

**Comparison of Two Survey Methods based on  
Response Distribution of Pediatricians Regarding Immunization for  
Children in India: Mail versus Telephone**

**ABSTRACT**

**Introduction:** The use of telephone and mail surveys raises the question to what extent the results of different data collection methods deviate from one another.

**Aim:** To determine if there is any difference in the response distribution between telephone and mail surveys of vaccination related-attitudes.

**Methods:** A random sample of 400 pediatricians who are members of the India Academy of Pediatrics and work at various locations in India was selected. Mantel-Haenszel chi-square test was applied; significance level was  $\alpha=0.05$ . Difference in percentage points of the majority response was calculated in the following way  $\Delta = \text{telephone\%} - \text{mail\%}$ .

**Results:** Only 36% responded to mail surveys and 57% responded to telephone surveys. Pediatricians in both telephone and mail surveys agreed for the majority of survey questions but to a different degree on particular items. More pediatricians in the telephone arm responded that measles eradication is important with a  $p=0.0006$  and  $\Delta \approx 8$ . More mail than telephone respondents reported that it is parents' responsibility to ensure child is vaccinated ( $\Delta \approx -8$ ,  $P=0.002$ ) and that they would refer parents to a facility of their choice to get vaccines ( $\Delta=14$ ,  $P=0.008$ ).

**Conclusion:** The results show evidence of the interviewer and/or social desirability bias and its influence on response choices. This suggests that mode of administration should be standardized or carefully adjusted for during analysis. Alternatively, further question development may minimize the sensitivity of items to mode of data collection.

*Keywords: Survey mode; attitudes; vaccines; India; pediatricians.*

**1. INTRODUCTION**

One of the main primary data collection instruments in social, health and epidemiological research is the survey questionnaire [1]. Modes of data collection by questionnaire vary in the method of contacting respondents, in the vehicle of delivering of the questionnaire, and in the way in which questions are administered [1]. These variations can have different effects on the accuracy and quality of the data obtained [1,2]. In addition to the traditional range of paper and pencil methods, there is increasing academic interest in tools commonly used in market and public opinion research, e.g. the use of computer assisted

face-to-face interviewing, computer-assisted telephone interviewing, self-administered computer methods, audio computer-assisted self-administered interviewing, and interactive voice response telephone methods [3]. With any mode of administration, there are many potential influences on responses [1, 4]. These differences, at different levels, can make it difficult to separate out the effects of each on the quality of the data obtained [5].

Broadly, these sources of error in surveys can be summarized as (i) non-measurement errors: survey design, sampling frame and sampling, non-response and item non-response; and (ii) measurement errors: survey instrument and data collection processes. Mode of questionnaire administration has effects on elements of both of these sources [1, 6].

Different response rates between mail and phone surveys could result in biased samples that impact the data quality. Methodological research comparing different methods of administering questionnaires has focused on the issue of response rates, item response, and on methods of increasing these, in particular in relation to postal surveys [7]. Non-response is thus likely to be influenced by mode of questionnaire administration. The lower the response rate to a study, the greater the danger that the responders may differ from non-respondents in their characteristics, which affects the precision (reliability) of the survey's population estimates, resulting in study bias, and weakening the external validity (generalizability) of the survey results [1,8,9]. A number of studies have since reported differences between response rates to telephone, face-to-face and postal questionnaires [10, 11, 12].

Differences in results between telephone and mail surveys have been demonstrated in numerous areas of interest, such as surveys of patient satisfaction [13, 14], alcohol and drug abuse [15, 16] or mental health [17, 18]. Interviews involve social interaction with another person, which can lead to respondents taking social norms into account when responding, resulting in social desirability bias (the desire of respondents to present themselves in the best possible light), resulting in the over-reporting of desirable behaviors, and under-reporting of

undesirable behaviors (confounding associations between variables by attenuating, inflating or moderating relationships). This impact, however, is dependent on the actual content of the questions. Previous studies have found that face-to-face or telephone surveys may result in a tendency toward less reported morbidity, health care utilization or socially inadequate behavior (e.g., drug use, sexual behaviors, illegal behaviors) compared with mail surveys [16, 19-22]. These results were mainly attributed to the reduced anonymity of face-to-face or phone surveys. Similarly, other studies have found more positive assessments of mental health dimensions of health-related quality of life when gathered by telephone rather than by mail survey [23-25].

Any excess of positive responses in interview, compared to self-administration situations, could also be due to increased 'yes-saying' or acquiescence bias: a culturally based tendency to agree with others because it is perceived to be 'easier' to agree than disagree. Although 'yes-saying' can also be evident on self-administered questionnaires, it appears to be less pronounced than in interviews. The potential for a different type of reporting bias due to 'ease' exists in self-administered questionnaires, based on evidence from classic psychological experiments. These respondents tend to check the nearest response choices to the questions. Commonly used attempts to control for this include switching the order of responses periodically in a measurement scale (e.g. from 'Strongly agree – Strongly disagree' to 'Strongly disagree – Strongly agree') [26]. Research has yielded inconsistent results in relation to differences between mode of questionnaire administration and 'yes-saying'. A meta-analysis on this issue by De Leeuw failed to detect any differences between postal, face-to-face and telephone interviews [27].

The presence of an interviewer can be distracting to respondents. If an excess of positive or socially desirable responses in interview situations is found, this could be due to interviewer bias (due to characteristics of the interviewer [26, 28] or because people may be reluctant to reveal beliefs unlikely to be endorsed by the interviewer; see earlier, social desirability bias).

In addition, interviewers can vary in their ability to appear or sound neutral, to listen, to probe adequately, to use techniques to aid recall and to record responses. Careful training and monitoring of interviewers can minimize this, and analysis of responses by interviewer (where more than one is used) can check for inter-viewer bias. Self-administration modes obviously avoid this source of bias.

The goal of this study is to provide an evidence-based statistical comparison of two survey methods (mail versus telephone) in a developing country, India, among pediatricians in private practice who are members of the Indian Academy of Pediatrics that controls for survey design and determine whether there is a difference in the response distribution between the two survey modes. Participants were sampled from across India and the survey questions were regarding immunization of children in India. We hypothesize that those taking the survey by telephone will be more likely to report favorable attitudes towards vaccines, compared to those taking the mail survey.

## **2. METHODS**

### **2.1 Sample Size and Sample Design**

Participants were members of the Indian Academy of Pediatrics (IAP). IAP members are predominately in private practice. The list of eligible participants from throughout India was provided by the Indian Academy of Pediatrics. The initial desired sample sizes of 400 for each survey group were determined based on variance estimates for vaccine efficacy and importance. Sample size was calculated by using a list provided by the IAP, we divides members i into five strata: 1) Bihar; 2) UP; 3) low-performing states; 4) mid-performing states; 5) high-performing states. Low-, mid- and high-performing states will be defined on the basis of UNICEF coverage estimates. From each strata we will select a simple random sample of IAP members (N=275 from UP; N=230 from Bihar; N=85 from low-performing states; N=125 from the middle-performing states; N=85 from the high- performing states) for a total sample of 800 IAP members. Assuming a 50% response rate, this sampling scheme allowed us to estimate true population

proportions with an error of  $\pm 10\%$  on a national level. The sample design was a dual-frame simple random sample. The allocation sequence for the randomization was generated using the SAS routine RANUNI and subsequent sorting procedure. Pediatricians with telephone numbers in the full frame were separated from the rest of the list, and a simple random sample of 400 pediatricians was selected for the phone sample from this list. Pediatricians who were not selected for the telephone sample were included in the remainder of the original frame and were potentially available for the mail survey. From this augmented sampling frame, a simple random sample of 400 pediatricians was selected for the mail survey.

## **2.2 Survey Procedures**

Two separate samples of pediatricians were surveyed, one by telephone and the other sample through mail. An identical questionnaire was used in both samples. Survey items were guided by the Health Belief Model (HBM) [29]. The survey instrument was designed to assess attitudes and practices associated with vaccines included in the Government of India's Universal Immunization Program (UIP) and vaccines that are available in India but not currently in the UIP but are potential candidates for inclusion in UIP. The instrument also included questions on barriers to immunization and interventions to improve immunization coverage. Based on focus group discussions and pilot studies, the questions were based on a three-point Likert scale. The instrument consisted of 27 questions, took approximately 30 minutes to complete, and was conducted in English. An experienced Indian survey team conducted the survey and an interviewer obtained verbal consent for the phone survey by reading a standard script and receipt of a completed survey served as consent for the mail survey. The survey team was based out of St. Stephen's Hospital Community Health Department where they conduct both urban and rural health surveys and provide education and health services based on the need of the communities. The survey team was made up of six members with varying educational backgrounds, including MBBS. The survey team was trained by the senior author (LMG) using a script developed by the study team with input from the survey team. The protocol and the data entry form was developed prior to the study starting. During a site visit, the survey team reviewed the protocol and were able to ask questions for clarification. At this time, the team practiced the scripts and the survey on other team members. For both groups, members selected for participation first received a telephone call to solicit their participation using the contact information provided by the national IAP office. During this call, persons randomized to the mail survey were asked for the best mail address. Persons in the telephone group were asked if they had time to complete the survey, or if there was a convenient

time for them to be called back. Persons in the mail group who accepted the invitation to participate were called up to two more times **to encourage them to send in their responses**. Persons in the phone group were called two additional times before being considered unreachable. If no telephone was available for those in the mail survey, a letter was mailed with the survey to the address on file with IAP. Confidentiality and anonymity were maintained by not recording any identifying information on the survey form or in the database. Records of participants and survey responses were not recorded or stored together. The study period was June 2009–June 2010.

### **2.3 Measures**

The items that were of particular interest were the views on disease susceptibility, vaccine delivery, and disease eradication. The comparison for disease susceptibility was on “How likely do you think a child in India under 5 years of age who has received no vaccine when recommended is to get the following diseases within the next year” (“likely”, “neither likely or unlikely”, “not likely”). Attitudes toward polio and measles eradication were assessed (e.g., How important is polio eradication? and How important is measles eradication?) (“important”, “neither important nor unimportant”, or “not important”), and (e.g., How likely is it that polio will be eradicated from India? and How likely is it that measles will be eradicated from India?) (“likely”, “neither likely nor unlikely”, or “not likely”). Another item that was compared was the viewpoint on who should be held accountable for getting a child vaccinated (“In your opinion, who is primarily responsible for ensuring that children are immunized”). Lastly, the participants were asked about who should provide the vaccination service (“If you identify a child who has not received all or some vaccines appropriate for his/her age, what do you do most frequently?”).

### **2.4 Data Analysis**

The main focus of this paper was to compare the two sampling methods, mail versus telephone, based on response distribution. In order to do so, particular questions (items) focusing on physicians' expectations were selected and statistically tested for significant differences in proportions. For the items analyzed, the response variables were multi-categorical. Any non-response counts were categorized as missing. Difference in percentage points of the majority response was calculated by subtracting the majority percentage response in the mail survey from the majority percentage response in the

telephone survey ( $\Delta = \text{telephone\%} - \text{mail\%}$ ). The Mantel-Haenszel chi-square test was used and significance levels were set prior to analysis as  $\alpha = 0.05$ . The statistical software used for the analysis was SAS®9.2 (SAS Institute, Inc.). In the analysis, each question item response was analyzed in two areas: (1) Which response choice did the majority select for each question in the two survey modes. (2) Were there any statistically significant differences between the telephone responses compared to the mail responses, and if so, by how many percentage points.

### **3. RESULTS**

#### **3.1 Response Rate**

For each survey mode, a sample size of 400 was selected; the number of returned mail surveys was 144 (36%), while the number of respondents who answered the telephone survey was 231 (58%).

#### **3.2 Disease Susceptibility**

diseases (Table 1), pediatricians via telephone were more likely to report disease susceptibility than mail respondents for hepatitis B ( $\Delta = 25.8$ ,  $P = 0.001$ ). For rotavirus more mail respondents reported likely disease susceptibility ( $\Delta \approx -7.1$ ,  $P = 0.02$ ), Table 1 shows the diseases in the order of the largest percentage point difference to the smallest difference. While not statistically significant, pediatrician responses showed large differences ( $\Delta > 10$ ) in percentage points with telephone respondents reporting rate for susceptibility higher for pneumonia ( $\Delta = 16.2$ ,  $P = 0.14$ ), tetanus ( $\Delta = 14.4$ ,  $P = 0.29$ ), polio ( $\Delta = 13.9$ ,  $p = 0.55$ ), hepatitis A ( $\Delta = 12.5$ ,  $P = 0.48$ ), rubella ( $\Delta = 11.1$ ,  $P = 0.34$ ), diphtheria ( $\Delta = 11$ ,  $P = 0.79$ ) and Hib disease ( $\Delta = 10.9$ ,  $P = 0.81$ ).

**Table 1. Comparison between mail and telephone response on “Likelihood of child contracting disease”**

| Question*   | Telephone<br>N (%) | Mail<br>N (%) | Difference in majority response<br>(telephone% - mail%) | P-value | Missing<br>N (%) |
|-------------|--------------------|---------------|---------------------------------------------------------|---------|------------------|
| Hepatitis B | 148 (67.0)         | 56 (41.2)     | 25.8                                                    | 0.001   | 10 (2.7)         |
| Pneumonia   | 140 (64.8)         | 69 (48.6)     | 16.2                                                    | 0.14    | 9 (2.4)          |
| Tetanus     | 164 (73.9)         | 85 (59.4)     | 14.4                                                    | 0.29    | 2 (0.5)          |
| Polio       | 152 (69.1)         | 79 (55.2)     | 13.9                                                    | 0.55    | 4 (1.1)          |
| Hepatitis A | 157 (71.3)         | 80 (58.8)     | 12.5                                                    | 0.48    | 11 (3.0)         |
| Rubella     | 121 (55.0)         | 61 (43.9)     | 11.1                                                    | 0.34    | 8 (2.2)          |
| Diphtheria  | 161 (72.5)         | 88 (61.5)     | 11.0                                                    | 0.79    | 2 (0.5)          |
| Hib         | 133 (61.3)         | 70 (50.4)     | 10.9                                                    | 0.81    | 11 (3.0)         |
| Typhoid     | 167 (75.6)         | 96 (67.6)     | 8.0                                                     | 0.08    | 4 (1.1)          |
| Varicella   | 171 (77.0)         | 102 (71.3)    | 5.7                                                     | 0.86    | 2 (0.5)          |
| Mumps       | 178 (80.2)         | 108 (75.5)    | 4.7                                                     | 0.93    | 2 (0.5)          |
| Pertussis   | 183 (82.8)         | 114 (80.8)    | 2.0                                                     | 0.31    | 5 (1.4)          |
| Measles     | 206 (92.8)         | 133 (93.0)    | -0.2                                                    | 0.55    | 2 (0.5)          |
| Rotavirus   | 130 (60.7)         | 93 (67.8)     | -7.1                                                    | 0.02    | 16 (4.4)         |

\* Responded 'Likely'

### 3.3 Disease Eradication

For the importance of eradicating measles (Table 2), more telephone respondents indicated eradication was important ( $\Delta \approx 8$ ,  $P = 0.001$ ). When pediatricians were asked about the importance of eradicating polio and likelihood of eradicating polio no significant differences were found between the mail and telephone responses (Table 2). On the other hand, for the item regarding the likelihood of eradicating measles, respondents were divided and showed a significant difference ( $\Delta = 22$ ,  $P = 0.003$ ) (Table 3).

**Table 2. Comparison between mail and telephone response on “Importance of disease eradication”**

| Question* | Telephone<br>N (%) | Mail<br>N (%) | Difference in majority response<br>(telephone% - mail%) | P-value | Missing<br>N (%) |
|-----------|--------------------|---------------|---------------------------------------------------------|---------|------------------|
| Measles   | 219 (97.8)         | 128 (89.5)    | 8.3                                                     | 0.001   | 8 (2.1)          |
| Polio     | 223 (99.5)         | 144 (100.0)   | -0.5                                                    | 0.42    | 7 (1.9)          |

\* Responded 'Important'

**Table 3. Comparison between mail and telephone response on “Likelihood of disease eradication”**

| Question* | Telephone<br>N (%) | Mail<br>N (%) | Difference in majority response<br>(telephone% - mail%) | P-value | Missing<br>N (%) |
|-----------|--------------------|---------------|---------------------------------------------------------|---------|------------------|
| Measles   | 169 (76.1)         | 76 (53.9)     | 22.2                                                    | 0.003   | 5 (1.4)          |
| Polio     | 204 (91.5)         | 130 (90.9)    | 0.6                                                     | 0.46    | 9 (2.4)          |

\* Responded 'Likely'

### 3.4 Vaccination Responsibility and Delivery

As for the responsibility for getting children vaccinated, respondents held everyone specified in the surveys as responsible but were divided on parents (Table 4). Parents' responsibility showed significant difference between mail and telephone response ( $\Delta = -7.9$ ,  $P = 0.002$ ); a greater percentage of responses in the mail survey choose parent's responsibility to ensure the child is vaccinated compared to the telephone majority response.

When pediatricians were asked what they would do if they were treating a child whose 206 vaccination status was not up-to-date, they were divided on advising the parents to

vaccinate at a facility of their choice with more telephone participants selecting this option

(Table 5,  $\Delta \approx 14$ ,  $P = 0.008$ ). There were more respondents in the telephone survey choosing

to deliver the service themselves compared to the mail survey response ( $\Delta \approx 6.5$ ,  $P = 0.24$ ).

There were no significant differences on recommending vaccination be done at a

UIP/Government facility ( $\Delta \approx 5$ ,  $P = 0.16$ ), referring vaccination be done by another physician

( $\Delta < 1$ ,  $P = 0.48$ ), and doing nothing ( $\Delta = 0.2$ ,  $P = 0.15$ ).

**Table 4. Comparison between mail and telephone response on “Responsibility for child vaccination”**

| Question          | Telephone<br>N (%) | Mail<br>N (%) | Difference in majority response<br>(telephone% - mail%) | P-value |
|-------------------|--------------------|---------------|---------------------------------------------------------|---------|
| ASHA workers      | 125 (57.3)         | 82 (56.9)     | 0.4                                                     | 0.94    |
| PHC physicians    | 134 (61.5)         | 88 (61.1)     | 0.4                                                     | 0.95    |
| GPs               | 129 (59.7)         | 87 (60.4)     | -0.7                                                    | 0.90    |
| ANMs              | 134 (61.5)         | 91 (63.2)     | -1.7                                                    | 0.74    |
| Pediatricians     | 181 (83.0)         | 123 (85.4)    | -2.4                                                    | 0.55    |
| Anganwadi workers | 134 (61.5)         | 92 (63.9)     | -2.4                                                    | 0.64    |
| Parents           | 198 (90.8)         | 142 (98.7)    | -7.9                                                    | 0.002   |

ASHA: Accredited Social Health Activist; PHC: Primary Health Center; GPs: General practitioners; ANM: Auxiliary Nurse Midwife

\* N (%) who selected this response option, multiple answers allowed

**Table 5. Comparison between mail and telephone response on “Delivery of child vaccination”**

| <b>Question</b>                                         | <b>Telephone<br/>N (%)</b> | <b>Mail<br/>N (%)</b> | <b>Difference in majority response<br/>(telephone%- mail%)</b> | <b>P-value</b> |
|---------------------------------------------------------|----------------------------|-----------------------|----------------------------------------------------------------|----------------|
| Vaccinate them yourself                                 | 147 (69.7)                 | 89 (63.1)             | 6.6                                                            | 0.24           |
| UIP/Government facility**                               | 179 (85.7)                 | 114 (80.9)            | 4.8                                                            | 0.16           |
| Refer to another physician**                            | 201 (95.7)                 | 134 (95.0)            | 0.7                                                            | 0.48           |
| Do nothing**                                            | 208 (99.5)                 | 140 (99.3)            | 0.2                                                            | 0.15           |
| Advise parents to vaccinate at facility of their choice | 114 (54.3)                 | 96 (68.1)             | -13.8                                                          | 0.008          |

\*\* The majority responses for these option 'not selected'

#### 4. DISCUSSION

This study is unique in that it is one of the few that focuses on survey mode comparison in an international setting. In this study we found that the mail survey had a lower response rate than the phone survey. Lower response rates for mail surveys compared to phone surveys have been seen in other mixed-mode survey collection [30-32]. In addition, we found that pediatricians, in both surveys, agreed on most of the questions relating to disease risk and eradication along with vaccination responsibility and delivery. However, 6 of the 30 question items analyzed had significant differences in majority responses between the two survey modes.

Overall, there is some evidence of mode effects in this analysis. In general, telephone respondents were more likely than mail respondents to give positive responses. This is consistent with previous studies [13, 33-35] and implies that some pediatricians, in an interview, tend to (1) make the current situation seem more dire, (2) place greater importance on the role that pediatricians should have in child vaccination, and (3) answer the question with a sense of social appeasement to the interviewer. What is clear is that the interviewer's presence resulted in a larger difference in degree of agreements and disagreements between the mail and telephone surveys. This evidence suggests that social desirability (e.g., being socially accepted) bias is at work in the telephone interviews. A tendency for telephone respondents to prefer extreme response categories has also been reported in other studies [24].

Others have proposed that the cognitive demands on telephone respondents are higher than the cognitive demands on questionnaire respondents which may explain why in this study those on the telephone had a tendency to provide responses in the extreme categories [36]. One reason for the differences in response may be that the mail survey allows the respondent to (1) answer the entire questionnaire in the order that the respondent desires [37-38]; (2) visualize the scale on paper which may have influenced respondents in the self-administered mode to choose the less extreme categories; [39-40] (3) the mail survey is self-administered, so it lacks the presence of an interviewer and other social effects (i.e. social compliance) [6, 7]; (4) the respondent can dictate the pace of completing the mail survey, but for the telephone survey that pace is dictated by the interviewer; [3] and (5) the mail respondents are not subjected to response order effect, since they can view all the response choices before choosing one, while the telephone respondents receive the response choices in the order that they were given by the interviewer [37, 38, 41].

Regarding the question concerning the likelihood of an unvaccinated child contracting polio, both the mail and telephone respondents showed agreement that it was likely; however, the difference in the degree of agreement was larger than 10 percentage points. A larger percentage of telephone respondents chose "likely" compared to the mail respondents. This large gap in percentage points seems unexpected in the sense that at the time of the survey polio was still endemic in India. More pediatricians in the mail survey believed that parents should have a greater role compared to those who answered in the telephone survey. This suggests that the pediatricians might have placed a greater importance on their social responsibility as a physician to deliver care to their patients, in the presence of an interviewer.

The main strengths of this study were the identical sampling methods and contemporaneous conduct of the two surveys in the same region and at the same time. In addition, the study was based on random samples, eliminating the concern of other factors like differences

between settings or genuine differences between respondents. The first limitation is that the sample came directly from the membership of the Indian Academy of Pediatrics; this sample does not take into account the characteristics of pediatricians, such as gender, years in practice, age nor does it take into account other immunization providers not associated with this Academy. Since random samples were taken, these factors should have been distributed evenly across both samples so the differences in the responses to these instruments ascertained in this study can potentially be attributed to the different methods of administration and to their interactions with other properties. The majority of Indian Academy of Pediatrics members are in private practice so these results are not generalizable to pediatricians or physicians outside of private practice. Also, knowing that only 36% of the sample size 400 responded to the mail surveys might lead to a less representative sample. This can potentially omit certain characteristics that the true population might have, which might also explain certain large percentage point differences between the mail and telephone survey responses. We were unable to compare characteristics of pediatricians who completed surveys with those who refused since no information was collected for refusals.

## **5. CONCLUSIONS**

This research provides valuable insight into the impact of mode on response to a number of commonly asked vaccine-related questions. This suggests that mode of administration of a survey should be held constant as far as possible or carefully adjusted for in statistical analysis. Alternatively, further question development may minimize the sensitivity of questions to mode of data collection. Adjusting scores for mode could control for any differences. Other measures such as efficiency and cost-effectiveness of the mode should also be considered when determining the most appropriate form of data collection.

## **ETHICAL APPROVAL**

Emory University's Institutional Review Board and Maulana Azad Medical College, New Delhi, Institutional Ethics Committee both determined that this study did not meet the definition of "Human Subjects Research" and was classified as "Quality Improvement", not requiring review.

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