

Participation Effects of Prepaid vs Postpaid Incentives in Mobile Phone Surveys: randomized controlled trials in Bangladesh and Uganda

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Abstract

Background

Airtime incentives improve participation in interactive voice response (IVR) surveys in low- and middle-income countries (LMICs), but the effect of incentive timing on participation rates, cost, and survey estimates has not been examined. We conducted parallel randomized controlled trials in Bangladesh and Uganda to evaluate the effect of prepaid versus postpaid airtime incentives on IVR survey participation and noncommunicable disease (NCD) indicator estimates.

Methods

Participants were recruited using random digit dialing and randomized to one of three arms: control (no incentive), prepaid (partial airtime before the survey, remainder on completion), or postpaid (full airtime on completion). The total incentive was 100 Bangladeshi Taka (US\$0.95) or 5,000 Ugandan Shillings (US\$1.34). The primary outcomes were contact, response, and cooperation rates according to the survey arms as defined by the American Association of Public Opinion Research. NCD indicator prevalence was compared across arms using chi-square tests.

Results

A total of 137,704 calls were made in Bangladesh and 44,440 in Uganda. Both incentive arms significantly improved contact, response, and cooperation rates compared to the control arm in both countries ($p < 0.001$ for all comparisons). Cooperation rates in Bangladesh were 35.5% (control), 54.6% (prepaid), and 52.4% (postpaid); in Uganda they were 52.9%, 70.1%, and 65.3%, respectively. Prepaid incentives required fewer calls per complete interview but had substantially higher cost per complete interview than postpaid incentives. Prevalence estimates for most NCD indicators were consistent across study arms in both countries.

Conclusion

Both prepaid and postpaid airtime incentives significantly improved participation in random digit dial IVR surveys in Bangladesh and Uganda. Postpaid incentives offered a more favorable balance between participation gains and implementation cost. Incentive timing did not systematically bias NCD indicator estimates, supporting the use of airtime incentives for IVR-based public health surveillance in LMICs

Introduction

More than three-quarters of global deaths are now attributable to noncommunicable diseases (NCDs), with the majority occurring in low- and middle-income countries (LMICs) [1, 2]. Four largely modifiable behavioral risk factors – tobacco use, excessive alcohol consumption, unhealthy diet, and inadequate physical activity – account for the predominant share of this burden [3]. Effective prevention and control of NCDs requires timely, population-level surveillance of these risk factors, yet many LMICs continue to lack the resources and infrastructure to implement repeated, nationally representative surveys, leaving substantial gaps in the data needed to guide prevention and control efforts [4].

The rapid growth of mobile phone ownership in LMICs creates an opportunity to supplement traditional household surveys with more frequent, lower-cost mobile phone surveys (MPS) [5]. Several MPS modalities have been developed, including computer-assisted telephone interviews (CATI) and interactive voice response (IVR) surveys, in which participants use a mobile phone keypad to enter responses to a prerecorded, automated questionnaire [6]. IVR and SMS

surveys have been used to collect subnational and national estimates of NCD behavioral risk factors across multiple LMIC settings, and validation studies comparing MPS estimates to those from nationally representative face-to-face household surveys are now beginning to emerge [6, 7]. These studies suggest that MPS estimates perform best in settings with higher mobile phone ownership, and that optimizing survey implementation — including maximizing participation across population subgroups — remains a critical priority for ensuring the quality and representativeness of MPS-derived health data.

One approach to improving MPS participation is the use of airtime incentives, which transfer mobile phone credit directly to participants as compensation for their time. Randomized controlled trials in Bangladesh, Uganda, Colombia, and Tanzania have demonstrated that fixed and lottery airtime incentives significantly improve cooperation and response rates for IVR surveys in LMIC settings [8–10]. Evidence from high-income countries suggests that providing an incentive prior to survey completion (prepaid) tends to produce better participation than incentives conditional on completion (postpaid), though overall findings have been mixed across survey modalities and settings [11, 12]. Some studies find that incentives have little or no effect on participation [13, 14], while others caution that non-random uptake of incentives may introduce selection bias in survey samples [15]. In LMIC settings, evidence consistently shows that incentivized recipients complete surveys at higher rates than non-recipients [8–10], but the effect of incentive timing on participation, cost, and the validity of resulting health estimates has not been examined.

The objective of this study was to evaluate the effect of incentive timing — prepaid, postpaid, and no incentive — on the contact, cooperation, response, and refusal rates of a random digit dial IVR survey of NCD behavioral risk factors in Bangladesh and Uganda. Secondary objectives were to compare the cost-effectiveness of each incentive arm and to assess whether incentive timing produced differential estimates of NCD indicator prevalence.

Methods

Study design and participants

We conducted parallel randomized controlled trials in Bangladesh and Uganda. Participants were randomly assigned to one of three arms: control (i.e., no incentive), prepaid, and postpaid. The total incentive amount for both intervention arms was 100 Bangladesh Taka (US\$0.95) or 5,000 Ugandan Shillings (US\$1.34). Participants in the prepaid arm first received an airtime credit of 20 Taka (US\$0.19) or 500 Ugandan Shillings (US\$0.13) before the survey began. The survey introduction then informed prepaid arm participants that the remaining 80 Taka (US\$0.76) or 4,500 Ugandan Shillings (US\$1.21) would be transferred upon survey completion. In the postpaid arm, the survey introduction explained that the full incentive, 100 Bangladeshi Taka (US\$0.95) or 5,000 Ugandan Shillings (US\$1.34), would be provided after survey completion. Numbers that were not answered were called back up to three times over a 24-hour period. The analysis and reporting of the results were implemented in accordance with the CONSORT 2010 statement[16].

Participants were recruited using the random digit dialing (RDD) method [17]. Phone numbers were generated using the country codes for Bangladesh (+ 880) and Uganda (+ 256) and a three-digit sequence specific to each mobile network operator as the base, with the remaining seven digits randomly generated to create a 10-digit phone number. Individuals aged 18 years or older were eligible to participate. No recruitment quotas were placed on age or sex categories. Participants who wished to enroll were asked to press 1 after hearing an introductory statement; only those who indicated consent were enrolled.

Randomization and masking

The randomization process was automated and carried out by the IVR platform (engageSPARK), with participants assigned to one of the three study arms after indicating their preferred language for survey completion (Uganda only: English, Luganda, Runyakitara, or Luo) and before giving consent to participate. Participants were informed of their arm allocation during the survey introduction and were therefore not masked to their group assignment. Data cleaning and analysis were performed by statisticians blinded to group allocation to minimize potential bias.

Procedures

IVR surveys were conducted between 08:00 AM and 08:00 PM local time. Participants who answered the phone were prompted to select a language; surveys were conducted in Bangla in Bangladesh, and in Luganda, Luo, Runyakitara, and English in Uganda. The survey questionnaire was adapted from the World Health Organization STEPwise approach to NCD risk factor surveillance (WHO STEPS) and consisted of six parts: language selection, survey introduction, age screening, consent, demographic questions, and NCD modules. The NCD modules were divided into five topically related groups covering tobacco, alcohol, diet, blood pressure, and physical activity. There were no costs for participants to take the survey.

Outcomes

The study classified participants into complete interviews (I), partial interviews (P), non-interviews (R), and unknowns (U) based on their responses to the NCD modules and their consent to participate in the survey (Table 1). The three primary outcomes were contact rate #2, response rate #4, and cooperation rate #1, as defined by the American Association of Public Opinion Research (AAPOR) [18]. We also reported the prevalence of several NCD indicators.

Table 1
AAPOR definitions and equations

AAPOR Definitions	Complete Interviews (I)	Participants who answered all modules.
	Partial Interviews (P)	Participants who answered at least one NCD module other than demographics but not all modules.
	Non-interviews (R)	Participants who either did not press a button on their mobile phone to indicate consent, refused consent, or who hung up at the consent question.
	Refusals	
	Break-offs	Participants who consented but did not complete a module other than demographics
	Unknown (U)	Participants who selected a survey language but did not answer the age question.
	Estimated Unknown (eU)	Estimated proportion of unknown cases that were age eligible.
	Ineligible on age	Participant who indicated an age less than 18 years of age.
AAPOR Equations	Contact Rate #2	$\frac{(I+P+R+O)}{I+P+R+O+eU}$
	Response Rate #4	$\frac{(I+P)}{I+P+R+O+eU}$
	Refusal Rate #2	$\frac{(R)}{I+P+R+O+eU}$
	Cooperation Rate #1	$\frac{(I)}{I+P+R+O}$

Statistical analysis

To calculate sample sizes for each trial, the same assumptions were used in both countries. A control arm cooperation rate of 30% was assumed a priori, based on cooperation rates observed in prior IVR surveys conducted in Bangladesh and Uganda [8]. Using an alpha of 0.05 and a statistical power of 80%, we determined that 376 individuals were needed to complete an IVR survey in each arm to detect a 10% difference in cooperation rates between two study arms. Sample sizes were not inflated for multiple comparisons, as increasing the sample size was not necessary and could lead to increased type II error probabilities for non-null associations.

First, we reported the sociodemographic characteristics of respondents with complete interviews by study arm. We then calculated the contact, response, and cooperation rates for each arm and used log-binomial regression to obtain risk ratios (RRs) and corresponding 95% confidence intervals, with the control arm as the reference group. We compared the prevalence of NCD indicators across arms using chi-square tests. Costs, including airtime charges and incentive disbursements, were summed by arm and divided by the number of complete interviews to calculate the average cost per complete interview. All analyses were conducted in R, with an alpha of 0.05 indicating statistical significance.

Results

A total of 137,704 RDD calls were made in Bangladesh, with 33,082 connected and randomized (Figure 1 (a) and (b)). In Uganda, 44,440 calls were made, of which 3,328 respondents selected a language and were randomized. The number of participants assigned to the control, prepaid, and postpaid arms were 10,445, 11,233, and 11,404, respectively, in Bangladesh, and 1402, 920, and 1006, respectively, in Uganda.

Table 2. Demographics of complete interviews by study arm in Bangladesh and Uganda

	Variables	Overall	Study Arm			p-values
			Control (n=156)	Prepaid (n=377)	Postpaid (n=321)	
Bangla-desh	Age (in year), 18-29	554 (64.9)	102 (65.4)	236 (62.6)	216 (67.3)	.037
	30-44	242 (28.3)	41 (26.3)	115 (30.5)	86 (26.8)	
	45+	58 (6.8)	13 (8.3)	26 (6.9)	19 (5.9)	
	Sex, male	695 (81.4)	128 (82.1)	297 (78.8)	270 (84.1)	.099
	Female	146 (17.1)	25 (16.0)	75 (19.9)	46 (14.3)	
	Other	8 (0.9)	1 (0.6)	4 (1.1)	3 (0.9)	
	Education, no school	50 (5.9)	9 (5.8)	23 (6.1)	18 (5.6)	.82
	Primary school	132 (15.5)	17 (10.9)	65 (17.2)	50 (15.6)	
	SSC/'O' level	256 (30.0)	47 (30.1)	112 (29.7)	97 (30.2)	
	HSC/'A' level	196 (23.0)	39 (25.0)	84 (22.3)	73 (22.7)	
	Graduation/higher	217 (25.4)	43 (27.6)	92 (24.4)	82 (25.5)	
Uganda	Age (in year), 18-29	781 (66.2)	279 (68.6)	251 (65.2)	251 (64.9)	.75
	30-44	306 (26.0)	97 (23.8)	102 (26.5)	107 (27.6)	
	45+	86 (7.3)	28 (6.9)	30 (7.8)	28 (7.2)	
	Sex, male	893 (75.7)	309 (75.9)	294 (76.4)	290 (74.9)	.59
	Female	272 (23.1)	96 (23.6)	85 (22.1)	91 (23.5)	
	Other	14 (1.2)	2 (0.5)	6 (1.6)	6 (1.6)	
	Education, no school	173 (14.7)	64 (15.7)	56 (14.5)	53 (13.7)	.87
	Primary school	313 (26.5)	114 (28.0)	98 (25.5)	101 (26.1)	
	'O' level	345 (29.3)	108 (26.5)	122 (31.7)	115 (29.7)	
	'A' level	121 (10.3)	40 (9.8)	37 (9.6)	44 (11.4)	
	Graduation/higher	213 (18.1)	76 (18.7)	66 (17.1)	71 (18.3)	

Abbreviations: NA, not applicable.

The sociodemographic characteristics of participants with complete interviews are shown in Table 2. In Bangladesh, the majority of completed interviews were male (82.5%; 695/854) and the largest age group was 18–29 years (64.9%; 554/854). A similar age-sex distribution was observed among completers in Uganda

Table 3. Cost by study arm in Bangladesh and Uganda

Country	Variable	Control	Prepaid	Postpaid
Bangla-desh	Total number of phone calls	50999	35705	51000
	Airtime to take the survey (US\$)	1563.38	1951.04	1848.49
	Incentive post (US\$)	0	542.63	574.35
	Presurvey incentive (US\$)	0	10791.35	0
	Total cost (US\$)	1563.38	13285.02	2422.84
	Total number of complete interviews	156	377	321
	Average cost per complete interview (US\$)	10.02	35.24	7.55
	Average number of calls to obtain a complete interview	327	95	159
Uganda	Total number of phone calls	19287	11853	13260
	Airtime to take the survey (US\$)	1354.86	967.72	1027.06
	Incentive post (US\$)	0	662.6	739.17
	Presurvey incentive (US\$)	0	4284.09	0
	Total cost (US\$)	1354.86	5914.41	1766.23
	Total number of complete interviews	407	385	387
	Average cost per complete interview (US\$)	3.33	15.36	4.56
	Average number of calls to obtain a complete interview	47	31	34

Next, we calculated the average airtime cost per completed interview, including incentives (Table 3). Both in Bangladesh and Uganda, the average cost to complete an interview was higher in prepaid arm than the other two arms. In Bangladesh, the average cost per complete interview was US\$10.02 in the control arm, US\$35.24 in the prepaid arm, and US\$7.55 in the postpaid arm. In Uganda, the corresponding costs were US\$3.33, US\$15.36, and US\$4.56. In both countries, the prepaid arm was the most expensive per complete interview. However, the average number of calls required to obtain a complete interview was lowest in the prepaid arm: 95 call attempts per complete interview in Bangladesh (vs. 327 in control and 159 in postpaid) and 31 calls in Uganda (vs. 47 in control and 34 in postpaid).

The disposition codes and survey participation rates by study arm are presented in Table 4. In Bangladesh, the contact, response, and cooperation rates were 0.9%, 0.5%, and 35.5% in the control arm; 2.5%, 1.7%, and 54.6% in the prepaid arm; and 1.2%, 0.8%, and 52.4% in the postpaid arm. All three rates were significantly higher in both the prepaid and postpaid arms compared to the control arm ($p < 0.001$ for all comparisons). In Uganda, the contact, response, and cooperation rates, respectively, were 4.0%, 2.7%, and 52.9% in the control arm; 5.3%, 4.1%, and 70.1% in the prepaid arm; and 4.5%, 3.4%, and 65.3% in the postpaid arm. As in Bangladesh, all three survey participation rates for Uganda were significantly higher in both incentive arms compared to the control arm ($p < 0.001$ for all comparisons).

Table 4. Disposition codes and survey rates by study arms

Variable	Bangladesh			Uganda		
Disposition codes	Control	Prepaid	Postpaid	Control	Prepaid	Postpaid
Total number of calls	50999	35705	51000	19287	11853	13260
Did not receive incentive	0 (0%)	7126 (20.0%)	0 (0%)	0 (0%)	1404 (11.8%)	0 (0%)
Complete interviews (I)	156 (0.3%)	377 (1.1%)	321 (0.6%)	407 (2.1%)	385 (3.2%)	387 (2.9%)
Partial interviews (P)	77 (0.2%)	84 (0.2%)	85 (0.2%)	106 (0.5%)	43 (0.4%)	54 (0.4%)
Refusals (R)	123 (0.2%)	142 (0.4%)	181 (0.4%)	131 (0.7%)	64 (0.5%)	82 (0.6%)
Break-off (R)	83 (0.2%)	88 (0.2%)	26 (0.1%)	125 (0.6%)	57 (0.5%)	70 (0.5%)
Unknown	50107 (98.3%)	27214 (76.2%)	49858 (97.8%)	18329 (95.0%)	9783 (82.5%)	12531 (94.5%)
Age ineligible	453 (0.9%)	674 (1.9%)	529 (1.0%)	189 (1.0%)	117 (1.0%)	136 (1.0%)
Contact rate	0.9%	2.5%	1.2%	4.0%	5.3%	4.5%
Risk Ratio (95% CI)	Ref	2.9 (2.5, 3.2)	1.4 (1.2, 1.6)	Ref	1.3 (1.2, 1.5)	1.1 (1.0, 1.2)
P-value	Ref	<0.001	<0.001	Ref	<.001	.031
Response rate	0.5%	1.7%	0.8%	2.7%	4.1%	3.4%
Risk Ratio (95% CI)	Ref	3.6 (3.1, 4.2)	1.7 (1.5, 2.0)	Ref	1.5 (1.4, 1.7)	1.3 (1.1, 1.4)
P-value	Ref	<0.001	<0.001	Ref	<.001	<.001
Cooperation rate	35.5%	54.6%	52.4%	52.9%	70.1%	65.3%
Risk Ratio (95% CI)	Ref	1.5 (1.3, 1.8)	1.5 (1.3, 1.7)	Ref	1.3 (1.2, 1.4)	1.2 (1.1, 1.3)
P-value	Ref	<.001	<.001	Ref	<.001	<.001

Ref: Reference group, RR: Relative risk , CI: Confidence Interval

Table 5. Participants responses to NCD questions by study arms, % (n/N)¹

Indicators	Overall	Study Arm			
		Control	Prepaid	Postpaid	p-value
Bangladesh					
Current smoker	28.0 (274/980)	32.2 (66/205)	25.1 (104/414)	28.8 (104/361)	.11
Alcohol drinker in the past 12 months	9.9 (94/952)	10.1 (19/188)	10.6 (43/406)	8.9 (32/358)	.74
No fruit in the past week	13.8 (136/987)	16.1 (32/199)	14.4 (61/425)	11.8 (43/363)	.34
No vegetables in the past week	4.8 (45/933)	6.1 (11/180)	4.2 (17/406)	4.9 (17/347)	.60
Had hypertension diagnosis	12.8 (108/847)	14.3 (22/154)	13.4 (50/372)	11.2 (36/321)	.56
No physical activity in the past week	18.1 (155/854)	21.2 (33/156)	15.6 (59/377)	19.6 (63/321)	.22
Uganda					
Current smoker	8.8 (122/1382)	10.1 (52/513)	7.7 (33/428)	8.4 (37/441)	.11
Alcohol drinker in the past 12 months	51.2 (697/1361)	52.6 (263/500)	49.3 (209/424)	51.5 (225/437)	.60
No fruit in the past week	10.3 (135/1311)	11.2 (52/466)	10.2 (43/421)	9.4 (40/424)	.70
No vegetables in the past week	10.0 (125/1249)	12.2 (54/444)	6.0 (24/401)	11.6 (47/404)	.005
Had hypertension diagnosis	16.1 (194/1202)	12.4 (52/421)	17.0 (66/389)	19.4 (76/392)	.021
No physical activity in the past week	11.6 (137/1179)	14.0 (57/407)	10.4 (40/385)	10.3 (40/387)	.18

Data are presented as % (n/N) as the proportion (%) of people = number of people responded yes to the question (n)/total number of people who responded to the question (N)

The prevalence of NCD indicators across study arms is shown in Table 5. In Bangladesh, prevalence estimates were not statistically different across all study arms for all indicators ($p > 0.05$ for all). For example, the prevalence of current smoking was 32.2%, 25.1%, and 28.8% in the control, prepaid, and postpaid arms, respectively ($p = 0.11$). Similarly, the proportion reporting no fruit consumption in the past week was 16.1%, 14.4%, and 11.8% across arms ($p = 0.34$), and no vegetable consumption was 6.1%, 4.2%, and 4.9% ($p = 0.60$). In Uganda, prevalence estimates were also similar across arms for most NCD indicators. However, two indicators differed significantly by arm: the proportion reporting no vegetable consumption in the past week (12.2% control, 10.4% prepaid, 11.6% postpaid; $p = 0.05$) and the proportion reporting a prior hypertension diagnosis (12.4% control, 17.0% prepaid, 19.4% postpaid; $p = 0.02$). For the remaining indicators in Uganda, no significant differences were observed across arms.

Discussion

In this study, participants randomized to the prepaid or postpaid incentive arms had significantly higher contact, response, and cooperation rates than participants in the control arm in both Bangladesh and Uganda. Although we observed differences in the cost of survey completion across arms, prevalence estimates for most NCD indicators were similar across study arms in both countries. The consistency of these findings across two geographically and culturally distinct LMICs supports the feasibility of airtime incentives for boosting IVR survey participation in low-resource settings. To our knowledge, this is the first study to examine the effect of incentive timing, prepaid versus postpaid, on IVR survey participation rates, costs, and NCD indicator estimates in LMICs.

Prior randomized controlled trials have established that airtime incentives improve participation in IVR-based NCD surveys in LMIC settings. In Bangladesh and Uganda, both fixed and lottery airtime incentives significantly improved cooperation and response rates compared to no incentive [8,9]. Similar findings were reported in Colombia and Tanzania, where fixed incentives outperformed lottery incentives across multiple participation outcomes [10]. Programmatic reports from mobile phone surveys in Zimbabwe, Mozambique, and Afghanistan, and Honduras have also examined the effect of airtime incentives on survey completion rates [19,20]. However, the incentive findings from Leo et al. are difficult to interpret: randomization failed in two of their four study countries, and in the remaining countries results were mixed, with lottery incentives modestly improving completion in Mozambique but no incentive effect observed in Afghanistan, leaving the overall evidence from that study largely inconclusive. The present study extends this evidence base by demonstrating that the timing of incentive delivery, not just the presence or amount of an incentive, meaningfully affects participation outcomes, with both prepaid and postpaid structures outperforming no incentive across all three primary outcomes in both countries

The average number of calls required to obtain a complete interview was lower in the prepaid arm than in the control or postpaid arm in both countries, suggesting that prepaid incentives can accelerate data collection. However, when cost per complete interview is considered, the prepaid arm was substantially more expensive, more than three times the cost of the postpaid arm in Bangladesh and more than three times in Uganda. Postpaid incentives therefore offer a more favorable balance between participation gains and implementation cost. Two additional factors are worth noting for researchers and implementers designing similar studies. First, we incurred a premium when disbursing incentive payments through a third-party platform; working directly with a mobile network operator would likely reduce these costs and improve the overall cost-effectiveness of incentive-based recruitment. Second, because participants were recruited through RDD rather than from an existing study roster or known sampling frame, many recipients of the prepaid incentive did not ultimately complete the survey, contributing to the higher cost per complete interview in that arm. Prepaid incentives may be more cost-effective in contexts where participants are already enrolled in a study and are aware they will be contacted, for example, in longitudinal cohort studies or face-to-face research settings where a pre-survey credit could increase follow-up response.

A key secondary finding of this study is that incentive timing did not appear to systematically bias NCD indicator estimates. In Bangladesh, prevalence estimates for all six indicators were statistically similar across study arms. In Uganda, four of the six indicators were also similar across arms; however, two indicators differed significantly, the proportion reporting no vegetable consumption in the past week and the proportion reporting a prior hypertension diagnosis. Importantly, there was no consistent directional pattern to these differences: the prepaid arm had a lower prevalence for both indicators relative to the postpaid arm, but the pattern did not suggest a systematic tendency for any incentive structure to attract healthier or less healthy participants. This is consistent with prior evidence suggesting that while incentives can influence who responds to a survey, they do not necessarily introduce systematic bias in reported health outcomes [11,15]. It is also consistent with the broader validation literature showing that MPS-derived NCD estimates can approximate household survey estimates, particularly in settings with higher mobile phone penetration, though meaningful discrepancies remain for some indicators [7]. The two significant Uganda findings should be interpreted with caution and warrant replication in future studies.

The ethical dimensions of mobile phone surveys, including the role of incentives, merit consideration [21,22]. Our survey began with an introduction describing the study purpose and assuring participants that their data would remain confidential. Participants were able to respond to or skip any question using their mobile phone keypad. Our incentive amounts were developed with input from local stakeholders and set below the equivalent of a daily wage to avoid undue influence on participation decisions [23,24]. Previous subgroup analyses from related studies have shown that airtime incentives are distributed fairly across demographic groups, including women, rural residents, older individuals, and those with less education [8].

Consistent with other MPS conducted in Bangladesh and Uganda [8,9,25], we observed that completed interviews overrepresented males, younger adults (18–29 years), and those with higher educational attainment relative to the general population. This pattern has been documented across multiple LMIC settings and reflects underlying inequalities in mobile phone ownership and access [26–29]. Recent multi-country validation work comparing MPS estimates to WHO STEPS household surveys found that MPS performed best in settings with high mobile phone penetration, and that face-to-face surveys currently reach more representative samples, particularly among rural, older, and less educated populations [7]. Strategies to improve MPS representativeness include quota sampling [30], post-stratification weighting [31], pre-announcement of surveys, and more targeted incentive structures designed to reach underrepresented groups. Future research should evaluate which combination of these approaches is most effective for producing nationally representative NCD estimates from mobile phone surveys in LMIC settings.

Our study has several notable strengths. Randomization was automated and integrated directly into the IVR platform, preventing misallocation and reducing the potential for selection bias. We used standardized protocols and questionnaires adapted from WHO STEPS in both countries, delivered through the same IVR technology, enabling reliable cross-country comparisons. Finally, we reduced coverage bias by including all known mobile network operators in each country within the sampling frame.

Several limitations should also be noted. A significant issue was the high number of calls in both countries where we were unable to confirm the phone number's status — specifically, whether these represented working numbers that were valid but unanswered or turned off, or non-working numbers not assigned to an individual [32]. Because randomization occurred after participants answered the phone, unanswered calls were classified as non-working numbers. This decision increases the contact, response, and refusal rates but does not affect the cooperation rate. Additionally, while language was not an issue in Bangladesh, where 99% of respondents completed the survey in Bangla, in Uganda the survey was offered in only four of the six major language groups, which may have introduced selection bias and has greater implications for achieving nationally representative surveys [33]. Finally, while our questionnaire was adapted from WHO STEPS, the mobile phone delivery format imposes constraints on question complexity, including the number of response options and the length of question stems, and precludes the use of show cards, which are standard in face-to-face household surveys and aid respondent comprehension. These differences may affect the comparability of estimates with those from household surveys for some indicators.

Conclusion

Both prepaid and postpaid airtime incentives significantly improved contact, response, and cooperation rates compared to no incentive in random digit dial IVR surveys conducted in Bangladesh and Uganda. Prepaid incentives accelerated recruitment but at substantially higher cost per complete interview; postpaid incentives offered a more favorable balance between participation gains and implementation cost. Prevalence estimates for most NCD indicators were consistent across study arms, suggesting that incentive timing did not systematically bias survey estimates. These findings support the use of postpaid airtime incentives as an efficient and scalable strategy for IVR-based public health surveillance in

LMICs. Future research should investigate strategies to improve representativeness, particularly the recruitment of women, older adults, and those with less formal education.

Declarations

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Ethical approval and consent to participate: Ethical approval was received from the institutional review boards of the institutions involved in the study, namely the Johns Hopkins University Bloomberg School of Public Health, Baltimore, Maryland, U.S; and Pontificia Universidad Javeriana, Bogotá, Colombia. All participants provided informed consent by pressing a number on their keypad. We only included adult individuals. All methods were performed in accordance with the relevant guidelines and regulations.

Data availability: Data will be available upon acceptance from the OpenICPSR repository database (<https://www.openicpsr.org/openicpsr/>.)

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Figures

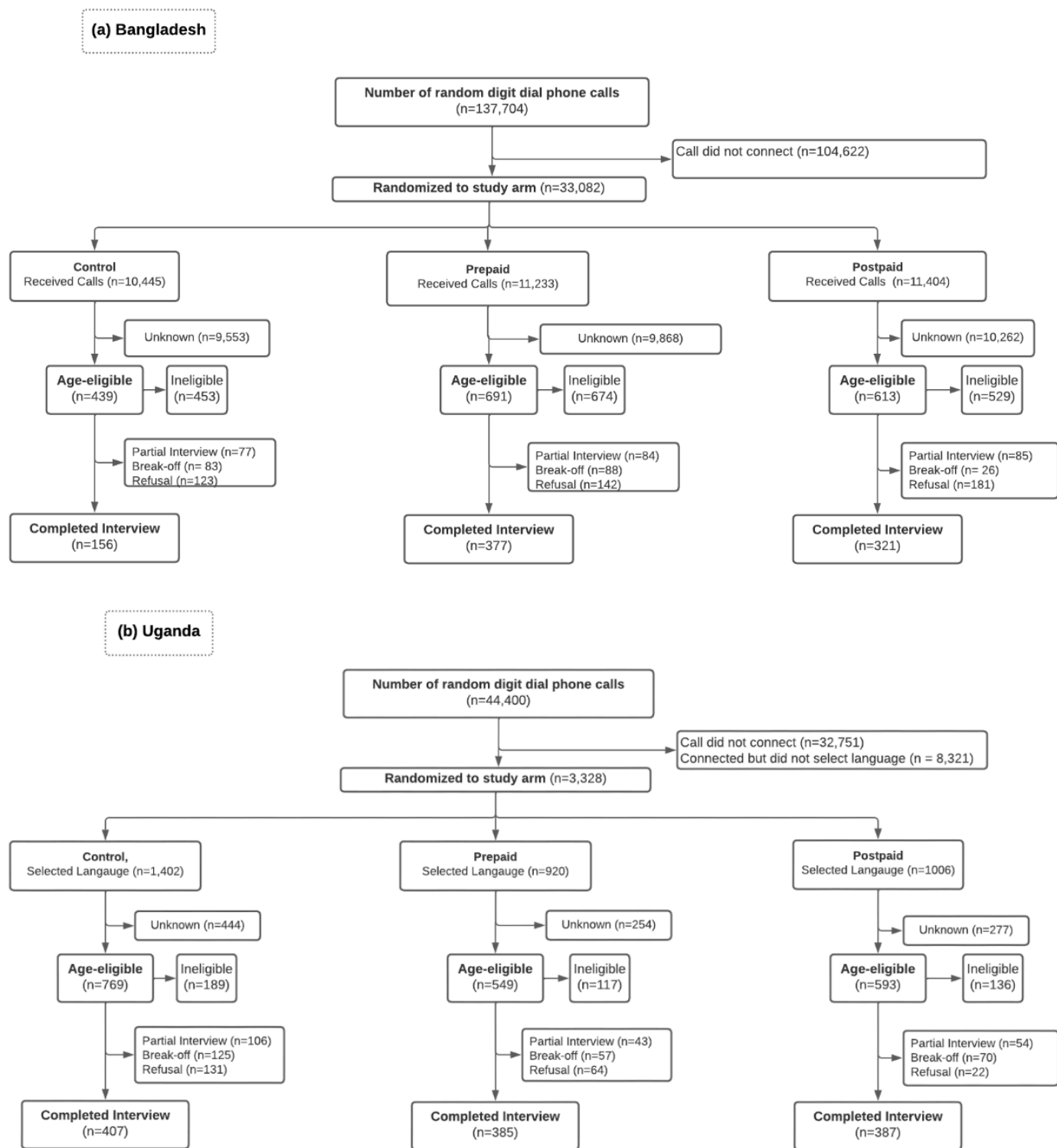


Figure 1

Consolidated Standards of Reporting Trials diagram