THE EMPIRICAL LIMITS OF RESPONSE TO MAIL SURVEYS

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ABSTRACT

Using the data from a nationwide mail survey of 2,300 primary care physicians, this paper measures the response rate for each of three successive mailings of questionnaires and follow-ups.

Applying "state-of-the-art" techniques, the three mailings achieved a gross response rate of 75 percent.

Regression analysis projects that five mailing waves will generate a gross response rate of 85 percent. This is seen as an economically feasible upper limit to responses. Seven mailing waves will generate a gross response rate of 90 percent. This is seen as an approximate absolute upper limit to responses.

By advancing the state of the art, the author anticipates attaining response rates in the 90 to 95 percent range. To do so will require incorporating into surveys pro forma filter questions to confirm the eligibility of initial questionnaire recipients for inclusion in the sample.

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Introduction

Our recent experimental comparison of mail and personal interview techniques has documented that in-depth mail interviews of physicians can be less expensive, require less time, and generate as high or higher response rate than equivalent personal interviews (Shosteck and Fairweather). With a national sample of primary care physicians, we achieved a "gross response rate" of 75 percent through persistent follow-up mailing. In the initial report of our findings, we estimated that further mailings would have raised that to 85 percent (Shosteck and Fairweather).

This paper presents the basis for that estimate. Using the response rate to each succeeding questionnaire mailing, we derive an algorithm for predicting the returns likely to be generated by each additional contact of residual non-respondents.

Our present analysis focuses on maximizing "gross response rate." Gross responses indicate the extent to which persons in the initial sample either answer the questionnaire or are otherwise accounted for. They encompass returned questionnaires, the recipients or intended recipients of which are ineligible for inclusion in the final sample. In this survey, these included physicians who were deceased, retired, not practicing medicine, not practicing primary care specialties, not in office practice, or residing outside the country. Gross response rate should not be confused with "completion rate." This latter refers only to questionnaires completed by qualified recipients.1/

The Research Design

This analysis is an adjunct to a broad study of antibiotic prescription practice. The data were gathered through a 12-page questionnaire mailed to a national probability sample of 2,700 primary care physicians.

The mailings took place over two phases. The first phase, implemented in late 1977, entailed a sample of n=400. This was designed to compare the efficacy of mail and personal interview techniques (Shosteck and Fairweather). The second phase, implemented in early 1978, entailed a sample of n=2,300. It is these data which serve as the basis for the present report.

To maximize responses, sampled physicians were contacted up to five times. All were sent

-- an initial announcement letter alerting them to the survey,

-- a questionnaire, cover letter, and return envelope, and shortly thereafter,

-- a reminder letter.

A week following, those who had not responded were sent a second questionnaire, cover letter, and return envelope. Two weeks afterward, remaining non-respondents were sent a third questionnaire, cover letter, and return envelope. These mailings incorporated the latest "state-of-the-art" enhancement techniques for mail surveys (Erdos, 1970).

The Pattern of Returns

Figure 1 depicts the pattern of returns for each questionnaire mailing. For each mailing there is an immediate peak of returns followed by a quick decay. Consistently, the peaks occur six to eight days after the mailing.

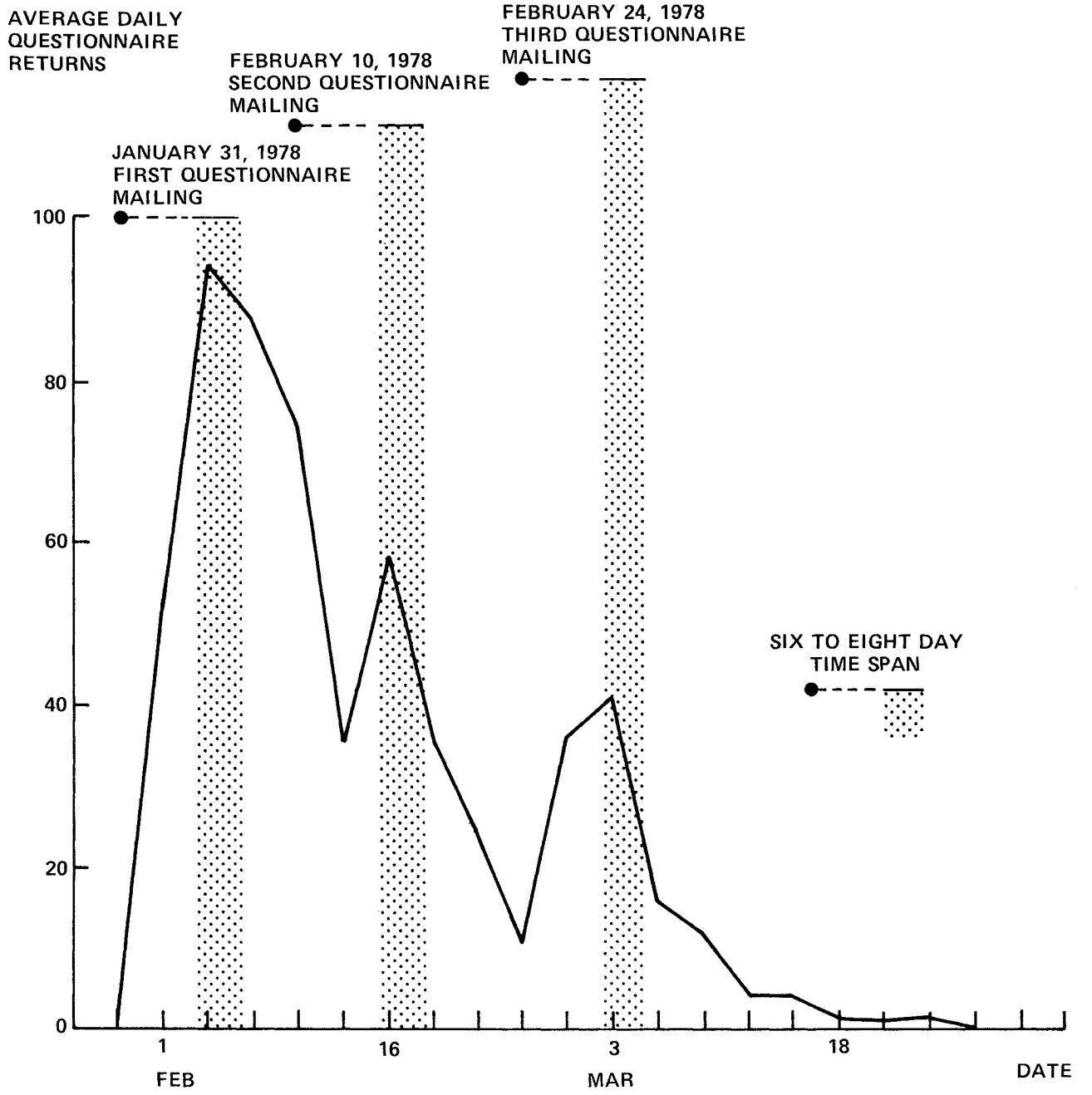
Clearly, if recipients fail to answer a

questionnaire as soon as they receive it, there is but a limited likelihood of their doing so later. This finding points to the importance of presenting the questionnaire in a manner which encourages an immediate response.

The second and third mailing waves stimulated return of questionnaires sent in earlier mailings. This indicates that

FIGURE 1

GRAPHIC REPRESENTATION OF THE IMPACT OF SUCCESSIVE CONTACTS ON QUESTIONNAIRE RETURNS[1]



[1]/From original mailing log. Initial sample, n = 2,344

even when questionnaire recipients intend to cooperate, follow-ups are necessary for encouraging them to fulfill their intentions.

Figure 2 records the "duration of effect" for each mailing and the number of returns associated with it. This is the period required for a single questionnaire mailing to generate 95 percent of the eventual replies. The duration of effect for American mail surveys is typically 14 to 16 days (Erdos, 1970, p. 262).

Out of the initial sample of 2,344, the first mailing wave generated 994 responses, the second wave generated 428 responses, and the third wave generated 308. An additional 22 residual returns trickled in afterwards. These totaled 1,752 responses, for a gross response rate of 74.7 percent.

Developing the Algorithm

Figure 3 presents the gross response rate for each succeeding questionnaire mailing. We derive this rate by subtracting the cumulated number of questionnaires returned up to the time of the mailing from the initial sample of 2,344. This remainder comprises the "remaining sample." The gross response rate for each wave is derived by dividing the number of questionnaires returned for that wave by the remaining sample. This is the same as the percentage of the mailing returned for the wave. We proportionately allocated the 22 residual returns to the three waves. This provided an "adjusted number returned."

Overall, the initial mailing wave generated a 43 percent response rate, the second wave generated a 32 percent response, and the third a 34 percent.

With this information it is now possible to apply the linear regression equation[2] and, thus, develop a "best estimate" of the likely response rate to successive mailing waves. The regression calculation facilitates deriving a general estimate of likely returns for three questionnaire mailings of this type as well as projecting likely return rates for four or more questionnaire mailings.

At this juncture we must be clear on two major limitations of this procedure. First, we are deriving the model from but a single empirical experience. This may or may not be similar to other empirical situations. To the extent that it may vary, the model is limited as a predictor. Second, we use a linear regression approach with but three observation points. If there is high variance

FIGURE 2

THE NUMERIC RETURNS FOR EACH QUESTIONNAIRE MAILING[1]

Questionnaire Mailing Wave and Approximate Duration of Effect	Date	Number of Returns
First Questionnaire Mailed	Jan. 31	
DURATION OF EFFECT OF FIRST QUESTIONNAIRE	Feb. 1-14	994
Second Questionnaire Mailed	Feb. 10	
DURATION OF EFFECT OF SECOND QUESTIONNAIRE	Feb. 15-28	428
Third Questionnaire Mailed	Feb. 24	
DURATION OF EFFECT OF THIRD QUESTIONNAIRE	Mar. 1-14	308
RESIDUAL RETURNS	Mar. 15-31	22
TOTAL RETURNS[2]		1,752

[1]From original mailing log. Approximate returns indicated in Figure 1.

[2]Given an initial sample of n=2,344, the gross response rate = 74.7%.

FIGURE 3

THE RETURNS FOR EACH QUESTIONNAIRE MAILING

Questionnaire Mailing Wave	Size of Remaining Sample[1]	Unadjusted Number Returned[2]	Adjusted Number Returned[3]	Percentage of Mailing Returned[4]
First Questionnaire Mailing	2,344	994	1,007	43.0%
Second Questionnaire Mailing	1,350	428	433	32.1%
Third Questionnaire Mailing	922	308	312	33.8%
Residual Returns	614	22	--	--

[1]Derived from subtracting the cumulated number of questionnaires returned from the initial sample of 2,344. Thus, prior to the second questionnaire mailing, n=994 out of n=2,344 were returned, leaving a remaining sample of n=1,350. Prior to the third questionnaire mailing, n=1,422 (994 + 428 = 1,422) were returned, leaving a remaining sample of n=922.

[2]From Figure 2.

[3]Based on a proportionate distribution of 22 residual returns among the three mailings.

[4]Adjusted number of returns divided by size of remaining sample. This is the gross response rate.

in the decay of responses to follow-up inquires, the paucity of observations will lead to a poor estimation of the "true" regression line, thus distorting final projections.

Because of these limitations, our model must be considered as only a tentative approximation. As such, we view its major value as outlining a technique by which to evaluate future experience using the mail methodology. With this caveat in mind, we now turn to our findings.

Using state-of-the-art techniques for in-depth mail surveys of physician populations, the linear least squares regression projects a "best estimate" of 40.9 percent response rate from an initial questionnaire mailing (versus an observed rate of 43.0 percent), 36.3 percent from a second mailing (compared to an observed 32.1 percent), and 31.7 percent from a third mailing (compared to an observed 33.8 percent). Overall, the regression analysis projects a 40.9 percent response to an initial mailing and a decrease in response of 4.6 percent to each subsequent mailing.

Using this finding, we can now project the likely outcome of additional mailings beyond the three used in this survey. Thus, we anticipate that 27.1 percent of residual non-respondents would reply to a fourth inquiry; 22.5 percent would reply to a fifth. Subsequent mailing waves would elicit replies from 18 percent or fewer of the residual non-respondents.

We then transpose these regression estimates into projections of the cumulative response to successive mailings.

With each successive mailing, there is, in general, a simultaneous decline in the size of the remaining sample as well as the likelihood that further contact will elicit a response. These joint conditions contribute to a precipitous drop in the percentage of the initial sample which will respond to repeated mailings.

Thus, the regression analysis projects that three initial mailings will draw responses from 41, 21, and 12 percent, respectively, of the total initial sample. This sums to a cumulative return of 74 percent. Three further mailings will likely generate seven, four, and three percent, respectively, of the initial sample or an additional 14 percentage points. This means that a doubling of procedural effort expands the total cumulative response by a fifth, from 74 to 88 percent.

The Implications for Survey Administration

Figure 4 graphically illustrates this pattern of diminishing returns. Using current "state-of-the-art" techniques and five mailing waves, in-depth mail surveys of physician populations can reach a response rate of about 85 percent. Assuming the best of current

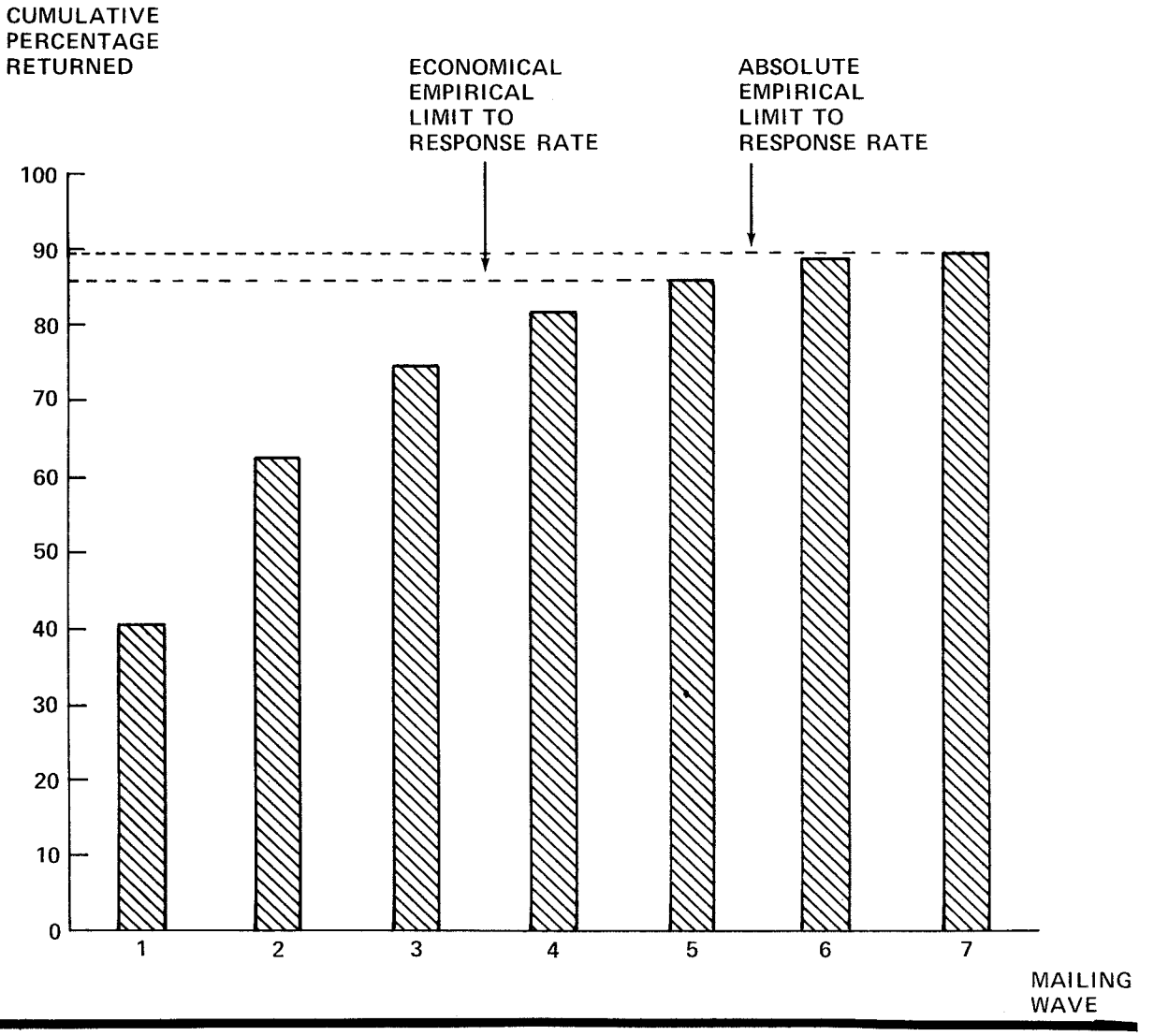
survey practice, this appears to define an economically feasible empirical upper limit to responses.

Where higher response rates are mandatory, two additional mailings, to a total of seven, will gain perhaps five percent added returns. This will provide a total response rate of approximately 90 percent. All further mail efforts will yield at most one or two percent more. Accordingly, 90 percent emerges as the approximate absolute empirical upper limit to responses from physician populations, using current state-of-the-art mail techniques.

Assuming that the model reasonably describes current field experience, to go beyond these limits, the state of the art must advance. In the initial discussion of our field experience, we proposed a procedure for such an advance (Shosteck and Fairweather). There we argued that

FIGURE 4

GRAPHIC REPRESENTATION OF THE RELATIONSHIP OF QUESTIONNAIRE MAILING WAVE TO THE CUMULATIVE PERCENTAGE RETURNED



future research must assume inefficiencies in available sampling frames and, on the basis of this assumption, define explicit criteria for inclusion or exclusion of initially sampled respondents.

Operationally, this means incorporating into surveys pro forma filter questions to reliably and precisely confirm the eligibility of initial questionnaire recipients for inclusion in the universe of inquiry and, thereby, the sample.

As researchers adopt this technique, we anticipate that the current empirical limits to response rates of 85 to 90 percent which we have just defined will be pushed upward into the 90 to 95 percent range (Shosteck, forthcoming).

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1. Erdos, P. L. Professional Mail Surveys. New York: McGraw-Hill, 1970.

2. Shosteck, H. "The Impact of Population Definition Upon Response Rates to Sample Surveys of Physicians," forthcoming.

3. Shosteck, H. and W. R. Fairweather. "Physician Response Rates to Mail and Personal Interview Surveys," Public Opinion Quarterly, 1979, 43:206-217.

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1/ For a detailed discussion of concepts, terminology, and methods, see Shosteck and Fairweather.

2/ The standard formula for the regression calculation is y-a+bx, where b =

$$\frac{N\Sigma XY-(\Sigma X)\ (\Sigma Y)}{N\Sigma X^2 - (\Sigma X)^2} \quad \text{and} \quad a = \frac{\Sigma Y - b\Sigma X}{N}.$$