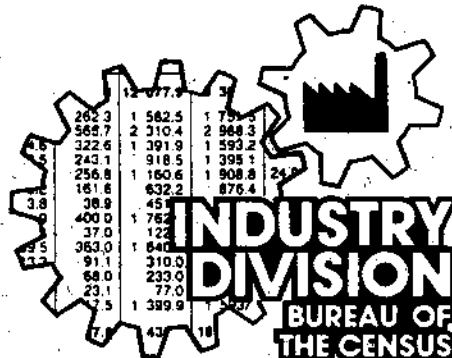# Working Papers

FINAL SUMMARY OF RESULTS FOR THE 1990 SURVEY OF POLLUTION ABATEMENT COSTS AND EXPENDITURES (PACE) MANDATORY/VOLUNTARY STUDY

By
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Industrial Statistics

A. Background

In the paper, "Nonresponse Under Mandatory vs. Voluntary Reporting in the 1989 Survey of Pollution Abatement Costs and Expenditures (PACE)," we established that under identical follow-up procedures, mandatory reporting yielded higher response than voluntary reporting. This was true for both the "new" establishments and to a lesser degree for those plants which were "conditioned" to report as a result of previous exposure to the survey. One could argue that no special efforts were made to maximize response for the mandatory and voluntary panels, and that if there had been, the response rate differences might have been reduced.

Therefore, based on the results from the 1989 PACE split panel study, other research questions arose. What effects would telephone prompting, telephone follow-up, or certified mail follow-up have on voluntary response rates? Would such data collection techniques, when used under voluntary reporting, narrow the difference between mandatory response rates and voluntary response rates? These questions dictated the need for further research in the area of mandatory vs. voluntary reporting. Out of this need, the 1990 PACE mandatory/voluntary study was developed.

B. Survey Design

1. Assumptions

The main goal of the 1990 PACE mandatory/voluntary study was to test various data collection and follow-up methods to see whether voluntary response could be improved to a level more comparable with the higher response currently obtained under mandatory reporting authority. The 1989 PACE split panel study indicated that under identical data collection treatments, mandatory response rates can be expected to be higher than corresponding voluntary rates. Based on this result, it was assumed for the 1990 study that mandatory response would again be higher than voluntary response.

It was further assumed that any additional data collection and follow-up methods used for 1990 would have similar effects on both the mandatory and the voluntary response rates. Therefore, we decided to limit the treatments to the voluntary portion of the study only, thus, de-emphasizing the mandatory vs. voluntary response rate comparisons and, at the same time, emphasizing more the comparisons among the various treatments. This was done so that we could infer whether any of the treatments being tested in the 1990 PACE mandatory/voluntary study would in fact lessen the existing response rate differences observed in the 1989 PACE mandatory vs. voluntary study.

Another assumption made in considering the design of the 1990 PACE study was that all establishments in the 1990 study were to some extent affected by prior exposure to the PACE survey. In other words, we felt there was no longer any basis for making comparisons between "old" and "new" plants as we did in the 1989 split panel study. This was due to the fact that plants which were new to the PACE survey for the 1989 study were now considered "previously exposed" to the PACE survey for the 1990 study.

Finally, our basic assumption of higher response rates for mandatory reporting again presumed that a certain percentage of establishments would no longer provide data if converted to voluntary status. Therefore, plants of certainty companies (certainty companies being large companies which have all of their plants included in the Annual Survey of Manufactures - ASM) were again excluded from the voluntary segment of the study. This was done again not only to prevent the potential loss of vital data, but also to preserve the same panel (except for coverage losses) for the 1990 study that was used for the 1989 study. This would allow us to maintain consistency in any comparisons we wanted to make between 1990 and 1989 response rates.

2. Sample Design

As stated earlier, the main goal of the 1990 PACE mandatory/voluntary study was to test alternative data collection and follow-up methods to see whether voluntary response rates could be improved to a level more comparable with the higher response rates observed for mandatory reporting. To do this, the entire voluntary panel from the 1989 PACE mandatory/voluntary study (both 1989 respondents and nonrespondents) was randomly split into five subpanels (panels V1-V5). Each panel was subjected to a different initial or follow-up treatment. The following describes each of these treatments.

Panel V1 - For this panel, a premail telephone call was made to each sample unit 30 days prior to mailout to inform the respondents to expect a PACE questionnaire in the mail soon. The normal PACE follow-up procedures described below for panel V4 were followed for all nonrespondents. This panel tested the effects of a prenotification telephone call on voluntary response.

Panel V2 - For this panel, a post-mail telephone call was made to each sample unit 30 days after mailout to confirm receipt of the PACE questionnaire and to remind the respondents of the questionnaire's due date.

This post-mail phone call, as well as the premail phone call made for establishments in panel V1, was strictly a reminder call and did not stress the importance of the PACE survey, nor strongly encourage the respondent to provide the requested data. Again, the normal PACE follow-up procedures described below for panel V4 were followed. This panel tested the effects of a reminder telephone call on voluntary response.

Panel V3 - For this panel, residual nonrespondents received intensive follow-up telephone calls to obtain the requested data at the 90-day due date and the 120-day follow-up date. This panel tested the effects of follow-up telephone calls on voluntary response.

Panel V4 (control group) - For this panel, the normal PACE follow-up procedures were followed (the same procedures followed for both the mandatory and the voluntary panels in the 1989 study). These are as follows:

- after 60 days, reminder letter mailed
- after 90 days (survey due date), questionnaire remailed with follow-up letter
- after 120 days, another follow-up letter mailed

Panel V5 - For this panel, residual nonrespondents received certified mail follow-up letters to obtain the requested data at the 90-day due date and the 120-day follow-up date. This panel tested the effects of certified mail follow-up letters on voluntary response.

There were many steps involved in allocating the voluntary panel across panels V1 through V5. The allocation was performed on a company basis since its prime objectives were to ensure that all establishments of a given company received the same treatment and that each panel contained a proportionate share of 1989 nonrespondents. A constraining factor in the panel establishment sizes was the telephone workload that could be supported by our analyst staff. The following summarizes the steps followed during the allocation process.

Step 1 - From the voluntary panel of establishments, a company file was created with the following fields:

CFN: SU (10 digits), MU (6 digits)
#R: number of respondent establishments in the 1989 split panel study for each company
#NR: number of nonrespondent establishments in the 1989 split panel study for each company
Stat: reporting status of company
1 (respondent) if #R > #NR
0 (nonrespondent) if #R < #NR
random choice if #R = #NR

* Only 13 companies out of 854 had both respondent and nonrespondent establishments.

#Est: number of establishments for each company

Step 2 - This company file was then partitioned into a file of respondents and a file of nonrespondents based upon the reporting status of each company (Stat value). This partitioning and the subsequent sampling ensured the stated objective that all five voluntary panels for the 1990 PACE mandatory/voluntary study have a proportionate share of respondents and nonrespondents from the 1989 study.

Step 3 - For both the respondent file and nonrespondent file, random numbers were assigned to each company. The files were then sorted in ascending random number order, resulting in purely randomly ordered files. Therefore, if the total file size is N, then any set of n_1 companies represents a simple random sample (SRS) of size n_1 from N. The first n_1 companies would be one such sample. To allocate the voluntary panel into panels V1 through V5, we needed five such random samples where $n_1 + \ldots + n_5 = N$. This was the strategy followed for step 5 below.

Step 4 - After the random sort was done, a cumulative establishment count (CumEst) field was created and computed for both files. For a given company, this field was the cumulative count of establishments for all companies preceding and including the given company.

Step 5 - The five voluntary panels for the 1990 study were then determined using the methodology described in step 3 above. The allocation for the respondent file was done first. This allocation was based upon the desired proportion of respondents for each voluntary panel and the total number of establishments desired for each panel. For example, the desired respondent count for panel V1 was determined to be 65 establishments. Thus, the CumEst field

for the respondent file was scanned for the first company whose value equaled or exceeded 65. This was company number 45, whose CumEst value was 66. Therefore, panel V1 consisted of these 66 establishments. Next, since the desired respondent count for panel V2 was also 65 establishments, the CumEst field was scanned for the first company whose value equaled or exceeded 131 (66+65). This was company number 102, whose CumEst value was 131. Therefore, panel V2 consisted of companies 46 through 102 (57 companies), comprising 65 establishments. This procedure was continued for the remainder of the respondent file and then repeated for the nonrespondent file.

After the allocation process was completed, the precise allocation of the voluntary sample was altered as a result of deletions and shifting between panels. Ghosted establishments were allowed to shift panels to ensure that all establishments of a given company received the same treatment. The following summarizes the final establishment counts for the mandatory portion and each of the five voluntary panels in the 1990 PACE mandatory/voluntary study:

panel	# establishments
M	9965
V1	104
V2	102
V3	105
V4	538
V5	147

	10,961

3. **Response Rate and Variance Estimation**

a. Response Rate Estimation

All of the results from this study, as well as the interpretations of these results, are based on the various response rates and the standard errors associated with these response rates. For this study, response was defined as the receipt of complete or partial data, or other relevant information. Receipt of a blank questionnaire was not considered to be a response.

As with the 1989 PACE split panel study, response rates for the 1990 PACE mandatory/voluntary study were calculated using a simple unweighted estimator. In other words, each panel response rate was calculated as the simple ratio of the number of respondent establishments to the total number of establishments.

This was done because we only wanted response rates to be based on the establishments in each panel, and at the same time, we wanted to maintain consistency between 1990 and 1989 response rates so that any comparisons between 1990 and 1989 response rates would be valid.

Therefore, using i to denote the sample panel (M, V1, etc.), the response rate for each panel was computed using the following formula:

$$R_i' = X_i/n_i$$

where, X_i = total number of respondents in panel i
n_i = total number of establishments in panel i

b. Variance Estimation

In considering variance estimation on response rates for this study, it was decided that the fixed PACE panel would be treated as the universe. This decision was made because we did not want to extrapolate the response rates obtained in this study to the entire manufacturing universe or to the ASM. In other words, variability due to sampling of the ASM from the manufacturing universe and sampling of the PACE survey from the ASM were ignored. Therefore, the estimates of variance for this study accounted for the sampling variability in selecting the voluntary panel from the PACE survey and the sampling variability in selecting the five treatment panels from the voluntary panel.

As mentioned earlier, the allocation of the voluntary panel into the five treatment panels was done on a company basis to ensure that all establishments of a given company received the same treatment. This allocation also independently ensured that each panel contained a proportionate share of respondent and nonrespondent companies from the 1989 study. Consequently, estimates of variance were calculated for both the respondent portion and nonrespondent portion of each voluntary panel and then added together to obtain the estimate of variance for the overall panel response rate.

In developing variance estimates of the panel response rates, Poisson sampling was assumed for both stages of sampling. This assumption was made despite the fact that the allocation of the voluntary panel into the five treatment panels was done using simple random sampling. Therefore, these variance estimates likely overstate the true variances. With these points in mind, the variance on each panel response rate was estimated using the

following formula:

$$\sigma^2_{R'_i} \approx \frac{1}{(n_i)^2} \left[\sigma^2_{X_i} + R^2 \sigma^2_{n_i} - 2R\sigma_{X_i n_i} \right]$$

$$\approx \frac{1}{(n_i)^2} \left[S^2_{X_i} + (R'_i)^2 S^2_{n_i} - 2R'_i S_{X_i n_i} \right]$$

$$\approx \frac{1}{(n_i)^2} \left[\sum_{j=1}^{n_i} (1-p_{ij})(X_{ij})^2 + (R'_i)^2 \sum_{j=1}^{n_i} (1-p_{ij})(n_{ij})^2 - \right.$$

$$\left. 2R'_i \sum_{j=1}^{n_i} (1-p_{ij}) X_{ij} n_{ij} \right]$$

where,

n_j — total number of sample companies in panel i

p_{ij} — probability of company j being in panel i

X_{ij} — total number of respondent establishments from company j in panel i

n_{ij} — total number of establishments from company j in panel i

$S^2_{X_i}$ — sample estimate of variance on variable X_i (total number of sample respondent establishments in panel i)

$S^2_{n_i}$ — sample estimate of variance on variable n_i (total number of sample establishments in panel i)

$S_{X_i n_i}$ — sample estimate of covariance between variables X_i and n_i

and n_i and R'_i are defined as before.

Variance estimates of response rate differences were also calculated. In producing these estimates, the covariance term was initially assumed to be positive. Under this assumption, the covariance was treated as being equal to zero, thus resulting in an overstatement of variance. Further investigation revealed that the covariance term could be negative, which would mean that our variance estimates were understating the true variances. However, since we could not detect significant differences between panel response rates at the 90 percent confidence level using the initial variance estimates, these estimates were not recalculated since our conclusions would not have been altered.

C. Results

All results from this study are results of analyses done on data received in weekly data transmission files from Jeffersonville. We obtained these files before any analyst review was done on the data. The results of this study are displayed in several tables and graphs, which can be seen in the appendices to this paper. This section provides brief descriptions of each table and each graph.

Appendices A-1 and A-2 deal with final response rates for the mandatory panel and the five voluntary panels in the 1990 PACE mandatory/voluntary study. Appendix A-1 is a table showing final response rates for the mandatory panel and the five voluntary panels, as well as an overall voluntary response rate. Along with the response rates themselves, the components of each response rate (i.e., the number of establishments in each panel and the number of respondents in each panel) are also shown. Standard errors on each response rate are provided as a means to test whether or not observed response rate differences are statistically significant.

Appendix A-2 is a graphical representation of the results seen in the table in Appendix A-1. Response rates for the mandatory panel and the five voluntary panels are plotted together to give a clearer indication of the observed differences between the various panel response rates.

Appendix B relates to the timeliness of response for the mandatory panel and the five voluntary panels. Appendix B is a timeline displaying response rates for all panels from the time of the 60-day reminder to closeout. Using this timeline, response rates can be compared at each weekly interval (each data transmission date). The 60-day reminder and ensuing follow-ups are denoted on the timeline so that response behavior after each follow-up can be clearly observed.

Appendix C deals with the follow-up treatments tested in the voluntary panels. There were three follow-up methods tested in the 1990 PACE mandatory/voluntary study. In addition to the control panel (normal PACE follow-up ; panel V4), total telephone follow-up (panel V3) and certified mail follow-up (panel V5) were also tested. Appendix C is a graph showing the increases in response rates from the 90-day due date to final closeout for each of these three panels. This graph gives a clear indication as to what effects each follow-up treatment had on improving voluntary response rates.

Appendix D examines the mandatory/voluntary comparison for the 1990 PACE study. As mentioned earlier, this comparison was de-emphasized in favor of comparing the various treatments tested in the five voluntary panels, but the comparison was still made as a point of interest. Appendix D is a graph showing final response rates for the mandatory panel and voluntary panel V4. This comparison was used as the mandatory/voluntary comparison for the 1990 study because panel V4, as the control group, was the only voluntary panel which did not test any treatment outside of the normal PACE follow-up procedure. Including any of the other four voluntary panels in this comparison (all of which tested different treatments) would confound the results and not be a true comparison of mandatory vs. voluntary reporting under like conditions and treatments. Therefore, the comparison between the mandatory panel and voluntary panel V4 was the only valid comparison between mandatory and voluntary response rates which could be made in the 1990 study.

Appendix E relates to the deterioration of voluntary response over time. Specifically, Appendix E is a graph showing the deterioration in voluntary response from the 1989 PACE split panel study to the 1990 PACE mandatory/voluntary study. To see this, the final response rates for the 1989 overall voluntary stratum and panel V4 from the 1990 study are shown. Panel V4 was again used as the voluntary response rate of comparison from the 1990 study because, as stated earlier, panel V4 provided the only voluntary response rate which would be valid to compare with the 1989 voluntary response rate. The final mandatory response rates for both the 1989 and 1990 studies are also shown to see whether or not the deterioration in response was unique to voluntary reporting.

Appendix F examines response patterns across the 1990 and 1989 PACE mandatory/voluntary studies. Appendix F is a crosstabulation of all establishments in the 1990 PACE study by panel x response pattern (all establishments here meaning all establishments in the 1990 PACE study which were also in the 1989 study). The panel is simply the panel in which each establishment was stratified for the 1990 study and the response pattern indicates in which study years each establishment reported (i.e., both 1990 & 1989, 1990 only, 1989 only, or neither 1990 nor 1989). For the mandatory panel, the five voluntary panels, and the total voluntary portion of the 1990 PACE study, the number of establishments for each response pattern and the response rate in each response pattern category (the percentage of the total number of establishments in each panel falling in each response category) are shown. This table, in addition to showing the frequency counts for each panel by response pattern category, also gives another indication as to how the various treatments tested in voluntary panels V1 through V5 affected response between 1989 and 1990.

D. Analysis and Evaluation

1. Interpretations

Results obtained from this study indicate that despite the various treatments tested in the five voluntary panels, mandatory reporting was still more effective in obtaining higher response than voluntary reporting. Some of the treatments tested in the voluntary panels had a positive effect on improving voluntary response rates, but the mandatory response rate, with no special efforts made to improve response, was still higher than all of the voluntary panel response rates.

The first results we looked at from the 1990 study were the final response rates for the mandatory panel and the five voluntary panels. As stated earlier, the five voluntary panels tested various data collection and follow-up methods, while normal operating procedures were followed for the mandatory panel. These final response rates can be seen in table form in Appendix A-1 and in the form of a graph in Appendix A-2, which more clearly shows the response rate differences between panels.

Comparing these response rates shows that the mandatory rate was still higher than all of the voluntary panel response rates, yielding 86.2 percent response. This was significantly higher than all of the voluntary panels. For panel V1, where telephone calls were made to each establishment 30 days prior to mailout, the final response rate was only 52.9 percent. It is safe to say that these premail telephone calls were not effective in improving voluntary response. Perhaps to be more effective, these premail phone calls should have been made closer to mailout so that respondents would be more likely to remember the phone calls. Also, more emphasis could have been placed on the importance of the survey itself instead of simply informing the respondents that they would soon be receiving the PACE questionnaire.

While the premail telephone calls did not seem to improve voluntary response, the post-mail telephone calls seemed to have a positive effect on improving voluntary response. Response rates for panel V2 were higher than those for all of the other voluntary panels before follow-up started. The final response rate for panel V2 was 69.6 percent, which was comparable with the final response rate for panel V5 (70.1 percent), which tested certified mail follow-up. Telephone follow-up also showed some positive effects on improving voluntary response, as seen in the final response rate for panel V3 (63.8 percent). The effects of the follow-up treatments tested in panels V3 through V5 are more closely examined later in this paper.

In addition to comparing final panel response rates, we also examined the timeliness of response for the mandatory panel and the five voluntary panels. This was done by monitoring response at weekly time intervals. Appendix B shows panel response rates at each weekly data transmission date from the 60-day reminder to closeout. This timeline shows that mandatory response was markedly higher than all of the voluntary panel response rates (at least 15 percentage points higher) before follow-up began at the 90-day due date. The post-mail telephone calls to remind respondents about the PACE questionnaire seemed to improve the timeliness of voluntary reporting. Response for panel V2 at the 90-day follow-up date was almost 15 percentage points higher than that of any other voluntary panel. After the 90-day follow-up, panel V3 and panel V5 showed the largest increases in response. Similar results were seen after the 120-day follow-up, though the increases were not as sizable. These results indicate that while mandatory reporting still yields better timeliness of response than voluntary reporting, post-mail telephone calls can at least improve the timeliness of voluntary reporting to a degree.

As mentioned above, we further examined the effects of the follow-up treatments tested in voluntary panels V3 through V5 on response. Appendix C shows response rates for voluntary panels V3, V4, and V5 at the 90-day follow-up date (before follow-up actually started) and at final closeout. Panel V4 (control panel) showed an increase in response of 16 percentage points after follow-up began. Telephone follow-up obtained a slight improvement in voluntary response compared with the control panel, as panel V3 yielded an increase in response of almost 22 percentage points. However, the greatest improvement in voluntary response was attained by panel V5, where certified mail follow-up yielded an increase in response of just over 32 percentage points once follow-up began. Also, the final response rate for panel V5 was just over 70 percent. From these results, we conclude that while telephone follow-up would improve voluntary response slightly, certified mail follow-up would improve voluntary response to a level still less than, but closer to, the higher response obtained under mandatory reporting.

In relation to the higher response obtained under mandatory reporting, we also examined the difference between mandatory and voluntary response in the 1990 PACE study. As stated earlier, this was not the main goal of the study, but it was still a point of interest. Appendix D shows the final response rates for the mandatory panel and voluntary panel V4. The response rate for panel V4 is shown because panel V4 employed all of the normal PACE operating procedures followed in the mandatory panel, and thus, provided the only valid comparison of mandatory and voluntary response rates

in the 1990 study. As seen in Appendix D, the mandatory response rate of 86.2 percent was almost 28 percentage points higher than the voluntary rate of 58.4 percent. This result further supports the idea that under the same survey conditions (no confounding treatments), mandatory reporting still yields higher response than voluntary reporting.

We also explored the notion that deterioration in voluntary response rates would occur over time. To do this, we compared the final overall voluntary response rate from the 1989 PACE split panel study with the 1990 panel V4 final response rate. Panel V4 was again used because it did not employ any confounding treatments. As seen in Appendix E, the voluntary response rate for the 1990 study was a little more than three percentage points lower than the 1989 voluntary response rate. This is a relatively small decrease in response, but if the rate continued to fall at this rate every year, voluntary response would become significantly lower. On the other hand, the mandatory response rate for 1990 was almost four percentage points higher than the 1989 mandatory response rate. These results may indicate that continuing with a voluntary survey without implementing procedures to improve voluntary response could lead to already-low response rates becoming even lower.

The last analysis done for this study was to examine response patterns among establishments that were active in both the 1990 and the 1989 PACE mandatory/voluntary studies. Appendix F shows that for the most part, establishments either reported in both years or neither year. The higher percentage of mandatory cases which reported in both 1990 and 1989 (compared to the voluntary panels) was expected simply because the mandatory response rates for both years were much higher than the voluntary rates.

For all of the panels in the 1990 study, there were some plants which reported only in 1990 or only in 1989. Appendix F indicates that response among establishments in panel V1 decreased in 1990 compared to 1989 since there were more plants that reported only in 1989. On average, roughly 10 percent of the plants in each voluntary panel receiving one of the treatments in 1990 (panels V1, V2, V3, and V5) responded in 1989 but did not respond in 1990. On the other hand, panels V2, V3, and V5 all showed increases in response from 1989 to 1990 since the number of cases that reported only in 1990 exceeded the number which reported only in 1989. Panels V2 and V5 showed the largest response improvement as the number of plants which reported only in 1990 was almost twice the number that reported only in 1989 for both panels. These results further indicate that post-mail telephone calls and certified mail follow-up both markedly improve voluntary response.

2. Limitations of the Results

There were several factors involved in the 1990 PACE mandatory/voluntary study which may have affected the results and/or the interpretations of these results. The first contributing factor was the limited scope of the study. The PACE survey excludes all establishments with total employment (TE) less than 20 employees, so consequently, as with the 1989 study, the 1990 study did not include any of these establishments. Also, since the panel of voluntary establishments from the 1989 study (which excluded ASM certainty company establishments) was used to allocate plants into the five desired voluntary panels for the 1990 study, the ASM certainty company establishments were also excluded from any chance of being in these five voluntary panels. Therefore, these plants were also excluded from the entire 1990 study. These plants were excluded again not only to prevent the potential loss of vital data, but also to maintain consistency in any comparisons between 1990 and 1989 response rates by preserving virtually the same panel for both the 1990 and 1989 studies.

Another factor which may have affected our results was the fact that over the course of the 1990 study, the study panel remained fixed. While deaths in the panel could be identified, births were not identified and, therefore, were not added to the study panel.

Since the PACE survey was again used as the test vehicle for the 1990 mandatory/voluntary study, all of the normal PACE operating procedures were again followed, except for the various treatments tested in the voluntary panels. Consequently, it should be realized that the results obtained from the 1990 mandatory/voluntary study apply to the PACE survey itself, and care should be exercised in extrapolating these results to other surveys.

One other factor which affected the results and/or interpretations of these results was sampling error. All of the study sample estimates for panel response rates were subject to sampling error. All significance testing for the 1990 PACE mandatory/voluntary study was done at the 90 percent confidence level. Due to the magnitude of standard errors on the voluntary panel response rates, we could not detect statistically significant differences between panel response rates at the 90 percent confidence level. However, the sizable differences between some of the response rates indicate that various treatments did have some effects on voluntary response rates.

E. Recommendations

The results obtained from this study show that despite the various alternative follow-up treatments tested on the voluntary panels to improve voluntary response, mandatory reporting still seems to yield higher response than voluntary reporting. While none of the treatments which were tested raised voluntary response to the level currently obtained under mandatory reporting, there was some improvement shown by panels V2, V3, and V5. Telephone follow-up marginally improved voluntary response relative to voluntary response under the current PACE follow-up procedures. Post-mail telephone reminders greatly improved the timeliness of voluntary response, while certified mail follow-up yielded the greatest improvement in voluntary response from the time follow-up began to closeout.

Therefore, we are recommending that a combined treatment be further considered (at least further tested) for surveys conducted on a voluntary basis. This treatment would utilize post-mail telephone reminders to improve the **timeliness** of voluntary response and certified mail follow-up to improve the overall **level** of voluntary response by getting more delinquent plants to respond. Of course, when considering this combined treatment, a cost-benefit analysis should also be done to determine whether or not the treatment is affordable. Although the results obtained from the 1990 PACE mandatory/voluntary study may be survey-specific, they certainly cannot be ignored. We need to make all possible efforts to alleviate the problem of nonresponse in our economic surveys, especially voluntary surveys.

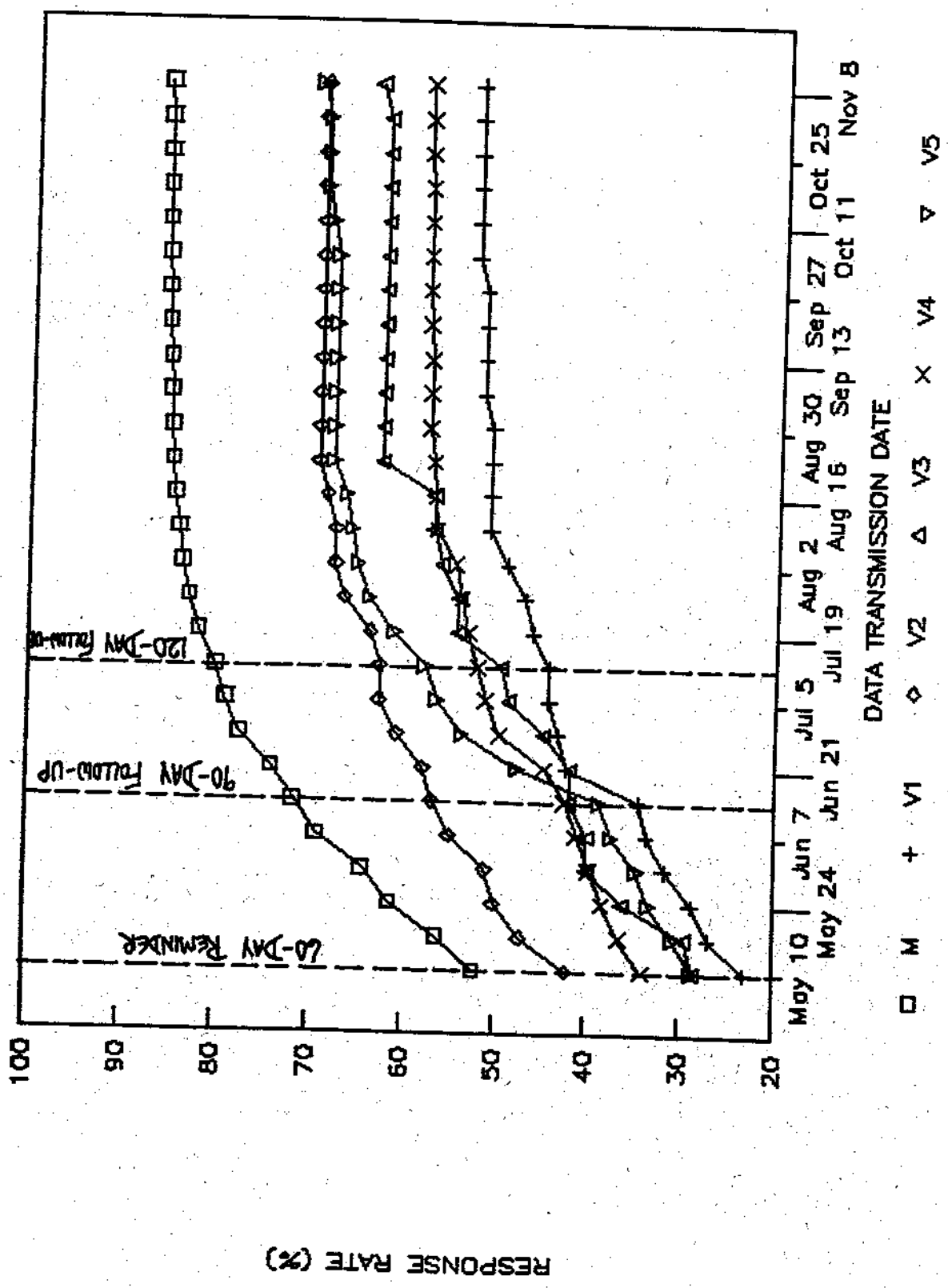**FINAL RESPONSE RATES FOR THE 1990 PACE MANDATORY/VOLUNTARY STUDY**

	Number of Cases	Number of Respondents	Response Rate (%)	Standard Error (%)
MANDATORY	9965	8590	86.2	0.1
VOLUNTARY	996	610	61.2	1.8
Panel V1	104	55	52.9	8.5
Panel V2	102	71	69.6	9.6
Panel V3	105	67	63.8	8.0
Panel V4	538	314	58.4	4.9
Panel V5	147	103	70.1	8.7

FINAL RESPONSE RATES FOR THE 1990 PACE
MANDATORY/VOLUNTARY STUDY

RESPONSE RATE (%)
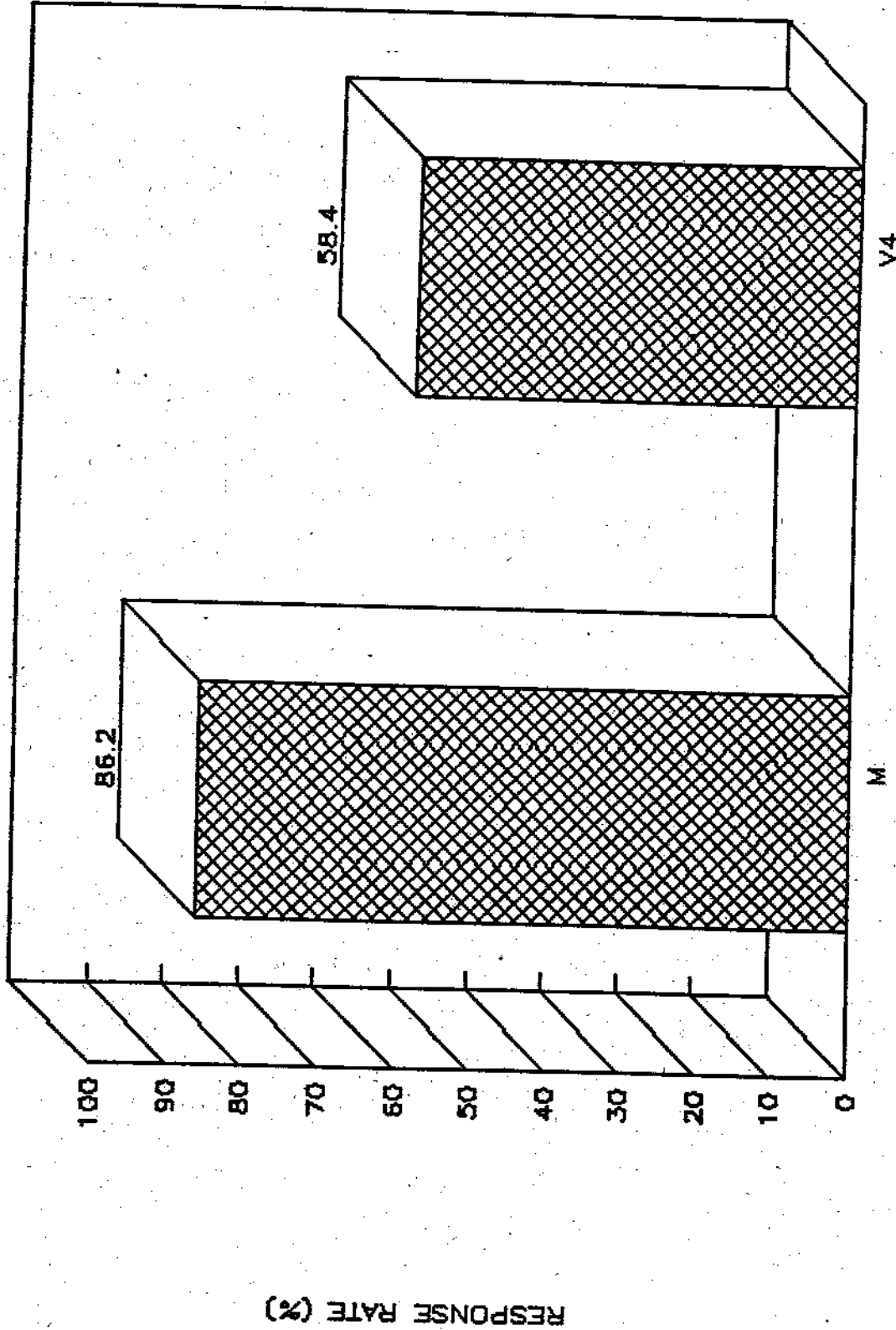
PANEL

M 86.2
V1 52.9
V2 69.6
V3 63.8
V4 58.4
V5 70.1
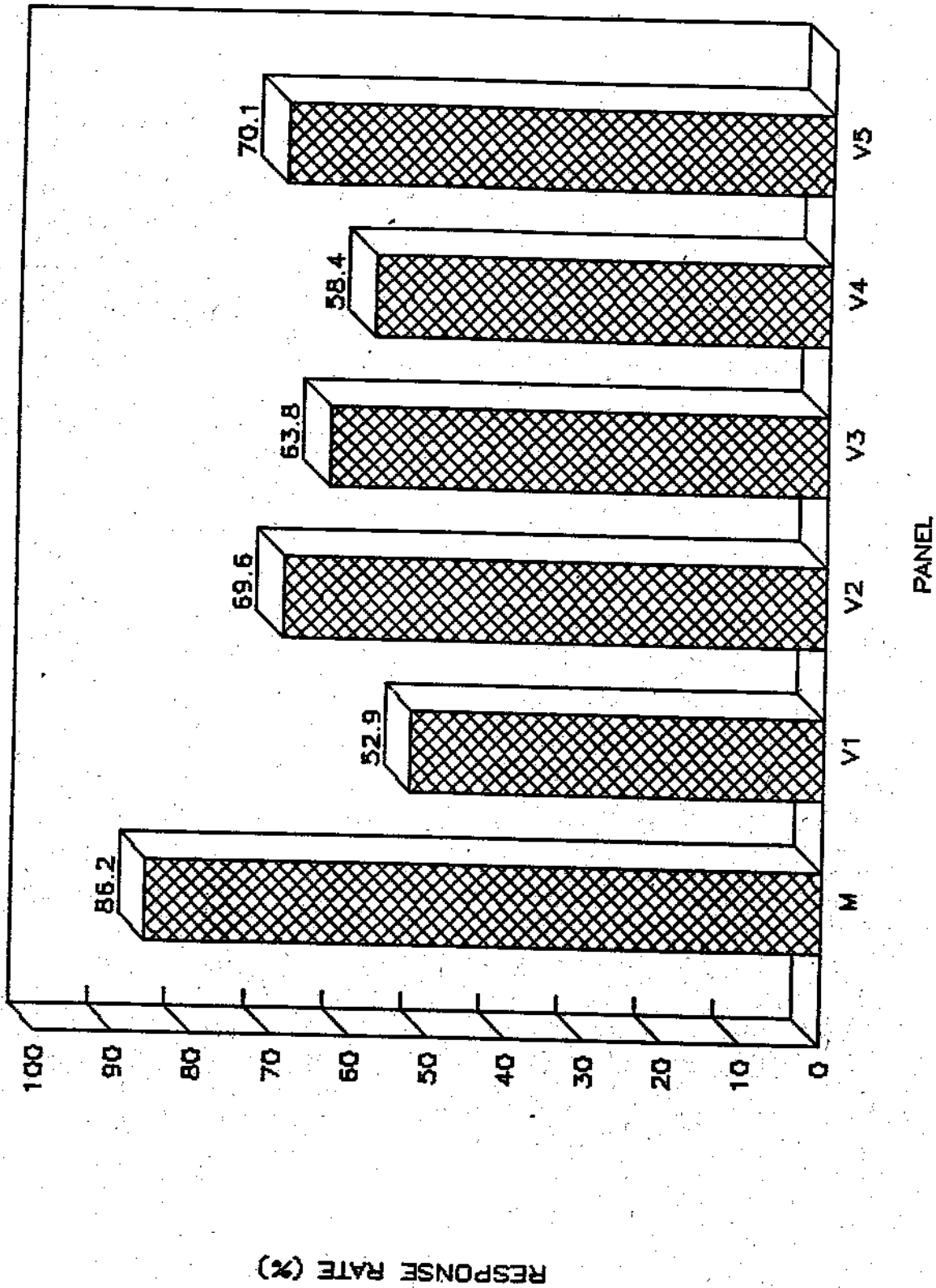
PROGRESSION OF RESPONSE RATES IN THE

1990 PAGE MANDATORY/VOLUNTARY STUDY

COMPARISON OF FOLLOW-UP TREATMENTS
TESTED IN VOLUNTARY PANELS

V3=PHONE V4=CONTROL V5=CERTIFIED MAIL
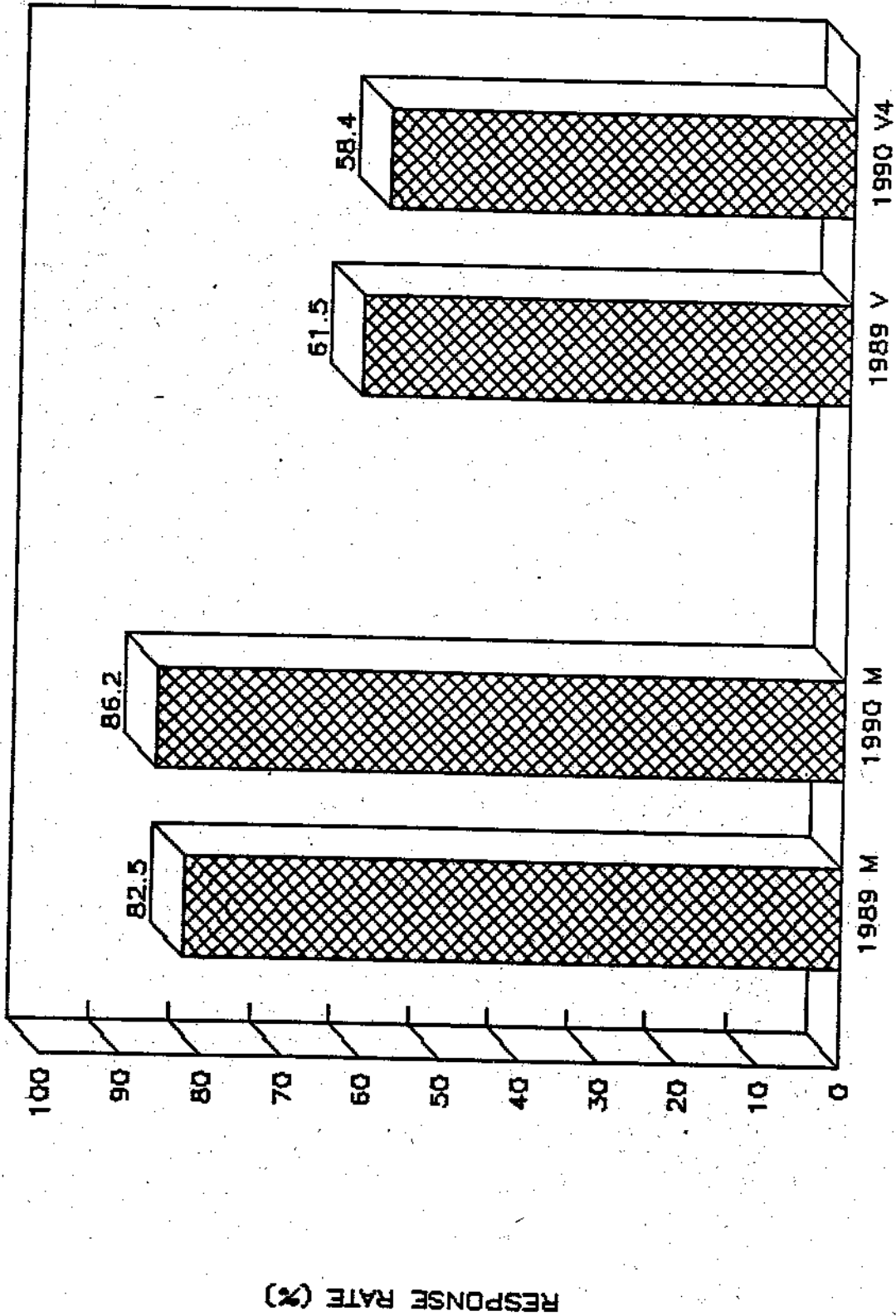
BEFORE FOLLOW-UP   FINAL

RESPONSE RATE (%)

V3: 41.9 / 63.8
V4: 42.4 / 58.4
V5: 38.8 / 70.1
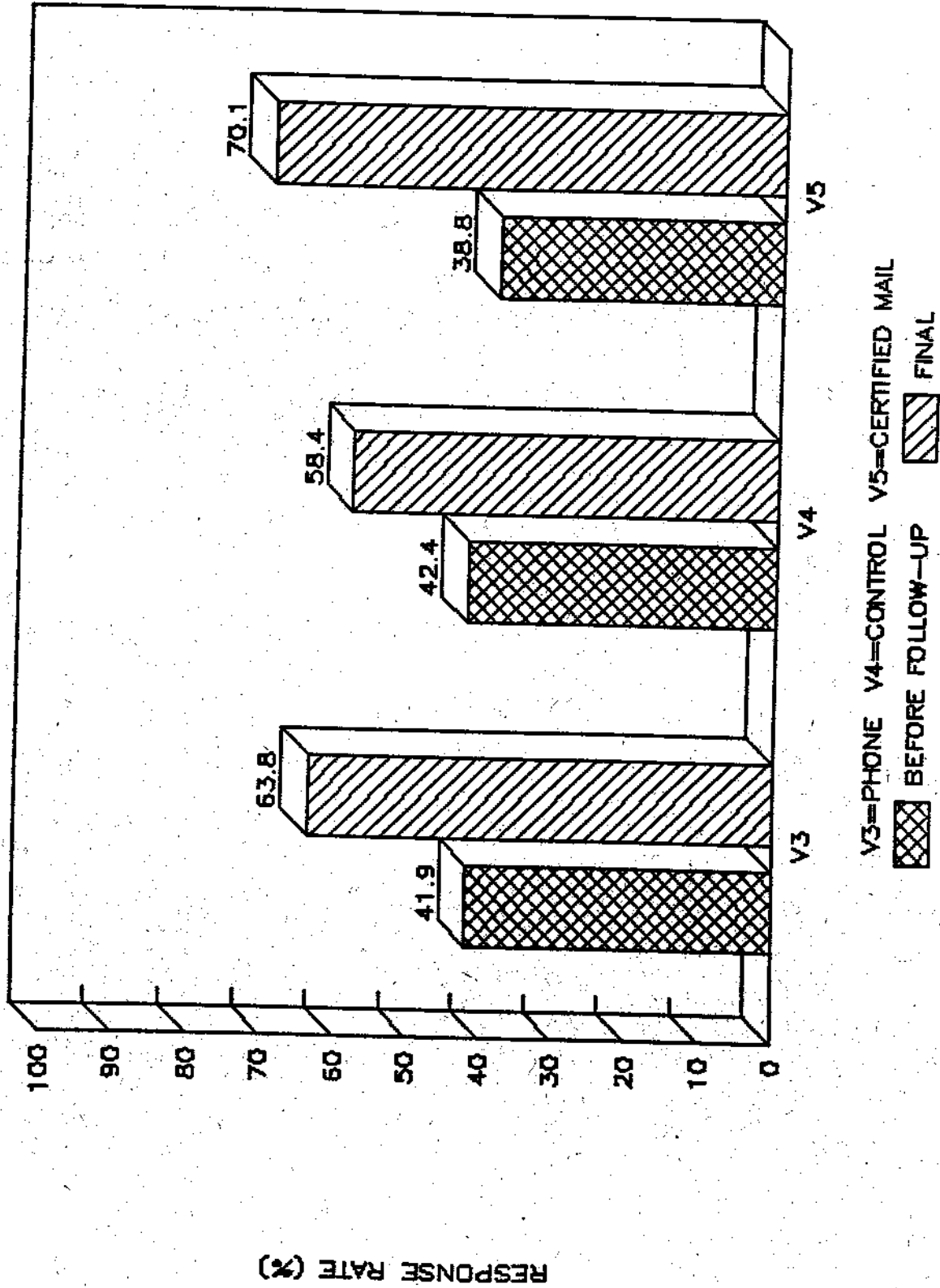
FINAL RESPONSE RATE COMPARISON BETWEEN
1990 M AND 1990 V4

86.2

58.4

M.

V4

* M vs. V (no confounding treatments)

RESPONSE RATE (%)

DETERIORATION OF RESPONSE FOR VOLUNTARY

REPORTING FROM 1989 TO 1990

RESPONSE RATE (%)

1989 M — 82.5
1990 M — 86.2
1989 V — 61.5
1990 V4 — 58.4

* no confounding treatments

RESPONSE PATTERNS ACROSS THE 1990 AND 1989 MANDATORY/VOLUNTARY STUDIES

REPORT IN:	M		V		V1		V2		V3		V4		V5	
	# OF RESP	RESP RATE (%)	# OF RESP	RESP RATE (%)	# OF RESP	RESP RATE (%)	# OF RESP	RESP RATE (%)	# OF RESP	RESP RATE (%)	# OF RESP	RESP RATE (%)	# OF RESP	RESP RATE (%)
1990 & 1989	7433	77.6	480	49.3	50	48.5	53	54.1	56	53.9	245	46.8	76	52.4
1990 ONLY	820	8.6	119	12.2	5	4.9	15	15.3	10	9.6	62	11.8	27	18.6
1989 ONLY	544	5.7	115	11.8	14	13.6	8	8.2	8	7.7	71	13.6	14	9.7
NEITHER	783	8.2	260	26.7	34	33.0	22	22.5	30	28.9	146	27.9	28	19.3
TOTAL	9580	100	974	100	103	100	98	100	104	100	524	100	145	100

* NOTE: INCLUDES ONLY CASES ACTIVE IN BOTH 1989 AND 1990