

## Research Paper

## Evaluation of monitoring tools for WASH response in a cholera outbreak in northeast Nigeria

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### ABSTRACT

Monitoring water, sanitation, and hygiene programs in cholera outbreaks is critical to improve humanitarian response. The objective of this research was to evaluate, and improve, WASH in cholera monitoring tools currently used in northeast Nigeria. We collected 723 forms from 2019 from three form types, combined them into one database of 980 activities, and stratified data by form type, response, implementing organization, activity, month/day, and geographical area. We conducted seven key informant interviews (KIIs) with monitoring tool users and decision-makers. Data irregularities (including in design, collection, and entry) led to an inability to meaningfully analyze monitoring forms. In KIIs, eight themes emerged: ease of use of current tools, improvement in monitoring over time, lack of access to data, need for training, inconsistent reporting practices, need for modification of current questions, need for the addition of new questions, and connectivity issues. Although informants reported monitoring helped organizations identify gaps during the response, the scarcity and inconsistency of the reported data make it difficult to draw any conclusions about program effectiveness, accountability in humanitarian response, or to make recommendations for improving programming. To improve monitoring, we recommend refining data collection by increasing the quantity of data reported, data consistency, and data relevancy.

**Key words:** cholera, data collection, humanitarian context, monitoring, Nigeria, WASH

### HIGHLIGHTS

- Monitoring helped reduce response gaps and improve coverage by allowing organizations to adjust implementation strategies and coordinate with other TWiG members.
- Unclear and undefined data collection processes and ambiguous questions in the monitoring forms led to inconsistent data collection.
- The scarcity and inconsistency of the reported data made it difficult to draw any conclusions about program effectiveness and accountability.

### INTRODUCTION

Since the first cholera pandemic in 1817, there have been seven subsequent pandemics (WHO 2018), and cholera today accounts for 1.3–4.0 million cases and 21,000–143,000 yearly deaths worldwide (Ali *et al.* 2015). Cholera cases and deaths are increasing in cholera hotspots, particularly in the Democratic Republic of the Congo, Somalia, South Sudan, and Nigeria (WHO 2018). In Nigeria, cholera is endemic: the first reported case was in Lagos in 1971, and multiple outbreaks have occurred since then, particularly in the northern region (Adagbada *et al.* 2012; Idoga *et al.* 2019).

As cholera is transmitted through the fecal-oral route (Sphere Association 2018; WHO 2019; CDC 2020), long-term sustainable water, sanitation, and hygiene (WASH) interventions are critical to prevent and control outbreaks (Taylor *et al.* 2015; Wolfe *et al.* 2018; Yates *et al.* 2018; Jones *et al.* 2020). In humanitarian response, WASH programs aim to reduce public health risks by creating barriers along transmission pathways through the following activities: promoting good hygiene practices, providing safe drinking water, providing appropriate sanitation facilities, and reducing environmental health risks (Neseni & Guzha 2009; Sphere Association 2018; Wolfe *et al.* 2018; Yates *et al.* 2018). In particular, displaced populations

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face conditions that favor communicable disease transmission, such as poor access to water and sanitation (Watson *et al.* 2007).

Since the 1990s, there have been efforts to improve monitoring of humanitarian response activities, including WASH, to ensure response effectiveness and improve accountability (EAPSG 2013; WHO & UNICEF 2017; WASH Cluster 2020). Monitoring enables service providers to identify where services are lacking, develop more sustainable and long-term programs, track project progress, and demonstrate impact (IFRC 2011; Cronka *et al.* 2015; Schwemlein *et al.* 2016; Wilner *et al.* 2017). Monitoring data can also be used to inform policy development, resource investment, and to measure and compare progress worldwide (Cronka *et al.* 2015; Schwemlein *et al.* 2016). However, to ensure monitoring data is reliable, the following are needed: a clear protocol to support data collection, entry, and reporting (IFRC 2011; Ramos 2019); the use of appropriate tools and methodologies (Hagens *et al.* 2008), including outcome and output results (Neseni & Guzha 2009; Ramesh *et al.* 2015); trained data collectors to support data standardization, consistency, and reliability over time (Hagens *et al.* 2008; UNDP 2009; IFRC 2011); and sufficient data to ensure statistical significance (INTRAC 2017).

Currently, armed conflict and terrorism in northeast Nigeria have created enabling conditions for cholera transmission such as overcrowded living conditions due to population displacement; disruption of water and sanitation services; and destruction of basic amenities, including health infrastructure (Denue *et al.* 2018; Elimian *et al.* 2020). In February 2019, there were approximately 1.95 million internally displaced persons (IDPs) in Borno State, where more than half of United Nations International Children's Fund (UNICEF) documented IDP camps did not meet Sphere Standards for water quantity (57%) and sanitation access (58%) (SI and Alima 2019). Furthermore, cholera cases in Nigeria have been documented to increase during the rainy season due to worsened sanitary conditions during flooding (Elimian *et al.* 2020). In 2018, the Nigerian government published a Public Health Advisory with five measures to prevent cholera transmission: boil and safely store drinking water, regularly wash hands with soap or hand sanitizer, consume well-cooked food, avoid open defecation, and visit a health-care facility in case of sudden watery diarrhea (Ihekweazu 2018).

WASH Cluster partners in northeast Nigeria are responding to vulnerable cholera-affected populations in IDP camps and host communities with targeted programs, including household disinfection, water point chlorination, hygiene training and promotion, hygiene kit distributions, and sanitation activities (WASH Sector Nigeria 2020). As the lead for the Cholera Technical Working Group (TWiG) in Borno State, Solidarités International developed WASH in cholera response monitoring tools using Kobo ToolBox (Cambridge, MA, USA) in June 2019.

The objective of this research was to review these monitoring tools, analyze existing data collected by WASH Cluster partners using these tools, interview tool users to understand and improve WASH in cholera monitoring in northeast Nigeria, and inform WASH in cholera response monitoring globally.

## METHODS

To complete this work, we analyzed data collected by implementing organizations using the WASH in cholera response monitoring tools from June to December 2019 and conducted key informant interviews (KII) with TWiG members. Each is further described below.

### Analysis of WASH in cholera monitoring database

Three different Kobo form questionnaires were available to TWiG partners on the monitoring dashboard: one reporting household disinfection activities (Form 1), one reporting water point chlorination activities (Form 2), and a third reporting on multiple WASH activities (Form 3). Each form collected was automatically submitted through the Kobo platform and data were available to the TWiG. The collected data were downloaded by SI in three associated Excel (Redmond, WA, USA) databases.

Before analysis, the Kobo forms were cross-checked with the databases to identify any discrepancies in the recorded data. Then, the three databases were aggregated into one master database, and data were cleaned. Cleaning included aligning questions across all three forms, such as matching identical questions; correcting typos and harmonizing names of places and WASH activities (as defined by the TWiG); crosschecking for, and merging, duplicates; adding a column with an ID number to indicate which of the three Kobo forms generated the data; and separating multiple WASH activities reported together on one form into different data entry points. After cleaning, forms were reviewed and questions not relevant to cholera outcomes were dropped from analysis.

Data were analyzed by Kobo form and whether the activity implemented was indicated as cholera preparedness, prevention, or response (only for Form 3). The merged database was stratified by implementing organization, WASH activity, month and day, and local government area (LGA). Data are presented in figures and summarized in text.

### Key informant interviews

A 24-question semi-structured KII guide was developed to understand successes, challenges, and barriers to using the monitoring tools and to collect recommendations for how the tools could be improved. The guide included sections on cholera-related interventions in Borno State, monitoring and evaluation activities, WASH in cholera monitoring tool use, and recommendations for improvement. The study protocol and the KII guide were approved by the Institutional Review Board at Tufts University (#STUDY00000317). Local approval was not necessary as all data were collected remotely.

Participants were recruited by email from the 14 organizations that are part of the cholera TWiG and are reporting activities on the Kobo dashboard. Participants included staff who had used the monitoring tools or were decision-makers on their use. Interviews were conducted in English after participants signed an informed consent form. Interviews lasted a maximum of 1 h and were recorded by WebEx (Milpitas, CA, USA) or Zoom (San Jose, CA, USA), transcribed using Temi (San Diego, CA, USA), cleaned, and uploaded to NVivo (Burlington, MA, USA) for qualitative analysis. Inductive qualitative content analysis was used because the KII guide featured open questions that did not induce pre-specified themes (Elo & Kynga 2008). Interview segments were coded into themes that emerged during analysis.

## RESULTS

Across all three data collection forms, a total of 723 were submitted to the dashboard from 30 July 2019 to 11 December 2019. After cleaning, the 723 submitted forms resulted in 980 separate activity entries in the combined database, as presented in Figure 1. Data were first analyzed by Kobo form (723 forms) and whether the activity was indicated as cholera preparedness, prevention, or response (329 forms from Form 3). The combined database (980 entries) was stratified by organization, activity, month and day data were reported, and LGA. Additionally, seven KIIs conducted with users/decision-makers led to eight emergent themes in qualitative analysis.

### Analysis of WASH in cholera monitoring database

#### Questionnaire analysis

Data cleaning across the three databases was time- and resource-intensive. Depending on which of the three Kobo data collection forms were used, there were differences in how activities were reported, which organization reported, and the frequency of reporting. Additionally, multiple questions had open-ended answers, such as water point name, which were challenging to clean because of typos/differences in data entry. Lastly, open-ended questions were sometimes unclear, leading to inappropriate answers.

#### Results by Kobo form and implementation motivation as cholera preparedness, prevention, or response activity

Out of the 723 forms collected, there were 36 forms collected from Form 1 from two organizations, 358 forms from Form 2 from seven organizations, and 329 forms from Form 3 from 13 organizations. Only Form 3 (329 entries) recorded if activities were implemented as cholera preparedness (166 entries, 50%), prevention (132 entries, 40%), or response (31 entries, 9%).

#### Analysis by stratification

There were 980 single activities reported in the combined database after cleaning (Table 1). The number of activities reported varied by organization, type of WASH activity, month (Figure 2), and LGA (included in Figure 2). Overall, 34% (329/980) of total activities were reported by one organization (because their donor required reporting in this system), 51% (498/980) of activities were reported in September, and 34% (332/980) of activities were reported in one LGA. Of note is that no organization reported every month, forms were collected irregularly throughout the week, and the number of forms reported per day varied from 0 to 132.

### Key informant interviews

In total, 18 individuals were contacted, from the 14 organizations that were part of the cholera TWiG. Seven KIIs were conducted with males that had used or were decision-makers in the use of the monitoring tools. All informants were

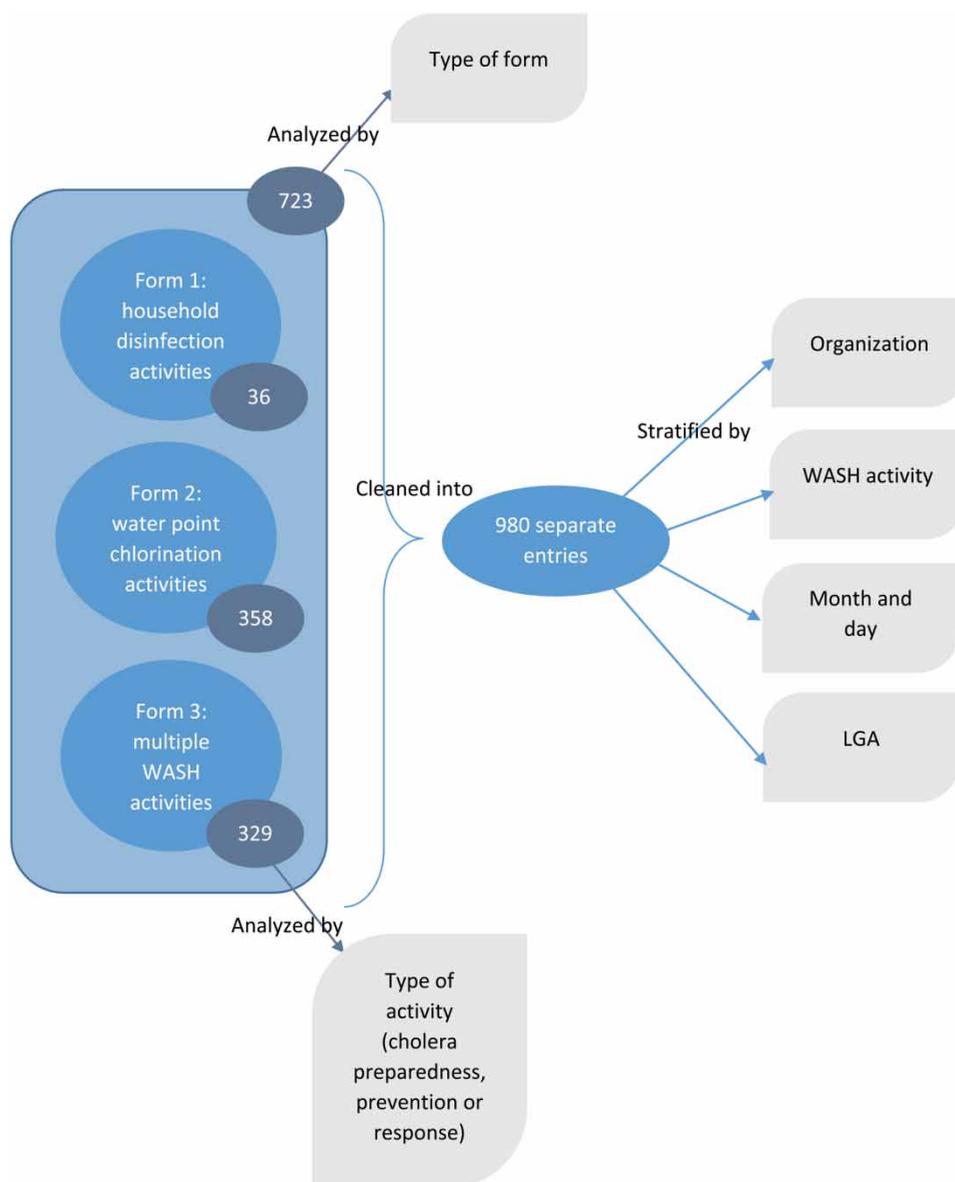
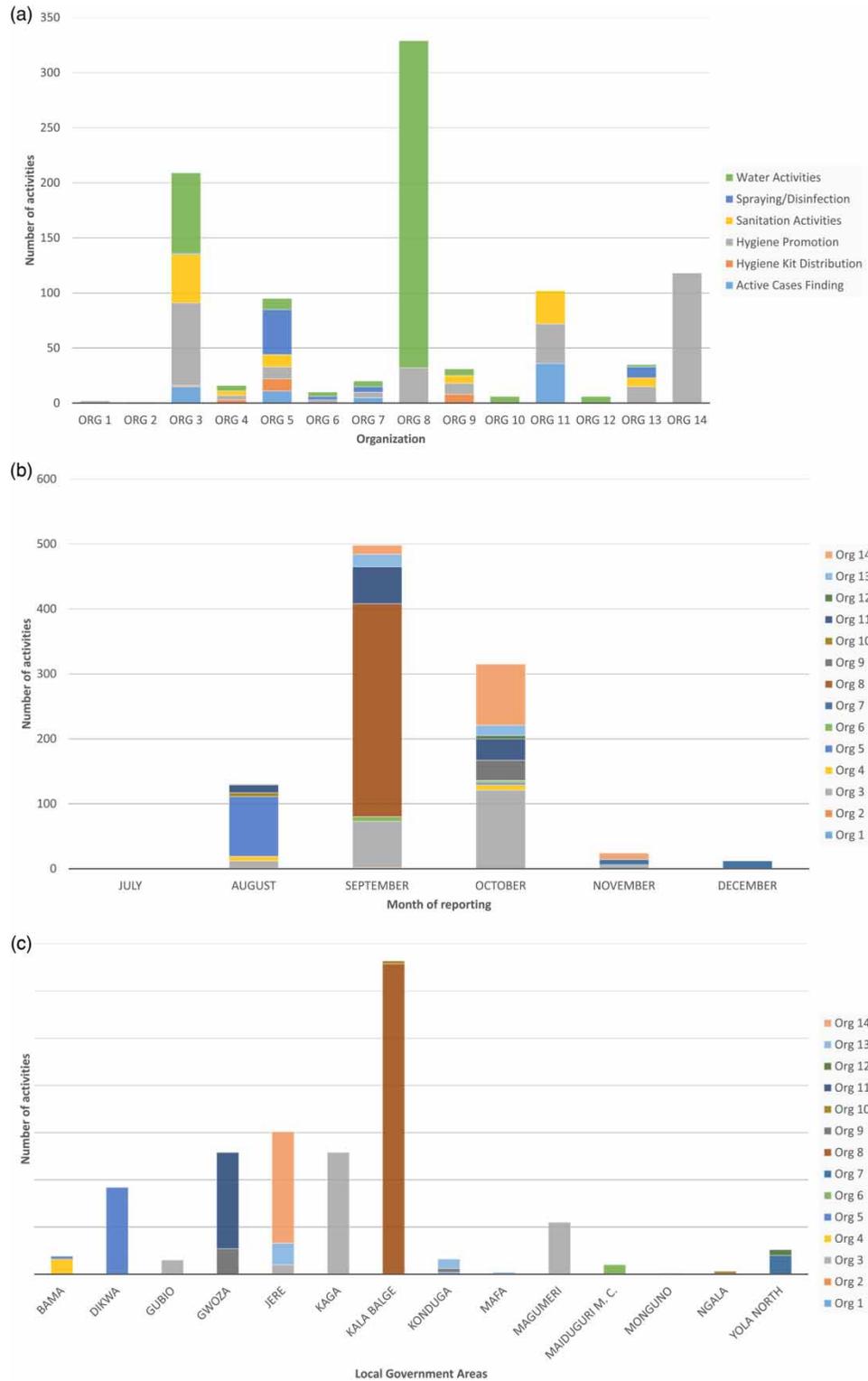


Figure 1 | Database analysis process.

Table 1 | Number of single WASH activities reported

Active case finding	Hygiene kit distribution	Hygiene promotion	Sanitation activities	Spraying/disinfection	Water activities	Total
67	24	311	104	60	414	980
7%	2%	32%	11%	6%	42%	100%

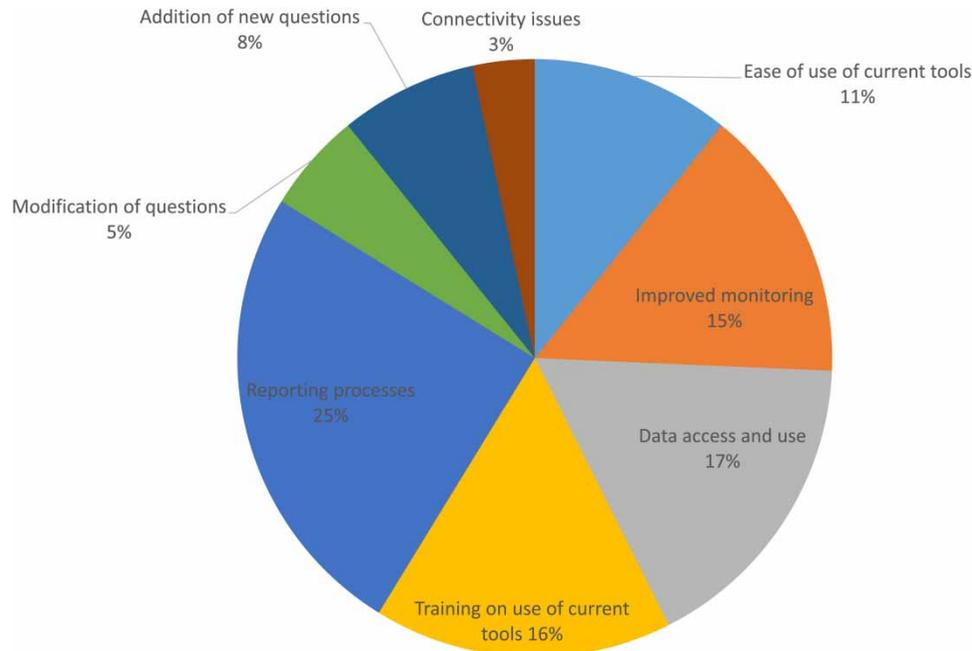
based in Nigeria, four worked as field WASH practitioners and three in WASH coordination, for six (43% of the number of organizations in the TWiG) different international non-governmental organizations. Eight themes emerged from KII responses: ease of use of current tools, improved monitoring, data access and use, training on the use of current tools, reporting processes, modification of current questions, addition of new questions, and connectivity issues (Figure 3). They are summarized below.



**Figure 2** | Number of activities reported by (a) organization and activity, (b) month of reporting and organization and (c) LGA and organization.

### Use of current tools

Five out of the seven informants (71%) interviewed indicated that the current WASH in cholera monitoring tools were user-friendly and easy to use. In particular, informants mentioned the application was easy to install and understand, did not



**Figure 3** | Number of coding reference per theme.

require a lot of space on a smartphone, and did not consume much internet data. Moreover, GPS coordinates are automatically recorded in the tools, as indicated by one informant. However, two informants reported not being able to access GPS coordinates in some field locations, with one describing: 'I tried when I was on site and the GPS location kept running round and round and round.' Informants also reported appreciating that Kobo 'works offline because in some of the locations that we are working there is no network. But you can use it offline, and when you come to the location where there is network you can upload whatever you have reported in the different locations.' However, one informant had trouble uploading the data on the server due to poor internet service. One informant summarized the overall user experience with Kobo monitoring tools as follows: 'When you're going to the field, it makes it easy, [...] you don't need a pen to write something. You don't need a book or paper or all those kind of things, and of course coming down again to sit at a computer and start referring to the notes that you had done in the field to put it in the computer. So this one is very easy. It's on-spot reporting.'

### Improved monitoring

Six informants (86%) reported their WASH in cholera monitoring was improved due to the Kobo tools. Additionally, six informants reported that the data being uploaded to the monitoring platform dashboard informed TWiG meetings by allowing responders 'to know the gaps in real time' and helped provide a clear picture of where each organization was working and what activities were being implemented. One informant noted that this helped the TWiG adapt current response activities and prepare for future response as: 'It will help us to know the previous cholera hotspot zones [...]. So with this information, we will be able to monitor closely those previous cholera hotspot locations, and then we will be able to equip our team; we'll be ready at those locations.' Overall, the tools resulted in a better-coordinated response, as reported by one informant: 'It has really helped our response [and made it] very easy and then made us [have] very good data not like in the previous years.'

### Data access and use

Three informants reported not having access to the database with the results collected from using the monitoring tools. However, they had access to the consolidated data during the Cholera TWiG meetings and by email. Another informant sought to have 'access to the dashboard; it will give partners the opportunity to, maybe even daily, just a way to check the progress to see what is going where, and who are doing it, and what are the duplications.'

Three out of seven informants (43%) reported that their organizations were not using the data reported on the Kobo tools. The other four informants (57%) reported that their organizations were using the Kobo data to adapt their programs and

improve their WASH in cholera response, as explained by one informant: 'It will guide us where we need to intensify our activities, where we need to improve on chlorination within the field.'

### **Training on the use of current tools**

Informants indicated that the monitoring tools were presented during one of the TWiG meetings, and participants were trained on the form and platform use. One participant reported difficulties in training their staff due to movement and time constraints: 'Considering the access constraints sometimes, the movement constraints and also, considering the emergency of the situation, we don't have enough time to wait to go to the field to explain to our teams how to use the tools. So the only thing is to now support them remotely on how to use the tools. So, most of the time, they find it very difficult to understand how actually the tools work.'

Despite the training, three informants noted some questions still needed clarification. For example, an informant asked: 'The implementer, does it mean the person who is actually in the field reporting? [...] That's something which was not so clear with the tool.' Additionally, one informant was not reporting active case-finding activities, although this activity was included in the reporting and their organization was implementing it.

### **Reporting process**

Informants declared different reporting frequencies: two out of six (33%) informants reported daily, and the other four (66%) reported weekly. One informant indicated reporting more often during WASH in cholera response activities. Two informants stated that partners were not reporting through the monitoring tools consistently enough, with one saying: 'Everything is being under reported. So if all partners can be able to use this tool properly, a lot of information will be gathered that will serve a lot.' To solve this, one suggested displaying the organizations that reported during the Cholera TWiG meetings to make organizations accountable. Another suggested supporting the organizations with less reporting and monitoring capacity, as well as those that were not familiar with using Kobo tools for reporting. One informant also recommended the WASH sector insist partners report forms consistently.

Four out of five informants (80%) reported completing one form per activity. However, one activity could include multiple similar activities that had been conducted in the same location, over a certain time period. For example, two informants reported the chlorination of multiple water points from the same location into one form, as described by one of them: 'At one particular camp we may have up to 40 water points which we're chlorinating. All the water points, we report as to one location, taking the coordinate of that particular camp. We are going to name the camp and then the activity and possibly where there is a comment, we mention the number of water points we're chlorinating.'

However, the right process was not clear to them and they asked: 'If proper guidelines could be given in preventive measure for water points, one form for a particular water point or one form for your whole camp? Such information should be included in the form or the general guideline.' Another informant completed one form per week that included all the activities implemented that week.

One informant discussed the difficulty of reporting joint activities. They suspected this might result in the duplication of the activities reported if each partner reported the activity that had been done jointly. One informant indicated that choosing which form to fill was confusing: 'But upon entering you see many forms, you wonder which one to even choose and report on. [...] I suggest if you have only two forms in the Kobo platform where you have cholera prevention, then you have cholera response.'

### **Modification and addition of questions**

One informant noted the monitoring tools were previously reviewed and questions were modified accordingly. However, there were still modifications to make, such as making certain questions optional. Two informants also discussed that some location names were not included in the pre-defined answers list. They had to type in the name, which takes time and introduces typos. They suggested including the names of all usual locations where cholera-related activities are implemented based on data from the International Organization for Migration.

Moreover, four out of six informants (67%) indicated that questions should be added to collect more details on WASH activities. As one of them explained: 'It has not captured the number of the actual interventions. It has not captured the number of beneficiaries for the activities we have carried out at that particular location.' Questions should be output-focused and include the scope of the activity. Other examples from informants included: the volume of water chlorinated, the number

of containers chlorinated at a water point, the number of water points chlorinated, and the number of facilities assessed with operation and maintenance.

Overall, the KII data indicate that, while the Kobo monitoring system was considered an improvement to preexisting systems, there was still room for improvement of the monitoring process.

## DISCUSSION

The objective of this research was to review data collection monitoring tools for WASH in cholera activities currently used in northeast Nigeria to identify opportunities for improvement and to share learnings for how to strengthen monitoring tools for improved collection and use of data in humanitarian contexts. To meet our objective, we analyzed 723 data forms filled out from 30 July to 11 December 2019 by 14 different organizations implementing WASH activities in 14 LGAs. We also conducted seven KIIs with tool users and decision-makers. We analyzed form data by form type and whether activities were implemented for cholera preparedness, prevention, or response and stratified it by organization, activity, month and day, and LGA. In the KIIs, eight themes emerged: ease of use of current tools, improved monitoring, data access and use, training on the use of current tools, reporting processes, modification of current questions, addition of new questions, and connectivity issues. In our research, we found that data irregularities led to an inability to meaningfully analyze monitoring results, recommendations were made to improve monitoring, and our research highlights the need for global quality assurance accountability mechanisms.

Overall, data irregularities led to an inability to meaningfully analyze results. Cholera preparedness and prevention activities add up to 90% of the reported activities in Form 3. This is likely because: tools were launched in mid-2019, but there was no cholera outbreak later in the year; there was confusion on the categories; and/or there was reporting of multiple activity categories on one form (Form 3). In the analysis by stratification from the combined database, implementation numbers may be biased because certain organizations reported more than others. For example, the organization that reported the most activities is correlated to the month and LGA that have the highest number of activities reported. In addition, four organizations and three LGAs reported so infrequently that they represented <1% of all activities; thus, it may not be representative of the activities they actually implemented. It is unclear if this lack of data is due to a lack of reporting from organizations, or that no activities were implemented due to having few acute watery diarrhea cases. Indeed, epidemiological data of cholera cases were not available to compare them with the number of activities implemented, which indicates a weakness in the monitoring of WASH response in a cholera outbreak. Overall, the lack of regularity in reporting makes it challenging to compare and interpret the data.

While the WASH in cholera monitoring tools helped the TWiG identify where WASH services were lacking, the scarcity and inconsistency of the reported data made it difficult to draw any conclusions about program effectiveness and accountability in humanitarian response, as outlined by [Hagens \*et al.\* \(2008\)](#), or to make specific recommendations to improve WASH in cholera response in northeast Nigeria. Overall, data collected from the tools did not lead to analyzable monitoring data.

Unclear and undefined data collection processes and ambiguous questions in the monitoring forms led to inconsistent data collection. Organizations had different reporting frequencies; thus, their data were difficult to study collectively and consistently. Furthermore, there was no clarification on when to use each of the three monitoring forms; this sometimes resulted in duplicate entries. Moreover, respondents answered questions in different ways, which led to different data being collected depending on respondent. Ultimately, these ambiguities were due to lack of a data collection protocol and insufficient training for data collectors, which led to non-harmonized and inconsistent data, as documented by [IFRC \(2011\)](#) and [Ramos \(2019\)](#). This made it difficult to generate conclusions from the data in this review, and also for the TWiG to act on to improve cholera programming locally.

Overall, the monitoring data did provide real-time information for responders to identify which organization was responsible for the activities being implemented in each location. However, the data collected does not show if vulnerable people benefited from WASH services. The ineffectiveness of monitoring data to show the impact of WASH programs in humanitarian contexts is not a new challenge, as pointed out by [Neseni & Guzha \(2009\)](#) and [Ramesh \*et al.\* \(2015\)](#). In the short term, monitoring helped reduce response gaps and improve coverage by allowing organizations to adjust implementation strategies and coordinate with other TWiG members. However, the tools were not used consistently enough and forms lacked questions on outputs and outcomes, which resulted in the TWiG not being able to use the data to assess the overall sector preparedness and response to cholera nor to improve specific implementations.

The study has several limitations, including: (1) KIIs were conducted in English, which could have limited national-level staff participation; (2) 11 of 18 informants responded to the recruitment process, but only seven were able to schedule the interview (this is attributed to conducting KIIs in March 2020, at the beginning of the COVID-19 crisis); a greater number of informants would have allowed to collect additional feedback and expand in more details on the emerging themes; however, saturation of data was reached and all relevant themes were identified, as the scope of the KII guide was narrow and focusing on data collection through the monitoring tools; (3) the anticipated cholera outbreak in July–December 2019 did not happen in Nigeria, possibly limiting the use of the WASH in cholera monitoring tools; and (4) the KII methodology is limited to self-reported data by each individual, and interpretations are subject to personal bias, selective memory, or misattribution (for instance, there was a discrepancy between the reporting frequency indicated by KII participants and the reporting frequency in the data set). We do not feel these results impacted our analysis or the results obtained in this study.

To improve monitoring the WASH in cholera response in northeast Nigeria, we conducted the following changes: reducing to one collection form, modifying questions to closed answers, adding output questions, clarifying the data collection process, and updating the training tools. More broadly, we recommend improving data collection by increasing: (1) the quantity of data reported; (2) data consistency; and (3) data relevancy via the addition of output and outcome metrics. To increase the quantity of data reported: users should have direct access to the consolidated database to strengthen data usefulness and encourage filling forms more regularly, as this was found to be an incentive in [Guerrero \*et al.\* \(2013\)](#); the importance of completing the reporting should be regularly emphasized; organizations with less experience on monitoring activities and with using Kobo tools should be supported; reporting should be a grant requirement; and publicly displaying the data of those organizations that reported could serve as an incentive to collect data more frequently ([Pasanen & Mason 2019](#)).

To ensure data consistency, we first recommend having only one monitoring form in Kobo, which will streamline data collection and prevent duplicate reporting, as advised in [ACF \(2011\)](#). Following [ACF's \(2011\)](#) recommendations, the first page of the monitoring form should explain the general use of the tool, and each question should be accompanied by a short explanation on how to correctly answer. In the form, we recommend having clear and closed-answer questions with a fixed-choice list of answers whenever possible. They ensure consistent answers and are simpler to analyze than open-ended questions, as discussed in [WHO \(2012\)](#) and [INTRAC \(2017\)](#). Moreover, according to [IFRC \(2011\)](#) and [WHO \(2012\)](#), if open-ended questions are used, sufficient time should be allocated for cleaning the data and data analysis. GPS coordinate data should be reviewed for accuracy before submission. To maximize accuracy, it is advised to leave the GPS recording process uninterrupted and to carry out the data collection on a clear, sunny day ([Agung 2017](#)). A question should be added to the monitoring form for joint activities, with partners agreeing on which organization reports to avoid duplication. The TWiG should coordinate using agreed-upon definitions for activities throughout the form. Furthermore, we recommend having regular refresher training for data collectors on the reporting process and the questionnaire, as advised in [Hagens \*et al.\* \(2008\)](#) and [IFRC \(2011\)](#). This prevents variation use between users, allows users to clarify concerns, and develops users' capacity to use data ([Pasanen & Mason 2019](#)). The addition of a videotaped training ensures the same information for all and can be re-watched as a reference. Lastly, we recommend the TWiG defines a clear monitoring process including: the frequency of data collection and reporting, whether activities are reported when they are ongoing or completed, and whether each entry is for a single activity, or multiple activities implemented by the organization over a time period.

To improve data relevancy in order to better the WASH in cholera response in northeast Nigeria, we recommend expanding the current monitoring forms from activity metrics to include questions that gain deeper knowledge of implementation outputs or outcomes, as described by [IFRC \(2011\)](#). As an example, to improve the monitoring data collected for water activities, the number of beneficiaries, the volume of water provided and chlorinated, the number of containers chlorinated at a water point, the number of water points chlorinated, and the number of facilities assessed with operation and maintenance could be added to the questionnaire. It is however important to only collect data that are analyzed and that support evidence-based decision-making.

Overall, while evidence-based guidance exists for the implementation of monitoring systems of WASH interventions and/or in humanitarian contexts (e.g. [IFRC 2011](#); [WHO 2012](#)), these guidance documents generally focus on overarching monitoring plan development (e.g. identifying data users, developing indicators and questions, and planning for data collection and analysis). Guidance also exists with more practical information and good practice to develop tools for data collection, such as [Hagens \*et al.\* \(2008\)](#). However, there is little review of monitoring tools for collection and use of data once the monitoring system is in place and the collection tools are in use, especially for WASH in cholera for humanitarian contexts ([Welle \*et al.\* 2015](#); [Agung 2017](#)). As cholera often happens in crisis settings, this was a gap. As we identified,

challenges in data collection and processing can present barriers to data use, particularly if data are unavailable (Pasanen & Mason 2019) and monitoring WASH interventions is critical to control cholera outbreaks in humanitarian contexts (Taylor *et al.* 2015; Yates *et al.* 2018). Our research highlights the need for quality assurance monitoring in the cholera response, and indeed, the Global WASH Cluster is developing quality assurance and accountability systems to ensure that commitments to quality are being fulfilled for WASH interventions in humanitarian contexts, including cholera (WASH Cluster 2020).

## CONCLUSION

In summary, monitoring WASH activities is critical to measure activity effectiveness and improve humanitarian response accountability. Guidelines exist on the development of practical monitoring tools for WASH activities, but few reviews of tools have been completed once they are in use. Further research should be conducted, analyzing the results of the modified tools on the WASH in cholera response by the TWiG partners, to confirm that improving monitoring data quantity, consistency, and relevancy results in improved data collection. While the recommendations herein evolved from the northeast Nigeria cholera context, they are applicable to monitoring many types of humanitarian response activities; implementing these recommendations could help ensure monitoring tools produce sufficient, reliable data to improve WASH response in outbreaks.

## FUNDING

This research was funded through the Office of Foreign Disaster Assistance. The funding source had no involvement in the study design; in the collection, analysis, and interpretation of data; in the writing of the report; and in the decision to submit the article for publication.

## DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

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First received 1 April 2021; accepted in revised form 29 August 2021. Available online 13 September 2021