

RESULTS OF AN EXPERIMENT USING DIFFERENT MAIL CARRIERS FOR A MAIL SURVEY OF IMMUNIZATION PROVIDERS

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Background

The National Immunization Survey provides coverage estimates for children aged 19 to 35 months in each of 78 state and urban areas designated as Immunization Action Plan (IAP) areas by the National Immunization Program in the Centers for Disease Control and Prevention (CDC). Coverage-level estimates for the 78 areas and for the nation as a whole are published in *Morbidity and Mortality Weekly Report (MMWR)*, U. S. Department of Health and Human Services/Public Health Service (Ezzati-Rice *et al.*, 1995).

The NIS uses a list-assisted random-digit-dial (RDD) sample design. A randomly generated sample of telephone numbers is screened to determine whether each number is a working or nonworking telephone line; if working, whether the number is for a household or some nonresidential entity (business, fax/modem line); and, if a household, whether it contains any NIS-eligible children in the target age range of 19-35 months. Households with eligible children are invited to participate in the survey by providing immunization data about each eligible child in the household.

In addition to the telephone survey of households, an equally important data collection component of the NIS is the Provider Record Check Study. In the telephone survey of households, respondents are encouraged to rely on shot cards given to them by physicians and other immunization providers. More than half of the respondents do use these records as they respond to the survey, but a significant proportion do not. Respondents who rely on memory alone are likely to misrepresent the immunization history of their children, because they may forget a vaccination or may misremember the date of a particular shot. Even when respondents do refer to shot records during the interview, they may have incomplete records. Parents can lose a copy of the shot card and be given a new one that omits earlier vaccinations, or they may have changed physicians and kept only the shot card from the newer provider. The Provider Record Check Study was designed to address these shortcomings in the household data by obtaining vaccination records from providers themselves.

Procedures for the NIS Provider Record Check Study follow generally the model suggested by Dillman for mail questionnaires (Dillman, 1978; Dillman, 1991; Paxson, Dillman, and Tarnai, 1995)—that is, repeated mail requests, including special handling, and telephone follow-up. The initial request, sent by Federal Express, contains the following items:

- Cover letter from CDC
- Immunization History Questionnaire, including child-specific information to allow the provider to identify the child's medical record
- Documentation of telephone consent (signed by the interviewer of record)
- An *MMWR* article with the most recent annual NIS results

The initial mail requests are timed to occur throughout the field period of the telephone survey, as soon as is practical following the completion of the household interview. The first follow-up effort is a postcard prompt, sent by the United States Postal Service (USPS) to all providers two weeks after the initial mail request. A second request, duplicating the initial mailing, is sent by USPS Priority Mail to providers who have not responded after five weeks. Telephone prompting of nonresponders begins after seven weeks.

While this procedure of scheduled repeated requests followed by telephone attempts generally follows the Dillman model, it does vary from the model in some details. Whereas the model suggests that the initial request use First Class mail and that special handling should be reserved for later contacts, the NIS Provider Record Check Study uses special handling both for the initial request (Federal Express) and for the second request (USPS Priority Mail). The decision to use Federal Express and Priority Mail was based on the relatively low Federal Express government rate (\$3.45), the comparable cost of Priority Mail (\$3.00), and attractive features of Federal Express and Priority Mail that are not available through First Class mail. These features include the visually distinctive packaging of

Federal Express and Priority Mail, which makes the piece stand out in the flow of business mail received by immunization providers. In addition, Federal Express offers signed receipts, tracking of each piece mailed, return of undelivered mail, and forwarding of mail with an incorrect initial address. Federal Express promises next-day delivery and Priority Mail offers delivery within two days. These features are not offered reliably by First Class mail.

Other carrier services, including United Parcel Service (UPS) and other services offered by the USPS, have been investigated. None offered guaranteed delivery within a day or two at the relatively low rates of Federal Express government rate and USPS Priority Mail.

Despite the apparent advantage of guaranteed delivery and other features of special handling, the cost-effectiveness of Federal Express and Priority Mail has been questioned. Reactions of providers toward these services is also an issue. A small number of providers, unaware of the low Federal Express government rate, have complained about the cost to CDC of using this carrier.

Experiment Design

For these reasons, an experiment was designed to assess the relative benefits of First Class, Priority Mail, and Federal Express as carrier options for the initial and second request. In addition, the experiment assessed the impact of using a relatively less expensive carrier for the initial request and reserving the more expensive carrier for the second request.

The experimental design is summarized in Table 1. The top row of the table outlines current procedures. The second row represents the experimental procedure, in which the initial request uses First Class and the second request uses Federal Express. The second experimental condition (in the third row of the table) is similar but uses Priority Mail as the carrier for the second request. In the third experimental condition (fourth row), both the initial and second request rely on First Class mail. This is the least expensive approach of the four, and assessment of its relative effectiveness is an important objective of the experiment. The second column of the table displays the number of child/provider pairs assigned to each of these conditions.

The experiment was completed for the first quarter of 1997 (Q1/97). A total of 9,066 requests (one request for each child/provider pair) were mailed to providers distributed across the control and experimental categories as shown in Table 1. Because providers can be named by several respondents in the telephone survey, a single provider may receive requests for more than one NIS child. To minimize the number of times providers are contacted, several requests are included in one envelope whenever possible. When consolidating requests in this manner was not possible, care was taken to assure that all requests to a

single provider used the same experimental condition. Aside from this constraint, requests were randomly assigned to the experimental conditions.

Outcome measures of the experiment were the percentage of nonresponding providers requiring prompts by mail and by telephone, the final provider participation rates for the three methods, and the average costs per responding provider.

Results

Table 2 displays provider participation rates. A provider is counted as participating if any information has been received from the provider about the child. By this definition, a provider response indicating no records for the specified child is counted the same as a response with immunization data. The category of "participation following the initial mail request" indicates that no additional contact with the provider beyond the original request was necessary. Participation following the second mailing indicates that the provider was contacted twice in writing but was not contacted by telephone. The final participation rate indicates participation after the completion of all attempts (including telephone prompting) to contact a provider. These categories are cumulative rather than mutually exclusive.

The differences in participation rates at the first stage are statistically significant at the 1% level. This can also be seen from the nonoverlapping confidence intervals. The same is true of the participation rates at the second stage. However, the final participation rates are essentially equal. A chi-squared test of the equality of the four percentages showed that the differences are not statistically significant. In fact, the computed value of $\chi^2 = 1.61$ has a probability of more than 50% under the assumption that the population participation rates under the four methods are equal. The confidence intervals shown in the last column overlap each other.

Table 3 displays these results in a slightly different way by comparing the proportion of child/provider pairs that required mail and telephone follow-up (the complement of the participation rates presented in the third and fifth columns of Table 2), the final participation rate, and the cost for each response (that is, the cost for each return). The costs include the carrier charges for pieces of mail and the direct cost of interviewer labor for telephone follow-up (that is, costs excluding administrative costs, overhead including long-distance telephone service, and fees).

Level and Timing of Provider Response Second Request

Second requests were mailed to all providers that had not responded by the fifth week following the mailing of the initial request. Table 3 shows that the percentage of second requests is much higher for each of the experimental conditions compared with the current procedure. The

differences between the current procedure and each of the experimental conditions are each statistically significant at the .05 level (9.3 percentage points for First Class/Federal Express, 4.6 percentage points for First Class/Priority Mail, and 5.4 percentage points for First Class/First Class).

Telephone Prompting

Telephone prompting calls were initiated in the seventh week following the initial mailing. Similar to the result for second requests, compared with the current procedure, a higher percentage of initial requests in the experimental conditions required telephone prompting. The differences between the current procedure and each of the experimental conditions are each statistically significant at the .05 level (6.2 percentage points for First Class/Federal Express, 8.8 percentage points for First Class/Priority Mail, and 9.5 percentage points for First Class/First Class).

Final Participation Rates

Following the telephone prompting calls, providers are given another week or two to reply (a total of between eight and nine weeks from the initial mailing) before being classified as nonresponding. Despite statistically significant differences in the proportion of cases requiring mail and telephone prompting, the final participation rates (provider responses for a child divided by the number of child/provider pairs) are not significantly different between the current procedure and each of the experimental conditions. Notably, using first class mail for mailing both the initial and second request—the least expensive approach—yields a final participation rate that is nearly equivalent to the participation rate using the current procedure.

Timing of Provider Responses

The additional costs of special handling (Federal Express and Priority Mail) might be worthwhile if the data collection period could be shortened. However, Figure 1 suggests that this is not the case. This figure displays the cumulative participation rates for each week following the initial mailing. It shows that the current procedure did yield higher rates initially; however, the gap begins to close at week 4 and by the end of the field period participation rates are virtually identical. The higher rates were not sustained and eight weeks were necessary to attain high levels of participation for each set of procedures.

The increase from a range around 80% to a range around 95% occurs following the initiation of telephone prompting, suggesting that these calls are effective in encouraging providers to participate in the study.

Costs

The final column of Table 3 presents the average cost for a provider's participation for each type of carrier. This cost was calculated by first deriving the total variable costs

for each category of the experimental design (essentially, shipping cost for each carrier and the costs of telephone prompting calls), and then dividing by the number of responses yielded in each condition. (Fixed costs, such as management time or training time, were not included in this calculation, as these costs would be the same for each of the experimental conditions.) The unit cost of returns from the initial mailing is much smaller for the experimental condition using USPS First Class for both the initial request and reminder request.

In Table 4, projected marginal costs for completing a full quarter of data collection under the different carrier conditions are displayed for a hypothetical sample of 9,066 provider requests. These hypothetical costs were calculated using each carrier's charge for sending each piece of mail, the unit costs of telephone prompting, and the proportions of initial requests requiring each level of prompting from Table 2. This table clearly shows the cost advantage (over \$26,000) of using First Class postage for both the initial and reminder request, despite the higher proportion of follow-up cases required by this method.

Figure 2 displays these hypothetical costs for the initial mailing, second request, and telephone prompting calls for each combination of carriers in the experiment. This figure dramatically demonstrates that the projected costs for the initial mailing alone, using current procedures, exceed the total projected costs of each of the other experimental procedures. Tables 3 and 4 and Figure 2 demonstrate that using a less expensive carrier for the initial mailing would result in cost savings that more than pay for increases in the proportion of cases requiring second requests and telephone prompting calls.

Conclusion and Recommendations

This experiment demonstrates a clear cost advantage to changing carriers from the current procedure of using Federal Express for the initial request and Priority Mail for the second request to using First Class postage for both requests. The change will result in savings on the order of \$26,000 in direct charges per quarter without lowering the final provider participation rate in the Provider Record Check Study.

The outcome of this experiment was somewhat unexpected and it may be interesting to speculate about possible explanations. The initial justification for using special handling services was that the request for immunization records would thereby stand out in the normal flow of business mail received by medical offices and other immunization providers and receive special attention. It is possible that the proliferation of services such as Federal Express and Priority Mail is such that these are no longer unusual and attention-getting.

Another plausible explanation is that requests for medical records, and immunization records in particular, are routinely handled in medical offices and that calling

attention to the request may disrupt a routine response. In other words, to the extent that special handling does command attention, it may be counter-productive by causing the request to be reviewed rather than processed in a routine manner.

As a result of this experiment, a recommendation was proposed and accepted to revise the mail procedures for the NIS Provider Record Check Study so that First Class postage is used for both the initial and second request. Participation rates will continue to be monitored to confirm that this will have no effect on the final participation rate in the physician survey. In addition, the proportion of cases requiring follow-up efforts (second requests and telephone prompting calls) will be monitored to assure that the new procedure continues to be cost-effective. Changes in the costs of postage and/or telephone service or large increases in the number of cases requiring telephone prompting could affect the threshold at which the cost savings are realized by using First Class mail.

References

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Table 1
Design of the Carrier Experiment

Procedure	Number of Child/Provider Pairs	Initial Request	Second Request
Current Procedure	5,152	Federal Express	Priority Mail
Condition 1	1,308	First Class	Federal Express
Condition 2	1,303	First Class	Priority Mail
Condition 3	1,303	First Class	First Class
TOTAL	9,066		

Table 2
Results of the NIS Carrier Experiment

Procedure	Number of Child/Provider Pairs	Participation Following Initial Mail Request		Participation Following Second Mail Request		Final Participation Rate	
		%	(95% C.I.)	%	(95% C.I.)	%	(95% C.I.)
Federal Express/ Priority Mail	5,152	69.5	(68.2-70.7)	77.9	(76.8-79.0)	95.8	(95.3-96.4)
First Class/ Federal Express	1,308	60.1	(57.5-62.8)	71.7	(69.2-74.1)	96.1	(95.1-97.1)
First Class/ Priority Mail	1,303	64.8	(62.2-67.4)	69.0	(66.6-71.6)	96.3	(95.4-97.4)
First Class/ First Class	1,303	64.1	(61.4-66.7)	68.3	(65.8-70.9)	95.4	(94.3-96.6)
Total	9,066	66.7		74.4		95.8	

Source: National Immunization Survey Provider Record Check Study, Q1/97

Table 3
Proportion of Initial Requests Requiring Follow-up, Final Participation rates and Costs per Response

Procedure	Number of Initial Requests (Child/Provider Pairs) (100%)	Cases Requiring 2nd Mail Request		Cases Requiring Telephone Prompting		Final Responses		Cost per Response
		n	%	n	%	n	%	
Federal Express/ Priority Mail	5,152	1,572	30.5	1,137	22.1	4,937	95.3	\$5.41
First Class/ Federal Express	1,308	521	39.8	370	28.3	1,257	95.9	\$3.34
First Class/ Priority Mail	1,303	458	35.1	403	30.9	1,256	96.0	\$3.10
First Class/ First Class	1,303	468	35.9	412	31.6	1,244	95.1	\$2.35

Source: National Immunization Survey Provider Record Check Study, Q1/97

Table 4
Projected Costs for Hypothetical Sample of Requests Using Different Carriers

Carrier for Initial and Reminder Requests	Number of Initial Requests	Unit Cost of Initial Request	Number of Reminder Requests	Unit Cost of Reminder Request	Number of Telephone Prompts	Unit Cost of Telephone Prompts	Total Projected Costs
Federal Express/ Priority Mail	9,066	\$3.45	2,766	\$3.00	2,001	\$3.73	\$47,039
First Class/ Federal Express	9,066	\$0.78	3,611	\$3.45	2,565	\$3.73	\$29,1095
First Class/ Priority Mail	9,066	\$0.78	3,187	\$3.00	2,804	\$3.73	\$28,524
First Class/ First Class	9,066	\$0.78	3,256	\$0.78	2,867	\$3.73	\$20,304

Figure 1 Response to Requests by Carrier
 National Immunization Survey Provider Record Check Study, Q1/97

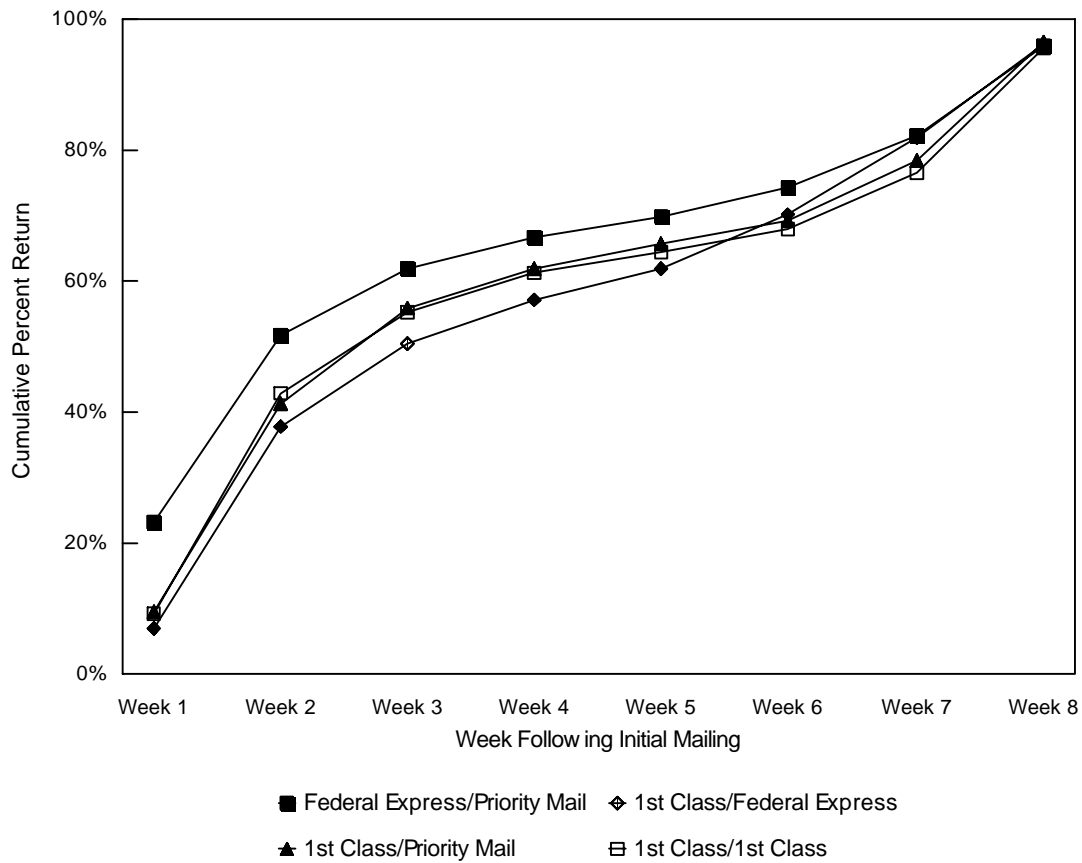


Figure 2 Projected Costs of Initial Mailing, Second Request, and Telephone Prompts

