

Effect of Community-Led Total Sanitation Intervention on the Knowledge Level and Perceptions of Adults about Open Defaecation Practices and Its Health Implications in Cross River State, Nigeria

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DOI: <https://doi.org/10.36348/sb.2025.v11i02.001>

| Received: 13.01.2025 | Accepted: 18.02.2025 | Published: 24.02.2025

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Abstract

Introduction: Open defaecation (OD) has been strongly linked to high prevalence of cholera and other sanitation-related diseases. This study was conducted to assess community-led total sanitation (CLTS) on the reduction of OD practices and its health implications in Cross River State. The study design was a community-based randomized controlled trial. **Materials and Methods:** A multi-stage sampling technique was used in selecting LGAs, wards, communities, households and respondents. Data were collected from 744 respondents at pre- and post-intervention. Data were analyzed using Statistical Product and Service Solution (version 24). **Results and Discussions:** Results were presented as frequencies, percentages, tables and charts. The findings from this study showed a significant increase in knowledge level of OD due to the CLTS intervention; at baseline, 344 (46.2%) of respondents had good knowledge of OD, which was later increased to 395 (53.1%) at post-intervention, indicating that there was a statistically significant difference in respondents' knowledge level of OD and diseases associated with OD practices due to the CLTS intervention. The perceptions of respondents about OD were 404 (54.3%) at baseline, and was improved to 701 (94.2%) at post-intervention, implying that there was a statistically significant difference in the perceptions of respondents about OD practices due to the CLTS intervention. **Conclusion:** Based on the findings, the CLTS intervention was effective in increasing knowledge of OD practice, changing wrong perceptions about OD and improving toilet ownership and maintenance. To scale up the gains of this study, continued commitments to the eradication of OD practices from community members, governments at all levels and NGOs is crucial.

Keywords: Open defaecation practices; Community-led total sanitation; Knowledge; Perceptions.

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INTRODUCTION

The United Nations (UN) has positively declared sanitation as a fundamental right for every human being. However, over 2.6 billion people have been reported to have no access to improved sanitation while approximately 1.3 billion people are practicing open defaecation, in nearly all low and middle-income

countries and mostly in rural areas [1]. As a result, millions of people are suffering from water, sanitation and hygiene-related diseases such as diarrhoea, cholera, typhoid, trachoma, helminthic and skin diseases [1]. Open defaecation practice creates a huge public health hazard, as residents of communities where open defaecation is practiced are at increased risks of

Citation: Inah Simon Alain, Amadi Agwu Nkwa, Iwuala Chimezie Christian, Ebirim Chikere Ifeanyi Casmir, Ezelote Judith Chinelo, Ajoku Bright Chibunna (2025). Effect of Community-Led Total Sanitation Intervention on the Knowledge Level and Perceptions of Adults about Open Defaecation Practices and Its Health Implications in Cross River State, Nigeria. *Sch Bull*, 11(2): 13-20.

developing diarrhoeal and other sanitation-related infections [2].

In low and middle-income countries, particularly Nigeria, open defaecation is a common unhygienic practice. Nigeria is one of the countries in the world with the greatest rate of open defaecation (OD), with an estimated population of over 46 million people engaging in the practice [3].

Due to the decay in sanitation and hygiene, and the lack of basic amenities like pipe-borne water, there has been series of reports of cholera outbreak with many casualties in many parts of Cross River State. It was reported that in the year 2022, there were seven deaths in February and six deaths in the month of August in Odukpani L.G.A. due to cholera outbreak [4]. Similarly, in December 2022, over 22 people died and many hospitalized in Abi L.G.A. due to another cholera outbreak [5]. Barely a month after the outbreak in Abi and Odukpani communities, other communities in the State have continued to record more casualties as 19 persons died and 286 hospitalized following an outbreak of cholera in Obubra L.G.A. of the State [6]. Consequently, this study assessed the knowledge level of open defaecation among respondents during pre- and post- the community-led total sanitation intervention and the perceptions of respondents about open defaecation, and diseases associated with open defaecation practices during pre- and post-intervention in Cross River State in particular and Nigeria in general.

MATERIALS AND METHODS

Study Setting: The study was carried out in Cross River State, Nigeria.

Study Design: A community-based, randomized controlled trial (RCT) was conducted to evaluate the study's outcome.

The Study Consisted of Three Phases:

- **Phase 1:** Pre-intervention (baseline) assessment.
- **Phase 2:** Intervention (implementing CLTS).
- **Phase 3:** Post-intervention assessment.

Study Population

The target population for this study were adults, males and females (18 years and above) resident in Cross River State, Nigeria.

Sample Size Determination

The sample size for this study was determined using the Two Proportion Estimation Formula by Wang and Chow (2007): Where: $Z_{\alpha/2}$ is the critical value of the normal distribution at $\alpha/2$; Z_{β} is the critical value of the normal distribution at β and P_1 and P_2 are the expected sample proportions of the two groups ($P_1 = 45\%$ (0.45); $P_2 = 55\%$ (0.55) (Bakobie *et al.*, 2020; UNICEF & WHO, 2020).

$$n = \frac{(1.96 + 0.84)^2 \times 0.45(1 - 0.45) + 0.55(1 - 0.55)}{(0.55 - 0.45)^2}$$

$$= 218.79 \approx 219 \text{ for each group}$$

Sample Size Determination (cont'd.)

A design effect of 1.5 was assumed to overcome the design effect. Then the sample size was: $219 \times 1.5 = 328.5$. The sample size was further increased by 10% to account for contingencies such as attrition or non-response, i.e., $328.5/1 - 0.1 = 328.5/0.9 = 365$

Total sample size required (for both CLTS and non-CLTS communities) was $= 365 \times 2 = 730$. For the ease of selecting equal respondents from the 24 communities, the final sample size was 744.

Sampling Procedure

This study utilized the multistage (simple random and systematic) sampling in the selection of study respondents.

Instruments for Data Collection

A semi-structured questionnaire and an observational checklist were used to collect data from the respondents for this study, and sterilized sampling bottles were used to collect water samples from natural water sources of selected communities.

Methods of Data Collection

With the aid of six (6) research assistants, baseline assessment was carried out in the 24 selected communities, followed by the implementation of CLTS intervention and then the post-intervention assessment that was conducted by collecting data from both the CLTS and non-CLTS communities using the same instruments. Water samples from natural sources were collected and analyzed of bacteriological characteristics using standard procedures.

Ethical Considerations/Informed Consent

Ethical clearance from the CRS Health Research Ethics Committee (CRS-HREC) was obtained, permission was sought for and obtained from the community leaders of the selected communities and an informed consent was sought for and obtained from every respondent.

RESULTS AND DISCUSSION

Results

Socio-demographic Characteristics of Study Respondents

Slightly above half 386 (51.9%) of the 744 respondents were females while 358 (48.1%) were males. Most of the respondents 200 (26.9%) were within the age group 38-47 years, followed by 181 (24.3%) within the age group of 48-57 years, respondents aged 28-37 years were 165 (22.2%), followed by 103 (13.8%) within the age group of 18-27 years and the least 95 (12.8%) were within the age group of 58 years and

above. Majority 219 (29.4%) were married, followed by 212 (28.5%) singles, 131 (17.6%) were divorced, 104 (14.0%) widowed while the least 78 (10.5%) were cohabiting. Most of the respondents 279 (37.5%) had 4-6 members in their households, followed by those 222 (29.8%) who had 7-9 household members, 156 (21.0%) had 1-3 household members while the least 87 (11.7%) had 10 members and above. A greater proportion 162 (21.8%) were traders, followed by 149 (20.0%) farmers, 130 (17.5%) were civil servants, 94 (12.6%) were housewives, 65 (8.7%) were artisans, 54 (7.3%) were students 63 (8.5%) were unemployed while 27 (3.3%) did not disclose their occupations. A higher proportion of the respondents 692 (93.0%) subscribed to Christianity, 35 (4.7%) were traditionalists while only 17

(2.3%) were Muslims. Most of the respondents 339 (45.6%) had secondary education, followed by 212 (28.5%) who had tertiary education, 129 (17.3%) had primary education and 64 (8.6%) had no formal education. Most of the respondents 357 (48.0%) were earning within ~~₦~~30,000-~~₦~~70,000 while 265 (35.6%) earned less than ~~₦~~30,000 and only 122 (16.4%) respondents earned above ~~₦~~70,000. A greater proportion 212 (28.5%) were living in mud houses with zinc roof, 150 (20.2%) lived in block houses with zinc roof/asbestos roofing sheets, this was followed by 164 (22.0%) who lived in uncompleted buildings while 134 (18.0%) lived in mud house with bamboo roof and the least 84 (11.3%) lived in wooden-made houses (Table 1).

Table 1: Socio-demographic characteristics of study respondents (n=744)

Variables	Abi (%)	Biase (%)	Yakurr (%)	Total (%)
Sex of respondents				
Females	125(16.8)	134(18.0)	127(17.1)	386(51.9)
Males	123(16.5)	114(15.3)	121(16.3)	358(48.1)
Age of respondents (years)				
18-27	27(3.6)	40(5.4)	36(4.8)	103(13.8)
28-37	49(6.6)	54(7.3)	62(8.3)	165(22.2)
38-47	77(10.3)	59(7.9)	64(8.6)	200(26.9)
48-57	66(8.9)	61(8.2)	54(7.3)	181(24.3)
58 and above	29(3.9)	34(4.6)	32(4.3)	95(12.8)
Marital status				
Married	73(9.8)	82(11.0)	64(8.6)	219(29.4)
Single	64(8.6)	75(10.1)	73(9.8)	212(28.5)
Divorced	42(5.6)	49(6.6)	40(5.4)	131(17.6)
Widowed	40(5.4)	29(3.9)	35(4.7)	104(14.0)
Cohabiting	29(3.9)	13(1.7)	36(4.8)	78(10.5)
Household size				
1-3 members	40(5.4)	52(7.0)	64(8.6)	156(21.0)
4-6 members	100(13.4)	86(11.6)	93(12.5)	279(37.5)
7-9 members	83(11.2)	75(10.1)	64(8.6)	222(29.8)
10 and above	25(3.4)	35(4.7)	27(3.6)	87(11.7)
Occupation				
Farming	70(9.4)	49(6.6)	30(4.0)	149(20.0)
Traders	47(6.3)	60(8.1)	55(7.4)	162(21.8)
Civil servants	35(4.7)	45(6.0)	50(6.7)	130(17.5)
Housewives	24(3.2)	34(4.6)	36(4.8)	94(12.6)
Artisan	19(2.6)	21(2.8)	25(3.4)	65(8.7)
Students	18(2.4)	17(2.3)	19(2.6)	54(7.3)
Unemployed	25(3.4)	17(2.3)	21(2.8)	63(8.5)
Others	10(1.3)	5(0.7)	12(1.6)	27(3.6)
Religion				
Christianity	228(30.6)	233(31.3)	231(31.0)	692(93.0)
Islam	8(1.2)	4(0.5)	5(0.7)	17(2.3)
Traditional religion	12(1.6)	11(1.5)	12(1.6)	35(4.7)
Educational level				
No formal edu.	21(2.8)	16(2.2)	44(5.9)	64(8.6)
Primary	45(6.0)	40(5.4)	93(12.5)	129(17.3)
Secondary	114(15.3)	132(17.7)	84(11.3)	339(45.6)
Tertiary	68(9.1)	60(8.1)	27(3.6)	212(28.5)
Monthly income				
Less than ₦ 30,000	87(11.7)	74(9.9)	104(14.0)	265(35.6)
₦ 30,000- ₦ 70,000	110(14.8)	129(17.3)	118(15.9)	357(48.0)

Above ₦70,000	51(6.9)	45(6.0)	26(3.5)	122(16.4)
House type				
Mud house /bamboo roof	56(7.5)	33(4.4)	45(6.0)	134(18.0)
Mud house with zinc roof	76(10.2)	59(7.9)	77(10.3)	212(28.5)
Block house with zinc roof/asbestos roofing sheets	23(3.1)	57(7.7)	70(9.4)	150(20.2)
Uncompleted building	57(7.7)	65(8.7)	42(5.6)	164(22.0)
Wooden-made house	36(4.8)	34(4.6)	14(1.9)	84(11.3)

Respondents' knowledge of open defaecation

Majority of the respondents 254 (34.1%) disagreed to the assertion that community-led total sanitation is a health/hygiene intervention or campaign while about 230 (30.9%) agreed to this assertion. Most of the respondents 313 (42.1%) disagreed to the claim that open defaecation means passing excreta in any convenient place, whether toilet or outside while about 186 (25.0%) agreed to this claim. A greater proportion of the respondents 263 (35.3%) disagreed to the assertion that open defaecation means passing excreta outside in places like markets, gutters, streams, bushes and abandoned buildings while 221 (29.7%) agreed to the assertion. Most of the respondents 244 (32.8%) agreed to the affirmation that open defaecation means not passing excreta into a latrine/toilet facility while 236 (31.7%) disagreed to this affirmation. A total of 244 (32.8%) respondents disagreed to the assertion that defaecating in

the field/open space is unsafe while just 233 (31.3%) respondents agreed to this assertion (Table 2).

Most of the respondents 255 (34.3%) agreed to the claim that sharing of a clean latrine/toilet is safe while 222 (29.8%) disagreed to this claim. Majority of the respondents 250 (33.6%) disagreed to the assertion that some illnesses are caused by open defaecation while 248 (33.3%) agreed to this assertion. A greater proportion 237 (31.9%) agreed to the assertion that tradition/religion is not against latrine use while 219 (29.4%) disagreed to this assertion. A total of 255 (34.4%) disagreed to the claim that defaecating in the river, lake, stream, pond and any water body is unsafe while 228 (30.6%) agreed to the claim. Most of the respondents 243 (32.7%) disagreed to the affirmation that defaecating in nylon bags and throwing it into dustbin, bushes or gutters is unsafe while only 236 (31.7%) agreed to this affirmation (Table 2).

Table 2: Knowledge of open defaecation (n = 744)

Variables/assertions	Baseline (Pre-intervention)				Endline (Post-intervention)			
	SA F(%)	A F(%)	D F(%)	SD F(%)	SA F(%)	A F(%)	D F(%)	SD F(%)
Community-led Total Sanitation is a health/hygiene intervention or campaign.	118(15.9)	230(30.9)	254(34.1)	142(19.1)	248(33.5)	250(33.8)	102(13.8)	140(18.9)
Open defaecation means passing excreta in any convenient place, whether toilet or outside.	73(9.8)	186(25.0)	313(42.1)	172(23.1)	313(42.1)	172(23.1)	73(9.8)	186(25.0)
Open defaecation means passing excreta outside in places like markets, gutters, streams, bushes and abandoned buildings.	111(14.9)	221(29.7)	263(35.3)	149(20.0)	261(35.3)	300(40.5)	112(15.1)	67(9.1)
Open defaecation means not passing excreta into a latrine/toilet facility.	126(16.9)	244(33.0)	236(31.7)	138(18.5)	312(42.2)	244(33.0)	46(6.2)	138(18.5)
Defaecating in the field/open space is unsafe	115(15.5)	233(31.3)	244(32.8)	152(20.4)	291(39.3)	233(31.3)	135(18.2)	81(10.9)
Sharing of a clean latrine/toilet is safe	138(18.5)	255(24.3)	222(29.8)	129(17.3)	138(18.5)	255(24.3)	222(29.8)	129(17.3)
Some illnesses are caused by open defaecation	113(15.2)	248(33.3)	250(33.6)	133(17.9)	248(33.3)	113(15.2)	133(17.9)	250(33.6)
Our tradition/religion is not against latrine use	134(18.0)	237(31.9)	219(29.4)	154(20.7)	134(18.0)	237(31.9)	219(29.4)	154(20.7)
Defaecating in the river, lake, stream, pond and any water body is unsafe	114(15.3)	228(30.6)	256(34.4)	146(19.6)	212(28.5)	228(30.6)	256(34.4)	48(6.5)
Defaecating in nylon bags and throwing it into dustbin, bushes or gutters is unsafe	116(15.6)	236(31.7)	243(32.7)	149(20.0)	314(42.4)	216(29.2)	123(16.6)	87(11.8)

All values in parenthesis represent percentages

The mean knowledge score was $24.26 \pm 3.37SD$. To determine for the knowledge level, all scores below the mean were grouped as poor knowledge, scores around the mean were grouped as fair knowledge, while scores above the mean were grouped as good knowledge. The summary of knowledge level showed that at pre-intervention phase, less than half 344 (46.2%) had good

knowledge, 93 (12.5%) had fair knowledge while 307 (41.3%) had poor knowledge of open defaecation whereas at post-intervention the knowledge level increased where more than half 395 (53.1%) had good knowledge, 85 (11.4%) had fair knowledge while 264 (35.5%) had poor knowledge (Figure 1).

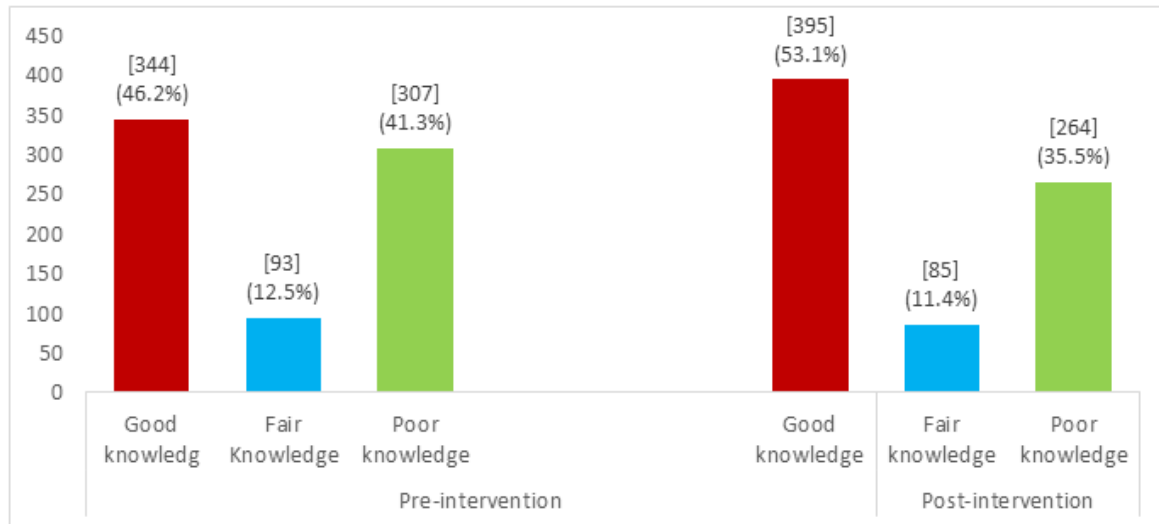


Figure 1: Summary of knowledge level of respondents on open defaecation (pre- and post-intervention)

Respondents' perceptions about open defaecation

A large proportion 250 (33.6%) of respondents agreed to the perception that defaecating in streams, bushes and gutters causes problem to both humans and the environment while 249 (33.5%) disagreed to this perception. A greater proportion of respondents 242 (32.5%) disagreed to the perception that defaecating on farmlands/soil only increases soil fertility and also causes serious threats to man and environment while only 211 (28.4%) agreed to this perception. Most of the respondents 251 (33.7%) disagreed to the perception that defaecating in an open area is unsafe and is not more convenient than using a toilet while 236 (31.7%) agreed to this perception. Majority of the respondents 284 (38.2%) agreed to the perception that sharing of public latrines or toilets is an easy way to contract an infection while only 258 (34.7%) disagreed to this perception. A reasonable number of the respondents 259 (34.8%) agreed to the perception that open defaecation is safer

than latrines because latrines are often dark, filthy, smelling and unattractive while 253 (34.0%) disagreed to this perception. Most of the respondents 250 (33.6%) agreed to the perception that tattered walls and poor flooring materials encourages open defaecation while 234 (31.5%) disagreed to this perception (Table 3). The mean perception was $14.88 \pm 2.4SD$. To determine the overall perception, all scores from the mean and above were grouped as right perceptions while all scores below the mean were grouped as wrong perceptions. The overall perception scores showed that at the pre-intervention phase, more than half of the respondents 404 (54.3%) had right perceptions about open defaecation while 340 (45.7%) had wrong perceptions about open defaecation whereas at the post-intervention phase, the perception increased where a greater proportion 701 (94.2%) had the right perceptions while only 43 (5.8%) still had the wrong perceptions about open defaecation (Figure 2).

Table 3: Perceptions about open defaecation (n = 744)

Variables/assertions	Baseline (Pre-intervention)				Endline (Post-intervention)			
	SA F(%)	A F(%)	D F(%)	SD F(%)	SA F(%)	A F(%)	D F(%)	SD F(%)
Defaecating in streams, bushes and gutters causes problem to both humans and the environment	107(14.4)	250(33.6)	249(33.5)	138(18.5)	210(28.2)	270(36.3)	112(15.1)	152(20.4)
Defaecating on farmlands/soil only increases soil fertility and also causes serious threat to man and environment	152(20.4)	211(28.4)	242(32.5)	139(18.7)	301(40.5)	261(35.1)	82(11.0)	100(13.4)

Variables/assertions	Baseline (Pre-intervention)				Endline (Post-intervention)			
	SA F(%)	A F(%)	D F(%)	SD F(%)	SA F(%)	A F(%)	D F(%)	SD F(%)
Defaecating in an open area is unsafe and is not more convenient than using a toilet	118(15.9)	236(31.7)	251(33.7)	139(18.7)	271(36.4)	306(41.1)	117(15.7)	50(6.7)
Sharing of public latrines or toilets is an easy way to contract an infection	115(15.5)	284(38.2)	258(34.7)	87(11.7)	309(41.5)	302(40.6)	91(12.2)	42(5.6)
Open defaecation is safer than latrines because latrines are often dark, filthy, smelling and unattractive	122(16.4)	259(34.8)	253(34.0)	110(14.8)	291(39.1)	284(38.2)	99(13.3)	70(9.4)
Tattered walls and poor flooring materials encourages open defaecation	114(15.3)	250(33.6)	234(31.5)	146(19.6)	300(40.3)	291(39.1)	87(11.7)	66(8.9)

All values in parenthesis represent percentages

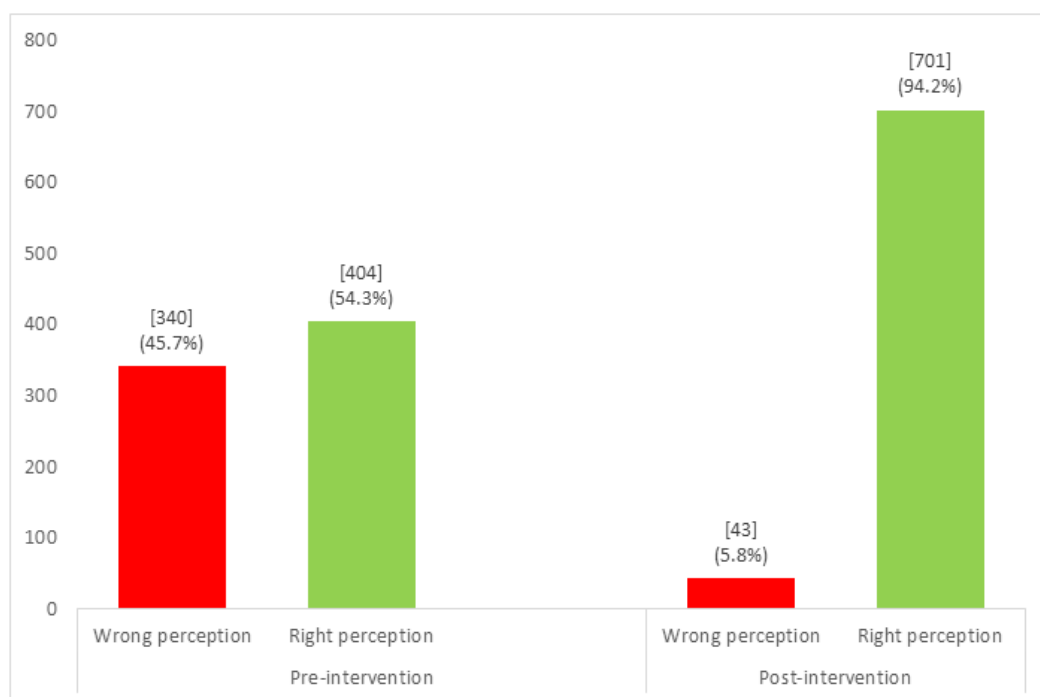


Figure 2: Overall perception level of respondents about open defaecation (pre- and post-intervention)

DISCUSSION

Knowledge level of OD among respondents

The results in this part of the study showed that the mean knowledge score was 24.26 ± 3.37 SD. At pre-intervention phase, less than half 344 (46.2%) of the respondents had good knowledge, 93 (12.5%) had fair knowledge while 307 (41.3%) had poor knowledge of open defaecation whereas at post-intervention the knowledge level got better where more than half 395 (53.1%) of the respondents had good knowledge, 85 (11.4%) had fair knowledge while only 264 (35.5%) had poor knowledge. The findings here showed an improvement in the knowledge level of respondents after the intervention. This study findings corroborates with that of [7], where majority of the Indonesian communities were aware of the campaign against open defaecation. This finding also agrees with the finding by

[8], who reported that residents of Bihar were knowledgeable of the problems linked with open defaecation practice.

The test of hypothesis showed a significant difference in respondents' knowledge level of open defaecation and diseases associated with open defaecation practices following the CLTS intervention ($p = 0.001$). This finding is in tandem with that of [9], in Kenya who reported a high level of awareness and knowledge level of open defaecation. This is also corroborated by [10], who posited in their study that intensive health education and promotion programmes resulted in a significant reduction in open defaecation practice in Mali and Tanzania. This is also similar with a study done in Ethiopia by [11], whose finding showed that 66% of respondents were aware of CLTS, and 88%

obtained such knowledge from health experts in their community.

Perceptions of respondents about OD, and diseases associated with OD practices pre- and post- CLTS intervention

The findings in this part of the study showed that the mean perception of respondents was $14.88 \pm 2.4SD$. At the pre-intervention phase, more than half of the respondents 404 (54.3%) had right perception about open defaecation and the diseases associated with its practice while 340 (45.7%) had wrong perceptions about open defaecation whereas at the post-intervention phase, the perception increased by 39.9% where a greater proportion 701 (94.2%) had right perceptions of OD and the diseases associated with its practice leaving only a negligible number of 43 (5.8%) respondents who still had wrong perceptions of open defaecation and the diseases associated with its practice. This in other words, showed that the intervention was positively effective in changing the perceptions of the respondents. The test of hypothesis showed a statistically significant difference in the perceptions of respondents on OD practices following the CLTS intervention ($p = 0.001$). This study finding is in line with that of [11], who reported that fourteen percent (14%) of participants had a wrong perception that showed that they did not believe CLTS could be used to eradicate open defaecation, and 52% were unaware of the triggering events of CLTS. This is not too different from the finding by [12], that 78% of study participants had a better perception of what OD is and what its associated dangers are.

CONCLUSION

Open defaecation practice remains a serious public health problem in low and middle-income countries, including Nigeria. The drive to protect human health and improve environmental sanitation would essentially require ending open defaecation practice. In line with the findings of this study, it was revealed that community-led total sanitation (CLTS) has demonstrated significant impact in reducing open defaecation and mitigating its harmful health implications in the study area. By empowering communities to take ownership of sanitation, CLTS intervention was effective in increasing knowledge level on open defaecation practice, changing wrong perceptions about open defaecation, improving toilet ownership and maintenance, improving access to sanitation facilities, reduced open defaecation practices significantly, enhanced community-led initiatives for sustainability, decreased incidence of sanitation-related diseases and fostered improved sanitation and hygiene practices.

ACKNOWLEDGMENT

The authors appreciate the all the respondents who participated in the research work and also appreciate co-authors for their commitment during the research.

Grant Support Details: The research was a Ph.D Thesis, fully funded by Mr. INAH S. ALAIN as the lead researcher.

Conflict of Interest: The authors declare that there is not any conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy has been completely observed by the authors.

Life Science Reporting: No life science threat was practiced in this research.

REFERENCES

1. Bakobie, N., Ibrahim, A. R., & Duwiejuah, A. B. (2020). Sanitation Practices and Microbial Quality of Drinking Water in Open Defaecation Free and Open Defaecation Communities in the Savelugu Municipality. *Ghana Journal of Science*, 61(2), 1-12. doi: <https://dx.doi.org/10.4314/gis.v61i2.1>
2. Islam, M., Ercumen, A., Ashraf, S., Rahman, M., Shoab, A. K., Luby, S. P., & Unicomb, L. (2018). Unsafe disposal of feces of children < 3 years among households with latrine access in rural Bangladesh: association with household characteristics, fly presence and child diarrhea. *PloS one*, 13(4), e0195218.
3. Sawyerr, H., & Adepoju, A. (2019). Assessment of Community-led Total Sanitation Sustainability in Ejigbo Local Government Area of Osun State, Nigeria. *Archives of Current Research International*, 1-11.
4. Oloyede, O. (2022, August 24). Cholera kills six in Cross River, preventive measures stepped up. *AIT Live*. Retrieved from <https://ait.live/>
5. Nsa, G. (2022, December 18). Many fear dead as Cross River confirms cholera outbreak in Abi Local Government Area. *The Nation*. Retrieved from: <https://thenationonlineng.net/>
6. Okoro, J. (2023 January 21). Cholera outbreak: 19 dead, 286 hospitalized in Cross River community. *The Sun*. Retrieved from <https://www.sunnewsonline.com>.
7. Odagiri, M., Muhammad, Z., Cronin, A. A., Gnilo, M. E., Mardikanto, A. K., Umam, K., & Asamou, Y. T. (2017). Enabling factors for sustaining open defecation-free communities in rural Indonesia: a cross-sectional study. *International Journal of Environmental Research and Public Health*, 14(12), 1572.
8. Jain, A., Wagner, A., Snell-Rood, C., & Ray, I. (2020). Understanding open defecation in the age of Swachh Bharat Abhiyan: Agency, accountability, and anger in rural Bihar. *International Journal of Environmental Research and Public Health*, 17(4), 1384.
9. Busienei, P. J., Ogendi, G. M., & Mokuu, M. A. (2019). Open defecation practices in Lodwar,

- Kenya: a mixed-methods research. *Environmental health insights*, 13, 1178630219828370.
10. Gertler, P., Shah, M., Alzua, M. L., Cameron, L., Martinez, S., & Patil, S. (2015). *How does health promotion work? Evidence from the dirty business of eliminating open defecation*.
 11. Tessema, R. A. (2017). Assessment of the implementation of community-led total sanitation, hygiene, and associated factors in Diretiyara district, Eastern Ethiopia. *PloS one*, 12(4), e0175233.
 12. Ngene, M. M., & Okwudiri, E. (2016). Influence of safe excreta disposal campaigns on knowledge, attitude and practices among rural residents in South-East Nigeria. *Research on Humanities and Social Sciences*, 6(9), 43-55.