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THE SOCIO-ECONOMIC, CULTURAL, AND INFRASTRUCTURAL DETERMINANTS OF OPEN DEFECATION IN MALAM INNA, JAURO KUNA, AND TUDUN WADA IN GOMBE LOCAL GOVERNMENT AREA (LGA), GOMBE STATE

***[1]Seni J. barka, [2]Comfort S. James, [3]Shittu S. Bello, [4]Ahmed Garba, [5]Daniel, L. Abidan, [6]Taibatu I. Umar, [7]Sammy Salomi and [8]Sammy Sarah**

[1]Faculty of Medical and Allied Sciences, Department of Community Medicine, Gombe State University, Nigeria.
[2]Department of Zoology, Faculty of Science, Gombe State University, Gombe State, Nigeria.
[3]University Health Services Department, Federal University of Kashere, Gombe State, Nigeria.
[4]Primary Health Care Department, Shongom Local Government Area,
[5]Department of Public Health, Gombe State College of Health Science and Technology, Kaltungo
[6]Department of Environmental Health, Gombe State College of Health Science and Technology, Kaltungo
[7]Department of Health Information Management, Gombe State College of Health Science and Technology, Kaltungo
[8]Department of Community Health, Gombe State College of Health Science and Technology, Kaltungo

*Corresponding authors' email: mennabarka@gmail.com Phone: +2347031536134

ABSTRACT

Open defecation (OD) continues to pose significant public health and environmental challenges in Nigeria, particularly in rural and peri-urban communities where sanitation facilities are inadequate. This study examines the socio-economic, cultural, and infrastructural determinants of OD in Malam Inna, Jauro Kuna, and Tudun Wada within Gombe Local Government Area, Gombe State. A descriptive research design was employed, with data collected from 362 returned questionnaires, 91% response rate using structured questionnaires, field observations, and interviews. Quantitative analysis through SPSS provided insights into knowledge, attitudes, and practices related to sanitation. Findings reveal that poverty (51.1%) and inability to construct toilets (40.3%) are the most critical socio-economic drivers of OD, while unemployment (28.2%) and limited awareness (20.4%) further contribute to its persistence. Cultural traditions (40.1%) and beliefs (30.9%) reinforce the practice, highlighting the role of social norms in sustaining poor sanitation behaviors. Infrastructural deficiencies, particularly the lack of public toilets (57.5%) and poor sanitation facilities (48.6%), exacerbate the problem, alongside inadequate waste disposal (37.0%) and insufficient water supply (33.4%). Encouragingly, 80.7% of respondents believe improved sanitation infrastructure would reduce OD, with building more toilets (40.3%) and public health campaigns (28.2%) identified as the most effective strategies. The study concludes that tackling OD requires a multi-dimensional approach that integrates infrastructure development, economic support, cultural reorientation, and hygiene education. Such interventions are essential to achieving sustainable behavioral change and advancing progress toward national and global sanitation goals.

Keywords: Socio-Economic, Cultural, Infrastructural Factors, Open Defecation

INTRODUCTION

Background to the Study

Approximately one billion people worldwide still defecate in the open, while an additional 1.4 billion use inadequate restrooms. Approximately forty (40) million Nigerians engage in open defecation, and up to one hundred and five (105) million still lack access to modern, safe restrooms, (Bello, Ibrahim, Ladan, Yunusa, & Yaro, 2024). Nigeria consistently ranks first in the world for open defecation, a detrimental practice that affects children's health and education. The National Action Plan, a 13-year plan to revitalise Nigeria's WASH sector with the goal of guaranteeing universal access to safe and sustainable WASH services by 2030, was created in response to the country's 2018 declaration of a crisis in the WASH sector. Sustainable Development Objectives. Nigeria is still far from reaching its objectives, though, and development has been slow, (Prince-Edward, 2025).

Open defecation (OD) refers to the practice of defecating in open spaces such as fields, forests, rivers, or other unregulated areas instead of using a designated toilet or latrine. This practice is common in many rural and peri-urban areas, particularly in developing countries, where access to sanitation facilities is limited (WHO, 2021). OD is closely associated with a range of public health risks, including the transmission of waterborne diseases such as cholera, typhoid fever, and dysentery. The lack of proper waste management systems results in the contamination of water sources, soil, and the environment, contributing to high morbidity and mortality rates in affected communities (Prüss-Üstün et al., 2014).

In cities like Kaduna, open defecation is practiced in both traditional locations like drainage lines and open spaces, as well as more recent ones like insitu disposal on collapsed toilets and "short put," unfinished or abandoned buildings, railway tracks found in high-density areas, and some medium- and low-density residential built-up areas. In order to lessen soft targets for other types of OD, property owners should protect all incomplete buildings and/or undeveloped or unused ground with a perimeter fence. The creation of an OD Community Abatement Committee should promote surveillance and monitoring of OD hotspots. To stop the dangerous behaviour, public education about the dangers of OD should be strengthened through awareness programs.

In global terms, open defecation remains one of the major barriers to achieving sustainable sanitation, particularly in low-income countries. According to the World Health Organization (WHO), an estimated 673 million people worldwide still engage in open defecation, with the majority residing in South Asia, sub-Saharan Africa, and parts of Latin America (WHO, 2021). The practice is often exacerbated by poor infrastructure, inadequate sanitation facilities, socio-

economic constraints, and cultural attitudes toward hygiene and waste disposal (Awuor & Opiyo, 2020). Eliminating OD is a key focus of the United Nations' Sustainable Development Goal (SDG) 6, which aims to achieve universal access to safely managed sanitation services by 2030 (UNICEF, 2020).

In the Nigerian context, open defecation remains widespread, with rural areas, such as those in Gombe State, experiencing particularly high rates of the practice due to a combination of poverty, lack of infrastructure, and inadequate education on sanitation (Akinmoladun & Akinmoladun, 2017). The government's "Clean Nigeria: Use the Toilet" campaign is an effort to reduce open defecation nationwide by 2025, but significant barriers remain in rural regions where cultural practices, lack of resources, and poor enforcement of sanitation policies continue to perpetuate the issue (Gombe State Ministry of Health, 2021).

MATERIALS AND METHODS

The study was conducted in Malam Inna, Jaurokuna, and Tudun Wada, three Sub-urban communities located in Gombe Local Government Area, Gombe State, Nigeria. These communities were selected due to the high prevalence of open defecation and limited access to proper sanitation facilities. Gombe State, like many other parts of northern Nigeria, faces significant challenges in sanitation, and these communities represent a small unit of broader regional issues. The study explored factors influencing open defecation at the community level and assess local interventions aimed at improving sanitation.

The study adopted a descriptive research design. This design was chosen because it allows for an in-depth understanding of the current state of open defecation, the knowledge and attitudes of community members, and their sanitation practices. Descriptive research is particularly useful in identifying the key factors influencing behavior and the effectiveness of existing interventions without manipulating the variables.

The target population for this study are residents of Malam Inna, Jaurokuna, and Tudun Wada, who engaged in sanitation practices and are affected by open defecation. The study population specifically included households in these areas, with respondents being adult individuals (aged 15 years and above) responsible for household sanitation decisions. The study included local leaders, community health workers, and key stakeholders involved in sanitation programs within these communities.

The sample size for the study was determined using proportionate stratified sampling with random selection within strata. This Sampling technique allows the researcher to use a sample size perceived to be best for the study Creswell (2018).

Location and Population Distribution

Table 1: Location and Population Distribution

Location	Population	Percentage Population (%)
Tudun Wada	46200	52.01
Malam Inna	23,576	26.54
Jauro Kuna	19,052	21.45
Total	88,828	100.00

The sample size was calculated using Taro Yamane's formular which is given as

$$n = \frac{N}{1+N(e)^2}$$

$$\frac{88828}{1+88818(0.05)^2}$$

$$\frac{88828}{1+88828(0.0025)}$$

$$\frac{88828}{1+222.07}$$

$$\frac{88828}{223.07}$$

$$n = 398.2$$

$$n = 398$$

The number of samples drawn from each stratum is calculated using the formular below:

$n_h = (N_h / N) \times n$

Where:

n_h = Sample size for stratum h

N_h = Population size of stratum h

N = Total population size

n = Total sample size

Calculated Sample Size of Respective Populations

Table 2: Calculated Sample Size of Respective Populations

Location	Sample Population	Sample Population Percentage (%)
Tudun Wada	207	52.01
Malam Inna	106	26.54
Jauro Kuna	85	21.45
Total	398	100.00

In order to evaluate behavioural patterns and their underlying cognitive and contextual drivers, the study employed a structured Knowledge–Attitudes–Practices (KAP) questionnaire to examine the factors and prevalence of open defecation among residents in the study communities (Awuor & Opiyo, 2020; Fagioli et al., 2019). The Health Belief Model (HBM) (Rosenstock, 1974) and the Theory of Planned Behaviour (TPB) (Ajzen, 1991) in particular were taken into consideration when designing the questionnaire. According to these frameworks, people's knowledge, attitudes, perceived dangers, social norms, and perceived behavioural control all have an impact on their health-related behaviours. The incorporation of environmental and observational factors influencing sanitation practices was also influenced by aspects of Social Cognitive Theory (Bandura, 1986).

Demographic characteristics, awareness of open defecation, attitudes about the practice, and sanitation practices and contributing factors make up the four sections of the questionnaire. Data on respondents' age, gender, marital status, level of education, and occupation were gathered in the

demographic characteristics section. In order to facilitate stratified study of sanitation practices across sociodemographic categories, these variables were evaluated using categorical scales. Second, respondents' knowledge of open defecation and health risks it poses were evaluated in the knowledge of open defecation and health risks section. Items included sources of sanitation information, understanding of disease transmission pathways, and awareness of WASH concepts. Binary responses (Yes/No) for awareness and multiple-response items for recognising illness risks were used to gauge knowledge. Likert- scales to evaluate perceived importance and seriousness. Respondents' opinions, convictions, and normative dispositions toward open defecation were assessed in the third component, "attitudes towards open defecation." Perceived acceptability of open defecation, perceived community prevalence, support for its eradication, and willingness to embrace better sanitation practices were among the constructs that were measured. Ordinal Likert scales were used to record responses, making it possible to gauge the intensity of attitudes. Finally, self-reported sanitation behaviours and the contextual factors influencing them were recorded in the Practices and Contributing factors section. faeces frequency and location, handwashing habits after faeces, and socioeconomic, cultural, and infrastructure factors were among the important variables. Here, behavioural data were gathered utilising multiple-response items to identify contributing factors, categorical response options, and frequency scales (e.g., daily, occasionally, never).

The enumerators selected are locals. Both male and female enumerators are well-represented. Both genders are represented in each group of enumerators. Particularly in households that strictly adhere to Islamic rules, where males who are not relatives are prohibited from entering that particular households, a balanced ratio of both genders is required. In order to guarantee consistency, dependability, and adherence to ethical and methodological norms in data collecting, enumerators completed an organised, multi-component training program. The two days of training included both actual field exercises and theoretical teaching.

A pilot study was carried out on the residents of Hayin Kwarin-Misau, Akko Local Government Area. Questions difficult to answer or ambiguous areas were resolved. A trial study was carried out using test re-test on forty (40) residents of Malam Inna, Jaurokuna, and Tudun Wada**.** The residents used in the trial test were not be part of the sample for this research. The instrument developed was administered and re-administered at an interval of two (2) weeks. The data gathered was analyzed using Pearson Product Moment Correlation Coefficient Statistics. The instrument for this study was subjected to validation by Public Health Experts from Gombe State Ministry of Health.

The questionnaire was administered face-to-face by trained enumerators, who ensured that the data collected is accurate and consistent. Accordingly, field observations were conducted in the communities to assess the physical sanitation infrastructure, such as the presence or absence of latrines, waste disposal methods, and open defecation sites. This complemented the data gathered from the surveys and interviews.

The data analysis involved quantitative approaches. Data from the surveys were entered into **SPSS** for statistical analysis. Descriptive statistics (frequencies and percentages) was used to summarize demographic information, levels of knowledge, attitudes, and practices.

The study adhered to ethical principles to ensure the safety, privacy, and rights of participants. All participants were informed about the purpose of the study, the voluntary nature of participation, and the confidentiality of their responses. Consent was obtained before data collection. Personal information and responses were kept confidential and stored securely. Data was anonymized during analysis to protect the identity of participants.

RESULTS AND DISCUSSION

The analysis and interpretation of the data collected from the respondents. A total of 398 questionnaires were distributed, out of which 362 were returned, yielding a response rate of **91.0%**. The analysis includes demographic information and other relevant sections of the study.

Table 3: Common Locations for Open Defecation in the Community

Location	**Frequency (n=362)**	**Percentage (%)**
Fields or Farmlands	142	39.2
Rivers or Streams	86	23.8
Open Spaces	134	37.0
Total	**362**	**100**

Table 3 above, displays respondents' views on where open defecation commonly occurs in their community. The results show that 39.2% of respondents identified fields or farmlands, 37.0% pointed to open spaces, and 23.8% mentioned rivers or streams. This suggests that open defecation is prevalent in multiple locations, with farmlands and open spaces being the most common.

Table 4: Frequency of Personal Open Defecation Practice

Frequency	**Frequency (n=362)**	**Percentage (%)**
Daily	45	12.4
Weekly	86	23.8
Rarely	134	37.0
Never	97	26.8
Total	**362**	**100**

Table 4 above presents the frequency of open defecation among respondents. It reveals that 12.4% engage in the practice daily, 23.8% weekly, 37.0% rarely, while 26.8% never practice open defecation. This indicates that although a significant portion of the respondents avoid open defecation, a considerable number still practice it at varying frequencies.

Table 5: Socio-Economic Factors Influencing Open Defecation

Factor	Frequency (n=362)	Percentage (%)
Poverty	132	36.5
Unemployment	73	20.1
Lack of Awareness	53	14.6
Inability to Build Toilets	104	28.8

Table 5 above presents the socio-economic factors influencing open defecation in the community. The results indicate that poverty (36.5%) is the most significant factor, followed by an inability to build toilets (28.8.3%). Unemployment (20.1%) and lack of awareness (14.6%) also contribute to the persistence of open defecation.

Table 6: Infrastructural Issues Contributing to Open Defecation

Issue	Frequency (n=362)	Percentage (%)
Lack of Public Toilets	118	32.6
Inadequate Waste Disposal	134	21.0
Poor Sanitation Facilities	176	27.5
Insufficient Water Supply	121	18.8

Table 6 above highlights infrastructural challenges contributing to open defecation. The most reported issue is the lack of public toilets (32.6%), followed by poor sanitation facilities (27.5%). Inadequate waste disposal (21.0%) and insufficient water supply (18.8%) also contribute significantly to the persistence of open defecation.

Table 7: Cultural Factors Contributing to Open Defecation

Factor	Frequency (n=362)	Percentage (%)
Cultural Beliefs	98	27.0
Tradition	130	36.0
Lack of Sanitation Awareness	87	24.0
Gender Affiliation	47	13.0

Table 7 illustrates the cultural factors contributing to open defecation. The data reveal that tradition (36.0%) is the most significant factor, followed by cultural beliefs (27.0%) and lack of sanitation awareness (24.0 %). Gender affiliation (13.0%) plays a lesser role in sustaining the practice.

Table 8: Belief in Sanitation Infrastructure as a Solution to Open Defecation

Response	Frequency (n=362)	Percentage (%)
Yes	292	80.7
No	30	8.3
Not Sure	40	11.0
Total	**362**	**100**

Table 8, presents respondents' beliefs about whether improving sanitation infrastructure would reduce open defecation. The majority (80.7%) believe that better sanitation facilities would help, while 8.3% disagree, and 11.0% remain uncertain. This suggests that investment in sanitation infrastructure is widely seen as a solution to open defecation.

Table 9: Most Effective Strategies to Reduce Open Defecation

Strategy	Frequency (n=362)	Percentage (%)
Building More Toilets	146	40.3
Public Health Campaigns	102	28.2
Community-Based Solutions	67	18.5
Government Intervention	47	13.0

Table 9, above outlines respondents' views on the most effective ways to reduce open defecation. The most preferred approach is building more toilets (40.3%), followed by public health campaigns (28.2%). Community-based solutions (18.5%) and government intervention (13.0%) are also considered effective but less favored.

Table 10: Handwashing After Open Defecation

Response	Frequency (n=362)	Percentage (%)
Yes	238	65.7
No	82	22.7
Not Sure	42	11.6
Total	**362**	**100**

Table 10 above, presents respondents' handwashing practices after open defecation. The results indicate that 65.7% of respondents wash their hands, 22.7% do not, while 11.6% are unsure. This highlights the need for further education on proper hygiene practices to prevent disease transmission.

Discussion

The findings from the study reveal that in Table 3, open defecation remains a persistent practice in many communities due to various socio-economic, cultural, and infrastructural factors. The data indicate that open defecation is most commonly practiced in fields, farmlands (39.2%), and open spaces (37.0%), with a smaller percentage occurring near rivers or streams (23.8%). This widespread practice aligns with prior research indicating that the absence of proper sanitation facilities compels individuals to resort to open defecation (Freeman et al., 2020). Additionally, in Table 4, the frequency of open defecation among respondents shows that while 26.8% have never engaged in the practice, a significant proportion (37.0%) still practice it occasionally, weekly (23.8%), or even daily (12.4%). This highlights the urgent need for interventions addressing this issue at both the individual and community levels.

The study also identifies socio-economic factors as major contributors to open defecation. Poverty is the most significant factor (36.5%), followed by an inability to build toilets (28.8%), unemployment (20.1%), and a lack of awareness (14.6%) as shown in Table 5. These findings align with previous research indicating that economic constraints prevent many households from constructing or maintaining adequate sanitation facilities (Bartram & Cairncross, 2019).

In Table 6, Infrastructure deficiencies were also identified as significant challenges, with the lack of public toilets (32.6%) being the most reported issue. Other major factors include poor sanitation facilities (27.5%), inadequate waste disposal systems (21.0%), and insufficient water supply (18.9%). These findings are consistent with previous studies that highlight the correlation between poor infrastructure and the prevalence of open defecation (Prüss-Ustün et al., 2019).

Similarly, in Table 7, cultural beliefs and traditions also play a crucial role, as 40.1% of respondents cited tradition as a reason for open defecation, while 30.9% attributed it to cultural beliefs. This suggests that social norms and ingrained habits contribute to the persistence of the practice, reinforcing the need for targeted behavioral change campaigns (Dreibelbis et al., 2016).

Encouragingly, 80.7% of respondents believe that improving sanitation infrastructure would help reduce open defecation, suggesting broad community support for investment in sanitation development as illustrated in Table 8. Additionally Table 9 shows that 40.3% of respondents believe that building more toilets is the most effective strategy to combat the issue, while 28.2% advocate for public health campaigns. These results underscore the importance of a multi-faceted approach that combines infrastructure development with education and awareness campaigns.

Finally, the Table 10 highlights hygiene practices related to open defecation, particularly handwashing habits. While 65.7% of respondents reported washing their hands after defecation, a significant portion (22.7%) did not, and 11.6% were unsure. This finding suggests a gap in awareness and practice, which could increase the risk of disease transmission (Freeman et al., 2020). Public health campaigns should therefore emphasize the importance of hand hygiene alongside efforts to reduce open defecation. Overall, the findings suggest that addressing open defecation requires a combination of improved sanitation infrastructure, economic support, cultural reorientation, and public health education to ensure lasting behavioral change.

CONCLUSION

The knowledge, attitude and practices of open defecation in Mallam Inna, Jauro Kuna and Tudun Wada Community. The purpose of the study was to assess the knowledge, attitudes, and practices of the participants on open defecation in these communities and identify the socio-economic, cultural, and infrastructural factors influencing it.

The aims led to the formulation of two research questions. In order to gather information on the target population, the study adopted a descriptive research design**.** The sample for the study consisted of 398 resident of Malam Inna, Jauro Kuna, and Tudun Wada that are fifteen (15) years old. A structured questionnaire titled "Knowledge, Attitudes and practices of Open Defecation "was used as the study's data gathering tool. The data analysis involved quantitative approaches. Data from the surveys will be entered into **SPSS** for statistical analysis. Descriptive statistics (frequencies and percentages) was used to summarize demographic information, levels of knowledge, attitudes, and practices.

From the data collected, it can be concluded that socio-economic factors are major contributor to open defecation along with poverty, infrastructure deficiencies. A multi-faceted approach that combines infrastructure development with education and awareness campaigns can mediate the menace of open defecation. Overall, the findings suggest that addressing open defecation requires a combination of improved sanitation infrastructure, economic support, cultural reorientation, and public health education to ensure lasting behavioral change

RECOMMENDATIONS

1. Within 6 months, there should be deterrence to open defecation. The Local Government Health Department should hold organised Community-Led Total Sanitation (CLTS) seminars in conjunction with the National Orientation Agency and local leaders. LGA sanitation budgets and UNICEF WASH assistance should be the sources of funding. Furthermore, the LGA Works Department should work with non-governmental organisations to make it easier to build simple pit latrines using local resources. Community donations and World Bank WASH projects can provide funding. Finally, low-income households should be eligible for subsidies from the State Social Welfare Unit, which might pay up to 70% of building costs.
2. Sanitation and hygiene education should be integrated into school curricula and religious teachings for a duration of six to eighteen months. Within nine (9) months, all schools ought to be covered. Following a six-month first sensitisation period, environmental health officers should enforce sanitation legislation. To ensure compliance and assess progress, they should be complemented with community sanitation monitoring committee.
3. Sanitation infrastructure must be upgraded from ventilated pit systems between the period of 18 and 36 months through state-led programs and collaborations with development banks. More so, there should be provision of solar-powered boreholes and shared water sources, to significantly improve sanitary habits within 24 months.

REFERENCES

Akinmoladun, O. O., & Akinmoladun, F. O. (2017). *The implications of open defecation on public health in Nigeria*. Journal of Public Health and Epidemiology, 9(4), 86-91.

Ajzen, I. (1991). *The theory of planned behavior*. Organizational Behavior and Human Decision Processes, 50(2), 179-211.

Awuor, R., & Opiyo, N. (2020). *The knowledge, attitudes, and practices on sanitation in rural Kenya*. African Journal of Environmental Science, 25(2), 152-160.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice Hall.

Bartram, J., & Cairncross, S. (2019). Hygiene, sanitation, and water: Forgotten foundations of health. *PLoS Medicine, 7*(11), e1000367. https://doi.org/10.1371/journal.pmed.1000367

Bello, U. L., Ibrahim, A. H., Ladan, A. M., Yunusa, U., & Yaro, N. A. (2024). Pattern and distribution of open defecation practices in Kano State, Nigeria. *Journal of Institute of Africa Higher Education Research and Innovation (IAHERI), 1*(1). https://doi.org/10.59479/jiaheri.v1i001.40

Creswell, J. W. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

Dreibelbis, R., Winch, P. J., Leontsini, E., Hulland, K. R., Ram, P. K., Unicomb, L., & Luby, S. P. (2016). The integrated behavioral model for water, sanitation, and hygiene: A systematic review of behavioral determinants. *Environmental Health Perspectives, 124*(11), 1453-1461. https://doi.org/10.1289/ehp.1510452

Fagioli, J., Petersen, A., & Shrestha, M. (2019). *Improving hygiene behaviors in low-resource settings: A systematic review of KAP-based interventions*. Global Health Action, 12(1), 1638493.

Freeman, M. C., Garn, J. V., Sclar, G. D., Boisson, S., Medlicott, K., Alexander, K. T., & Bartram, J. (2020). The impact of sanitation on infectious disease and nutritional status: A systematic review and meta-analysis. *International Journal of Hygiene and Environmental Health, 226*, 113496. https://doi.org/10.1016/j.ijheh.2020.113496

Gombe State Ministry of Health. (2021). *Annual health report: Addressing waterborne diseases and sanitation challenges in Gombe State*.

Prince-Edward, O. R. (2025). A review of the impact of open defecation on Nigeria's water, sanitation and hygiene. *International Journal of Epidemiology and Health Sciences, 6*, 1–10. https://doi.org/10.51757/ijehs.6.2025.724810

Prüss-Ustün, A., Bartram, J., Clasen, T., Colford, J. M., Cumming, O., Curtis, V., Bonjour, S., Dangour, A. D., De France, J., Fewtrell, L., Freeman, M. C., Gordon, B., Hunter, P. R., Johnston, R. B., Mäusezahl, D., Mathers, C., Neira, M., Stocks, M., Wolf, J., & Cairncross, S. (2019). Burden of disease from inadequate water, sanitation and hygiene for selected adverse health outcomes: An updated analysis with a focus on low- and middle-income countries. *International Journal of Hygiene and Environmental Health, 222*(5), 765-777. https://doi.org/10.1016/j.ijheh.2019.05.004

Rosenstock, I. M. (1974). *Historical origins of the Health Belief Model*. Health Education Monographs, 2(4), 328-335.

UNICEF. (2020). *Ending open defecation: Key facts and statistics*. United Nations Children's Fund.

UNICEF. (2020). Progress on sanitation and drinking water: 2020 update and SDG baselines. UNICEF and WHO.

World Health Organization (WHO). (2021). Sanitation: A key element of public health. WHO.