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Research Article

The effect of airtime incentives to improve participation in noncommunicable disease interactive voice response surveys: randomized controlled trials in Colombia and Tanzania

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Abstract

Objective: We assessed whether airtime incentives can improve cooperation and response rates for a noncommunicable disease interactive voice response survey in Colombia and Tanzania.
Methods: Participants were randomized to four arms: (a) no incentive; (b) 1X incentive, where X equals to 5000 Colombian Pesos (US$1.35) or 3000 Tanzanian shillings (TSh; US$1.29); (3) 2X incentive; or (4) lottery incentive of 50 000 COP (US$18.90) or 50 000 TSh (US$21.50), where the odds of winning the lottery were 1:20. Adults aged 18 years and older who possessed a functioning mobile phone were sampled using random digit dialling. We analyzed the primary outcomes, cooperation and response rates using a log binomial regression model as computed by the American Association of Public Opinion Research. Results: In Colombia, between October 15 to November 13, 2018, 125 745 phone calls were made. In Tanzania, 67 800 random digit dial phone calls were made from August 9 to 28, 2018. In Colombia, we observed significantly higher cooperation rates in the 1X, 2X and lottery incentive groups compared to control. Additionally, response rates were significantly higher in the 1X and 2X incentive groups but were significantly lower in lottery group compared to control. In Tanzania, both cooperation and response rates were significantly higher in the 1X, 2X and lottery incentive groups compared to control. Conclusion: Except for the lottery incentive arm in Colombia, which yielded a response rate lower than the control, the introduction of airtime incentives significantly improved cooperation and response rates in Colombia and Tanzania, with no notable variations between the incentive arms.

Keywords: interactive voice response; risk factor surveillance; noncommunicable disease; incentive; survey methodology; mobile phone surveys

INTRODUCTION

The impact of noncommunicable diseases (NCDs) is significantly higher in low- and middle-income countries (LMICs), where more than 75% of worldwide deaths are linked to NCDs. [1, 2]. To effectively prevent and control NCDs, it is crucial to prioritize surveillance and actively reduce exposure to risk factors [3]. However, many LMICs are unable to conduct timely and high-quality data collection and systematically track NCD risk factors [4]. With increasing global access to mobile phones, mobile phone surveys (MPSs) are being used more frequently in health research and surveillance as a supplementary method to household surveys and helping reach large sections of the LMIC population with shorter turnaround times and potentially lower costs [5].

MPSs can be delivered using short message service, computer-assisted telephone interviews and interactive voice response (IVR) [6]. An IVR survey makes participants enter responses to a prerecorded questionnaire using the keypad on a mobile phone that is associated to a particular numeric key or response (e.g. 'Press 1 if you agree to take the survey, press 2 if you disagree'). IVR surveys have been used to collect health data in high income countries and LMICs, and with the recent COVID-19 pandemic, there has been an uptake of IVR technology in LMICs for providing an alternate way to screen patients and share COVID-19 awareness and treatment messages [7]. IVR technology has also provided cancer awareness messages to patients and public through a small study in Uganda [8]. However, the utilization of these methods to gather population health estimates in LMICs is in its early stages [6, 9–12].

Given the relative nascency of the field, there is little evidence available regarding methods to enhance survey performance and representativeness specifically in LMIC settings [11]. In high income areas, increasing incentive amounts tend to lead to increased survey response rates up until a certain threshold [13].

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Table 1. Equations used to calculate survey rates

Survey rate	Equation
Contact rate 2	(I + P + R + O)/(I+ P + R + O + NC + *e*(UH + UO))
Response rate 4	(I + P)/(I+ P + R + O + NC + *e*(UH + UO))
Refusal rate 2	R/(I+ P + R + O + NC + *e*(UH + UO))
Cooperation rate 1	I/(I + P + R + O)

I, interview; P, partial interview; R, refusal/break-off; O, other; NC, noncontact; UH, unknown household; UO, unknown other; *e*, estimated proportion of unknown cases that were age-eligible.

Lottery incentives, which theoretically work by tempting participants with a larger payout but at reduced odds of receiving, have also been used, but their effect on response and cooperation rates is unclear and may be dependent on the survey mode (e.g. postal versus telephone versus web survey) [14]. In LMIC, there are limited studies that have examined the effect of varying incentive amounts and its structure (lottery or nonlottery) on survey participation. However, there is a larger evidence base that suggests incentives can improve healthcare utilization and vaccination [15, 16].

This objective of this study is to address these gaps by evaluating the effect of different airtime incentives (i.e. no incentive versus a fixed or lottery incentive) on cooperation and response rates of an NCD behavioural risk factor IVR survey in Colombia and Tanzania using two randomized controlled trials with random digit dial (RDD) sampling [17].

MATERIALS AND METHODS

Data collection

In 2017, our group conducted randomized controlled trials to assess the impact of two different airtime incentive amounts on cooperation and response rates of an IVR survey in Bangladesh and Uganda [18]. We adopted a similar study design to gather data in both Colombia and Tanzania, taking into account the respective mobile phone subscription rates of 131 per 100 people in Colombia and 82 subscribers per 100 people in Tanzania [19]. We employed RDD to sample participants [17]. The country codes for Colombia (57) and Tanzania (255) were followed by unique three-digit sequences that were specific to mobile network operators operating in each country. The remaining seven numbers were generated randomly to form a complete mobile phone number.

Respondents were randomized to one of four study arms: (1) no incentive; (2) 1X incentive, where X was equal to 5000 Colombian Pesos (COP; US$1.35 as of May 20, 2021) or 3000 Tanzanian shillings (TSh; US$1.29 as of May 20, 2021), hereby referred to as the low incentive arm; (3) 2X incentive, i.e. 10 000 COP (US$2.70) or 7000 TSh (US$3.01), hereby referred to as the medium incentive arm; or (4) lottery incentive of 50 000 COP (US$18.90) or 50 000 TSh (US$21.50), where the odds of winning the lottery were 1:20, hereby referred to as the lottery arm. Incentive amounts were guided by results from key informant interviews and country experiences in Colombia and in Tanzania complemented by focus groups. The denomination amount that was able to be transferred to participant's mobile phones across all mobile networks operating in the country also influenced the amounts chosen.

In both countries, similar to the previous study, IVR survey calls were placed from 8:00 AM to 8:00 PM local time [15]. To mask the origin of the phone call, a selected local phone number showed on the participant's caller display when called. The surveys were conducted as a one-time administration for each randomly selected mobile phone number. Eligible participants included those who were aged 18 or older. After receiving an introductory message that contained basic informed consent information, eligible respondents were asked to 'press 1' to signal their agreement to complete the IVR survey. The IVR platform (Viamo for Tanzania and engageSPARK for Colombia) automatically randomized participants to one of the four arms, each offering a different airtime incentive amount. Study participants were not masked as the survey introduction described the assigned airtime incentive according to their study arm. The study statistician, however, was blinded to the allocation.

The study was conducted, analyzed and reported in adherence to the guidelines provided by the Consolidated Standards of Reporting Trials (CONSORT) [20]. The protocol was approved by the institutional review boards of Johns Hopkins University Bloomberg School of Public Health, USA; the Institute of Public Health of Pontificia Universidad Javeriana, Colombia; the Ifakara Health Institute, Tanzania, and the National Institute for Medical Research of Tanzania. A comprehensive description of the methodology and research protocol has been documented in another publication [18]. The trials are registered with ClinicalTrials.gov, number NCT03772470.

IVR survey design

The RDD survey was offered in Spanish for participants in Colombia, and Kiswahili for Tanzania. The first part of the survey included introduction, age screening, consent and demographics modules. The remainder included five NCD modules that were groups of topically related questions on tobacco and alcohol usage, dietary habits, physical activity levels, as well as blood pressure and diabetes status (Supplementary Table S2–S3). These modules were randomized in order to reduce attrition bias. However, questions within each of these NCD modules were not randomized so as to preserve skip patters. Participants did not bear any costs (i.e. no personal airtime was used) by receiving and answering the IVR call and would take no more than 20 minutes to complete the IVR survey. Participants who completed the whole survey were automatically sent airtime incentives through the IVR platform as per their allocated study arm.

Outcomes

The primary outcomes were the cooperation rate and response rate, calculated using equations 4 and 1, respectively, as defined by the American Association for Public Opinion Research (AAPOR) [21]. Cooperation rate was determined by dividing the number of complete interviews by the total of complete, partial and noninterviews. The response rate was calculated by dividing the number of complete and partial interviews by the sum of complete and partial interviews, noninterviews and the estimated proportion of age-eligible unknowns. Secondary outcomes considered in the study encompassed contact and refusal rates [21].

Participants who answered at least four out of five NCD modules were classified as having completed interviews (I). Partial interviews (P) were categorized when participants answered one, two or three NCD modules. Noninterviews (R) were further divided into refusals or breakoffs. Refusals occurred when age-eligible participants terminated the survey at the consent question or failed to provide consent by pressing a button on their mobile phone keypad. Breakoffs referred to age-eligible participants who gave consent but did not complete an NCD module. Participants who initiated the survey but failed to answer the age eligibility

Table 2. Demographics of complete interviews by study arm in Colombia and Tanzania

	Colombia				Tanzania			
Demographic	**Control (*n* = 411)**	**Low incentive (*n* = 391)**	**Medium incentive (*n* = 399)**	**Lottery incentive (*n* = 406)**	**Control (*n* = 410)**	**Low incentive (*n* = 391)**	**Medium incentive (*n* = 404)**	**Lottery incentive (*n* = 401)**
Sex								
Male	193 (47.0)	189 (48.3)	190 (47.6)	174 (42.9)	313 (76.3)	273 (69.8)	293 (72.5)	287 (71.6)
Female	218 (53.0)	202 (51.7)	209 (52.4)	232 (57.1)	97 (23.7)	118 (30.2)	111 (27.5)	114 (28.4)
Age group (years)								
18–29	161 (39.2)	175 (44.8)	192 (48.1)	174 (42.9)	253 (61.7)	225 (57.5)	268 (66.3)	240 (59.9)
30–49	163 (39.7)	157 (40.2)	148 (37.1)	156 (38.4)	122 (29.8)	142 (36.3)	109 (27.0)	133 (33.2)
50–69	77 (18.7)	50 (12.8)	52 (13.0)	70 (17.2)	35 (8.5)	24 (6.1)	27 (6.7)	28 (7.0)
70+	10 (2.4)	9 (2.3)	7 (1.8)	6 (1.5)	0	0	0	0
Median age (IQR)	33 (25–46)	31 (25–42)	30 (23–41)	32 (25–45)	26 (22–35)	27 (22–35)	26 (21–33)	27 (22–34)
Education attempted								
None	5 (1.2)	10 (2.6)	3 (0.8)	5 (1.2)	27 (6.6)	30 (7.7)	34 (8.4)	40 (10.0)
Primary	58 (14.1)	57 (14.6)	62 (15.6)	61 (15.0)	194 (47.6)	216 (55.4)	191 (47.5)	190 (47.5)
Secondary	135 (32.9)	132 (33.9)	139 (34.9)	140 (34.5)	146 (35.8)	105 (26.9)	121 (30.1)	123 (30.8)
Technological	95 (23.1)	106 (27.2)	112 (28.1)	97 (23.9)	NA	NA	NA	NA
Tertiary or higher	118 (28.7)	85 (21.8)	82 (20.6)	103 (25.4)	41 (10.0)	39 (10.0)	56 (13.9)	47 (11.8)
Refused	0	1	1	0	2	1	2	1
Location								
Urban	306 (75.2)	269 (69.7)	291 (73.1)	298 (73.4)	227 (55.6)	218 (55.9)	242 (59.9)	232 (57.9)
Rural	101 (24.8)	117 (30.3)	107 (26.9)	108 (26.6)	181 (44.4)	172 (44.1)	162 (40.1)	169 (42.1)
Refused	4	5	1	0	2	1	0	0

Data are *n* (%) for complete interviews.

question were considered as unknowns (U). The estimated proportion of age-eligible participants (e) was calculated from among those who were screened for age eligibility but remained in an unknown status. Respondents who either indicated they were under 18 years old or whose phone numbers were dialled, but their phone number status could not be confirmed as active, were classified as ineligible. Refer to Table 1 for the AAPOR equations employed.

Statistical analysis

The estimation of sample sizes in both Colombia and Tanzania followed the same assumptions. With a cooperation rate of 30% in the control arm, 5% Type 1 error and 80% statistical power, a total of 376 participants were needed to complete an IVR survey in each of these arms. This sample size was necessary to detect a 10% difference in survey cooperation rates among the four study arms. The cooperation rate in the control arm came from a previously conducted study in Bangladesh [15]. In each country, considering the trial had four arms, the total sample size per trial consisted of 1504 complete surveys. Following the recommendation by the Rothman, sample sizes were not increased to account for multiple comparisons [22].

Using log binomial regression, we calculated risk ratios and corresponding 95% confidence intervals for contact, response, refusal and cooperation rates, with the control arm serving as the reference group [23]. Demographic characteristics of complete and partial interviews across the four study arms were compared using chi-square tests. The analyses for this study were conducted using STATA/SE 14.1 (Stata Corp, College Station, TX, USA). For all tests of statistical significance, an alpha of 0.05 was assumed.

RESULTS

In Colombia, 125 745 phone calls were made starting October 15 to November 13, 2018 (Fig. 1). The sociodemographic characteristics of the participants who completed the interviews were comparable across the control (*n* = 411), low incentive (*n* = 391), medium incentive (*n* = 399) and lottery (*n* = 406) groups (Table 2). Most complete interviews were from younger age groups between ages of 18 and 29 years old, 43.7% (*n* = 702), and 30 to 49 years old, 38.8% (*n* = 624). Males and females reported similar numbers of complete interviews. More than 50% of the participants who completed the interviews reported residing in an urban area. No significant differences in sociodemographic characteristics were observed between participants who completed the interviews and those who only partially completed them (Table S1). On average, participants took 9 minutes and 15 seconds [standard deviation (SD): 1 minute, 7 seconds] to complete the interactive voice response survey (Table 3).

In Tanzania, a total of 67 800 RDD phone calls were conducted between August 9 and August 28, 2018 (Fig. 2). Sociodemographic characteristics of participants who completed the interviews were comparable across the control (*n* = 410), low (*n* = 391), medium (*n* = 404), and lottery (*n* = 401) incentive groups (Table 2). Majority of complete interviews were aged 18 to 29 years old, 61.3% (*n* = 986), and male, 72.6% (*n* = 1166). The demographic characteristics between complete and partial interviews were similar (Supplementary Table S1). On average, participants took 12 minutes and 20 seconds to complete the IVR survey (Table 3).

The cooperation and response rates in Colombia were 43.4% and 7.6% in control, 61.8% and 9.4% in low, 64.7% and 9.6% in medium and 58% and 5.5%, respectively, in lottery incentive groups (Table 4). Cooperation rates in Colombia were significantly

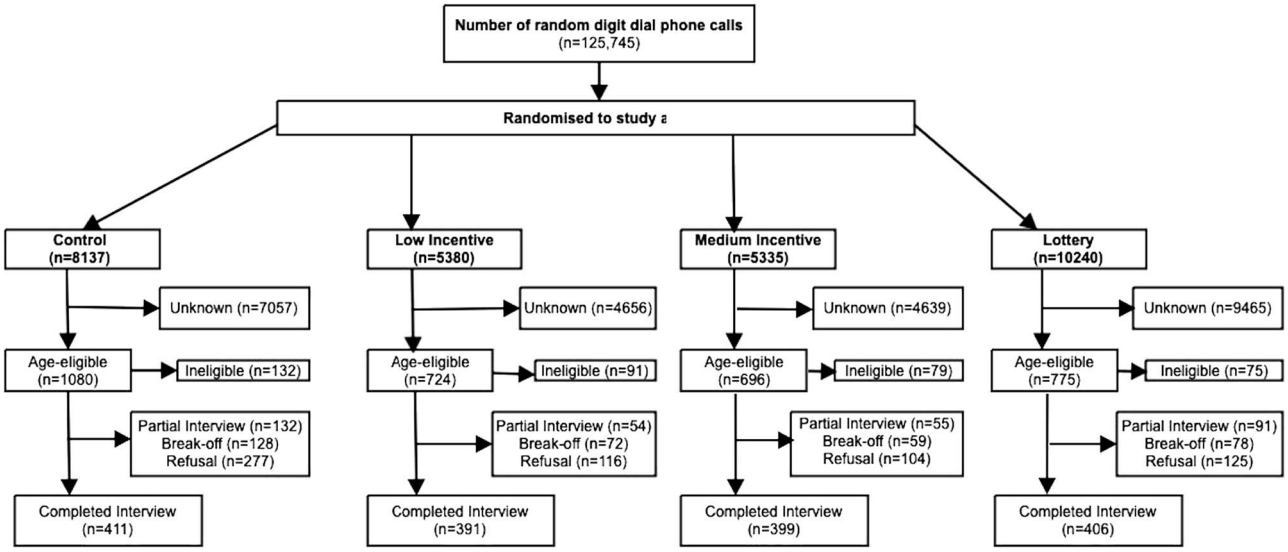

Figure 1. CONSORT diagram—Colombia

Table 3. Disposition codes by study arm in Colombia and Tanzania

	Colombia				Tanzania			
	Control	Low incentive	Medium incentive	Lottery incentive	Control	Low incentive	Medium incentive	Lottery incentive
Complete interview (I)	411	391	399	406	410	391	404	401
Partial interview (P)	132	54	55	91	134	87	95	81
Refusal (R)								
Refusal	277	116	104	125	151	105	111	119
Breaks-off	128	72	59	78	180	102	89	101
Unknown other (UO)	7057	4656	4639	9465	5050	3100	3474	3473
e Unknown *e*(UO)*	6245	4120	4105	8376	3658	2245	2516	2245
Ineligible								
Underage	132	91	79	75	383	240	261	242
Call did not connect†	33 773	19 896	19 354	23 630	12 154	12 154	12 154	12 154
Average survey length	7 min 33 s	7 min 57 s	7 min 51 s	8 min 4 s	12 min 4 s	12 min 21 s	12 min 29 s	12 min 25 s
Phone calls to get complete interview	100	64	61	81	46	42	42	42

*Estimated proportion of unknown cases that were age eligible was 88.5% for Colombia and 72.5% for Tanzania. †For Tanzania, evenly distributed to each study arm due to randomization occurring after survey intro.

higher in the low (risk ratio (RR), 1.42; 95% confidence interval (CI), 1.30–1.57; $P < 0.0001$), medium (RR, 1.49; 95% CI, 1.36–1.64; $P < 0.0001$) and lottery incentive groups (1.34; 95% CI, 1.22–1.47; $P < 0.0001$) as compared to control. Response rates were also significantly higher in the low incentive (RR, 1.24; 95% CI, 1.10–1.40) and medium incentive groups (RR, 1.27; 95% CI, 1.13–1.43; $P = 0.0001$) but were significantly lower in the lottery group (0.73; 95% CI, 0.64–0.82; $P < 0.0001$) as compared to control.

In Tanzania, the cooperation and response rates were 46.9% and 12% in control, 57.1% and 16.3% in low, 57.8% and 15.5% in medium and 57.1% and 16.4%, respectively, in lottery incentive groups (Table 5). Cooperation rates in Tanzania were significantly higher in the low (RR, 1.22; 95% CI, 1.11–1.34; $P < 0.0001$), medium (RR, 1.23; 95% CI, 1.12–1.36; $P < 0.0001$) and lottery incentive groups (1.22; 95% CI, 1.11–1.34; $P < 0.0001$) as compared to control. Response rates were also significantly higher in the low (RR, 1.36; 95% CI, 1.21–1.52; $P = 0.0001$), medium (RR, 1.29; 95% CI, 1.16–1.45; $P < 0.0001$) and lottery incentive groups (1.36; 95% CI, 1.22–1.53; $P < 0.0001$) as compared to control.

For secondary outcomes in Colombia, contact rates in the lottery group were significantly lower (RR, 0.59; 95% CI, 0.53–0.64; $P < 0.0001$) as compared to the control group (Table 4). Low and medium incentive groups had similar contact rates as compared to control. Refusal rates in the low (RR, 0.70; 95% CI, 0.59–0.83; $P < 0.0001$), medium (RR, 0.61; 95% CI, 0.51–0.73; $P < 0.0001$) and lottery incentive groups (RR, 0.40; 95% CI, 0.34–0.47; $P < 0.0001$) were lower than the control group. In Tanzania, contact rate improved in the low (RR, 1.21; 95% CI, 1.11–1.32; $P < 0.0001$), medium (RR, 1.13; 95% CI, 1.03–1.23; $P < 0.0085$) and the lottery groups (RR, 1.23; 95% CI, 1.13–1.35; $P < 0.0001$) as compared to the control group (Table 5). Refusal rates in Tanzania showed no significant differences between the four study arms.

DISCUSSION

The IVR survey data collection method yielded 3213 complete interviews and demonstrated that the provision of low, medium and lottery incentives significantly improved cooperation rates in Colombia and Tanzania, with no difference between the incentive

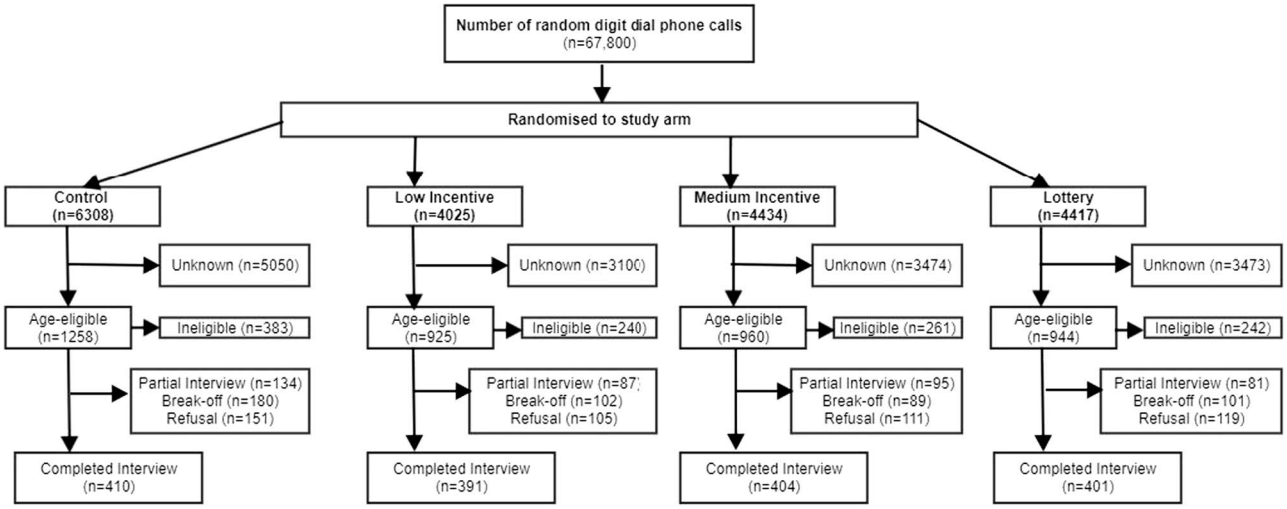

Figure 2. CONSORT diagram—Tanzania

Table 4. Survey rates by study arm in Colombia

	Control	Low incentive	Medium incentive	Lottery incentive
Contact rate 2	13.2%	13.3%	13.1%	7.7%
Risk ratio (95% CI)	Ref.	1.01 (0.92–1.11)	0.99 (0.90–1.09)	0.59 (0.53–0.64)
P value	Ref.	0.8270	0.8583	<0.0001
Response rate 4	7.6%	9.4%	9.6%	5.5%%
Risk ratio (95% CI)	Ref.	1.24 (1.10–1.40)	1.27 (1.13–1.43)	0.73 (0.64–0.82)
P value	Ref.	0.0004	0.0001	<0·0001
Refusal rate 2	5.6%	4.0%	3.5%	2.2%
Risk ratio (95% CI)	Ref.	0.70 (0.59–0.83)	0.61 (0.51–0.73)	0.40 (0.34–0.47)
P value	Ref.	<0.0001	<0.0001	<0.0001
Cooperation rate 1	43.4%	61.8%	64.7%	58.0%
Risk ratio (95% CI)	Ref.	1.42 (1.30–1.57)	1.49 (1.36–1.64)	1.34 (1.22–1.47)
P value	Ref.	<0.0001	<0.0001	<0.0001

Ref., reference group.

Table 5. Survey rates by study arm in Tanzania

	Control	Low incentive	Medium incentive	Lottery incentive
Contact rate 2	19.3%	23.4%	21.7%	23.8%
Risk ratio (95% CI)	Ref.	1.21 (1.11–1.32)	1.13 (1.03–1.23)	1.23 (1.13–1.35)
P value	Ref.	<0.0001	0.0085	<0.0001
Response rate 4	12.0%	16.3%	15.5%	16.4%
Risk ratio (95% CI)	Ref.	1.36 (1.21–1.52)	1.29 (1.16–1.45)	1.36 (1.22–1.53)
P value	Ref.	<0.0001	<0.0001	<0.0001
Refusal rate 2	7.3%	7.1%	6.2%	7.5%
Risk ratio (95% CI)	Ref.	0.97 (0.82–1.14)	0.85 (0.72–1.01)	1.02 (0.87–1.20)
P value	Ref.	0.699	0.064	0.792
Cooperation rate 1	46.9%	57.1%	57.8%	57.1%
Risk ratio (95% CI)	Ref.	1.22 (1.11–1.34)	1.23 (1.12–1.36)	1.22 (1.11–1.34)
P value	Ref.	<0.0001	<0.0001	<0.0001

Ref., reference group.

arms. Similarly, with the exception of the lottery incentive arm in Colombia, which yielded a response rate lower than the control, the three different incentive arms significantly improved the IVR survey's response rate in both countries.

For cooperation rates, our observed risk ratios ranged from 1.34 to 1.42 for Colombia and 1.22 to 1.23 for Tanzania, which were comparable to findings from studies in Bangladesh (1.36–1.39) and Uganda (1.29–1.32) where similar airtime incentives were used [15]. For response rates too, risk ratios were similar for all four countries except the lottery group in Colombia, which had a significantly lower response rate than the control arm. This lower response rate was due to a higher percentage of unknowns in the lottery incentive group compared to control, low and medium incentive groups. Unknowns are defined as people who hang up the phone before answering the age eligibility question 'Are you 18 or older?' and contribute to the denominator of the response rate. There are several explanations. First, it could be that the language used to explain the lottery incentive may have been confusing, therefore causing participants to terminate the survey. Another reason, which was identified in qualitative work [24], may

be that offer of incentives might raise suspicion about the surveys particularly in countries where phone-based scams have been reported. In Colombia, especially, this may be associated with fear of mobile phone extortion and fraud cases [25]. Further qualitative research on this is needed.

Our control arm response rates in Colombia (7.6%) and Tanzania (12.0%) were within the range of those reported by others for RDD IVR surveys in LMICs. Published response rates have ranged from <3% in Morocco, Philippines, Sri Lanka and Zambia to 15.9% in Ecuador and 31% in Ghana [9, 11, 12]. There are several potential explanations for this wide range in response rates. First, response rates can differ based on the AAPOR equation used and the classification of call outcomes, particularly whether phone calls that are not picked up are classified as unknown or ineligible. Moreover, employing a sampling frame that includes known mobile phone numbers or those prescreened to be active has the potential to enhance response rates. Media campaigns and sending a text message notification before and after survey delivery may also improve response rates [26, 27].

Regarding our sample composition, in Tanzania, we found that males constituted approximately three-fourths of complete surveys. This is a consistent finding for RDD IVR surveys in low-income countries like Afghanistan, Ethiopia, Ghana, Mozambique, Zimbabwe, Bangladesh and Uganda [15, 16] and represents gender differentials in phone ownership [28], although this gap is beginning to narrow [29]. In Colombia, we found that females had higher participation than males in our IVR surveys, ranging from 52% to 57% of participants across the study arms in Colombia. A more even gender distribution in response could be due to Colombia having higher levels of phone ownership (132 subscribers versus 82 subscribers per 100 people) and a higher GDP per capita (US$5332 versus $1076) as compared to Tanzania [19, 30]. In Colombia and Tanzania, the majority of complete interviews were skewed towards a younger age group as has been documented elsewhere [15, 16].

This study exhibits several notable strengths. We automated randomization of study participants to different study arms through the IVR platform to ensure that our primary outcomes were unbiased. Consistent with our previous findings, this study revealed no differences in demographic characteristics between participants who completed the interviews and those who only partially participated, in both Colombia and Tanzania. Also, since we applied a standardized protocol to both countries, research findings can be compared easily. Lastly, we included all known mobile network operators in Colombia and Tanzania to minimize potential selection bias resulting from subscriber characteristics.

The study also has a few limitations. First, we had many phone calls that may have nonworking phone numbers or that would have not gone through due to poor connection. As we could not segregate functioning or nonfunctioning phone numbers from our dial list, we conservatively classified these as working numbers that deflated our response, contact and refusal rates with no effect on cooperation rates. Second, we dialed each number only once. Future studies can attempt redialing a sample of these unknowns for a few times, and at various times during the day, to better ascertain final call dispositions [10, 16]. Third, in Colombia and Tanzania, participants took approximately 8 and 12 minutes, respectively, to complete the IVR survey. An RDD IVR survey conducted in Ghana reported an average length of approximately 10 minutes [9]. Lastly, people who did not have access to a mobile phone or did not speak English or Spanish or Kiswahili had no possibility of being represented in our study and could potentially produce selection bias. This bias is minimal but may have larger implications when collecting nationally representative survey data.

CONCLUSION

In conclusion, the provision of low, medium and lottery incentives significantly improved cooperation and response rates in Colombia and Tanzania, except for the lottery incentive arm in Colombia, which yielded a response rate lower than the control. This study presents compelling evidence regarding the effectiveness of airtime incentives to improve cooperation and response rates in LMIC settings, and even though it is doubtful that MPS can wholly replace household surveys, IVR is gaining popularity as a primary data collection method for survey research in LMICs [11]. With the continuous rise in mobile phone ownership within LMICs, further research can fully optimize the potential of these supplemental data collection methods.

SUPPLEMENTARY DATA

Supplementary data are available at *Oxford Open Digital Health* online.

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CONFLICT OF INTEREST

None.

AUTHORS' CONTRIBUTIONS

Vidhi D. Maniar led the review, editing and visualization of the original draft of the manuscript. Dustin G. Gibson led the study conceptualization, data curation and formal analysis. Andres I. Vecino-Ortiz contributed to the analysis. Dustin G. Gibson, Alain B. Labrique, Joseph Ali, Andres I. Vecino-Ortiz, Angelica Torres-Quintero, Stephanie Puerto-García, Camila Solorzano-Barrera, Honorati Masanja, Frank Kagoro and George W. Pariyo contributed to the review and editing. All authors approved the final manuscript.

DATA AVAILABILITY

All data files are accessible and available for download from the ICPSR database (https://www.openicpsr.org/openicpsr/project/186821/version/V1/view). Upon creating an account, researchers can access the data set from the provided ICPSR link.

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