

## Research Paper

# Strategic value of interviewer training and local community-based organisations for WaSH and antibiotic resistance surveys

Gopal Iyer, Myra J. Giesen, Rohit Juneja and David W. Graham 

### ABSTRACT

Water, sanitation, and hygiene (WaSH) research has long relied on household surveys to gather knowledge, attitudes, and practice (KAP) data with local enumerators or community correspondents (CCs). However, CCs must be trained to build capacity and ensure representative survey responses. Here, we use a case study in low-income, informal communities from New Delhi, India to assess the value of structured training for individuals who lead the gathering of KAP data (CC leaders, CCLs) on WaSH and antibiotic resistance. Feedback from CCLs showed that directed training increased their motivation, confidence, and technical competence and provided them skills that enhanced data collection. Training further strengthened relationships and empowered our local community-based organisation (CBO), expanding their role beyond being an implementing partner. Empowerment led to new insights, such as evident problems with communications between local doctors and community dwellers. Only three of 38 focus group attendees knew what an antibiotic was, apparently because they were never told. Overall, this work shows that interviewer training has many trickle-down benefits, improving the quality of data, building confidence in field teams, and empowering local CBOs, but most importantly, by increasing knowledge among community dwellers, such that they also might be empowered.

**Key words** | antibiotics, empowerment, KAP research, surveys, training, WaSH


### HIGHLIGHTS

- Local knowledge, attitude, and practices (KAP) surveys are key to WaSH implementation.
- Surveys on complex topics, such as antibiotic resistance, require interviewer training.
- A study of informal communities in New Delhi showed ~95% of focus group participants knew nothing about antibiotics.
- Training increased the confidence of interviewers and empowered the local community-based organisation (CBO).
- The foreign research team gained reciprocal benefit from training with the CBO by improving the KAP survey.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Licence (CC BY 4.0), which permits copying, adaptation and redistribution, provided the original work is properly cited (<http://creativecommons.org/licenses/by/4.0/>).

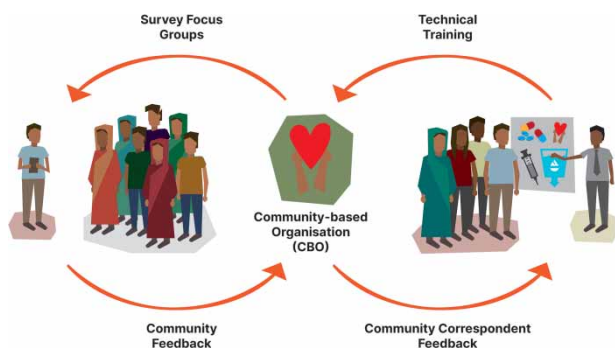
doi: 10.2166/washdev.2021.232

**Gopal Iyer** (corresponding author)  
School of Education Communication and Language  
Sciences,  
Newcastle University,  
Newcastle upon Tyne,  
UK  
E-mail: [gopal.iyer@newcastle.ac.uk](mailto:gopal.iyer@newcastle.ac.uk)

**Myra J. Giesen**  
**David W. Graham**   
School of Engineering,  
Newcastle University,  
Newcastle upon Tyne,  
UK

**Rohit Juneja**  
Centre for Urban and Regional Excellence,  
New Delhi,  
India

## GRAPHICAL ABSTRACT



## INTRODUCTION

Training is an essential component of all community-based water, sanitation, and hygiene (WaSH) surveys (Standing & Chowdhury 2008). Training is essential for face-to-face (F2F) interviewers who are gathering information on complex topics that rely on technical terms and/or must be translated into a different language. Interviewer training is also vital because it improves their understanding of the survey's objectives and terminology and allows them to make wiser decisions about who is included in or excluded from a survey, which can increase response rates and data value from F2F interviews (Durrant *et al.* 2010; Brick 2018: 24). This is crucial for the statistical interpretation of results. Therefore, interviewers who live within their local communities, which we refer to as community correspondents (CCs), need to be empowered in technical and communications skills and be confident in their use. CCs usually are associated with a community-based organisation (CBO), often as volunteers, with initial and ongoing training for specific tasks.

Empowering CCs in WaSH studies has many additional benefits, including improved morale, increased investment in work, improved data quality, and reduced data collection errors (Aitken 2014). CCs directly liaise with a community, with roles spanning from being researchers to being community members. This is key because WaSH assessments can be very personal, requiring sensitivity to local traditions and morays. However, being a community member can introduce other challenges, requiring CCs to navigate

potential conflicts related to overlapping roles and community expectations (Salway *et al.* 2007). Salazar (1990: 572) states that 'interviewer selection and training may be the most important tasks for the researcher' when it comes to reducing interviewer bias.

Here, we use a case study in New Delhi, India to show how survey design, data collection, field pilots, and research tool calibration can be enhanced by training and working more closely with community-based organisations (CBOs) and CCs. In this case, surveys were developed to better understand knowledge, attitudes, and practices (KAP) among residents and healthcare providers in vulnerable informal communities in Delhi, related to WaSH implementation and antibiotic resistance mitigation. Antibiotic resistance refers to the ability of bacteria, including pathogens, to defend themselves against antibiotic agents. This is a subset of antimicrobial resistance (AMR), which refers to all microorganisms. Antibiotic resistance is used in this paper because it is the more colloquial term, but we use it here to refer to resistance to both antibiotic and antimicrobial drugs.

Antibiotics and antibiotic resistance are complex topics, which challenge CCs and, in turn, KAP studies. Therefore, training is especially important here to ensure clear communications and gather representative data of high quality. Within this context, the goal was to co-develop approaches with a local CBO, the Centre for Urban and Regional Excellence (CURE), to promote knowledge and awareness of the

consequences of antibiotic use among local populations to encourage practices that might reduce antibiotic resistance in the communities. The more knowledgeable CCs felt more able to perform efficient and effective data collection and had widened personal horizons. They then were able to gain deeper KAP insights that would not have been possible without specific training.

## BACKGROUND AND METHODS

### Mitigating antibiotic resistance by WaSH implementation

Since Sir Alexander Fleming first discovered penicillin in 1928, antibiotic use has dramatically improved global human and animal health (Adedeji 2016). Typically, antibiotics fight bacterial infections saving lives by stopping bacteria from reproducing or killing them. However, the overuse of antibiotics around the world has changed bacteria, reducing the relative effectiveness of most antibiotic therapies, and creating new types of resistance. Increasing resistance is leading to higher medical costs, prolonged hospital stays, and increased mortality (WHO/FAO/OIE 2020), with the United Nations advocating the need to raise awareness and understanding of resistance and promote behavioural change through effective communication, education, and training.

Antibiotic resistance is a product of accelerated bacterial evolution due to the inappropriate use of antibiotics, which is especially problematic in developing countries (Graham *et al.* 2019a). Although resistance is a natural phenomenon, anthropogenic antibiotic use has caused bacteria to evolve and become stronger so that antibiotics are less effective in the treatment of bacterial infections. Such changes have made medicines that previously killed or inhibited their growth or proliferation ineffective, which includes 'superbugs' that can defend themselves against many different antibiotics. The WHO/FAO/OIE (2020) identifies antibiotic resistance as one of the biggest threats to global health, food security, and development today and unless practices are changed, we may enter a post-antibiotic era where common infections can once again kill.

As background, increasing antibiotic resistance was primarily believed to be driven by the imprudent use of

antibiotics in human and veterinary medicine. However, growing evidence suggests that environmental and behavioural factors may be of equal or greater importance to the spread of resistance, especially in the developing world due to poor water quality and inadequate sanitation (Graham *et al.* 2019b), thus the link between antibiotic resistance and WaSH. Technical solutions exist for reducing antibiotic resistance, but most technical options require physical infrastructure. However, such infrastructure rarely exists in informal communities; therefore, promoting behaviour change in association with WaSH principles is more feasible and economical as the first action (Graham *et al.* 2019b). The WHO/FAO/OIE (2020) recently recommended that WaSH and wastewater management be integrated to reduce antibiotic resistance, i.e., by implementing WaSH, one achieves the 'collateral benefit' of reducing antibiotic resistance.

To effect change at a human level, greater KAP towards antibiotics, antibiotic use, and antibiotic resistance is required to encourage the most suitable sociotechnical interventions. This study, which is part of a more comprehensive KAP project, targets gathering such information from an informal settlement in New Delhi to identify best-fit WaSH interventions. Our team is conducting similar KAP surveys elsewhere in the world (e.g., UK, Ethiopia, and Israel) to guide local solutions while identifying global similarities.

### Design of the KAP study

A review of similar KAP studies was performed to identify potential items to include in our surveys (Carter *et al.* 2016; Castro-Sánchez *et al.* 2016; Bassoum *et al.* 2018; Dyar *et al.* 2018). However, in the area of WaSH, there are very few evaluations that outline the influence of a training programme on CCs involved in the study. Crocker *et al.* (2016) delivered a training programme to 42 government officials in Kenya; however, the study was undertaken over a period of 8 months. Danish Committee for Aid to Afghan Refugees (DACAAR) comes close to providing short-term training programmes; however, the agency was established as a Water Expertise and Training Centre rather than a CBO interacting directly with the community (Barat *et al.* 2014).

We started with a 'core' question set appropriate for a broad audience and then added supplemental items for

human medical practitioners, thereby constructing two questionnaires. Our household survey contained the core question set, while our professional survey comprised most of the core questions plus supplemental questions relevant to professionals. Both surveys have six parts covering the different attributes: (1) demographic characteristics; (2) knowledge; (3) attitudes; (4) practices/experiences; (5) solution/mitigation interventions; and (6) learning. Initially, we planned all the project surveys to be administered online. However, given the opportunity to work in India with CURE, we went with F2F surveys. To this end, we added more questions related to water and sanitation, bringing it more fully under a WaSH umbrella. The Newcastle University (NU) research team reviewed both surveys before sharing them with CURE. However, CURE expressed concerns with both surveys because they felt they were too technical. They also were concerned that household surveys would need to be administered in Hindi, which required key and technical terms to be changed in translation.

To address these concerns, CC leaders (CCLs) at CURE ran five focus groups in low-income informal communities to identify terms/words used for ‘antibiotics’; determine the best way to confirm antibiotic use; and obtain other relevant information to ensure semantic access to the survey questions. Focus groups were conducted in South Delhi ( $n = 3$  groups, with 6, 7, and 12 participants), East Delhi ( $n = 1$  group with 7 participants), and North Delhi ( $n = 1$  group, with 6 participants) resulting in a total of 38 participants (see Figure 1 for locations).

CURE conducted focus groups particularly in the informal settlements of Delhi including Haiderpur Badli Mod, Hanuman Mazdoor Camp, and Trilokpuri, where the organisation was engaged with the communities for more than 5 years aiming to improve the WaSH conditions in these areas. The CCLs have a good rapport with the residents, where the participants for the focus groups were consciously chosen individuals that crossed age, gender, occupation, and social status.

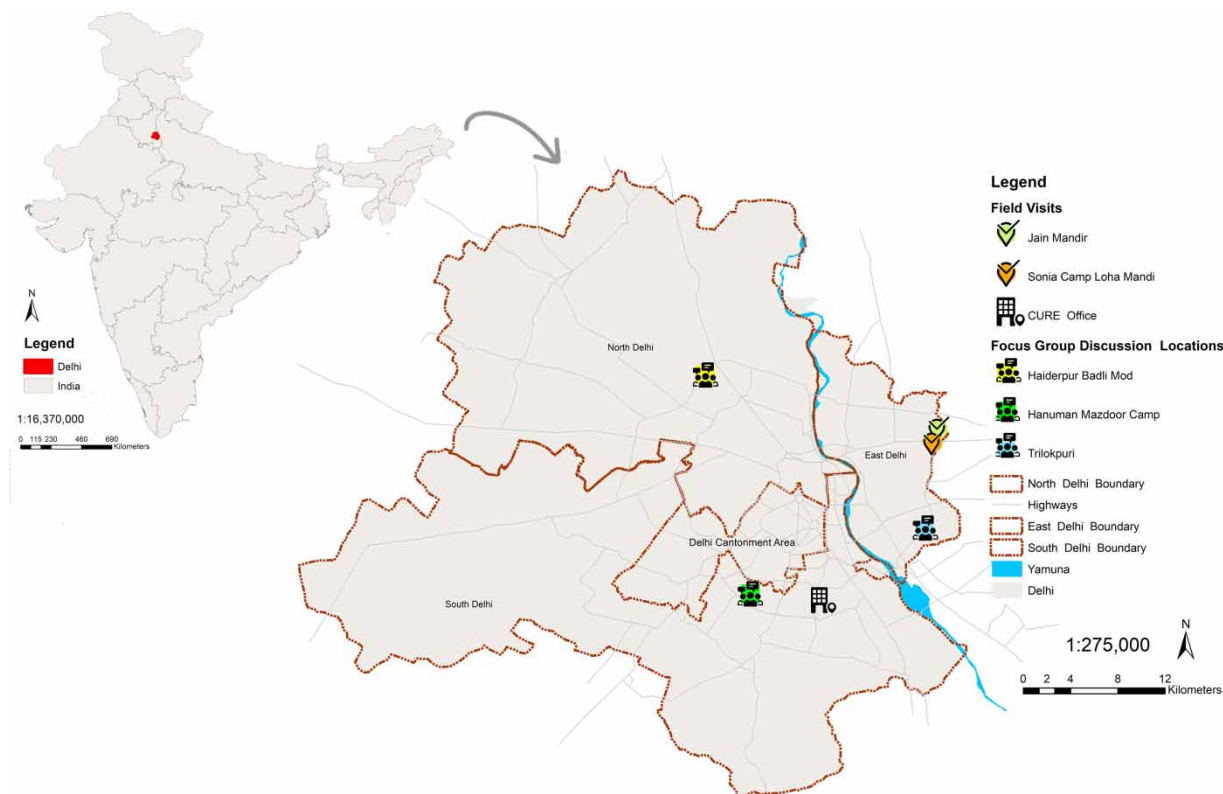


Figure 1 | Map of focus, training, and field visit sites.

## Training approach, programme, and evaluation

Our training approach for the CCLs was fourfold. First, we wanted to equip them with knowledge and understanding related to technical aspects of the survey (e.g., terminologies associated with WaSH, disease, infection, and antibiotics). Secondly, we wanted to clarify and address any misconceptions held by CCLs before initiating the field interviews. Thirdly, we wanted to increase confidence in the CCLs, such that they might train and instruct CC team members who would, along with the leaders, gather survey results. Finally, through field visits, we wanted to pilot the surveys while engaging our targeted communities, allowing CCLs to put into practice the knowledge and know-how gained during training.

Training took place at CURE's office in New Delhi, while the field visit happened in two informal settlements, which were Jain Mandir and Sonia Camp Loha Mandi (see [Figure 1](#)). The training team comprising of two people – Trainer 1: an anthropologist with technical expertise and primary drafter of the KAP surveys and Trainer 2: an experienced trainer, with an educational background and native Hindi speaker. Seven CCLs and a CURE Project Coordinator attended Days 1 and 2. On Day 3, one CCL; two additional CC team members working in the East District; the Project Coordinator; and the two trainers were present. [Table 1](#) provides an outline of the training itinerary.

Day 1 began with a brief welcome and introductions. Trainers outlined the training goals, objectives, and, more importantly, agreed to raise queries as and when required during the presentations. The trainers made it clear that they welcomed CCLs input throughout the training, encouraging them to reflect on the topics and share their thoughts. A technical session in English was delivered by Trainer 1 to introduce relevant terms including antibiotics, antibiotic and antimicrobial resistance, and actions to promote WaSH.

Trainer 2 facilitated the discussion in Hindi, bringing in Trainer 1 as needed. The rest of the training focused on the surveys, including the use of language, flow, and consolidating questions, and mock interviews, with Day 3 involving trialling the professional survey and informational focus group discussion around the household survey.

To measure the success of the training, attending CCLs were e-mailed an invitation to provide feedback on a list of

**Table 1** | Training itinerary

Day	Time	Scheduled activities
Day 1	10.00–10.30	Welcome, introductions, and setting training goals and objectives
	10.30–11.00	Technical presentation on WaSH and antibiotic resistance, noting how antibiotic and AMR differ
	11.00–13.00	General community-based survey approach discussion
	13.00–14.00	Lunch
	14.00–17.30	Item-by-item consideration of household survey
	17.30–18.30	Survey streamlining discussions between technical and field teams
Day 2	10.00–10.30	Day 1 recap – revisiting concepts
	10.30–13.00	Item-by-item consideration of professional survey
	13.00–14.00	Lunch
	14.00–15.00	Resolution of issues for household and professional surveys
	15.00–17.30	Practical mock interviews using revised household survey
	17.30–18.00	Training reflection and closure.
Day 3	10.00–17.30	Field visit to two East Delhi settlements

questions and a request to sign a consent form to allow feedback to be used for analyses and publication. All CCLs attending the training were keen to share their feedback. The invitation was drafted in English and translated to Hindi, as most of the CURE CCLs were native Hindi speakers ([Table 2](#) translated version).

## RESULTS AND DISCUSSION

### CBO's role in community surveys

CBOs often are local non-profit groups that work to generate improvements within a community at the local level and are critical mediums for delivering the benefits of a WaSH intervention ([Ramanadhan \*et al.\* 2013](#)). CBOs are locally formed and locally staffed, with their activities aimed at the community they work within, helping them to cement relationships. These relationships draw upon establishing social capital, allowing CBOs to achieve their objectives ([Lin 2001](#)). CBOs are in a unique position to

**Table 2** | Post-training feedback and survey questions

- 
1. Have you attended topic-related training in the past related to delivering a specific household survey?
    - (a) If yes, what were the topics covered in training?
    - (b) If yes, how different was the 10–11 Feb 2020 training?
  2. How confident (on a scale from 1 to 10, where 10 is very high and 1 no confidence) were you on the technical topics of WaSH, antibiotic resistance and/or AMR before and after the training? (Please share some examples.)
  3. Did you like the structure of the two-day intensive training? Please describe what you liked the most about the training?
  4. What was your opinion about the facilitators who trained the group? Do you think that the technical and social expert assisted you in understanding the concepts better?
  5. Do you think having a facilitator with technical expertise made a difference to the training process?
  6. Do you believe the objectives of the training were achieved? Elaborate training objectives.
    - Convey a general overview of the project objectives and assist community researchers in administering technical tools in the settlements.
    - Explain technical terms and concepts related to the survey instrument and make the administering team aware of the ethical components of the study.
    - Identify and adjust the survey instrument to make it more accessible (primarily language) to the targeted settlements and healthcare providers.
    - Discuss the underlying difference between the instruments and outlining the need for separate instruments for household and healthcare providers.
    - Build capacity among the training team so that they become familiar with the tools and are confident in administering the surveys.
  7. What comments or suggestions would you give to improve the gaps (or overall delivery) in future training processes?
  8. How confident do you feel to conduct the surveys now that you have taken the training? With the knowledge gained during the training, will you be able to instruct your other colleagues (CC team members) to conduct the survey?
  9. Do you have any additional feedback related to the training or the project?
- 

ensure that community stakeholders actively engage in WaSH-related conversations within the community. Importantly, they allow a two-way conversation model about mutual interests or concerns, enabling community-based participatory research and smoothening the challenges that arise in the data collection process.

Low and declining response rates present a real threat to conventional approaches to data collection in WaSH survey

research; hence, community-based involvement is becoming more relevant (Miller 2017). For F2F surveys, interviewers play a vital role in data collection from gaining cooperation from participants to clarifying survey questions. Based on their personal qualities, some F2F interviewers introduce what is termed ‘interview bias’ (Salazar 1990), which can be exacerbated when multiple people are interviewing in parallel. Chan-Golston *et al.* (2016), however, suggest that community-based interviewers may induce participants to be more comfortable.

A significant difficulty in conducting F2F/household WaSH surveys is the unscripted discussions that take place between the interviewer and participant. Interviewers need to be skilled in building connections and using conversational techniques to respond to unpredictable interview situations, especially when sensitive topics in sanitation and hygiene emerge in conversations. Interviewers need to ensure that deviations from scripted interactions are productive in achieving valid and accurate responses. Thus, adequate training in the WaSH arena, especially for something as complex as antibiotic resistance, helps to equip interviewers with sufficient knowledge and skills to develop rapport and flexibility in the interview situation (Bell *et al.* 2016). Whether building rapport improves data quality or not is not absolute. Rapport may lead to response bias as it causes respondents to ingratiate themselves to interviewers, encouraging distorted responses, especially to sensitive questions (Weiss 1968). However, Holbrook *et al.* (2003) argue that rapport reduces response bias by encouraging respondents to participate more deeply with the survey and give more thoughtful, honest answers.

In our case, NU initially identified CURE as a service provider to assist with data collection only due to its experience in WaSH surveys. However, due to CURE’s relationship and commitment to local communities, the relationship has developed into a research partnership. CURE, established in New Delhi, started with a mission to reconnect urban societies and help them make informed decisions by improving aspects in the areas of WaSH, housing, livelihoods, environment, and health. It aims to strengthen local agencies with capacities for participatory community development, using evidence from the ground to build an effective service delivery in the above-listed areas. CURE’s local knowledge and established participatory reputation within the community, along with

NU's understanding of drug resistance and knowledge of mitigation strategies, makes for a complementary partnership. A partnership with the potential to shift the KAP and antibiotic resistance work from an 'academic exercise' to one that genuinely enables local interventions to improve WaSH-related practices, thereby contributing to community health and well-being.

### Pre-training focus group observations

The pre-training focus group results showed that most participants were not aware of antibiotics, with only three participants confirming that they knew something about them, such as antibiotics were used to treat infections. Participants also were unaware of any alternate names or terms used to refer to an antibiotic. Most participants indicated that they consumed the medicine their doctor prescribed, usually without question. These observations required both surveys to be modified to reflect a more basic set of questions.

### The value of training

As stated previously, training is an essential component of all community-based WaSH surveys. However, very few studies exist that specifically outline the influence of training on local CCs. Crocker *et al.* (2016) delivered a training programme that threw light on six categories that influence affecting due to training, including attitude and motivation, ability, knowledge sharing, training design, organisation factors, and external factors. A robust training programme is likely to empower CCLs, inspire confidence, and enable them to share knowledge with their team on the ground.

WaSH trainings often are criticised due to the inconsistent use of terms (Beidas & Kendall 2010; Rakovshik & McManus 2010). Interpretations of key terms differ, e.g., population, intervention (treatment vs. control group), sample size, effects, and impact (Graham *et al.* 2006; Damschroder *et al.* 2009). Such differences lead to confusion, simplifying terms is an underappreciated, yet invaluable, step in the training process. CCLs, when equipped with a better understanding of such technical terms, become capable of negotiating and structuring the F2F interviews better.

Technology-embedded training programmes can be effective and robust, which has been shown in medical, human resource, and substance abuse studies (Beidas *et al.* 2011). Such training programmes make use of diverse learning methods and procedures to facilitate knowledge and skills acquisition, encouraging participants to be more enthusiastic (Cucciare *et al.* 2008). It makes the use of capturing data on cloud-based platforms and network-based infrastructure, facilitating easy data gathering and analysis. Even in the current study, we observed that CCLs were more enthusiastic about using mobile platforms as compared to a pen and paper survey, especially as they previously had used similar technology in data collection.

### Training feedback

We adopted a qualitative approach to analyse the feedback data, using a conventional content thematic analysis (Hsieh & Shannon 2005), with the goal to identify themes and patterns capable of providing answers to our research questions. Additionally, this approach provides a richer way of examining the data, allowing for interpretation, rather than just summarisation of responses (Hsieh & Shannon 2005). CCLs who attended the training completed and returned the signed feedback forms. Responses were provided in Hindi and English, with translation to English by the authors (G.I. and R.J.). All responses were consolidated by question for analysis.

Five key themes are emerging from the analysis: knowledge acquisition; level of engagement reflected by the participants; ability to form associations from real-life examples; ability to master the learning objectives for effective decision-making; and knowledge transfer to community members with confidence. Table 3 shows the sample verbatim responses that best support these underlying themes, with the corresponding vocabulary supporting the themes identified in bold.

### Knowledge acquisition

CCL feedback shows that the training provided them with a platform to engage and learn through dialogues, enabling them to share their own experiences and assisted their ability to talk about sensitive WaSH topics. Frequent interactions during the training helped CCLs understand,

**Table 3** | Themes from CCL feedback**Knowledge acquisition**

- CCL 2a* Prior to the training, we have attended training on health- and WaSH-related areas in the past. However, during this short training course, we **improved our knowledge of sanitation and hygiene** and our **understanding of antibiotics**. We introspected on **more profound questions like** ‘What kind of medicines are prescribed by the doctor?’ How to identify antibiotics? Do people living in the community ask doctors for prescribing antibiotics? And do people living in communities provide or share information on antibiotics?
- CCL 5a* We learnt about people’s preferences related to WaSH and **their awareness about antibiotics** and by what names do people refer to antibiotics. Also, do **people know** that doctors prescribe antibiotics for them or do **people prefer homemade remedies** for fever or other illnesses?
- CCL 6a* I had limited **information** about antibiotics and aspects of WaSH areas; however, after the training, I **developed an interest** in these subjects and collected more information on the topic to **enhance learning**.

**Level of engagement reflected by the participants**

- CCL 3a* We **learnt about antibiotics** and how resistance can be developed. One should be **aware** of the medicines that he/she is consuming and always asks the healthcare provider about them when he’s prescribing them to you.
- CCL 3d* The trainers made a lot of difference and made it **more engaging**.
- CCL 4a* **I learnt a great deal** about, and I even **came to know how excessive use** of antibiotics is harmful, and how poor sanitation and hygiene could be contributed to the problem. I **loved the way the technical terminologies** were explained during the course of the two-day training. The **entire process was very satisfying**.
- CCL 6b* The **interactive nature** of the programme made us more aware of the themes in WaSH, antibiotic, and AMR. Only consumption of antibiotics is not the sole reason for developing resistance to other factors like feeble sanitary practices, deteriorating ecology, and infected livestock could be potential causes.

**Ability to form associations from real-life examples**

- CCL 2b* We started to understand more about the different kinds of drugs prescribed to us. We have **begun conversing** with our doctors, and we do resist being given antibiotics and prefer alternative medicines.
- CCL 5b* Yes, since we would have to go to the field for the data collection and if we wouldn’t know about the technicalities, then we wouldn’t be able to collect the right information. And having a facilitator with technical expertise made it a little easier to understand.
- CCL 6c* Yes, I liked the training programme, as it made me aware of learning about antibiotics and encouraged me **to look deeper into the sanitary practices** of the people in the community. I also learnt that consumption and prescription of excessive antibiotics could harm the body, and everyone should not be prescribed antibiotics for every minor problem.

**Ability to master the learning objectives for effective decision-making**

- CCL 6d* I believe that the **training objectives were achieved**. Before the training, I was **not thoroughly aware of sanitation** and hygiene-related problems, the emerging issues of antimicrobial and antibiotic resistance likely to be found among the community. The training programme **helped me understand better** and assisted me in **making the right decisions** during the course of fieldwork.
- CCL 7d* In my opinion, the short training course’s goal helped us to **link our techniques** to the slums. The training **encouraged us to think** that we would need to strengthen WaSH practices, work with medicine and healthcare providers to mitigate antibiotic resistance.

**Knowledge transfer to community members with confidence**

- CCL 2c* Yes, we are **confident of conducting the surveys**, in the way they were explained during the training. The training **encouraged us to read more** about the WaSH concepts and **dig deeper into complex topics** of antimicrobial and antibiotic resistance. This gives us the **necessary confidence** to undertake the work.
- CCL 3b* I am now a little **more confident than earlier**. Wasn’t sure more before due to the diverse nature of the WaSH survey, but after the training, I feel I would be **able to conduct them** and should be able to **support my colleagues** to accomplish the same.
- CCL 5c* We can easily **explain the complex topics** to our teammates. Our knowledge on the subject was limited; however, the training helped us to **improve our understanding** of the issue.



recall, and retain the novel and somewhat complex concepts related to the research (Table 2: CCL 2a).

Throughout the training, CCL discussed colloquial terms often used for antibiotics within their communities, alongside typical practices by doctors when prescribing antibiotics, building on observations reported during the previous focus group interactions. Some leaders indicated that the training raised their curiosity on several issues, leading to increased awareness and desire to learn more about the topic. This curiosity, combined with greater knowledge, reflects the empowerment of the CCLs. Experiences and reflections provided by CCLs show the impact of our WaSH training, triggering participants desire to learn more, encouraging them to gather more information on the essential WaSH training topics, and promoting increased awareness of antibiotics and antibiotic resistance in the communities (Table 2: CCL 5a and CCL 6a).

### Level of engagement reflected by the participants

CCLs rated their post-training confidence levels involving complex topics on a scale from 1 to 10, where 1 indicated no confidence and 10 indicated high levels of trust. The sample mean for reporting the overall levels of confidence of the group was established using the following formulae:

$$\bar{X} = \frac{\sum x_i}{n}$$

where  $\sum x_i$  represents the sum of all scores present in the sample and  $n$  represents the total number of individuals or observations in the sample. The mean score was 7.14, indicating that CCLs perceived themselves more confident than a median level (i.e., 5) about their knowledge gained during the training. Determining confidence helps to understand the transfer of learning that takes place.

Confidence enables learners to appreciate the sort of knowledge that they are supposed to understand and undertake in the field after training (Kontoghiorghes 2001). Such confidence also allows CCLs to become potential advocates on the complex topics related to health, hygiene, antibiotics, and antibiotic resistance that will extend to community members because of CURE's active involvement in WaSH activities in Delhi communities.

### Ability to form associations from real-life examples

CCLs were asked to provide examples related to WaSH behaviour from their own lives, helping them to draw upon personal experiences. This enabled them to make sense of the technical concepts associated with the research (Table 2: CCL 2b, CCL 5b, and CCL 6c). As they shared their experiences and reflections during training, they felt more motivated to execute their tasks. This knowledge acquisition and understanding around these while talking through real-life scenarios built their confidence to share their understanding with the community members.

### Mastering the learning objectives for effective decision-making with confidence

A critical component of the training was to empower CCLs on the grounds of decision-making. Trainers witnessed enjoyment by the CCLs in the participatory structure of the training, allowing them to share their knowledge with their peers. CCLs were encouraged to ask questions, with trainers ensuring that training goals were achieved through productive question-and-answer sessions by covering the instrument flow, ranging from WaSH aspects to complex antibiotic and AMR concepts. Trainers, through a sequence of demonstrations and supervised practices like mock training, ensured to cement the decision-making skills, which the CCLs confirmed in their feedback (Table 2: CCL 6d).

CCLs were expected to interact with the community members post-training and handle CC teams independently to survey selected settlements. From the viewpoint of CCLs, the training made them confident regarding their instructional ability. It raised their awareness of complex topics, enabling them to support their CCs with technical queries more confidently (Table 2: CCL 2c, CCL 3b, and CCL 5c).

### More training-related observations

At the outset of the paper, we set up the premise that how community-based training undertaken in partnership grassroots-level organisations like CURE can inspire a two-way learning system. Even in the case of our research, we brought CURE on board as an implementation agency. However, CURE's connection with the community and its

ability to understand WaSH-related aspects enabled its escalation as a full research partner, essential for planning and implementation of the research efforts. CURE helped to facilitate the Newcastle team to connect with the community stakeholders, enabling smooth integration of all the stakeholders involved. Uddin *et al.* (2014) showed that the lack of a CBO could toughen the process of community connection, which can hamper new research or interventions by international agencies.

## CONCLUSIONS

Here, we show the positive value of local training in KAP surveys on WaSH practices and antibiotic resistance in informal communities in New Delhi. The local CCLs clearly were empowered by the training process and became more confident in their ability to gather technical and other data in F2F interviews. This had trickle-down benefit by increasing the capacity of the local CBO, CURE, to perform further surveys and interventions on this complex topic, potentially driving more local solutions to the global problem of antibiotic resistance. Additionally, the positive value of the training process also was felt among the NU team.

The initial KAP surveys for WaSH and antibiotic resistance developed by NU proved to be too technical and did not fully consider the social context of data gathering. Therefore, the partnership between NU and CURE provided an ideal blend of general knowledge and local expertise, creating more suitable WaSH and antibiotic resistance KAP surveys for future use. Our team's experience in New Delhi shows that training goes both ways, and we strongly encourage increased involvement and empowerment of CBOs, especially in the emerging and developing world to develop local solutions to global problems.

## ACKNOWLEDGEMENTS

Work within this manuscript was funded by two UK EPSRC Impact Acceleration Awards (Nos EP/K503885/1 and EP/R511584/1), a Newcastle University Global Challenge Academy Rapid Response award (No. RR#52GRAHAM), and the Water Security and Sustainable Development Hub

funded by UK GCRF (No. ES/S008179/1). We thank Prof. Pauline Dixon and Dr Steve Humble for useful comments during the development of the work. Additionally, we thank Zachary Hammersley for providing the graphic abstract for the manuscript.

## DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

## REFERENCES

- Adedeji, W. A. 2016 The treasure called antibiotics. *Annals of Ibadan Postgraduate Medicine* **14** (2), 56–57.
- Aitken, I. 2014 Training community health workers for large-scale community-based health care programs. In: *Developing and Strengthening Community Health Worker Programs at Scale A Reference Guide for Program Managers and Policy Makers* (H. Perry & L. Crigler, eds). USAID/MCHIP, pp. 9–24. Available from: [https://www.mchip.net/sites/default/files/MCHIP\\_CHW%20Ref%20Guide.pdf](https://www.mchip.net/sites/default/files/MCHIP_CHW%20Ref%20Guide.pdf).
- Barat, A., Bhandari, B. & S.Wali, A. 2014 Capacity building and training services in the WASH sector in Afghanistan. In *Sustainable Water and Sanitation Services for All in a Fast-Changing World: Proceedings of the 37th WEDC International Conference*, Hanoi, Vietnam, pp. 1–5.
- Bassoum, O., Sougou, N., Diongue, M., Lèye, M., Mbodji, M., Fall, D. & Tal-Dia, A. 2018 Assessment of general public's knowledge and opinions towards antibiotic use and bacterial resistance: a cross-sectional study in an urban setting, Rufisque, Senegal. *Pharmacy (Basel)* **6** (4), 103.
- Beidas, R. S. & Kendall, P. C. 2010 Training therapists in evidence-based practice: a critical review of studies from a systems-contextual perspective. *Clinical Psychology* **17** (1), 1–30.
- Beidas, R., Koerner, K., Weingardt, K. & Kendall, P. 2011 Training research: practical recommendations for maximum impact. *Administration and Policy in Mental Health and Mental Health Services Research* **38**, 223–237. <https://link.springer.com/article/10.1007/s10488-011-0338-z>.
- Bell, K., Fahmy, E. & Gordon, D. 2016 Quantitative conversations: the importance of developing rapport in standardised interviewing. *Quality & Quantity* **50** (1), 93–212.
- Brick, J. M. 2018 Sampling to minimize nonresponse bias. In: *The Palgrave Handbook of Survey Research* (D. L. Vannette & J. A. Krosnick, eds). Palgrave Macmillan, Basingstoke, pp. 23–28.
- Carter, R. R., Sun, J. & Jump, R. L. 2016 A survey and analysis of the American public's perceptions and knowledge about antibiotic resistance. *Open Forum Infectious Diseases* **3** (3), ofw112.

- Castro-Sánchez, E., Moore, L. S., Husson, F. & Holmes, A. H. 2016 What are the factors driving antimicrobial resistance? Perspectives from a public event in London, England. *BMC Infectious Diseases* **16** (1), 465.
- Chan-Golston, A. M., Friedlander, S., Garcia, R. E., Santos, R., Chen, J., Prelep, M., Glik, D. C., Brookmeyer, R., Belin, T. & Ortega, A. N. 2016 Comparing lay community and academic survey center interviewers in conducting household interviews in Latino communities, progress in community health partnerships. *Research, Education, and Action* **10** (3), 435–442.
- Crocker, J., Shields, K. F., Venkataramanan, V., Saywell, D. & Bartram, J. 2016 Building capacity for water, sanitation, and hygiene programming: training evaluation theory applied to CLTS management training in Kenya. *Social Science and Medicine* **166**, 66–76.
- Cucciare, M. A., Weingardt, K. R. & Villafranca, S. 2008 Using blended learning to implement evidence-based psychotherapies. *Clinical Psychology: Science and Practice* **15** (4), 299–307.
- Damschroder, L. J., Aron, D. C., Keith, R. E., Kirsh, S. R., Alexander, J. A. & Lowery, J. C. 2009 Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implementation Science* **4**, 50.
- Durrant, G. B., Groves, R. M., Staetsky, L. & Steele, F. 2010 Effects of interviewer attitudes and behaviors on refusal in household surveys. *Public Opinion Quarterly* **74** (1), 1–36.
- Dyar, O. J., Hills, H., Seitz, L. T., Perry, A. & Ashiru-Oredope, D. 2018 Assessing the knowledge, attitudes and behaviors of human and animal health students towards antibiotic use and resistance: a pilot cross-sectional study in the UK. *Antibiotics (Basel, Switzerland)* **7** (1), 10.
- Graham, I. D., Logan, J., Harrison, M. B., Straus, S. E., Tetroe, J., Caswell, W. & Robinson, N. 2006 Lost in knowledge translation: time for a map? *The Journal of Continuing Education in the Health Professions* **26** (1), 13–24.
- Graham, D. W., Bergeron, G., Bourassa, M. W., Dickson, J., Gomes, F., Howe, A., Kahn, L. H., Morley, P. S., Scott, H. M., Simjee, S., Singer, R. S., Smith, T. C., Storrs, C. & Wittum, T. E. 2019a Complexities in understanding antimicrobial resistance across domesticated animal, human and environmental systems. *Annals of the New York Academy of Sciences* **1441** (1), 17–30.
- Graham, D. W., Giesen, M. J. & Bunce, J. T. 2019b Strategic approach for prioritising local and regional sanitation interventions for reducing global antibiotic resistance. *Water* **11** (1), 27. <https://www.mdpi.com/2073-4441/11/1/27>.
- Holbrook, A., Green, M. & Krosnick, J. 2003 Telephone versus face-to-face interviewing of national probability samples with long questionnaires: comparisons of respondent satisficing and social desirability response bias. *Public Opinion Quarterly* **67**, 79–125.
- Hsieh, H. F. & Shannon, S. E. 2005 Three approaches to qualitative content analysis. *Qualitative Health Research* **15** (9), 1277–1288.
- Kontoghiorghes, C. 2001 Factors affecting training effectiveness in the context of the introduction of new technology – a US case study. *International Journal of Training and Development* **5** (4), 248–260.
- Lin, N. 2001 *Social Capital: A Theory of Social Structure and Action*. Cambridge University Press, Cambridge.
- Miller, P. V. 2017 Is there a future for surveys? *Public Opinion Quarterly* **81** (S1), 205–212.
- Rakovshik, S. G. & McManus, F. 2010 Establishing evidence-based in training in cognitive behavioural therapy: a review of current empirical findings and theoretical guidance. *Clinical Psychology Review* **30** (5), 496–516.
- Ramanadhan, S., Mendez, S., Rao, M. & Viswanath, K. 2013 Social media use by community-based organisations conducting health promotion: a content analysis. *BMC Public Health* **13**, 1–10.
- Salazar, M. K. 1990 Interviewer bias. How it affects survey research. *AAOHN Journal* **38** (12), 567–572.
- Salway, S., Platt, L., Chowbey, P., Harriss, K. & Bayliss, E. 2007 *Long-term Ill-Health, Poverty and Ethnicity*. The Policy Press, Bristol, UK.
- Standing, H. & Chowdhury, A. M. 2008 Producing effective knowledge agents in a pluralistic environment: what future for community health workers? *Social Science & Medicine* **66** (10), 2096–2107.
- Uddin, S. M. N., Li, Z., Mang, H.-P., Huba, E.-M. & Lapegue, J. 2014 A strengths, weaknesses, opportunities, and threats analysis on integrating safe water supply and sustainable sanitation systems. *Journal of Water, Sanitation and Hygiene for Development* **4** (3), 437–448.
- Weiss, C. H. 1968–1969 Validity of welfare mothers' interview responses. *The Public Opinion Quarterly* **32** (4), 622–633.
- WHO, FAO & OIE 2020 *Technical Brief on Water, Sanitation, Hygiene and Wastewater Management to Prevent Infections and Reduce the Spread of Antimicrobial Resistance*. World Health Organization, Food and Agriculture Organization & World Organisation for Animal Health. Available from: [https://www.who.int/water\\_sanitation\\_health/publications/wash-wastewater-management-to-prevent-infections-and-reduce-amr/en/](https://www.who.int/water_sanitation_health/publications/wash-wastewater-management-to-prevent-infections-and-reduce-amr/en/) (accessed 9 April 2021).

First received 18 November 2020; accepted in revised form 20 April 2021. Available online 19 May 2021