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mVAM: A new contribution to the information ecology of humanitarian work

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Abstract

This paper reviews the World Food Program's experience using mobile cellular technology to monitor food insecurity in humanitarian settings. The paper illustrates how the Mobile Vulnerability Assessment and Monitoring program (mVAM) conducted applied research and learning experiments to improve the accuracy and utility of information collected to monitor the dynamics of food insecurity in humanitarian settings.

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1. Introduction

The World Food Programme (WFP) is one of the most substantive contributors to representative population assessments and monitoring of communities affected by humanitarian emergencies. WFP normally undertakes over 100 food security assessments per year in more than 80 countries. These surveys serve as a reference for estimating food insecurity in humanitarian settings and WFP plays a leadership role in providing this information. Research has shown, however, that household survey data is cumbersome to collect and analyze, often coming up short to meet the needs of local and international decision makers who determine resources brought to bear on crisis response [1, 2, 3, 4].

Moreover, these surveys provide point estimates of food insecurity in what is often rapidly changing contexts. Recent advances in Information and Communications Technologies (ICT) and their global availability have made it possible to conduct household surveys remotely using cell phone technology. Continuing in its leadership role to strengthen food insecurity assessment and monitoring, the World Food Program's mobile Vulnerability Assessment and Mapping (mVAM) Programme utilizes cell phone technology to conduct high frequency food security monitoring of crisis affected populations. Typically on a monthly basis, mVAM collects data on a small number of food security indicators using either live phone calls (VOX), Short Messaging Systems (SMS) or Interactive Voice Response (IVR). Figure 1, outlines the key process of mVAM. This paper synthesizes mVAM learning on how to incorporate mobile technology in to food security monitoring in humanitarian contexts.

2. Background

In 2013, mVAM applied for and received seed funding from the Humanitarian Innovation Fund (IHF) to pilot the mVAM approach. MVAM was applied in differing humanitarian settings, including in large areas of instability and conflict, such as Sudan, Somalia, Iraq, Yemen; displacement camps, such as in Rwanda, DRC, Kenya, Niger; and in novel contexts where face to face surveys were impossible, such as the Ebola affected countries in West Africa. Between 2013 and 2015 more than 100,000

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surveys were administered using cell phones in 10 countries. The growth of the mVAM program was organic in that the application of cell phone monitoring in crisis contexts was requested by WFP staff and donors engaged in responding to potential food security crises.

The mVAM team, however, always maintained a learning culture, understanding the novelty of the work being undertaken. High frequency monitoring can be achieved through panel designs (monitoring the same households over time) or through repeated cross-sectional surveys or some combination of these. Only a limited amount of prior research and experience was available to inform design decisions. Many sources of error and bias potentially threatened the utility of high frequency monitoring. [5, 6, 7, 8, 9, 10, 11, 12, 13, 14] These include selection bias, response bias, instrumentation/modality bias, attrition, and information bias. Few panel studies have been conducted in humanitarian contexts and even fewer studies shed light on the additional sources of error associated with employing mobile technologies to implement surveys and panels.

mVAM used a variety of methods to facilitate its learning agenda. It set up and maintained a blog with regular blog posts for shared learning among the mVAM staff and their stakeholder communities. Where possible, mVAM collaborated with knowledge generation-oriented organizations such as Nielsen, Tulane University, ALNAP, and individuals active in promoting formative/summative research for the development of rapid high frequency monitoring using mobile technology. Both formal and informal networks were key to its progress.

mVAM developed a learning strategy, in retrospect, but again organic, that combined regular reflection between field staff and the mVAM core team with collaborative experiments conducted together with its partners. The result was a multiple method/partner-learning ecosystem for mVAM. Through deployments of the mVAM surveys in 10 countries and specific field friendly experiments, the mVAM team deliberately engaged in learning exercises to adjust its information strategy. Given the challenging circumstances where field experiments were conducted, the findings here are largely qualitative in nature, though some quantitative analyses are provided in support of conclusions where appropriate.

Monitoring measures were deliberately parsimonious, respecting early findings that mobile surveys of very short duration produced higher response rates and better accuracy [6]. Key indicators collected included a standard dietary consumption measure (the Food Consumption Score-FCS) collected by WFP; a measure of crisis coping behaviors (the Reduced Coping Strategy Index-rCSI); prices of key food commodities; manual labor daily wage rates; and an open-ended question querying respondents to comment on their food security situation. The specific items selected among these options varied across settings. The most commonly collected measures were the FCS and rCSI.

Experimentation in the form of field friendly operational research (lack of high quality randomized designs) was conducted in five specific settings based upon opportunity for experimentation and the learning agenda of mVAM. Research cases involved a number of specific potential sources of bias in survey monitoring including sample representativeness, attrition, response rate, enumerator error and instrumentation in the form of modality bias. mVAM also collected regular practical learning from field sites related to the design and implementation of mobile monitoring such as live operator characteristics that reduce bias, strategies to improve SMS and IVR response rates, optimal schemes to incentivize respondents with airtime credit, and ways to ensure that cell phones remain operational via charging points and reminders. These lessons were captured during the implementation of mVAM and frequently posted to the blog site. Other lessons were captured during a recent mVAM assessment [15].

Specific operational research studies were developed to examine specific sources of bias. These five cases involved deliberate design options that responded to specific hypotheses such as the 1. Representativeness of cell phone samples in different contexts (comparing cell phone subsamples to larger probability household face to face surveys); 2. Examining modality bias (F2F, IVR, SMS, VOX) by randomizing cell phone numbers in to different modality groups: face-to-face, SMS, IVR; 3. comparing the validity of panel designs to repeated cross sectional surveys.

3. Results: Specific operational research studies

3.1. DRC Refugee Camp

The first and earliest pilot study allowed the team to follow a panel of displaced persons who resided in the Mugunga3 displacement site of Eastern DRC over 18 months. The design included an extensive probability household survey conducted using face to face interviews with a subset of 330 households who constituted a panel that was monitored monthly for 18 months. Mobile phones were distributed to the households that expressed interest in participating in the survey. The initial panel size was 300 households. It was extended to 340 households after 5 rounds of data collection. This maiden pilot study enabled the team to generate learning around logistics of mobile monitoring, the significance of cell phone modality choice, representativeness of cell phone panels, and the impact of changes in panels related to resettlement.

Lessons from this study suggest that modality of interviews is an important determinant of estimates of food insecurity. Live voice interviewing consistently produced lower estimates of food insecurity and this difference was dependent upon the initial level of food insecurity reported. There was little difference between the F2F and live voice interviews at low levels of food security and increasing differences when initial levels were higher. The study also demonstrated differentials in food insecurity levels, as measured by the cell phone surveys, between those remaining in the displacement camp and those who had left the displacement camp. This finding suggests the importance of identifying the residential status of participants during high

frequency monitoring. The study also suggests that attrition, even if it decreases the accuracy of the estimators, was not a source of bias in this particular panel, but was more random in nature. This study also revealed important operational issues such as the potential role of live operators in building trust and connectivity between research teams and beneficiary populations; the importance of protection concerns in planning cell phone panel surveys; the importance of assessing and planning for mobile phone use patterns during the design of high frequency monitoring systems.

3.2. Iraq

This study was conducted in Iraq, aiming to collect data that might be nationally representative using a local cell phone operator, Korek to obtain cell phone numbers. VOX was implemented. Operators indicated that incentives for participation in the panel were not sufficient. Operators also reported the importance of communicating with respondents in their own Arabic or Kurdish dialect was important to achieve better response rate. Other findings included geographic clustering of response patterns, a high degree of urban bias in the sample, and mis-reporting of location by panel participants. For example, suburban residents reported their residence to be Baghdad even though they resided in suburban areas that were part of different governorates.

The study also found that working with a mobile network operator enables precise geographic targeting of respondents at the cell-tower level. This permitted mVAM to mitigate many of the aforementioned geographic biases. Therefore, a possible evolution of the monitoring tool is to survey specific hot-spot areas for WFP operations through a strategy of developing linkages with mobile network operators.

3.3. Sudan Displacement Camp

The third study involved formative research undertaken in Garsila Camp, Wadi Salih district in Sudan. The goal of the study was to assess differences between F2F and VOX specifically for the Food Consumption Score (FCS) measure. In this case an extensive F2F probably household survey was implemented and a 300 household subsample was provided mobile phones. They were interviewed 3 weeks after the F2F interview. The non-response rate was 10%. The FCS estimates were consistently lower as estimated by VOX except for the most food insecure group (FCS<30). This was a key finding for the veracity of the entire mVAM project; the most food insecure as measured by F2F reported similar levels of stress when interviewed by cell phone.

Furthermore, for the less food-insecure respondents (FCS>30), their observed decrease in FCS under VOX was almost entirely linear with their original F2F response. That is, the amount the respondents reduced their reported consumption habits by under VOX could be modelled by a simple linear increasing function of their original F2F response, accounting for over 50% of the variance. This was a remarkable insight, as it revealed a key quality about the nature of mode effects; the effect increases as the level of food insecurity decreases beginning at moderate initial levels of food insecurity. This opens the door to being able to model mode-effects and thereby remove mode-related bias from mVAM food-insecurity estimates.

3.4. Rwanda Refugee Camp

This cross-sectional study compared F2F and VOX modalities among residents in Gihembe and Nyabiheke refugee camps in Rwanda receiving mobile money disbursements from WFP. Originally 840 residents were selected for inclusion in the study; however, only 152 (18%) responded to the VOX survey. An additional 352 participants from the camps were recruited for the VOX survey. The unique aspect of this study is that the study population was participating both in a mobile money cash transfer program and mVAM monitoring.

The findings mirror in large part those from other experiments so far as FCS is concerned. VOX participants reported higher levels of food insecurity and the differentials between higher and lower levels of food insecurity also was found here; that is, those with higher levels of food insecurity as measured by F2F reported more consistently similar levels in VOX surveys, while those with initially lower levels of food insecurity reported higher levels on VOX surveys. Also, demographic differentials in VOX responders also were found, reflecting younger and somewhat higher socioeconomic levels.

This experiment yielded lower levels of participation than some studies. Exploration in to this problem suggests that the use of cell phones for mobile money transfer may affect their cell use patterns. They may keep their phones off more and synchronize their use to expected mobile cash distributions. Many beneficiaries hide their SIMs in safe places for fear of losing them. Beneficiaries often leave their SIM cards with traders as collateral when borrowing or making purchases with the coming month's entitlement. Thus, this study demonstrates potential interactions between mobile transfer entitlements and mobile monitoring that are important to assess when developing high frequency monitoring strategies.

3.5. Remote Monitioring in Ebola (EVD) Affected Countries

This study used all three modes, but the main tool utilized was SMS and represented the first large-scale deployment of SMS for MVAM. From January 2015 to December 2015, on a monthly basis, participants were randomly selected from a database of mobile subscribers and were asked socio-demographic questions, coping behavior questions, the prices of 3 commodities and manual labour wages as well as an open-ended question on food security. Over 30,000 observations were collected in the span

of the year. While this provided critical, high-frequency information on geographic priorities and monthly trends, several challenges were identified in this deployment which are attributed to SMS. Attrition of panel member each survey round was approximately 50 – 70% each round and further complicating this issue, participants dropped in and out of rounds (i.e. reporting in round 1 and 3 but not reporting in round 2). Despite the suspected bias towards more wealth and literate households, food security levels reported via SMS were higher than results from F-2-F Emergency Food Security Assessments conducted in the three countries within a similar time frame. A few cases of "flat-lining" or repeated digits to answers were suspected.

Additionally, a mode experiment between SMS and IVR was conducted in Montserrado County, Liberia for the month of June 2015. Liberia experiment allowed comparison of IVR and SMS among a small sample of households in Liberia (125 per group). The study was conducted in the summer of 2015. Findings suggested two coping strategy variables showed differences larger than would be expected by random chance.

At present, WFP is conducting an extensive review of MVAM and comparison to traditional data sources collected during the Ebola crisis for future publication. Key exploration will include: 1) weighting techniques to adjust for biases due to SMS 2) optimal survey design (cross sectional vs. panel) given challenges of attrition and irregular participation 3) quality control procedures to identify responses lack internal consistency or in a small number of cases, "flat-lining" suspected.

3.6. General lessons learned across studies and mVAM projects

These lessons can be crystalized as follows:

Cell phone estimates of food insecurity are higher than traditional F2F probably household survey estimates. The nature of the differences varies according to the level of food insecurity with populations having lower food security reporting food insecurity levels more consistently. This suggests that using cell phone monitoring in chronically food insecure populations might be more appropriate than monitoring in transitory/acute food insecurity settings or among the more privileged segments of populations.

Response and attrition levels are dramatically variable across settings, suggesting the need for formative research before designing/ implementing high frequency monitoring systems. This should include cell phone use patterns of target populations, variation in access and use of vulnerable groups, cultural norms in cell phone use, determinants of cell phone time access, determinants of the ability of target populations to respond due to financial or cultural constraints.

Survey design must be iterative and piloting is crucial. A mobile-based survey has more moving parts and less degrees of control than a traditional F2F survey. The two key differences with mobile-based surveys is the use of stratification as opposed to clustering and the sampling frame of mobile subscribers is often starkly different than the ideal census estimates. The survey designer must carefully iterate over stratification strategies and post-stratification variables that will produce the most representative sample from the given sample frame. Furthermore, without an enumerator present to verify answers or explain questions within the context of the home, the anthropological variables (culture, context, incentives to misrepresent, etc.) matter even more. The questionnaire must account for these variables with careful wording and choice of questions in and of themselves.

The most important of the aforementioned 'anthropological' variables is trust. The respondent must feel that their identity will be protected and they have no need to worry of any repercussions, its best to be truthful because there is no incentive to falsify information, and the activity is not a waste of time but will actually be used to help their community. Time and time again the altruism by far is the biggest driver of response, not material incentives. This is one of many reasons why two-way communication with respondents is very useful.

The growing use of mobile money to intervene in humanitarian settings will affect the design and implementation of high frequency monitoring. As the monetary benefits of response patterns become clearer to target populations, the likelihood of bias will increase. Also, mobile money transfers are affecting cell phone use patterns. Therefore, formative research continues to be a priority.

Developing a deliberate learning strategy and agenda is critical for the immediate future while the appropriate use of mobile high frequency monitoring is emerging. The WFP experience suggests that mVAM has proven its utility for food security management despite its limitations. Through continuous learning that incorporates field lessons learned and experiments, dynamic information strategies that guide interventions to improve food security can be designed.

The emphasis on learning enables mVAM to undertake adaptive management of its high frequency monitoring projects, which means adjusting sampling procedures, modality, indicators, item construction, analysis and reporting according to context.

There are at least five scenarios that merit specific consideration:

1. Situations where face-to-face interviews are not possible or feasible such as Ebola and severe conflict: in these cases, mobile strategies might be the only option for WFP to access information about difficult to reach populations. We believe, however, that mobile strategies in these contexts also might include multiple method techniques such as in-depth interviews with key informants, key indicator surveys and situational awareness monitoring through open-ended questions and an iterative data collection approach. A mix of panel and repeated cross-sectional approaches might be considered. We suggest that randomized experiments would work well in this context at some additional cost.

2. Situations where vulnerable populations are on the move, including cross-border, such as in the important examples of the Horn of Africa and the Sahel. Mobility introduces challenges to mobile cellular access. MVAM can focus further on

developing methods and approaches to better monitor vulnerable populations on the move. A single data collection effort might include more than one modality to best accommodate the intended participants.

3. Dynamic camps with frequent and/or large scale in and out movement: this is another example of a prominent vulnerable group of interest to WFP. Like the second scenario above, mobility may present specific challenges. However, mobile technology can be better harnessed to address this challenge. Again, here, a mix of panel and repeated cross-sectional designs should be considered. The importance of contrasting camp residents and those moving out of camps is an important consideration.

4. Stable refugee and IDP camps: these have been traditionally monitored through face-to-face interviews. Some combination of face-to-face and mobile techniques might be most appropriate for providing better information for these groups. Formative research here might focus on the effects of testing and/or gaming bias.

5. Stable vulnerable geographies: mobile technologies can provide better access to a broader geographic area. The geography of the responses that can be automatically collected in a random call cross-section has enormous potential to contribute to a more refined analysis. For example, the responses could be compared to a recent health survey in a specific district based on location or seasonal migration could be included based on where the responses come from over time. Because of the efficiencies of SMS or IVR data collection, it may also be possible to sample a wider demographic as a comparison group for assessment of particularly vulnerable places or for WFP beneficiaries.

4. Conclusion

The experience of mVAM suggests that while mobile monitoring holds great promise to improve timely access to important food security for decision support in humanitarian settings, several methodological aspects including mode effects, operator effects, respondent bias and attrition need be addressed to increase the confidence and applicability of information. MVAM will continue experimenting and learning from subsequent deployments. Where possible, mVAM will also continue to develop formal and informal networks to further refine it's remote data collection initiatives and remain on the edge of innovation.

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