



Research Paper

Association of Healthy Latrine Ownership and Clean Water Availability with Open Defecation Practices: A Study in 14 Ulu Village, Palembang, Indonesia

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Abstract

Open defecation (OD) remains a significant public health and sanitation challenge in Indonesia, particularly in communities like 14 Ulu Village, Palembang City. This practice poses substantial health and environmental risks, especially in areas lacking adequate sanitation facilities and access to clean water. This study aimed to analyze the association between healthy latrine ownership, clean water availability, and the practice of open defecation. A quantitative, cross-sectional design was employed, with a sample of 96 respondents selected via simple random sampling. Data were collected using structured questionnaires and direct latrine observation. Statistical analysis included univariate, bivariate (chi-square test), and multivariate (multiple logistic regression) methods. The bivariate analysis revealed significant associations between open defecation and education ($p=0.006$; $PR = 2.548$; 95% CI: 1.31–4.95), healthy latrine ownership ($p<0.001$; $PR = 14.85$; 95% CI: 5.70–38.69), and clean water availability ($p<0.001$; $PR = 4.41$; 95% CI: 2.11–9.23). Conversely, age ($p=0.235$), occupation ($p=0.627$), and the role of health workers ($p=0.972$) were not significantly associated with the practice. Multivariate logistic regression identified healthy latrine ownership as the most dominant predictor of open defecation ($p<0.001$; $PR = 298.502$; 95% CI: 30.457–2925.533). In conclusion, access to a healthy latrine is the most critical factor in mitigating open defecation in the study area. Interventions focused on improving community access to sanitation facilities are crucial for accelerating the achievement of Open Defecation Free (ODF) status.

Keywords

clean water, healthy latrine, ODF, open defecation, sanitation

1. INTRODUCTION

Poor sanitation persists as a critical global health challenge, especially within developing nations like Indonesia. According to a 2023 report by the WHO and UNICEF, 3.5 billion people lack access to safely managed sanitation services, while 419 million still resort to open defecation (OD) (WHO and Fund, 2023). This practice is a significant driver of environmental contamination and facilitates the spread of infectious diseases such as diarrhea, parasitic infections, and stunting. Nationally, despite Indonesia achieving 83.60% coverage for improved sanitation, 3.20% of its population continues to practice OD, a figure concentrated in areas with underdeveloped infrastructure (BPS, 2023). Although the government has implemented the Community-Led Total Sanitation (CLTS) program to achieve Open Defecation Free (ODF) status, its success has not been uniform across all regions.

South Sumatra Province exemplifies an area with ongoing sanitation deficits. As of 2023, its improved sanitation

coverage was only 80.54%, meaning 19.46% of households remain without adequate facilities (BPS, 2023). Within this province, 14 Ulu Village in Palembang City has been identified as a key area of concern. Preliminary observations revealed a high prevalence of households without healthy latrines or reliable access to clean water, particularly among communities situated on the banks of the Musi River. Consequently, a portion of the population continues to engage in open defecation.

The practice of OD poses a dual threat: it compromises public health by elevating the risk of diarrhea, stunting, and other waterborne diseases, and it inflicts ecological damage by contaminating essential water sources (WHO, 2022). The existing literature underscores that access to healthy latrines and a consistent supply of clean water are the most critical determinants for eliminating open defecation (Riyanti et al., 2023). Grounded in this context, the present study aims to analyze the association between household ownership of healthy latrines, clean water availability, and the prevalence

of open defecation in 14 Ulu Village. This research seeks to generate evidence-based recommendations to accelerate the attainment of ODF targets and enhance the overall sanitation standards of the community.

2. METHOD

This research was conducted using a quantitative, cross-sectional study design to investigate the associations between sociodemographic and environmental factors and the practice of open defecation. The independent variables examined were age, occupation, education level, ownership of a healthy latrine, availability of clean water, and the role of health workers. The study was conducted in 14 Ulu Village, Seberang Ulu II District, Palembang City, Indonesia.

The target population comprised all heads of households residing in the study area, totaling 2,475 households. A sample size of 96 respondents was determined and selected through a simple random sampling method. Primary data were gathered directly from participants via structured interviews and direct observations, which were guided by a standardized questionnaire. All collected data were subsequently analyzed using SPSS. The analysis involved three stages: univariate analysis to describe variable frequencies, bivariate analysis using the chi-square test to assess associations, and multivariate analysis using multiple logistic regression to identify the most significant predictors of open defecation.

3. RESULTS

The demographic and environmental characteristics of the 96 study participants are detailed in Table 1. A slight majority of respondents were over 40 years old ($n=52$, 54.2%). The distribution by education level was nearly even, with 49 respondents (51.0%) having a high level of education compared to 47 (49.0%) with a low level. More than half of the participants were employed ($n=57$, 59.4%).

Regarding sanitation and hygiene variables, a significant majority of respondents ($n=68$, 70.8%) reported owning a healthy latrine. In contrast, more than half of the participants ($n=53$, 55.2%) lacked access to a reliable clean water supply. Notably, the role of health workers in sanitation promotion was perceived as minimal, with a vast majority of respondents ($n=85$, 88.5%) considering them to be inactive in the community.

The association between age and open defecation is presented in Table 2. The results show that the prevalence of open defecation was higher among respondents aged > 40 years (38.5%) compared to those aged ≤ 40 years (25.0%). However, this difference was not statistically significant, as indicated by a p -value of 0.235 ($p > 0.05$). The Prevalence Ratio (PR) of 0.650 with a 95% Confidence Interval (CI) of 0.351–1.204, which includes the value of 1, further confirms that age is not significantly associated with open defecation

practices in this study.

The bivariate analysis presented in Table 3 reveals a notable difference in the prevalence of open defecation based on education level. The prevalence of this practice among respondents with a low education level was 46.8%, which is substantially higher than the 18.4% observed among those with a high education level.

The chi-square test confirmed that this association is statistically significant ($p=0.006$). The calculated Prevalence Ratio (PR) was 2.548 (95% CI: 1.312–4.952), indicating that individuals with a low education level were 2.55 times more likely to practice open defecation compared to their counterparts with a high education level. Furthermore, the 95% confidence interval suggests that in the broader population, the risk for individuals with low education is between 1.31 and 4.95 times higher than for those with high education.

Table 4 presents the analysis of the association between employment status and open defecation practices. The prevalence of open defecation was slightly higher among the employed group (35.1%) compared to the unemployed group (28.2%).

However, the chi-square test yielded a p -value of 0.627, which is greater than 0.05, indicating that there is no statistically significant association between occupation and the practice of open defecation. This is further supported by the Prevalence Ratio (PR) of 0.804 with a 95% Confidence Interval (CI) of 0.436–1.483. Since the confidence interval includes the value of 1, it confirms the absence of a significant relationship between these variables.

The bivariate analysis presented in Table 5 reveals a stark disparity in open defecation practices contingent on latrine ownership. The prevalence of open defecation among respondents without a healthy latrine was exceptionally high at 90.0%. In sharp contrast, only 6.1% of respondents who owned a healthy latrine engaged in this practice.

This strong association was confirmed to be highly statistically significant by the chi-square test ($p<0.001$). The analysis yielded a Prevalence Ratio (PR) of 14.85 (95% CI: 5.701–38.678). This indicates that individuals lacking a healthy latrine were nearly 15 times more likely to practice open defecation than those who owned one. The 95% confidence interval further suggests that in the wider population, the risk for individuals without a healthy latrine is estimated to be between 5.7 and 38.7 times higher than for those with access to one.

As detailed in Table 6, the availability of clean water was strongly associated with sanitation practices. The prevalence of open defecation was markedly higher among respondents who lacked access to clean water facilities (57.1%) compared to the 13.0% prevalence among those who had access.

This finding was confirmed to be highly statistically significant by the chi-square test ($p<0.001$). The analysis yielded a Prevalence Ratio (PR) of 4.41 (95% CI: 2.105–9.231),

Table 1. Characteristics of Study Respondents (n=96)

Variable	Frequency	Percentage (%)
Age		
≤40 years	44	45.8
> 40 years	52	54.2
Education		
Low	47	49.0
High	49	51.0
Occupation		
Unemployed	39	40.6
Employed	57	59.4
Healthy Latrine Ownership		
Does not own	28	29.2
Owns	68	70.8
Clean Water Availability		
Unavailable	53	55.2
Available	43	44.8
Role of Health Workers		
Inactive	85	88.5
Active	11	11.5

Table 2. Association between Age and Open Defecation Practices

Age Group	Open Defecation (OD)						<i>p-value</i>	PR (95% CI)
	Yes		No		Total			
	n	%	n	%	n	%		
≤ 40 years	11	25.0	33	75.0	44	100	0.235	0.650 (0.351-1.204)
> 40 years	20	38.5	32	61.5	52	100		

demonstrating that respondents without clean water facilities were 4.4 times more likely to practice open defecation than those with access. The 95% confidence interval suggests that in the broader population, the risk for individuals lacking clean water access is between 2.1 and 9.2 times higher than for those with an available supply.

Finally, the association between the perceived role of health workers and open defecation practices was examined, with the results presented in Table 7. The prevalence of open defecation was 32.9% among respondents who perceived health workers as inactive, and slightly lower at 27.3% among those who perceived them as active.

Despite this small difference, the chi-square test resulted in a *p*-value of 0.972, which is well above the 0.05 threshold for statistical significance. This indicates that there is no significant association between the perceived role of health workers and open defecation practices. The Prevalence Ratio (PR) of 1.208 with a wide 95% Confidence Interval (CI) of 0.439–3.321, which comfortably includes the value of 1, reinforces this conclusion.

The final multivariate logistic regression model, pre-

sented in Table 8, confirms that healthy latrine ownership is the most dominant predictor of open defecation practices in 14 Ulu Village. After adjusting for education and clean water availability, latrine ownership remained highly significant ($p < 0.001$), with an adjusted Prevalence Ratio (PR) of 298.5 (95% CI: 30.457–2925.533).

This exceptionally high PR is attributable to the near-perfect correlation between the lack of a latrine and the practice of open defecation within the sample. Specifically, of the 31 respondents who practiced open defecation, 27 (approximately 87%) were from the group that did not own a healthy latrine. This strong data separation explains the magnitude of the prevalence ratio. The final model, therefore, concludes that respondents without a healthy latrine at home are approximately 298 times more likely to practice open defecation than those with a latrine, even when other factors are considered.

Table 3. Association between Education Level and Open Defecation Practices

Education Level	Open Defecation (OD)						<i>p-value</i>	PR (95% CI)
	Yes		No		Total			
	n	%	n	%	n	%		
Low	22	46.8	25	53.2	47	100	0.006	2.548 (1.312-4.952)
High	9	18.4	40	81.6	49	100		

Table 4. Association between Occupation and Open Defecation Practices

Occupation	Open Defecation (OD)						<i>p-value</i>	PR (95% CI)
	Yes		No		Total			
	n	%	n	%	n	%		
Unemployed	11	28.2	28	71.8	39	100	0.627	0.804 (0.436-1.483)
Employed	20	35.1	37	64.9	57	100		

4. DISCUSSION

4.1 Association of Age with Open Defecation Practices

This study found no statistically significant association between age and the practice of open defecation (OD) in 14 Ulu Village ($p=0.235$). This outcome is contrary to the theoretical expectation that age influences sanitation behavior. Cognitive development theories suggest that as individuals mature, their capacity for risk assessment and understanding of long-term consequences improves. Consequently, older individuals would ideally demonstrate greater awareness of the health imperatives for using safe and sanitary facilities.

However, the lack of a significant association in this study is consistent with previous research. For instance, a study by Elahayati et al. (2024) in Merauke Regency also reported that age was not a significant predictor of open defecation. Their findings suggest that age is not a dominant determinant; instead, behavioral patterns are more strongly influenced by structural factors such as the availability of healthy latrines and deeply ingrained community customs (Elahayati et al., 2024). This implies that in environments where access to proper sanitation is limited and OD is a norm, the practice is likely to persist across all age demographics, overriding the potential influence of cognitive maturity.

4.2 Association of Education with Open Defecation Practices

This study confirms a significant inverse relationship between education level and the practice of open defecation (OD) ($p=0.006$). The prevalence of OD was substantially higher among respondents with low educational attainment (46.8%) compared to those with high educational attainment (18.4%). This finding underscores the critical role

of education in fostering awareness and influencing decisions regarding hygiene and sanitation. This is further supported by the data from the highly educated cohort (51% of the sample), of which a vast majority (81.6%) did not practice OD, linking their educational background to safer sanitation choices.

These results align with established health behavior theories. Education is a key predisposing factor that shapes an individual's knowledge, attitudes, and health-related practices (Notoatmodjo et al., 2012). Higher educational attainment enhances an individual's ability to receive, process, and comprehend complex health information, such as the risks associated with OD and the benefits of proper sanitation. The cognitive pathways influenced by education—including improved critical thinking and risk perception—facilitate the adoption of healthier behaviors. Thus, education is foundational to reducing open defecation.

Consequently, these findings have direct implications for public health interventions. To be effective, programs aimed at eradicating OD must integrate targeted educational components, with a particular focus on communities with lower educational levels. Health promotion strategies should be tailored to this demographic, utilizing simplified language, visual aids, and community-based channels to ensure the message is accessible and impactful. Such educational efforts are crucial for cultivating a sustainable shift towards the consistent use of healthy latrines.

4.3 Association of Occupation with Open Defecation Practices

This study did not find a statistically significant association between employment status and the practice of open defecation ($p=0.627$). This finding suggests that, within this specific community, occupation does not function as a primary

Table 5. Association between Healthy Latrine Ownership and Open Defecation Practices

Healthy Latrine Ownership	Open Defecation (OD)						<i>p-value</i>	PR (95% CI)
	Yes		No		Total			
	n	%	n	%	n	%		
Does not own	27	90.0	3	10.0	30	100	0.001	14.850 (5.701-38.678)
Owns	4	6.1	62	93.9	66	100		

Table 6. Association between Clean Water Availability and Open Defecation Practices

Clean Water Availability	Open Defecation (OD)						<i>p-value</i>	PR (95% CI)
	Yes		No		Total			
	n	%	n	%	n	%		
Unavailable	24	57.1	18	42.9	42	100	0.001	4.408 (2.105-9.231)
Available	7	13.0	47	87.0	54	100		

determinant of sanitation behavior. This is notable because, theoretically, occupation is a key proxy for socioeconomic status, which typically influences a household's capacity to afford and access proper sanitation facilities. It is generally expected that stable employment and higher income would correlate with lower rates of OD, while unemployment or informal labor might present financial barriers to sanitation access (Notoatmodjo et al., 2012).

The discrepancy between our findings and established theory may be attributed to several contextual factors specific to the study area. First, a potential homogeneity in the types of occupations among respondents, likely within the informal sector, could mean that employment status does not translate into significant income or accessibility differences. Second, it is plausible that powerful environmental determinants, such as the general scarcity of sanitation infrastructure, supersede the influence of individual economic status. Third, entrenched cultural norms and generational habits related to sanitation may be more influential in shaping daily behavior than an individual's occupation.

Therefore, while socioeconomic status is a known determinant of health behaviors, our results indicate that in the 14 Ulu Village, it is not a significant predictor of open defecation. This suggests that interventions should not be targeted based on employment status but should rather focus on universal strategies, such as improving community-wide access to sanitation facilities and promoting behavioral change through awareness campaigns for all residents.

4.4 Association of Latrine Ownership with Open Defecation Practices

This study provides compelling evidence of a highly significant association between healthy latrine ownership and

the practice of open defecation (OD) ($p < 0.001$). The findings are stark: 90% of respondents without a healthy latrine practiced OD, compared to just 6.1% of those who owned one. This demonstrates that access to a private latrine is a critical enabling factor for safe sanitation behavior. In the absence of household sanitation facilities, residents are often left with no alternative but to use open spaces like rivers and fields, thereby perpetuating the cycle of environmental contamination and disease transmission. This aligns with health behavior theory, which posits that the availability of necessary infrastructure, such as sanitation facilities, is a fundamental prerequisite for adopting and maintaining healthy practices (Notoatmodjo et al., 2012).

The inverse relationship observed in this study—where increased latrine ownership corresponds to decreased open defecation—underscores the foundational importance of sanitation infrastructure. A sanitary latrine provides not only a convenient and dignified space for defecation but also serves as a primary barrier against the fecal-oral route of disease transmission. The results, therefore, unequivocally confirm that increasing household latrine access is a powerful and direct mechanism for reducing OD. Consequently, sanitation development programs must prioritize interventions that expand the coverage of healthy latrines. This is especially critical in densely populated, low-resource settings where communal reliance on open defecation sites remains common.

4.5 Association of Clean Water Availability with Open Defecation Practices

A strong and significant association was also found between the availability of clean water and the practice of open defecation ($p < 0.001$). The prevalence of OD was substantially higher among households lacking access to clean

Table 7. Association between the Role of Health Workers and Open Defecation Practices

Role of Health Workers	Open Defecation (OD)						<i>p-value</i>	PR (95% CI)
	Yes		No		Total			
	n	%	n	%	n	%		
Inactive	28	32.9	57	67.1	85	100	0.972	1.208 (0.439-3.321)
Active	3	27.3	8	72.7	11	100		

water (57.1%) compared to those with a reliable supply (13.0%). This finding underscores that clean water is not merely a supplementary component but a critical prerequisite for the effective and consistent use of latrines. Without water for flushing and personal hygiene, even available sanitation facilities may be abandoned in favor of open defecation.

This result corroborates the findings of previous studies in Indonesia. Yuliana and Rahayu (2020) similarly concluded that water scarcity is a major contributor to open defecation, as households facing such shortages are more likely to resort to open spaces (Yuliana and Rahayu, 2020). Furthermore, as Wicaksono et al. (2019) noted, access to clean water is a cornerstone of broader Clean and Healthy Living Behaviors (PHBS), extending beyond sanitation to impact overall community health, particularly in densely populated settings (Wicaksono et al., 2019). Therefore, our findings reaffirm that sustainable progress in eliminating open defecation is inextricably linked to parallel improvements in community access to clean and sufficient water supplies.

4.6 Association of the Role of Health Workers with Open Defecation Practices

This study found no statistically significant association between the perceived role of health workers and the practice of open defecation ($p=0.972$). While the prevalence of OD was slightly lower among respondents who perceived health workers as active (27.3%) compared to those who did not (32.9%), the difference was negligible and not statistically significant (95% CI: 0.439–3.321). This suggests that, at present, the engagement of health workers is not a significant factor in deterring open defecation in this community.

This finding presents a notable discrepancy with established public health theory. Health workers are typically considered primary agents of change, responsible for driving community education and awareness. Within theoretical frameworks such as Green's (1980) PRECEDE-PROCEED model, they function as a crucial reinforcing factor, motivating individuals to adopt and sustain healthy behaviors. The lack of a significant association in this study does not necessarily negate this theory but rather points to a potential gap in the implementation and intensity of their current outreach efforts (Green, 1980).

Therefore, this result should be interpreted as a call for programmatic evaluation and enhancement. For health workers to effectively fulfill their role as agents of change in sanitation, their engagement must likely be more intensive, sustained, and deeply embedded within the community. A shift towards more structured, community-based health promotion strategies may be necessary to translate their presence into a significant and measurable impact on sanitation practices.

4.7 Latrine Ownership as the Dominant Predictor of Open Defecation

The final multivariate logistic regression model identified healthy latrine ownership as the single most dominant predictor of open defecation (OD). After controlling for other variables, the lack of a healthy latrine remained highly significant ($p<0.001$), with an adjusted Prevalence Ratio (PR) of 298.5 (95% CI: 30.457–2925.533). This indicates that an individual without a private latrine is nearly 300 times more likely to practice OD than someone with a latrine. In the final model, both education and clean water availability lost their statistical significance, suggesting they function as confounding variables.

Notably, the adjusted PR for latrine ownership (298.5) was substantially higher than its crude PR in the bivariate analysis (14.85). This dramatic increase suggests a synergistic effect, where the risk associated with not owning a latrine is amplified in the presence of other factors like low education and lack of clean water. This primary finding strongly reinforces the principle that access to sanitation infrastructure is a fundamental determinant of public health. The absence of a private, healthy latrine compels residents to use unsafe alternatives, directly leading to environmental contamination and increasing the risk of fecal-oral diseases (WHO, 2019; Ministry of Health RI, 2022). Therefore, these results provide a clear and compelling mandate for public health policy: interventions aimed at eliminating OD must prioritize structural improvements in sanitation infrastructure. To ensure long-term success, these infrastructure programs must be integrated with behavioral change education to foster sustainable adoption of safe sanitation practice (WHO and Fund, 2021).

5. CONCLUSION

The prevalence of open defecation (OD) in 14 Ulu Village was found to be 32.3%, a rate indicating that the practice remains a significant public health issue despite the majority (67.7%) using sanitation facilities. The study identified three factors with a statistically significant bivariate association with open defecation: education level ($p=0.006$), healthy latrine ownership ($p<0.001$), and clean water availability ($p<0.001$). Conversely, age, occupation, and the role of health workers were not significantly associated with the practice.

Upon multivariate analysis, healthy latrine ownership emerged as the single most dominant predictor of open defecation. After adjusting for other factors, the absence of a household latrine was associated with a nearly 300-fold increase in the likelihood of practicing OD (Adjusted PR = 298.5; 95% CI: 30.457–2925.533; $p<0.001$). This finding underscores that access to sanitation infrastructure is the most critical determinant in eliminating open defecation in this community.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest

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