Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 6 (2025): June 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i6.1640
Original Article



# Comparative analysis assessing the effectiveness and efficiency of paper-based Vs digital approaches in Kadoma cholera case area targeted interventions between june to august 2024. A cross-sectional study.

**Precious Sabina Banda*, Dr Anahita Ali**
James Lind Institute, Faculty of Public Health Sciences

## Abstract

### Study Aim

To assess the effectiveness and efficiency of paper-based vs digital approaches in the Kadoma cholera case area, targeted interventions between June to August 2024.

### Methodology

A field trial was employed to compare paper-based and digital data collection methods during Case Area Targeted Interventions (CATIs) within the context of the cholera outbreak. Twenty CATI team members were randomly assigned to two groups using a random number generation process.

### Results

The data reveal a fairly balanced gender distribution among the 20 implementors: 11 males and 9 females. The collection process uses paper-based and digital methods. There were 140 (98%) completed interviews using the paper-based method and 142 (100%) using the digital method. The number of completed interviews using the two approaches does not differ significantly (p-value < 0.05). The paper-based mean is 12 minutes (SD =2.89, **CI 11.53 - 12.47**), the digital mean is 9 minutes (SD =2.85, **CI 9.53 - 10.47**), and the t-test for the mean difference is 7.502. The p-value was 0.0001. The digital method demonstrated slightly higher completion rates (100%) compared to the paper-based method (98%).

### Conclusion

The study demonstrates that digital methods outperform paper-based approaches in terms of efficiency, resulting in considerable time savings during data collection. While both methods achieved high completion rates, the digital approach allows for faster data capture and swifter public health responses, which are crucial during outbreaks.

### Recommendations

Kadoma City Council should prioritize the adoption of digital methods for time-sensitive situations, particularly during outbreak investigations where a swift response is crucial.

***Keywords:*** *Effectiveness and efficiency, Paper-based vs digital approaches, Kadoma case area targeted interventions.*
***Submitted:*** *2025-03-19* ***Accepted:*** *2025-05-08* ***Published:*** *2025-06-01*

***Corresponding Author:*** *Precious Sabina Banda*
***Email:*** **psbanda88@gmail.com**
***James Lind Institute, Faculty of Public Health Sciences***

## Introduction

Cholera is a global health threat, particularly in low and middle-income countries (LMICs), where access to clean water, sanitation, and healthcare infrastructure is often inadequate (Endres et al., 2023). It is a waterborne disease caused by the Vibrio cholerae bacterium, which spreads rapidly in settings with poor sanitation and hygiene practices, especially after natural disasters or in conflict zones (Xu and Bai, 2023).

Field outbreak investigations, particularly Case Area Targeted Interventions (CATIs), play a crucial role in the rapid response and containment of infectious disease outbreaks (Ratnayake *et al.*, 2022). Effective data collection methods are vital for gathering accurate and timely information during these interventions. Traditionally, paper-based methods have been employed; however, digital technologies offer opportunities to enhance efficiency and improve data quality (Zeleke et al., 2019). Field outbreak investigations, especially Case

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 6 (2025): June 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i6.1640
Original Article



Area Targeted Interventions (CATIs), are essential for the swift response and containment of infectious disease outbreaks (Ratnayake et al., 2022).

CATIs have been used in Haiti, Yemen, Zimbabwe, Cameroon, South Sudan, Nepal, and the Democratic Republic of the Congo (Sikder et al., 2021) and have been effective in encouraging WASH behaviors and lowering suspected cholera cases when introduced quickly (Gartley *et al.*, 2013). Individuals living near cholera patients are at an increased risk of subsequent cholera infections (Ali *et al.*, 2016). A recent study conducted in eastern DRC in 2018 found that individuals living within 30 meters of a cholera patient were at a significantly higher risk, 20 times higher, of developing cholera within the week following the patient's hospitalization (Azman *et al.*, 2018). Research from other regions has shown that this elevated risk can persist for up to one month (Debes *et al.*, 2016). In a study comparing the efficiency of paper-based and electronic data capture during face-to-face interviews. A roving creel survey of recreational shore-based fishers in Western Australia in 2019 (Tate and Smallwood, 2021). One thousand sixty-eight interviews with recreational fishers were undertaken with a total error rate of 5.1% (CI95%: 4.8–5.3%) for paper-based data collection methods and 3.1% (CI95%: 2.9–3.3%) for Digital techniques (Tate and Smallwood, 2021). These results confirmed that Digital techniques can reduce errors whilst increasing efficiency and decreasing cost (Tate and Smallwood, 2021). While the financial implications of adopting digital tools in healthcare delivery are frequently discussed, there is a lack of comprehensive studies evaluating the cost-effectiveness of digital data collection methods in outbreak investigations. Research is needed to assess the initial investment costs (such as mobile devices, software, and training) as well as the long-term operational costs (including system maintenance, data hosting, and updates) in comparison to paper-based methods. This is particularly important in regions with limited budgets for health interventions (Gentili *et al.*, 2022). The study aims to assess the effectiveness and efficiency of paper-based vs digital approaches in the Kadoma cholera case area targeted interventions between June 2024 to August 2024.

## METHODS

### Study design

Comparative Study Design

A field trial was employed to compare paper-based and digital data collection methods during Case Area Targeted Interventions (CATIs) within the context of the cholera outbreak. Twenty CATI team members were randomly assigned to two groups using a random number generation process. One group collected data using the traditional paper-based form, while the second group used an electronic data collection form created in KoBo Toolbox. Before field deployment, the digital team received training on using the devices to ensure accurate data entry in the field.

To evaluate the practical impact of each method, six key informants were selected for in-depth interviews based on their role in receiving and using CATI data for decision-making. These key informants included:

- Director of Health and Environmental Services
- Chief Nursing Officer
- Head of Environmental Services
- Clinical Services Manager
- Environmental Health Manager
- Data Management Specialist

The feedback from these interviews offered insights into the effect of each data collection method on data quality, Ease of use, and timely access, which are critical for effective outbreak response.

### Study setting

The study was conducted in Kadoma, focusing on the ongoing cholera outbreak in the area. Kadoma City Council encompasses 17 residential wards, all affected by cholera, making it an ideal setting for comparing data collection methods in outbreak management.

### Participants

Participants were selected from these categories to provide insights into the use of both paper-based and digital data collection methods during the outbreak.

Field Staff (Implementors)**:** These are individuals who are directly involved in cholera outbreak investigations. This group includes Environmental Health Technicians, Environmental Health Officers, Clinical Officers, Nurses, and Data Entry Clerks.

Affected Population**:** This refers to community members who participated in cholera prevention, intervention, and surveillance activities. Examples of participation include receiving health interventions or taking part in case investigation.

Key Informants: These are public health professionals responsible for overseeing outbreak investigations and responses in Kadoma.

### Inclusion and Exclusion Criteria

#### Field Staff (Implementors)

#### Inclusion

Current employment in cholera outbreak response roles (Environmental Health Technicians/Officers, Clinical Officers, Nurses, Data Entry Clerks) during the study period.

Direct involvement in cholera outbreak investigations (e.g., data collection, case investigation, intervention delivery).

Willingness to provide informed consent.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 6 (2025): June 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i6.1640
Original Article



### Exclusion
Staff not actively participating in outbreak response (e.g., administrative roles unrelated to data collection or outbreak management).
Temporary or short-term personnel with incomplete participation (<50% of the outbreak response period).

### Affected Population
### Inclusion
Individuals residing in Kadoma's 17 affected wards during the cholera outbreak.
Participation in ≥1 cholera-related activity (e.g., received interventions, engaged in case investigations).
Ability to communicate in the local language (Shona/Ndebele) or English.

### Exclusion
Non-residents of Kadoma, or individuals not involved in cholera outbreak activities.

### Key Informants
### Inclusion
Public health professionals (e.g., outbreak coordinators and senior health officials) with direct oversight of Kadoma's cholera response.
Employment in a decision-making role for ≥3 months during the outbreak.

### Exclusion
Advisory roles without operational responsibilities (e.g., external consultants not involved in response teams).

### Ethical considerations
Approval was obtained from the Ethics and Research Board of the Health and Environmental Services Directorate. Participants were informed of the voluntary nature of their participation, and all personal information was kept confidential and used exclusively for research purposes.

### Analysis protocol
Data was analyzed using Epi Info 7, with both descriptive and comparative analyses employed:
Descriptive Analysis: Frequency counts and percentages illustrated data distribution.
Comparative Analysis: Chi-square tests were used to assess relationships between categorical variables and data collection methods, and t-tests were applied to compare mean differences between the two methods.
Qualitative data from key informant interviews was analyzed thematically to identify common themes, challenges, and recommendations for each data collection method.

## Results
### Demographic Information

**Table 1: Gender distribution of implementors, Kadoma City Council, 2024, N=20**

| Data collection method | Males | Females | Total |
|---|---|---|---|
| Paper Based | 7(70%) | 3(30%) | 10(100%) |
| Digital | 4(40%) | 6(60%) | 10(100%) |
| Total | 11(55%) | 9(45%) | 20(100%) |

### Basic summary of key informants

**Table 2: Basic Summary of Key Informants, Kadoma City Council, 2024, N=6**

| Position | Gender | Frequency |
|---|---|---|
| Director of Health and Environmental Services | M | 1 |
| Environmental Health Manager | F | 1 |
| Clinical Services Manager | F | 1 |
| Chief Nursing Officer | M | 1 |
| Head of Environmental Services | F | 1 |
| Data Management Specialist | M | 1 |

Table 2, A total of 6 respondents who had key positions were interviewed. 3(50%) were males and 3(50%) were females.
**Director of Health and Environmental Services (Male):** Oversees strategic planning, resource allocation, and health and environmental interventions coordination.
**Environmental Health Manager (Female):** Focuses on sanitation, water quality, and environmental risk mitigation (e.g., waste management, and hygiene campaigns).

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 6 (2025): June 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i6.1640
Original Article



**Clinical Services Manager (Female):** Manages clinical care, case management, and health facility operations during the outbreak.
**Chief Nursing Officer (Male):** Leads nursing teams in patient care, community health education, and surveillance.
**Head of Environmental Services (Female):** Implements environmental programs (e.g., clean water access, sanitation infrastructure).
**Data Management Specialist (Male):** Oversees data collection, analysis, and reporting systems for outbreak monitoring.
These roles span critical domains of outbreak response (clinical, environmental, data management), ensuring a multidisciplinary approach to cholera containment.

## Implementors thematic areas

**Table 3: Implementors' thematic areas, Kadoma City Council, 2024, N=20**

| Thematic Area | Number |
|---|---|
| **CATIs** | |
| Paper Based | 3(15%) |
| Digital | 3(15%) |
| **BURIAL SUPERVISION** | |
| Paper Based | 1(5%) |
| Digital | 2(10%) |
| **WASH** | |
| Paper Based | 2(10%) |
| Digital | 2(10%) |
| **RISK COMMUNICATION AND COMMUNITY ENGAGEMENT** | |
| Paper Based | 1(5%) |
| Digital | 1(5%) |
| **CASE MANAGEMENT** | |
| Paper Based | 1(5%) |
| Digital | 1(5%) |
| **SURVEILLANCE** | |
| Paper Based | 2(10%) |
| Digital | 1(5%) |

Table 3 provides insights into the implementation of various thematic areas by the Kadoma City Council in 2024, based on a sample size of 20 implementors. The data highlights the extent to which paper-based and digital methods are utilized across different sectors, revealing disparities in adoption and p.
**Case-area Targeted Interventions (CATIs)** emerged as the most active thematic area, with 15% of implementors using both paper-based and digital methods. This equal distribution suggests a balanced approach to documenting cholera field outbreak investigations, possibly due to the need for flexibility in field operations where digital tools may not always be accessible.
**Burial Supervision** shows a slight preference for digital methods (10%) over paper-based (5%), indicating a gradual shift toward digital record-keeping in this sensitive area. This could be driven by the need for efficient data management during emergencies, such as disease outbreaks, where real-time reporting is crucial.
Water, Sanitation, and Hygiene (WASH) programs demonstrate an equal split between paper and digital methods (10% each), reflecting a transitional phase where some implementors still rely on traditional methods while others adopt digital solutions. This balance may stem from varying levels of technological access and training among staff.
**Risk Communication and Community Engagement (RCCE)** and **Case Management** both report low adoption rates, with only 5% of implementors using either paper or digital systems. This minimal engagement suggests under-prioritization or resource constraints in these critical areas, which are essential for public health responsiveness and disease control.
**Surveillance** shows a higher reliance on paper-based methods (10%) compared to digital (5%), indicating potential barriers to digital adoption, such as infrastructure limitations or resistance to change. Given surveillance's importance in early disease detection, this gap could hinder timely data analysis and response.
Overall, the results reveal uneven digital transformation across thematic areas, with some sectors like CATIs and WASH showing progressive adoption, while others lag.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 6 (2025): June 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i6.1640
Original Article



**Assessing the effectiveness and efficiency of paper-based and digital data collection methods in CATIs.**

**Key Variables:**

Effectiveness: Percentage of completed interviews.
Efficiency: Time taken to complete data collection (in minutes).
Number of completed Interviews, Kadoma City Council, 2024

**Figure 1: Number of completed Interviews, Kadoma City Council, 2024**

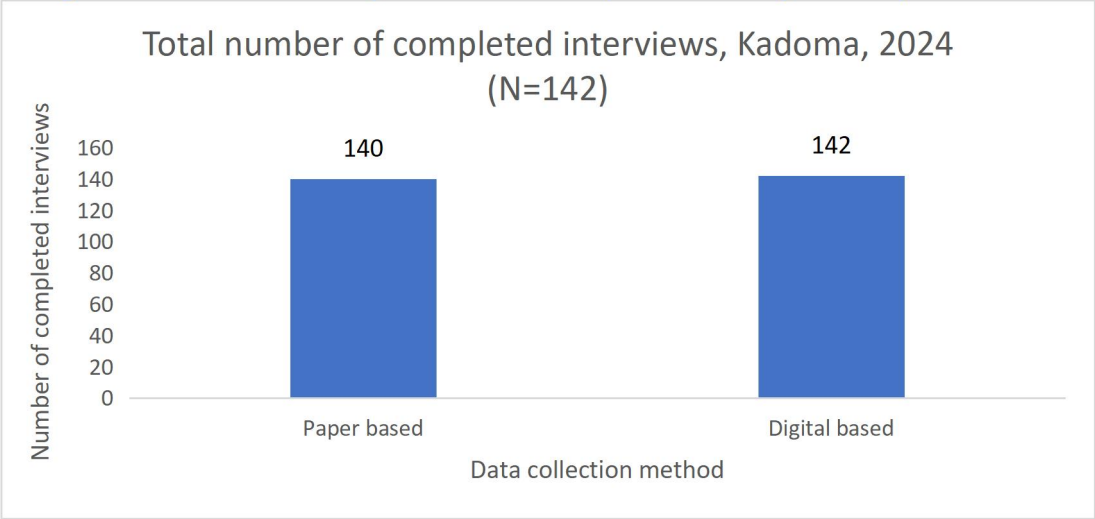
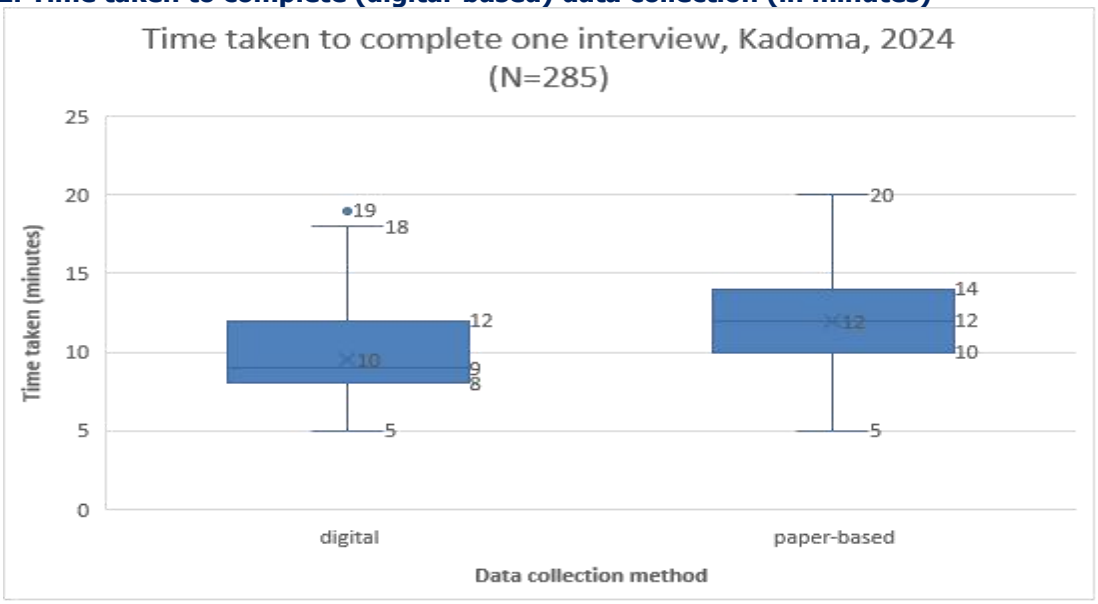



Figure 1 the number of completed interviews was evaluated once the respondents completed the data collection process using paper-based and digital methods. There were 140 (98%) completed interviews using the paper-based method and 142 (100%) using the digital method. The number of completed interviews using the two approaches does not differ significantly (p-value < 0.05).

## Time taken to complete data collection in minutes

**Fig 2: Time taken to complete (digital-based) data collection (in minutes)**



Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 6 (2025): June 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i6.1640
Original Article



Figure 2, The paper-based mean is 12 minutes (SD =2.89, **CI 11.53 -12.47**), The digital mean is 9 minutes (SD =2.85, **CI, 9.53 - 10.47**), The t-test for the mean difference is 7.502. The p-value is 0.0001, indicating that the result is statistically significant. Thus, there is a statistical difference between the time taken using the paper-based method and the time taken using the digital method.

## Qualitative Findings

### Effectiveness and Efficiency of Data Collection Methods

### Theme: Completion Rates and Ease of Data Collection

**Findings**: The digital method demonstrated slightly higher completion rates (100%) compared to the paper-based method (98%). Field implementers highlighted the ease of use of digital tools, which enabled real-time data capture and streamlined processes.

### Theme: Time Efficiency

**Findings**: Digital data collection was significantly faster (mean time: 9 minutes per interview) than paper-based methods (mean time: 12 minutes per interview). Statistical analysis indicated a significant difference ($p < 0.0001$).

## Discussion

### Assessing the effectiveness and efficiency of paper-based and digital data collection methods in CATIs.

### Effectiveness of Data Collection Methods

According to (Fitzgerald and FitzGibbon, 2014) the effectiveness of data collection methods in outbreak investigations plays a crucial role in determining the quality of the data gathered. In terms of effectiveness, both methods demonstrated high completion rates, with 98% of interviews successfully conducted using the paper-based approach and a perfect 100% completion rate for the digital method. However, statistical analysis indicated that the difference between the two methods was not significant ($p < 0.05$).

(Tate and Smallwood, 2021) found out that digital data collection tools enhance both the accuracy and efficiency of data gathered during public health emergencies. The accuracy of the data collected through the two methods was evaluated by comparing the responses obtained from each approach. The analysis revealed that the digital method was more accurate than the paper-based method, exhibiting a significantly lower error rate and fewer missing data points. Additionally, the timeliness of data collection was assessed by measuring the time taken to complete the process with both methods. The findings indicated that the digital approach was significantly faster than the paper-based alternative. The high completion rates for both approaches suggest that respondents were equally willing to interact with either style, which is good news for researchers planning future studies. The fact that both strategies had such high completion rates illustrates their usefulness in public health research.

## Conclusion

The study demonstrates that digital methods outperform paper-based approaches in terms of efficiency, resulting in considerable time savings during data collection. While both methods achieved high completion rates, the digital approach allows for faster data capture and swifter public health responses, which are crucial during outbreaks.

## Study limitations

The study was conducted within a limited timeframe (June to August 2024), which coincided with the peak of the cholera outbreak. This time constraint may have impacted the ability to gather data from a broader sample, particularly if the outbreak response activities were intense or resource-limited in certain areas. Additionally, the study may not have fully accounted for the long-term challenges and impacts of data collection methods, as it focused on a specific short-term outbreak response. The effectiveness of each method over a longer period or in a different context may differ.

The study compared two data collection methods (paper-based and digital) but did not include a third comparison (e.g., mixed-methods data collection) that may have provided additional insights into combining both methods for maximum efficiency. Focusing solely on two methods limited the scope of the analysis regarding alternative or hybrid data collection approaches.

## Recommendations

Kadoma City Council should prioritize the adoption of digital methods for time-sensitive situations, particularly during outbreak investigations where a swift response is crucial.

Kadoma City Council should invest in training and resources for field staff to effectively utilize digital data collection tools.

## Acknowledgment

We extend our heartfelt thanks to all the study participants from Kadoma City Council and the local community. Additionally, we are deeply grateful to the Faculty of Public Health Sciences at the James Lind Institute.

## List of abbreviations

CATIA: Case Area Targeted Interventions

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 6 (2025): June 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i6.1640
Original Article

 LMICs: Low and middle-income countries

## Source of funding
There was no source of funding

## Conflict of interest
The author did not declare any conflict of interest

## Author contributions
Precious Sabina Banda collected data and drafted the manuscript of the study.

## Data availability
Data is available upon request

## Ethical Considerations
Approval was obtained from the Ethics and Research Board of the Health and Environmental Services Directorate. Participants were informed of the voluntary nature of their participation, and all personal information was kept confidential and used exclusively for research purposes.

## Informed consent
The purpose of the study was explained and informed consent was sought from the respondents before they could participate in the study.

## Author Biography

Precious Sabina Banda is an Environmental Health Officer at Kadoma City Council in Zimbabwe. Having completed all coursework, she is awaiting results for her Master's degree in Biostatistics and Epidemiology. She holds a Bachelor of Environmental Science Honours Degree in Public Health. With nearly eight years of experience in outbreak management, she possesses a robust background in public health and contributes valuable insights to community health initiatives.

Dr Anahita Ali holds a PhD degree in Public Health with a strong background in epidemiology and mental health, which complements the interdisciplinary aspect of public health. Her research was primarily focused on the mental health issues, coping strategies, and challenges faced by Indian healthcare workers during the COVID-19 pandemic. During her professional journey of approximately 8 years, she has gained extensive knowledge in promoting community well-being and has honed analytical skills to assess public health challenges and devise evidence-based solutions critically. She has also completed certificate courses in faculty development programs, national/ international workshops, field epidemiology, leadership & management in health, and human health and climate change.

## Bibliography

1. Ali, M. *et al.* (2016) 'Potential for Controlling Cholera Using a Ring Vaccination Strategy: Re-analysis of Data from a Cluster-Randomized Clinical Trial', *PLOS Medicine*, 13(9), p. e1002120. Available at: https://doi.org/10.1371/journal.pmed.1002120.
2. Azman, A.S. *et al.* (2018) 'Micro-Hotspots of Risk in Urban Cholera Epidemics', *The Journal of Infectious Diseases*, 218(7), pp. 1164–1168. Available at: https://doi.org/10.1093/infdis/jiy283.
3. Debes, A.K. *et al.* (2016) 'Cholera cases cluster in time and space in Matlab, Bangladesh: implications for targeted preventive interventions', *International Journal of Epidemiology*, p. dyw267. Available at: https://doi.org/10.1093/ije/dyw267.
4. Fitzgerald, G. and FitzGibbon, M. (2014) 'A Comparative Analysis of Traditional and Digital Data Collection Methods in Social Research in LDCs - Case Studies Exploring Implications for Participation, Empowerment, and (mis)Understandings', *IFAC Proceedings Volumes*, 47(3), pp. 11437–11443. Available at: https://doi.org/10.3182/20140824-6-ZA-1003.02796.
5. Gartley, M. *et al.* (2013) 'Uptake of household disinfection kits as an additional measure in response to a cholera outbreak in urban areas of Haiti', *Journal of Water and Health*, 11(4), pp. 623–628. Available at: https://doi.org/10.2166/wh.2013.050.
6. Ratnayake, R. *et al.* (2022) 'Effectiveness of case-area targeted interventions including vaccination on the control of epidemic cholera: protocol for a prospective observational study', *BMJ Open*, 12(7), p. e061206. Available at: https://doi.org/10.1136/bmjopen-2022-061206.
7. Rukmana, D. (2014) 'Sample Frame', in *Encyclopedia of Quality of Life and Well-Being Research*. Dordrecht: Springer Netherlands, pp. 5640–5641. Available at: https://doi.org/10.1007/978-94-007-0753-5_2551.
8. Sikder, M. *et al.* (2021) 'Case-area targeted preventive interventions to interrupt cholera transmission: Current implementation practices and lessons learned', *PLOS Neglected Tropical Diseases*, 15(12), p. e0010042. Available at: https://doi.org/10.1371/journal.pntd.0010042.
9. Tate, A. and Smallwood, C. (2021) 'Comparing the efficiency of paper-based and electronic data capture during face-to-face interviews',

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 6 (2025): June 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i6.1640
Original Article

*PLOS ONE*, 16(3), p. e0247570. Available at: https://doi.org/10.1371/journal.pone.0247570.

10. Xu, R. and Bai, N. (2023) 'Spatio-temporal dynamics of an age-space structured cholera model with bacterial hyperinfectivity and imperfect vaccination', *Discrete and Continuous Dynamical Systems - B*, 28(11), pp. 5662–5700. Available at: https://doi.org/10.3934/dcdsb.2023071.
11. Zeleke, A.A. *et al.* (2019) 'Evaluation of Electronic and Paper-Pen Data Capturing Tools for Data Quality in a Public Health Survey in a Health and Demographic Surveillance Site, Ethiopia: Randomized Controlled Crossover Health Care Information Technology Evaluation', *JMIR mHealth and uHealth*, 7(2), p. e10995. Available at: https://doi.org/10.2196/10995.

**Publisher Details:**

**Student's Journal of Health Research (SJHR)**
**(ISSN 2709-9997) Online**
**(ISSN 3006-1059) Print**
**Category: Non-Governmental & Non-profit Organization**
**Email: studentsjournal2020@gmail.com**
**WhatsApp: +256 775 434 261**
**Location: Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa**