ACHIEVING ZERO OPEN DEFECATION: BEHAVIORAL TRANSFORMATION, PUBLIC HEALTH ADVANCEMENTS, AND COMMUNITY EMPOWERMENT

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Abstract

This study explores the implementation of sustainable sanitation practices to eradicate open defecation in Dapitan City, Zamboanga del Norte, Philippines, aligning with Sustainable Development Goal 6 (SDG 6): Clean Water and Sanitation. Utilizing the Community-Led Total Sanitation (CLTS) approach and supported by City Ordinance No. 2022-495, this initiative targeted 50 barangays to address public health issues related to poor sanitation. Initial implementation efforts in four barangays (Potol, Daro, Banbanan, and Sto. Niño) successfully achieved Zero Open Defecation (ZOD) status, inspiring other barangays to follow suit. The program utilized a comprehensive methodology involving ocular inspections, spot mapping, community engagement, sanitation infrastructure development, and health education campaigns. The results demonstrated improvements in public health, sanitation practices, and community awareness. Key findings suggest that coordinated efforts among local government units (LGUs), academic institutions, and community stakeholders can lead to sustainable behavior changes. This paper provides insights into how multi-sectoral collaborations and the CLTS framework can be scaled to address sanitation challenges in similar settings.

Keywords: *sustainable sanitation practices; open defecation eradication; community-led total sanitation (CLTS); public health improvement; behavior change interventions; sanitation infrastructure development*

Introduction

Access to safe and sustainable sanitation is a fundamental pillar of public health, environmental sustainability, and socio-economic development. According to the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) (2021), approximately 3.6 billion people worldwide still lack access to safely managed sanitation services, leading to severe health consequences, environmental degradation, and economic burdens. Open defecation, in particular, remains a major global challenge, contributing to the spread of waterborne diseases such as diarrhea, cholera, and typhoid fever. The United Nations Sustainable Development Goal 6 (SDG 6) underscores the urgent need for universal access to clean water and sanitation, emphasizing the elimination of open defecation as a crucial step toward achieving improved health outcomes and sustainable development.

Studies have shown that open defecation disproportionately affects vulnerable populations, particularly in low- and middle-income countries. Research by Spears (2018) highlighted the correlation between poor sanitation and child stunting, emphasizing that open defecation contributes to chronic malnutrition and increased morbidity. Additionally, sanitation initiatives in countries such as India, through the Swachh Bharat Mission, have demonstrated the effectiveness of large-scale behavioral change campaigns in reducing open defecation and improving overall sanitation (Jalan & Somanathan, 2020). Similar approaches in sub-Saharan Africa and South Asia underscore the importance of community-led interventions in achieving lasting improvements in sanitation behavior (Crocker et al., 2016).

In the Philippines, open defecation remains a persistent issue, particularly in rural and marginalized communities where inadequate infrastructure, socio-economic disparities, and cultural practices hinder progress toward improved sanitation. According to the Philippine Statistics Authority (PSA, 2020), approximately 7 million Filipinos still practice open defecation, posing significant public health risks. Recognizing these challenges, the Philippine government launched the National Sustainable Sanitation Plan (NSSP) to accelerate efforts toward Zero Open Defecation (ZOD) and align with global sanitation targets. Various local government units (LGUs) have adopted community-based sanitation programs, with notable successes in regions where multi-sectoral collaboration has been emphasized (Department of Health, 2021).

Dapitan City, Zamboanga del Norte, has been proactive in addressing open defecation through its "Implementation of Sustainable Sanitation Plan Towards Eradication of Open Defecation in the Community." This initiative, guided by City Ordinance No. 2022-495, aligns with SDG 6 and aims to improve sanitation coverage through the Community-Led Total Sanitation (CLTS) approach. CLTS has been widely recognized for its effectiveness in fostering sustainable behavioral change, as demonstrated in countries such as Bangladesh and Cambodia (Kar & Chambers, 2008). The program targeted 50 barangays, prioritizing areas with high rates of open defecation. The initial implementation phase focused on four barangays—Potol, Daro, Banbanan, and Sto.

Niño—which successfully achieved ZOD status, serving as models for replication across other communities.

A comprehensive strategy was employed, incorporating ocular inspections, spot mapping, community engagement, sanitation infrastructure development, and health education campaigns. These efforts aimed to enhance public awareness, improve sanitation practices, and strengthen community ownership of sanitation initiatives. Findings from the program underscore the critical role of local government units (LGUs), academic institutions, and community stakeholders in driving sustainable sanitation outcomes. By fostering a culture of hygiene and sanitation, the initiative contributes to the broader goal of reducing waterborne diseases, promoting environmental health, and empowering communities toward self-sustaining sanitation practices.

Methods

This study employs a mixed-methods approach to assess the effectiveness of the Community-Led Total Sanitation (CLTS) approach, the role of legal frameworks, the impact of sanitation interventions, and the scalability of multi-sectoral collaborations in Dapitan City. The following methods will be used to gather both qualitative and quantitative data, aligned with the study objectives:

1. **Effectiveness of the CLTS Approach (Objective 1)**: To determine the causal relationship between the CLTS approach and sustained behavioral change in sanitation practices, this study will utilize the following methods:
    - **Community-led approaches**: The study will involve spot mapping to identify open defecation areas within the targeted communities. Participatory community meetings and focus group discussions will be conducted to assess community involvement and behavioral changes before and after the intervention.
    - **Health education**: Seminars and workshops will be conducted to educate households on sanitation practices, and pre- and post-intervention surveys will be used to evaluate changes in knowledge, attitudes, and practices regarding sanitation.

2. Role of Legal Frameworks (Objective 2): To analyze the impact of City Ordinance No. 2022-495 on compliance rates, long-term sanitation behavior, and enforcement, the following methods will be employed:

- **Surveys**: A community survey will be distributed to assess awareness of the ordinance and its provisions, including perceived effectiveness in promoting Zero Open Defecation (ZOD).
- **Compliance tracking**: Government records and enforcement data will be reviewed to determine compliance rates, identifying gaps in enforcement and challenges faced by local authorities. This will be

supplemented by interviews with local officials involved in sanitation policy enforcement.

- **Interviews and Focus Groups**: Key informant interviews with barangay leaders, local government units (LGUs), and community members will explore enforcement issues and any barriers to compliance with the ordinance.

3. **Impact on Health & Behavior (Objective 3)**: To investigate the mediating role of community engagement in improving public health outcomes, the following strategies will be used:
    a. **Health statistics**: Pre- and post-intervention health data (e.g., rates of waterborne diseases, sanitation-related illnesses) will be collected from local health offices. Comparisons of disease trends before and after the intervention will assess health improvements linked to sanitation changes.
    b. **Health behavior surveys**: Structured surveys will be used to assess household sanitation practices and hygiene behaviors before and after the intervention. Questions will focus on handwashing, safe water handling, and toilet usage.
    c. **Compliance monitoring**: Field visits and community checks will monitor the consistency of sanitation practices, with emphasis on the maintenance of sanitary toilets and waste disposal methods.
4. **Scaling Multi-Sectoral Collaboration (Objective 4)**: To evaluate the scalability of multi-sectoral collaborations in addressing sanitation challenges, the following methods will be implemented:
    a. **Case study analysis**: Comparative case studies from other regions implementing similar sanitation programs will be analyzed. These case studies will provide insights into successful multi-sectoral collaborations, the role of NGOs, and local stakeholders in promoting sanitation.
    b. **Scalability assessment model**: A model will be developed to assess the adaptability and scalability of the CLTS approach to other regions. This model will consider factors such as geographical location, income levels, access to water, and community engagement. Data will be gathered from stakeholders in the Dapitan City sanitation initiative, and interviews will be conducted with partners in NGOs and other relevant organizations to evaluate the potential for replication.
5. **Data Analysis**: Quantitative data from surveys, health statistics, and compliance tracking will be analyzed using statistical methods to determine correlations and trends. Qualitative data from interviews, focus groups, and case studies will be analyzed thematically to identify key themes related to community engagement, legal enforcement, and collaboration effectiveness.

Data Analysis Procedure

To ensure a thorough and systematic analysis of the data, the following data analysis procedure will be implemented. The analysis process is designed to evaluate the effectiveness of the Community-Led Total Sanitation (CLTS) approach, the role of legal frameworks, and the impact of sanitation interventions, as outlined in the study objectives.

Types of Data Collected: The data collected for this study will include both **quantitative** and **qualitative** data:

1. **Quantitative Data**:
    - Number of households with improved sanitation facilities.
    - Compliance rates with City Ordinance No. 2022-495 regarding Zero Open Defecation (ZOD).
    - Pre- and post-intervention health statistics, such as the incidence of waterborne diseases.
    - Survey data on sanitation practices and behavior changes, including the number of households practicing safe sanitation methods.
2. **Qualitative Data**:
    - Community feedback on the effectiveness of the CLTS approach through focus groups and interviews.
    - Observational data on sanitation behavior and community engagement.
    - Stakeholder input on the implementation and challenges of legal frameworks through interviews with local officials and community leaders.

Data Processing: The data will be processed as follows:

1. **Quantitative Data**:
    - Raw data from surveys, health statistics, and compliance records will be entered into a statistical software package (e.g., SPSS, STATA) for cleaning and coding.
    - Outliers, missing data, and inconsistencies will be addressed through standard data cleaning procedures to ensure accuracy.
    - Numerical data will be coded and organized into appropriate categories (e.g., compliance levels, disease incidences).
2. **Qualitative Data**:
    - Data from interviews, focus groups, and open-ended survey questions will be transcribed verbatim and reviewed for accuracy.
    - The qualitative data will be coded manually or using qualitative data analysis software (e.g., NVivo).
    - Themes and patterns will be identified based on the responses related to community engagement, sanitation practices, and feedback on the legal framework's effectiveness.

Analysis Methods:

1. **Quantitative Analysis**:
    - Descriptive statistics will be used to summarize demographic data and the extent of behavior change (e.g., percentages, frequencies, means).
    - **Paired t-tests** or **chi-square tests** will be employed to compare pre- and post-intervention data on sanitation practices and health outcomes, such as changes in waterborne disease rates.
    - **Regression analysis** may be used to examine the causal relationship between the CLTS approach and behavioral change in sanitation practices, controlling for potential confounding variables (e.g., socio-economic status, geographic location).
2. **Qualitative Analysis**:
    - **Thematic analysis** will be applied to interview and focus group data to identify recurring themes, attitudes, and perceptions about the CLTS approach and the enforcement of the legal framework.
    - Responses will be grouped into categories such as perceived effectiveness, challenges, and barriers to compliance.
    - Thematic findings will be used to interpret how community engagement influences the success of sanitation interventions and the impact of legal frameworks.

Interpretation: The results will be interpreted in relation to the study's research objectives:

1. **Objective 1 (Effectiveness of CLTS)**: The comparison of pre- and post-intervention data will help assess the effectiveness of the CLTS approach in promoting sustained behavioral change. Regression analysis will help determine the strength of the relationship between CLTS and sanitation practices.
2. **Objective 2 (Role of Legal Frameworks)**: Analysis of compliance rates and enforcement records, along with feedback from stakeholders, will provide insight into how City Ordinance No. 2022-495 influences long-term sanitation behaviors and the success of Zero Open Defecation initiatives.
3. **Objective 3 (Impact on Health & Behavior)**: Changes in health statistics (e.g., reductions in waterborne diseases) will be analyzed to assess the direct health benefits of sanitation interventions. Community feedback will also shed light on behavioral shifts toward improved hygiene practices.
4. **Objective 4 (Scaling Multi-sectoral Collaboration)**: The effectiveness and scalability of multi-sectoral collaboration will be assessed by analyzing stakeholder interviews and case studies. Comparisons of collaborative efforts in different areas will provide recommendations for scaling interventions beyond Dapitan City.

Validity and Reliability: To ensure the validity and reliability of the data, the following measures will be taken:

1. **Triangulation**: Multiple data sources (quantitative surveys, qualitative interviews, health records, and community feedback) will be used to cross-check and validate the findings. This approach will increase the robustness and credibility of the study results.
2. **Pilot Testing**: Pre-testing of survey instruments and interview protocols will be conducted with a small group of participants to ensure clarity, consistency, and reliability before full-scale data collection.
3. **Inter-coder Reliability**: For qualitative data, multiple researchers will code the data independently to ensure consistency in the identification of themes and categories. Discrepancies will be resolved through discussion and consensus.
4. **Longitudinal Data**: The study's design, which includes pre- and post-intervention data collection, will help track changes over time, providing a more reliable assessment of the impact of sanitation interventions.

By following this structured data analysis procedure, the study will effectively evaluate the outcomes of sanitation interventions, the role of legal frameworks, and community engagement in promoting sustainable sanitation practices.

Sample Selection

The study's sample selection follows specific geographical, demographic, and health-related criteria to ensure that the intervention is targeted toward areas with the most pressing sanitation challenges. The selection process focuses on barangays with high open defecation rates, inadequate sanitation infrastructure, and limited access to water sources.

Geographical Criteria

The study focuses on four barangays: Potol, Daro, Banbanan, and Sto. Niño, based on their distinct sanitation and environmental conditions:

- Barangay Potol is a poblacion (urban) barangay where open defecation is prevalent in certain puroks near riverbanks and creeks. The presence of water bodies increases the risk of fecal contamination, making it a priority for sanitation interventions.
- Barangays Daro, Banbanan, and Sto. Niño are upland (rural) barangays where access to clean water is highly limited. The lack of adequate water supply poses a significant challenge for maintaining sanitary toilets, leading to higher open defecation rates.

Demographic Criteria

The selected barangays vary in population size and socio-economic conditions, ensuring that the study captures a diverse range of sanitation challenges:

- Households with no access to toilets or sharing unimproved sanitation facilities were prioritized.

- Communities with low-income households were included, as economic constraints are a significant factor influencing sanitation practices.
- Cultural practices that contribute to open defecation were considered, particularly in rural barangays where traditional habits and lack of awareness about sanitation persist.

Health and Sanitation Status

The barangays were selected based on high open defecation rates and susceptibility to sanitation-related diseases:

- Barangay Potol has been identified as a sanitation risk area due to its proximity to waterways, increasing the likelihood of fecal contamination and waterborne diseases.
- Daro, Banbanan, and Sto. Niño have reported cases of diarrhea, skin infections, and other hygiene-related illnesses, particularly among children and vulnerable populations. These areas were prioritized to assess the impact of improved sanitation on public health.

Stakeholder Involvement

The participants involved in community engagement include:

- Barangay leaders and health workers, who play a crucial role in advocacy and program implementation.
- Household representatives, particularly those without proper toilet facilities, to understand behavioral patterns and challenges in adopting improved sanitation.
- Community health volunteers and sanitation officers, responsible for monitoring compliance and providing education on proper sanitation practices.
- Representatives from government agencies and NGOs, who assist in the provision of resources and policy enforcement.

By incorporating these selection criteria, the study ensures that the intervention is strategically implemented in areas with the highest need, enabling a comprehensive evaluation of the effectiveness of the Community-Led Total Sanitation (CLTS) approach in different environmental and socio-economic contexts.

Study Design

This study employed a mixed-methods approach, integrating quantitative and qualitative data collection techniques to assess the effectiveness of the Community-Led Total Sanitation (CLTS) approach and legal frameworks in achieving Zero Open Defecation (ZOD) status in selected barangays in Dapitan City. The study utilized pre- and post-intervention assessments, comparative analysis, and stakeholder interviews to provide a comprehensive evaluation of sanitation improvements.

Study Area and Sampling

The study was conducted in four barangays—Potol, Daro, Banbanan, and Sto. Niño—which were selected based on geographical, demographic, and sanitation status criteria. Barangay Potol, located in the poblacion area, was identified due to persistent open defecation practices near riverbanks and creeks. Meanwhile, Barangays Daro, Banbanan, and Sto. Niño, situated in upland areas, were chosen due to their limited water sources, a known barrier to sanitation improvements. The selection process was guided by data from the City Health Office (CHO) and Barangay Health Workers (BHWs), ensuring that barangays with urgent sanitation challenges were prioritized.

To mitigate sampling bias, an effort was made to include barangays with different geographical challenges and sanitation conditions. However, the study acknowledges the absence of a control group, which limits the ability to compare outcomes with non-intervention areas. Future studies should consider including control barangays to enhance the generalizability of findings.

Data Collection Methods

The study incorporated multiple data collection methods to ensure triangulation and enhance the reliability of results:

1. Community Surveys – Structured questionnaires were administered to households, barangay leaders, and health workers to assess changes in sanitation practices, knowledge, and attitudes. To minimize self-reporting bias, survey responses were cross-validated with spot mapping and direct observations conducted by trained field researchers.
2. Spot Mapping and Observational Studies – Systematic pre- and post-intervention mapping of open defecation sites was conducted using GPS-based monitoring tools. This method provided objective evidence of changes in sanitation behavior and helped identify areas where interventions were most effective.
3. Health Records Analysis – Data from the City Health Office, Rural Health Units (RHUs), and Barangay Health Stations (BHSs) were reviewed to assess trends in waterborne diseases (e.g., diarrhea, typhoid fever). Comparative analysis of pre- and post-intervention health data helped establish the public health impact of sanitation improvements.
4. Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) – Interviews were conducted with barangay officials, community health workers, and residents to gather qualitative insights into challenges, perceptions, and factors influencing sanitation adoption. FGDs allowed for a deeper exploration of community engagement dynamics, including the role of the City Ordinance No. 2022-495 in reinforcing behavior change.
5. Policy and Program Analysis – A review of local and national sanitation policies was conducted to assess the effectiveness of City Ordinance No. 2022-495 in facilitating ZOD achievement. This included an evaluation of policy enforcement mechanisms, resource allocation, and stakeholder collaboration.

Data Analysis

Quantitative data from surveys and health records were analyzed using descriptive and inferential statistics, including chi-square tests and logistic regression, to determine the association between sanitation interventions and behavioral outcomes. Qualitative data from KIIs and FGDs were analyzed thematically using NVivo software, allowing for the identification of recurring themes related to community participation, policy enforcement, and sustainability challenges.

Addressing Methodological Limitations

To enhance the study's rigor and address potential methodological issues, the following measures were taken:

- Reducing Self-Reporting Bias – By incorporating spot mapping, observational studies, and cross-validation of survey responses, the study minimized the risk of overreported compliance with sanitation practices.
- Long-Term Follow-Up – While the study initially assessed short-term outcomes, a follow-up evaluation after six months was conducted to track sustained behavioral changes and policy adherence. Future research should extend the monitoring period to assess long-term sustainability.
- Diversifying Data Sources – The study integrated data from households, health workers, local government units, and secondary health records, ensuring a multi-stakeholder perspective on sanitation improvements.
- Balanced Discussion of Community Engagement – While community participation was a key success factor, challenges such as resource limitations, cultural resistance, and enforcement difficulties were also acknowledged and analyzed.

  By addressing these methodological concerns, the study enhances its validity, reliability, and applicability for guiding future sanitation interventions in Dapitan City and similar communities.

Ethical Consideration

The study will adhere to ethical principles to ensure the protection, dignity, and rights of all participants. One of the fundamental ethical considerations is informed consent. Participants will be provided with a detailed explanation of the study's purpose, methodology, potential risks, and benefits. Written informed consent will be obtained from all participants, ensuring that they voluntarily agree to participate. For minors or vulnerable individuals, parental or guardian consent will be required. This process ensures that participants are fully aware of their involvement and can make an informed decision.

Another crucial ethical consideration is confidentiality and privacy. All data collected during the study, including surveys, interviews, and health statistics, will be treated with the utmost confidentiality. Participants' personal information will not be disclosed without their explicit consent, and any identifying information will be

anonymized during data analysis. Data will be securely stored and accessed only by authorized personnel involved in the research, further safeguarding participants' privacy.

The study will also adhere to the principle of non-maleficence, ensuring that no harm comes to participants as a result of their involvement. The research will approach topics such as sanitation and health in a sensitive and respectful manner, ensuring that participants are not subjected to any discomfort or distress. Health and sanitation practices will be discussed in a non-judgmental way, and participants will not be exposed to risks or burdens during the study. If any risks or discomforts arise, participants will be informed immediately.

The principle of beneficence will guide the study, with the goal of maximizing benefits to the participants and the community. The research aims to improve sanitation practices, reduce health risks, and contribute to evidence-based policies that support public health outcomes. Participants will also benefit from access to educational materials and information on improving sanitation and hygiene practices. The findings of the study will be used to inform local health interventions that benefit the broader community.

In line with ethical guidelines, the study will ensure that participation is voluntary and that participants have the right to withdraw at any point without facing any negative consequences. This includes the right to withdraw from the study without providing a reason, and participants will be assured that their decision to withdraw will not affect their access to services or their relationship with the research team.

Given the socio-cultural context of the study area, cultural sensitivity will be a priority. The research team will respect the local customs, traditions, and beliefs of the communities involved. Efforts will be made to communicate in a culturally appropriate manner, and language barriers will be addressed through the use of local dialects or interpreters when necessary. Participants will be encouraged to voice any concerns or questions, and the research team will remain receptive and responsive to their needs.

Before the study commences, it will be submitted for ethical review and approval by an Institutional Review Board (IRB) or Ethics Committee. This review will ensure that the study meets established ethical standards, particularly concerning participant welfare, privacy, and the integrity of the research process. Ethical approval will also verify that the study design is ethical and the rights of participants are adequately protected.

Finally, the study will uphold transparency and accountability. The research team will ensure that the findings are reported honestly and accurately, regardless of the outcomes. Participants will be informed of the results and how their data will be used. Any potential conflicts of interest will be disclosed, and the research team will maintain accountability throughout the study.

By adhering to these ethical principles, this study will ensure the well-being and protection of participants while conducting the research with integrity and respect for ethical standards.

Results and Discussions

Achievement of Zero Open Defecation (ZOD) Status

The attainment of Zero Open Defecation (ZOD) status in four barangays—Potol, Daro, Banbanan, and Sto. Niño—represents a crucial step towards improving sanitation and public health in Dapitan City. This success aligns with the Philippine Sustainable Sanitation Roadmap (Department of Health [DOH], 2022), which emphasizes the role of local government units (LGUs) in achieving sanitation goals. The implementation of City Ordinance No. 2022-495 provided a structured framework for compliance, making Dapitan one of the pioneering cities to integrate legal mandates with Community-Led Total Sanitation (CLTS).

Research from UNICEF and WHO (2021) highlights that legal frameworks significantly accelerate sanitation progress by ensuring institutional accountability. Similarly, studies from Indonesia and India found that strong policy implementation led to an 80% reduction in open defecation within three years (World Bank, 2020). In the Philippines, the National Sustainable Sanitation Plan (NSSP) stresses the importance of multi-sectoral collaboration (DOH, 2021), a key factor contributing to Dapitan City's success.

Locally, the Department of Health – Zamboanga Peninsula (DOH-IX) has reported that municipalities implementing strict ZOD policies observed a significant decline in waterborne diseases (DOH-IX, 2023). The ZOD status of the four barangays in Dapitan mirrors successes in nearby provinces, where localized enforcement of sanitation laws resulted in improved hygiene behaviors and compliance (DILG, 2022).

Behavioral Change Outcomes in Sanitation Practices

The integration of the CLTS framework was instrumental in fostering behavioral change among community members. The CLTS approach shifts the focus from infrastructure provision to community ownership of sanitation improvements (Kar & Chambers, 2020). This method has been successfully employed in Bangladesh, Cambodia, and Vietnam, where community-led sanitation programs resulted in long-term reductions in open defecation rates (WaterAid, 2022).

In Dapitan City, barangay health workers (BHWs) and community volunteers played a crucial role in social mobilization, educating households on proper sanitation practices and the dangers of open defecation. This aligns with global findings that peer-driven sanitation education leads to higher compliance rates and sustained behavioral changes (Chambers & Pasteur, 2021).

Local findings from Cebu and Leyte support the effectiveness of CLTS interventions, showing that community-driven sanitation programs led to a 60% increase in latrine construction and usage within two years (DOH, 2021). Similarly, in Dapitan City's coastal barangays, particularly Cawa-Cawa and Banonong, the adoption of

culturally appropriate hygiene education resulted in a significant decrease in open defecation near water sources (DOH-IX, 2023).

Public Health Improvements: Reduction of Waterborne Diseases

The sanitation interventions in Dapitan City led to notable improvements in public health, particularly a decline in waterborne diseases such as diarrhea, typhoid, and dysentery. According to WHO (2020), poor sanitation contributes to 60% of diarrheal diseases globally, making sanitation interventions a crucial strategy for public health.

Data from the City Health Office (CHO) of Dapitan indicate that diarrhea cases among children under five declined by 45% between 2022 and 2024 following ZOD implementation (CHO-Dapitan, 2024). This trend mirrors national findings, where municipalities with active ZOD programs reported a significant reduction in hospital admissions due to waterborne diseases (DOH, 2022).

Internationally, studies from Ethiopia and Nepal highlight that achieving ZOD status leads to improved child health outcomes, including a 50% reduction in stunting and malnutrition rates (UNICEF, 2021). Dapitan City's experience aligns with these findings, as improved sanitation contributed to better overall health indicators, particularly among children and vulnerable populations.

Moreover, the Integrated Water, Sanitation, and Hygiene (IWASH) program, which complemented ZOD efforts, ensured that households had consistent access to safe water, reducing the incidence of contaminated drinking sources (WHO & UNICEF, 2021). Similar interventions in Zamboanga del Norte's rural communities have reported a 35% decrease in cases of waterborne illnesses within three years (DOH-IX, 2023).

Community Empowerment and Sustainability of Sanitation Programs

A key factor in the success of ZOD implementation was the empowerment of local communities, particularly barangay councils, health workers, and school educators. Research from the Philippines and Indonesia indicates that local leadership is a critical determinant in the sustainability of sanitation programs (ADB, 2022).

Dapitan City's experience demonstrates that when communities take ownership of sanitation efforts, they are more likely to sustain progress beyond initial project implementation. Findings from the Philippines' WASH Sustainability Index (DOH, 2022) reveal that barangays with strong local governance structures maintain higher sanitation standards over time.

Moreover, the establishment of Barangay Sanitation Committees (BSCs) ensured that local leaders and volunteers actively monitored compliance and reinforced hygiene behaviors. Similar approaches in Rwanda and Kenya have led to long-term success in sanitation programs, demonstrating that local governance and community-driven monitoring are key to sustaining ZOD achievements (World Bank, 2021).

In the context of Dapitan City, barangays that received continuous training and financial support from local government units (LGUs) demonstrated higher adherence to sanitation regulations, reinforcing the idea that sustained investment in community empowerment is vital for sanitation programs (DOH-IX, 2023).

Conclusions

The achievement of Zero Open Defecation (ZOD) status in the four barangays of Potol, Daro, Banbanan, and Sto. Niño highlights the effectiveness of legal frameworks, community-led initiatives, and health interventions in improving sanitation practices in Dapitan City. The implementation of City Ordinance No. 2022-495, which provided a legal basis for sanitation improvements, played a crucial role in ensuring compliance and long-term sustainability. This aligns with global findings that strong policy support enhances the success of sanitation programs by institutionalizing accountability, resource allocation, and enforcement mechanisms (World Bank, 2020).

The study also underscores the importance of behavioral change in achieving sustained sanitation improvements. By adopting the Community-Led Total Sanitation (CLTS) approach, residents actively participated in the process of eliminating open defecation, leading to significant improvements in hygiene practices. This mirrors the success of similar initiatives in Bangladesh and Cambodia, where CLTS interventions resulted in lasting behavioral changes and reduced open defecation rates (WaterAid, 2022). The participatory nature of CLTS, which fosters a sense of community responsibility, proved to be a key factor in sustaining the intervention's impact.

Furthermore, the sanitation interventions contributed to public health improvements, particularly in the reduction of waterborne diseases. A 45% decline in diarrhea cases among children under five was observed following the implementation of the program, demonstrating the direct correlation between improved sanitation and reduced disease incidence. This finding is consistent with WHO (2020) and UNICEF (2021) reports, which indicate that safe sanitation can significantly decrease the prevalence of diarrheal diseases, particularly in vulnerable populations. By improving access to sanitation infrastructure and hygiene education, Dapitan City has made strides in enhancing the overall well-being of its residents.

Another critical outcome of the initiative was the empowerment of local stakeholders, particularly barangay councils and community health workers. By actively engaging in the planning, implementation, and monitoring of sanitation programs, local leaders took ownership of the initiative, ensuring its sustainability beyond the project timeline. Similar findings have been reported in Indonesia and India, where community-led sanitation efforts were most successful when local governance structures were actively involved (ADB, 2022). The empowerment of barangay health workers (BHWs) further strengthened the initiative, as they played a pivotal role in mobilizing households and conducting health education.

In conclusion, Dapitan City's ZOD achievement serves as a model for other local government units seeking to improve sanitation and public health outcomes. The integration of policy enforcement, community-led behavioral change strategies, and multi-sectoral collaboration has proven effective in addressing sanitation challenges. However, to maintain the long-term success of these efforts, continuous support, policy reinforcement, and infrastructure improvements are essential. The lessons learned from this initiative highlight that achieving and sustaining ZOD status requires a holistic approach, combining governance, education, and community participation.

Recommendations

Based on the results and discussion, the following recommendations are proposed to enhance and sustain the achievements of the sanitation initiative in Dapitan City and to serve as a guide for similar projects in other regions:

Expand the Implementation of ZOD Practices: Scale the successful Zero Open Defecation (ZOD) practices to the remaining barangays in Dapitan City. Focus on replicating the strategies used in Potol, Daro, Banbanan, and Sto. Niño while adapting them to the unique needs and challenges of other communities. Prioritize underserved and geographically isolated areas, ensuring equitable access to sanitation facilities and education.

Strengthen Legal and Policy Support: Build on the foundation of City Ordinance No. 2022-495 by institutionalizing incentives for barangays that achieve and maintain ZOD status. Examples include financial rewards, recognition programs, and resource allocations for sanitation improvements. Develop policies that integrate sanitation with broader public health and environmental goals, such as waste management and clean water access.

Enhance Community Engagement and Capacity Building: Continue empowering barangay councils and local monitoring teams by providing ongoing training, technical support, and resources. This will enhance their capacity to enforce sanitation standards, maintain infrastructure, and sustain behavior change.Conduct regular community consultations to incorporate feedback and ensure that sanitation interventions remain relevant and effective.

Improve Sanitation Infrastructure: Collaborate with local government units (LGUs), NGOs, and private sector stakeholders to expand and upgrade sanitation facilities, especially in areas with limited access. Ensure that infrastructure projects are gender-sensitive and inclusive, addressing the specific needs of women, children, and persons with disabilities.

Intensify Health Education Campaigns: Regularly update and disseminate educational materials on Integrated Water, Sanitation, and Hygiene (IWASH) practices. Emphasize the link between sanitation, hygiene, and the prevention of diseases such as diarrhea and cholera. Use innovative approaches, such as digital

tools and community theater, to engage diverse audiences and reinforce behavior change.

Promote Multi-Sectoral Collaboration: Strengthen partnerships among academic institutions, LGUs, community organizations, and international agencies to leverage resources and expertise. Advocate for increased funding and technical support from national and international bodies to ensure the sustainability of sanitation initiatives.

Scale and Replicate Best Practices: Document and disseminate the success stories and lessons learned from Dapitan City to encourage other municipalities and regions to adopt similar approaches. Advocate for the integration of the Community-Led Total Sanitation (CLTS) framework into national sanitation policies as a scalable and sustainable model for eradicating open defecation.

By implementing these recommendations, Dapitan City can build on its successes, ensuring long-term sustainability and widespread impact. These strategies also provide a blueprint for other regions aiming to address sanitation challenges and achieve Sustainable Development Goal 6: Clean Water and Sanitation.

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In compliance with Threshold's guidelines for the ethical use of artificial intelligence (AI) and automated tools in academic research, the authors disclose the use of OpenAI's ChatGPT for enhancing the quality and clarity of the manuscript. ChatGPT was utilized to assist in refining the language, structure, and formatting of the text, ensuring a high level of academic rigor and coherence. The authors confirm that all data analysis, critical interpretations, and conclusions presented in this manuscript were conducted independently by the research team. The AI tool was employed strictly for editorial assistance and did not influence the scientific content or ethical considerations of the study. All intellectual contributions from the AI tool are in accordance with the authors' original intentions and have been reviewed and approved by all co-authors. The use of ChatGPT complies with Threshold's ethical standards and guidelines for transparent reporting of AI involvement in research. The authors remain fully responsible for the integrity and accuracy of the content presented in this paper.

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