Global Poverty Research Lab Research Methods Notes

Optimal Timing for Random Digit Dialing

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Working paper no. 21-107
June 2021

Keywords: research methods, phone surveys, response rates

This note is part of the Research Methods Initiative, which is a collaboration between Northwestern University's Global Poverty Research Lab (GPRL) and Innovations for Poverty Action (IPA). More information is available at GPRL's website and IPA's website.

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Optimal Timing for Random Digit Dialing

We examine optimal time of day and day of week for conducting random digit dial (RDD) surveys in low- and middle-income countries (LMICs). There are many reasons to expect that survey timing matters. Different types of survey respondents have competing time demands such as farm work, wage employment, child care, and meal times that influence when they are likely to be able and willing to answer the phone and complete an interview. Although IPA's field experience provides advice on best practices for increasing efficiency and data quality, there has not been recent systematic inquiry into these questions for LMICs. In this brief, we consider whether there is a best time of day or day of week for improving survey response rates and sample representativeness based on RDD surveys in nine countries.

We restrict our analysis to first attempt calls, which function like a randomized experiment, given that phone numbers are attempted in random order. This randomization identifies the causal effect of time of day and day of week on s on the first attempt. We consider both contact and completion rates on the first attempt as separate outcomes, as even a contacted respondent that doesn't complete on the first attempt, represents a potential completed survey at a later attempt.

We find that midday calls produce a slightly higher survey completion rate on average than morning calls across the set of nine countries we studied. Evening calls have the lowest survey completion rate. For days of week, there is no evidence of a statistically significant difference in completion rates. We find some evidence that calls earlier in the week have higher contact rates than those made later in the week and that calls made in the evening have lower contact rates than those made earlier in the day. In both cases, the effect on contact rates does not result in a proportional change in completion rates, likely due to differences in cooperation by times of day and days of the week.

For all of these findings, results vary by country. For example, lower completion rates in the evening are especially pronounced and statistically significant in East/South African countries, but not statistically significant in West Africa, Latin America, or the Philippines. Therefore, optimal survey timing may be country-specific.

We do not find evidence that the time of day or day of week of the first attempt affects the composition of the sample. All things being equal, this suggests that decisions about when to dial can be motivated more by maximizing response rates rather than achieving representativeness.

Literature

Public opinion research in higher-income countries (HICs) has established general patterns of phone survey timing on respondent behavior. Although there is some consensus in these settings that making calls during

This note is part of a series investigating survey implementation using computer-assisted telephone interviewing (CATI) and other remote survey modes by Northwestern University's Global Poverty Research Lab (GPRL) and Innovations for Poverty Action (IPA). It was prepared by Navishti Das, Emma Davies, Andrew Dillon, Steve Glazerman, and Michael Rosenbaum with helpful input from Dean Karlan, Chris Udry, and Shana Warren. These methods notes are made possible with the generous support from GPRL. More information is available on IPA's website about phone survey methods and GPRL & IPA's Research Methods Initiative.

weekday evenings and weekends increases pick-up and completion rates,[1] recent evidence suggests that the conclusions on the effects of survey timing are mixed.[2] Much of the evidence was published one to three decades ago, much before the widely-observed overall decline in survey response rates.[3]

In LMICs, the impact of phone survey timing on productivity is understudied. A study in Turkey reports that call successes increased after altering survey protocols by increasing the maximum number of call attempts and including late evening calls.[4] They do not differentiate the effects of an increase in attempts from an increase in allowed call times. While this aligns with findings from HICs, evidence from surveys on COVID conducted in India finds that the late morning is the most productive time to conduct surveys for a population of agricultural workers.[5]

Given the 2020 slowdown in face to face data collection, researchers have accelerated the search for evidence on best practices for improving productivity in phone surveys. Recommendations often include calling respondents multiple times, at different times of the day, and different days of the week, including weekends.[6] Some guidance suggests adaptive protocols, where projects should monitor and react to trends including the best and worst times to call to maximize the rate of contact/completion.[7] However, this evidence does not provide insight on what the optimal default is, nor does it provide information on expected variation in completion rate that would justify adaptive protocols.

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Data and Methods

The analysis comes from RDD surveys that Innovations for Poverty Action (IPA) conducted between April and September 2020 in nine LMICs, resulting in 12,145 complete surveys from 64,635 attempted numbers. Surveys were conducted in Africa (Burkina Faso, Ghana, Rwanda, Sierra Leone, Uganda, and Zambia), Asia (Philippines), and Latin America (Colombia and Mexico City). These data are intended to be representative of the cell-phone using population in each country or city, in the case of Mexico City.

Many elements of these surveys are common across countries.[8] All but one are variants on the same survey focusing on COVID response. All surveys dialed numbers from lists provided by SampleSolutions, which preverified that numbers from their lists were active.

We measure survey productivity in two ways: the percentage of cases resulting in a pickup on the first attempt (contact rate) and the percentage resulting in a completion on the first attempt (completion rate). We only examine the first attempt for every case because the timing of that attempt is determined randomly in an RDD survey, as phone numbers are attempted in random order. The amount and types of effort on subsequent attempts depend on whether the first attempt is successful and may be scheduled based on factors that could explain subsequent success. First-attempt randomization provides strong assurance that timing is not confounded with other factors.

While *completion* on the first attempt is an important predictor of final response rate, *pickup* on the first attempt is also important because first-attempt pickups that do not result in a first-attempt completion can later be converted into completed surveys. In fact, 6.2 percent of respondents who answer, but fail to complete the survey on the first attempt go on to complete the survey in subsequent attempts. This compares to 14.2 percent who complete the survey on the first attempt across all nine countries.

We also investigate if there are differences in sample composition on observable demographic variables: age, educational attainment, gender identity, employment status, household size, and predicted poverty probability among completed surveys, owing to the time of the first call attempt.

To conduct the time-of-day analysis, we first define three bins of potential call times: morning (7:00 AM to 11:59 AM), midday (12:00 PM to 3:59 PM), and evening (4:00 PM to 10:59 PM), and use morning as the reference category against which other time blocks are compared.[9] For the day-of-week analysis, Monday is used as the reference day. Weekend days are collapsed into one category, since Sunday interviews were rare.

Results (effects and standard errors) are presented as percentage changes from the response rate (or contact rate) of the reference category (morning or monday) instead of percentage points. This is because

[8] Some country-specific criteria may influence how those results might be interpreted. The Mexico City survey required respondents to reside in Mexico City and only dialed area codes from Mexico City. The Philippines survey only sampled numbers from a prepaid phone provider in an attempt to oversample lower income respondents. The Uganda survey required respondents to have used mobile money and quota sampling, where respondents were sampled until a minimum number of respondents with combinations of educational attainment and geographical area had completed surveys. The Uganda survey was also focused on consumer protection issues around mobile money.

[9] IPA research teams in each country provided information on norms for working hours in their country to create these bins. We use the same bins for each country as differences were not meaningful between countries. Results presented here are similar when we examine effects by each individual hour of the day or by time blocks defined differently by country.

response rates vary considerably by country. A relative measure such as percentage change allows for easier comparisons.

Findings

Time of Day

We find that, on average across the nine countries we examine, time of day affects contact and completion rates. There is a statistically significant set of differences in completion rates across time blocks than what we would expect by chance (Table 1, Panel 2). That is to say, the p-value of this joint test of equivalence is less than 0.001. Compared to morning calls, completion rates for midday calls show a statistically significant increase of 3.2 percent (standard error [SE] of 1.9 percent of the base rate) and evening calls show a statistically significant decrease in completion rates of 3.5 percent (2.0 percent SE). Although these differences are statistically significant, they are small in magnitude, less than 2 percentage points in contact and completion rates, and are only statistically significant at the ten percent level. Table 1 shows the effect of time block for initial attempt on contact and completion rates across all study sites. Differences are reported with respect to calls made in the morning. We report proportional differences to facilitate comparisons between countries.

These averages mask some variation between sites. Results by country show statistically significant decreases during evening hours in both pickups and completions in Rwanda and Uganda, and a statistically significant decrease in completions in Zambia. Although these three countries are all in East Africa, we can not point to any mechanisms that explain why this would occur. Differences between sites remain. For example, in Mexico City, evening calls result in a statistically significant increase in contact rate.

The differences between completion rates and contact rates suggest that respondent cooperation may be different throughout the day. If each unanswered call directly translated into an incomplete survey, we would expect proportional differences between contact and completion rates. We do not see this in the data. Therefore, we also test how completion rates are affected by the time of day among answered calls. We find statistically significant differences between times of days (p = 0.019).

These effects are not driven by sample composition. We find that there is no statistically significant difference in sample composition due to time of day than what we would expect by chance for respondent's age, gender identity, educational attainment, employment status, household size, and predicted poverty probability. The p-value of this test of joint equality is 0.946.[10] We find no patterns of statistically significant differences among individual comparisons, except in Rwanda, where call attempts in the afternoon yield an increase (9 percentage points and 4 pp SEs) in those with a secondary education in the sample of completed surveys.

[10] The F-test for homogeneity of time of day effects on sample composition is not rejected at the 10 percent-level. To construct this test we use a seemingly unrelated regression to jointly test that each time block indicator's effect on each demographic variable is 0.

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Table 1: Effects of Time of Day Overall and by Country (percentage of first attempts)

	Morning (7:00-11:59)	Midday (12:00-3:59)		Evening (4:00-10:59)		Attempts	All times	Joint difference (p-value)
	Mean	Mean	Difference	Mean	Difference	N	Mean	
Panel 1: Contact Rate (Percentage of First Attempts Answered)								
All countries	**46.9**	**47.2**	**0.7**	**45.5**	**-2.8****	**64,322**	**44.8**	**0.002*****
Burkina Faso	75.5	73.4	-2.8	72.6	-3.8	2,324	74.0	0.413
Colombia	53.1	53.6	0.8	53.6	0.9	6,184	53.4	0.940
Ghana	45.7	45.6	-0.2	43.1	-5.6	7,806	45.3	0.337
Mexico City	37.7	40.2	6.6**	40.2	6.6**	21,391	39.9	0.061*
Philippines	39.4	42.0	6.5**	39.8	1.0	8,378	40.6	0.085*
Rwanda	49.6	49.5	-0.2	42.4	-14.5***	3,861	48.3	0.003***
Sierra Leone	53.1	51.5	-2.9	51.4	-3.1	3,116	52.0	0.717
Uganda	44.3	41.5	-6.4**	35.4	-20.1***	8,024	40.6	0.000***
Zambia	47.2	51.7	9.5**	47.7	1.1	3,238	49.2	0.056
Panel 2: Completion Rate (Percentage of First Attempts Resulting in Completed Survey)								
All countries	**18.0**	**18.5**	**3.2***	**17.3**	**-3.5***	**64,322**	**14.2**	**0.000*****
Burkina Faso	57.1	56.8	-0.5	54.2	-5.1	2,324	56.3	0.504
Colombia	18.6	19.3	3.4	20	7.3	6,184	19.2	0.577
Ghana	13.6	14.9	9.3	14.4	6.2	7,806	14.4	0.337
Mexico	3.2	3.6	13.5	3.4	6.8	21,391	3.5	0.505
Philippines	14.0	14.3	2.1	14.3	2.3	8,378	14.2	0.931
Rwanda	36.1	36.6	1.2	27.5	-24.0***	3,861	34.8	0.000***
Sierra Leone	32.6	32.7	0.4	30.3	-7.0	3,116	32.2	0.513
Uganda	5.0	5.6	10.8	3.9	-21.6*	8,024	4.9	0.014**
Zambia	24.9	28.5	14.6**	20.5	-17.7**	3,238	25.3	0.000***

*Note: All values are in percentages. The sample was restricted to the first attempt of RDD surveys. The "difference" column shows the proportional difference to morning from OLS regressions with indicator variables for time of day and country fixed effects in the pooled regression of all countries. The "Joint difference" column reports the p-value for an F-test for homogeneity of time of day effects. "Answered" is any instance where the attempt was answered including rescheduled calls, ineligible participants, drops, inadequate audio, refusals, partial surveys, and completed surveys. Standard errors are available from authors. * p< .10; ** p< .05; *** p< .01.*

Day of Week

We find that day of week does not affect completion rates, but has modest effects on contact rates. For all nine countries combined, there is no statistically significant difference in completion rates across days of the week (Table 2, Panel 2). The p-value of this joint test of equivalence of completion rates is 0.168. There are some statistically significant differences between pairs of days of the week. Fridays show statistically significant differences in completion rates from calls made on Mondays, with 6.5 percent fewer calls (3.1 percent SE) resulting in completed surveys. No other days have different completion rates at a statistically significant rate. All differences are reported with respect to calls made on Mondays.

Panel 1 of Table 2 shows that the differences in contact rates by days of the week is statistically significant (p = 0.025) for all countries we examine.[11] We find that contact rates are highest on Mondays and lowest on weekends, with statistically significant decreases (relative to Mondays) on Thursdays, Fridays, and weekends of 3.2 percent (1.5 percent SE), 3.7 percent (1.4 percent SE), and 4.2 percent (1.6 percent SE), respectively.

[11] The F-test for homogeneity of day-of-week effects is rejected at the 5 percent level.

The fact that day of week matters for contact rate but not completion rate on the first attempt suggests that levels of cooperation vary by day of week. Statistically significant differences in contact rates may be mediated by different levels of cooperation among answered calls on different days of the week. However, we find that there is no statistically significant difference in completion rates between days of the week among answered calls.[12]

Table 2: Effects of Day of Week by Country (percentage of first attempts)

Country	Monday	Tuesday		Wednesday		Thursday		Friday		Weekend		Attempts	All days	Joint difference
	Mean	Mean	Diff.	Mean	Diff.	Mean	Diff	Mean	Diff.	Mean	Diff.	N	Mean	(p-value)
Panel 1: Contact Rate (Percentage of First Attempts Answered)														
All Countries	**45.5**	**45.1**	**-0.7**	**44.6**	**-1.9**	**44.0**	**-3.2****	**43.8**	**-3.7*****	**43.5**	**-4.2*****	**64,305**	**44.8**	**0.025****
Burkina Faso	79.6	68.7	-13.7***	81.3	2.2	67.7	-14.9***	70.2	-11.7**	75.2	-5.5	2,328	73.9	0.000***
Colombia	56.7	50.1	-11.8***	53.2	-6.2	49.8	-12.2***	53.2	-6.2*	59.6	5.0	6,184	53.4	0.000***
Ghana	45.1	44.8	-0.7	45.9	1.8	47.3	4.9	43.2	-4.1	n.a.	n.a.	7,765	45.3	0.214
Mexico City	40.2	42.1	4.9*	39.9	-0.6	41.3	2.9	39.5	-1.6	37.5	-6.7**	21,391	39.9	0.001***
Philippines	40.3	40.7	0.9	39.3	-2.4	39.1	-3.1	42.1	4.4	42.5	5.4	8,378	40.6	0.442
Rwanda	55.2	54.4	-1.4	49.6	-10.0**	45.5	-17.4***	41.9	-24.0***	n.a.	n.a.	3,862	48.3	0.000***
Sierra Leone	52.7	53.2	0.9	50.0	-5.1	53.8	2.1	52.4	-0.6	49.8	-5.4	3,121	51.9	0.709
Uganda	41.1	41.6	1.2	41.0	-0.4	39.1	-5.0	41.3	0.3	38.6	-6.2	8,024	40.6	0.534
Zambia	49.5	49.6	0.2	48.1	-2.8	48.1	-2.8	50.3	1.5	49.6	0.2	3,252	49.2	0.972
Panel 2: Completion Rate (Percentage of First Attempts Resulting in Completed Survey)														
All Countries	**13.9**	**13.5**	**-2.9**	**14.1**	**1.0**	**13.6**	**-2.4**	**13.0**	**-6.5****	**14.0**	**0.1**	**64,305**	**14.2**	**0.168**
Burkina Faso	61.6	55.0	-10.8*	62.0	0.7	48.0	-22.1***	55.6	-9.8	56.8	-7.8	2,328	56.3	0.001***
Colombia	20.1	18.4	-8.8	18.9	-6.3	16.1	-19.9**	19.4	-3.8	23.9	18.8*	6,184	19.2	0.005***
Ghana	13.4	15.1	13.0	13.7	2.5	15.7	17.7*	13.3	-0.4	n.a.	n.a.	7,765	14.3	0.188
Mexico	3.7	3.6	-3.1	3.5	-5.5	4.0	9.2	3.4	-6.7	2.8	-22.7**	21,391	3.5	0.101
Philippines	14.2	12.3	-13.1	14.4	1.2	14.9	4.9	14.4	1.8	16.5	16.1	8,378	14.2	0.104
Rwanda	38.1	38.4	0.9	39.9	4.9	32.7	-14.0**	29.1	-23.6***	n.a.	n.a	3,862	34.8	0.000***
Sierra Leone	32.5	35.6	9.4	28.5	-12.5	32.7	0.7	32.9	1.1	31.2	-4.0	3,121	32.2	0.315
Uganda	4.4	3.6	-18.6	6.2	38.5**	6.1	36.3*	5.2	16.8	4.1	-8.6	8,024	4.9	0.007***
Zambia	24.0	24.7	2.9	25.7	7.2	27.7	15.2	23.0	-4.1	28.7	19.4	3,252	25.4	0.339

*Note: All values are in percentages. The sample was restricted to the first attempt of RDD surveys on days with more than 1% of the sample. The "average" column displays the average rate for each day of the week in each panel. The "Difference" column shows the proportional difference from Monday in OLS regressions that included indicator variables for day of week and country fixed effects in the pooled all countries specification. The "Joint difference" column reports the p-value of an F-test for homogeneity of day of week effects. Standard errors are available from authors. * p< .10; ** p< .05; *** p< .01.*

There are substantial differences by day in some countries. Phone calls were answered at a lower rate later in the week in Burkina Faso, Colombia, and Rwanda amid broadly statistically insignificant changes in other sites. However, there is no clear pattern among completions. Completion rates increase in Burkina Faso, Colombia, and Rwanda on Thursdays and Fridays, but decrease in Ghana, Sierra Leone, and Uganda. Weekends show the same mixed pattern. We do not think these country-level results are entirely driven by sampling variation, as the number of statistically significant contrasts is more than would be expected by chance. Differences in the cultural context, phone infrastructure, and work scheduling in these countries may drive differences in productivity on different days.

[12] The F-test for homogeneity of day-of-week effects could not be rejected at the 10 percent level.

Similar to time of day, these effects are not driven by sample composition. We find that for respondent's age, gender identity, educational attainment, employment status, household size, and predicted poverty probability there is no statistically significant difference in sample composition due to days of week than what we would expect by chance. The p-value of this test of joint equality is 0.570.[13] There are no patterns in terms of sign (positive or negative) or effect size, with the exception of two countries. In Burkina Faso, attempts later in the week yield a slightly younger sample by 2.0 years (1.0 years SE) on Wednesdays, 3.4 years (1.0 years SE) younger on Thursdays, 1.8 years (1.5 years SE) younger on Friday, and 1.5 years (0.9 years SE) younger on weekends. In Rwanda, such attempts produce a sample with lower secondary education attainment, by 13 percentage points (4 pp SE) on Wednesdays, 5 percentage points (4 pp SE) on Thursdays, and 10 percentage points (4 pp SE) on Fridays.

Implications

The evidence presented in this brief provides initial insight into how the times of day and days of week of a call affect respondents' behavior. In future surveys, it may be meaningfully cost-effective to increase effort during certain time periods when productivity is highest, especially since we do not find that altering the time of day or day of week has a systematic effect on the composition of the sample. Calls in midday (12:00 - 3:59 pm), and to a lesser extent, in the morning (7:00 - 11:59 am) may be more productive than calls in the evening (4:00 - 10:59 pm). Day of week is less likely to be important. There is insufficient evidence to suggest that weekend interviews are necessary, except to shorten the total number of days until survey completion. Large variation in magnitude and direction of these effects between sites imply that any effects are context dependent. In particular, three sites in East Africa report less call success in evening hours and one of those, Rwanda, had substantially less success on Fridays.

Prior research has recommended monitoring call times and adapting call time protocols based on initial response rates.[14] The result of this brief provides evidence that this approach may be effective, especially for samples that are not representative of the general population.

Evidence on the contact rates of call attempts made later in the week suggests that some of these productivity changes may be mediated by differences in cooperation. This means that different protocol strategies may be more relevant for different days of the week or times of the day. For example, if respondents are less likely to pick up the phone later on weekdays, sending pre-survey SMS messages may be more effective to increase completion rates than shortening an introduction script.

[13] The F-test for homogeneity of time of day effects on sample composition is not rejected at the 10 percent-level, based on a seemingly unrelated regression jointly estimated for each demographic covariate and time block.
[14]Amankwah, A., Kanyanda, S.; Illukor, J., Radyakin, S., Sajaia, Z., Shaw, J., Wild, M., Yoshimura, K. 2020. High Frequency Mobile Phone Surveys of Households to Assess the Impacts of COVID-19 (Vol. 3) : Guidelines on CATI Implementation. Washington, D.C.: World Bank Group.