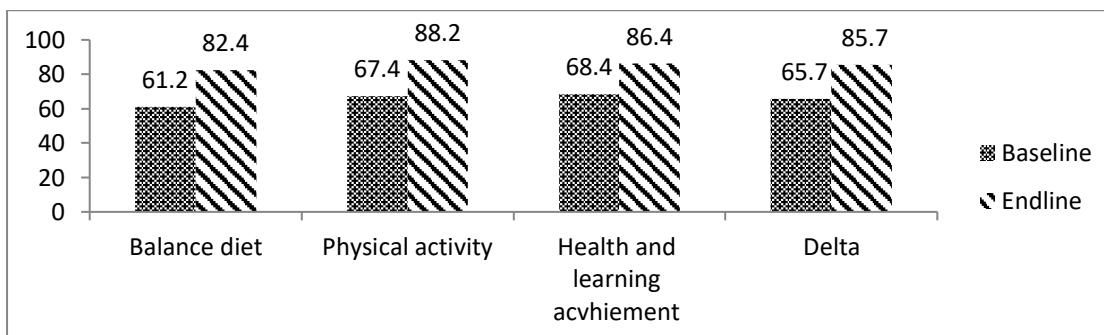


Figure 3 Baseline and end-line adolescent knowledge

Table 2 Impact of BCC intervention on adolescent lifestyle, BMI, and anemia

Variable	Before		After		OR CI95%
	n	%	n	%	
Breakfast habits					
Yes (≥ 5 times per week)	467	65.5	584	81.9	6.07* (5.09-7.04)
No (<5 times per week)	246	34.5	129	18.1	
Physical activity					
Enough (30 minutes/day & 5 times a week)	487	68.3	503	70.5	2.23 (0.28-2.89)
Not enough	226	31.7	210	29.5	
Adequate sleep					
Not appropriate (<7 or >8 hours/day)	249	34.9	242	33.9	1.61 (0.95-3.23)
Appropriate (7-8 hours/day)	464	65.1	471	66.1	
Sitting time					
7-8 hours/day	498	69.8	471	66.1	0.62 (0.31-0.99)
≤6 hours/day	215	30.2	242	33.9	
Fruit and vegetable consumption					
<5 servings/day	476	66.8	493	58.2	5.83* (4.44-7.22)
5 servings/day	237	33.2	199	41.8	
Drinking water					
<8 glasses/day	490	68.7	402	56.4	6.70* (5.67-7.73)
≥8 glasses/day	223	31.3	311	35.1	
Fast food consumption					
<3 times/week	421	59	467	65.5	2.53 (0.68-3.89)
≥3 times/week	292	41	246	34.5	
Fried food consumption					
1-3 times/day	358	50.2	230	62.4	9.27* (8.28-10.25)
>3 times/day	355	49.8	377	37.6	
Nutritional status					
Malnutrition (BMI:<18.5 & ≥ 23)	378	53	255	52.6	2.52 (0.43-2.89)
Normal (BMI:18.5-22.9)	335	47	338	47.4	
Anemia among female adolescents (n = 413)					
Yes	112	27.1	109	26.4	3.32 (2.89-5.67)
No	301	72.9	304	73.6	

*p-value <0.05; BMI: Body Mass Index

Social Norms/Environmental Support

Social or environmental norms attempt to maintain knowledge and program continuity after the intervention. The environmental modification was executed through internal and external methods. In this study, the internal method was to select a pair of HLM ambassadors in each school based on considerations of the best knowledge, lifestyle, and health status at the end of the intervention, as well as HLM declarations and campaigns by all school members, both teachers, education staff, and students. Meanwhile, the external method was executed by strengthening networking between schools, universities, and local health centers. This study was conducted to ensure the program's sustainability by creating an environment or social norms internally and externally. Ambassadors were set for male and female students in each school as an internal strategy to create role models with the

best knowledge, values, lifestyle, and health status to positively influence HLM practices in schools. At the same time, we strengthen this program through campaigns and advocacy.

We also evaluate this behavior change communication as a strategy to improve healthy living movement-related knowledge and behavior among adolescents using an in-depth interview with some key informants. They stated as follows:

".. this kind of activity is something that we hoped for, not only literacy but active involvement of students so that they learn by doing" (Teacher, 41 years old, male).

"I followed this activity from beginning to end and helped design this strategy, an excellent model to apply in other places" (Teacher, head of school, 45 years old, male).

“.. cool, very interesting.. I am happy to participate in this activity; it is the best” (Student, female 15 years old).

No significant obstacles were found due to assistance in program implementation, as confirmed by the following information:

“So far, it is safe, and students can participate actively and happily” (Student, 15 years old, female).

Meanwhile, the challenge was the independence in creating optimal student health status to integrate with health-promoting schools (HPS). The opinion of the informant is as follows:

“I manage health promoting school, and this activity is a challenge to integrate it to increase optimum student well-being” (Teacher, 38 years old, female).

Regarding the program’s sustainability, all schools believed they could continue this activity due to the networking between universities, schools, and health centers. The informants responded as follows:

“I strongly support this program. Let’s support our children to be healthy, superior, and accomplished” (Teacher, 51 years old, male).

Discussion

The results showed that the BCC intervention significantly increased knowledge and behavior comprising breakfast, fruit and vegetable consumption, drinking water, and fried food. But the improvement in BMI and anemia among adolescents was not significant. Factors related to intervention education are adequate facilities and infrastructure, such as appropriate large rooms, not crowded nor loud, clear sound, attractive slides, good projector, and overall conducive environments (Mushtaq & Khan, 2012; Tiruneh et al., 2020). In addition, the brain during adolescence is very plastic for receiving stimulations (Konrad et al., 2013), including positive information about health issues to support the maturation of developmental functions and morphology (Spear, 2013). Several risk factors experienced by adolescents raised concerns for the development of early NCDs. These include inadequate of vegetables and fruit (Rautiainen et al., 2015), less physical activity (Pojskic & Eslami, 2018; Urmey et al., 2020), oversitting (Roake et al., 2021),

inappropriate water consumption (Fransé et al., 2019) and frequent fried or fast food causing overweight (Sudargo et al., 2017), which mutually interact with these risk factors leading to early NCDs (Dreher & Ford, 2020; Pulungan et al., 2018). Although not statistically significant, we also found that malnutrition and anemia in female adolescents decreased after the intervention. Consequently, we need a strengthening strategy to maintain the program’s sustainability for the further goal of student well-being and reduce the double burden of malnutrition. Several studies stated that obesity in adolescents has implications for hypertension and glucose intolerance (Wójcik & Kozioł-Kozakowska, 2021). In addition, obesity can interfere with learning achievement (Correa-Burrows et al., 2018), academic performance, and income in adulthood (Fowler Brown et al., 2010; Rah et al., 2021). It influences adolescent learning achievement through several paths, including low social acceptance in their circles, self-confidence (Harrist et al., 2016), self-esteem, quality of life, feeling hopeless, easily depressed (Valaiyapathi et al., 2020), and low level of fitness. Anemia and underweight adolescents are also correlated with a low potential to grow up during the growth spurt, irregular menstrual periods, low quality of life, susceptibility to infection, difficulty concentrating, and poor human capacity (Mengistu et al., 2019). Furthermore, adolescent anemia correlated with poor health in women of childbearing age health and increases maternal mortality as well as morbidity, and poor pregnancy outcomes such as low birth weight, premature birth, anemic infants, Intrauterine growth retardation (IUGR), intergenerational malnutrition, and even death (Mengistu et al., 2019). Overall, implementing the BCC intervention improved students’ knowledge and behavior of HLM. Previous studies stated that nutrition education improved academic achievement for continuing to higher schools and prevented NCDs and DALY loss due to malnutrition, along with its implications (Lua & Elena, 2012).

The advantageous factor supporting the long-term viability of this program is internal and external strategies, such as the appointment of environmental ambassadors, the launching of environmental campaigns, and networking. Moreover, declarations or campaigns as an effective mass communication effort to strengthen this program (Dix et al., 2021). Then external advocacy at the program level is established by building

networking and commitment between universities, schools, and public health centers as a strategic collaboration to improve student well-being (Schraeder et al., 2021) synergistically with existing school health programs.

Strengths and Limitations

The study provides much information about the adolescent lifestyle with adequate participants. This strategy was tailored to the user-centered engagement of participants actively and strengthened by internal and external advocacy to support the sustainability of the program. The limitation of this study is that it only examines a single intervention; hence there is no comparison group.

Conclusion

The BCC intervention increases students' knowledge about HLM, including breakfast habits, eating fruits and vegetables, water consumption, and reducing the frequency of fried foods consumed. Therefore, BCC is an appropriate intervention design to change health behavior. In addition, to improve academic performance among adolescents and reduce the occurrence of noncommunicable diseases at an earlier age, this BCC strategy may potentially be implemented in additional educational settings, particularly with newly enrolled students who have not previously been exposed to health education.

Declaration Conflicting Interest

We declare there is no conflict of interest.

Funding

None.

Acknowledgment

Thanks to all participants, Head of School of SMA 1 Pajangan, SMA 1 Sewon, SMA 1 Godean, SMA 1 Jumapolo, and SMA 1 Karanganyar, and students. Thanks to Naura Laksita Devi for editing the manuscript.

Author Contribution

All authors met the contribution criteria for authorship. All authors approved the final version of the article to be published.

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Cite this article as: Siswati, T., Widiyanto, S. Y. D., Olfah, Y., Setyowati., & Paramashanti, B. A. (2023). The impact of behavior change communication on healthy living movement-related knowledge and behavior among adolescents: A mixed-methods study. *Public Health of Indonesia*, 9(1), 21-30. <https://doi.org/10.36685/phi.v9i1.654>