# Factors related to the occurrence of typhoid fever in the residential population of Musi River, Southern Sumatra

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## Abstract

**Purpose:** This study aims to determine the factors related to typhoid fever occurrence in the Musi River residential area in Seberang Ulu Palembang. **Methods:** Using a proportional cluster sampling technique, this quantitative study uses a case-control design with a population of 106 samples in the Musi River suburb of Seberang Ulu. Data analysis carried out in this study was univariate, bivariate, and multivariate. **Results:** The results of the study of the incidence of typhoid fever in the population of the Musi River region in Seberang Ulu showed a low socioeconomic (p-value = 0.032), low education (p-value = 0.015), individual hygiene (p-value = 0,000), using the toilet (p-value 0.025), clean water quality (p-value = 0.034), garbage storage facility (p-value = 0.006), fecal leasing facility (pvalue = 0.018) is related to the incidence of typhoid fever, age, gender, occupancy density is not relationship with the incidence of typhoid fever Based on the results of multivariate analysis, the variable waste disposal facility is the most influential variable with the Odds Ratio 3.557; 95% CI 0.951-13,229. **Conclusions:** It can be concluded that the waste disposal facilities in the Musi River suburb in Seberang Ulu are still not good and have become a dominant factor influencing the incidence of typhoid fever. Hence, it is advisable to carry out outreach efforts to increase environmental awareness and provide garbage disposal infrastructure to meet the requirements of a healthy environment. We are also looking for trash transport officers to transport to temporary landfills.

**Keywords**: case-control; Musi River edge; typhoid fever

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## INTRODUCTION

Typhoid fever is caused by Salmonella enterica serotype Typhi, an organism that generally occurs in areas with poor sanitation and contaminated food or drink. Salmonella typhi releases toxins that will cause fever symptoms in the patient [1]. According to the World Health Organization (WHO), in 2017, it was estimated that 11-20 million people fell ill due to typhoid fever, and between 128,000 and 161,000 people died each year. The risk of typhoid fever is higher in populations that do not have access to safe water and adequate sanitation, with poor communities and vulnerable groups, including children, being at the highest risk [2]. In Southeast Asia, it is estimated that 70% of deaths are caused by typhoid fever incidents due to poor personal hygiene, low socioeconomic status, slum settlements, and high population density conditions [3].

Data from the Indonesian Ministry of Health in 2011 shows that typhoid fever in Indonesia ranks third among the ten most treated diseases in hospitals, with 55,098 cases and a Case Fatality Rate (CFR) of 2.06%. The impact of this disease includes high absenteeism rates, decreased productivity, the emergence of complications both in the digestive tract and outside of it, and economic losses due to treatment, care, and mortality costs [4]. Data from the South Sumatra Health Office shows that cases of typhoid fever increased by 27% from 2016 to 2017.5Data from the South Sumatra Health Office shows that typhoid fever in the Seberang Ulu district health center was found to have 923 positive Widal cases in 2017, with more than 50% of typhoid fever cases occurring in individuals over 15 years old [5].

The results of the research conducted by Aziz Atikawati (2015) state that there is a relationship between waste disposal facilities and personal hygiene, while waste disposal facilities and kitchen sanitation are not factors in the occurrence of typhoid fever in the Mlatibaru village, Semarang Timur district [6].The results of the research by Nurvina Wahyu (2013) state that gender, socioeconomic status, and sanitation facilities are factors that influence typhoid fever at the Kedungmundu Health Center in Semarang City [7]. This means that environmental factors and personal hygiene still significantly influence the incidence of typhoid fever.

The initial observation on the outskirts of the Musi River in Seberang Ulu Palembang revealed inadequate environmental factors and poor water facilities. Many slum settlements are located along the banks of the Musi River. As for personal hygiene, there is a lack of the habit of washing hands before eating and washing raw food in contaminated water. Therefore, a study was conducted on the factors related to typhoid fever incidence among the Musi Riverbank area residents in Seberang Ulu Palembang.

## METHODS

This research is a quantitative study with a case-control design, a type of observational analytical research conducted by comparing case groups and control groups based on their exposure status. The design moves from effect to cause. The sample in this study consisted of residents from the Musi Riverbank area in Seberang Ulu Palembang, totaling 106 samples, which included 53 case samples and 53 control samples. Using the proportional cluster sampling tech-

nique, the results were as follows: in the 1 Ulu sub-district, there were 15 case residents and 15 control residents; in the 7 Ulu sub-district, there were 20 case residents and 20 control residents; in the Bagus Kuning sub-district, there were 17 case residents and 17 control residents; and in the Tangga Takat sub-district, there was 1 case resident and one control resident. The data analysis conducted in this study was univariate, bivariate with chi-square tests, and multivariate. Data collection using the interview method was conducted through direct interviews with respondents using questionnaires, measuring housing density with a rolling meter, and observing toilet facilities, clean water quality, waste disposal facilities, and garbage disposal facilities with observation sheets from each respondent.

## RESULTS

### Univariate analysis

The frequency distribution of factors related to the incidence of typhoid fever among the residents of the Musi Riverbank area in Seberang Ulu Palembang can be seen in Figure 1. The research results show that the population aged less than 30 years has a difference of 5.6% compared to those aged more than 30 years. Many of the respondents in this study were male, with a difference of 51.0% compared to female respondents. In this study, the majority of the population has low socioeconomic status, with a difference of 77.4% compared to the high socioeconomic status population. Most residents have low education levels, with a difference of 47.2% compared to those with higher education levels. Residents with poor personal hygiene outnumber those with good personal hygiene by 18.8%.

Figure 2 shows that most residents with toilet facilities do not meet the requirements, with a difference of 62.2% between those who meet the toilet facility requirements. Many residents have unsatisfactory clean water quality, with a difference of 68.0% between those with satisfactory and those without. Residents with unsuitable housing density differ from those with suitable housing density by 39.6%. Most residents with latrine facilities do not meet the requirements, with a difference of 56.6% between those with latrine facilities that meet the requirements. In addition, most residents with waste disposal facilities do not meet the standards, with a difference of 62.2% between those with compliant waste disposal facilities and those without.
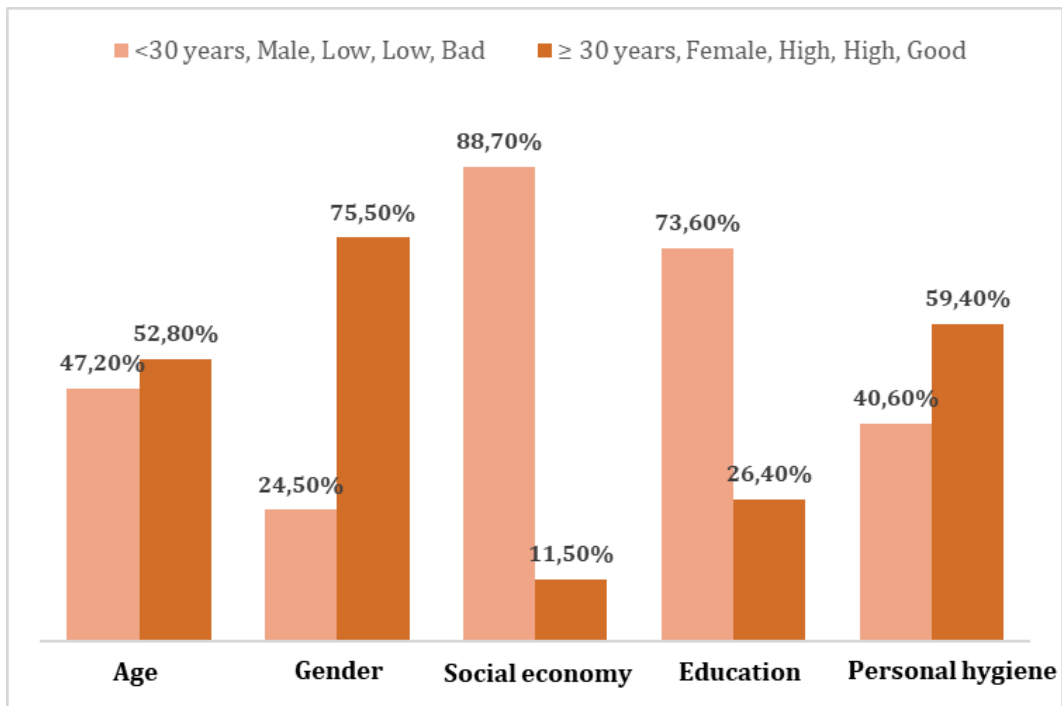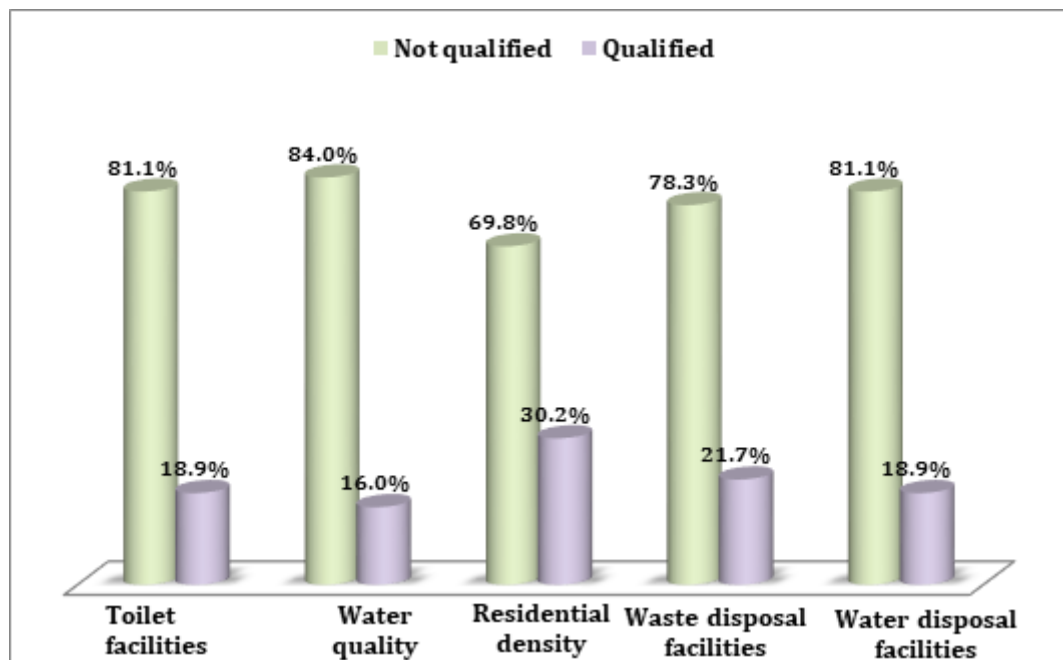
**Figure 1. Individual characteristics**



**Figure 2. Environmental**

**Bivariate analysis**

Table 2 shows that the variables related to the incidence of typhoid fever are socioeconomic (p-value= 0.032), education (p-value = 0.015), personal hygiene (p-value = 0.000), toilet facilities (p-value = 0.025), clean water quality (p-value = 0.034), fecal disposal facilities (p-value = 0.018), and waste disposal facilities (p-value = 0.006) with p-value < α=0.05. Meanwhile, the variables that are not related are age, gender, and housing density.

**Table 2. The relationship between independent variables and the incidence of typhoid fever among residents of the Musi Riverbank area in Seberang Ulu Palembang**

| Variable | Typhoid fever cases | | | | | | p-value | OR (95%CI) |
|---|---|---|---|---|---|---|---|---|
| | Case | | Control | | Total | | | |
| | n | % | n | % | n | % | | |
| **Age (years)** | | | | | | | | |
| < 30 | 29 | 54,7 | 21 | 39,6 | 50 | 47,2 | 0,173 | 1,841 (0,851-3,983) |
| ≥ 30 | 24 | 45,3 | 32 | 60,4 | 56 | 52.8 | | |
| **Gender** | | | | | | | | |
| Male | 10 | 18,9 | 16 | 30,2 | 26 | 24,5 | 0,259 | 0,538 (0,218-1,328) |
| Female | 43 | 81,1 | 37 | 69,8 | 80 | 75,5 | | |
| **Socioeconomic** | | | | | | | | |
| Low | 51 | 96,2 | 43 | 81,1 | 94 | 88,7 | 0,032 | 5,930 (1,232-28,547) |
| High | 2 | 3,8 | 10 | 18,9 | 12 | 11,3 | | |
| **Education** | | | | | | | | |
| Low | 45 | 84,9 | 33 | 62,3 | 78 | 73,6 | 0,015 | 3,409 (1,339-8,683) |
| High | 8 | 15,1 | 20 | 37,7 | 28 | 26,4 | | |
| **Personal hygiene** | | | | | | | | |
| Bad | 31 | 58,5 | 12 | 22,6 | 43 | 40,6 | 0,000 | 4,814 (2,070-11,197) |
| Good | 22 | 41,5 | 41 | 77,4 | 63 | 59,4 | | |
| **Toilet facilities** | | | | | | | | |
| Not eligible | 48 | 90,6 | 38 | 71,7 | 86 | 81,1 | 0,025 | 3,789 (1,264-11,361) |
| Eligible | 5 | 9,4 | 15 | 28,3 | 20 | 18,9 | | |
| **Clean water quality** | | | | | | | | |
| Not eligible | 49 | 92,5 | 40 | 75,5 | 89 | 84,0 | 0,034 | 3,981 (1,204-13,165) |
| Eligible | 4 | 7,5 | 13 | 24,5 | 17 | 16,0 | | |
| **Residential density** | | | | | | | | |
| Not eligible | 41 | 77,4 | 33 | 62,3 | 74 | 69,8 | 0,139 | 2,071 (0,885-4,844) |
| Eligible | 12 | 22,6 | 20 | 37,7 | 32 | 30,2 | | |
| **Fecal disposal facility** | | | | | | | | |
| Not eligible | 47 | 88,7 | 36 | 67,9 | 83 | 78,3 | 0,018 | 3,699 (1,325-10,330) |
| Eligible | 6 | 11,3 | 17 | 32,1 | 23 | 21,7 | | |
| **Waste disposal facility** | | | | | | | | |
| Not eligible | 49 | 92,5 | 37 | 69,8 | 86 | 81,1 | 0,006 | 5,297 (1,634-17,168) |
| Eligible | 4 | 7,5 | 16 | 30,2 | 20 | 18,9 | | |

**Multivariate analysis**

Based on Table 3, it is known that the final model of variables significantly related to the incidence of typhoid fever is waste disposal facilities with an OR value of 3.557, which means that residents with inadequate waste disposal facilities are 3.557 times more at risk of typhoid fever compared to residents with adequate waste disposal facilities, with a confidence interval (95% CI; 0.951-13.229).

**Table 3. The final model of multivariate analysis of factors associated with the incidence of typhoid fever in the residents of the Musi Riverbank area in Seberang Ulu Palembang**

| Variable | p-value | OR (95% CI) |
|---|---|---|
| Age | 0,118 | 2,111 (0,828-5,383) |
| Gender | 0,300 | 0,572 (0,199-1,645) |
| Socio economy | 0,480 | 2,374 (0,215-26,197) |
| Education | 0,388 | 1,667 (0,522-5,320) |
| Personal hygiene | 0,026 | 3,034 (1,144-8,042) |
| Toilet facility | 0,686 | 1,334 (0,330-5,385) |
| Clean water quality | 0,738 | 1,429 (0,176-11,604) |
| Waste disposal facility | 0,059 | 3,557 (0,951-13,229) |
| Residential density | 0,483 | 1,434 (0,524-3,925) |

## DISCUSSION

### Age

This study found that many residents were under 30 years old, with a difference of 5.6% compared to residents over 30. The bivariate analysis results obtained a p-value of 0.173, meaning there is no relationship between age and the incidence of typhoid fever among the residents of the Musi River outskirts in Seberang Ulu Palembang. Most cases were suffered by respondents aged $\geq$ 30 who rarely consume food outside of home preparation and tend to consume processed foods.

This study's results align with Kukuh's research, which shows no relationship between age and the incidence of Typhoid Fever, with a P-value of 0.378 [8]. The results of this study are also in line with Andayani's research (2018), which showed no relationship between age and the incidence of Typhoid Fever at the Karangmalang Health Center, with a P-value of 0.380 [9].

### Gender

This study found that the respondents were predominantly male, with a difference of 51.0% compared to female respondents. The results of the bivariate analysis obtained a p-value of 0.538, which means there is no relationship between gender and the incidence of typhoid fever among the residents of the Musi River outskirts in Seberang Ulu Palembang, as the majority of typhoid fever cases were female respondents. This is different from most cases of typhoid fever, which are more common in males, and it is associated with the fact that males engage in more outdoor activities, making them more likely to be infected with Salmonella Typhi than females.

This study's results align with the research conducted by Farissa, which states that there is no significant relationship between gender and the incidence of Typhoid Fever, with a P-value of 1.000 [10]. However, it contradicts the findings of Kukuh's research, which states that there is a significant relationship between gender and the incidence of Typhoid Fever, with a value of 0.037 and an OR of 3.501 with a 95% CI = 1.053-8.839, indicating that male respondents have a 3.501 times greater risk of suffering from Typhoid Fever than female respondents [9].

### Social economy

Economic status affects a person's ability to provide the means and facilities to maintain personal hygiene. This study found that residents with low socioeconomic status had a difference of 77.4% compared to residents with high socioeconomic status. Meanwhile, the results of the bivariate analysis obtained a p-value = 0.032, which means there is a relationship between socioeconomic status and the incidence of typhoid fever among residents in the Musi River outskirts area in Seberang Ulu Palembang because the majority of the residents have low socioeconomic status, which affects their food intake, housing facilities, and health status.

This study's results align with the research conducted by Divana, which states a significant relationship between socioeconomic status and the incidence of Typhoid Fever with a P-value of 0.001 (11). The results of this study are also in line with the findings of Nurvina's research, which stated that there is a significant relationship between socioeconomic status and the incidence of Typhoid Fever, with a value of 0.016 and an OR of 8.800 with a 95% CI = 1.349-957.426, indicating that residents with low socioeconomic status have an 8.800 times greater risk of suffering from Typhoid Fever than residents with high socioeconomic status [7].

Economic status affects a person's ability to provide the facilities and infrastructure needed to maintain personal hygiene, which significantly affects a person's health status. Generally, people with low socioeconomic status do not prioritize self-care or personal hygiene, resulting in low personal hygiene and a decline in health status [12].

### Education

This study found that respondents with low education had a difference of 47.2% compared to those with higher education. The bivariate analysis results obtained a p-value of 0.000, which means 0.015, indicating a significant relationship between education and the incidence of typhoid fever among the residents of the Musi River outskirts in Seberang Ulu Palembang. Most residents have low education levels, which limits their knowledge and understanding. That affects a person's perception of health and illness, which ultimately influences the individual's and family's need to live healthily, including the efforts of individuals and families in disease prevention.

This study's results align with Edi's research, which states a significant relationship between education and the incidence of Typhoid Fever with a P-value of 0.000 [13]. The results of this study are also in line with the research conducted by Putri, which states that there is a significant relationship between education and the incidence of Typhoid Fever in the working area of the Ngrambe Health Center, Ngawi Regency, with a P-value of 0.000. The analysis results obtained an OR value of 10.764 with a 95% CI of 3.538-32.747, meaning that respondents with low education are 10.764 times more likely to experience Typhoid Fever compared to respondents with high education [14].

The level of education can be related to the ability to absorb and receive health information and participate in health development. Communities with low levels of education generally have limited knowledge and understanding, making it difficult for them to absorb and accept information and actively address health issues for themselves and their families [15].

**Personal hygiene**

This study found that respondents with poor personal hygiene had a difference of 18.8% compared to those with good personal hygiene. The results of the bivariate analysis obtained a p-value of 0.000, which means there is a significant relationship between personal hygiene and the incidence of typhoid fever among the residents of the Musi Riverbank area in Seberang Ulu Palembang. This is because most residents have poor handwashing habits and non-compliance with cleanliness, leading to the transmission of Salmonella Typhi bacteria through fingers, nails, and food.

This study's results align with Edi's research, which states a significant relationship between personal hygiene and the incidence of Typhoid Fever with a P-value of 0.000 [13]. The results of this study are also in line with the research conducted by Syarifah, which states that there is a significant relationship between personal hygiene and the incidence of Typhoid Fever in hospitalized patients at RSU Dr. Soedarso Pontianak, with a P-value of 0.041. The analysis results obtained an OR value of 0.238 with a 95% CI of 0.069-0.824, meaning that respondents with poor personal hygiene are 0.238 times more likely to experience Typhoid Fever than respondents with good personal hygiene [16].

Personal hygiene is a risk factor for contracting typhoid fever. Personal hygiene is also a behavior that keeps the body clean and helps prevent the spread of infectious disease germs. This can be accomplished in several ways, including washing hands with soap after defecation and before eating [17].

**Toilet facilities**

This study found that respondents with inadequate toilet facilities differed by 62.2% from those with adequate toilet facilities. The results of the bivariate analysis obtained a p-value of 0.025, which means there is a significant relationship between toilet facilities and the incidence of typhoid fever among the residents of the Musi Riverbank area in Seberang Ulu Palembang. This is because most residents have toilet facilities that lack enclosed spaces, adequate lighting systems, and dirty toilet conditions, which can influence the occurrence of typhoid fever.

The results of this study are in line with the research conducted by Daniel, which states that there is a significant relationship between toilet facilities and the incidence of Typhoid Fever in the working area of the Ngaliyan Health Center in Semarang City, with a P-value of 0.034 and an OR of 3.750 with a 95% CI = 1.225-11.481. This indicates that residents with inadequate toilet facilities have a 3.750 times higher risk of suffering from Typhoid Fever than residents with adequate toilet facilities [18].

Toilet facilities are sanitation amenities that accommodate a person's needs for defecation and urination, which are important for many infectious diseases. If the toilet facilities meet the requirements, they can help prevent the spread of contagious germs [19].

**Clean water quality**

This study found that respondents with clean water quality did not meet the standards, with a difference of 68.0% between those who met the clean water quality standards. The results of the bivariate analysis obtained a p-value of 0.034, which means there is a significant relationship between the quality of clean water and the incidence of typhoid fever among the residents of the Musi Riverbank area in Seberang Ulu Palembang because most residents use Musi River water for daily needs, which does not meet the physical quality standards such as taste, odor, and turbidity.

This study's results align with Dwi's research, which states a significant relationship between clean water quality and the incidence of Typhoid Fever, with a P-value of 0.033 [20]. The results of this study are also in line with the research conducted by Syarifah, which states that there is a significant relationship between clean water quality and the incidence of Typhoid Fever, with a P-value of 0.000 and an OR of 11.440 with a 95%

CI = 3.092-42.026. This indicates that the risk of suffering from Typhoid Fever is 11.440 times greater for residents with substandard clean water quality than those with standard clean water quality [16].

Typhoid fever is a disease that can be transmitted through water, commonly known as a Waterborne Disease. Water contaminated by Salmonella Typhi can become a source of Typhoid disease. This pollution is usually due to community habits such as defecating indiscriminately in rivers, which contaminates the water and causes clean water not to meet physical standards such as taste, odor, and color [21].

### Residential density

This study found that respondents with housing density did not meet the criteria, with a difference of 39.6% between those who met the housing density criteria and those who did not. The results of the bivariate analysis obtained a p-value of 0.136, which means there is no significant relationship between population density and the incidence of typhoid fever among residents of the Musi Riverbank area in Seberang Ulu Palembang because most residents of the Musi Riverbank area in Seberang Ulu often spend more time outside than at home, as well as the case subjects. The comparison group has the same chance of being exposed to and suffering from Typhoid Fever.

The results of this study are in line with the findings of M.I. Khan's research, which stated that there is no significant relationship between housing density and the incidence of Typhoid Fever, with a P-value of 0.710 and an OR of 1.110 with a 95% CI = 0.650-1.910. This indicates that residents with housing density that do not meet the standards have a 1.110 times greater risk of suffering from Typhoid Fever than those with housing density that meet the standards [22].

### Sanitation facilities

This study found that respondents with sanitation facilities did not meet the requirements, with a difference of 56.6% between those who met the criteria and those who did not. The results of the bivariate analysis obtained a p-value of 0.018, which means there is a significant relationship between sanitation facilities and the incidence of typhoid fever among the residents of the Musi Riverbank area in Seberang Ulu Palembang. This is because most residents in the Musi Riverbank area still manage their waste using open pit latrines without septic tanks, and those without sanitation facilities dispose of their waste anywhere (Musi River). This can certainly increase the risk factor for contracting Typhoid Fever.

This study's results align with the research conducted by Ni'ma, which states that there is a significant relationship between sanitation facilities and the incidence of Typhoid Fever with a P-value of 0.023 [15]. The results of this study are also in line with the findings of Nurvina's research, which stated that there is a significant relationship between sanitation facilities and the incidence of Typhoid Fever, with a P-value of 0.047 and an OR of 5.337 with a 95% CI = 0.968-29.393. This indicates that sanitation facilities that do not meet the standards have a 5.337 times greater risk of suffering from Typhoid Fever than residents with sanitation facilities that meet the standards [7].

Disposing of infected feces unhealthily or without meeting health standards can pollute water sources. Thus, human waste disposal must be appropriately managed to prevent or reduce fecal contamination of the environment. Feces should be disposed of in a designated place or a proper fecal disposal site [23].

### Waste disposal facility

This study found that respondents with inadequate waste disposal facilities differed by 62.2% compared to those with adequate waste disposal facilities. The results of the bivariate analysis obtained a p-value of 0.006, which means there is a significant relationship between waste disposal facilities and the incidence of typhoid fever among residents in the Musi Riverbank area in Seberang Ulu Palembang. This is due to some residents' waste disposal facilities lacking covers, and some residents living near the Musi River disposing of waste directly into the river without prior processing, leading to pollution that can cause disease.

The results of this study are in line with the research conducted by Andayani, which states that there is a significant relationship between waste disposal facilities and the incidence of Typhoid Fever in the working area of the Karangmalang health center, with a P-value of 0.034 and an OR of 3.190 with a 95% CI of 1.190-8.520. This indicates that waste disposal facilities that do not meet the requirements have a 3.190 times greater risk of suffering from Typhoid Fever than residents with waste disposal facilities that meet the requirements [9]. The results of this study are also in line with the findings of Aziz (2016), which state that there is a significant relationship between waste disposal facilities and the incidence of Typhoid Fever, with a P-value of 0.032 and an OR of 3.263 with a 95% CI = 1.890-9.776. This indicates that waste disposal facilities that do not meet the standards have a 3.263 times higher risk of suffering from Typhoid Fever than

residents with waste disposal facilities that meet the standards [6].

Waste is all substances or objects that are no longer in use. Waste can be a source of disease, so it needs to be managed to avoid polluting the environment, becoming a breeding ground for vectors or a nest for diseases. Waste must be placed in designated areas. The trash can size should be such that one person can easily lift it. Families with a designated trash bin for waste disposal are trying to prevent Typhoid Fever. In contrast, families without a waste disposal site are at double the risk of contracting Typhoid Fever. Not adequately managed waste managed correctly, will become a breeding ground for disease-carrying insects, produce unpleasant odors, and affect aesthetics [24].

**Multivariate analysis of variables affecting typhoid fever**

Based on the results of the multivariate analysis conducted using multiple logistic regression tests, it was found that the variable most associated with the incidence of Typhoid Fever among residents in the outskirts of the Musi River in Seberang Ulu is waste disposal facilities, with an odds ratio of 3.557. This means that residents with inadequate waste disposal facilities are 3.557 times more likely to suffer from Typhoid Fever than residents with adequate waste disposal facilities.

Based on the observation results, it was found that most of the waste disposal facilities used by the communities along the Musi River in Seberang Ulu still do not provide temporary waste disposal, both inside and outside the house. Only a few communities have waste disposal facilities, but some do not have covers and can cause odors, potentially leading to the emergence of Typhoid Fever.

Waste disposal facilities are the variable most closely related to the incidence of typhoid fever among residents in the Musi Riverbank area of Seberang Ulu because they are supported by personal hygiene factors, where residents exhibit unhealthy behaviors such as littering, which can attract the vectors of typhoid fever. Additionally, the education factor among the residents of the Musi River outskirts in Seberang Ulu is primarily low, where the lack of education results in limited knowledge and awareness of environmental cleanliness, causing the waste disposal facilities to be inadequate. The socioeconomic factor among the residents of the Musi Riverbank area in Seberang Ulu, most of whom have low socioeconomic status, causes these residents to be unable to provide the facilities and infrastructure needed to maintain

personal and environmental cleanliness, such as inadequate waste disposal facilities, which can lower health standards.

## CONCLUSION

There is a relationship between socio-economic status, education, personal hygiene, toilet facilities, clean water quality, sewage disposal facilities, and waste disposal facilities with the incidence of Typhoid Fever among the residents of the outskirts of the Musi River in Seberang Ulu. Meanwhile, age, gender, and population density do not have a significant relationship with the incidence of Typhoid Fever among the residents of the riverside area of the Musi River in Seberang Ulu.

Waste disposal facilities are the most significant risk factor associated with Typhoid Fever among residents on the outskirts of the Musi River in Seberang Ulu. Respondents with inadequate waste disposal facilities are at 3.557 times higher risk of suffering from Typhoid Fever than residents with adequate waste disposal facilities.

Further research is needed to develop unknown or other variables related to Typhoid Fever and improve the study design. It is hoped that the community will be more concerned about the environment, especially waste disposal facilities, such as finding waste collection officers to transport the waste to temporary disposal sites.

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