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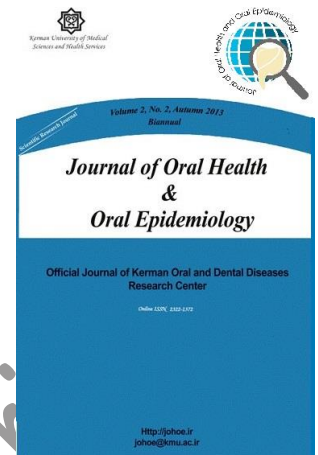
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Applying the last-birthday respondent selection method to an oral health telephone survey in an Iranian population

Mohammad Solati¹, Farzaneh Boroumand², Hedyeh Toutouni^{3*}

- 1- Dental student, School of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran.
- 2- PhD in Biostatistics, Research Fellow and Biostatistician, University of Sydney, Sydney, NSW, Australia.
- 3- DDS, PhD, Assistant Professor, Community Oral Health Department, School of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran.

Correspondence to: Hedyeh Toutouni ; toutounih@mums.ac.ir

Abstract

Background: A representative sample in health surveys ensures the findings can be reliably generalized to the target population. Conducting oral health surveys through telephone interviews has become more common, and ensuring respondent randomness is necessary for any health survey. Several techniques have been suggested. This paper reports applying the last-birthday method as a within-household random selection method for the first time in an oral health telephone survey in Iran.

Methods: This study was part of a larger research in which adult citizens' self-perceived oral health was compared with an objective dental examination. The last-birthday method randomly selected a household member for each attempted landline number, asking the primary respondent to select an eligible family member with the most recent birthday. The selected respondent was then either contacted or replaced with another respondent from the same household based on the research criteria.

Results: Of the 6745 called numbers, 1771 were invalid, 3129 did not respond, 364 were not households, and 771 declined to be interviewed. Finally, 710 respondents entered the random selection procedure, of which 53 had no eligible family member to select. The sample selection method's difficulty caused 36 refusals. Of the 621 selected final respondents, 30 could not be contacted or refused upon introduction. The total percentage of "selection" and "post-selection" dropouts that could be attributed to the sample selection method was 7.41%. Based on the American Association for Public Opinion Research (AAPOR Response Rate 1) guidelines, the minimum response rate for the interview was 13%, and the AAPOR Response Rate 3 was 39.6%. In all characteristics except for employment status ($P = 0.488$), the final participant's demographic characteristics were significantly different from those of the city population ($P < 0.0001$).

Conclusion: Oral health science can make use of the last-birthday selection strategy. This technique seems to obtain a reasonably representative sample through a respondent-friendly selection process in telephone surveys.

Keywords

Iran, last-birthday, oral health, population, telephone interview

Introduction

Participant selection is the quintessence of all types of health surveys. A representative sample group ensures that the findings and conclusions can be reliably generalized to the target population. Oral health surveys are no exception in this regard, and with increasing interest in conducting community-level oral health studies, particularly in developing countries, utilizing sample selection methods that are both easy to implement and scientifically proven is of great importance ¹.

Conducting oral health surveys through telephone interviews has become more popular over the past decades due to ease of access, efficacy in time and resource use, and favorable reception in populations ²⁻⁴. Designing a study in the form of a telephone survey has its specific requirements and intricacies. Maintaining randomness in contacting phone numbers and selecting respondents is one of these necessities.

Most telephone surveys contact households on landlines. Random selection of phone numbers before calling is fairly similar among studies. When a person answers the phone call, it should be determined who the survey participant is – the primary answerer or another household member. Various methods have been proposed and used for this purpose. Interviewing the person who picks up the phone, known as the "no-selection" method, is the simplest and most common among researchers. This method, however, falls short in terms of representativeness and homogeneity ⁵.

The objective respondent selection method devised by Kish is possibly the most famous technique for sample selection ⁶. Despite its overall success in randomly selecting respondents, this technique might take a lot of time and expertise to implement and increases suspicion and unfavorable impressions in people, especially in telephone interviews where there is no person-to-person contact to compensate. The need for easier, more acceptable methods has led to several other techniques being proposed, validated, and used ⁷⁻¹².

Selecting the final respondent based on the birth dates was proposed by Salmon and Nichols to eliminate listing all household members, using tables, or asking troublesome questions ¹³. The "next-birthday" respondent selection method has proven to be faster, easier, and more acceptable among interviewers and the population, incorporating the elements of randomness and representativeness. Moreover, asking the phone call responder to identify the person with the most recent birthday in the past has been suggested to yield similarly acceptable results ¹⁴. ¹⁵. Remembering the person with the last birthday is also easier for the potential responders, further reducing the refusal rate ¹³. This method of random respondent selection, the "last-birthday" technique, has been used and tested in several research studies worldwide ^{5, 16-18}. There is, however, little or no data available to show the utilization of this technique in telephone surveys in developing countries.

Iran is a developing country with a diverse population. A few oral health surveys have been done in this country via telephone interviews, and even fewer have started to use a within-household random selection method ¹⁹. Highlighting the importance of this step in the surveys' validity and reliability, the present study reports applying the last-birthday method for the first time in an oral health telephone survey in Iran.

Methods

This study was part of a broader research project from September 2021 to July 2022, comprising a telephone survey and a clinical oral examination in Mashhad, Iran. The aim was to compare the self-perceived oral health of adult citizens with objective dental examinations.

Sampling frame and sample size determination

Mashhad has a population of over 3 million, with a mean age of 31 and a median age of 28.9. The data from the most recent population and household census in 2016 indicate that the population of adults aged 18 to 64 (the study's target population) was 1,978,867 (983,631 males and 995,236 females). The city is divided into 13 municipal districts²⁰.

The exclusive provider of landline phone services in Iran is the Telecommunication Company of Iran. Twenty-seven separate telecommunication centers provide landlines for the municipal districts of Mashhad. The telephone numbers were acquired from the Telecommunication Company. By overlapping the borders of the telecom centers' coverage area in the municipal districts, it was possible to choose telephone numbers that were evenly distributed among the 13 districts. The numbers were fed into an online system to make random selections among them. The final estimated minimum sample size for completed oral examinations in the study was 234, which was later increased to 294 for additional analyses. Telephone interviews were done by the Iranian Students Polling Agency (ISPA), which carries out public opinion and polling research in Iran. Seven experienced female interviewers made the phone calls from September 2021 to July 2022. Since the final goal of the main study was to reach the desired number of oral examinations for each district, as many telephone interviews were conducted as needed. The selected phone numbers were contacted during the morning and evening from Saturday to Wednesday. Each available number was called three times at 10-minute intervals before being considered a non-contact. In case contact was made, the interview would start as follows.

Questionnaire and interview procedure

After the phone was answered by a "primary respondent," the interviewer would introduce herself and explain the study to the person on the phone. If the phone number belonged to a household and the primary respondent agreed to their family's participation in the study (including oral examination), the interviewer would randomly select the main respondent. The question asked:

"Based on the research method and to determine whom to interview, it is necessary to select an adult family member to participate randomly. The selection method is based on the most recent birthday. Could you tell me which member of your household who is 18 to 64 years old had their birthday most recently? Is it possible to call them to the phone? I do not mean the youngest member of the family."

If the person did not know all birthdays, they were asked, "Of the ones you know, who had the most recent birthday? Could you call them to the phone?"

The interview would end if no household member met the selection criteria.

If a main respondent were selected in the household but was not present at the time of the call, the interviewer would either arrange another call or ask for their mobile phone and attempt to call them. If this attempt got no response, the interview was considered canceled.

If the selected person was present but could not or did not want to come to the phone for any reason, the next family member with the most recent birthday (if available) was interviewed as an alternative. If this "alternative selected respondent" was absent, another call for a later time would be arranged, or their mobile phone would be obtained for direct contact. If this attempt got no response or the alternative final respondent was in the house but could not or did not want to come to the phone for any reason, the interview was considered canceled.

If a selected respondent answered the phone call, the interviewer introduced herself and explained the study to them. If the selected respondent agreed to continue, the conversation would continue, and the questionnaire would be completed. The questions involved personal and social background, demographic data, the person's oral health-related behaviors, and their perceived oral and dental health status.

Data analysis

Phone calls and telephone interviews were assessed regarding outcome rates, people's attitudes, and the interviewers' perception of the sampling method and its ability to select a homogeneously representative sample from the population. Outcome rates were calculated based on the American Association for Public Opinion Research (AAPOR) standard definitions of dispositions and outcome rates calculator^{21, 22}. Based on the definitions, Response Rate 1 (RR1), or the minimum response rate, is the number of complete interviews divided by all eligible cases and cases with unknown eligibility. Response Rate 3 (RR3) is also calculated by assuming a proportion of eligible cases in cases with unknown eligibility. This estimation was based on the AAPOR calculator defaults.

Respondents' demographic data were compared to the target population using the chi-square test for nonparametric legacy dialogue describing values for each variable in SPSS.²⁴

Results

A total of 6745 phone numbers were called, of which 1771 were not valid, and 3129 were not answered, leaving 1845 answers by a primary respondent (27.35% of the total). Of these numbers, 364 belonged to places other than households and were excluded. Of the remaining 1481 numbers, 771 primary respondents refused to begin the interview. As a result, 710 respondents entered the random selection procedure. Table 1 shows the disposition of all sample cases.

The minimum response rate (AAPOR Response Rate 1) for the interview was 13%, and the AAPOR Response Rate 3 was 39.6%. The distribution of exclusions, refusals, and non-contacts in the interview process is described in Table 2.

As shown in Table 2, a very small proportion of the dropouts were directly caused by the sample selection (4.04%). In total, 36 out of 710 primary respondents who entered the random selection procedure (5.07%) were either confused by the method or found it too difficult. Of the 621 selected respondents, 30 could not be contacted or refused the introduction. The total percentage of "selection" and "post-selection" dropouts that could be attributed to the sample selection method was 7.4%.

Table 3 compares the demographic characteristics of interviewed respondents with the study population.

Comparing the selected respondents' characteristics with the target population indicated no significant difference regarding employment between the sample respondents and the target population. Nevertheless, there was a noticeable difference in other aspects, including gender, age, education, and household size ($P < 0.0001$).

Having completed the telephone survey, the interviewers were asked a few questions about their experience with the interviews, possible difficulties with the sampling procedure, and people's reactions to it. All interviewers had prior experience with other sampling methods, but this technique was new. When asked to rate the sampling method's ease of use, most interviewers rated it as "fair," with one rating "difficult" and one "very difficult." The interviewers similarly rated the method's intelligibility to the audience as "fair" or worse. The citizens' cooperation with the sampling method was rated mostly as "fair," with one rating as "high." The average time consumed in the procedure was five minutes. Although there were some issues, like difficulty selecting the respondents or reaching the selected sample, most interviewers favored the method over other techniques they had used.

Discussion

This paper reports applying a within-household sample selection method in an Iranian population. Although globally prevalent, conducting oral health surveys through telephone interviews does not get as much attention in less developed or developing countries as in other countries. Moreover, very few oral health researchers have mentioned a method for

within-household random sampling in their papers. The study by Ghorbani et al. was the only published study in Iran with a random sample selection method – the Kish technique¹⁹. The last-birthday technique has not been documented in an oral health survey.

Selecting the household member with the most recent birthday is categorized as a quasi-probability method, in which there is no need to list all family members, thus reducing the interview length and potentially increasing respondent cooperation^{5, 18}. It has gained substantial popularity due to these advantages. The present study was designed to compare different aspects of people's perception of their oral and dental health with a thorough clinical examination. The last-birthday method was used to select a family member randomly in a short time, and the results were quite acceptable for both the researchers and the subjects.

Since the main study aimed to attract as many in-person examinations as possible, the primary respondents were asked whether they wanted their family members to participate fully, including coming in for the examination appointment. This might explain some of the 771 refusals at the introduction point (87% of total dropouts). Respondents were offered incentives, including free dental scaling and root planing, which proved to be highly effective in encouraging participation. Interviewers also asked the respondents to select any family member within the age limit with the most recent birth date, regardless of whether they were at home or not. Furthermore, substitutions were allowed in case of the selected sample's refusal or non-contact. This was also suggested in several other studies⁵.

One major difference between the present study and other examples using the last-birthday technique is the topic. A study's topic will likely affect the respondents' interest in continuing the telephone conversation. We could not find a study with a similar scope and selection method, so this variable could not be fully addressed. The sociodemographic background should also be noted in analyzing acceptances and refusals. Most surveys with this selection method were public opinion research conducted in the United States or other developed countries^{5, 13, 14, 16, 18}. Similar community-based surveys are encouraged to utilize this method or other proper techniques to assess their suitability in such societies.

Analyzing the resulting sample group showed a tendency toward the selection of females. This has also been observed in other studies, as women are more likely to be present at home and to answer the call. They might – intentionally or mistakenly – fall into the self-selection bias^{5, 18}. The risk is not always high, as O'Rourke et al. showed that the last-birthday method resulted in a very small number of respondents selecting the wrong family member or themselves¹⁵. Using true probability methods like the Kish technique is suggested to reduce the risk of such bias¹. The closest study with such criteria by Ghorbani et al. could recruit a 60% proportion of females in their survey, further confirming the theory¹⁹. In order to shorten the interview's duration, the primary respondents' selections were not validated by listing all family members and their birth dates, as is done in some other research¹⁵. As mentioned above, previous studies have shown a self-selection tendency in primary respondents or occasional inaccuracy in sample selection. Although minor, checking the method's validity in the Iranian population is suggested. Another seemingly unrelated observation was that families with larger household sizes had a higher proportion in the sample compared with the target population. This can be explained by the higher chance of a family member's presence at home in larger households at the time of the call.

Overall, respondents' and interviewers' reception of the selection procedure was quite positive. The AAPOR Response Rate 1 was 13 percent, in line with other studies using the same method¹⁷. Moreover, about 90% of interviews that entered the selection procedure ended with a complete interview. Most refusals occurred before the interviewer could even mention the selection protocol to the respondent (86% pre-selection "refusal"). Another 6% dropped out due to the study's exclusion criteria - mostly when the interviewer asked them to select a family member in the age limit. However, the definition of the term "refusal" and its

disposition is not fully clear in the comparative studies, so the rates and percentages should be regarded with care.

Strengths and Limitations

The last-birthday respondent selection method is considered a highly effective approach for obtaining a robust and representative sample despite the perceived challenges associated with its implementation. Given the more complex structure of the main study and the respondents' unfamiliarity with such surveys and selection methods, it is recommended that this method be utilized in more oral health studies in the future to confirm its effectiveness.

Conclusion

Using the last-birthday technique as a sample selection method in this oral health study was successful. It yielded a reasonably representative sample, was respondent-friendly, and did not exert excessive costs on the research.

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Authors' Contribution

Conceptualization: HediyeH Toutouni and Mohammad Solati

Data Curation: Farzaneh Boroumand and Mohammad Solati

Investigation: Mohammad Solati

Formal Analysis: Farzaneh Boroumand

Methodology: HediyeH Toutouni, Mohammad Solati, and Farzaneh Boroumand

Project Administration: HediyeH Toutouni

Supervision: HediyeH Toutouni

Software: SPSS24 and Farzaneh Boroumand

Resource: HediyeH Toutouni and Mohammad Solati

Validation: HediyeH Toutouni and Mohammad Solati

Visualization:-

Writing- Original Draft: Mohammad Solati

Writing- Review & Editing: HediyeH Toutouni and Mohammad Solati

Competing Interests

The authors of this work declare no competing interests.

Data Availability Statement

Data is available to be presented on demand.

Ethical Approval

Under the code IR.MUMS.DENTISTRY.REC.1399.054, all study phases were reviewed and approved by the Research Commission at the Deputy of Research and Technology, School of Dentistry, Mashhad University of Medical Sciences.

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Tables

Table 1: Final disposition of the sample cases as of AAPOR's Standard Definitions (Revised 2016).

Disposition of cases		Number of cases
Interviews	Complete interview	591
	Partial interview	0
Eligible, no interview (non-response)	Refusals and break-offs	20
	Non-contact	10
	Others	0
Unknown eligibility, non-interview	Always busy and no answer	3129
	Household with unknown eligible respondent residence	771
	Others: Primary respondent's refusal because of sample selection difficulty	36
Not eligible	Outside the sampling area's geopolitical boundary	0
	Non-working and disconnected number	1771
	Non-residence and fax/data line	364
	Housing unit with no eligible respondent	53
	Others	0
Total cases		6745

Table 2: Exclusion, refusal, and non-contact status in households

Point of Dropout		Number	Percentage
Pre-selection	Introduction to the primary respondent	771	86.62
	Housing unit with no eligible respondent	53	5.95
Sample Selection	Sample selection difficulty	36	4.04
Post-selection	Selected respondents not contacted	10	1.12
	Selected respondent's refusal	20	2.24
Total refusals		890	100

Table 3: Demographic characteristics of survey respondents and the city's total population (Data from the 2016 national census)

		Sample respondents		Target population		Expected Respondents	P-value
		N	%	N	%	N	
Gender	Male	180	30.5	983631	49.7	294	< 0.0001
	Female	411	69.5	995236	50.3	297	
Age	18–24	62	10.5	314498	15.8	94	< 0.0001
	25–34	126	21.3	653237	33.0	195	
	35–44	197	33.3	469713	23.7	140	
	45–54	128	21.7	323356	16.3	97	
	55–64	78	13.2	218063	11.0	65	

Education	Less than a high school diploma	172	29.3	772417	46.6	275	< 0.0001
	High school diploma	229	38.9	496078	29.9	176	
	Associate degree	41	7.0	97667	5.9	35	
	Bachelor's degree	115	19.6	232531	14.0	83	
	Master's degree or higher	31	5.3	56283	3.4	20	
	Other	3	-	-	-	-	
Employment	Employed	207	35.1	858014	34.7	205	0.488
	Unemployed	20	3.4	110703	4.4	26	
	Not in the labor force (homemakers, students, retirees, etc.)	362	61.5	1499462	60.7	358	
	Not stated	2	-	-	-	-	
Household size	1	12	2.0	76589	8.3	49	< 0.0001
	2	74	12.5	185299	20.2	119	
	3	157	26.6	260512	28.4	168	
	4	234	39.7	264002	28.7	170	
	5 or more	113	19.2	130711	14.2	84	
	Not stated	1	-	-	-	-	