An Analysis of Mode Effects in Three Mixed-Mode Surveys of Veteran and Military Populations

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Abstract: Studies on mixed-mode survey designs and mode effects so far have produced mixed findings. Such findings have not been analyzed in the context of special populations such as US veterans. This paper aims to contribute to the literature by examining the mode effects in three recent surveys of veteran populations administered on paper and online. The three surveys are: the US Army MWR Leisure Needs Survey, Survey of Veteran Satisfaction with the VA Home Loan Guaranty Process, and the 2008 Veterans Burial Benefits Survey. Study results indicate that the mail survey mode is largely preferred over the web, with some variation in mode preference across surveys. The analysis examines survey response rates, respondent profiles and demographics, and studies key statistical estimates for mail and web modes. Chi Square tests, t- tests, and logistical regression were used to compare survey modes.

Key Words: mixed-mode, mode effects, web survey, mail survey, response rate

1. Introduction

In the center of this study are three recent surveys administered to veterans living in the United States and Puerto Rico. All three surveys are mixed mode - paper and web, and the respondents are given the choice of how to respond to avoid possible measurement differences. The intent is to encourage as many recipients as possible to use the electronic version of the questionnaire along with the paper version. This is done for several reasons - first, Groves and Kahn (1979) wrote that individuals have different mode preferences. Griffin, Fischer, and Morgan (2001) on the other hand, wrote that "mixed mode surveys try to take advantage of respondents' preferences in order to reduce levels of survey non-response". Second, using a parallel mixed mode survey is intended to take advantage of the increasing popularity and penetration of the internet among the population of the United States. The internet has been gaining popularity as a vehicle to collect survey information among all age groups and walks of life. The remarkable surge in online computing for the last fifteen years has already produced a significant social and educational impact on modern society. According to recent studies, the worldwide web has ceased long ago to be a public space reserved for the highly educated. The estimated 2007 population internet penetration is 73.6%, while the estimated use growth for 2000-2008 is 129.6%[1]. Third, Dillman and other authors suggest that some normative and cognitive mechanisms, such as desirability, acquiescence, question order effects, or primacy and recency effects might contribute to mode differences (Dillman 2000). It is also true that little is known about the response of survey populations to web-based surveys (Dillman, 2000; Couper, 2000). Based on these trends, the central question raised in this study is: is there a significant difference between veterans responding via the web compared to veterans responding on paper, and if there is, what are the basic characteristics or the profiles of these survey populations?

2. Purpose of the Study

The purpose of this study is to determine whether mode effects can be detected in veteran responses to three mixed-mode surveys administered to veteran populations via paper and online. Three questions guided us in our research. Do veterans who use the paper version of the survey respond differently to questions about their experiences than those who respond online? Are the observed mode effects, if any, related to certain characteristics of the veteran population? Which variables are the main predictors of the paper/web choice? We want to examine whether there are any significant differences in the answers between the paper and the web questionnaires based on the data collected by those three veteran surveys. We try to explain those differences by examining certain characteristics and trends in the veteran

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[1] Source: www.internetworldstats.com, Miniwatts Marketing Group, Corywright©2008.

population, and also try to come up with some recommendations about what should be considered when using the internet as an option in mixed mode surveys.

3. The Surveys

The surveys under discussion are the *US Army Morale, Welfare, and Recreation Leisure Needs Survey* (LNS) conducted in 2005, the *2007 Survey of Veteran Satisfaction with the Department of Veterans Affairs Home Loan Guaranty Process* (VLGY), and the *2008 Veterans Burial Benefits Survey* (VBBS).The surveys used different veteran population sampling frames: the LNS was distributed at 92 Army installations to four key sub-populations: active duty personnel, spouses of active duty personnel, civilian employees, and retired military. For the purposes of our analysis we studied the retired military (veteran) subpopulation in those installations. The VLGY was sent to veterans who had closed a purchase home loan in fiscal year (FY) 2007 from October 2006 to May 2007. The VBBS was sent to veterans from all major service periods from World War II to the current Gulf War, in other words the sampling frame covered all veterans who were born between the years 1918 and 1990.

4. Survey Administration

All three surveys were administered by mailing a survey invitation to a random sample of the target survey population. The invitations for all surveys included the option of taking the survey online by providing the survey URL and a unique survey login and password for each respondent. All three surveys used modifications of the total design method (Dillman, 1978) the basic elements of which are: minimize the burden on the respondent by designing questionnaires that are attractive in appearance and easy to complete, personalize communication with the respondent, provide information about the survey to respondents, use regular follow-up contacts with respondents, and distribute survey materials in five specific steps throughout the field period of the survey The structure and format of the Web survey matched the paper survey as closely as possible considering the inevitable differences in visual appearance between paper and web modes.

5. Survey Samples, Sample Populations and Response Rates

A random sample of 52,082 LNS surveys was distributed to a population of 226,209 retired military from 92 US Army installations. 38,733 VBBS surveys were sent to a stratified survey population of 23,287,032 veterans living in private households in the US and Puerto Rico whose service separation took place between World War II and October 2007. The VLGY survey was mailed to a random sample of 13,506 veterans from a population of veteran beneficiaries who had closed a purchase home loan between October 2006 and May 2007. The LNS response rate[2] for retired military was 23.78% of which 71.7% chose the paper option and 28.3% took the survey online. The VBBS response rate was 43.68% where the majority of the responses (87.9%) were obtained by mail and the remaining responses (12.1%) were collected via the web. The VLGY had a response rate of 33.31% where 72.5% of the completed surveys were paper surveys and 27.5% were web surveys.

6. Analytic Approach

We used a multivariate logistical regression to predict the profile of veterans who elected the web option. Before conducting the regression we checked for sample size: the logistical model is likely to require more cases than an OLS regression because it uses maximum likelihood techniques. We also examined the samples for cell size - we ran cross-tabulations on categorical predictors and the outcome variable to check for cells that have a very few or 0 cases. This was done to ensure the stability of the regression model as well as the robustness of regression results. The null hypothesis tested on all three surveys was "H_0: there are no significant differences between survey modes". Hundreds of Likert-style scale questions from the

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[2] As defined in "The American Association for Public Opinion Research. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys.* Lenexa, Kansas: The American Association for Public Opinion Research, 2008."

three surveys were examined and compared to establish the presence or the absence of mode effects. Other used statistical techniques include: cross-tabulations with observed and expected values with a Pearson's Chi-square test, independent samples t-test using the dichotomous variable paper/web to distinguish between modes, and one-way ANOVA test with a Bonferroni post-hoc analysis testing for statistically significant differences in the means for the selected groups or variables.

7. Findings

7.1 VBBS Results

The logistical regression results for VBBS indicated that the variables "highest civilian education or degree", "total family income", "gender", "race", and "age" were statistically significant at the $p<0.05$ level and were found to significantly increase the odds that a person with those characteristics would select the web option of the survey. Other demographic variables such as being Hispanic, Spanish, or Latino and pay grade were not found to be significant predictors.

Table 1: Binomial logistical regression model results for VBBS

	B	S.E.	Wald	df	Sig.	Exp(B)
Spanish, Hispanic or Latino	-0.188	0.121	2.423	1	0.120	0.828
Highest Education/Degree	0.134	0.018	57.662	1	0.000*	1.143
Total Family Income	0.116	0.016	49.820	1	0.000*	1.123
Pay Grade at Discharge	0.029	0.020	2.133	1	0.144	1.030
WhiteVsOther	0.201	0.080	6.375	1	0.0012*	1.223
Gender(Male)	0.484	0.102	22.342	1	0.000*	1.623
Age	-0.052	0.002	587.297	1	0.000*	0.949
Constant	-0.571	0.178	10.301	1	0.001	0.565

* Indicates statistically significant results for a two-tailed independent samples t-test.

7.2 LNS Results

The logistical regression results for the LNS showed that the variables "level of education", "age", "marital status", and "gender" increase a survey participant's odds of selecting the web option. "Race", as well as "rank at discharge", were not found to be significant predictors of mode choice in this case.

Table 2: Binomial logistical regression model results for LNS

	B	S.E.	Wald	df	Sig.	Exp(B)
Gender (Male)	0.532	0.096	30.644	1	0.000*	1.702
Level of Education	0.120	0.030	16.029	1	0.000*	1.127
MarriedVsNotMarried	0.238	0.070	11.402	1	0.0007*	1.268
Age	-0.065	0.003	643.108	1	0.000*	0.938
WhiteVsNotWhite	0.081	0.060	1.847	1	0.174	1.084
OfficerVsNotOfficer	0.094	0.066	2.066	1	0.151	1.099
Constant	2.172	0.204	113.050	1	0.000*	8.774

7.3 Significant Differences Between Modes

When testing the null hypothesis of no significant differences between survey modes we found that for LNS and VBBS there was a significant difference between modes. For these two surveys our findings did not allow us to conclude that online responses were essentially identical to those generated from paper and we were able to reject the null hypothesis for the majority of Likert-style scale question tests performed for those two surveys. Online responses for the majority of the examined survey items were found to be more

favorable than paper. In other words, the calculated mean scores for web response questions were consistently higher than the calculated means for paper responses; especially in the case of LNS (see Tables 3 and 4). In contrast with the other two surveys, VLGY independent samples t-tests showed no mode effect and no significant differences between mode means. We were not able to reject the null hypothesis for the majority of comparisons and concluded that there was not enough statistical evidence that shows significant differences between survey modes.

Table 3: Means, Standard Deviations, and Mean Differences of Scales and Single Items for VBBS

		Web			Paper			Web vs. Paper
Scale/Item	*Metric*	*Mean*	*SD*	*N*	*Mean*	*SD*	*N*	*Mean Difference*
Understanding and Appreciation of the Service of Veterans	Sum of 8 Z-scored items	0.297	6.503	1940	-0.426	6.039	13537	-0.34*
Importance of Military Funeral Honors	Sum of 9 items	-0.285	6.158	1943	0.040	5.777	13669	0.33*
Factors Influencing Burial Choice	Sum of 11 items	0.330	5.326	1960	-0.048	4.669	13417	-0.38*
Burial Preferences	Sum of 11 items	1.335	1.440	1959	-0.188	3.970	13892	-1.52*
Likelihood of choosing a burial in a veterans cemetery	A single Z-scored item	-0.230	0.907	1968	0.032	1.008	14003	0.26*
How likely would it be to choose the closest cemetery if cremation was the only option	Z-scored item	-0.166	0.944	1887	0.024	1.006	12883	0.19*
The kind of cemetery (e.g., veterans vs. private) is more important than the type of burial	Z-scored item	0.007	0.962	1953	-0.001	1.006	12922	-0.008
If the closest veterans cemetery is closed a private cemetery is acceptable	Z-scored item	0.066	0.917	1923	-0.012	1.013	10911	-0.08*
Concern that the cost of burial will be a financial burden for the family	Z-scored item	-0.104	0.886	1932	0.018	1.017	11259	0.12*
How likely is the use of the World Wide Web to find the needed information	Z-scored item	-0.952	0.601	1945	0.134	0.972	13771	1.09*

Table 4: Means, Standard Deviations and Mean Differences of Scales and Single Items for LNS

		Web			Paper			Web vs. Paper
Scale/Item	*Metric*	*Mean*	*SD*	*N*	*Mean*	*SD*	*N*	*Mean Difference*
ACS positive impact on work, personal, family, and community life	Sum of 11 Z-scored items	0.325	6.811	1465	-0.213	5.615	2228	-0.54*
Expenditures per person when eating out	Sum of 3 Z-scored items	0.229	2.299	3149	-0.095	2.373	7573	-0.32*
Take out, order in, or dine out using various service options available on and off post	Sum of 11 Z-scored items	0.902	6.824	3238	-0.365	6.506	8014	-1.27*
Satisfaction with utilities typical for every installation	Sum of 13 Z-scored items	0.336	2.691	1685	-0.225	3.033	2515	-0.56*
Satisfaction with recreational facilities typical for every installation	Sum of 12 Z-scored items	0.425	3.232	1876	-0.275	3.612	2900	-0.70*
Satisfaction with installation-specific facilities	Sum of 15 Z-scored items	0.302	2.295	1878	-0.190	2.396	2977	-0.50*
Rating of the overall quality of food and beverage services available on post and off post	Sum of 4 Z-scored items	0.028	2.130	2741	-0.012	1.933	6149	-0.04
Average expenditures per bowling game off post	A single Z-scored item	0.164	1.089	3161	-0.068	0.952	7586	-0.23*

7.4 Differences in Results Between Surveys

Following the results described above, we studied the mode-effects difference between LNS and VBBS on one side and VLGY on the other. Based on all things known about the three surveys, we inferred that the disparity in the results comes from the way the various survey frames were constructed. While the LNS and particularly VBBS samples may possibly claim to capture the variation within the US veteran population, the VLGY survey population represents a unique veteran subpopulation subject to a number of special conditions, e.g., the sampling frame is comprised of veterans who had closed a purchase home loan within a strictly defined time frame. Such restrictions lead to population homogeneity which in its turn leads to lower sample variability. These conclusions were reinforced by our observations of the VLGY age group distribution. As shown in *Table 5* below, we found out that more than 70% of the survey sample population is between ages 30 and 60 and more than 50% of the sample population is between 30 and 50 years of age.

Table 5: Percentage Distribution among Age Groups in VLGY

	Frequency	*Valid Percent*	*Cumulative Percent*
Below 30	565	13.0	13.0
31 to 40	1,129	26.0	39.1
41 to 50	1,097	25.3	64.4
51 to 60	835	19.3	83.7
Above 60	708	16.3	100.0
Total	4,334	100.0	

8. Limitations

A major limitation of this study is that these three surveys were not designed to fit any research goals. We rather used the results of the surveys to find out more about mode effects among surveyed US veterans. Another limitation is that only VBBS can be considered a truly representative sample of the total US veteran population. The other two surveys, LNS and VLGY, are administered to subpopulations of the total veteran population.

Ideally, the two survey modes should appear identical to survey respondents in all aspects, however this is unattainable and does not seem sensible in practical terms, and thus is a limitation to our research design. Another limitation is that survey instruments did not contain enough sensitive or provocative questions and none of the questions posed potential embarrassment or risk. All these research design constraints may have reduced the magnitude of the observed effects.

9. Conclusions

The findings of this study suggest the existence of mode effects in two out of the three veteran surveys which are in the focus of this research effort. The data from LNS, VLGY, and VBBS allowed us to establish a significant relationship between education, income, gender, age, and possibly racial origin on one side and survey mode choice on the other. In terms of a demographic profile - better educated, younger (white) male veterans are more likely to choose the web survey option. Due to the limitations of this study it is not possible to claim that we have discovered the true origins of the observed mode effects among the US veteran population. What we have established in our findings, however, suffices to demonstrate the need for further research for possible mode differences between paper and web for US veteran populations and for the population at-large.

Acknowledgements

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