

Can mobile phone-based household surveys in rural Papua New Guinea generate information representative of the population surveyed?

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RESEARCH OVERVIEW

Conducting household surveys through face-to-face interviewing in rural Papua New Guinea is beset with difficulties and high costs. With phone network coverage spreading across PNG, using mobile phones to obtain information from respondents can allow such surveys to be done more quickly and at significantly lower cost. However, not all rural households own mobile phones. In this Project Note, an assessment is made of whether survey information collected by calling respondents on their mobile phones will be representative of the population surveyed or, rather, might be subject to systematic biases. This assessment is done by analyzing the characteristics of households in four rural areas of PNG that were interviewed in a field survey in mid-2018. For the analysis, the survey households were disaggregated into two groups based on whether they own a mobile phone.

Mobile phone ownership is found to be closely associated with a range of household characteristics. Consequently, one cannot assume that the sample for a mobile phone-based survey in rural PNG will be representative of the broader population. Many inferences on the rural population drawn from analysis of household data obtained from such a phone-based survey will be biased.

However, from the standpoint of monitoring food security and related conditions across rural PNG, the food security-related characteristics of mobile phone-owning households in the 2018 survey are not statistically different from those of households that do not own a mobile phone. Consequently, a relatively good indication of the food security and related conditions of communities across rural PNG can be obtained using mobile phones to conduct such surveys.

INTRODUCTION

Conducting individual and household surveys through face-to-face interviewing in rural Papua New Guinea

(PNG) is beset with difficulties. Travel to remote communities is costly, time consuming, and frequently impossible due to floods, landslides, or local conflict obstructing the routes. Most communities across the country view strangers with suspicion, so enumeration teams must invest time and resources in engaging with local leaders to obtain their agreement and support so that community members can be surveyed. Conflict between local communities may erupt without warning as enumeration teams are working, forcing the teams to leave the area until it is sufficiently safe to continue with the survey. Certain areas may be off-limits to any enumeration at all. These challenges in conducting survey fieldwork across rural PNG result in very high costs per household interviewed, a high risk of non-sampling errors in the data obtained, and survey implementers not using the total populations in the areas surveyed as the strata from which the survey sample is chosen.

With expanding mobile phone coverage across PNG and a growing share of households having the devices,¹ using mobile phones to obtain information from respondents offers a means to conduct household surveys more quickly and at significantly lower cost than is possible through face-to-face interviewing. However, not all rural households in PNG own mobile phones. In this Project Note, an assessment is made of whether information collected from rural households in PNG by calling them on their mobile phones will be representative of the population surveyed or, rather, due to patterns of mobile phone ownership among rural households, the information generated might be subject to systematic biases. This assessment is done by analyzing the characteristics of households in four rural areas of PNG who were interviewed in a field survey in mid-2018 – the Papua New Guinea Household Survey on Food Systems.² Among the information collected was that on mobile phone ownership by the surveyed households. The analysis reported on here examines whether there are significant differences between the characteristics of survey households that own at least one mobile phone and those that do not. Significant differences in

¹ PNG's population in 2019 is estimated to be 8.5 million. Mobile phone connectivity in the country is currently estimated at 2.7 million connections (GSMA Intelligence, <https://www.gsmainelligence.com/research/2019/04/the-mobile-economy-pacific-islands-2019/747/>).

² The Australian Department of Foreign Affairs and Trade (DFAT) provided funding for the survey implementation and analysis. World Vision-PNG played an important role in the survey fieldwork, supporting Tebbutt Research as their teams of enumerators implemented the survey. The support of the staff members involved with the survey at these various agencies is gratefully acknowledged. Thanks also to IFPRI colleagues Emily Schmidt, Gracie Rosenbach, Brian Holtemeyer, and Rachel Gilbert for their work with and continuing guidance on the use of the 2018 survey data set.

household characteristics between these two groups may call into question how well a mobile phone-based survey can capture information on the full population in a survey area and not simply on the sub-population made up of mobile phone-owning households.

THE MOBILE VULNERABILITY AND MAPPING (mVAM) MONITORING APPROACH OF THE WORLD FOOD PROGRAMME

The motivation for this analysis is the mobile phone-based survey program of the World Food Programme (WFP) in PNG to monitor food insecurity – the mobile Vulnerability and Mapping (mVAM) approach. Since 2013, WFP has used mVAM to monitor food security and other factors affecting nutrition, diets, and household livelihoods in over two dozen countries around the world.³ In PNG, six mVAM surveys were implemented between 2016 and 2018 in partnership with a local mobile phone service provider, Digicel PNG (Table 1).

The mVAM survey respondents were randomly selected from Digicel’s database of mobile phone subscribers for each Local Level Government (LLG). For the first four surveys, 19 respondents were to be interviewed in each LLG, while for the two earthquake-related surveys in 2018, 50 respondents were sought in each LLG. However, these targets could not always be met due to insufficient subscribers being available to be reached by mobile phone in each location during the period of enumeration for each survey.

Digicel PNG operators were used to conduct the survey using short and simple questionnaires provided in Tok Pisin and English languages. Questionnaire modules common to the first four mVAM surveys included information on the respondent, the community food security situation, the recent food security experience of the respondent’s household and the resources they might employ to cope with food insecurity, and the local availability of humanitarian assistance. The earthquake-related surveys included many of the same questions as earlier surveys, but were more focused on capturing information on community conditions more generally, rather than on the experience of the respondent’s household that earlier surveys examined.

In the description in each mVAM report of the survey methods used, the limitations that a household survey in PNG based on mobile phone enumeration will face are highlighted. These include that members of wealthier households and men are more likely to be respondents than poorer households or women simply because members of wealthier households and men are more likely to own a mobile phone. The reports for both mVAM surveys of 2017 note that only a quarter of survey respondents were women.

To better understand the biases that may emerge in the information collected through mVAM mobile phone-based surveys in PNG, WFP asked the International Food

Table 1: mVAM monitoring surveys of the World Food Programme in Papua New Guinea, 2016 to 2018

Survey period	Focus areas, motivation	Local Level Governments surveyed	Mobile phone owners interviewed
Jan. to Feb. 2016	Areas identified by National Disaster Center as affected by drought associated with the 2015/16 El Niño Southern Oscillation (ENSO) event	231	3,708
Nov. to Dec. 2016	Follow-up to earlier ENSO-related survey, expanded to cover entire country	326	4,708
Apr. to Jun. 2017	Nationwide survey to establish a national baseline for monitoring food security and livelihoods	326	4,490
Nov. to Dec. 2017	Nationwide follow-up survey to monitor food security and livelihoods	326	4,450
Mar. to Apr. 2018	Emergency assessment in areas affected by 26 Feb. magnitude 7.5 earthquake – Hela, Southern Highlands, Western, and Enga provinces	31	1,534
Jun. to Sep. 2018	Monitoring of recovery in areas affected by 26 Feb. earthquake – Hela, Southern Highlands, and Western provinces	35	1,806

Source: mVAM PNG survey reports from http://vam.wfp.org/sites/mvam_monitoring/papua_new_guinea.html.

Policy Research Institute (IFPRI) to analyze data collected in the 2018 Papua New Guinea Household Survey on Food Systems. This survey was implemented by IFPRI with its partners in communities in four rural areas of lowland PNG. As this was a multi-topic household survey, the survey data can be used for analysis of how significant differences on a broad range of household characteristics are between households that own mobile phones and those that do not. Where significant differences in household characteristics are seen, insight is gained into likely areas of bias in the information collected using mobile phones for household surveys in rural PNG.

THE PAPUA NEW GUINEA HOUSEHOLD SURVEY ON FOOD SYSTEMS, 2018

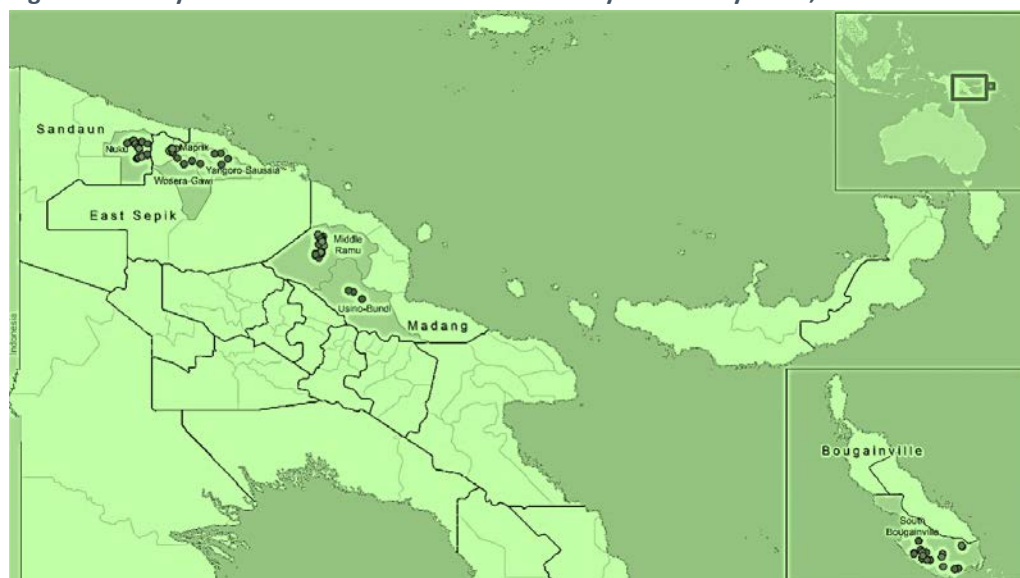
Between May and July 2018, IFPRI and its partners implemented the survey in four areas of PNG (Figure 1):

- Autonomous Region (AR) of Bougainville in South Bougainville district in the Siwai and Buin areas at the southern end of the island,
- Madang province in Middle Ramu and Usino-Bundi districts, a remote area on the Ramu River only accessible by boat,
- East Sepik province in Maprik, Yangoro-Saussia, and Wosera-Gawi districts near Maprik town or near the main road from Wewak, and
- West Sepik (Sandaun) province in Nuku district.

The design of the survey involved interviewing 15 randomly selected households in 70 communities

³ See http://vam.wfp.org/sites/mvam_monitoring. mVAM reports for PNG and a description of the methodology used in PNG are available at http://vam.wfp.org/sites/mvam_monitoring/papua_new_guinea.html.

Figure 1: Survey communities – PNG Household Survey on Food Systems, 2018



Source: Based on data from the Papua New Guinea Household Survey on Food Systems, 2018.

selected for enumeration. Two questionnaires were used: a household questionnaire and a community questionnaire that was administered to a small group of leaders in each survey community. The final survey sample consists of 1,026 households.⁴

The survey investigated the food systems of rural households and how they assure sufficient food to meet the nutritional needs of their household members. The household questionnaire focused on agricultural production systems, household livelihoods, and health outcomes and included modules on production; consumption and expenditure; labor activities (farm and non-farm); nutritional status; and the experience of the survey households with recent agricultural production or other shocks that impacted their livelihoods. However, given the challenges of conducting a representative survey in rural PNG discussed in the introduction, the survey information collected is not representative at the provincial or even district level. Communities in the most remote areas of the districts in which the survey was conducted were not part of the survey strata. Nonetheless, the survey data provide insights into the characteristics and livelihoods of rural households across a spatially expansive set of communities.

SURVEY ANALYSIS RESULTS

Mobile phone network coverage

Mobile phone network coverage in rural PNG, while expanding, is still not universal. In administering the community questionnaire, community leaders were asked whether the community had reliable mobile phone network service (Table 2).

All four study areas do not have complete mobile phone coverage. The remote study area on the Ramu River in Madang province has the most limited coverage with only six of the 20 communities enumerated there reporting having reliable mobile phone network service. In the

other study areas, around one-quarter of communities had no or unreliable mobile phone network coverage.

In terms of household characteristics, there is not much difference between survey households that reside in communities that have reliable mobile phone network service and those that do not. Households with the youngest household heads are more commonly found in communities with unreliable mobile phone network service, but these make up only 3.2 percent of sample households. Female-headed households also

are somewhat more likely to be located in communities that do not have reliable mobile phone network coverage. However, at least for the four study areas of the 2018 survey, whether or not mobile phone network service is available within the survey communities does not appear to introduce substantial bias in how representative a mobile phone-based survey sample would be of the population of those study areas.

Mobile phone ownership

Mobile phone ownership by the survey households is reported in Table 3 and Figure 1, disaggregated by location, sex of household head, age of household head,

Table 2: Survey communities and survey households in communities with reliable mobile phone network service

	Survey communities count	Survey communities percent	Survey households percent
All	45	65.2	65.0
AR of Bougainville	13	76.5	75.7
East Sepik	12	75.0	75.3
Madang	6	30.0	29.1
West Sepik	14	87.5	87.4
Male-headed			65.6
Female-headed			59.6
Household head age under 25			48.4
Household head age 25 to 35			63.1
Household head age 36 to 64			67.2
Household head age 65 or older			67.1
Poorest consumption quintile			67.0
2 nd poorest consumption quintile			65.2
Middle consumption quintile			60.5
2 nd richest consumption quintile			65.2
Richest consumption quintile			67.2
<i>Observations</i>		69	1,020

Source: Analysis of data from the Papua New Guinea Household Survey on Food Systems, 2018.

Note: No information on mobile phone coverage was obtained for one survey community in East Sepik with six survey households.

⁴ A detailed report on the survey, including specific on the design of the sample, has been published as an IFPRI Discussion Paper - <http://www.ifpri.org/publication/papua-new-guinea-survey-report-rural-household-survey-food-systems>.

Table 3: Number of mobile phones owned, percent of survey households

	none	one	more than one	observations
All	54.1	34.6	11.3	1,026
AR of Bougainville	58.2	35.5	6.4	251
East Sepik	30.6	46.1	23.3	245
Madang	67.5	26.0	6.5	292
West Sepik	57.6	32.4	10.1	238
Male-headed	52.3	36.0	11.7	922
Female-headed	70.2	22.1	7.7	104
Household head age under 25	58.1	29.0	12.9	31
Household head age 25 to 35	57.0	35.3	7.8	309
Household head age 36 to 64	51.9	35.0	13.2	578
Household head 65 or older	67.1	25.7	7.1	70
Poorest consumption quintile	73.8	22.8	3.4	206
2 nd poorest consumption qtile	60.0	35.6	4.4	205
Middle consumption quintile	59.0	28.3	12.7	205
2 nd richest consumption qtile	45.9	39.5	14.6	205
Richest consumption quintile	31.7	46.8	21.5	205
Community with reliable phone network service	50.1	37.3	12.7	663
Community without reliable phone network service	61.6	30.0	8.4	357

Source: Analysis of data from the Papua New Guinea Household Survey on Food Systems, 2018.

and a household consumption-based indicator of household wealth. Just over half of all of the surveyed households do not have a member who owns a mobile phone. Phone ownership is not closely correlated with mobile phone network coverage. Even though the communities surveyed in Bougainville, East Sepik and West Sepik reported similar levels of access to mobile phone network coverage, households surveyed in East Sepik are about twice as likely to own a mobile phone than are survey households in Bougainville or West Sepik. Not surprising, the share of survey households owning mobile phones is lowest in the remote study area in

Madang province that has poor mobile phone network connectivity.

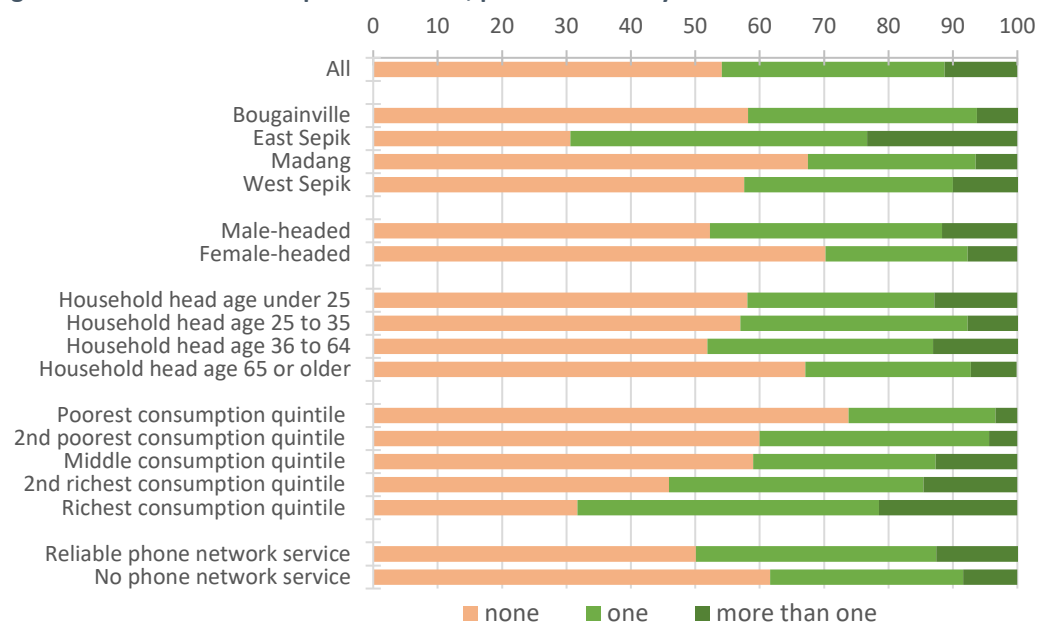
Households headed by women are less likely to own mobile phones than are households headed by men. The age of the household head is weakly associated with mobile phone ownership – as the age of the household head increases, households are more likely to own a phone. However, households with heads aged 65 years and older are significantly less likely to own a mobile phone.

The association between mobile phone ownership and household welfare, as measured by the value of average daily household consumption per capita, is as expected. Poor households are unlikely to own phones – only a quarter of households in the poorest 20 percent (quintile) of households do so. The share of households owning mobile phones rises as the welfare level of the households rise. Over two-thirds of the richest quintile of rural households own a phone.

We find relatively high mobile phone ownership among households resident in communities without reliable mobile phone network service. Further investigation is needed to better understand how these phones are used. It may be that some of the communities reporting unreliable network service nonetheless are able to connect at times to distant network towers. However, it should be expected that conducting a mobile phone-based survey in such communities will be difficult.

The differences for a range of household characteristics between mobile phone-owning survey households and those that do not own a phone are examined in Table 4 in a univariate analysis. Most of the household characteristics in Table 4 are presented as the share possessing that characteristic of all households in the three categories – all survey households, mobile phone-owning households, and those without phones. The first column of numbers in Table 4 presents the average for the household characteristic for all survey households.

Figure 1: Number of mobile phones owned, percent of survey households



Source: Analysis of data from the Papua New Guinea Household Survey on Food Systems, 2018.

The next two columns show the average for mobile phone-owning households and for households not owning a phone, respectively. The last two columns present the result of a means comparison test to assess whether any difference in mean household characteristics between households that do and do not own mobile phones is statistically significant.

Based on the 2018 survey sample, the results in Table 4 suggest that if a large number of mobile phone-owning households

in rural PNG were selected as the sample for a survey, the share of the sample made up of respondents from East Sepik would not be representative of the share of the rural PNG population make up by East Sepik residents, but would be significantly greater. Similarly, mobile phone survey respondents from Madang would make up a much smaller share of the survey sample than their population share would indicate that they should. However, in Bougainville and West Sepik a mobile phone-based sample would be relatively representative of the overall 2018 survey sample.

It is not surprising to find that mobile phone ownership is quite strongly associated with communities that have reliable phone network service. Although even in such

communities, a large share of households do not own a mobile phone.

The results indicate that a mobile phone-based survey sample would not include adequate numbers of female-headed households. Although such households are not very common in the four study areas for the 2018 survey, most of them were found not to own mobile phones. If the use made of mobile phone-based survey data will require close consideration of the sex of the household head to guide decisionmaking, use of the data would not be appropriate, since it will under-represent female-headed households within the population as a whole.

The principal findings for the other variables examined in Table 4 include:

Table 4: Differences in characteristics of all sample households between those that own at least one mobile phone and those that have none

	All	Mobile phone owners	No mobile phone	Means comparison	p-value
Autonomous Region of Bougainville, % of all survey sample households	24.5	22.3	26.3	ns	0.136
East Sepik, %	23.9	36.1	13.5	***	0.000
Madang, %	28.5	20.2	35.5	***	0.000
West Sepik, %	23.2	21.4	24.7	ns	0.221
Community with reliable phone network service, % (obs. = 1,020)	65.0	70.7	60.1	***	0.000
Female headed households, %	10.1	6.6	13.2	***	0.001
Household head age under 25, %	3.0	2.8	3.2	ns	0.653
Household head age 25 to 35, %	30.1	28.2	31.7	ns	0.227
Household head age 36 to 64, %	56.3	59.0	54.1	ns	0.110
Household head age 65 or older, %	6.8	4.9	8.5	**	0.023
Poorest consumption quintile, %	20.1	11.5	27.4	***	0.000
2 nd poorest consumption quintile, %	20.0	17.4	22.2	*	0.058
Middle consumption quintile, %	20.0	17.8	21.8	ns	0.114
2 nd richest consumption quintile, %	20.0	23.6	16.9	***	0.008
Richest consumption quintile, %	20.0	29.7	11.7	***	0.000
Household size, average, number	5.90	5.93	5.88	ns	0.768
Working age members (ages 16 to 64 years), average % share of household members (obs. = 1,025)	52.8	55.0	51.0	***	0.002
Sex ratio, males: females	1.07	1.10	1.04	n/a	n/a
No formal education for household head, %	9.2	4.2	13.3	***	0.000
Primary education highest educational attainment of household head, %	49.7	45.6	53.2	**	0.017
Secondary or tertiary education highest educational attainment of household head, %	41.1	50.1	33.5	***	0.000
No formal education is highest educational attainment for any individuals age 5 years and older in household, %	1.2	0.2	2.0	***	0.009
Primary education is highest educational attainment for any individuals age 5 years and older in household, %	22.8	14.0	30.3	***	0.000
Secondary or tertiary education is highest educ. attainment for any individuals age 5 years and older in household, %	76.0	85.8	67.7	***	0.000
Agriculture is household head's primary occupation, %	75.0	69.2	79.8	***	0.000
Non-farm activity is household head's primary occupation, %	22.5	28.7	17.3	***	0.000
Household members engage in wage employment, %	8.5	10.0	7.2	ns	0.113
Household members engage in non-farm enterprises, %	38.8	46.5	32.3	***	0.000
Household members include a current migrant who still is considered a part of the household, %	17.3	21.0	14.1	***	0.003
Household owns solar panel or electricity generator, %	62.9	74.5	53.0	***	0.000
Household Dietary Diversity Score, foods consumed in past 24 hours out of 16 food groups	4.96	5.09	4.85	ns	0.111
Worried about household food insecurity in past four weeks, %	44.7	42.3	46.8	ns	0.140
Households with child under five years of age, %	68.6	66.7	70.3	ns	0.216
Stunted child in household, % of households with child under five years of age for whom height data was collected (obs. = 628)	38.9	36.2	40.9	ns	0.233

Source: Analysis of data from the Papua New Guinea Household Survey on Food Systems, 2018.

Note: Except where noted, observations: 1.026 sample households. ns = not significant; * = p < 0.10, ** = p < 0.05, *** = p < 0.01. Not applicable = n/a.

- The age of the household head generally is not correlated with mobile phone ownership, except for households with heads aged 65 years and older, who tend not to own a phone.
- As noted earlier in Table 3 and Figure 1 and recognized in the mVAM reports for PNG, richer households are more likely to own mobile phones.
- The household size of mobile phone-owning households does not differ significantly from the size of households without a phone, suggesting that mobile phone-based surveys will provide reasonable estimates of household size for the broader population.
- Mobile phone-owning households have a greater share of working age (ages 16 to 64 years) household members than households that do not own phones.
- As seen by their respective sex ratios, mobile phone-owning households tend to have a greater share of males among their members than households without phones.
- Attainment of at least some secondary education by either the household head or by any member of the household is strongly associated with the household owning a mobile phone. In contrast, a mobile phone-based survey sample will under-represent those households in which either the household head did not achieve an educational level above primary school or the highest educational attainment of any household member was not above primary.
- Among households that do not own a mobile phone, the primary occupation of the household head is more likely to be in agriculture than is the case for all rural households. Consequently, a mobile phone based-survey will under-represent the importance of agriculture in the livelihoods of rural households. In contrast, households whose heads have a primary occupation outside of agriculture are more likely to own a mobile phone.
- With regards to the type of employment outside of agriculture, households with members engaged in wage employment are no more likely to own a mobile phone than is the general population. In contrast, households with members engaged in some form of non-farm enterprise are more likely to own a phone.
- The 2018 rural household survey asked about household members who recently migrated for work, schooling, or other reason, but were still considered to be part of the household. Households with such members are more likely to own a mobile phone.
- Households that own a solar panel or generator are more likely to own a phone, since these sources of electricity for the household sharply reduce the challenges associated with recharging phone batteries in rural communities.

Finally, household characteristics associated with food security, diet, and the nutritional status of household

members were examined – dietary diversity; whether the household experienced food insecurity in the past four weeks; households with members under five years of age; and whether any of those underfives are stunted in their growth, which is an indicator of chronic undernutrition. The mean values for all these characteristics showed no significant differences between mobile phone-owning households and those without phones. This is an encouraging finding if the mVAM approach is to continue to be used for monitoring food security and related outcomes across rural PNG, as it suggests that a sample made up of mobile phone-owning households will be representative of the population as a whole for these measures.

Many of the household characteristics examined in the univariate analytical framework in Table 4 are used as explanatory variables in a multivariate logistic regression analysis, the results of which are presented in Table 5. The dependent variable for this logistic analysis is whether the survey household owns a mobile phone.

The coefficients for each explanatory variable in the logistic regression are presented as odds-ratios. The value of the odds-ratio is the chance of the dependent variable changing from 0 to 1 (a positive outcome in statistical terms) as a result of a one-unit positive change in the explanatory variable – that is, in the case here, the chance that the household would own a mobile phone with a one-unit change in the explanatory variable. In contrast to the presentation of the results of most regression-based models for which a statistically insignificant coefficient is zero, a statistically insignificant odds-ratio is one – that is, a 1-to-1 or even chance. Statistically significant odds-ratios that are less than one represent an inverse relationship between the independent and dependent variable, while odds-ratios greater than one represent a direct relationship.

Overall the multivariate analysis in Table 5 confirms the patterns seen in the results of the univariate analyses presented in Table 4. Some of the household characteristics with low frequencies which showed significant differences between mobile phone-owning households and those without phones in the univariate analysis are not shown in the logistic regression analysis results to be significant (e.g., household head age 65 years or older) or the level of statistical significance is reduced (e.g., female-headed household).

However, the strong direct relationships that were seen in the univariate analysis between mobile phone ownership and being resident in East Sepik, being in the wealthier consumption quintiles, the household head having been educated to at least secondary school level, the household head being principally engaged in a non-farm occupation, and the household having a non-farm enterprise as part of its livelihood portfolio are confirmed in the results of the logistic analysis. Similarly, the strong inverse relationships continue to be seen between mobile phone ownership and a household being resident in the remote study area in Madang province, being in the

Table 5: Logistic regression analysis of mobile phone ownership by household, odds-ratios

Dependent variable: Household owns a mobile phone, 0/1	Odds-ratio	Standard error	z-score	p-value	
East Sepik, 0/1	3.634	0.836	5.61	0.000	***
Madang, 0/1	0.581	0.139	-2.27	0.023	**
West Sepik, 0/1	0.993	0.229	-0.03	0.976	ns
Female headed households, 0/1	0.604	0.158	-1.93	0.053	*
Household head age under 25 years, 0/1	0.791	0.366	-0.51	0.612	ns
Household head age 25 to 35 years, 0/1	0.902	0.170	-0.55	0.585	ns
Household head age 65 years or older, 0/1	0.659	0.203	-1.35	0.177	ns
Poorest consumption quintile, 0/1	0.613	0.148	-2.03	0.042	**
2 nd poorest consumption quintile, 0/1	0.921	0.205	-0.37	0.710	ns
2 nd richest consumption quintile, 0/1	1.523	0.337	1.90	0.057	*
Richest consumption quintile, 0/1	2.660	0.620	4.20	0.000	***
Household size, number	1.056	0.042	1.36	0.173	ns
No formal education for household head, 0/1	0.450	0.134	-2.68	0.007	***
Secondary or tertiary education highest educational attainment of household head, 0/1	1.606	0.268	2.83	0.005	***
Non-farm activity is household head's primary occupation, 0/1	1.681	0.305	2.86	0.004	***
Household members engage in wage employment, 0/1	0.897	0.227	-0.43	0.667	ns
Household members engage in non-farm enterprise, 0/1	1.508	0.231	2.68	0.007	***
Household members include a current migrant (still considered part of household), 0/1	1.502	0.288	2.12	0.034	**
Household owns solar panel or electricity generator, 0/1	2.057	0.327	4.54	0.000	***
Worried about household food insecurity in past four weeks, 0/1	0.965	0.158	-0.21	0.830	ns
Households with child under five years of age, 0/1	0.806	0.140	-1.24	0.216	ns
Constant	0.228	0.074	-4.56	0.000	***
Observations	1,020				
Pseudo R-squared	0.187				

Source: Analysis of data from the Papua New Guinea Household Survey on Food Systems, 2018.

Note: ns = not significant; * = $p < 0.10$, ** = $p < 0.05$, *** = $p < 0.01$.

An explanatory variable on the household being resident in community with reliable phone network service cellphone coverage was not included in the regression, as it was found to be somewhat collinear with the Madang variable.

Reference categories:

- Study area province: Autonomous Region of Bougainville
- Age of household head: Household head age 36 to 64 years
- Consumption quintile: Middle (third) quintile
- Educational attainment of household head: primary education

poorest consumption quintile, and the household head not having received any formal education. The logistic regression analysis also confirms that a survey sample selected on the basis of mobile phone ownership can be expected to be reasonably representative of the wider population in terms of age of household head; household size; participation in wage employment; and, most crucially for the analysis here, recent experience of food insecurity.

DISCUSSION

The motivation for the analysis presented in this report was to assess whether information collected from a randomly selected set of rural households in PNG by calling them on their mobile phones will be representative of the broader population of the area surveyed.

Mobile phone connectivity is not assured in rural PNG. Communities in many remote areas of the country, including about one-third of the communities that participated in the 2018 survey, cannot be reliably reached by mobile telephone. The analysis showed that, at least in the four study areas of the 2018 survey, whether a survey community had reliable mobile phone

network coverage is not associated with any key differences in the characteristics of survey households. However, there is no reason to assume that this will always be the case. Consequently, this broader issue of access to mobile phone communication infrastructure remains a possible source of bias in how representative a mobile phone-based survey sample might be of the broader population of other study areas.

The analysis of mobile phone ownership by the 2018 survey households, the main analysis reported on here, shows that ownership is quite closely associated with a range of household characteristics, including location, sex of household head, educational attainment within the household, employment and livelihood strategies pursued by household members, and the relative well-being of the household. Consequently, one cannot assume that the sample for a mobile phone-based survey in rural PNG, even if respondents are randomly selected from mobile phone subscriber lists, will be representative of the broader population. A mobile phone approach to conducting living standards measurement or other integrated multi-topic household surveys cannot be recommended for use in rural PNG, particularly if the data

will be used to guide the design of programs that will be targeted to individuals or households based on their characteristics. Many inferences drawn from analysis of household data obtained from such a phone-based survey will be biased. Use of such data would suggest that the rural population of PNG is resident in reasonably well-connected areas, is more male, is more educated, is more engaged in economic pursuits outside of farming, and is wealthier than it really is.

However, from the standpoint of monitoring food security and related conditions across rural PNG, as is the objective of the mVAM monitoring approach of WFP, the results of this analysis confirm the usefulness of employing a sample made up of randomly selected mobile phone owners to obtain information on both household and local community conditions related to food security. The analysis shows that the food security-related characteristics of mobile phone owning households in the 2018 rural household survey are not statistically different from those of households that do not own a mobile phone. This is likely because the

principal sources of food insecurity for most households in rural PNG are linked to livelihood shocks that are covariate in nature and affect all households in a community, regardless of demographic make-up, educational attainment, wealth level, or whether they own a mobile phone. In addition, although food systems across rural PNG are extremely diverse, diets within communities are quite homogenous across households.

Consequently, particularly if the questionnaire is designed so that the respondent is asked to consider conditions in their community as a whole, rather than only that of their own household, a relatively good indication of the food security and related conditions of communities across rural PNG can be obtained using mobile phones to conduct such surveys. The mVAM approach of calling mobile phone subscribers to monitor food insecurity across PNG has much to commend it, so long as the limits to the inferences that can be drawn for the population as a whole from the data collected are respected.