Socioeconomic Factors Associated with Diarrhea among Under-Five Children in Manado Coastal Area, Indonesia

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Original Article

Socioeconomic Factors Associated with Diarrhea among Under-Five Children in Manado Coastal Area, Indonesia

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Abstract

Background: Diarrhea is a condition where individuals experience defecation as much as 3 or more per day with a soft consistency. Diarrhea in children one of the environmentally-based diseases, and Manado is one of the cities faced with this environmental lead diarrhea problems. The purpose of this study is to analyze the influence of socioeconomic factors on the occurrence of diarrhea among under-five children in the coastal area of Manado city. **Materials and Methods:** A cross-sectional study design was conducted in August 2017. The numbers of respondents were a total of 120 mothers or caregivers with children under five who suffered from diarrhea in the coastal area of Manado. The respondent candidates were selected from the community health center's records of the diarrhea program and further selected by the inclusion/exclusion criteria. The characteristics of mothers and family income were used as indicators of socioeconomic factors. All of the respondents were questioned about the occurrence of their child's diarrhea that they had experienced in the previous 6 months. A structured and well-designed questionnaire was used to obtain data, which were related to sociodemographic, economic, and diarrh Generalized structured component analysis in GeSCA software was applied for data analysis. **Results:** The findings of this study showed significant influence from socioeconomic factors on diarrhea incidence in under-five children (critical ratio = 2.74). In other words, as socioeconomic factors improve, the incidence of diarrhea decreases ($B = -0.246$). The characteristics of the mother are the indicator of the highest influence (loading value = 0.846). **Conclusions:** This study identified that the socioeconomic factors are influencing the diarrhea incidence among children under five in the coastal area of Manado city. Thus, to minimize a childhood diarrheal disease, socioeconomic factors are considered when promoting health and community empowerment among the coastal communities of Manado city.

Keywords: Coastal area, diarrhea, GeSCA, socioeconomic factors, under-five children

Introduction

Diarrhea is a condition where individuals experience defecation as much as 3 or more per day with a soft consistency. This disease could be caused by various bacteria, viruses, and parasites. The transmission of diarrhea could be from contaminated food or drinking water, even from person-to-person as the effect of bad personal hygiene and sanitation. Severe diarrhea could be deadly by the severe dehydration and nutrition deficiency that it caused.[1]

Diarrhea is a contributory factor for high rates of the morbidity and the mortality in under-five children and is also known to be the second most diseases which lead to death after pneumonia in this population.[2] Diarrhea kills 1.8 million children annually in developing countries, an increase from 1.5 million in the past 20 years. The annual incidence of diarrheal diseases in under-five children in developing countries is 2 billion cases, with an average incidence rate of 3.2 cases per child illness. A previous community-based study of under-five children suffering acute diarrhea found a ratio of 1.2:1.4 for boys and girls, respectively. These data are necessary because in some countries (e.g., in South Asia), the number of boys is higher than in girls.[3,4]

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In basic health study, the prevalence of diarrhea in Indonesia was 9.0% (4.2%–18.9%). In 2013, Indonesia had at least 162,000 cases of diarrhea, and about 460 children died from diarrhea. In 2012, the morbidity rate of diarrhea was 214/1000 population, and the number of diarrhea sufferers was 2,843,801 cases. Moreover, an increased number of provinces are experiencing a higher extraordinary occurrence and crude fatality rate. The diarrhea incidences in infants are around 40 million/year, and the death rate is in 200,000–400,000 cases.[5]

Data from the Manado City Health Office showed that diarrhea is the highest health problem among environmentally-based diseases according to the morbidity rate. Efforts to suppress the prevalence of diarrhea have been conducted through a diarrheal intervention (prevention/control) program. Unfortunately, it has not been effective, and the rate of diarrhea cases, especially among under-five children, has not decreased. Data from the Manado City Health Office over the period 2013–2015 show an increased prevalence from 2545 cases in 2013 to 3068 cases in 2015, that is, an increase of about 523 cases in 3 years or about 174 cases/year.[6,7]

The factors affecting the incidence of child diarrhea are age and exclusive breastfeeding (at least 6 months). This study on infant diarrhea in the urban slums of Bankura, West Bengal, with 152 under five revealed that the incidence of childhood diarrhea gradually declines with the increasing age. Moreover, children who receive exclusive breastfeeding were found to be less likely to have diarrhea than those who did not. Furthermore, other factors, such as access to health care, behavior, and the environment, also affect the incidence of childhood diarrhea. A study conducted in rural South Africa showed that inadequate health care is one of the factors causing the increasingly severe condition of under-five patients with diarrhea. This study showed that the longer the time required to reach the health service (>12 h), higher the severity of diarrhea.[8]

A study undertaken by Cronin *et al*.[9] revealed that the habit of carelessly disposing of infant feces in Indonesia is strongly associated with the risk of diarrhea in children. Thus, water, sanitation, and hygiene intervention activities should be strengthened and conducted simultaneously throughout Indonesia. A study by Sumampouw *et al*.[10] found that the contaminated environment mostly caused the incidence of diarrhea in under-five children in Manado.

A risk factor that is prominent in the incidence of childhood diarrhea is the socioeconomic status of the family. The lower the economic level, the higher the risk of diarrhea because poverty and health are interconnected each other. Developing countries tend to have people with lower health status compared to other countries.[11] Oliveira *et al*.[12] found that family socioeconomic factors, including family income and maternal knowledge, are related to the prevention of diarrheal disease in under-five children. Furthermore, Mansur *et al*.[13] noted that the socioeconomic vulnerability of families living around the river (delta and estuary areas) could increase the exposure to disease risks, especially in times of floods. In addition to environmental factors (climate) and socioeconomic factors affect the incidence of disease outbreaks.[14]

Different studies have shown that administering vaccines for diarrhea, measles, and pneumonia will not contribute to decreasing the disease prevalence if there is a difference in family income levels.[15] Poor families encounter more illness and even death than moderate- and high-income families; they also cannot modify or create a better environment for living to avoid the development of disease in their area. Diarrhea, measles, and pneumonia are environmentally based diseases, and hence, environmental factors are the most crucial in influencing disease.[15] This study aimed to analyze the influence of socioeconomic factors on the diarrhea incidences in under-five children in the coastal city of Manado.

Materials and Methods

Study design and period

A cross-sectional study was conducted in August 2017. The data were collected by interview questionnaire to the respondent only during the interview.

Study setting

This study was carried in the coastal area of Manado city; at four Community Health Centers (Puskesmas) in the areas of Bahu, Sario, Wonasa, and Tuminting. The operating area of the Bahu Health Center is a business area (shopping center) and a highly populated region (student housing area located adjacent to Sam Ratulangi University). The operating area of the Sario Health Center is in the watershed and coastal areas. Some part of these areas is flooded nearly every year. There is a slum neighborhood adjacent to the shopping center. This area has a high density of housing due to the high number of rental houses. The operating area of the Wonasa Health Center is in the Tondano River region and the settlements along the coastal area. Some areas often experience floods every year. The operating area of the Tuminting Health Center is in a highly populated region by the beach with a traditional market. This study was ethically granted by the Health Ethics Committee of Public Health Faculty, Sam Ratulangi University, with letter number: 778/UN12.11/LL/2018.

Survey population

The study population for this study was comprised all mothers/caregivers with children under-five who had suffered from diarrhea and received outpatient care at the Bahu, Sario, Wonasa, and Tuminting Health Centers of Manado City over the previous 6 months. Only the mother/caregiver, not the children, was included as the respondent in this study.

Sample size and sampling methods

The sample size from the survey population was determined using the Lemeshow formula, which is suitable for an unknown population (equation 1). Based on the equation, the minimum sample size was 120. Thus, the same number of respondents needed to be gathered from four health-care centers.

Where,

$$n = \frac{Z^2_{1-\alpha/2} P(1-P)}{d^2} \quad (1)$$

n = Minimum sample size

d^2 = Precision (level of confident = 90%)

$Z^2_{1-\alpha/2}$ = Distribution value in Z table (95% =1.96)

P = Proportion estimate = 50% (0.5)

The study respondent was determined based on the following criteria of inclusion:

1. Willing to be a respondent-based on signed informed consent
2. Treated a maximum of one time and had suffered diarrhea at least 3 months before the study. To minimize errors in the data with the expectation that respondents would still remember the behaviors and events experienced, there was a time limit used during this study
3. Available at home when the study was conducted (interviews).

The study respondent was also determined based on the following exclusion criteria:

1. Having a communication disability
2. Suffering from a psychiatric disorder.

The interviews were undertaken in the afternoon based on the assumption that the respondents would be available to be interviewed. The respondent candidate was selected randomly from the records of treated children with diarrhea of the community health center. A total of 30 respondents were selected per community health center.

Data collection

The data were collected using structured questionnaires to all respondents. The questionnaire items had these following questions: (1) the mother's level of formal education, (2) age of having a first child (variables for mothers' characteristics), (3) family income, and (4) the amount of money saved in the bank (variables for family's financial condition). The questionnaire was tested for its validity and reliability. The author conducted the interviews with the assistance of trained personnel, lecturers, and students from the Faculty of Public Health, Sam Ratulangi University, Manado, Indonesia. The interviewer was given briefings on the interview procedures and to ensure understanding of each question beforehand. The data collection was conducted in August 2017, and the data from this questionnaire were analyzed further.

Data quality management

In addition to the reliability and validity testing, data collector training, editing, coding, processing, and cleaning were done to maintain the quality of data. Editing is checking the questionnaire sheet for incomplete data recording. If the questionnaire was not complete, then redo the data collection process (http://www.sem-gesca.com/). Coding is done during the input process to the GeSCA software. Processing is done during the data analysis to check the progress, which is based on the standard operating procedure. Finally, cleaning is done in the end: recheck whether the data are completed, based on the questionnaire or missing data occurred.

Data analysis

First, the data from the questionnaire were then analyzed for its frequency distribution using a univariate test. After that, the data were analyzed for its construct reliability using the measures of fit in the GeSCA software using the Cronbach's alpha and the discriminant reliability. The construct is considered reliable if Cronbach's alpha is >0.6 and discriminant reliability is >0.5. The loading factor of social and economy was obtained using the convergent validity analysis three times (1st order, 2nd order, and discriminant validity), which could represent the correlation between the variable with the diarrhea case. Both tests are to validate the model sensitivity as well. The hypothesis testing was analyzed using *t*-test and resampled using bootstrap method. The hypothesis of this study was socioeconomic factors which have to influence the incidence of diarrhea in under-five children in the coastal city of Manado. Chi-square test was used to test the relationship model, and double linear regression was employed to check the relationship between each variable.

Results

Characteristic of respondents

As much as, 279 infants with diarrhea were recorded the study sites for the past 3 months. Out of the 279, 130 infants were selected by randomization, and from 130 only 10 were not eligible based on the inclusion and exclusion criteria [Figure 1]. A total of 120 mothers with children under five participated in the study with a 100% response rate. Every respondent had signed the informed consent to be included in this study.

Most of the respondents were ethnic Minahasa by ethnicity (64.2%). The great proportion of mothers was found in the age group of 21–30 years (61.7%). The majority of mothers were homemakers (95.8%), and most of the fathers were working in a private sector (69.2%) [Table 1]. All of the respondents gave all of the necessary data during the interview process, and hence, no missing data were recorded.

Construct reliability

Reliability tests were carried out using the construct reliability measure Cronbach's alpha and the total variance in the items based on average variance extracted, that is, discriminant reliability. A construct was deemed reliable if the value of Cronbach's alpha was ≥0.60, and the discriminant reliability value was ≥0.50.

From Table 2, the values for discriminant reliability on all dimensions are higher than the cutoff value of 0.50. Moreover, the Cronbach's alpha values are more significant than the

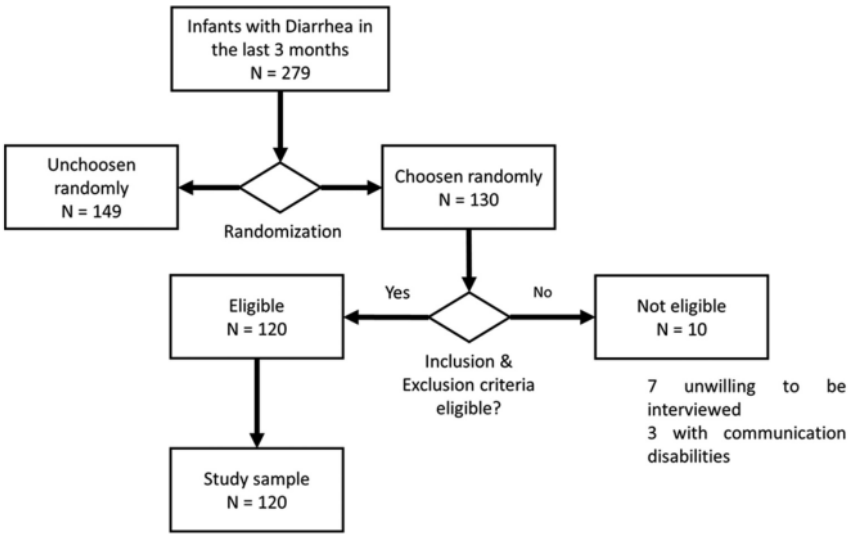

Figure 1: Study sample selection flow chart

Table 1: Distribution of respondent characteristic

Respondent Characteristic	*n*	%
Ethnic		
Minahasa	77	64.2
Gorontalo	12	10.0
Sangir Talaud	22	18.3
Lainnya (Jawa, Ambon, Papua, Batak)	9	7.5
Total	120	100.0
Sex of under-five children		
Male	57	47.5
Female	63	52.5
Total	120	100.0
Age of Mother		
<21 years old	15	12.5
21-30 years old	74	61.7
>30 years old	31	25.8
Total	120	100.0
Work of Mother		
Housewife/Unemployed	115	95.8
Private sector	5	4.2
Total	120	100.0
Work of Father		
Private sector	83	69.2
Enterpreneur	33	27.5
Civil servant	4	3.3
Total	120	100.0

cutoff value of 0.60 for all dimensions. Thus, all constructs are considered reliable.

Latent variable measurement indicators

The amount of charge or contribution of items in measuring latent variables can be identified based on the loading factor of each item. As shown in Table 3, the measurement model examining the dimensions of mothers' characteristics gives a loading of 0.893 for the level of formal education. This indicates that education explains the 89.3% of diversity in mothers' characteristics. Age at first birth of a child gives a loading of 0.866, indicating that this explains 86.6% of the diversity in mothers' characteristics. Thus, the level of education is dominant in measuring the characteristic dimensions of the mother.

Table 3 also shows that the measurement model for the dimensions of the family's financial condition gives a loading of 0.874 for family income, indicating that the contribution of this factor to the family's financial condition is 87.4%. The loading value for saving is higher at 0.913, meaning that this factor makes a more significant contribution (91.3%) to the family's financial condition. Regarding the socioeconomic status of the family as a whole, the data indicate that the family's financial condition is the most dominant dimension.

The testing of hypotheses is intended to test whether or not exogenous variables (family socioeconomic factors) or directly influence endogenous variables (children's diarrhea). The existence of a direct effect can be understood through the critical ratio (CR) value [Table 4]. As shown in Table 4, the CR value for the influence of socioeconomic factors is 2.74 (>2.00), indicating a significant direct influence of socioeconomic factors on the diarrhea incidence in children under 5 years. Indeed, the coefficient for the direct effect of family socioeconomic factors on the diarrhea incidences in under-five children was −0.246. This indicates that family socioeconomic factors have an adverse and significant effect on diarrhea in young children. Furthermore, it is suggested that improving the socioeconomic conditions of families would tend to reduce the risk of diarrhea in infants and young children.

Table 2: Construct reliability

Variable/dimensions	Discriminant reliability	Cronbach's alpha
Mother's characteristics	0.774	0.629
Family economy	0.799	0.727
Child diarrhea	0.932	0.927

Table 3: Factor loadings of socioeconomic family items

Dimensions	Item	Loading (dimensions)	Loading (item)
Mothers' characteristics	Level of formal education	0.846	0.893
	Age at first birth		0.866
Family financial condition	Income	0.804	0.874
	Savings		0.913

Table 4: Hypothesis testing

Relation	*B*	SE	CR
Family socioeconomic factors → children diarrhea	−0.246	0.090	2.74*

*Significant influence of the variables. SE: Standard error, CR: Critical ratio

Discussion

Based on this study, there was a significant influence of family's socioeconomic factors on the diarrhea incidence in under-five children. Indeed, the improving of family's socioeconomic conditions would reduce the risk of diarrhea in infants and young children. Various studies are in accordance with the results of this study. According to Ottay *et al*.,[16] the level of family income was one of the factor attributable to diarrhea in under-five children in Manado. Social health factors, such as poverty, lack of access to health services, lack of access to education, stigma, racism, and gender bias, were identified as some of the key factors contributing to health inequalities.[17,18]

The socioeconomic factors of the family can be measured with several indicators, such as parents' educational level, parents' job type, and income.[10] In this study, the authors restricted the analysis only to the mother's educational level, age at the birth of the first child, family income, and savings level. Maternal education is one of the major determinants of children's survival in developing countries. Furthermore, the protective effect of maternal education on the incidence of diarrhea among children varies according to the socioeconomic environment in which the mother lives. Maternal education is a protective factor against the incidence of childhood diarrhea in societies with good socioeconomic levels and does not affect low socioeconomic communities. However, the effect of the mothers' education on diarrhea incidence in children is lower among families with high economic status.[19]

The study of Chowdhury *et al*.[20] undertaken with 365 under-aged children of five (55% boys) suffering from diarrhea in Bangladesh showed that under-five children with low-educated mothers had twice more likely to get diarrhea. Moreover, children who came from families with the lowest family economic levels showed a seven times higher risk of getting diarrhea. The study of Sinmegn Mihrete *et al*.[2] concerning the risk factors for under-five children suffering from diarrhea in the Benishangul-Gumuz Region of Western Ethiopia showed mother's education and the number of children (≥two children) are related to the incidence of diarrhea. The study also suggested that more opportunities need to be provided for women to attain higher levels of education to reduce the mortality rate of under-five children.

In 2014, Canada's Public Health Leader, Marc Lalonde, described the factors that cause disease. This theory is known as the Lalonde Framework and presents four factors at various levels that affect health: (1) environmental (biotic-socio-culture), (2) behavioral (lifestyle), (3) health service related, and (4) individual (biopsychosocial). Furthermore, based on the theory of the occurrence of disease (epidemiological triangle), diarrhea will not occur in children if there is a balanced interaction between the three components such as the host, agent, and environment. The condition will occur if there is an imbalance.[21]

A balanced state between the three diarrhea-causing components, namely the host (in this case, the condition of the children), the agent as a causative factor (such as bacteria, virus, or protozoa), and the environment (including the home environment, parental behavior, and family income level) [Figure 2].

As shown in Figure 3, model 1 shows the imbalance of the three components based on which the mutation of causative agents of the disease occurs. Model 2 also demonstrates imbalance due to a large number of children in the population (H) that sensitive to diarrhea, and hence, the population is vulnerable to disease. Model 3 represents an imbalanced condition in which changes in the global climate (E) cause gene mutations in disease agents (A) and the population (H), which caused them to be sensitive to disease. Furthermore, the occurrence of floods (E) means that populations (H) are quickly exposed to the risk of diarrhea. Model 4 presents an imbalanced condition due to water pollution (E) caused by the agents of disease (A) contaminating water and food, potentially resulting in diarrhea when consumed by children (H).

Based on these models, it can be understood that health problems and public health status are a multifactorial problem. Health problems are influenced by environmental determinants (including social conditions), behaviors, health services, and genetic factors (psycho-sociobiological endurance). Based on the above models, we have compiled a theoretical framework/perspective. The theoretical framework is represented in a diagram that depicts the outline of the logical flow of a study.[22]

To put it, people living in poverty will live in conditions of low health status. This arises because poor people cannot access adequate health services. Indeed, people experiencing diseases are consistently found to live in poverty. The observation results have shown some areas of Manado city are densely populated

residential areas, and some populations are located in coastal areas. Each population group has distinct behaviors, socioeconomic factors, and residential environments. For example, the ethnic Sangihe mostly work as fishermen; they tend to wash their hands in seawater or not wash their hands before eating, dispose their feces in coastal areas, and have a low level of education. The ethnic Gorontalo work as traders, spending their time mostly in the traditional market area; and thus hand washing before eating is done only using the water available there. Moreover, they tend to be low educated, and the number of family members could reach 10–15 people/household. In this context, there is a need for government action to address such situations.

The other study suggests that an increase in maternal education may not always have a beneficial effect on children's health. Improvement in children's health status can be accomplished by improving the access of mothers and children to community resources. Furthermore, there need to be efforts to help mothers more effectively in various social roles. This is a prerequisite for improving the level of maternal education to improve children's health.[19]

Some studies have shown that maternal education leads to earlier preventive care initiation, reduces smoking, reduces fertility, child mortality, and chronically malnourished children. On the other hand, maternal education leads to an increase in the early child health investments and increases the age at first birth.[23-25] The other study suggested that the low-income family was attributed to the incidence of low birth weight. As the low-income family lacked resources to invest high-quality childcare and health.[25-27] The improvements mothers' knowledge can improve child health in general

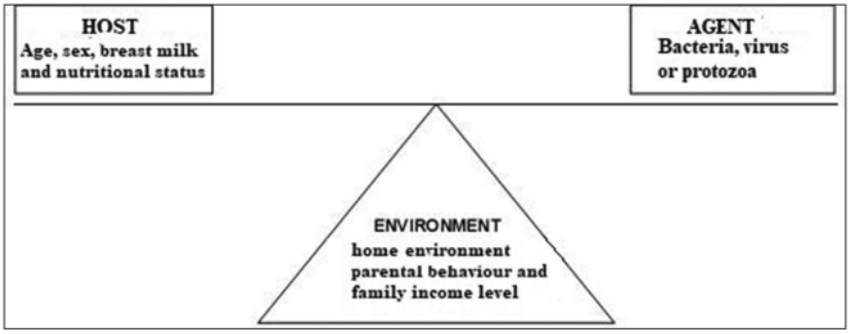

Figure 2: The states in the epidemiological triangle in which child diarrhea occurs

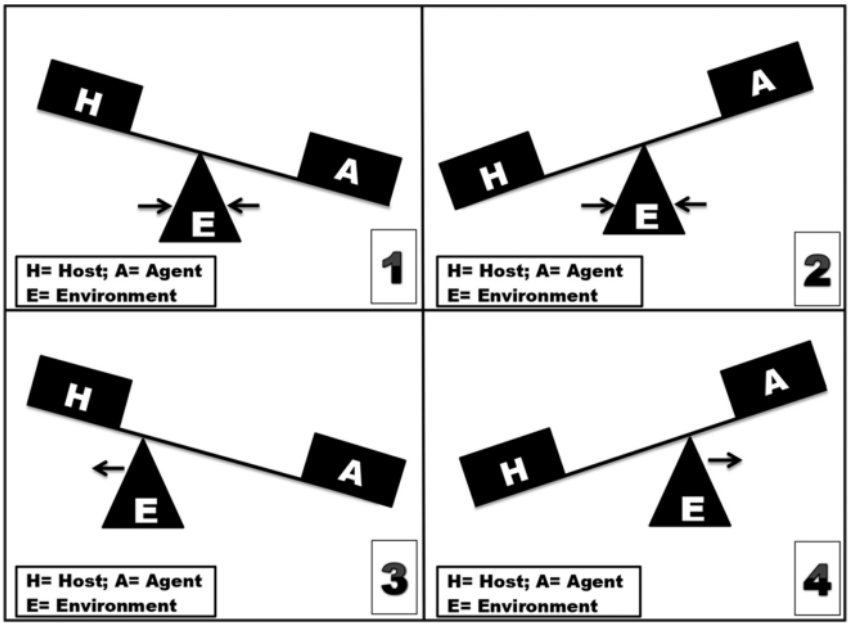

Figure 3: The imbalance models of the three components which potentially resulting in diarrhea

through various means, such as exclusive breastfeeding, nutrition level, and infant feeding practices.[28-31]

Limitation

The limitation of this study is used the small sample size (120 respondents). Thus, it cannot be used to generalize these findings as to the general population.

Conclusions

This study indicates that socioeconomic factors affect the incidence of diarrhea in under-five children in the coastal of Manado city. The coefficient value for the direct effect indicates that an increase in the socioeconomic condition of the family could reduce the risk of diarrhea occurrence in under-five children. This study was shown that diarrhea in under-five children was more prevalent in low-educated mothers and low-income families.

Based on the above findings, the researcher recommends empowering communities, especially coastal communities, in Manado city. The community empowerment activities can be done through the activities to improve the knowledge of mothers and economic conditions of families. The Manado health office must carry out the health education/health promotion to the mother or the caregiver of under-five children about how to prevent diarrhea in children.

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Conflicts of interest

There are no conflicts of interest.

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Socioeconomic Factors Associated with Diarrhea among Under-Five Children in Manado Coastal Area, Indonesia

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