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Comparison of Two Survey Method based on Response Distribution:

Mail versus Telephone

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Advisor: Paul Weiss, M.S.

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Abstract:

This paper focused on whether there was any difference in the response distribution between two survey modes conducted through mail and telephone surveys. The questionnaires were given to pediatricians, who are part of the India Academy of Pediatrics and work at various locations in India. Both survey modes have a sample size of 400, but only 36% responded to the mail surveys and 57% responded to the telephone surveys. The results found that pediatricians in both telephone and mail surveys agreed for the majority of survey questions but to a different degree on particular items. It was found that pediatricians mostly agreed that Indian children were likely to contract polio and had a 14 percentage points difference in degree of agreement (p= 0.5507) [Δ = telephone % - mail %], reported in percentage points. With regards to "importance of disease eradication" pediatricians agreed between both surveys that polio is "important" ($\Delta < 1$, p= 0.4227). However, pediatricians were divided on the importance of measles eradication with a p=0.0006 and Δ is approximately 8 percentage points. As regards to the "Likelihood" of eradicating polio, pediatricians agreed that for it is "likely" ($\Delta < 1$, p= 0.4591). However, for the likelihood of eradicating measles, pediatricians were divided in their response (Δ=22, p= 0.0033), where more telephone respondents chose "likely". Lastly, pediatricians were also divided on both the parent's' responsibility on child vaccination ($\Delta \approx 8$, p=0.0024) as well as their role on the delivery of child vaccination (Δ = 14, p=0.0084). Generally, there might be a subtle pattern where pediatricians on the telephone tend to respond with more agreeable and socially expected answers. In particular, there were more telephone responses projecting a stronger emphasis on the likelihood of children contracting "vaccine-able" diseases compared to the mail survey responses. The response distribution did show evidence of potential interviewer effect in the telephone survey.

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Chapter I

Introduction

As the population of interest for any group grows, studies are conducted in the interest of understanding certain characteristics of that growing population. Yet it is neither prudent in cost nor in efficiency to try and collect data from the entire population of interest. Instead, a more effective method would be to gather data from a sample deemed to have an accurate representation of that entire population.

To initiate the isolation of such a sample, the target population should be determined, which defines the set of elements that are measures of interests; for instance registered voters of a country, hospitals of a particular region, or even drivers of a particular state/province. Then within the target population, a sampling frame is establishing consisting of an enumerated list that details a subset of elements in the target population; for example voter registration lists, list of hospitals of the region of interest, or a list of the licensed drivers in the specific state/province. Then finally, a sample is drawn from the sampling frame where certain sampling methods are used. Ideally the sample is drawn at random with measurable probability of selection and most importantly that the sample is an accurate representation of the target population.

In many fields of study, particularly in Public Health, surveys are implemented in order to gather a collection of data, however there are several different choices of survey modes, where each takes advantages of different communication mediums. Each of the survey modes has their own pros and cons, in the context of this study, mail surveys would tend to be more cost-efficient than telephone surveys but that does not mean that

mail surveys will always be a better choice between the two. There are several factors that have been constantly changing the landscape of survey implementation, affecting the overall results, accuracy, and methods of data collection. The first factor has to be the continuously increasing population and its movement. To collect data on a particular group is only a snapshot of that small portion of the population within a particular time frame, the target population can always change in size and characteristics. Another factor to consider is the advancement in technological communications. Mail has been the predominant method and format of data collection before the face-to-face interviews, telephone, or internet came into use. Yet, with the introduction of faster, more efficient and cost-effective communication methods, mail survey response rates have decreased steadily. There are two main survey administration formats: (1) self-administered and (2) interview; mail surveys are self-administered in the definition that a survey is sent to a respondent who is responsible to return the completed survey through the mail. For interviews, a trained interviewer will either ask questions from the survey in a face-to-face session with the respondent or administer the survey through a telephone session.

Background

The study mentioned in this paper focuses on vaccination for children in India. The survey was given to pediatricians and other physicians of several hospital sites across various provinces in India; the survey measured their attitudes and viewpoints on the importance of childhood vaccination, responsibility of vaccination delivery, and the pertinent goal of specific disease eradications. The data collected in this study was gathered through two survey methods. One sample was given a self-administered mail survey while the other sample was sampled through a telephone interview. The main

interest of this paper is to compare the response distribution between the two sampling methods to discern if there are significant differences between the two distributions and if so, whether these differences are due to certain effects or errors that would disrupt the accuracy of the sample's representation of Indian pediatrician's nation-wide viewpoint on child vaccination.

Problem Statement

With all these communication media as choices, questions will stem from which medium of communication is the optimal choice for gathering the best response rates along with precision and minimal bias. The result can potentially place more confidence in a more high-tech communications medium and potentially replace other media, or it might still justify that traditional communication methods are the proven and preferred choice of data collection. In this study, the formats of the surveys (question design and question order) are identical in both the telephone and mail questionnaires. If they were different then we would need to take into consideration of the two types of design for surveys: Tailored Design and Total Design (Dillman, 2000). In the surveys that this paper focuses on, Total Design was utilized for both the mail and telephone surveys.

When non-response becomes a large issue, a study's findings can contain bias and high variability because certain characteristics of the population are not collected in the representative sample. Thus, to pursue an effective survey method starts at the key decision of determining the most effective medium of communication that returns high response rate, minimal variability/bias, and precise representation at the lowest possible cost.

Purpose Statement

The goal of this paper is to provide an evidence-based statistical comparison of two survey methods (mail versus telephone) that controls for survey design and target population. Both surveys have identical question format, question order, response format, and response order along with the sampling of individuals with the same occupation. This paper will demonstrate from the results whether there is a difference in the response distribution between the two survey modes. An additional goal for this paper would be to provide evidence for the argument of whether self-administered questionnaires are preferred over their interview-formatted counterparts due to potentially lower costs.

Significance Statement

The focal point of this paper might provide greater evidence and emphasis on the possible shift of communication usage and survey methods in the advancement of sampling methods in order to achieve higher response rates, greater precision in sample representation, and minimized bias/variability.

Chapter II

Introduction

The following sources (books, articles, and scientific papers) provide for a more clarified context of the effects, supplemental concepts, and various theories that have gone through experimental tests, in which to support the argument and analysis of this study. Many of these effects, concepts, and theories cannot always be controlled for due to the degree of difficulty, the ever-changing landscape of target populations, and the inflating costs of sampling procedures. However, these concepts will provide an explanation of the challenges surveyors face as well as explain the evolution of sampling techniques in order to account for these challenges.

Literature

Surveys have always taken advantage of the various communication mediums in order to reach out to the population and collect necessary data. One common survey done on an intermittent basis is the United States National Census, which sends out questionnaires in order to (at best) measure a precise estimation of the demographically diverse population of the country. Starting from the early 1950s, mail surveys were the preferred method of sampling; however door-to-door interviews were also common. (Dillman, 2000) Before the telephone became a dominant communication medium in every household during the 1970s-80s, mail was the most cost-effective and prevalent method for surveys to be administered. Every survey, regardless of the method of communication used, was designed to achieve accuracy and high response rates. When American households began to install telephones, the cost of sampling greatly decreased

because of the speed and efficiency of reaching someone, this provided more choices for data collection methods. Finally by the 1990s the internet led to online surveys that are even faster and more cost-effective than telephone surveys. (Dillman, 2000; Groves, 1988) All of these methods have pros and cons, and each provides challenges from their designs and the target population that is being sampled.

Regardless of the sampling method, there are four main errors that every survey faces: sampling, non-response, measurement, and coverage error. These errors can introduce bias and variability in results that may skew the perception of the true population characteristics being depicted. *Sampling error* occurs, when the attempt to survey all the units of the survey population is incomplete. (Dillman, 2000) *Coverage error* occurs when the list from which the sample is drawn does not include all elements of the population, thus making it impossible to give all elements of the population an equal or known chance of being included in the sample survey. (Dillman, 2000) *Measurement error* occurs when a respondent's answer to a survey question is inaccurate, imprecise, or cannot be compared in any useful way to other respondents' answers. (Dillman, 2000) Measurement error can occur due to poor question wording and questionnaire construction as well as intrusive questions that respondents would not be inclined to answer truthfully. The last error, *non-response error*, is when a significant number of people in the survey sample do not respond to the questionnaire and have different characteristics from those who do respond, especially when these characteristics are important to the study. (Dillman, 2000) In order to combat these common errors, surveys questions are designed, modified, and tested to be more effective and efficient as well as supported by supplemental materials.

Prior to the 1970s, mail surveys allowed researchers to reach out to large survey samples and during the 1970s-1980s telephone survey became a gateway into every private household in America. The current growing trend has been a shift towards self-administered questionnaires through email, websites, and other more cost-effective communication methods. However, designing a quality survey begins with two fundamental assumptions: (1) responding to self-administered questionnaire involves not only cognition, but also motivation. (Jenkins, 1995) (2) Multiple attempts are essential to achieving satisfactory response rates to self-administered surveys regardless of whether administered by email, the web, or postal delivery. (Scott, 1961); (Heberlein, 1978); (Dillman, 2000). Basically, respondents should understand what the questionnaire requests from them as well as the fact that respondents should be contacted multiple times in order to increase response rates, particularly for mail surveys. It has shown that multiple contacts, the contents of letters, appearance of envelopes, incentives, personalization, sponsorship and clarified explanation along with other supplemental materials have a significantly greater influence on response rates than that of questionnaire design, especially for mail surveys. (Dillman, 2000) Thus all these factors prove that a common mistake in mail survey designs is the assumption of the existence of a "magic bullet" or a "one technique" that will assure a high response rate regardless of how other aspects of the survey are designed. (Dillman, 2000)

Mail Survey

There are five key elements needed in order to achieve high response rates. These elements are shaped in ways that complement each other. These elements are: (1) a respondent-friendly questionnaire; (2) a list of up to five contacts with the questionnaire

recipient; (3) an inclusion of stamped return envelops; (4) a personalized correspondence; and (5) a token financial incentive that is sent with the survey request. (Dillman, 2000)

Respondent-friendly questionnaire requires survey questions to be clear and easy to comprehend. Also question order should suggest high salience to the respondent as well as the possibility of shortened question or survey length such that the tradeoff of the social exchange theory between cost and benefit favors more and gives the respondents a greater incentive to answer the survey. (Dillman, 2000)

Multiple contacts are essential in order to maximize response rates for mail surveys. According to the social exchange theories, stimuli that are different from previous ones are generally more powerful than repetition of previously used techniques. (Dillman, 2000) Thus it is recommended that subsequent notifications to respondents be different in content or should not be exactly the same word for word. A guideline of five compatible contacts includes the following: (Dillman, 2000)

1) A brief *pre-notice letter*: This is sent to respondents just a few days prior to the respondents receiving the questionnaire. The letter emphasizes the importance of the survey and notify when the survey will arrive as well as encouraging the person's response with appreciation. (The time between the pre-notice letter and the actual questionnaire should be within 2-3 days; the longer the time between these two mailings, the less likely the respondent will remember anything about the questionnaire.)
2) A *questionnaire* mailing attached with a cover letter that explains the importance of the survey

3) A *gratitude postcard* that is sent a few days to a week after the questionnaire. This acts as a friendly reminder if the survey had not been completed and returned.
4) A *replacement questionnaire* that is sent to non-respondents 2-4 weeks after the previous questionnaire mailing. This gives an indication either the previous questionnaire has not been received and urges the recipient to respond or the previous questionnaire has already been returned but is still in the shipping process.
5) A final contact would be made through telephone a week or so after the fourth contact (if telephone numbers are available). Or it can be made through Express or Priority Mail. The urgency in mode of contact distinguishes each type of final contact from regular mail delivery.

Each of these contacts has shown to improve overall response rates to mail surveys. (Heberlein, 1978)

Element three is to provide return *envelopes with real first-class stamps*. The use of real stamps affixed on the return envelop instead of business reply envelopes have proven to improve response rates. By sending a real stamp demonstrates a gesture of goodwill; the sender has sent the recipient an object of value that can be used for other purposes. This example shows the focal idea of the social exchange where this particular quality delineates a reciprocation of an effort of value. (Dillman, 2000)

Personalization of correspondence is the last of the five elements needed to improve response rates. This element refers to real names printed instead of pre-printed salutations of “Dear Resident”, and authentic signatures. It has shown that over the years,

with updated technology of Word Processor programs, it is much simpler through computers to write letters but at a point becomes impersonal mainly due to extreme efforts to insert personal references. (Dillman, 2000)

Telephone Survey

During the 1970's large-scale, nationally prominent, general public surveys were usually conducted through face-to-face interviews (from household to household) but the telephone medium quickly took over. Initially telephones were installed in both the public sector as well as companies in the private sector. By the 1970's telephones were affordable enough to become part of individual households. The speed and efficiency of telephone surveys was demonstrated in the Watergate hearings in 1974. (Dillman, 2000) The shift from face-to-face interviews to telephone interviews mainly began due to increasing costs of travel for interviewers and more urbanized neighborhoods that are harder to interview door-to-door. The telephone not only decreased and eliminated travel costs, but it was also faster in reaching a household. The American culture in the 1970's and 80's demonstrated a common etiquette of answering phone calls mainly because at the time there were no answering machines or caller IDs. Thus missing a phone call was less likely and also the fact that the majority of calls at that time period were pertinent and not some sort of advertisement. (Groves, 1988; Kahn, 1979) Then towards the 1990's and onward, Caller ID and answering machines were developed that allowed household and private companies the freedom of letting the phone ring unanswered, causing the popularity and response rates of the telephone sampling method to drop. Nowadays the telephone has evolved into computer-assisted telephone interviewing (CATI) software which eliminates key-punching and installs automatic call-scheduling,

dialing random telephone numbers, and have self-data compilation which contributes to its efficiency. (Dillman, 2000)

All of these new technologies have both have enhanced and deterred the convenience of telephone sampling and the response rates respectively. In the mid 20th century, household telephones controlled behavior, where a ringing telephone demanded households to answer. In addition, a norm of politeness prevailed for dealing with callers, as the same expected behavior for in-person contacts. However, as telephones became a major method of marketing products and the number of unwanted calls substantially increased, people increasingly became less tolerant of such intrusions. (Dillman, 2000)

From previous studies there are noticeable patterns to the overall telephone structure in the United States overtime as well as internationally. For instance, the United Kingdom has lagged behind in household telephones main due to the densely populated urban areas that are in such close proximity, which deterred the installment of household phones since people did not need them as much compared to their American counterparts. (Groves, 1988) As for the United States, telephones have been installed mostly in urban and suburban areas predominantly, yet Southern and Midwestern rural farmlands and towns lack the telephone infrastructure. (Groves, 1988) Thus geographical layout has had an effect on the growing use of telephones. One important note is with the current evolution of mobile phones, nations with dense population that live in close proximities have observed a flourishing market for such technologies. (Groves, 1988)

Telephone Survey Designs

As telephone sampling became more frequent so did the sampling errors. In order to combat these errors, new techniques and designs were implemented and tested. Initially telephone sampling frames came from two main sources: (1) telephone directories (i.e. Phone book or "Yellowbook") and (2) commercial directories of that company's loyal customers. A third source would be a set of all possible telephone numbers. However, with passing of time, the frequency of unlisted numbers increased to a level that raised concerns about the accuracy of telephone surveys based on these directories. (Groves, 1988) In response to this concern, three other sampling methods were developed: (Groves, 1988)

(1) Random Digit Dialing (RDD), which provided coverage of both listed and unlisted telephone households by generating telephone numbers at random from the frame of all possible telephone numbers.
(2) List-Assisted Designs, where it used information in telephone directories (or other frames based on telephone directories) to generate telephone number samples that included both listed and unlisted telephone households.
(3) Multiple Frame Sampling Methods, combined directory and RDD sampling frames and sampling methods into a single design.

Directories and Listings

The sampling frame can determine the type and feasibility of sampling methods that can be used. The frame also determines the coverage of telephone households as well as provides auxiliary information that can be used to reduce non-response. (Groves,

1988) Lastly, the frame can also have a substantial impact on the cost of the proportion of ineligible listings (i.e., listings that are not eligible for the study) will increase the costs of identifying eligible ones. (Groves, 1988) There are three frame deficiencies that need to be taken into account for telephone design: (1) ineligible listings, for which there is no telephone household that is assigned to a frame element; (2) duplicate listings, for which there are two or more frame elements that identify the same telephone household; and (3) non-coverage, in which telephone households in the population do not have any frame element which can identify them. (Groves, 1988) These deficiencies exist in all frames but their frequencies vary.

Directory samples will produce biased estimates for the entire population of telephone households to the extent that listed and unlisted households differ with respect to the survey measures. (Groves, 1988) Comparisons of listed and unlisted household characteristics show important differences for many measures. (Brunner, 1971; Fletcher, 1974; Rich, 1977) Thus there is the potential for coverage bias in the directory samples. The size of the bias will depend on both the size of the difference between listed and unlisted household characteristics and the size of the proportion not covered. Even with these potential errors that would create large variability and substantial bias, directories remain a popular option because they can be obtained at "low or no cost". (Groves, 1988) Also there are two types of commercial list frames: (1) city directories and (2) master address lists. Both are based on telephone directories, with features added by a commercial firm for enhancing the directory's utility in telephone sampling. Master address lists are nationwide and can be read by machines. Some of these master lists are assembled through tedious processes of collecting all telephone directories in the country,

manually comparing directory and current list entries, noting differences that are found, and updating the list frame through computer processing. These commercial lists have coverage deficiencies as well, similar to that of directories. Usually commercial lists tend to leave out remote rural areas and master address lists tend to have more ineligible listings. (Groves, 1988) Therefore, it would be appropriate to compare cost and error of telephone directory, city directory, and master address sampling. Commercial lists allow for an advantage with the option for stratified selection that can produce gains in precision compared to un-stratified sample selection. However, the larger the expenditure for frame acquisition and sample selection associated with a commercial list may overwhelm gains in precision due to stratification. (Groves, 1988)

Telephone Non-response

Like mail surveys, telephone surveys also have total and partial non-response issues. These non-response issues arise because (a) persons associated with sampled numbers are never contacted by an interviewer; (b) once contacted the sample person (or another household member) refuses to participate in the survey; or (c) the sample person has a physical, mental, or language disability and is unable to provide the survey information. (Groves, 1988) These total non-response cases, where no data is gathered are labeled as "unit" non-response; while some sampled persons choose to provide only a subset of the data requested, this is issue is labeled as "item" non-response. There are three main reasons that non-response will become a major nuisance in telephone surveys: (1) to the extent that the non-respondents are different from the respondents on the survey measures, statistics based on respondent data alone will biased estimates of the full telephone population parameters of interest. (2) Non-response reduces the size of the

sample which forms the basis for the estimates. Thus, due to the extent that sampling error is a function of the number of cases, the sampling variance of survey estimates is increased. (3) Survey costs are increased by efforts to reduce non-response. These efforts include multiple dialing on sample telephone numbers which were not initially answered, attempts to persuade reluctant sample persons to cooperate, and extension of the survey period to permit repeated dialing on non-respondent cases. (Groves, 1988)

Response and non-response rates are usually the main focus of evaluating surveys, however there are four survey design aspects that affect the response rate calculations: (Groves, 1988)

(1) The necessity to determine whether some numbers on the sampling frame are eligible for the survey (i.e. some units on the frame might not be members of the target population). In other words, if the sample focused on business numbers but contains a few entries of household numbers.

(2) The unit sampled might contain more than one sample element. The primary example would be a household that contains at least two or more members. Some survey designs take into account by sampling every household member, while other surveys use an informant to obtain information about attributes of the entire household. In the first approach, if non-response existed, several sample elements (persons) are lost; in the second, only one element (household).

(3) Whether all sample persons have the same probability of selection. Some surveys might oversample certain groups in the population for special analyses (i.e. age groups). In this type of design, non-response error depends on the pattern of non-response across groups sampled with different probabilities.

(4) Whether substitution at the sampling stage is permitted by the design. Some designs allow for the survey administrator to substitute a similar household for a sample one which cannot be contacted or which refuses the interview. For this case, a decision must be made about how the initial non-interview case contributes to the response rate.

Back in the 1970's and 1980's, the social etiquette of answering phone calls was pertinent. People rarely left a phone unanswered. However there have been increasing frequencies of refusal on phone interviews than compared to that of the face-to-face interviews. It is more difficult to ask an interviewer to leave the house after they begin a face-to-face interview, but people apparently feel freer to terminate in the middle of a telephone interview. (Groves, 1988) And lastly, sampling frames are only a list of numbers that existed at the time they were created, some of the members on that list might have become deceased by the time the surveys were implemented. Deaths are most often treated as non-sample cases, although if the respondent was to report on past events, these cases might be treated as non-response cases.

One of the most difficult challenges for telephone interviewers is to assess the structure of the condition/place that the number they dialed. This means that the number works because there are consecutive rings when the number is dialed, however no one answers the line. Whether this a temporary situation where the family have left for vacation, changed job shifts, etc. is unknown. And most importantly, there is no golden rule on how many rings the interviewer should allow before disconnecting. (Groves, 1988) There is however, a commonly acknowledged procedure where if the interviewer receives a normal busy signal, this will indicate that the number is in use and the

interviewer should wait between 5 to 15 minutes before dialing that number again. This takes advantage of the higher probability of contact given that the number was engaged. (Groves, 1988)

There are common factors that affect non-response in telephone compared to its counterpart—face-to-face interviews—where the length of the questionnaire, the topic of the survey, the survey organization, the length of the survey period, the administrative rules on callbacks and refusal conversion, as well as other design features. (Groves, 1988) From previous works there have been certain explanatory variables that have shown correlation to telephone survey non-response. The first is age, where there is repeated evidence that elderly group disproportionately refuses to be interviewed in telephone surveys. (Brown, 1982; Cannell, 1987; Weaver, 1975) Education also plays a factor where it has been found that higher non-response tends to occur among lower education groups. (Cannell, 1987) Urban and rural geography also plays a role, where there are higher non-response cases in large urban areas than others. (Steeh, 1981) These densely populated urban units tend to be harder to check, sometimes multi-unit complexes are locked at the front gate or are guarded by security.

The next two factors will be mentioned again under Interviewer Effects but they also play a strong role in non-response. The voice quality of the interviewer has shown to affect the levels of cooperation from respondents. (Groves, 1988) As well as the gender and experience of the interviewer might affect the response rates, where it has been found that higher individual response rates among female interviewers are higher than those of their male counterpart. In particular, when a male interviewer approaches female respondents, the response rates tend to be lower, yet when the years of experience

of the interview is analyzed, the gender effect no longer plays a role in non-response. Meaning, the more years of experience have a stronger association to higher response rates than that of the gender effect. (Groves & Fultz, 1985)

The length of the survey period has shown to have positive correlation where longer survey period is correlated with higher response rates. (Groves, 1988; Mulry-Liggan, 1983) However, the true test showed that between cold telephone surveys and cold face to face surveys, it takes longer for the telephone survey to reach a desired response rate, meaning because an interviewer for face-to-face to observe when the household would be available by asking neighbors. Cold telephone surveys would require more attempts of redialing mainly based on trial and error. This last effect is related to the Social Exchange Theory, where the benefit outweighs the cost/effort for the respondent. This last effect is the interview length, where common survey administers believe that the telephone survey length should be shorter than that of a face-to-face interview in order to achieve the same effect, however there is not sufficient enough data to support this theory.

There were several techniques developed to tackle these non-response telephone challenges. The first was various introduction formats implemented, where the interviewer would give a full description of the purpose of the study and why the survey is important. This is the equivalent to the mail survey's cover letter. The result was that the introduction has no significant difference in response rates with the new implementation compared to the lack thereof. (Dillman, 2000; O'Neil, 1979) Another factor tested was the position of household roster using a family informant respondent rule. Two method orders were compared where the first half of the sample, the roster

was first obtained and then the respondent was asked to answer questions; while the second half of the sample, data on the respondent was obtained first, then the roster was obtained for information on the other persons in the household. The study found higher response rates in the second half of the sample compared to the first. (Monsees, 1979) This result fits the beliefs that the household roster is one of the more difficult sets of information to obtain from sample persons early in the interaction. (Groves, 1988) Also, similar to the mail surveys, advance letters were sent ahead of time to respondents to notify them of an upcoming telephone interview. This letter has shown to have strong correlation to higher response rates. (Dillman, 2000) There are two hypotheses related to advance letter effects: (1) the letter, if sent by a credible, authoritative source, tends to legitimize the later survey request, and (2) the knowledge that an advance letter was sent reduces anxiety felt by interviewers about the cold contact and improves their performance at the first contact. (Groves & Snowden, 1987) Related to this advance letter effect is the fact that it will not be applicable with RDD telephone surveys. There is no way of knowing in advance who the letters should be sent to.

Interviewer Effect

Interviewers tend to have their own effect/bias on the data they collect. Thus, usually interviewers will be assigned to a random sample of the population. If the averages differ among the interviewers by more than chance would predict, then this difference is attributed to the interviewer effect. (Groves, 1988) The following are reasons that suggest the existence of the interviewer effect:

(1) Interviewers might not follow directions exactly, either purposefully or because those directions are not explicit enough. They might not ask questions exactly as worded or follow skip patterns correctly. They may make mistakes in recording responses. However, research designed to test whether individual interviewer biases are not correlated with frequency of incorrect interviewer behavior have generally not been able to detect relationships. (Groves, Magilavy, & Mathiowetz, 1981)

(2) Interviewers may vary in their inflection, tone of voice, or other personal mannerisms that are not controlled or discussed in training. It is difficult to measure these characteristics. However, interviewer vocal characteristics have been found to be related to interviewer response rates but have not been investigated with interviewer bias. (Groves, 1988) It has also been found that interviewer attitudes about a question (Bailar, 1977) and the interviewer expectations about the difficulty of the task for the respondent (Singer, 1983), which may subtly influence interviewer behavior, are associated with response rates.

(3) The characteristics of the interviewer that cannot be changed might have effects on the respondent's reaction such as race, age, and sex. Evidence has shown respondent deference behavior, which is an attempt to give a socially acceptable answer to interviewers according to their race, have been found in both face-to-face (Campbell, 1981; Schuman & Converse, 1971) and telephone interviews on items that are racially sensitive. (Cotter, 1982; Reese, 1986)

(4) An observed interviewer effect may actually result from non-response, since the characteristics of an interviewer's non-respondents may vary. In this case, the cause of the observed differences is not that a single respondent would respond differently to different interviewers, but rather that interviewers have access to different subsets of the population. Since it is known that interviewer response rates often differ and that non-response is generally not at random in the population, this would seem to be a likely source for differences among interviewers. (Groves, 1988)

Interviewer differences have a strong impact on the mean square error of estimates of means and totals. If interviewers were seen as fixed features of the survey design, then a useful measure of total error for an estimate might be obtained by treating the interviewer effect as a bias. On the other hand, if interviewers were seen as random feature of the design, where the interviewer was chosen randomly from a population of interviewers, then their impact on the estimate could also be described as an increase in its variance. This way, the mean square error would reflect the expected variability from one sample realization, with a particular set of interviewers, to the next realization, which used a different set of interviewers. (Groves, 1988) Lastly it has been tested that the faster pace of telephone interviews leas to less thoughtful responses, which in turn may lead to greater susceptibility to interviewer effects. (Miller, 1982)

Social Exchange Theory

There are three literatures in psychology that are pertinent to non-response. The literatures pertain to compliance, altruism, and persuasion. There are a large set of

factors that affect decisions of persons to behave in a manner consistent with a formal request to do so made by another. These include notions of "reciprocation", the tendency to comply with requests from those who have provided some service in the past. (Cialdini, 1975) Supplemental materials such as advance letters, incentives, even solicitous behavior of interviewers may fit this concept. Interviewers may also use the perception of scarcity regarding to opportunities to perform the behavior requested. (i.e. "This survey only has two more days before it's over, so you won't have any opportunity to respond if you wait.") Conformity to behavior norms also influences compliance. Some respondents clearly consent because of belief that they have a duty as citizens to participate in efforts seeking information about society. (Groves, 1988)

Response Effects in Self-Administered and Telephone Surveys

Some interesting effects that tend to cause variability and bias in the interview surveys do not have an effect on the mail surveys. For one, question order effect tends to affect mail survey responses in a lesser degree compared to the same effects in interview surveys. Unlike the telephone or face-to-face, where the interviewer dictates the order of the questions, the mail survey allows the respondent the freedom to consider all response choices and questions before answering. Consequently, the response order effect in mail surveys would also be minimal with the exception of long lists or item scales that respondents might inspect hastily. (Schuman & Presser, 1981) In contrast, question form and wording effects should be just as likely to occur in a self-administered survey as in a telephone or face-to-face interview because the information presented to respondents in all of these modes of data collection is essentially equivalent. Because respondents in the mail survey have more time to contemplate the meaning of the questions, however, subtle

variations in how they interpret them may well occur, resulting in significant differences between the two types of surveys. (Groves, 1988) Previous studies have shown that in both survey methods, respondents were much more likely to select a middle response alternative if it were explicitly offered than if it was not. (Bishop, 1987; Schuman & Presser, 1981) Finally, the tone of wording varied when samples of different cultures were asked about a particular subject. Groves talked about a study conducted in Germany and US concerning college students on their opinion about public smoking. The two words used in different forms were "forbidden" and "not allowed" regarding public smoking; the results found that Americans were significantly more likely to use "forbidden" when it comes to public smoking while the Germans were significantly more likely to use "not allowed" when it comes to public smoking. Thus cultural background might affect respondent attitude and tone of wording on the same topic.

Chapter III

Methods

Introduction

This study was conducted through the Indian Academy of Pediatrics, where several survey methods were employed in order to estimate a representative viewpoint and characteristics of pediatricians, child physicians, and other health workers (who operate and deliver child vaccination services) on their stance about child vaccination, disease eradication, care delivery and responsibilities in India. There were several questionnaires that were sent out to various vaccination and pediatric sites (hospitals) that surveyed an array of professionals. Each questionnaire utilized different modes of communication methods as well as was given to different samples. For the context of this paper, the two surveys of concern were the mail and telephone surveys given to the pediatricians.

Questionnaire Content

Two separate samples of pediatricians were surveyed, one through telephone and the other sample through mail. An identical sample of questionnaire was used in both samples. The questionnaire asked the pediatricians about several aspects of Indian children vaccination statuses. The first set of questions asked pediatricians about the likelihood for an Indian child, at a certain age, to contract a specified list of diseases without being properly vaccinated. The diseases include: Polio, Diphtheria, Tetanus, Pertussis (Whooping Cough), Hepatitis B, Measles, Mumps, Rubella (German measles), Hepatitis A, Invasive pneumococcal diseases (i.e. meningitis, pneumonia), Varicella,

Typhoid, and Rotavirus diarrhea. Pediatricians were then asked about their view on the effectiveness of the vaccines corresponding to the diseases mentioned in the previous questions. The survey then moves towards asking pediatricians about their trust on certain vaccines by asking their viewpoint on safety, side effects, and the frequency of use of the specified vaccines. Then physicians were asked about a list of health care workers and parents on who should be held responsible for a child to be immunized. Other questions in the survey included disease eradication, intervention procedures for improving routine immunization rates, and the importance of overcoming barriers to get children vaccinated. Other sets of questions asked the pediatricians to estimate the number of children that get vaccinated in their respective clinics, the cost of receiving vaccinations at the clinic, the maintenance and administering of the vaccination process. Lastly, the questionnaire ends with questions regarding who should be the one to deliver the vaccination.

Survey Sites

The surveys were sent to pediatric sites in the following states: Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, GOA, Gujarat, Haryana, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal. The area surveyed by mail overlaps for the most part with that of the telephone but there are some different sites sampled, where the mail survey did not collect data from (GOA, Jammu & Kashmir). The mail survey also collected from regions that the telephone data did not have, such as Manipur.

Sample Size & Sample Design

The initial desired sample sizes for each survey group were determined based on variance estimates for vaccine efficacy and importance. The resulting calculation found that each sample size of 400 was desired. The sample design was a dual-frame simple random sample. 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 into 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. The purpose of this paper focused on the comparison of the two data collection modes, telephone versus mail. The whole frame was provided by the India Academy of Pediatrics, who sent the most up-to-date membership list; the sample was then prepared by researchers at the Rollins School of Public Health's department of Biostatistics and Bioinformatics. There are some limitations to the mail and telephone sampling methods for this study but the most important is that the selection process was not perfect and weights were applied in order to adjust for unequal probabilities of selection for each element in the sampling frame. Even though the design of the sampling method is simple random sample, the weights were not used in the analysis of the study because this study was focused only on the comparison of the survey modes and not focused on inferring the sample as a representation of a larger population. Thus the weights did not apply to the analysis purposes of this study.

Analysis of Interest

The main interest 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) were selected and statistically tested for significant differences in proportions. For the question items that were analyzed, the response variables were multi-categorical and they were not reduced to dichotomous variables because the interest of the study was to focus on the comparison between the response distributions of the two survey modes, particularly on those who responded. Therefore, reducing to dichotomous variables could leave out variables with response observations, which may result in greater variability in the analysis. Non-response count was small enough that they were not included in the analysis tables. This exclusion might affect the precision of the analysis as well as increase variability.

The Mantel-Haenszel chi-square test was applied because at least 20% of the cells had less than 5 observations and the fact that the Fisher's Exact Test has a lower power. The items that were of particular interest were the views on vaccination and eradication of polio; other diseases were also compared between the two survey responses. The comparison for diseases also investigated any potential differences in attitude and viewpoint from the respondents between questions about which diseases were important to vaccinate and which diseases were important to eradicate. Another item that was compared was the viewpoint on who should be held accountable for the responsibility of getting a child vaccinated. This item demonstrates the viewpoint and attitude that the pediatricians have on others (health workers, nurses, parents) as well as on themselves. Lastly, the responsibility of child vaccination analysis was also compared to the response

analysis of the vaccination delivery question where pediatricians were asked who should properly deliver the vaccination service. This comparison looked for the existence of an agreement or disagreement on the responsibility and delivery of child vaccination.

Significance levels were set prior to analysis as $\alpha=0.05$, any differences deemed significant had to be less than α. Non-response was minimal in both samples, thus analysis of chi-square tables did not include non-response categories in order to solely focus on the majority that did respond. Thus the concluding χ^2 values might be slightly different had non-response counts been accounted for in the tables. Any non-response counts were categorized as missing. The statistical software used for the analysis was SAS®9.2 (SAS Institute, Inc.). There were 27 test questions, where some question items consisted of several smaller questions, this might increase the number of false positives in the results. In the analysis, each question item response was analyzed in two areas: (1) Which response choice did the majority choose for each question in the two survey modes. (2) Were there any statistical significance in the difference between the observed responses compared to the expected responses, if so by how many percentage points.

Chapter IV

Results

(All of the following data can be found in tables in Appendix A)

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 228 (57%). Difference in percentage points of the majority response is calculate by the majority percentage response in the telephone survey subtracting the majority percentage response in mail survey (Δ = telephone% - mail%), reported in percentage points.

Disease Contraction

Regarding the first set of questions on the likelihood of a child contracting a list of specified diseases (Table 1), pediatricians were significantly divided on Hepatitis B (Δ=25.8, p=0.0007) and on rotavirus ($\Delta \approx 7$, p= 0.0213). Table 1 shows the diseases in the order of the largest percentage point difference to the smallest difference. Pediatrician responses showed large differences ($\Delta > 10$) in percentage points for Invasive Pneumonia (Δ = 16.2, p=0.1433), Tetanus (Δ = 14.4, p=0.2911), Polio (Δ = 13.9, p=0.5507), Hepatitis A (Δ = 12.5, p=0.4815), rubella (Δ = 11.1, p=0.3363), DPT (Δ = 11, p=0.7942) and HIB (Δ =10.9, p=0.8133).

Disease Eradication

For the importance of eradicating measles (Table 2), pediatricians responded significantly different between the two survey modes. ($\Delta \approx 8$, p=0.0033,). And finally,

for the item regarding the likelihood of eradicating measles (Table 3), respondents were divided and showed significant difference ($\Delta = 22$, p=0.0033). When pediatricians were asked about the importance to eradicate polio (Table 2), no significant differences were found between the mail and telephone responses ($\Delta = 0.45$, p= 0.4227). As for pediatricians responding to the likelihood that polio was to be eradicated (Table 3), the results also showed no significant differences between mail and telephone respondents (Δ= 0.57, p= 0.4591,).

Vaccination Responsibility & Delivery

As for the responsibility aspect of getting children vaccinated, respondents held everyone specified in the surveys as responsible but were divided on parents (Table 4). Parent's' responsibility showed significant difference between mail and telephone response ($\Delta \approx 8$, p=0.0024), where a greater percentage of majority responses in the mail survey choose parent's responsibility need to be "present" compared to the telephone majority response. Pediatricians felt ASHA workers ($\Delta < 1$, p=0.9408), PHC physicians ($\Delta<1$, p=0.9457), GPs ($\Delta\approx1$, p=0.8953), pediatricians, ANMs ($\Delta\approx2$, p=0.5447), Angawadi Workers (Δ=2.4, p=0.642). They all have a stake in the responsibility of getting children vaccinated.

Finally when it came to the delivery of vaccination (Table 5), where pediatricians are asked who should vaccinate the child if the vaccination was not up-to-date, pediatricians were divided on the role of the parents when it came to delivery of vaccination ($\Delta \approx 14$, p=0.0084). The majority of pediatricians chose to deliver the service themselves ($\Delta \approx 6.5$, p= 0.2425). There were more majority responses in the

telephone survey choosing to deliver the service themselves compared to the mail survey response. As for other ways for the delivery of vaccination service, pediatricians had no significant differences on agreeing that UIP/Government facility ($\Delta \approx 5$, $p=0.1562$), "referring to another physician" ($\Delta < 1$, $p=0.4757$) and "Do nothing" ($\Delta = 0.2$, $p=0.15$) should not be considered as options for the delivery of vaccination.

Chapter V

Discussion

Overall, the study had 36% response rate for the mail survey and 57% response rate for the telephone survey. Pediatricians, in both surveys, agreed on most of the questions relating to disease contraction and eradication along with vaccination responsibility and delivery. However, 6 out of the 30 question items analyzed had significant differences in majority responses between the two survey modes.

The mail survey is possibly closer to the true characteristics or representation of the Indian pediatrician's population than that of the telephone survey mainly because the mail survey allows the respondent to (1) answer the entire questionnaire in the order that the respondent desires; (2) mail survey is self-administered, so it lacks the presence of an interviewer and other social effects (i.e. social compliance); (3) the respondent can dictate the pace of completing the mail survey but for the telephone survey that pace is dictated by the interviewer, (4) the mail respondents are not subjected to response order effect, where 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.

Effects

Regarding the question that asked about the likelihood for a child to contract polio, both the mail and telephone respondents show agreement on that fact that it was likely, however the difference it the degree of agreement was larger than 10 percentage points. A greater majority of the telephone respondents chose "likely" than the majority of mail

respondents. This can possibly be attributed to the interviewer effect, where the mail respondents did not feel pressured in any way to have a higher frequency of choosing an answer that seems socially appeasing or demonstrate a stronger gravity of the situation. This large gap in percentage points seem unexpected in the sense that polio is one of the oldest diseases with viable vaccines and that for most of the Western Hemisphere, the disease has been eradicated through vaccination. Thus, pediatricians are expected to respond with smaller gap in their percentage points on Indian children contracting polio. Another large difference in majority response regards to the likelihood for a child to contract Hepatitis B, where telephone respondents have 25 percentage points more choosing "likely" than the mail majority responses. Other large difference in degree includes "Likely to eradicate Measles" (Δ =22),

"Parents should deliver vaccination by taking child to hospital of parent's choosing" (Δ = 14), showed more mail respondents choosing that parents should be involved in the delivery compared to those of the telephone respondents. This 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 on child vaccination, and (3) possibly answering the questionnaire with a sense of social appeasement to the interviewer. It is not clear how the interviewers were trained and monitored during the actual sampling; there could have been an interviewer tone effect, gender effect, experience effect, or even a combination of all of them. What is clear is that the interviewer's presence demonstrated a larger difference in degree of agreements and disagreements between the mail and telephone surveys. For instance, in the first set of questions regarding "likely for a child to contract" diseases such as DPT, Tetanus,

Rubella, Hepatitis A, Invasive Pneumonia, and Hib have all shown to have at least a $\Delta > 10$ where the majority responses in telephone were greater than those of the mail survey. This means that a pediatrician has demonstrated to have a greater frequency to respond "Likely" that "for a child to contract a vaccine-able disease" in the telephone interview than how they would respond in a mail survey without the presence of the interviewer. As for the parent's role in delivery, more pediatricians in the mail survey believe that parents should have a greater role compared to those who answered in the telephone survey. This depicts that the pediatricians might have placed a greater importance on their social responsibility as a physician to deliver care to their patients, mainly in the presence of another (in this case the interviewer).

Strengths & Limitations

One strength of the study is that for both sampling frames, item non-response was low (< 8% missing), suggesting that the pediatricians who did respond to the questionnaire answered most or all the question items. Yet this low item non-response rate is also a limitation in this study.

The main concern is that the sample came directly from the membership and realm of the India Academy of Pediatrics; this sample does not however take into account the characteristics of pediatric vaccination facilities that are not associated with this academy. India is very diverse, where each province speaks a different language from the others and practices a secular variation of Hinduism, Buddhism, etc. that at certain locations hold a strong control over politics and science. Even though the data was

collected from various locations, it still does not account for characteristics that fall outside this academy as well as rural versus urban child vaccination characteristics.

The results show evidence of the interviewer effect and its influence on response choices, which brings concern about using the telephone survey responses for purposes, such as setting public policies. 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 leave out certain characteristics that the true population might have, which might also explain certain large percentage points between the mail and telephone survey responses.

Implications

The limitations will tend to increase variability in the precision of the collected data and it might also provide bias in the pediatricians' viewpoints, which might shift the response distribution farther from the true characteristics of the population.

Recommendations

For the interviewer effects, there must be prior training to the implementation of the sampling. Interviewers must understand how to minimize the effects of their presence, ask the questions as it is written, have a pace that has minimal effect on the response chosen by the pediatricians (where they do not feel rushed). Also interviewers should be trained in a specific tone that does not insinuate any viewpoint to a particular question item that can sway the respondent from one answer choice to another. As for gender effect, this can be negated if the interviewer has more experience than others.

When it comes to non-response, mail surveys should be re-sent with friendly reminders as well as with the appeals of a "token" as a reward for their effort and time and also the implementation of notices that requests for respondents to act soon or the survey will end at a near specified date. These techniques will encourage and instill motivation through "cost versus benefit" social exchange theory as well as instill a sense of physician obligation respectively. For telephone surveys, interviewers should be trained in the technique of coaxing those who initially refuse as well as have a specified number of dialing attempts before the sample element is considered as a non-response. Also, if costs permit, try to extend the sampling period if the initial deadline does not produce a sufficient response sample size. One important note, non-response might pertain to completely missing, it might also pertain to item non-response; from the data analysis, it seems that item non-response was small. This can be accounted for with well phrased questions and response choices that do not seem intrusive or incomprehensible.

As for sampling error, the administrator should have a clear idea on the target population and the sampling frame. The ultimate goal is to get the most representative sample. In this study, pediatric facilities that are not associated with the India Academy of Pediatrics should also be included in the sampling frame. This would give a more representative and precise sample. Lastly measurement error will be difficult to adjust for, particularly demonstrated with this data that the interviewer effect might have affected the accuracy of the responses leading to higher frequencies of response choices that might not accurately represent the true population. Ultimately, every step of the sampling method should be monitored, from the initial design to its implementations. If costs permit, it would be ideal to perform a pilot test of the design surveys in order to

gather a preliminary idea of the entire process, what steps that can be improved, and an opportunity to have quality assessment and changes to be made before the study takes place.

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Appendix A

Table 1

Comparison between Mail & Telephone Response on "Likelihood of Contracting Disease"

item	question	majority response	diff majority reponse (tele%-mail%)	p-value
1	**likely to get**			
q1e	Hep B	likely	25.8	***0.0007***
q1j	inv. Pneum	likely	16.2	0.1433
q1c	Tetanus	likely	14.4	0.2911
q1a	Polio	likely	13.9	0.5507
q1i	Hep A	likely	12.5	0.4815
q1h	rubella	likely	11.1	0.3363
q1b	DPT	likely	11.0	0.7942
q1k	Hib	likely	10.9	0.8133
q1m	typhoid	likely	8.0	0.07962
q1l	Varicella	likely	5.7	0.8622
q1g	mumps	likely	4.7	0.9331
q1d	pertussis	likely	2.0	0.309
q1f	measles	likely	-0.2	0.5499
q1n	rotavirus	likely	-7.1	***0.0213***

Note: All statistics were calculated using Mantel-Haenszel χ^2 with 1 degree of freedom and applies for all tables.

Table 2

Comparison between Mail & Telephone Response on "Importance of Disease Eradication"

item	question	majority response	diff majority reponse (tele%-mail%)	p-value
11	**Important to Eradicate**			
q11b	measles	important	8.3	***0.0006***
q11a	polio	important	-0.5	0.4227

Table 3

Comparison between Mail & Telephone Response on "Likelihood of Disease Eradication"

item	question	majority response	diff majority reponse (tele%-mail%)	p-value
12	**Likely to eradicate**			
q12b	measles	Likely	22.2	***0.0033***
q12a	polio	Likely	0.6	0.4591

Table 4

Comparison between Mail & Telephone Response on "Responsibility on Child Vaccination"

item	question	majority response	diff majority reponse (tele%-mail%)	p-value
9	**Primarily Responsible**			
q9b	ASHA workers	present[1]	0.4	0.9408
q9e	PHC physicians	present	0.4	0.9457
q9g	GPs	present	-0.7	0.8953
q9c	ANMs	present	-1.7	0.7406
q9f	pediatricians	present	-2.4	0.5447
q9d	Anganwadi Workers	present	-2.4	0.642
q9a	parents	present	-7.8	***0.0024***

[1] Present means that this response choice was marked.

Table 5

Comparison between Mail & Telephone Response on "Delivery on Child Vaccination"

item	question	majority response	diff majority reponse (tele%-mail%)	p-value
26	**Vaccinate Not Up-to-date**			
q26a	vaccinate them yourself	Present	6.6	0.2425
q26c	UIP/Government facility	not present	4.8	0.1562
q26b	refer to another phys.	not present	0.7	0.4757
q26e	Do nothing	not present	0.2	0.15
q26d	Advise parents to vaccinate at facility of their choice	present	-13.8	***0.0084***

Appendix B

Questions for IAP member survey

Draft 14: 13 Aug 2009

1. How likely do you think a child in India under 5 years of age who has received no vaccines when due is to get the following diseases within the next one year? Predictor/descriptive

	Not Likely	Neither Likely or Unlikely	Likely
Polio			
Diphtheria			
Tetanus			
Pertussis/whooping cough			
Hepatitis B			
Measles			
Mumps			
Rubella/German measles			
Hepatitis A			
Invasive pneumococcal disease (e.g., meningitis, pneumonia, bacteremia)			
Invasive *Haemophilus influenzae* type b (Hib) (e.g., meningitis, pneumonia, bacteremia, septic arthritis, epiglottitis)			
Varicella			
Typhoid			
Rotavirus diarrhea			

2. If a child under 1 year of age gets the following diseases, how likely is that child to be seriously ill? Predictor

	Not Likely	Neither Likely or Unlikely	Likely
Polio			
Diphtheria			
Tetanus			
Pertussis/whooping cough			
Hepatitis B			
Measles			

Mumps			
Rubella/German measles			
Hepatitis A			
Invasive pneumococcal disease (e.g., meningitis, pneumonia, bacteremia)			
Invasive *Haemophilus influenzae* type b (Hib) (e.g., meningitis, pneumonia, bacteremia, septic arthritis, epiglottitis)			
Varicella			
Typhoid			
Rotavirus diarrhea			

3. If a child 1 to < 5 years of age gets the following diseases, how likely is that child to be seriously ill? Predictor

	Not Likely	**Neither Likely or Unlikely**	**Likely**
Polio			
Diphtheria			
Tetanus			
Pertussis/whooping cough			
Hepatitis B			
Measles			
Mumps			
Rubella/German measles			
Hepatitis A			
Invasive pneumococcal disease (e.g., meningitis, pneumonia, bacteremia)			
Invasive *Haemophilus influenzae* type b (Hib) (e.g., meningitis, pneumonia, bacteremia, septic arthritis, epiglottitis)			
Varicella			
Typhoid			
Rotavirus diarrhea			

4. How protective do you think each of these vaccines is against disease? Predictor

	Not Very Protective	**Somewhat Protective**	**Protective**
BCG Vaccine			
Oral Polio Vaccine			
Inactivated Polio Vaccine			
Hepatitis B Vaccine			

DPT			
Measles			
MMR			
Japanese Encephalitis			
Hepatitis A Vaccine			
Pneumococcal Conjugate Vaccine			
Hib Vaccine			
Varicella Vaccine			
Typhoid Vaccine			
Influenza Vaccine			
Rotavirus Vaccine			
Human Papillomavirus Vaccine			

5. How safe do you think these vaccines are? Predictor

	Unsafe	**Neither Safe or Unsafe**	**Safe**
BCG Vaccine			
Oral Polio Vaccine			
Inactivated Polio Vaccine			
Hepatitis B Vaccine			
DPT			
Measles			
MMR			
Japanese Encephalitis			
Hepatitis A Vaccine			
Pneumococcal Conjugate Vaccine			
Hib Vaccine			
Varicella Vaccine			
Typhoid Vaccine			
Influenza Vaccine			
Rotavirus Vaccine			
Human Papillomavirus Vaccine			

6. If a child experiences an adverse event following vaccination, would you inform the following people/groups? Descriptive

	Yes	**No**

Local health authorities		
Indian Academy of Pediatrics		
Vaccine Manufacturer		
National Polio Surveillance Project		
Other (please specify):		

7. How often do you use the following vaccines? descriptive

	Not at All	**Selectively**	**Routinely**
BCG Vaccine at birth			
BCG Vaccine subsequently (if not at birth)			
Birth Dose of OPV			
Oral Polio Vaccine			
Inactivated Polio Vaccine			
Hepatitis B Vaccine			
DPT			
Measles			
MMR			
Japanese Encephalitis			
Hepatitis A Vaccine			
Pneumococcal Conjugate Vaccine			
Hib Vaccine			
Varicella Vaccine			
Typhoid Vaccine			
Influenza Vaccine			
Rotavirus Vaccine			
Human Papillomavirus Vaccine			
Other (please specify):			

8a. How important is the opinion of the following persons/groups in determining whether a child gets vaccinated? descriptive

	Not Important	**Neither Important or Unimportant**	**Important**
Indian Academy of Pediatrics			
Government			

Mother			
Father			
Grandparents			
Other family members			
Religious leaders			
Community Influencers			
The Media			

8b. Which of the following is the single most important person/group in determining whether a child gets vaccinated? IAP, government, mother, father, grandparents, other family members, religious leaders, community influencers, or the media:_____ descriptive

9. In your opinion who is primarily responsible for ensuring that children are immunized. Mark all that apply. Predictor/descriptive

	Please tick ("√")
Parents	
ASHA workers	
ANMs	
Anganwadi workers	
PHC physicians	
Pediatricians	
General practitioners	
Other (please specify)	

10. How important do you feel it is to use the following vaccination strategies to eliminate the last chains of polio transmission in endemic areas?descriptive

	Not Important	**Neither Important or Unimportant**	**Important**
Use of Mass Campaigns with Injectible Polio Vaccine (IPV)			
Use of Mass Campaigns with Bivalent Polio Vaccine			
Use of Mass Campaigns with Monovalent Polio Vaccine			
Strengthening Routine Immunization			

11. How important do you think it is to eradicate the following diseases? Outcome

	Not Important	Neither Important or Unimportant	Important
Polio			
Measles			

12. How likely do you think it is that we will eradicate the following diseases? descriptive

	Not Likely	Neither Likely or Unlikely	Likely
Polio			
Measles			

13. How important are the following interventions for improving routine immunization rates? descriptive

	Not Important	Neither Important or Unimportant	Important
Training and educational materials for providers, nurses and vaccine administrators			
Mass awareness campaigns			
Unhindered access and availability to routine vaccines			
Periodic review & evaluation of routine immunization campaigns			
Fixing accountability to district level			
Parent education			
Ensuring vaccines are affordable for parents			
Advocacy with the government			
Minimizing “missed opportunities” (i.e. vaccinating eligible children visiting a health facility for other health reasons)			
Following up with children through their entire routine immunization series			

Provide mobilizes financial incentives for full immunization			
Provide vaccine administrators financial incentives for full immunization			
Provide families incentives for full immunization			
Mandatory UIP vaccination for school entry			
Other (please specify):			

14. How likely are you to implement a new vaccine recommendation if it is supported by the following groups? descriptive

	Not Likely	**Neither Likely or Unlikely**	**Likely**
Government of India/UIP schedule			
Indian Academy of Pediatrics			
Vaccine Manufacturers			
WHO			
Other (Please specify):			

15. How important are the following barriers for pediatricians to getting children vaccinated? descriptive

	Not Important	**Neither Important or Unimportant**	**Important**
Other demands on physicians' time			
Inadequate financial compensation for physicians providing vaccines			
Parents' lack of awareness of the importance of vaccines			
Parents' lack of confidence in vaccination			
Parents' fears of side-effects			
Parents' inability to pay for vaccines			
Parents believe that children are fully vaccinated through receiving OPV during mass campaigns			
Superstition			

Parents' religious beliefs			
Parents' cultural beliefs			
Lack of time or priority for parents			
Lack of awareness of time and place of vaccination			
Other (Please specify):			

16. How important are the following barriers to polio eradication? descriptive

	Not Important	**Neither Important or Unimportant**	**Important**
Parents' lack of awareness of the importance of the polio eradication			
Parents' lack of confidence in polio vaccine			
Parents' fears of side-effects of polio vaccine			
Parents' religious beliefs regarding polio vaccine			
Parents' cultural beliefs			
Superstition			
Lack of time or priority for parents			
Other (Please specify):			

16b. Which are the two most significant barriers? parents' lack of awareness of the importance of the polio eradication, parents' lack of confidence in polio vaccine, parents' fears of side-effects of polio vaccine, parents' religious beliefs regarding polio vaccine, parents' cultural beliefs, superstition, lack of time or priority for parents, other (please specify): descriptive

1. _____
   _____

2. _____
   _____

17. How many children do you normally immunize in a month? descriptive

< 100	**100-500**	**> 500**

18. For what percent of infants do you provide a birth dose of OPV within the first 15 days of life? outcome

0-24%	25-49%	50-74%	≥ 75 %

19. How many doses of measles vaccine do you usually recommend? outcome

1 dose	2 doses

20. What do you usually charge for a sick child office visit? Predictor

Do not charge/ N/A	< 50 Rupees	50 to < 100 Rupees	100 to < 200 Rupees	≥ 200 Rupees	Declined to answer

21. What do you usually charge for an immunization visit, excluding the cost of the vaccines? Predictor

Do not charge/ NA	< 50 Rupees	50 to < 100 Rupees	100 to < 200 Rupees	≥ 200 Rupees	Declined to answer

22. Do you use the following strategies to ensure maintenance of an adequate cold chain? descriptive

	Yes	No
Use of a dedicated refrigerator for storing vaccines		
Check vaccine vial monitor before administering vaccine		
Check refrigerator temperature twice per day		
Check refrigerator temperature once per day		
Check refrigerator temperature once per week		
Use of backup generators for power failures		
Use of warning system to announce power failures		
Alternative plan for maintaining cold chain if refrigeration fails		

23. Do you keep a clinic-based record for each child of the vaccines you administer? descriptive

Yes	No

24. Do you give vaccination card to parents? descriptive

Yes	No

25. If a 1 year-old child that you have not treated previously presents to you with an illness do you verify if he/she has received all of the recommended vaccine? outcome

Always	Sometimes	Never

26. If you identify a child has not received all or some vaccines appropriate for his/her age, what do you do most frequently? descriptive

	Please tick ("√")
Vaccinate them yourself	
Refer them to another physician for vaccination	
Refer them to a UIP/government facility for vaccination	
Advise the parents to get their child vaccinated at facility of their choice	
Do nothing	
Other, specify	

27. Do you procure UIP vaccines from the following sources? descriptive

	Yes	No
Vaccine Distributors		
Government Agencies		
Others (Please specify):		