Meta analysis: The relationship of mother's hand washing behavior, clean water supply and availability of latrines with the incidence of diarrhea in toddlers

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Abstract

Diarrhea is one of the environmental-based diseases that causes morbidity and mortality. Nearly a quarter of all deaths globally can be attributed to environmental impacts on health. The high incidence of environmental-based disease cases is caused by the poor condition of basic sanitation owned by the community, especially clean water, the increase in environmental pollution, and the lack of awareness of clean and healthy living behavior (PHBS) by the community such as hand washing behavior. One of the factors that cause diarrheal disease is environmental factors which include water supply facilities and the availability of latrines. The differences in the results obtained in studies related to the relationship between hand washing behavior, clean water supply, and the availability of latrines with the incidence of diarrhea triggered researchers to combine related studies. This study aims to analyze and examine related studies that explain the relationship between hand washing behavior, clean water supply and the availability of latrines with the incidence of diarrhea. The method used in this study is a meta-analysis with research searches on the Pubmed and Google Scholar databases. After going through the identification and selection stages, 21 articles were included in the meta-analysis. Pooled Odds Ratio (POR) was calculated using a random effect model for data analysis according to the heterogeneity test using Comprehensive Meta Analysis version 3. The results showed the pOR value for the mother's hand washing behavior variable was 1.599 (CI 95% 0.953-2.682), for the variable clean water supply 1.463 (CI 95% 1.120-1.911) and for the latrine availability variable 2.249 (CI 95% 1.477-3.424).

I. INTRODUCTION

A. Background

According to the UNICEF [1] diarrhea is defecation (BAB) with more liquid stool consistency with a frequency of > 3 times a day, except for neonates (babies < 1 month) who are breastfed, usually defecate more frequently (5-6 times a day) with good consistency is considered normal. In Southeast Asia, 3,8 million lives could be saved by addressing environmental risks in their homes, workplaces and communities [2]. Children and toddlers are among the most vulnerable and in 2015 an estimated 5.9 million children died before the age of 5 years. A quarter of these lives could be saved by reducing risks due to environmental factors [3]. According to WHO [4], the causes of death for children under five years of age include diarrhea (14%), pneumonia (14%), malaria (8%), non-communicable disease (4%), other infections (9%). Meanwhile, based on the Indonesian Ministry of Health [5], in Indonesia cases of diarrhea found in health facilities were 7.07-7.299 and cases of diarrhea handled were 4.27-4.790 (60.4%) of the total cases.

According to Solomon et al [6] said that toddlers aged 6 to 11 months have a 1.01 times greater risk of experiencing diarrhea compared to the 12-23 month age group which has a 0.94 times greater risk. From this study, the high cases of diarrhea in toddlers can be caused by differences in the behavior of each child by the mother or caregiver, besides

that the difference in the sanitation environment can also have an effect. Based on the Basic Human Servicer (BHS) study in Indonesia in 2006, people's behavior in washing their hands is 12% after defecating, after cleaning the feces of infants and toddlers 9%, before eating 14%, before feeding the baby 7%, before preparing food 6%. So that hand washing behavior is one of the factors that cause diarrhea [7, 8].

In another BHS study on the behavior of household drinking water management, it showed that 99.20% boiled water to get drinking water, but 47.50% of the water still contained Eschericia coli. This condition contributes to the high incidence of diarrhea in Indonesia [9, 10]. Research by Getahun [11] which states that there is a relationship between hand washing behavior with the incidence of diarrhea in toddlers with a *p*-value of 0.001. This is contrary to the research of Bennion et al [12] which states that there is no relationship between mother's hand washing behavior with the incidence of diarrhea in toddlers with a *p*-value of 0.24.

Based on the results of previous studies, there are differences in the results obtained in research related to the relationship between mother's hand washing behavior, clean water supply, and the availability of latrines with the incidence of diarrhea in toddlers so that the research gap triggers researchers to find out further which risk factors affect diarrhea in toddlers.

II. METHOD

The research design used is Meta Analysis. Meta-analysis is a statistical technique to combine the results of two or more similar studies in order to obtain a quantitative blend of data. Research searches on Pubmed and Google Scholar databases. After going through the identification and selection stages, 21 articles were included in the meta-analysis. POR was calculated using a random effect model for data analysis according to heterogeneity test using Comprehensive Meta Analysis version [13].

III. RESULTS AND DISCUSSION

A. Meta Analysis of the Relationship of Mother's Handwashing Behavior with Incidence of Diarrhea

The heterogeneity test in 9 combined studies related to mother's handwashing behavior with the incidence of diarrhea in toddlers showed that there was a *p*-value of 0.000 and an I^2 value of 87% including very high heterogeneity where *p*-value < 0.05 and I^2 > 50% means that it varies between studies (heterogeneous). With the results of the heterogeneity, the Random Effect Model is used to measure the combined effect of the research data used [14].
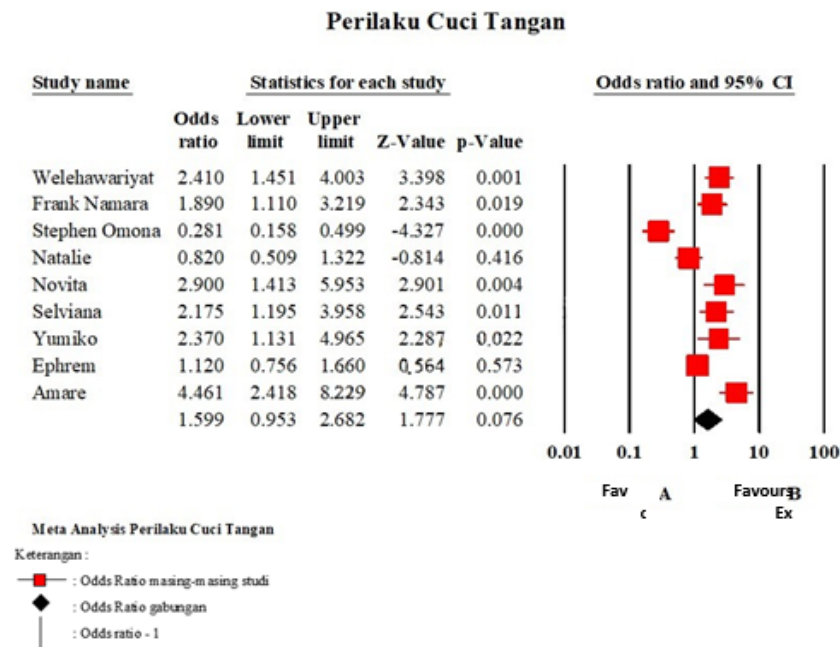

Fig. 1. Graph of forest plot random effect model of the relationship between mother's hand washing behavior and the incidence of diarrhea in toddlers extraction

Statistically, the combined effect was significant when the *p* value < 0.05, where the combined test results at the *p* value of 0.076, which means the null hypothesis is rejected, indicating that there is no relationship between maternal hand washing behavior and the incidence of diarrhea in children under five. Based on data from the forest plot graph, the pooled odds ratio value is 1.599 with a 95% confidence interval (95% CI = 0.953-2.682).

The absence of a significant relationship between mother's hand washing behavior and the incidence of diarrhea in toddlers is in line with the research [15] which is indicated by the *p*-value of 0.24. This is due to the lack of resources, namely clean water, so that people are unable to wash their hands as a routine. This is supported by Syah's research [16] which shows a *p*-value of 0.291 indicating there is no relationship between hand washing behavior and diarrhea. In addition, the research conducted by Annisa [17] with a *p* value of 0.188 also stated that there was no relationship between hand washing behavior and the incidence of diarrhea in toddlers. This study states that most respondents have washed their hands so that it can minimize the cause of diarrhea in toddlers [18].

Penyediaan Air Bersih

Study name	Odds ratio	Lower limit	Upper limit	Z-Value	p-Value
Ugochukwu Uzoechina Nwokoro	5.610	0.752	41.856	1.682	0.093
Selviana	1.457	0.447	4.750	0.624	0.532
Patmawati	5.300	1.641	17.123	2.787	0.005
Megalina Limoy	0.850	0.292	2.476	-0.298	0.766
Minanda Oktariza	2.846	1.593	5.085	3.532	0.000
Menik Samiyati	1.801	1.115	2.909	2.405	0.016
Pintu Paul	1.170	1.102	1.242	5.137	0.000
Ephrem Tefera Solomon	1.190	0.874	1.620	1.106	0.269
Atalay Getachew	0.980	0.634	1.515	-0.091	0.923
	1.463	1.120	1.911	2.794	0.005

Meta Analysis Penyediaan Air Bersih
Keterangan :
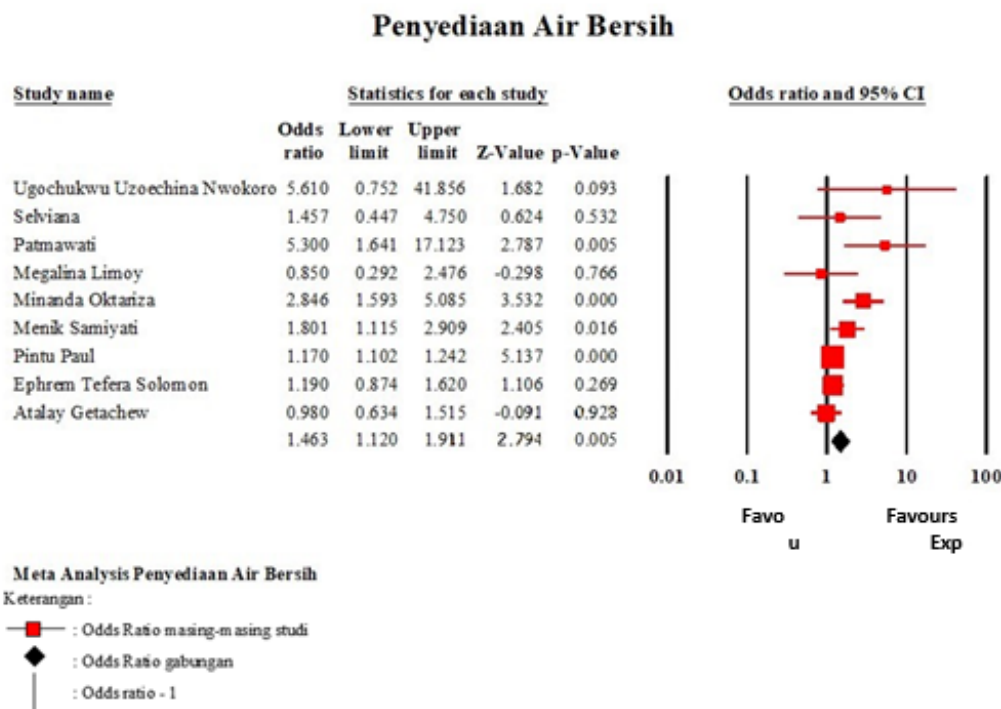: Odds Ratio masing-masing studi
: Odds Ratio gabungan
: Odds ratio - 1

Fig. 2. Graph of forest plot random effect model of the relationship between clean water supply and the incidence of diarrhea in toddlers extraction

Statistically, the combined effect is significant if the *p* value < 0.05, where the combined test results on the *p* value of 0.005 which means the null hypothesis is accepted, indicating that there is a relationship between the provision of clean water and the incidence of diarrhea in children under five. Based on data from the forest plot graph, the pooled odds ratio value is 1.463 with a 95% confidence interval (95% CI = 1.120-1.911) [19].

This significant relationship is supported by research by Oktariza [20] which is shown by the p-value of 0,037 which states that there is a relationship between the provision of clean water and the incidence of diarrhea in children under five, where 2.846 times the risk of diarrhea in respon-

dents who do not meet the requirements for clean water supply. Provision of clean water that meets the requirements is the provision of good quality water-based resource facilities that meet the requirements of quality, quantity, and continuity. Water quality must meet requirements, one of which is physical quality requirements such as odorless, colorless, tasteless and not cloudy. In addition, it is also supported by research from Grafika et al [21] which shows a *p*-value of 0.000 which states that there is a relationship between the provision of clean water and the incidence of diarrhea. Based on these studies, many of the community's clean water supply does not meet health requirements. In accordance with the results of observations, some samples

of houses have clean water and its distribution uses pipes, but in terms of the quality of the physical requirements of clean water, most of them do not meet the requirements, clean water is not always available at all times and the quantity of water is always not enough for daily needs.

B. Meta Analysis of the Relationship between Clean Water Supply and Diarrhea

The heterogeneity test in 9 combined studies related to the provision of clean water with the incidence of diarrhea in children under five showed that there was a *p*-value of 0.006 and an I^2 value of 63% including quite high heterogeneity where the *p*-value < 0.05 and the I^2 > 50% value indicated that the studies varied (heterogeneous). With the results of the heterogeneity, the Random Effect Model is used to measure the combined effect of the research data used.

Ketersediaan Jamban

Study name	Odds ratio	Lower limit	Upper limit	Z-Value	p-Value
Stephen Omona	0.721	0.370	1.404	-0.962	0.336
Pintu Paul	0.820	0.800	0.840	-15.944	0.000
Samer Abuzerr	278.600	99.872	777.178	10.756	0.000
Apriani Endawati	7.000	2.012	24.356	3.059	0.002
Ephrem Tefera Solomon	1.210	0.913	1.604	1.324	0.185
Getachew Yismaw Workie	5.600	3.007	10.429	5.430	0.000
Zhifei He	1.104	0.950	1.283	1.291	0.197
Atalay Getachew	1.650	1.005	2.708	1.981	0.042
Melkamu Molla Ferede	1.390	1.091	1.771	2.663	0.008
	2.249	1.477	3.424	3.778	0.000

Meta Analysis Ketersediaan Jamban

Keterangan :
◼ : Odds Ratio masing-masing studi
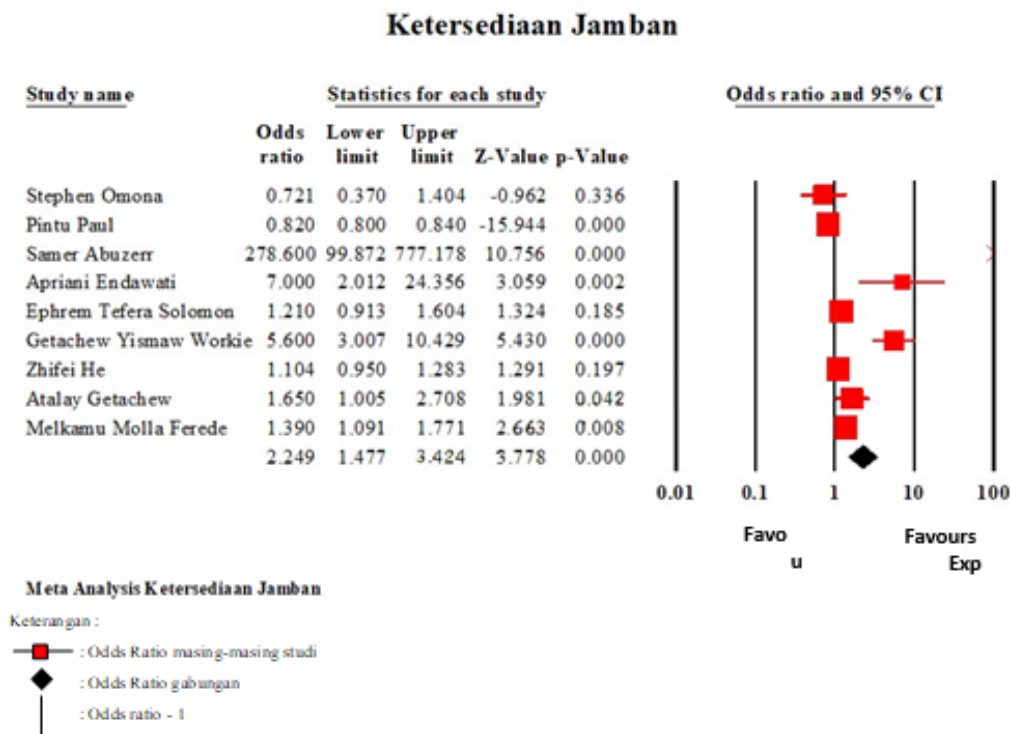◆ : Odds Ratio gabungan
| : Odds ratio - 1

Fig. 3. Graph of forest plot random effect model of the relationship between the availability of latrines and the incidence of diarrhea in toddlers

Statistically, the combined effect was significant if the *p* value < 0.05, where the combined test results at the *p* value of 0.000 which means the null hypothesis is accepted, indicating that there is a relationship between the availability of latrines and the incidence of diarrhea in children under five. Based on data from the forest plot graph, the pooled odds ratio value is 2.249 with a 95% confidence interval (95% CI = 1.477-3.424).

The above results are also supported by Endawati [18] which states that there is a significant relationship between latrine ownership and the incidence of diarrhea with a p value of 0.004. Based on the results of the data obtained, there are still many people in the working area of the Pembina City Health Center of Palembang who are not aware of the need to have clean and healthy family latrines so as to facilitate the incidence of diarrhea in toddlers The availability of latrines in each household is able to reduce fecal contamination in the surrounding environment. The presence of these latrines facilitates the disposal of feces thereby reducing contact between diarrhea-causing organisms and the host. In addition, Ganiwijaya et al research [22] also stated that there was a relationship between the availability of latrines and the incidence of diarrhea in toddlers with a p-value of 0,024. Toilets are very useful for humans and are part of human life, because latrines can prevent the proliferation of various diseases caused by human waste that are not managed properly. On the other hand, if the disposal of feces is not good and indiscriminate, it can result in con-

tamination of water, soil, or become a source of infection, and will pose a hazard to health.

IV. CONCLUSION AND IMPLICATIONS

The results of the meta-analysis showed that the two variables in the study, namely the provision of clean water and the availability of latrines, both had a statistical relationship with the incidence of diarrhea in children under five. Based on the results of the meta-analysis, it can also be seen that the latrine availability variable has a stronger relationship than the clean water supply variable. This can be seen from the combined z value, the z value for the latrine availability variable is 3.778 and the clean water supply variable is 2.794. In addition, the pOR value in the latrine availability variable is also greater than the supply of clean water. Recommendations based on the results of this study are health promotion efforts by the Government, especially the Health Office related to the importance of providing clean water, availability of latrines and hand washing behavior in the community to reduce the occurrence of diseases related to environmental health, especially diarrhea in toddlers.

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