Impact of a Sequential Mixed Mode Strategy on Response Rates and Reporting Errors in a Sample of US Veterans who applied for Department of Veterans Affairs Disability Benefits for Posttraumatic Stress Disorder

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Running Head: SEQUENTIAL MIXED MODES ON RESPONSE RATE AND REPORTING ERRORS

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Abstract

Background: Sequential mixed-mode methods, where one data collection strategy in a sample is followed by a second strategy, are increasingly popular for improving survey response rates and reducing non-response bias. There is risk, however, that switching data collection modes will exacerbate non-response bias or introduce interactions between reporting errors and data collection mode. **Objectives:** To assess the impact of adding a telephone interview to a mailed questionnaire on: 1) overall response rate and estimates of the population's attributes, 2) differences in participants' attributes across modes, and 3) the concordance of responses across modes among those who responded to both modes. **Methods:** observational, cross-sectional survey of 4,918 nationally representative US Veterans who applied for Department of Veterans Affairs disability benefits for posttraumatic stress disorder (PTSD) between 1994 and 1998. Analyses were stratified by gender. **Results:** In men, the response rate increased from 65.6% to 80.2% after the telephone interview and in women, from 66.7% to 80.2% ($ps < 0.001$). There were no differences across modes for the percentage of men and women who said they worked any hours for pay, went out socially, participated in sports, or experienced combat ($ps > 0.05$). The percentage of men and women saying they were sick or unable to work was 40 percentage points higher in the telephone interview than on the mailed questionnaire ($ps < 0.001$). Comparing the telephone interview to mailed questionnaire, the percentage reporting unwanted sexual attention while in the military was 18.5 percentage points lower in the men and 9.7 percentage points lower in the women ($ps < 0.001$). Total population estimates for being sick or unable to work increased by 7.3-8.3 percentage points after the telephone interviews, unwanted sexual attention in the military lowered by 1.6-3.2 percentage points. **Conclusions:** Adding a second data collection mode substantially improved response rates but may have introduced

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reporting errors that affected our estimates of why Veterans did not work for pay and whether they experienced unwanted sexual attention in the military.

Key Words or Tags: Non-Response Bias, Mixed Modes, Reporting Errors, Satisficing, Social Desirability Bias, Bias, Mailed Surveys, Mailed Questionnaires, Telephone Interviews, Survey Methods, Response Rate, Military Sexual Trauma, Combat Exposure, PTSD, Veterans, Disability, Functioning

Introduction

Sequential mixed-mode methods, where one data collection strategy in a sample is followed by a second strategy, are increasingly popular for improving survey response rates and—potentially—for reducing non-response bias [1-6]. Typically, data collection begins with a relatively inexpensive process (e.g., mailed survey, web-based questionnaire) followed by more expensive techniques (e.g., telephone or face-to-face interview) to recruit the remaining non-respondents [3, 7].

Changing data collection modes risks recruiting research participants who differ from one another systematically according to the mode used to enroll them. In other words, sequential mixed-mode strategies may result in interactions between data collection modes and non-response bias. Depending on the situation, this may be a strategy feature or downside. Imagine, for example, that some sample members carry an attribute of interest that, unknown to the investigators, is strongly linked to the sample's propensity to participate in research only via telephone. In this situation, a mailed survey by itself will undercount the attribute. Were the mailed survey followed by telephone interviews with survey non-respondents, however, one might successfully recruit—even over recruit—participants with the attribute. Thus, even though the survey participants and telephone interviewees differ systematically on this variable, when combined, they should better reflect the attribute's true prevalence in the population [2, 4, 6]. Mixed-mode strategies may conversely exacerbate non-response bias. For example, were individuals with particular attributes especially likely to opt out of mailed surveys and more likely yet to opt out of telephone interviews, then using these two methods sequentially would worsen population underestimates.

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How questions are worded, ordered, or presented (e.g., visually v. aurally) across modes may also elicit different responses from the same subject [7], leading to interactions between reporting errors and data collection mode. This may be of especial concern when addressing potentially sensitive, stigmatizing topics, such as experiences with unwanted sexual attention. Survivors of sexual harassment and sexual assault may be unwilling to disclose such information to strangers in interview or face-to-face settings, for example [8], whereas self-administered surveys may lead to more complete and honest reporting [9, 10].

Regardless of the topic, tests for interactions between mode and reporting errors should ideally examine the same individual's responses across different modes. Instead, more typically, responses by mode have been compared across different subsamples comprised of completely different individuals, e.g., [11-13]. It is impossible, therefore, to determine whether observed differences in respondents' answers result from mode effects or from innate differences between the subsamples. Even when individuals are randomly assigned to one mode or another, random error can result in maldistribution of attributes across modes. Further, because each mode may trigger distinctive research participation propensities, apparently different disclosure rates across modes could actually be a function of which people were recruited by each mode [14]. In other words, mode discrepancies could reflect true differences between unique subsamples of respondents.

The present study takes advantage of a sequential mixed-mode approach that examined several constructs we believed would relate to PTSD disability claims outcomes for US Veterans. We specifically examined the impact of a mixed mode strategy on total response rate, characteristics of participants across the two modes, and whether adding a second mode materially changed

population-based estimates derived from the first mode alone. Eighty-three individuals responded to both modes, allowing us to compare the same person's responses across them.

Methods

Study Design

The study is a post hoc, secondary analysis of an observational, cross-sectional survey using a mailed questionnaire followed by telephone interviews of non-respondents.

Setting and Subjects

Of the approximately 101,000 men and 4,000 women who applied for VA PTSD disability benefits between 1994 and 1998, we randomly selected 2,700 men and 2,700 women for survey. After excluding 5 duplicate names, 81 deceased veterans, and 396 veterans with invalid addresses, a total of 4,918 Veterans (2,466 men and 2,452 women) remained eligible for survey. Data were collected between 1998 and 2000.

Details of the survey have been reported elsewhere [15]. At the time of survey, men respondents' mean age was 52.3 years (SD = 10.6), and women's, 38.3 years (SD = 10.2). 73.2% of men and women were white, 15.2% of men and 18.4% of women were African American or black, and 6.1% of men and 4.6% of women reported Hispanic ethnicity. 76.4% of the men and 24.6% of the women served during the Vietnam Conflict. 71.4% of men's PTSD disability claims and 52.3% of the women's claims were approved.

Protocol

A 20-page questionnaire, cash incentive, and cover letter were mailed to Veterans' homes, followed by a postcard reminder and a second copy of the questionnaire at two-week intervals. Two weeks after mailing the second questionnaire, all remaining non-respondents ($n = 1,493$) were referred to the Data Collection Survey Support Center at the University of Minnesota's

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School of Public Health for brief telephone interviews. 690 Veterans (358 men and 332 women) agreed to answer 6 questions described below, in “Measures.” Of these 690 subjects, 83 later returned their mailed questionnaire (“dual respondents”). 537 Veterans from the original sampling frame were also randomly selected for a disability claims audit. Abstracted data included whether a sexual assault was reported during their military service.

Human Protections

The Minneapolis VA Medical Center’s Subcommittee for Human Studies approved the study’s protocol. Veterans received a cover letter with their surveys that described the risks and benefits of participating in the survey and the voluntary nature of participating. Veterans signified consent to take part in the study by returning a completed survey. Consent to take part in the telephone interview was obtained verbally just prior to the interview.

Study Outcomes

Our primary outcome was the change in response rate resulting from adding a second mode to the mailed questionnaire. Secondary outcomes included differences in participants’ characteristics across the two modes, change in population-based estimates of study constructs when telephone participants’ responses were added to the mailed questionnaire respondents’, and, among the dual responders, concordance of their answers across the two modes.

Measures

The present analysis derives from a study whose main goal was examining potential disparities in PTSD disability awards [15-17]. For reasons of cost and time, it was not feasible to ask survey non-respondents to complete the entire 20-page questionnaire by telephone. We therefore identified 6 key constructs that we anticipated would be related to receiving or not receiving disability awards, including whether the Veteran: 1) had worked for pay recently, and 2) if not, why not; 3) was engaged with others on a social level; and 4) had impaired physical

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functioning. Two additional constructs asked during the telephone interview were believed to be strongly related to PTSD disability benefit awards: 5) whether the Veteran had been in combat, or 6) had experienced sexual trauma while in the service [16].

Four items in the mailed questionnaire and telephone interview were the same. These included a Social Adjustment Scale (SAS) [18] item asking participants whether they had worked any hours for pay in the last 2 weeks. For those answering negatively, a follow-up question asked why not. Options were, “sick or unable,” “on vacation,” and “do not work for pay.” Another SAS item asked “How many times in the last 2 weeks have you gone out socially with other people? For example, visited friends; gone to movies, bowling, church, restaurants; or invited friends to your home?” Responses ranged from 1 (“more than three times”) to 5 (“not at all”). One RAND Physical Functioning Battery [19] item asked, “If you wanted to, could you participate in active sports, such as swimming, tennis, basketball, volleyball, or rowing a boat?” Options included, “yes,” “yes, but only slowly,” or “no.”

The final two items asked about combat experiences and experiences with unwanted sexual attention while in the military. We considered these items to pose more threat than the other four, and we assessed them differently on the mailed questionnaire than in the telephone interview. On the questionnaire, combat exposure was assessed with a modified, 22-item version of the Combat Exposure Index (CEI) [20]. In the telephone interview, subjects were asked a single question, “While you were in the military, were you ever in a combat situation?” Those responding “yes” to any item on the CEI or to the single telephone interview question were considered combat-exposed. On the questionnaire, we assessed unwanted sexual attention while in the military using a modified, 22-item Sexual Harassment Inventory (SHI) [21]. In the telephone interview, subjects were asked “While you were in the military, did you ever receive unwanted sexual

attention?” The wording of this question was carefully chosen in consultation with experienced telephone interviewers to reduce perceived threat and stigma. Participants who responded yes to any modified SHI item or to the single telephone interview question were considered to have experienced unwanted sexual attention while in the military.

Analysis

In keeping with our sampling strategy, all analyses were stratified by gender. Individuals who returned a completed, useable, mailed questionnaire or answered the telephone interview questions were considered a “response.” The mailed questionnaire response rate was calculated as the number of returned, completed, useable questionnaires divided by the total number of Veterans eligible for survey. The final response rate was calculated as the number of returned, completed, and useable questionnaires plus the total number of completed telephone surveys divided by the total number of Veterans eligible for survey. We used the binomial proportions test to compare men and women’s final response rate to their mailed questionnaire’s response rate.

Within each gender, we used Yates’ continuity-corrected χ^2 test to compare characteristics of the mailed questionnaire respondents to telephone interviewees. Because dual responders returned their mailed surveys only after completing their telephone interviews, we grouped them with the other telephone interviewees for this comparison. We used the binomial proportions test or χ^2 test to compare results of the mailed questionnaire respondents alone to the combined samples of mailed questionnaire and telephone respondents.

For dual responders, response concordance was estimated using the observed agreement, calculated as the number of concordant answers divided by all answers, and Cohen’s kappa [22]. We used published “rules of thumb” that interpret observed agreements between 0.75 and 0.90 as

minimal and > 0.90 as high [23]. We followed Landis and Koch's [24] conventions for interpreting kappa, such that < 0.00 indicates agreement no better than chance; $0.00 - 0.20$, poor agreement; $0.21 - 0.40$, fair agreement, $0.41 - 0.60$, moderate agreement; $0.61 - 0.80$, substantial agreement; and $0.81 - 1.00$, almost perfect agreement. We also report the 2 X 2 contingency tables for mailed questionnaire and telephone interview agreement for unwanted sexual attention.

Results

Response rate

1,620 men and 1,634 women returned completed, useable questionnaires for a mailed questionnaire response rate of 65.6% for the men and 66.7% for the women. 358 men and 332 women completed telephone interviews, for a final response rate of 80.2% for both the men and women ($ps < 0.001$ for response rate difference for both men and women). Sixty additional Veterans returned surveys that were not counted in the response rate because they tore off the questionnaire's identification number ($n = 39$) or returned their questionnaire after the study's analysis cut-off date ($n = 21$).

Differences in participants' characteristics between modes

Table 1 shows that for both the men and women, the percentage who worked any hours for pay in the last 2 weeks, went out socially, participated in sports, or experienced combat did not differ importantly or statistically significantly between mailed questionnaire respondents and telephone interviewees. Among respondents who did not work for pay, the reasons given for not working differed substantially between mailed questionnaire respondents and telephone interviewees for both men and women. Men and women responding to the telephone interviews were also substantially and statistically significantly less likely to report having experienced unwanted sexual attention in the military compared to mailed questionnaire respondents. Table

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1's final row shows that, despite the discrepancy in self-reports across modes, the prevalence of military sexual assault reported in audited Veterans' claims files was similar among those responding to the mailed survey questionnaire and among those responding to the telephone interviews.

Impact of adding telephone interviews to mailed questionnaires on prevalence estimates

Combining telephone interviewee responses to the mailed questionnaires resulted in the percentage of men and women saying they were sick or unable to work to increase almost 7 to 8 full percentage points compared to the mailed questionnaire alone; this was accompanied by a similar reduction in the percentage who said they did not work (all $ps < 0.001$). Despite the substantial discrepancy between men reporting unwanted sexual attention on the mailed questionnaire compared to the telephone interviews, combining the two groups' responses caused the overall estimated prevalence of unwanted sexual attention to decrease by only 3 full percentage points compared to using the mailed questionnaire alone ($p < 0.001$). For women, combining the telephone interviewees and mailed respondents caused the overall estimated prevalence of unwanted sexual attention to decrease by 1.6 percentage points ($p = 0.07$). The remaining estimates were not meaningfully changed by combining the two groups.

Concordance of dual responders' answers across modes

As Table 2 shows, except for unwanted sexual attention, all kappas were statistically significantly better than chance. Kappas' magnitudes were also similar by gender for working for pay, reasons for not working, and frequency of social outings. Men's cross-mode kappas were substantial for sports participation and perfect for combat experience, whereas women's cross-mode kappas were moderate for these items.

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For both men and women, cross-mode kappas for unwanted sexual attention were no better than chance. Observed agreement across modes, however, was better than minimal for men and almost high for women. Table 3 shows that the marginal totals –that is, the distribution of “yes” and “no” responses to this construct by mode, were highly skewed and unbalanced. Table 3 also indicates that men accounted for most of the under-reporting of unwanted sexual attention in the telephone mode relative to the mailed survey: Of the 11 men who reported unwanted sexual attention on the mailed questionnaire just 1 (9.1%) reported the same in the telephone interview. In contrast, 40 of the 45 women (88.9%) who reported unwanted sexual attention on the mailed questionnaire reported the same in the telephone interview. The telephone interviews identified 2 additional cases of unwanted sexual attention among the men compared to the mailed questionnaire and 1 additional case among the women.

Discussion

Our sequential mixed-mode strategy boosted our response rate by nearly 14 percentage points and added 690 additional data points to our analysis. For most of our measures, the follow-up telephone interview had little impact on our final population estimates. Although mode effects appeared to be substantial for reporting unwanted sexual attention in the military, the final, combined-mode prevalence estimate differed from the survey-only estimate by only 2 to 3 full percentage points. For reasons why participants did not work, combining the two modes resulted in a larger change of 7 to 8 full percentage points to the final estimate.

In any study and regardless of mode used, only three outcomes of representativeness are possible: 1) respondents participate in the research representatively so their characteristics’ distribution mirrors the underlying population’s, 2) individuals with certain attributes are over recruited so prevalence of those attributes in the study sample exceeds the population’s, or 3)

individuals with certain attributes are under recruited, resulting in a lower prevalence in the sample than in the population. In the present study, working any hours for pay, the frequency of social outings, the ability to participate in sports, and having combat experiences did not differ importantly or statistically significantly across modes. This suggests that either there was no non-response bias related to these characteristics or that the non-response bias operated similarly across modes.

In contrast, mailed questionnaire respondents and telephone interviewees differed substantially in terms of their reasons for not working and their reports of unwanted sexual attention while in the military. Either or both modes could have under or over recruited individuals with these characteristics relative to the base population. Further, because the mailed questionnaire was fielded first, one might expect compensatory differences in the telephone interviews relative to the mailed questionnaires. For example, if those who did not work and those who experienced unwanted sexual attention in the military were especially likely to complete their mailed questionnaires, then proportionately fewer such individuals would have remained among those referred for telephone interviews.

While the mailed questionnaire could have over recruited individuals who did not work or who were exceptionally likely to have experienced unwanted sexual attention in the military compared to the telephone interviews, it is also feasible that there was an interaction between reporting errors and mode of data collection. Two strands of evidence suggest that telephone interviewees underreported their experiences with unwanted sexual attention while in the military. First, our claims file audits indicated that military sexual assault claims were reasonably evenly distributed between mailed questionnaire respondents and telephone interviewees. One might therefore expect that, absent mode effects, their reports of unwanted sexual attention

should be similar. Second, when the same respondent completed both a mailed survey and a telephone interview, they were less likely to report unwanted sexual attention in the telephone interview.

This evidence is not definitive. Any number of sexual behaviors can constitute “unwanted sexual attention,” including sexual catcalls, leering, and propositions. Just because sexual assault claims were distributed evenly across modes does not mean that other forms of unwanted sexual attention were. Also, we measured unwanted sexual attention differently across the two modes. Typically, measures using more items to define an underlying construct, such as unwanted sexual attention, result in higher prevalence estimates than when measured with fewer items [25]. Our dual responders were also self-selected. Perhaps they made a particular point of returning their mailed questionnaires precisely because they had not answered the telephone question accurately and wished to rectify the record.

Dual responders were also more likely to say they were sick or unable to work in telephone interviews than on the mailed questionnaire. On net, all telephone interviewees (not just dual responders) were more likely than mailed questionnaire respondents to say they were sick or unable to work. The order in which forced choices are presented in a survey can influence which option respondents choose [26]. Typically, individuals completing self-administered tests tend to prefer the first option presented (primacy effects), whereas individuals completing telephone interviews tend to prefer the last option (recency effects) [26]. Our patterns of responses in the present study were precisely opposite this: When asked why they did not work, mailed questionnaire respondents were more likely to endorse the last option, “I do not work,” whereas telephone interviewees were more likely to endorse the first option, “I was sick or unable to

work.” We speculate that the telephone interviewees may have believed that saying they had been sick or unable to work was more socially desirable than admitting they did not work.

To our knowledge we are the first to compare the same respondents’ answers across different modes. Our findings suggest that some constructs, such as working for pay, frequency of social outings, ability to participate in sports, and experiencing combat did not differ substantially across modes, even though, in the case of combat, we measured it differently. Reasons for not working and experiences with unwanted sexual attention, however, differed by mode. We cannot, unfortunately, say which mode generated the most accurate estimate for these two constructs; nor can we be confident that, in this case, combining answers across the two modes would reduce total non-response bias.

Limitations

This study’s sampling frame is unique, and findings may not apply to other populations. Individuals self-selected into the telephone interview by not returning a mailed questionnaire, and dual responders likewise were not randomly selected from the telephone interviewees. Unmeasured attributes related to these self-selections could account for differences we observed across modes. In hindsight, failure to use the same question to measure unwanted sexual attention across the two modes was a critical error. Lengthier telephone interviews might have permitted more rapport to develop between participants and interviewers, thus increasing confidence that interview responses were accurate, e.g., [27]. Audio computer-assisted self-interviewing (ACASI) techniques might also have reduced any socially desirable response biases in the telephone interviews [3, 28-32]. Skew in the proportion of “no” and “yes” responses to our unwanted sexual attention question could have paradoxically lowered the kappa for this construct [33].

Conclusion

To truly test for mode effects, one must have the same individual respond to the same question across different modes, ideally randomizing the mode's order. When discrepant answers are identified, cognitive interviews might help elucidate the mechanisms for the discrepancy. Sequential mixed-methods may reduce non-response bias by increasing participation among the homeless, those without landline telephones or computers, or even individuals who simply prefer one mode over another. Under other circumstances, however, such strategies may worsen bias.

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Table 1. Characteristics of Mailed Survey Respondents and Telephone Interviewees, Stratified by Gender

Characteristic	Men			Women		
	Mailed Survey Respondents (N = 1,620)	Telephone Interview Respondents (N = 358)	Survey and Telephone Respondents Combined (N = 1,978)	Mailed Survey Respondents (N = 1,634)	Telephone Interview Respondents (N = 332)	Survey and Telephone Respondents Combined (N = 1,966)
Did you work any hours for pay? % <i>yes</i>	25.2	22.7	24.8	37.1	34.4	36.3
Why didn't you work ^a ? % <i>reporting</i> :						
Sick or unable	27.9	72.5***	36.2 [†]	31.1	72.8***	38.4 [†]
On vacation	0.5	0.0	0.4	1.7	2.3	1.8
I do not work	71.6	27.5***	63.4 [†]	67.3	24.9***	59.8 [†]
How many times did you go out socially? % <i>reporting</i> :						
>3 times	10.2	11.7	10.6	13.3	16.2	13.8
3 times	5.2	4.9	5.2	6.9	8.8	7.2
Twice	13.2	11.1	12.8	16.1	16.8	16.2
Once	17.6	16.6	17.4	24.1	21.0	23.6
Not at all	52.2	55.7	52.8	39.6	37.2	39.2
Can you participate in sports? % <i>reporting</i> :						
Yes	14.9	16.5	15.2	22.5	24.1	22.8
Yes, but only slowly	21.7	18.2	21.0	28.3	28.4	28.3
No	63.4	65.3	63.8	49.1	47.6	48.9
Were you in combat ^b ? % <i>yes</i>	93.6	95.8	94.0	28.9	24.4	28.1
Did you experience unwanted sexual attention ^b ? % <i>yes</i>	30.3	11.8***	27.1 [†]	93.1	83.4***	91.5
Claims File Audit	N = 171	N = 72	N = 204	N = 166	N = 39	N = 205
Military sexual assault reported, % <i>yes</i>	0.6	0.0	0.5	80.7	89.7	82.4

Telephone interview respondents include 83 participants who later returned a mailed survey. ^aAmong those not working for pay. ^bConstruct was assessed differently on the mailed survey than in the telephone interview. NA = Not applicable. ***p < 0.001, comparing mailed survey respondents to telephone interviewees within gender. [†]p < 0.05, [‡]p < 0.001 comparing combined sample's proportion to the mailed survey's proportion within gender.

Table 2. Response Agreement by Mode among Dual Respondents

Construct	Men (n =35)		Women (n = 48)	
	Observed Agreement	Kappa	Observed Agreement	Kappa
Did you work any hours for pay?	0.91	0.75***	0.88	0.74***
Reasons unable to work ^a	0.63	0.45***	0.68	0.51***
How many times did you go out socially?	0.57	0.31*	0.51	0.37***
Can you participate in sports?	0.82	0.70***	0.73	0.58***
Were you in combat ^b ?	1.00	1.00***	0.83	0.50**
Did you experience unwanted sexual attention ^b ?	0.66	0.01	0.86	-0.08

^aAmong those not working for pay. ^bConstruct was assessed differently on the mailed survey than in the telephone interview. *p < 0.05, ***p < 0.001

Table 3. Unwanted Sexual Attention While in the Military by Gender, Response by Mode (Reported as Raw N's)

		Men					Women		
		Response on Mailed Questionnaire					Response on Mailed Questionnaire		
		Yes	No	Total			Yes	No	Total
Response in Telephone Interview	Yes	1 (0.03)	2 (0.06)	3 (0.09)	Response in Telephone Interview	Yes	40 (0.87)	1 (0.02)	41 (0.89)
	No	10 (0.28)	22 (0.62)	32 (0.91)		No	5 (0.11)	0 (0.0)	5 (0.11)
Total		11 (0.31)	24 (0.69)	35 (1.00)	Total		45 (0.98)	1 (0.02)	46 (1.00)

Marginal totals in **bold-face font**. Proportions in ().