

## HOUSEHOLD RISK FACTORS FOR DIARRHOEA DISEASE IN CHILDREN UNDER FIVE YEARS OLD IN INDONESIA

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### ABSTRACT

**Background:** Diarrhoea caused the death of six children under five years old in the world in 2016, in developing countries and low-income children under three years of age experienced diarrhoea three episodes of each year. Diarrhoea being the main cause of malnutrition in children under five years old, but can be prevented and treated with safe drinking water and good sanitation. This study aims to examine factors at the household level that influence the incidence of diarrhoea in children under five years old in Indonesia including drinking water sources, toilet facilities, maternal education and residence.

**Method:** This study uses a cross-sectional design with Chi Square test. The data analysed were secondary data from the results of 2017 IDHS performed on 17,155 toddlers, with a sample of 2,440 diarrhoea children under five years old and 14,715 children under five years old without diarrhoea. Data processing was performed using SPSS with univariate, bivariate, and multivariate analysis.

**Study Results:** Chi Square Test results show a relationship between the incidence of diarrhoeal diseases and drinking water sources  $p$ -value = 0.035, toilet facilities  $p$ -value = 0.000, maternal education  $p$ -value = 0.000 and residence  $p$ -value = 0.000. Multivariate analysis with Logic Regression shows that the most dominant factors affecting the incidence of diarrhoea were toilet facilities, maternal education, and residence.

**Conclusion:** The most dominant variables affecting the incidence of in under-fives years old are toilet facilities, mother's education, and residence. Efforts made by the government and the public to prevent diarrhoea are implementing open defecation, promotion hand washing with soap, managing household drinking water and food, safeguarding household waste, and securing household liquid waste.

**Keywords:** children under five years old diarrhoea, risk factors, Indonesia

## FAKTOR-FAKTOR DALAM RUMAH TANGGA YANG MEMPENGARUHI KEJADIAN DIARE BALITA DI INDONESIA

### ABSTRAK

**Latar Belakang :** Diare penyebab kematian ke enam balita didunia tahun 2016, di negara berkembang dan berpenghasilan rendah rata-rata balita dibawah tiga tahun mengalami diare tiga kali setiap tahunnya. Diare penyebab utama kekurangan gizi balita, namun bisa dicegah dan diobati melalui air minum aman dan sanitasi yang baik. Penelitian ini bertujuan mengetahui faktor-faktor dalam rumah tangga yang mempengaruhi kejadian diare balita di Indonesia diantaranya sumber air minum, fasilitas jamban, pendidikan ibu dan tempat tinggal.

**Metode :** Penelitian ini menggunakan desain cross sectional dengan uji Chi Square, data dianalisis adalah data sekunder hasil SDKI Tahun 2017 dengan populasi balita berjumlah 17.155, sampel 2.440 balita diare dan 14.715 balita tidak diare. Pengolahan data menggunakan SPSS dengan analisis univariat, bivariat, dan multivariat.

**Hasil Penelitian:** Hasil Uji Chi Square ada hubungan antara kejadian penyakit diare dengan sumber air minum  $p$ -value = 0,035, Fasilitas jamban  $p$ -value = 0,000, pendidikan ibu  $p$ -value = 0,000 dan tempat tinggal  $p$ -value = 0,000. Analisis multivariat dengan Regresi Logistik didapatkan faktor paling dominan mempengaruhi kejadian diare adalah fasilitas jamban, pendidikan ibu, dan tempat tinggal.

**Kesimpulan:** Variabel paling dominan mempengaruhi kejadian diare balita adalah fasilitas jamban, pendidikan ibu dan tempat tinggal. Upaya oleh pemerintah dan masyarakat dalam pencegahan diare adalah melaksanakan Stop buang air besar sembarangan, cuci tangan pakai sabun, pengelolaan air minum dan makanan rumah tangga, pengamanan sampah rumah tangga, dan pengamanan limbah cair rumah tangga.

**Kata kunci :** Diare balita, faktor resiko, Indonesia,

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## INTRODUCTION

Diarrhoea is the release of soft or runny stool with a frequency of three times or more in 24 hours. On average, children under the age of three in developing countries experience three episodes of diarrhoea each year.<sup>1</sup> Diarrhoea is a major cause of morbidity and mortality in under-five years old in developing and low-income countries caused by dehydration, bloody diarrhoea (dysentery), and persistent diarrhoea with malnutrition.<sup>1</sup> In each case of diarrhoea, the patient will be more likely to fall ill.<sup>2</sup> According to WHO data in 2016, diarrhoea is the cause of under-five mortality of 8.4 per 1,000 live births, while in the Southeast Asia region diarrhoea is ranked 5th in the cause of under-five mortality of 8.8 per 1,000 live births.<sup>3</sup> Global, there are almost 1.7 billion cases of diarrhoea disease in children every year, and it serves as causes of deaths from around 525,000 children under the age of five.<sup>2</sup> Most deaths from diarrhoea occur in children less than two years of age living in South Asia and sub-Saharan Africa.<sup>4</sup>

In Indonesia these particular age groups have the highest prevalence of suffering from diarrhoea with an incidence of 6.7%.<sup>5</sup> Although the prevalence of diarrhoeal diseases decreased from 18.5% in 2013 to 12.3% in 2018, diarrhoea remain a contagious disease for infants in Indonesia.<sup>6</sup> According to UNICEF, under-five mortality rate in Indonesia in 2017 amounted to 25.4 per 1000 live births.<sup>7</sup> Estimates number of diarrhoea cases in health facilities increased from 2016 from 6,897,463 to 7,077, 299. Diarrhoea cases finding rate handled in 2016 amounting to 2,544,084 (36.9%) and amounting to 4,274,790 (60.4%) in 2017.<sup>8,9</sup> Diarrhoea is caused by microorganisms, such as Rotavirus, Escherichia coli, cholera, Shigella, protozoa and helminths<sup>10</sup> These microorganisms infect and spread through contaminated food or drinking water or from person to person due to poor hygiene. It is

estimated that 88% of deaths from diarrhoea a cross the world are caused by unsafe water, inadequate sanitation, poor hygiene and diarrhoea due to widespread infection of microorganisms in developing countries.<sup>2,11</sup>

Some of the causes of diarrhoea in households include poor hygiene quality, no safe water source for drinking, cooking and washing food ingredients, poor food management, unsafe septic tanks or toilets polluting water sources, babies not receiving exclusive breastfeeding during the first six months, not washing hands properly and timely such as after defecation, after cleaning child's stool, before and after preparing food and before eating.<sup>1,2</sup> Considering demographic aspects, access to household drinking water in rural areas is still low compared to urban areas, where difficult access to water sources limits personal hygiene and the practice of hand washing, whereas washing hands with soap and at the right time can reduce the incidence of diarrhoea by 40%. In addition improving household water quality in terms of both water sources and good water storage will reduce the incidence of diarrhoea by 47%.<sup>11</sup>

Previous studies have found a link between diarrhoea and risk factors for diarrhoea in households, such as maternal education levels that greatly affect the incidence of diarrhoea in infants where lower educational background of mother, leads to higher risk of diarrhoeal disease.<sup>12-18</sup> Some studies indicate living in urban areas leads to risk of diarrhoea in children compared to living in rural areas.<sup>13</sup> while other studies contrast that it is more risky for children under five living in rural areas to get diarrhoea than in urban areas.<sup>18,19</sup>

Factors for such as consuming unsafe and unhygienic drinking water and drinking water sources, especially those having been contaminated with E coli, increase the risk of diarrhoea in infants.<sup>15,18-20</sup> Moreover, unsafe

faeces disposal, latrine availability, and inadequate toilet facilities are also strongly associated with the increasing incidence of diarrhoea in infants.<sup>13,14,18,21,22</sup>

Prevention of diarrhoea is strongly related to the factors that cause diarrhoea. Some steps to prevent diarrhoea according to WHO and UNICEF include: 1). Access to safe drinking water, by ensuring sources of drinking water used by families free from contamination of household waste, human faeces, animal faeces, and, closed drinking water storage, as well as ensuring the use of boiling water to drink and sufficient water availability. 2). Better sanitation. The use of unhealthy latrines and the disposal of unsafe faeces contribute to spreading diarrhoea agents. 3). Wash hands with soap. All agents causing diarrhoea can be spread by hands contaminated with faeces. Washing hands with soap reduces the risk of transmission of diarrhoea. 4). Exclusive breastfeeding until the baby is six months old. Babies who get exclusive breastfeeding are far less likely to get diarrhoea or die compared to babies not getting exclusive breastfeeding. Nearly half of episodes of diarrhoea can be prevented by increasing breastfeeding in low and middle income countries. Personal cleanliness and good food. Giving additional food to babies is done after six months of age. Good feeding includes nutritious food, feeding patterns, and hygiene in preparing food. Good nutrition supports a strong immune system and provides protection from disease. 6). Health education about how infection spreads. Health education delivered includes how to prevent infection at home with a clean and healthy lifestyle. 7). Rotavirus vaccination. Rotavirus is the most common cause of severe diarrhoeal disease in children under five. Rotavirus infection can be prevented by Rotavirus immunisation. WHO recommends that the Rotavirus vaccine be included in the national immunisation programme. 8). Vitamin A supplementation

Supplementation with high doses of Vitamin A helps maintain the immune system and can reduce diarrhoea cases by up to 15%.<sup>4,1,2,23,11</sup>

By varying the risk factors for diarrhoeal disease and their relevance to the prevention of diarrhoea, this study aims to determine risk factors affecting diarrhoeal disease in toddlers in Indonesia using the 2017 IDHS data so that local health workers can plan for combating diarrhoea in the community since it is line with their scope of tasks. This study aims to examine factors at the household level that influence the incidence of diarrhoea in children under five years old in Indonesia including drinking water sources, toilet facilities, maternal education and residence.

## METHOD

This study uses a survey and secondary data from the results of the Indonesian Demographic and Health Survey data (2017 IDHS).<sup>24</sup> The study design uses a cross-sectional design on children under five suffering from diarrhoea two weeks before the survey as the research subjects with a total sample of 17,155 of which 2,440 are children with diarrhoea and 14,715 are without diarrhoea. The data in this study was processed using univariate analysis, bivariate analysis with chi square test and multivariate analysis with multiple logistic regression prediction models. The dependent variable in this study is the incidence of diarrhoeal disease in infants, while the independent variables are: 1) Feasible drinking water sources in households from PAM – a local water provider company, from own plumbing or public piping systems, boreholes or pumps, closed dug wells, protected springs, rainwater and bottled water, or unfeasible sources of drinking from open dug wells, unprotected springs, water tank trucks, picnic water, irrigation channels, rivers, lakes, ponds or dams, and refill water, 2) Adequate

household toilet facilities such as own flush toilets with septic tanks, or latrines such as inadequate flush toilets without septic tanks, public or shared toilets, rivers, cubicles, dispose of yard and so on, 3) Educational backgrounds of mothers of children under

five categorized as non-schooling, primary education, secondary education or tertiary education, 4) Household residences categorized as living in the village or living in the city.

**RESULTS**

The results of univariate analysis depict the number of diarrhoeal disease events and the characteristics of the variables studied, namely the incidence of diarrhoeal

diseases in infants, sources of drinking water, toilet facilities, mother's education and residence. The frequency distribution is illustrated in the table below

**TABLE 1.**  
**UNIVARIATE ANALYSIS OF DIARRHOEA DISEASE EVENTS AND HOUSEHOLD CHARACTERISTICS IN INDONESIA IN 2017**

Variables	Category	Frequency (n=17,155)	%
<b>The incidence of diarrhoea</b>	Diarrhoea	2,440	14.2
	No Diarrhoea	14,715	85.8
<b>Source of drinking water</b>	Worthy	9,750	56.8
	Not feasible	7,405	43.2
<b>Toilet Facilities</b>	Qualify	11,358	66.2
	Not Eligible	5,797	33.8
<b>Mother's Education</b>	No School	236	1.4
	Basic Education	4,253	24.8
	Middle Education	9,567	55.8
	Higher Education	3,099	18.1
<b>Residence</b>	Village	8,433	49.2
	City	8,722	50.8

From the data in table 1, it can be seen that as many as 14.2% of children under five experience diarrhoea, 56.8% of households have a decent source of drinking water, 66.2% of households have adequate toilet facilities, 55.8% of mothers of infants has a secondary education background, and 50.8% of households live in urban areas.

**TABLE 2.**  
**RESULTS OF BIVARIAT ANALYSIS BETWEEN DRINKING WATER SOURCES, JAMBAN FACILITIES, MOTHER EDUCATION, PLACE TO STAY AND EVENTS OF DIARRHOEA DISEASE IN INDONESIA IN 2017**

VARIABLES	P VALUE	OR	95% CI	
			LOWER	UPPER
Source of drinking water	0.035	1.097	1.007	1.196
Toilet Facilities	0.000	1.360	1.245	1.485
Mother's Education	0.000	1.199	1.127	1.276
Residence	0.000	1.219	1.119	1.329

The results of the bivariate analysis on the incidence of diarrhoea and characteristics in the households in Table 2 indicate that there a relationship between drinking water sources ( $p = 0.035$ ,  $OR = 1.097$ ), toilet facilities ( $p = 0.000$   $OR = 1.360$ ), maternal education ( $p = 0.000$   $OR = 1.119$ ) and residence ( $p = 0.000$   $OR = 1.219$ ) with the incidence of diarrhoea in infants. It was found that inadequate drinking water sources lead to (1.097) times higher for diarrhoeal diseases in infants compared to households with a decent source of drinking water. Inadequate toilet facilities are (1.360) times more likely to cause diarrhoea than latrines meeting adequate requirements. Lower educational background of mothers lead to (1.119) times occurrence of diarrhoeal disease in children under five compared to those with higher education. Futhermore, children under five living in rural areas are (1.219) times more likely to have diarrhoea than those living in cities.

**TABLE 3.**  
**RESULTS OF MULTIVARIAT TEST ON EVENTS OF DIARRHOEA DISEASE AND DRINKING WATER SOURCES, TOILETS FACILITIES, MOTHER’S EDUCATIONAL BACKGROUND AND RESIDENCE IN INDONESIA IN 2017**

VARIABLES	B	P VALUE	OR	95% CI
Toilet Facilities	0.233	0.000	1.263	1.150 – 1.386
Mother's Education	0.119	0.000	1.127	1.055 – 1.203
Residence	0.107	0.020	1.113	1.107 – 1.218

The results of multivariate analysis with logistic regression prediction models indicate that there are variables significantly associated with the incidence of diarrhoea in infants. In the initial modelling, drinking water sources have  $p \text{ Value} > 0.05$  ( $p = 0.094$ ) and thus was excluded from the model. The final modelling results obtained can be seen in Table 3. Of the three related variables, it was found that latrine facilities were the most dominant factor causing diarrhoea in infants with ( $OR = 1.263$ ) which means households with inadequate latrines are (1.263) times more likely to cause diarrhoea in infants compared to households with adequate toilet facilities.

**DISCUSSION**

The results of multivariate analysis show that inadequate latrine facilities poses 1.263 times greater risk of diarrhoea incidence in infants ( $p = 0.000$   $95\% \text{ CI} = 1.150 - 1.386$ ). This finding is in line with the study of Cronin et al. stating that the likelihood of diarrhoea would be greater in households with unsafe dispose of children's stools ( $p = 0.0001$   $OR = 1.37$ ).<sup>14</sup> Mohammed & Zungu 2016 assert that households with better toilet facilities would have low prevalence of diarrhoea children compared to toilets facilities ( $OR = 0.37$   $CI = 0.16-0.87$ ).<sup>21</sup> Susanti et al. 2016 find that types of faecal disposal sites or inadequate toilet facilities greatly influence the increasing ( $p =$

$0.649$   $OR = 1.038$ ).<sup>18</sup> Thiam, et al state that collective use of toilets with other households has a relationship with the incidence of diarrhoea in infants ( $OR = 1.69$ ,  $95\% \text{ CI} 1.11-2.56$ ).<sup>22</sup> Alebel et al, (2018), find that children living in households without toilet facilities would be twice as likely as to have diarrhoea than children living in households with toilet facilities ( $OR = 2.0$   $95\% \text{ CI} 1.3 -3.2$ ).<sup>13</sup> According to WHO and UNICEF JMP criteria of 2006, latrine or sanitation facilities were improved, specifically self-owned sanitation facilities, connected to septic tanks and using goose necks.<sup>25</sup> Adequate Toilet facilities are

extremely important to prevent contamination of drinking water sources and the environment from human faeces containing bacteria which can cause diarrhoea and other digestive diseases. Furthermore, it also prevents contamination in the household environment managed by mothers with children under five years old, such as food for toddlers, drinking water, and processing of food raw materials.

Most mother's in this study have elementary and secondary educational backgrounds. The results from the statistical analysis also reveal maternal education as a variable having a relationship with the incidence of diarrhoea in infants, with (OR = 1.127) which means that the lower educational background poses the risk for children under five years old having diarrhoea (1.127) times greater than children whose mothers possess higher education. This is in line with Adeyemika Desmennu et al. stating that children aged 0-24 months whose mothers have primary education are more likely to experience diarrhoea than those with secondary education (OR = 2.13 CI = 1.33-3.41).<sup>12</sup> Hasan & Richardson state that mothers who do not graduate from primary school (OR = 1.69, CI 1.20 to 2.38) and mothers with junior secondary education (OR = 1.70 CI 1.16-2.49) have a higher risk of getting diarrhoea compared to children whose mothers have higher education.<sup>15</sup> In line with Cronin et al. it was found that maternal education greatly affects the incidence of diarrhoea in children under 24 months where mothers with primary or secondary education have a risk greater incidence of diarrhoea in children compared to mothers with higher educational background (OR = 1.52 CI 1.20-1.92).<sup>14</sup> Kumi- Kyereme et al states that a child whose mother is only primary education graduate is more likely to experience diarrhoea compared to those whose mother is secondary or tertiary education graduate (OR = 1.611 CI = 0.961-2.699).<sup>16</sup> According to Maroof Saira et al (2017) there is a significant correlation between mother's educational background and the behaviour

implementation of hand washing and exclusive breastfeeding which is one of the contributing causes for diarrhoea in children under five (p Value = 0.001).<sup>17</sup> Susanti et al, also state that there is a relationship between maternal education and the incidence of diarrhoea (OR = 1.47 CI = 1.140-1.910) where maternal education levels affect knowledge and level of information received.<sup>18</sup> Alebel et al. assert the relationship between maternal education and diarrhoea in children where the likelihood of diarrhoea will be greater in children whose mothers cannot read and write than those with literate mothers (OR = 2.5 CI = 1.3-2.1) and educated mothers have better knowledge about hygiene rules, proper child feeding, and diarrhoea signs and symptoms which are key determinant of the occurrence of diarrhoea in childhood. Education can increase maternal awareness in the prevention of diarrhoea and can have a major impact on a change of behaviour in the household.<sup>13</sup> Mothers who are highly educated will have good thought patterns, attitudes and behaviour in maintaining personal, family and environmental hygiene such as washing hands with soap at the right time, and carrying out healthy and hygienic toddler care patterns. Mothers who are highly educated will also tend to have the ability to find information on their own about prevention and treatment of diarrhoea.

The majority of household residences in this study are living in cities. The results of multivariate analysis showed that dwellings have a relationship with the incidence of diarrhoea where households living in rural areas are (1.113) times more likely to incur incidence of diarrhoea in infants compared to those living in the cities. This is in line with Alebel et al. (2018) which states that children from rural households are (1.9) times more likely to develop diarrhoea than children who live in the cities (OR = 1.9 CI = 1.2 -3.0). Residents living in urban areas have better access to clean water, sanitation facilities, and care facilities. Urban populations tend to be of higher economic

conditions which will have an impact on hygiene practices.<sup>13</sup> This is line with Nworie and Aluh stating that place of residence is a strong predictor of diarrhoea in infants. Those living in the countryside will tend to experience diarrhoea compared to those who live in the cities (OR = 1.2 CI = 1.10-1.30).<sup>(19)</sup> Susanti et al. also stated that there is a relationship between place of residence and incidence of diarrhoea (OR = 1.177 CI = 1.043-1.329) . Living in the countryside will pose more risk of diarrhoea in infants compared to living in the cities. In general, people who live in urban areas will tend to have easier access to information about the diarrhoea prevention and handling, and to proper sanitation facilities and clean water sources.<sup>(18)</sup> In urban areas, people also rarely keep livestock, where as in rural areas animal manure can also pollute drinking water sources and household environment. The management of municipal waste water in urban areas is also better because of ease of access in the construction of household waterways and safe disposal of faeces. Similarly, waste management in urban areas is more organized and safer than in rural areas, where waste tends to not be managed properly, and thus will cause the breeding of germs and flies which are spreading vectors of diarrhoeal diseases.

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## CONCLUSION

The most influential variables the incidence of diarrhoea which toilet facilities, followed by maternal education and residential place. It is expected that the results of this study can be an illustration of the importance of interventions to improve the sources of decent drinking water, adequate latrine facilities, maternal education and housing as a factors that influence the incidence of diarrhoea in Indonesia to improve health programmes, especially environmental health, which is strongly associated with diarrhoeal diseases, as one of the environmentally related infectious diseases. One effort that needs to be optimized is to implement a holistic community-based sanitation programme that has five pillars, stopping open defecation, washing hands with soap, managing drinking water and household food, securing household waste, and securing household liquid waste. These five pillars are a form of preventive behaviour that can be carried out by the community independently in order to realise hygienic and sanitary community behaviour and achieve the highest degree of public health.

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