Interactive Voice Response for Data Collection in Low and Middle-Income Countries

Viamo Brief
April 2018

Suggested Citation
Greenleaf, A.R. Vogel, L. 2018. *Interactive Voice Response for Data Collection in Low and Middle-Income Countries.* Toronto, Canada: Viamo.

0 - EXECUTIVE SUMMARY

Expanding mobile network coverage, decreasing cost of cellphones and airtime, and a more literate population have made mobile phone surveys an increasingly viable option for data collection in low- and middle-income countries (LMICs). Interactive voice response (IVR) is a fast and cost-effective option for survey data collection.

The benefits of trying to reach respondents in low and middle-income countries (LMICs) via cell phone have been described by The World Bank,[1] academics[2,3], and practitioners[4] alike. IVR, a faster and less expensive option than face-to-face surveys, can collect data in areas that are difficult for human interviewers to reach. This brief explains applications of IVR for data collection in LMICs. Sections 1- 4 provide background information about IVR and detail the advantages of "robo-calls". The next three sections explain the three main target groups for IVR. Beginning with Section 5 we outline the four approaches to sampling a general population and address IVR data quality. Known respondents, who are often enrolled for monitoring and evaluation, are covered in Section 6, along with best practices for maximizing participant engagement. Finally, in Section 7 we explain how professionals use IVR for surveillance and reporting. Woven throughout Sections 5-7, four case studies illustrate how four organizations have successfully used IVR to for data collection.

1- CONTEXT

Who is writing this paper?

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Viamo connects individuals and organizations using digital technology to make better decisions. With origins in Ghana, *Viamo* now works worldwide, offering its partners a suite of services for data collection and behavior change through cell phones. As of early 2018, more than 5.5 million people have answered at least 5 *Viamo* survey questions in 106 countries.

Why are we writing this paper?

Although IVR has been used for myriad projects in high-income countries for decades[5], IVR is less frequently used in LMICs. The aim of this paper is to share IVR applications and case studies to help international development practitioners assess if their project could benefit from IVR data collection.

2- WHAT IS IVR?

Interactive Voice Response is a technology that allows respondents to listen to a pre-recorded question, then answer by pressing the number corresponding to their answer on their phone keypad. For example, "What is your gender? For female, press 1. For male, press 2."

3- HOW CAN IVR BE USED?

To date, the two main uses of IVR in LMICs have been data collection and behavior change communication. This paper will focus on data collection.

4- WHY IVR, WHY NOW?

4.1 IMPROVED INFRASTRUCTURE BROADENS IVR REACH

When cell phone and air time costs decrease and mobile network coverage and electricity access increase, cell phone ownership increases. Greater cell phone ownership means the respondent pool is more representative of the general population.[6] In Sub-Saharan Africa, investments in communication technology have increased cell phone penetration[7] from 50% in 2015 to projected 100% cell phone penetration in 2021.[8]

4.2 PARTICIPATION LIMITED ONLY BY PHONE OWNERSHIP & NETWORK COVERAGE

Populations that are typically hard to reach in face-to-face (FTF) surveys due to mobility (nomads, migrants) or are out of the house during the day (men, employed) are available via cell phone. Further, follow-up surveys can be administered at a higher frequency and a lower cost than FTF surveys. A smartphone is not required to participate in an IVR survey and only basic literacy (i.e., being able to recognize numbers on a keypad) is required. In order to contain costs, many nationally representative FTF surveys cluster interviews in geographic areas. IVR, on the other hand, can reach respondents throughout a country, including areas usually avoided during FTF surveys: remote regions, areas with poor roads, insecurity, natural disasters, or epidemics.[1]

4.3 RAPID DATA COLLECTION & RESULTS

Globalization has resulted in a highly-connected world that changes rapidly: diseases spread swiftly, new information travels in an instant, and markets quickly change. IVR provides the opportunity to rapidly collect data. Whereas FTF or computer-assisted telephone interview surveys require interviewer training, dissemination of survey tools and extensive logistic planning, IVR requires very little local infrastructure. In 2016 *Viamo* collaborated with World Food Program (WFP) to rapidly assess the extent of a drought in Zimbabwe. The 18-question survey in two languages (English and Shona) was completed by 1,070 respondents (44% female) within 5 days.[9] The ability to have more timely data, as well as more frequently collected data, facilitates real-time decision-making.

4.4 LOW PROJECT COST

No physical space in-country is required for IVR data collection. The start-up and project management fees are minimal. Software automates data collection so human oversight of data collection is unnecessary. The main cost associated with an IVR survey is the airtime spent answering the survey; a cost not incurred by the respondent. In 2013, a 10-question survey in Honduras was estimated to cost $40 per FTF respondent and $17 per IVR respondent.[10] A 10-question survey in Honduras administered by *Viamo* in 2017 would cost approximately $7 per respondent, which is itself higher than the average cost per completed 10-question survey ($5), based on the 106 countries where *Viamo* has conducted research. A recent 19-question survey in Ghana cost $4.95 per completed survey, with an average length of 9 minutes and 50 seconds.

OPTIMUM NUMBER OF QUESTIONS FOR AN IVR SURVEY

The length of an IVR questionnaire depends on the project's research objectives and target sample. *Viamo's* longest survey to date is 38 questions. The highest drop-off occurs within the first 8 questions of the survey. The highest number of hang-ups occur between the 1st and 2nd question, then continually decrease until a leveling off at approximately the 8th question. By the 30th question, you have lost 70% of respondents that picked up, but still have 80% of the participants that reached question 8. IVR is best used for surveys with multiple choice questions with five or fewer answer options. Open-ended questions and questions with more options are not impossible but they tend to increase drop-off rates.

5- GENERAL POPULATION SURVEYS

There are four main sampling options for those who aim to survey a sample of citizens in order to create inferences about a large population. The first approach, enrolling respondents FTF, requires respondents to provide a cell-phone number for follow-up. The second approach to sampling is purchasing a list of phone numbers, preferably with demographic characteristics about the potential respondents, which some mobile network operators (MNO) offer. Third, *Viamo* is creating a database of respondents who after finishing an IVR survey opt-in to be contacted for future surveys. The fourth option, the most frequently used, is to random digit dial (RDD) respondents to reach the required number of completed surveys. In high-income countries, a sampling frame (i.e. a list of phone numbers) is used to call potential respondents. However, phone sampling frames are rare in LMICs, so phone numbers for RDD are created by using the prefixes from MNO, then randomly generating the remaining digits. Typically 10-50% of the numbers randomly dialed will be valid numbers (depending on the MNO's phone number density). Of those that pick-up, typically 30% will start the survey and of those, about half will complete a 10-question survey. The main benefit of RDD is that you can poll a sample of citizens in every country in the world within a few days. The main drawback to RDD sampling is that minority groups (women, minority ethnicities or languages) are difficult to reach because they are less likely to own a cell phone. To mitigate bias in a RDD sample, one can use quota sampling.[6] It is helpful to know the level of phone ownership in a country in order to estimate bias. The Demographic and Health Survey or Afrobarometer data quantifies the bias that calling respondents on their phone introduces to a study and could be used to weight the sample.

CASE STUDY 1: LISTENING TO LATIN AMERICA AND THE CARRIBEAN: USING CELL PHONES FOR HIGH FREQUENCY DATA COLLECTION[10]

For this research study, the World Bank partnered with Gallup World Poll in Honduras. All participants (n=600) were enrolled FTF and were given a cell phone if the participant did not already own one. Between FTF enrollment and follow-up via IVR, 40% of the population was retained. The attrition rate for the first IVR call was higher among women, urban, more affluent and educated participants and the youngest age group (15-30 year-olds). However, over time those differences attenuated and overall attrition was similar in all areas except that youngest participants were less likely to participate compared to older participants. For 6 of the 7 questions, the value of Cronbach's Alpha, a measure of internal consistency, was above 0.80 indicating good reliability.

ENSURING DATA QUALITY

Because IVR is automated data collection, researchers have limited ability to confirm a respondent's answer, thus raising questions about the reliability and validity of the data. Listed below is what is known about IVR data quality:

- Using professional translators and pre-testing questions[11] mitigates measurement error that could arise from the respondent misunderstanding the question
- There is insufficient data to conclude whether respondents in LMICs are more or less honest or likely to misreport data during IVR surveys compared to in-person surveys[12]
- Interviewer effects are reduced since all respondents hear the same recording
- Validation questions that have one correct answer for all respondents, such as "What country do you currently live in?" can be used to gauge respondent ability to answer questions and give the respondent the opportunity to practice answering questions before responding to key survey questions
- Validation formulas can be used to reject answers or questionnaire, and asking the same question twice in a survey can provide an indication of data quality

CASE STUDY 2: Random Digit Dial For FHI360's "Health Communication 4 Life" Project
In 2017, FHI360 fielded an IVR survey in Malawi with the objective of measuring citizens' knowledge, and attitudes of misuse of government resources from a national sample. 928,281 calls were placed, of which 82,118 were viable numbers. It took 4 days to complete 1,425 surveys. In order to survey a more representative population, FHI360 applied gender and household quotas. FHI360 used the data to identify focus areas for a new behavior change communication campaign and plan for additional data collection.

MAXIMIZING PARTICIPANT ENGAGEMENT

Over the past five years, *Viamo* has amassed knowledge about how to increase response rates. Best practices vary across countries, but the following approaches have improved response rates in a number of projects:

- Briefly (0.5~1 min) explaining to the respondents the benefits of answering the survey (improved services, voice in policy making, etc.) - in fact, creating a survey introduction with a compelling intrinsic incentive provides the greatest benefit to survey engagement
- Offering the survey in multiple languages
- Recording either in a man or woman's voice, depending on which gender target participants are more responsive to (to be tested locally)
- Implementing a retry protocol that tries to reach participants if they don't pick up on the first attempt
- Identifying the time of day women or other target groups are likely to pick up a call

For longitudinal studies:

- Explaining to the respondent how their previous responses have been used
- Implementing strategies to increase motivation to complete a survey (e.g., by naming a participant who has consistently reported data)
- Providing valued information, such as news or market prices, alongside the survey

6 - KNOWN BENEFICIARIES

IVR can be used to monitor and evaluate programs by collecting data directly from the participants. These participants provide their phone numbers to an enumerator, at a point of service or are asked to call a phone number to register. Participants receive monitoring calls but can also call (toll-free) at their convenience to offer feedback or share an observation in real-time. Furthermore, the frequency and content of each call can be customized to each respondent. As a result, program managers receive feedback about their program with quicker turnaround than traditional approaches. The data collected can be used to:

1- Test different interventions and quickly understand which is best received by the beneficiaries[13]
2- Evaluate which aspects of an information campaign or training is reaching the beneficiaries, being understood, retained, and leading to behavior change
3- Compare and evaluate the performance of field agents

Finally, regular monitoring calls can be intertwined with the intervention itself, such as mobile-enabled trainings, reminders, customer service, etc.

CASE STUDY 3: NORTHERN GHANA PREGNANCY INFORMATION AND SURVEY PROJECT
In 2015, 3,012 women in Northern Ghana were enrolled via radio ads and public health facilities to receive informative messages about self and baby-care over 42 weeks. At least 55% of enrolled women picked up the call weekly; the average was 62%. Of the women who picked up the weekly calls, 80% finished the calls, which were approximately 5 minutes total, with 3 minutes of educational messaging and 2 knowledge questions and 1 M&E question. The women all lived in Northern Region, where two-thirds of women have no formal education.[14]

7- PROFESSIONALS

Professionals (typically staff on payroll) are an attractive population to reach using IVR because they have most likely attained a high level of technology literacy, are more likely to speak the country's official language, and their jobs serve as extrinsic motivation for engaging in IVR data collection. *Viamo* has enrolled professionals for data collection in Bangladesh (disaster response), Niger (animal health) and Zambia (voting). Professionals most often use IVR for reporting data as part of a surveillance system. Data collection frequency ranged from bi-weekly to monthly. Participation requires 4 hours of training or less. The collected data can by synthesized into reports and automatically disseminated via phone calls, text or email, or made available via a web dashboard.

CASE STUDY 4: NIGER HUMAN & ANIMAL HEALTH WORKERS SURVEILLANCE

In Niger, where there are only 18,000 miles of roads in a country three times the size of California (394,000 miles of paved road), human and animal community health workers use IVR to report suspect cases of human and animal diseases. After 276 community workers were trained by the Ministry of Livestock, they were enrolled to receive a weekly call to ask if they had seen any suspect cases. Workers were also able to call-in to report cases at any time at no cost. Among those who were trained in 2017, 80% have remained engaged. As of June 2017, 97 percent of Niger's rural districts have at least one trained animal health worker using the system, facilitating significantly faster reporting of communicable diseases in hard-to-reach areas.

8- CONCLUSIONS

Due to technology and infrastructure advances in LMICs over the past decade, IVR is now a feasible data collection approach. IVR is a more rapid, cost-effective data collection approach than FTF or call center (CATI) surveys. Although certain groups, such as women and minority-language speakers, are difficult to reach due to lower cell phone ownership, the four population sampling approaches outlined above can aide researchers in enrolling a representative population sample. Both known beneficiaries and professionals have successfully used IVR to report data that could be too expensive or difficult to routinely collect FTF.

As *Viamo* and other international mobile data collection organizations continue to amass data and identify best practices, the reliability and validity of the results will become better documented. Nonetheless, this paper outlines approaches for ensuring data quality as well as maximizing participation response. As populations are increasingly exposed to IVR and cell phone ownership becomes nearly universal, data quality will increase as well as the representation of participants. The ability to rapidly collect data via IVR will continue to contribute to better planned, better managed, more cost-effective programs in an array of development sectors across the world.

9 - REFERENCES

1. Dabalen, A., et al., *Mobile Phone Panel Surveys in Developing Countries: A Practical Guide for Microdata Collection*, in *Directions in Development*. 2016, World Bank Washington, DC.

2. Hyder, A.A., et al., *Noncommunicable Disease Risk Factors and Mobile Phones: A Proposed Research Agenda.* J Med Internet Res, 2017. **19**(5): p. e133.

3. L'Engle, K., et al., *Survey research with a random digit dial national mobile phone sample in Ghana: Methods and sample quality.* PLoS One, 2018. **13**(1): p. e0190902.

4. Leo, B., et al., *Do Mobile Surveys Work in Poor Countries*, in *CGD Working Paper 398*. 2014, Center for Global Development Washington, DC.

5. Corkrey, R. and L. Parkinson, *Interactive Voice Response Review of Studies 1989–2000.* Behavior Research Methods, Instruments & Computers, 2002. **34**(3): p. 342-353.

6. Labrique, A., et al., *Health Surveys Using Mobile Phones in Developing Countries: Automated Active Strata Monitoring and Other Statistical Considerations for Improving Precision and Reducing Biases.* J Med Internet Res, 2017. **19**(5): p. e121.

7. Poushter, J. and R. Oates, *Cell Phones in Africa: Communication Lifeline*. 2015, Pew Research Center: Washington, DC.

8. *Sub-Saharan Africa: Ericsson Mobility Report*. Ericsson: Stockholm, Sweden. 2016.

9. *Zimbabwe: High levels of negative coping seen in eastern provinces*, in *mVAM Bulletin*. 2016, World Food Program. p. 3.

10. Ballivian, A., et al., *Listening to LAC: Using Mobile Phones for High Frequency Data Collection*. 2013, The World Bank: Washington, DC.

11. Gibson, D.G., et al., *The Development of an Interactive Voice Response Survey for Noncommunicable Disease Risk Factor Estimation: Technical Assessment and Cognitive Testing.* J Med Internet Res, 2017. **19**(5): p. e112.

12. Greenleaf, A.R., et al., *Building the Evidence Base for Remote Data Collection in Low- and Middle-Income Countries: Comparing Reliability and Accuracy Across Survey Modalities.* J Med Internet Res, 2017. **19**(5): p. e140.

13. Kohavi, R. and S. Thomke. *The Surprising Power of Online Experiments*. Harvard Business Review. 2017; Available from: https://hbr.org/2017/09/the-surprising-power-of-online-experiments.

14. Ghana Statistical Service (GSS), G.H.S.G., and ICF International, *Demographic and Health Survey 2014*, G. GSS, and ICF International, Editor. 2015: Rockville, Maryland, USA.