IMPROVING SURVEY RESPONSE IN MAIL AND INTERNET GENERAL PUBLIC SURVEYS USING ADDRESS-BASED SAMPLING AND MAIL CONTACT PROCEDURES

By

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Abstract

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Problems associated with random-digit dialing (RDD) telephone surveys, including under-coverage and increased non-response, have stimulated new investigations for using alternative data collection methods. The Internet is increasingly being used as a survey method but also suffers from incomplete coverage of households. However, mail, once thought inferior due to lack of an adequate sample frame, now may become used much more frequently with the development of a new address-based sample frame (ABS), the U.S. Postal Service's Delivery Sequence File (DSF), which provides a near- complete listing of U.S. residential postal addresses. Yet it remains unclear as to what procedures are most effective in using the DSF with mail and the Internet survey modes to obtain acceptable levels of non-response, particularly for statewide general public household surveys. The 2008 Washington Community Survey (WCS) provides an opportunity to examine these issues. The WCS was conducted by sampling from the DSF and asking people in nine different panels to respond by Internet and/or mail. Different implementation procedures were also tested to determine their impact on non-response. These include an Internet instruction card (vs. none), a $5 cash incentive (vs. none), and multiple ways of introducing the choice between Internet and mail. Statistical comparisons of the characteristics

between WCS Internet and mail respondents as well as between WCS Internet and mail respondents and both the American Community Survey (ACS) and the Current Population Survey (CPS) respondents to determine whether differences exist and how representative different WCS respondents are of general public households in Washington. Overall, I found mail and Internet respondents are very different types of people but an Internet preference approach with a $5 incentive and a mail follow-up sent three weeks later can obtain reasonable response rates (46.3%) and levels of non-response error. A mail-only treatment, with a $5 incentive, obtained the highest response rates (56.7%) but also produced similar levels of non-response error as the Internet preference approach. Furthermore, neither mail nor Internet preference respondents were consistently representative of the general population.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

Social scientists depend on sample surveys to obtain precise estimates about the characteristics of human populations. Sample survey methods enable social scientists to collect information from only a few hundred or thousand people in order to make statistically reliable evaluations about millions or even hundreds of millions of people (Dillman, Smyth, & Christian, 2009a). However, some changes in survey methods have occurred in recent years that present both new opportunities and considerable challenges for those using surveys as a research methodology.

The adoption of landline telephone service throughout the US in the second half of the 20th century facilitated a substantial increase in the use of telephone surveys so that by the 1990s it was the most dominant survey methodology, particularly for general public household surveys (Dillman, 2005; Lepkowski, Tucker, Brick, de Leeuw, Japec, Lavrakas, Link, & Sangster, 2007). High telephone coverage in the U.S. meant that it was possible to obtain samples of households that gave nearly all members of the general public a known (non-zero) chance of being included in the survey sample. A telephone sampling method known as random digit dialing (RDD) was developed whereby telephone numbers could be randomly sampled using a mathematical algorithm. In the 1990s, RDD telephone surveys were producing high response rates of 60% or more, with reasonable levels of non-response error, but, beginning in the late-1990s, response rates began to plummet so that now only about 20% of dialed numbers result in completed surveys and non-response error is much higher (Steeh, 2008; Curtin, Presser, & Singer, 2005; de Leeuw & Heer, 2002; Steeh, Kirgis, Cannon, & DeWitt, 2001). In addition, the advent and diffusion of cell phones has resulted in about 15-20% of the population no longer having landline telephone service (Blumberg, Luke, Davidson, Davern, Yu, & Soderberg, 2009; Link, Battaglia,

Frankel, Osborn, & Mokdad, 2008; Blumberg & Luke, 2008), which renders RDD sampling much less effective in terms of coverage of the general population. It is currently unclear whether RDD will remain a viable data collection methodology for general public household surveys.

The Internet has also recently become a potentially viable survey method for responding to general public surveys as more and more people have gained Internet access since the 1990s. The Internet is a particularly attractive survey method because of greater response and data collection speed, lower per unit cost over that of telephone or mail, and enhanced survey designs, such as use of interactive graphical features (Couper, 2000; Couper & Miller, 2007). However, coverage and non-response error is endemic in Internet-based surveys as well (Dillman et. al., 2009a). For example, it estimated that just under 2/3s of U.S. households have Internet access and only 2/3s of these have high-speed Internet connections (Horrigan, 2008; Zhang, Callegaro, & Thomas, 2008; NTIA, 2007). This means that a substantial proportion of the general population would be excluded from Internet-based surveys. Internet survey response rates have also been found to be consistently lower than those achieved by other modes, by an average of 11.0 percentage points (Manfreda, Bosnjak, Berzelak, Haas, & Vehovar, 2006). Moreover, an Internet-based sample frame for the general population currently has not been developed and ethical guidelines limit use of email to contacting individuals only with who a previous relationship exists (e.g. students, clients, etc) (CASRO, 2009). Thus, it does not yet seem practical to obtain a probability sample for general public surveys using the Internet or to approach such a population with an Internet-only request but using the Internet with other survey methods may be a feasible strategy.

Mail, too, has often been used as a survey method but has been considered inferior due to the lack of an adequate sample frame that allows all households an equal chance of being

included in survey sample. However, this situation may be changing. The development of mass data storage and collection technologies has enabled the U.S. Postal Service (USPS) to compile a database of addresses of all residential households in the U.S. (Link et. al., 2008). The postal address data, known as the Delivery Sequence File (DSF), is available for purchase from private vendors for survey researchers to use as a sampling frame or for other purposes. It does not, however, include names but only address information. If it is possible to sample households via postal addresses with high coverage of the U.S. household population, to contact them without names, and to convince household members to respond to surveys, then mail may currently be a very appropriate survey method for conducting general public household surveys. Moreover, contacting households via mail provides possibilities to implement multiple survey methods, such as the more cost- and time-efficient Internet method. Whether and how this can actually be accomplished with acceptable response rates and non-response error remains a pertinent question for survey methodologists.

My purpose in this thesis is to evaluate the effectiveness of different implementation methods using the DSF and a mail contact method to conduct mail and the Internet surveys of the general public households in Washington. This involves several issues. For example, does offering a mail-only survey to respondents do as well in terms of non-response as providing respondents with an Internet option, and vice versa? Are mail and/or Internet respondents representative of the target population? Does the inclusion of an Internet instruction card convince more and different types of people to respond via the Internet? What impacts, if any, do cash incentives have on mail and Internet non-response and are there differences in the effects of the incentive between mail and Internet respondents?

Research has been conducted with similar methods to analyze many of these issues but it remains unclear whether general public household surveys in large geographic areas, such as states, will produce similar results. For example, Link et. al. (2008) used the DSF and RDD with a mail and telephone method, respectively, to conduct the Behavioral Risk Factor Surveillance System (BRFSS) in several states and found that the DSF achieved higher coverage and the mail survey produced higher response rates and cost less compared to the RDD telephone survey. This study, however, did not use the Internet as a survey method (Link et. al., 2008). Smyth, Dillman, Christian, and O'Neill (Forthcoming) implemented a similar method, using the DSF with mail, and also employed the Internet, to sample and conduct a general household survey in a small rural region of about 50,000 people. The authors found that reasonable response rates could be achieved with using mail and the Internet but that non-response error was also present between mail and Internet respondents (Smyth et. al., Forthcoming). However, due to the smallness of the survey region, in which comparative data was unavailable, the authors could not conclude whether mail and Internet respondents were representative of the population in that region. Israel (2009) also implemented the same methodology in Florida and found comparable results but the survey was a non-probability survey of Florida extension clients, which limited the findings only to those who expressed interest in extension programs in the state.

My research is aimed at extending this methodology to a much larger population – about 6.3 million people in 2.5 million households – in Washington. Statewide surveys are very common in U.S., particularly for state governments, and inform social scientists and policy makers about the characteristics of the states population. However, the current trends with other survey methods may spur more and more social scientists to begin using a similar mail and Internet methodology. To determine which mail and Internet methods produce reasonable

response rates and levels of non-response error in a statewide survey, I use a probability sample of postal addresses obtained from the DSF with nine experimental groups each employing different contact procedures for mail and the Internet. Demographic data from the U.S. Census Bureau's American Community Survey (ACS) and Bureau of Labor Statistic's Current Population Survey (CPS) are also utilized for comparison with my data to assess the representativeness of mail and Internet respondents to the target population. Moreover, the survey design permits analyses to determine the efficacy of several other implementation procedures, including a $5 cash incentive (vs. none) and an Internet instruction card for responding over the Internet (vs. none). Overall, this research demonstrates the individual effects of using mail and Internet survey modes and implementation methods on survey response and respondent representativeness, and evaluates further the suitability of the USPS's DSF as a sample frame for conducting general public household surveys in large geographical areas.

In the following, I first provide a summary of the literature applicable to the study, with a focus on coverage error in sample frames, non-response error with the use of multiple survey modes, and different survey implementation procedures. Second, I describe the methods of the research, including details about the survey sample, the questionnaire and other survey materials, the various experimental treatment groups, and the data analysis methods. Third, I present the results with analyses of response rates and non-response error using different mail and Internet methods and the impact of a $5 cash incentive and an Internet instruction card on non-response. Finally, I conclude with a discussion of the findings and limitations, along with some recommendations for survey researchers and for future research.

CHAPTER TWO

THEORETICAL BACKGROUND

Survey quality largely hinges on four sources of survey error (Dillman et. al., 2009a; de Leeuw, Hox, & Dillman, 2008; Groves, 1989). These sources are known as coverage, sampling, non-response, and measurement error, each corresponding to different but interrelated aspects of survey design and implementation. Achieving low levels of each source of error is necessary to ensure that the data are valid and reliable so that results are unbiased and representative (Dillman et. al., 2009a; de Leeuw et. al., 2008; Groves, Dillman, Eltinge, & Little, 2002). However, achieving and maintaining low levels of survey error pose significant and often contradictory challenges, particularly when confounded with recent trends in coverage for available sample frames and with the advent of new survey modes, e.g. Internet and IVR, and the increased use of these modes.

The decision to use mixed-mode surveys typically involves careful consideration of coverage, non-response and measurement error (Dillman et. al., 2009a). Measurement error, which results when respondent's answers are inaccurate, can be of particular concern when using mixed-modes because respondents to different modes have been found to provide different answer to the same questions (Dillman et. al., 2009a). However, measurement error lies outside the scope of this research due to methodological reasons discussed below.

The primary focus of this research is on the coverage and non-response error in using the DSF with mail and Internet survey modes. First, it is necessary to discuss coverage error in available sample frames and to underscore the advantages and limitations of the DSF. This is followed by an examination of non-response error and response rates, with an emphasis on

mixed mode surveys, particularly with mail and the Internet. The expectations of the current research are also developed.

2.1 Coverage Error in Sample Frames

Coverage error is the extent to which all members of a target population are given an equal or known (non-zero) chance of being included in the sample frame. This type of error becomes an issue when a segment of the population is excluded from being sampled, such as those without a landline telephone in an RDD sample. Coverage error has recently been increasing in RDD sample frames and is perhaps even more problematic in other potential sampling frames, such as cell phones and the Internet. The DSF is also not impervious to coverage error but it is reported to have higher coverage compared to RDD (Link et. al., 2008) and may be a viable alternative.

2.1.1. RDD

Growing coverage error in RDD sample frames can be most attributed to increases in the use of cellular phones, and particularly in cell phone-only households, and the corresponding decrease in landline service subscriptions (Tucker and Lepkowski, 2008; Keeter, Kennedy, Clark, Thompson, & Mokrzycki, 2007). Furthermore, greater proliferation and use of cell phones has contributed to a cultural shift in which the telephone is becoming a personal device rather than one that belongs to the household (Blumberg, Luke, Cynamon, & Frankel, 2008; Dillman et. al., 2009). Each member of a household can now more affordably and conveniently obtain a cell phone with their own personal telephone number, as opposed to previous trends in which most households had one landline telephone number for all members of the household.

In 2007, between 15-20% of the U.S. population did not have landline telephone service, the majority of these being cell-only households (Blumberg & Luke, 2008; Link et. al., 2008). In Washington, cell-only households comprise about 16.3% of total households in the state

(Blumberg et. al., 2009) It has also been found that those excluded from RDD sampling are more likely to be young people who rent their residence, live with unrelated roommates, are in poverty, and live in the South (Blumberg & Luke, 2008). Young adults, particularly, represent a large proportion of the population, estimated at 30%, who live in cell-only households (Blumberg & Luke, 2007; Keeter et. al., 2007). Excluding this substantial proportion of the population from RDD sampling produces high under-coverage error and potentially biased results (AAPOR Cell Phone Task Force, 2008).

Sampling households with the inclusion of these cell phone numbers is also likely to produce significant coverage error. This method can potentially decrease under-coverage with the inclusion of cell-only households in the sample frame but could also create over-coverage problems for household surveys in that multiple members of a household could each have a personal cell phone number included in the sample frame (AAPOR Cell Phone Task Force, 2008). Moreover, this method may not increase response rates or lower costs (Keeter, Dimrock, Christian, & Kennedy, 2008). For example, sampling cell phone numbers requires enhanced contact methods and guidelines compared to those used for landline telephone numbers (Lavrakas, Shuttles, Steeh, & Fienberg, 2007). Automated dialers must be replaced with actual interviewers to contact cell phone numbers and cell phone respondents may need to be reimbursed for time spent on the cell phone, which creates additional survey costs (AAPOR Cell Phone Task Force, 2008). In addition, cell phone numbers can have any area code regardless of actual geographic location, which creates problems for sampling specific populations based on geography, such as a region, state, or city (e.g. AAPOR Cell Phone Task Force, 2008). These problems pose significant challenges to RDD surveying and have encouraged the development and greater use of alternatives.

2.1.2. Internet

Until recently, few alternative sample frames existed that survey researchers could draw on and that did not carry extra costs and burdens compared to RDD. One of these alternatives is the Internet. The Internet is a relatively new survey mode and has become very popular and useful due to the lower costs and faster response and data collection time, as well as because of the enhanced survey features it permits (Dillman et. al., 2009a). However, coverage and random probability sampling for the Internet is currently problematic. For example, in the U.S. approximately 62-65% of the population has Internet access from home, with an additional 10-12% having Internet access at other locations (e.g. work, school, etc.) (NTIA, 2007; Zhang et. al., 2008; Horrigan, 2008). Moreover, only 51-54% of the U.S. population has broadband or high speed Internet at home (NTIA, 2007; Horrigan, 2008; Zhang et. al., 2008), which can reduce burden for completing Internet surveys, especially if the survey has graphical and/or interactive features. In Washington, these numbers are a bit higher, with an estimated 82% having Internet access from anywhere, 72% from home, and 58% with broadband at home (NTIA, 2007). These figures have been gradually increasing but, nevertheless, the current rates of under-coverage remain somewhat higher than that of RDD.

In addition, the subgroups of the population without Internet access are also quite different from those with access to the Internet. For instance, reports show that those without Internet access are likely to be older, unemployed or retired, not married, have lower levels of education and income, and live in smaller households compared to those with Internet access (Horrigan, 2008; Zhang et. al., 2008). Excluding these people from the sample frame can have a large impact on the representativeness of the survey results. Overall, these trends indicate that coverage error is perhaps the major issue in the development of Internet-based sample frames.

Furthermore, very limited contact information is available from the majority of the population that has access to the Internet, as is the case with most other sample frames. However, this information, email addresses, is fraught with sampling issues. For many people, email has become a preferred method of communication, but, as with the case of telephone numbers, people can and do have multiple email addresses, which creates concerns of over-coverage for email sampling. There is also currently not national or, in most cases, regional or state lists of residents' email addresses from which to obtain random probability samples (Dillman et. al., 2009). Oftentimes, email sample frames are comprised of volunteers (non-probability sampling) or of members of an organization. Additionally, email addresses lack structural forms that are conducive to algorithmic sampling methods used for 10 digit telephone numbers, rendering random sampling more costly and burdensome (Dillman et. al., 2009). On top of all this, ethical issues for contacting email addresses are a constraint for Internet surveying. For example, it is considered unethical to contact potential respondents via email, especially with a survey request, without having already established a prior relationship with such person (CASRO, 2009), primarily because the Internet, unlike mail and telephone, is not a public utility. Thus, currently, conducting Internet-only general public household surveys remains a distant dream, or unachievable goal.

Researchers have developed some methods of potentially assuaging coverage, and also non-response error, with the Internet and RDD but improvements to the data using these methods have been found to be small or negligible in many cases with telephone (Groves & Couper, 1998) and Internet surveys (Rookey, Hanway, and Dillman, 2008; Couper, Kapteyn, Schonlau, and Winter, 2007). For example, post-stratification data weighting offers a way to more accurately generalize to the general public population, regardless of coverage, by weighting

certain demographic variables according to the actual measures in the population (Biemer & Christ, 2008). This method, however, produces mixed results in accounting for demographic differences when compared to unweighted data from using multiple or alternative modes (Rookey et. al., 2008; Couper, Kapteyn, Schonlau, and Winter, 2007), indicating that results can be biased even when weighting techniques are applied.

Many researchers are diligently working to overcome these problems but currently random probability sampling for general household surveys using the Internet does not seem feasible. However, this does not imply that the Internet should be avoided as a mode of surveying. The cost and time benefits associated with the Internet make it very appealing and practical to use. The way forward could be through a mixed mode design, in which a sample is obtained from a more reliable and universal sample frame with lower coverage error and sampled respondents are sent a request to complete an Internet survey (Dillman et. al., 2009a). The potential sampling solution pursued in this research is discussed in more detail next.

2.1.3. ABS

A third, and perhaps the most promising method of sampling for household surveys, at least in terms of coverage, is by postal addresses or address-based sampling (ABS) (Link, Daily, Shuttles, Bourquin, & Yancey, 2009). The DSF is an ABS frame comprised of a near complete and up-to-date listing of all postal addresses in the U.S. and is now widely available for purchase at reasonable prices from two private vendors (Link et. al., 2008). Reportedly, the DSF has comparatively high coverage rate of up to 95-97% of U.S. households, especially in urban areas, but lower rates have been found in rural areas (Link et. al., 2008; O'Muircheartaigh, English, & Eckman, 2007; Steve, Dally, Lavrakas, Yancey, & Kulp, 2007; Smyth et. al., Forthcoming; Link, Battaglia, Giambo, Frankel, & Mokdad, 2005; Staab & Iannacchione, 2004; Iannacchione, Staab,

& Redden, 2003). This high coverage, combined with the ability to sample cell-only households, gives the DSF some leverage over RDD. To demonstrate, Link et al (2008) used the 2005 Behavioral Risk Factor Surveillance System (BRFSS) to compare coverage and costs between a RDD-based computer-assisted telephone interview (CATI) and a DSF-based mail survey. The authors found that the DSF and a mail survey methodology obtained higher response rates, provided access to cell-only and no-telephone households, and cost less to conduct compared to the RDD telephone survey (Link et. al., 2008). Similarly, the DSF could also provide adequate coverage to those households without Internet access.

Some additional benefits of using the DSF include the capabilities to conveniently stratify the sample, conduct geographical analyses, and compare data with external data sources. For example, the DSF can be stratified in several ways for sampling target populations by type of postal address (e.g. residential, business, PO Box, seasonal, etc.) and by geographic area (e.g. city, county, zip code, state, urban/rural, etc) (Link et. al., 2009). The format of the sample frame, postal addresses, further allows for geographic or spatial analyses since geographic location is available using maps or geographic software. Information about geographic location also facilitates data comparisons with external data sources such as the U.S. Census, which also stratifies data by different geographical boundaries such as region, state, county, or zip code (Link et. al., 2008). Postal address information from households can also be matched with telephone numbers so that the telephone or IVR could be used as a survey method as well (Link et. al., 2009).

There are also some notable limitations in using the DSF for sampling. Postal addresses (i.e. street, city, state, and zip code) are the only information available in the DSF, necessitating the use of mail as the initial contact method if address data is not matched with corresponding

telephone data for the household (Link et. al., 2009). Since names are not available, enhanced personalization methods may be required to attract potential respondents to the survey. There are also some issues with coverage, such as multiple addresses per resident, multi-drop postal boxes, unlisted or vacant households, and types of addresses listed (e.g. residential, business, etc), particularly with PO Box types (Link et. al., 2008). It is estimated that these coverage issues are minor (Link et. al., 2008) and, as shown above, are also present, if not more prevalent in RDD and Internet sampling (e.g. unlisted telephone numbers or email addresses, multiple telephone numbers or email addresses per household or per person, out-of-service telephone numbers, etc). In sum, given the coverage rates reported in other studies (e.g. Link et. al., 2008, Smyth et. al., Forthcoming), it appears that the DSF is a viable sample frame that can produce relatively high coverage in random sampling households in Washington.

2.2 Non-response and Non-response Error in Mixed Mode Surveys

One of the greatest potentials of the DSF is its suitability for conducting mixed-mode surveys (Link et. al., 2009). For example, combining the improved coverage capabilities of the DSF with the cost and time benefits of the Internet as a survey mode could be a very advantageous strategy. Additionally, using mail as the initial contact mode could also bypass many of the coverage, sampling, and ethical issues involved in Internet sampling and surveying. While mail as a survey mode has not been used frequently in the past due in part to lack of an adequate sample frame (Link et. al., 2008), as well as other considerations, the development of the DSF may also render mail an effective and efficient mode to use. However, many questions remain unanswered about whether and how the DSF and a mail contact can be used effectively for conducting a mixed-mode household survey with the Internet or a combination of mail and Internet.

Two measures of effectiveness are applicable here. These are response rates and non-response error. Non-response error, the second error source of concern, occurs when respondents are somehow different than non-respondents (Dillman et. al., 2009a; de Leeuw et. al., 2008). According to Couper (2000), "Not all people included in the sample are willing or able to complete the survey" (473). However, using multiple modes such as mail and the Internet may increase the likelihood of reducing non-response error as opposed to using the Internet or mail alone, in which respondents to each mode will be significantly different.

Response rates are also an important facet of survey quality. High response rates can, but may not necessarily improve non-response error and will improve confidence in the results by increasing the sample size of respondents (Dillman et. al., 2009a; Lynn, 2008; Groves, 2006; Groves et. al., 2002; Keeter, Miller, Kohut, Groves, & Presser, 2000). High response rates also provide legitimacy to surveys. For example, the U.S. Office of Management and Budget does not accept surveys with less than a 60% response rate (Dillman et. al., 2009a). An additional measure of non-response is item non-response, in which different respondents do not answer specific questions, or items, in the survey. This type of non-response error can vary depending on the survey mode and question topic and structure but appears most pronounced in self-administered modes such as mail and the Internet (Groves et. al., 2002). Furthermore, different contact and implementation procedures can heavily impact non-response error. For example, using a uni-mode design and including pre-notice letters, incentives, and/or special instructions in the survey design can potentially reduce non-response and non-response error.

2.2.1 Response Rates

A substantial amount of research found mixed-mode surveys can reduce both non-response and non-response error (e.g. Dillman et. al., 2009a; de Leeuw et. al., 2008; Groves, 2006; Link &

Mokdad, 2006; de Leeuw, 2005; Voogt & Saris, 2005; Groves et. al., 2002; Dillman, 1999). The basic premise was established thirty years ago by Groves & Kahn (1979), who found that some people preferred to respond by one mode while others preferred a different mode. A more recent study by Millar, O'Neill, & Dillman (2009) reported similar results. According to this, offering different types of respondents multiple modes should increase the likelihood of their responding while using a single mode may entail higher non-response and non-response error. This seems to be the case in recent years, in which non-response and non-response error have been increasing, especially in RDD telephone surveys (Steeh, 2008; Curtain, Presser, & Singer, 2005; de Leeuw & Heer, 2002; Steeh et. al., 2001). This trend has contributed to the more frequent use of mixed-mode surveys, particularly when combined with the advent of new survey modes such as the Internet.

As mentioned above, RDD telephone surveys (Curtain, Presser, & Singer, 2005; de Leeuw & Heer, 2002; Steeh et. al., 2001) have recently been producing very low response rates and response rates for the Internet have been lower than for other modes, by approximately 11 percentage points on average (Manfreda et. al., 2006). This is undesirable, particularly when using these modes alone. Mixed-mode surveys have been found to increase response rates, as discussed below, but even in mixed-mode surveys, overall improvements in response rates can be heavily influenced by the modes used and the way these modes are presented to respondents (Dillman et. al, 2009a).

Offering the choice between modes sequentially to respondents has been consistently found to increase response rates. For example, Shettle and Mooney (1999) reported significant improvements by offering mail, then telephone to non-respondents, and finally in-person interviews after the telephone follow-up. The authors obtained a 68% response rate with four

mail contacts and a cash incentive, with another 13% from the telephone follow-up, and an additional 7% from the in-person interviews (Shettle & Mooney, 1999). The Census 2000 Supplementary Survey (C2SS), predecessor to the ACS, was also implemented with sequential strategy of mixed modes that achieved a total 95.4% weighted response rate (Griffin & Obenski, 2002). The C2SS began with mail, and then switched to CATI for a subsample of mail non-respondents, and then finally to computer-assisted personal interviews (CAPI) for a subsample of CATI non-respondents (Griffin & Obenski, 2002). More recently, Dillman et. al. (2009b) reported varying response rate improvements by sequentially switching from mail to phone, phone to mail, IVR to phone, and Internet to phone. In this study, the second, or follow-up mode was offered several days after a request to complete the first mode had been sent. Finally, Link & Mokdad (2006) obtained significantly higher response rates with using Internet with CATI and mail with CATI designs compared to the CATI-only survey, with the mail/CATI groups achieving the highest overall rates by 10 percentage points or more over either the CATI baseline or Internet/CATI groups.

In contrast, survey researchers have found that when provided with a choice of modes, response rates can actually be the same as or lower than in those surveys that steer respondents to one specific mode or that offer the choice of different modes sequentially (de Leeuw, 2005; de Leeuw et. al., 2008). For example, Dillman, Clark, and West (1995) did not find improvements in response rates when offering a choice between mail and phone modes. Balden (2004) also reported similar results with no improvements in overall response rates when offering a choice between mail and Internet, mail and IVR, and phone and Internet.

This also seems to be the trend with some mail and Internet mixed-mode designs. In the 2001 American Community Survey (ACS), Griffin, Fisher, and Morgan (2001) found that

providing a choice between mail and Internet obtained response rates 5.8 percentage points lower than in the mail-only group. Similarly, Gentry and Good (2008) and Grigorian and Hoffer (2008) also discovered that response rates were lower when a choice between mail and Internet was offered compared to a mail-only approach.

However, other studies using mail and the Internet have reported some contradictory results. For example, Sax, Gilmartin, and Bryant (2003) found that providing college students a choice between mail and the Internet actually achieved the highest response rates compared to a mail-only or Internet-only design, but this could be due to heavy Internet penetration among college students. Smyth et. al. (Forthcoming) also discovered that when contacted via mail and offered a choice between Internet and mail modes, the response rates were 50.4% for mail and 12.6% for the Internet, for a total rate of 63% and a significant overall improvement. On the other hand, when respondents were contacted by mail and offered a paper questionnaire, with an Internet follow-up sent three weeks later, the mail response rate was 70.6% while the Internet response rate was a meager 0.5%; the total response rate in this group, 71.1%, was the highest among the three groups (Smyth et. al., Forthcoming). In the third group the authors reversed the design, sending respondents a mail invite to complete the survey on the Internet, followed by a mail questionnaire sent three weeks later (Smyth et. al., Forthcoming). Internet response rates in this group were somewhat higher at 14.1%, with mail obtaining an additional 41%, which is a substantial improvement (Smyth et. al., Forthcoming) Also, a greater proportion of people responded via the Internet (80%) in this group compared to others but the total response rate was significantly lower overall compared to the mail and choice groups, at 55.1% (Smyth et. al., Forthcoming).

Comparable mixed findings were also reported from a non-probability survey of extension clients in Florida using mail as the initial contact mode and combining mail and the Internet to administer the survey (Israel, 2009). In this study, the mail-only group achieved a 64.5% response rate, the highest among the groups (Israel, 2009). The mail/Internet choice group was somewhat lower at 59.2%, but the majority of respondents completed the mail survey (51.4%) compared to the Internet survey (7.8%) (Israel, 2009). The Internet preference group that began with Internet obtained the lowest rate of 52.6%, with the Internet contributing 29.2% and the mail 23.4% (Israel, 2009). In both studies (Smyth et. al. Forthcoming; Israel, 2009), however, not all respondents had Internet access and respondents were contacted by mail which, as Smyth et. al.'s (Forthcoming) and Israel's (2009) findings suggest, may reduce overall response rates. In sum, these studies demonstrate that it is currently difficult to determine the best strategy for achieving lower non-response and non-response error, particularly when using mail and the Internet as survey modes. It may be difficult to obtain high response rates with the Internet or substantial response rate improvements by offering the Internet with mail (Couper & Miller, 2007) but results are mixed and more research is needed.

In the present research, a sequential mixed-mode strategy is employed, using various combinations of mail and the Internet, in which respondents are offered one mode first and then offered another mode at a later date. In line with the recent research, I expect that high overall response rates (>50%) will be obtained by both mail-only and Internet and mail mixed-mode methods in a statewide general public survey. Also, the mail-only method will obtain the highest response rates, followed by the mail preference method, then the Internet preference method. Offering the Internet first will obtain higher Internet response rates and a mail follow-up will

significantly improve these rates. Offering mail first will obtain the highest response rates and the Internet follow-up will produce only marginal improvements.

2.2.2 Non-response Error

Recent research has also found that respondents to different modes are indeed different types of people, suggesting that using one mode alone may result in high non-response error. For example, using the BRFSS, Link et. al. (2008) demonstrated that respondents to a DSF mail survey were more likely to be white, childless, living with fewer adults, and have higher levels of income and education compared to respondents to the RDD telephone survey. Mail and the Internet, particularly, have been increasingly used in mixed-mode surveys and respondents to each mode are quite different on a number of demographic characteristics. Link & Mokdad (2006), for example, found that respondents to an Internet version of the BFRSS were more likely to be younger and married and to have children and higher levels of education and income compared to mail respondents. Rookey et. al. (2008) report similar differences between Internet and mail respondents in a panel survey by The Gallup Organization.

In a general public household survey using the DSF with several combinations of mail and the Internet in a rural area, Smyth et. al. (Forthcoming) found respondents to the different modes were significantly different on several demographic and technology characteristics. Mail respondents were older, retired or unemployed, less educated, had less income, were less likely to be married, and had less children in the household compared to Internet respondents (Smyth et. al., Forthcoming). Mail respondents were also less likely to be as technologically-oriented as Internet respondents. For example, mail respondents tended to live in households with only a landline or no phone at all reported less computer use and less access to the Internet from home, and also required more assistance with the computer and Internet compared to Internet

respondents (Smyth et. al., Forthcoming). However, using logistic regression to control for these characteristics, the authors concluded that technology differences were more salient than demographic differences but that both types of differences could be somewhat mitigated with a combination of mail and Internet modes (Smyth et. al., Forthcoming), thus improving the non-response bias in the data.

In a similarly designed study using mail and the Internet to survey extension clients in Florida, Israel (2009) found Internet respondents to be younger, more educated, employed, and more likely to live in an urban area compared to mail respondents. These differences were also somewhat reduced by combining the mail and Internet respondents. In this study using mail and the Internet survey methods I expect that mail and Internet respondents will be different on a variety of different demographic characteristics – gender, age, education, etc. – and that combining the two types of respondents will also reduce non-response error between the two methods.

The use of mixed-modes, however, will not entirely eliminate non-response error. Respondents to many types surveys have been found to be different from the target population in terms of education and age, regardless of the survey method used (Groves et. al., 2002). Non-response error between respondents and non-respondents can also be difficult to determine without knowing the characteristics of the target population, which are seldom available for many types of surveys.

A few studies were able to acquire this data for non-response comparisons and found significant levels of non-response error. For example, in a quasi-general public household survey of long-distance telephone service subscribers, Dillman, Phelps, Tortora, Swift, Kohrell, Berck, & Messer (2009b) reported differences between respondents to several modes, including mail,

telephone, IVR, and the Internet, compared to non-respondents. The study by Link & Mokdad (2006) also found respondents to the Internet/CATI and mail/CATI surveys were different than the target population, as reported by the ACS. Respondents to both mixed-mode surveys were over-representative of older, white, females with higher levels of education and income compared to members of the target population. Link et. al. (2008) report similar findings between RDD telephone respondents and DSF mail respondents compared to target population estimates provided by the CPS. In this study, the telephone and mail respondents did not approximate the target population in terms of race, education, marital status, number of children, or number of adults in the household. Rookey et. al. (2008) also found comparable differences in contrasting mail and Internet panelists with data provided by the U.S. Census, in which respondents to either mode were not representative of the general population in terms of income, education, marital status, employment, age, and gender.

Whether the respondents to mail and Internet modes were actually representative of the target population could not be determined in the Smyth et. al. (Forthcoming) study using the DSF, or in Israel's survey of Florida extension clients (due to non-probability sampling issues) but this seems to be an important measure of overall non-response error that needs further evaluation, particularly in larger geographical areas. In this study, I use both the CPS and ACS to compare with data from the Washington survey to determine the representativeness of mail, Internet, and mail & Internet combined respondents. The CPS collects employment and other types of data and uses ABS methods to sample about 72,000 households across the U.S. The CPS also employs CATI and CAPI survey methods to conduct surveys throughout the year. The ACS replaced the Census Long Form in 2001 and, like the CPS, also uses an ABS frame. However, about 3 million households across the U.S. are sampled for the ACS and mail, CATI,

& CAPI methods are employed in sequential stages. Using this data for comparison, I anticipate none of the methods to be entirely devoid of non-response error. There will be at least some salient differences between CPS and ACS respondents and mail and Internet respondents in this study. Concurrently, I also expect that mail-only and Internet-only respondents will produce higher levels of non-response error relative to respondents to a combination of the two methods.

2.2.3 Item Non-response

Different levels of item non-response error can introduce bias in the survey data between survey modes, in which respondents to one mode complete more or less items than respondents to another mode. This makes combining data between the different modes somewhat difficult. Item non-response is salient problem particularly in self-administered modes in part because respondents are under less social pressure to answer all the questions as in interview modes such as telephone (Groves et. al., 2002). However, current research shows mixed results in regards to item non-response rates between these modes. For example, Manfreda & Vehovar (2002) found that the Internet exhibited more item non-response compared to the mail, especially for quantitative and close-ended questions. Bates (2001) reported comparable findings in a survey of U.S. Census Bureau employees, with Internet respondents having higher item-non-response rates than mail respondents, except on demographic questions. On the other hand, Rookey et. al. (2008) and Israel (2009) each found small overall differences in item non-response between mail and the Internet. With these mixed results, it is difficult to determine whether differences in item non-response will result from mail and Internet modes but a better understanding is required in order to adequately assess total non-response error in these types of surveys. In this survey, in which the mail and Internet questionnaires were designed exactly the same, I expect there will be negligible overall levels of item non-response error between the Internet and mail modes, but

some differences will be manifest for different question types, such as close- and open-ended questions.

2.2.4 Cash Incentives, the Internet Instruction Card, and Non-response Error

Non-response can be affected by different contact and implementation methods used in mail and Internet surveys. Using mail as the initial contact mode also provides opportunities to test the impact of different implementation and contact procedures, such as incentives, special instructions, and the ways these are presented to respondents.

Cash incentives have consistently been shown to increase response rates (Sudman and Bradburn, 1974), particularly in mail administered surveys (Ryu, Couper, & Marans, 2005; Lesser, Dillman, Lorenz, Carlson, & Brown, 2002; Church, 1993; James & Bolstein, 1990). Lesser et. al. (2002) indicated that response rates to general public surveys can be increased 15 to 20 percentage points by the inclusion of an incentive. The general idea is that offering an incentive recompenses the respondent for the cost or burden of completing the survey (Biner & Kidd, 1994) and poses as a symbol of trust between the respondent and survey organization (Dillman et. al, 2009a), which can also evoke a norm of reciprocity (Gouldner, 1960), particularly in mail surveys in which the incentive can be sent unconditionally. It is somewhat difficult to provide a cash incentive over the phone or the Internet, at least until the survey has been completed and the cash incentive can be mailed to the respondent afterwards. These incentives have also been shown to have less of an effect on response rates than unconditional incentives sent ahead of time (Singer, 2002). Moreover, incentives may have varying impacts, or leverages, depending on the types of people that receive them (Groves, Singer, & Corning, 2000). Use of cash incentives, for example, has been found to have higher leverages for lower-income respondents than for higher-income respondents (Ryu, et. al., 2005).

However, little research has been conducted to determine what impacts cash incentives have on non-response and non-response error in Internet and mail and Internet mixed-mode surveys. Smyth et. al. (Forthcoming) included a $5 incentive to all mail and Internet respondents and was thus unable to test the effects. A $5 cash incentive was provided in this survey to only some mail and Internet respondents but not others in order to determine the effects of the incentive on non-response. I anticipate that the incentive will significantly increase response rates and will reduce non-response error, at least in terms of income. The incentive will also have a differential impact on Internet respondents compared to mail respondents but it is unknown as to which survey method will be affected most.

The type of contact procedures used in surveys can also influence non-response. For example, use of pre-notification letters has been found to increase response rates by approximately 6 percent (Link & Mokdad, 2005). Multiple contacts and reminders can increase response rates as well (Dillman et. al, 2009a; Groves et. al., 2002; James & Bolstein, 1990). For example, in a DSF mail survey, Link et. al. (2008) reported that response rates were higher when a second questionnaire was mailed (vs. no second questionnaire) four weeks after the first and the inclusion of a reminder postcard (vs. no postcard) also had a small positive effect. Another type of contact that may have an influence, particularly in Internet surveys, is special instructions. It has been found that providing respondents with general survey instructions can decrease non-response and measurement error (Dillman et. al., 2009a; Groves et. al., 2002).

Since the Internet is relatively new, and given the under-coverage rates of those without Internet, it may be helpful to provide potential respondents with special Internet instructions with illustrations and a survey sponsor logo to reduce burden for those unskilled at using the Internet or fearful of providing personal information over the Internet and to increase the legitimacy of

the survey (Smith, 1997). However, to date, no research has been conducted to determine the effectiveness of this procedure. Smyth et. al. (Forthcoming) included the Internet card in mailings to all Internet respondents, which could have increased response rates in the Internet groups. In this study, only some Internet respondents received the Internet card while some did not. I expect the Internet card will increase response rates and reduce non-response error between Internet respondents with and without the card by attracting different types of people who otherwise would not have responded, or would have responded via mail.

The actual timing of the contacts can potentially affect non-response. For example, offering a simultaneous choice of mode, which has been found to reduce response rates, could introduce complexity or increase burden into the decision-making process, especially if too many materials are presented at once (e.g. letter, paper questionnaire, URL and passcode, Internet instructions, etc) (Dillman et. al., 2009a). For example, Schwartz (2004) has argued that when presented with too many choices or too much information, decision making can be overwhelmed with complexity, in which case people may opt to choose nothing at all or to not participate. Thus, introducing "complexity" in the survey implementation process through use of too many materials or by providing respondents with choices of modes could possibly push respondents to opt for the option of not responding at all and to disregard the survey altogether.

Even with a sequential mixed-mode strategy, the timing of contacts and what materials are included in each contact seems important for non-response. I test whether excluding the Internet card from the survey request contact, in which the survey request letter and/or questionnaire is included, and delaying the mailing card until after the survey request contact will have an impact on Internet non-response. Delaying the mailing of the card and presenting respondents with one piece of pertinent information at a time may reduce complexity and burden

and therefore result in more completed surveys. I anticipate that delaying the mailing of the Internet card will result in higher response rates for the Internet than when the card is included with the survey request mailing or when the card is not included at all.

CHAPTER THREE

METHODS

For this study, I analyze data from a state-wide general public household survey that was conducted in Washington in two separate waves, one during the summer and the second during the fall of 2008. Each wave was conducted over the course of two months. The DSF was utilized to obtain the sample and various combinations of mail and Internet modes were employed to administer the survey, with six different treatment groups in Wave 1, or the summer wave, and three treatment groups in Wave 2, or the fall wave. The survey was titled the "Washington Community Survey" (WCS) and included 41 questions about community satisfaction and where people perform various activities, as well as people's Internet and cell phone usage and demographic characteristics. Washington is estimated to have 2,501,509 households, with a population of 6,329,469 individuals, based on estimates from the 2007 ACS for Washington. Although a survey of Washingtonians is not the equivalent of a U.S. general public survey, the state's population and geographical size allows for comparable estimates to be made at least for other states or regions.

3.1 WCS Treatment Groups

Each wave of the WCS lasted about two months, with the implementation process occurring over the course of the first month and data collection extending an additional month. The six treatment groups that comprise the Wave 1 and the contact materials mailed to each group are listed in Table 1. As illustrated in the table, half of the treatment groups began with mail, with the $5 mail-only group 1 using only mail throughout the survey and mail preferences groups 2 & 3 offering Internet in the fourth contact. The remaining three Internet preference groups 4, 5, & 6 began with Internet, followed by a mail option sent in the fourth contact. The first contact was a

pre-notification letter and was the same across all treatment groups. The second contact was mailed three days later and contained a letter, questionnaire and return envelope for the mail groups, with an additional $5 incentive of mail groups 1 & 2. Internet groups received a letter with the survey URL and passcode, and groups 4 & 5 also received a $5 incentive while groups 5 & 6 received the Internet card. The third contact, a postcard, was mailed 11 days after the second contact and varied by mode, with the Internet groups containing the URL. Finally, the fourth contact, mailed 16 days after the third, was the same across all groups except the mail-only group, which did not receive a URL letter.

Wave 2 of the survey consisted of three additional treatment groups, as shown in Table 1. This wave was designed to determine whether the Internet card could be more effective for non-response if it was mailed to respondents after the initial request to complete the survey. Wave 2 utilized the same materials used in Wave 1, with the exception of the Internet card, in which the cards used in this wave contained the respondent's passcode. As shown in Table 1, the first contact was the pre-notification letter. The second contact was mailed one week later and varied depending on the survey mode. All groups received a $5 incentive but the two Internet groups received the URL letter while the mail group received the questionnaire and a letter. The third contact, sent one week after the second contact, is somewhat different from that in Wave 1. In Wave 2 the third contact included a reminder letter for all groups and an Internet card for groups 8 & 9 rather than the reminder postcard used in Wave 1. Finally, the fourth contact, mailed two weeks after the third contact, contained the same materials between all the groups, a questionnaire and URL letter.

TABLE 1: Implementation Procedures and Dates for WCS Wave 1 & 2 Treatment Groups

Treatment Groups	1st Contact	2nd Contact	3rd Contact	4th Contact
Wave 1	June 23, 2008	June 26, 2008	July 7, 2008	July 23, 2008
(1) $5 Mail-only	Pre-notice Letter	Questionnaire[1], Letter, & $5	Reminder postcard	Questionnaire[1] & Letter
(2) $5 Mail Preference	Pre-notice Letter	Questionnaire[1], Letter, & $5	Reminder postcard	Questionnaire[1] & URL letter
(3) Mail Preference, No $5	Pre-notice Letter	Questionnaire[1] & Letter	Reminder postcard	Questionnaire[1] & URL letter
(4) $5 Internet Preference, No Internet card	Pre-notice Letter	URL-only letter & $5	Reminder postcard with URL	Questionnaire[1] & URL letter
(5) $5 Internet Preference, w/Internet Card	Pre-notice Letter	URL letter, Internet card, & $5	Reminder postcard with URL	Questionnaire[1] & URL letter
(6) Internet Preference, w/Internet Card & No $5	Pre-notice Letter	URL letter & Internet card	Reminder postcard with URL	Questionnaire[1] & URL letter
Wave 2	September 22, 2008	September 29, 2008	October 6, 2008	October 20, 2008
(7) $5 Internet Preference, No Internet Card	Pre-notice Letter	URL-only letter & $5	Reminder URL letter	Questionnaire[1] & URL letter
(8) $5 Internet Preference, w/Internet Card	Pre-notice Letter	URL-only letter & $5	Reminder URL letter & Internet card	Questionnaire[1] & URL letter
(9) $5 Mail Preference, w/Internet Card	Pre-notice Letter	Questionnaire[1], Letter, & $5	Reminder URL letter & Internet card	Questionnaire[1] & URL letter

Notes: [1] Return envelopes were included in each mailing with a paper questionnaire

3.2 Data Analysis

Several statistical analyses were conducted with the WSC data to determine the effects of different implementation methods used in the WCS. The multiple comparisons are presented in Table 2 for clarity. Comparisons of response rates and demographic data between respondents to different treatment groups provide measures of the levels of non-response. Demographic variables include gender, age, education, race/ethnicity, children in household, number in household, marital status, employment status, and household income. Furthermore, demographic data on these variables from the WCS was compared with the 2007 data for Washington from

both ACS and the CPS to discern whether respondents to the WCS are representative of the general state population.

TABLE 2: Response Rate and Non-response Error Comparisons of WCS Treatment Groups for Mail vs. Internet, Internet Card vs. No Internet Card, and $5 Incentive vs. No Incentive Analyses

Comparisons	Mail vs. Internet	Internet Card vs. No Internet Card	$5 Incentive vs. No Incentive
Response Rates	• Mail and total respondents in Mail Treatments 1 vs. 2 • Mail and total respondents in Mail Treatments 1 & 2 vs. Internet and total respondents in Internet Treatments 4 & 5	• Internet, mail, and Internet/mail combined respondents in Internet Treatments 4 vs. 5 and 7 vs. 8	• Mail and Internet/mail combined respondents in Mail Treatments 2 vs. 3 • Internet, mail, and Internet/mail combined respondents in Internet Treatments 4 & 5 vs. 6 • Mail respondents in the difference between Mail Treatment 2 minus Mail Treatment 3 vs. Internet respondents in the difference between Internet Treatments 4 & 5 minus Internet Treatment 6
Non-response Error	• Internet respondents in Internet Treatments 4, 5, 7, & 8 vs. mail respondents in Mail Treatments 4, 5, 7, & 8 • Internet respondents in Internet Treatments 4, 5, 7, & 8 vs. mail respondents in Mail Treatments 1, 2, & 9 • Internet/mail combined respondents in Internet Treatments 4, 5, 7, & 8 vs. mail respondents in Mail Treatments 1, 2, & 9 • Internet respondents in Internet Treatments 4, 5, 7, & 8 vs. 2007 ACS/CPS • Mail respondents in Mail Treatments 1, 2, & 9 vs. 2007 ACS/CPS • Internet/mail combined respondents in Internet Treatments 4, 5, 7, & 8 vs. 2007 ACS/CPS	• Internet, mail, and Internet/mail combined respondents in Internet Treatments 4 vs. 5, 7 vs. 8, 5 vs. 8, and 4 & 5 vs. 7 & 8.	• Mail and Internet/mail combined respondents in Treatments 2 vs. 3 • Internet, mail, and Internet/mail combined respondents in Treatments 4 & 5 vs. 6.

In some of the non-response comparisons it seemed important to include other variables relevant to the WCS and to mail and Internet respondent differences. For example, a variable for urbanicity is included and was measured based on whether respondents receive their postal mail in one of the five urban counties in Washington. Internet and mail respondents could be disproportionately located in different types of areas. Internet and computer status variables are also included as a measure of Internet access and computer and Internet usability, which will very likely be different between mail and Internet respondents. Variables include Internet access in the household, high-speed Internet access in the household, Internet use, computer use, and assistance with using the Internet. A telephone status variable was constructed from whether respondents had no phone, a cell phone only, landline telephone service only, cell and landline telephone service, or unknown. This seemed an important measure given the current changes taking place in telephone surveying. WCS respondents were also asked which method of communication – face-to-face, telephone, Internet, or other – they most often use to communicate with others inside and outside their community. Those who preferred to respond via mail may also prefer a different method of communication with others compared to those who preferred to respond via the Internet. Finally, the main topic of the WCS, community satisfaction, is used to determine whether Internet and mail respondents feel different levels of satisfaction – completely, mostly, somewhat, and not at all satisfied – towards their community.

Also, corresponding treatment groups between waves of data collections are combined, where indicated, for certain response rate and non-response error analyses. Since Wave 1 and Wave 2 of the WCS were conducted only three months apart and used mainly the same implementation protocols, it seemed reasonable to combine corresponding groups. Initial tests

were also conducted to determine whether combining corresponding treatment groups between waves was practical.

3.3 Sampling

The sample for the survey consisted of 5,400 randomly selected residential addresses in Washington, 3500 for Wave 1 and 1900 Wave 2. Business, seasonal, and vacant addresses were excluded from the sample frame to ensure that the sampled addresses were residential and were also more likely to belong to full-time citizens and residents of Washington. For random selection at the household level, a request that the adult with the most recent birthday fill out the survey was included in the contact letters and on the questionnaire. This method of within-household sampling has been found to be as effective as some alternatives, including any adult and all adults in the households (Battaglia, Link, Frankel, Osborn, & Mokdad, 2008).

The sample was also weighted to include more people in rural counties. Over two-thirds of Washingtonians live in five of the thirty-nine counties in the state (ACS, 2007; Albrecht, 2008). Thus, the sample was weighted so that 50% of the sample was drawn from the five most populous, urban counties while the other 50% was drawn from the remaining 34 rural counties. This was done in order to avoid an urban bias in the data and to obtain a sufficient number of respondents from the rural counties without increasing the overall sample size. Post-stratification weights were applied to the data to offset the effects of the disproportionate number of rural respondents on the representativeness of the results.

3.4 WCS Survey Implementation Materials

Implementation of the WCS involved several components, including a paper and Internet version of the questionnaire, paper contact letters and envelopes, an Internet instruction card for some Internet respondents, and a $5 incentive for some respondents. Careful design procedures were

followed to ensure both consistency and personalization in each of these components across the different treatment groups. Visual and content consistency was maintained to minimize the negative effects of using different visual designs or content in surveys (see Dillman, 2000; Dillman et. al., 2009a), such as increases in measurement error. Tailoring each component to the sample population using pictures of different areas of the state was applied to increase the likelihood of respondent affiliation or appeal with the WCS. This is particularly important given the topic of the survey and also since the different components could not be tailored to respondents by name or any other personal characteristic aside from place of residence.

3.4.1 The WCS Questionnaire

The mail and Internet versions of the questionnaire were designed using a uni-mode construction, in which the different modes utilized in the survey are designed as similarly as possible (Dillman et. al., 2009a). Consistency in the visual and content components of the questionnaire between different modes can help reduce measurement error because respondents to either mode are presented with the same information, regardless of mode (Dillman et. al., 2009a). Research has also found that respondents to visual modes, such as mail and the Internet, tend to respond similarly when a uni-mode construction is employed (Dillman et. al., 2009b) but measurement error between visual modes may still not be eliminated entirely (Rookey et. al., 2008).

Employing a uni-mode construction in the WCS questionnaires required asking the same questions in the same order in both versions and designing each mode with identical visual characteristics, including the same colors, fonts, pictures, and question formats. This is demonstrated in Figure 1, which provides illustrations of different pages from each questionnaire. The primary differences between the two versions are largely inherent in the

FIGURE 1: WCS Mail and Internet Questionnaires

different modes. For example, the Internet version presents questions page-by-page (i.e. one question per screen) whereas the mail version presents multiple questions per page in a 12 page 8.5" X 11" booklet.

In an attempt to mitigate any undesired effects from this mode difference, questions in the mail version are enclosed in stand-alone colored regions so each question can be seen as visually distinct from other questions. Another inherent mode difference exists in the branching of questions and skip instructions. Internet respondents are automatically directed to the next question, even on questions that include branching or skip options. On the other hand, mail respondents must follow skip instructions and navigate question branching on their own. Branching questions in the mail version are thus visually offset on the page and bold direction arrows are used along with visually prominent skip instructions (as seen in Question 5 in Figure 1) to help reduce any mode differences with regards to question branching.

The WCS questionnaires also contained pictures of regions across the state to potentially increase respondent affiliation with the survey. Both versions begin with a picture of a prominent geographic symbol of the state, Mount Rainier, located on the front cover of the mail survey and on the opening screens of the Internet survey. Four other pictures of state symbols are displayed on the back cover of the mail version and in the banner of web pages in the Internet version.

3.4.2 WCS Contact Letters and Materials

The contact materials, including the letters, envelopes, postcards, and Internet instructions, were also designed to maintain consistency between different modes. First, the content of the letters and reminder postcards are exactly the same across treatments with the only exception being differences in the survey instructions for each of the two modes. As illustrated in Figure 2, letters and postcards sent to Internet respondents include instructions on how to access the survey on

the Internet (e.g. a URL) as well as the passcode and also a note to non-Internet users that a mail survey will be sent in a few days. Letters to mail respondents, on the other hand, include instructions on returning the mail questionnaire but a prior notification that an Internet option would be sent in a few days is excluded. Both versions of the survey were mailed to respondents in 12" X 9" brown envelopes with a stamped return envelope included with the mail questionnaires. Contact materials were also tailored to respondents in various ways. For example, as seen in Figure 2, each letter and postcard sent to respondents were addressed to the resident of *X* town (e.g. Dear *X* Resident,…) and contained survey sponsor letterheads at the top (not shown in Figure 2).

Some minor differences also existed in the contact materials used in each of the two waves of the WCS. Letters used in the Wave 1 included a picture of Mount Rainier in the lower right-hand corner; this picture was omitted in Wave 2 to reduce printing costs. Also, in Wave 2 a reminder letter in a small envelope replaced the reminder postcard used in the first wave. Envelopes used in the Wave 1 included the address of the town resident and return address of the survey sponsor, along with a sticker at the upper left-hand side with the picture of Mount Rainier and the title of the survey. On the other hand, envelopes used in Wave 2 included only the residential address and return address, as well as a "Return Services Requested" stamp. The survey title sticker was also excluded from these mailings.

FIGURE 2: WCS Mail and Internet Preference Letters and Postcards

Mail Preference

June 19, 2008

«CITY» Area Resident
«ADDRESS» «UNIT»
«CITY», «STATE» «ZIP»«dash»«ZIP4»

Dear «CITY» Area Resident,

I am writing to ask for your help to gain a better understanding of how communities across the state of Washington are providing for the people who live in them. We are especially interested in what people think about important issues in their community, from the availability of jobs and needed services to the use of newer technologies such as cell phones. Most importantly, we want to understand how these issues affect the quality of life in different types of Washington communities.

The best way we have of learning about these issues is by asking all different kinds of people throughout the state of Washington, from towns and cities both large and small, to share their thoughts and opinions. Your address is one of only a small number from each of the 39 counties in Washington that have been randomly selected to help in this study.

To help us make sure we hear from all different types of people who live in Washington communities, please have the adult (age 18 or over) in your household who has had **the most recent birthday** be the one to complete the enclosed questionnaire.

The questions should only take about 15 minutes to complete. Your responses are voluntary and will be kept confidential. Your names are not on our mailing list, and no one's answers will ever be associated with the mailing address. If you have any questions about this survey of Washington communities, please call Thom Allen, the study director, by telephone at 1-800-833-0867 or by email at ted@wsu.edu.

By taking a few minutes to share your thoughts and opinions about life in the Washington community where you live, you will be helping us out a great deal, and a small token of appreciation is enclosed as a way of saying thank you. We expect that the results of this study will be useful in helping state and community leaders throughout Washington better understand how different aspects of communities contribute to providing a good quality of life for residents.

I hope you enjoy completing the questionnaire and look forward to receiving your responses.

Many Thanks,

Don A. Dillman
Regents Professor and Deputy Director

Internet Preference

June 26, 2008

«CITY» Area Resident
«ADDRESS» «UNIT»
«CITY», «STATE» «ZIP»«dash»«ZIP4»

Dear «CITY» Area Resident,

I am writing to ask for your help in gaining a better understanding of how communities across the state of Washington are providing for the people who live in them. We are especially interested in what people think about important issues in their community, from the availability of jobs and needed services to the use of newer technologies such as cell phones. Most importantly, we want to understand how these issues affect the quality of life in different types of Washington communities.

The best way we have of learning about these issues is by asking all different kinds of people throughout the state of Washington, from cities and towns both large and small, to share their thoughts and opinions. Your address is one of only a small number from each of the 39 counties in Washington that have been randomly selected to help in this study.

To help us make sure we hear from all different types of people who live in Washington communities, please have the adult (age 18 or over) in your household who has had **the most recent birthday** be the one to complete the questionnaire.

We are hoping that you will be able to complete the questionnaire on the Internet. Doing that is easy: just enter this web page address in your Internet browser, and then type in your access code to begin the survey.

http://opinion.wsu.edu/Washington **Your access code: <access code>**

We realize that some households may not have Internet access. If this is the case for you, in about three weeks we will send a paper version of the questionnaire for you to fill out and mail back to us. If you prefer to receive one sooner, please let us know and it will be sent to you shortly.

The questions should only take about 15 minutes to complete. Your responses are voluntary and will be kept confidential. Your names are not on our mailing list, and no one's answers will ever be associated with the mailing address. If you have any questions about this survey of Washington communities, please contact Thom Allen by phone at 1-800-833-0867 or by email at ted@wsu.edu.

By taking a few minutes to share your thoughts and opinions about life in the Washington community where you live, you will be helping us out a great deal, and a small token of appreciation is enclosed as a way of saying thank you. We expect that the results of this study will be useful in helping state and community leaders throughout Washington better understand how different aspects of communities contribute to providing a good quality of life for residents.

I hope you enjoy completing the questionnaire and look forward to receiving your responses.

Many Thanks,

Don A. Dillman
Regents Professor and Deputy Director

June 26, 2008

Last week a questionnaire was mailed to you because your household was randomly selected to help in an important study about the quality of life in the Washington community where you live.

If someone at your address has already completed and returned the questionnaire, please accept our sincere thanks. If not, please have the adult in your household who has had the **most recent birthday** do so right away. We are especially grateful for your help with this important study.

If you did not receive a questionnaire, or if it was misplaced, please call us at 1-800-833-0867 and we will get another in the mail to you.

Sincerely,

Don A. Dillman, Regents Professor and Deputy Director

June 26, 2008

Last week a letter was mailed to you because your household was randomly selected to help in an important study about the quality of life in the Washington community where you live.

If someone at your address has already completed the questionnaire, please accept our sincere thanks. If not, please have the adult in your household who has had the **most recent birthday** do so right away. We are especially grateful for your help with this important study.

To complete the survey enter this web page address in your internet browser and then type in your access code to begin answering questions.

http://opinion.wsu.edu/Washington **Your access code: <acces>**

If you do not have internet access, we still very much want to hear from you. A paper questionnaire will be sent to you in about two weeks.

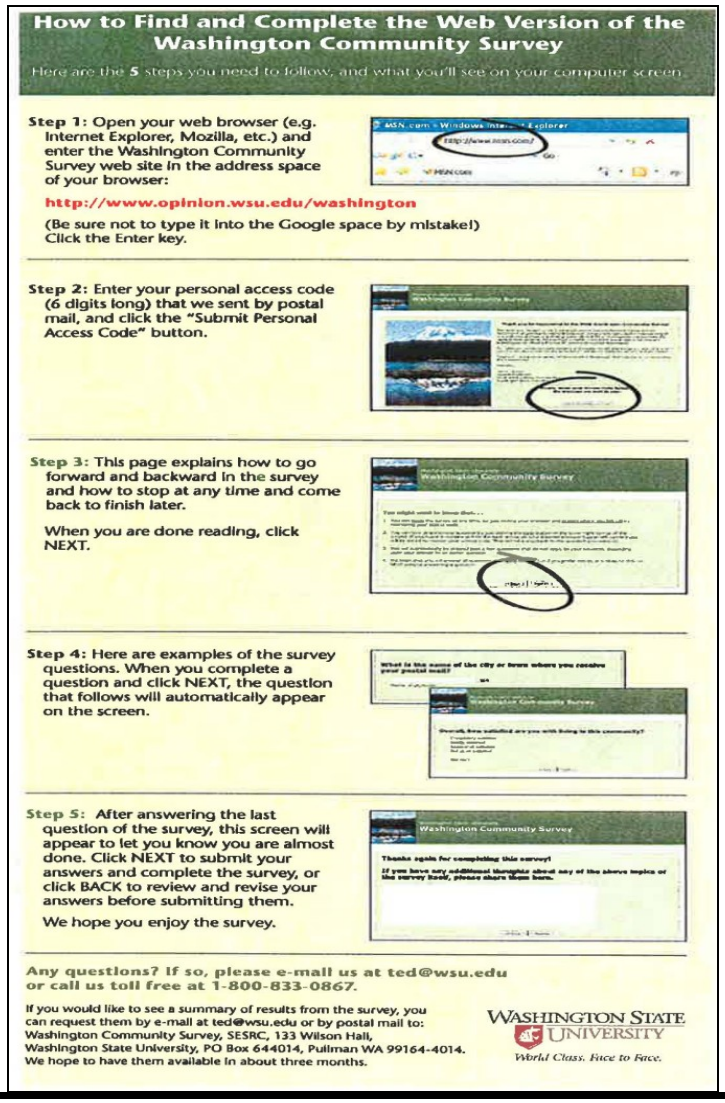
Sincerely,

Don A. Dillman, Regents Professor and Deputy Director

Internet respondents in Treatments 5 & 8 were also sent a stand-alone Internet instruction card (hereafter referred to as 'an Internet card') that displays the title of the survey, the URL, screen shots of the questionnaire, detailed instructions on how to access and complete the Internet questionnaire, and survey sponsor contact information and logo. An illustration of this Internet card is provided in Figure 3. These cards were designed and included in only three

Internet groups with the intended result of potentially increasing the number of Internet respondents by providing some assistance to those with low Internet skills or with a distrust or fear of providing information via the Internet. Internet cards used in Wave 2 of the WCS also contained each respondent's passcode (not shown in Figure 4).

FIGURE 3: WCS Stand-alone Internet Instruction Card (12 ¾" X 5 ¾")



CHAPTER FOUR

RESULTS

4.1 WCS Response Rates

High response rates are important to provide legitimacy to the survey, to increase the likelihood of obtaining respondents as representative of the population as possible, and to ensure that the level of confidence in statistical estimates is high. As reported in Table 2, several response rate comparisons are made for the different tests between WCS treatment groups. First, total response rates are reported as a measure of whether the mail preference and Internet preference groups obtain acceptable response rates in a statewide general public household survey using the DSF and a mail contact. Second, response rates are compared between Internet preference groups to determine the efficacy of the Internet card. Third, mail, Internet, and mail and Internet combined response rates are compared to establish which mode or combination of modes obtains the highest response rates. Finally, mail incentive and non-incentive and Internet incentive and non-incentive response rates are evaluated to ascertain the impact of the incentive.

4.1.1 Does mail or a combination mail and the Internet used with the DSF obtain reasonable response rates in statewide household surveys?

Using a DSF sample with a mail contact obtained total response rates that were not has high as those achieved in other studies using similar methods but are relatively modest overall among the $5 incentive groups. As reported in Table 3, the groups that most closely resemble traditional mail surveys, the mail preference groups, obtained slightly over half of the sampled respondents, with the $5 mail-only group (Treatment 1) in Wave 1 achieving the highest response rate of 56.7% and the $5 mail preference group obtaining 53.6% of respondents. These rates are also comparable to, if not higher than, those achieved in telephone and Internet surveys (Curtin, et.

al., 2005; de Leeuw & Heer, 2002; Steeh et. al., 2001; Manfreda, Bosnjak, Berzelak, Haas, & Vehovar, 2006). The $5 Internet preference groups obtained less than half of the sampled respondents, at 42.8% for the URL-only group and 46.3% for the Internet card group. Similar response rates were also reported in the Wave 2 of the WCS (see Table 2). The $5 mail preference group had the highest rate of 55%, slightly higher than its equivalent (Treatment 2) in Wave 1. The rates for the Internet preference groups were 44.7% for the URL-only group and 42.9% for the Internet card group, both within the range achieved by those in Wave 1. Whether or not the response rates are "reasonable" can, in part, be determined by levels of non-response error, as discussed below.

Another indicator of the quality of the DSF as a sample frame for statewide general public households is the occupancy rate obtained from the sample. Occupancy rate is determined by subtracting the number of undeliverables, or those mailings returned to the survey sponsor, from the original sample size and dividing the difference, or number of deliverables, by the original sample size. These rates are reported in Table 3 and are based on undeliverables from the second contact, which used the large envelopes containing the survey request letter and/or questionnaire. As shown in the table, occupancy rates ranged from a low of 91.9% to a high of 95.3%, which are comparable to those found in similar studies (e.g. Smyth et. al., Forthcoming; Iannacchione et. al., 2003). Moreover, the three lowest occupancy rates all occurred in Wave 2, indicating that use of the "Return Services Request" stamp on the envelope may have had an effect, but more research is needed to obtain conclusive results.

TABLE 3: WCS Coverage, Total Completes, and Response Rates by Wave, Treatment Group, and Survey Mode, with Significance Tests between Selected Treatment Groups and Modes

Treatment Groups	Original Sample Size (OSS)	OSS less Undeliver-ables	Completes and Rates by Survey Mode				Total*
Wave 1	N	N (%)	1st Mode	N (%)	2nd Mode	N (%)	N (%)
(1) $5 Mail-only	500	471 (94.2)	Mail:	267 (56.7)	--	--	267 (56.7)
(2) $5 Mail Pref.	500	474 (94.8)	Mail:	249 (52.5)	Internet:	5 (1.1)	254 (53.6)
(3) Mail Pref., No $5	700	648 (92.6)	Mail:	254 (39.2)	Internet:	6 (0.9)	260 (40.1)
(4) $5 Internet Pref., No Int. card	600	554 (93.2)	Internet:	158 (28.5)	Mail:	79 (14.3)	237 (42.8)
(5) $5 Internet Pref., w/Int. card	500	464 (92.8)	Internet:	145 (31.3)	Mail:	70 (15.0)	215 (46.3)
(6) Internet Pref., w/Int. card & No $5	700	643 (91.9)	Internet:	86 (13.4)	Mail:	79 (12.3)	165 (25.7)
Wave 2							
(7) $5 Internet Pref., No Int. card	700	667 (95.3)	Internet:	185 (27.8)	Mail:	113 (16.9)	298 (44.7)
(8) $5 Internet Pref. w/Int. card	700	665 (95.0)	Internet:	174 (26.2)	Mail:	111 (17.0)	285 (42.9)
(9) $5 Mail Pref. w/Int. card	500	476 (95.2)	Mail:	247 (51.9)	Internet:	15 (3.1)	262 (55.0)

Significance Tests	Internet Card		$5 Incentive	
	(4) No card vs.	(7) No card vs.	(2) $5 Mail vs.	(4&5) $5 Internet vs.
Mode	(5) Card	(8) Card	(3) Mail	(6) Internet
Mail.....t(p)	-0.37 (0.36)	0.04 (0.48)	6.11 (0.00)	1.36 (0.09)
Internet.....t(p)	-0.95 (0.17)	0.71 (0.24)	n/a	7.82 (0.00)
Mail & Internet Combined.....t(p)	-1.14 (0.13)	0.67 (0.25)	5.95 (0.00)	7.83 (0.00)

*Response rate=number of completed/(original sample size - undeliverables).

4.1.2 Does the inclusion and/or timing of an Internet instruction card increase response rates?

The Internet card was designed to attract more respondents to the Internet, particularly those unaccustomed to using the Internet. It appears from Table 3, however, that the Internet card produced mixed results in terms of increasing response in the Internet groups. In Wave 1, the $5 Internet card group (Treatment 5) had a higher response rate than the $5 Internet No Card group (Treatment 4), with a difference of 3.4% for the total response rate and 2.8% between Internet

respondents to both groups. However, as shown in Table 3, the differences in the total, mail, and Internet response rates are not statistically significant. Moreover, delaying the mailing of the Internet card in Wave 2 in order to reduce complexity resulted in contradictory results in response rates between the Wave 2 $5 Internet groups. The $5 Internet No Card group (Treatment 7) outperformed the $5 Internet card group (Treatment 8) by 1.8 percentage points in total response rate and by 1.6 percentage points between Internet respondents. Table 3 reports that the total, mail, and Internet response rate differences between these groups were also not statistically significant at the .10 level. The $5 Internet card group in Wave 2 (Treatment 8) also obtained the lowest total and Internet-only response rates among all the groups, and specifically the $5 Internet card group in Wave 1 (Treatment 5), suggesting that delaying the Internet may have had the opposite intended effect.

When mail is offered as the first mode, the Internet card seems to have steered more respondents to the Internet as opposed to not including an Internet card. Table 3 illustrates that Internet respondents comprised 2 percentage points more in the $5 mail group with the Internet card (Treatment 9), at 3.1%, than in the $5 mail group without the Internet card (Treatment 2), at only 1.1%. Nevertheless, this improvement is quite marginal, particularly given the small proportion of Internet respondents in each group. Furthermore, a larger proportion of mail respondents were obtained when the Internet card was sent after the survey request (in the 3rd contact), as in the Wave 2 Internet card group (Treatment 8), at 17%, compared to when the Internet card was sent along with the survey request, as in the Wave 1 Internet card group (Treatment 5), at 15%, but overall response rates between the groups were statistically similar (46.3% vs. 42.9%). Nevertheless, this further suggests that delaying the Internet card to reduce

complexity had the opposite effect as was intended by not attracting people away from mail and toward the Internet.

4.1.3 Does offering a mail option to Internet respondents increase overall response rates, and vice versa?

According to the results reported in Table 3, a mail follow-up to an Internet survey had a substantial positive impact on response rates while an Internet follow-up to a mail survey produced negligible improvements. For the two $5 Internet preference groups in Wave 1 (Treatments 4 & 5), the mail follow-up obtained an additional 14.3% and 15% of respondents, respectively. A mail follow-up to the two $5 Internet preference groups in Wave 2 (Treatments 7 & 8) performed similarly, gaining an additional 16.9% and 17% of respondents, respectively. Thus, providing respondents with a mail follow-up in an Internet survey does seem to reduce non-response. On the other hand, the Internet follow-up to the $5 mail preference groups in Waves 1 & 2 (Treatments 2 & 9) brought in very few additional responses, increasing response rates by only 1.1% and 3.1%, respectively, with the Internet card possibly having a slight impact on the latter, as discussed above.

Moreover, offering the Internet method first to respondents appears to obtain a greater proportion of Internet respondents compared to mail respondents. For example, in Wave 1 $5 Internet preference groups (Treatments 4 & 5), Internet respondents comprised 66.6% and 67.4% of total respondents, respectively; these figures were a bit lower, at 62.1% and 61.0%, respectively, in the Wave 2 $5 Internet groups (Treatments 7 & 8). However, in Waves 1 & 2 $5 mail preference groups (Treatments 2 & 9), the proportions were radically reversed, with Internet respondents comprising only 2% and 5.7%, respectively.

Overall, the $5 mail-only group (Treatment 1), which did not use an Internet follow-up mode, obtained a total response rate higher than the $5 mail preferences groups in either wave of the WCS, by at least 2.7 percentage points (Treatment 1 vs. 9). All the $5 mail preference groups (Treatments 1, 2, & 9) also outperformed the $5 Internet preference groups (Treatments 4, 5, 7, & 8) by at least 8.7 percentage points (Treatment 9 vs. 5), even when combined with the follow-up modes.

4.1.4 Do cash incentives increase response rates for incentive vs. non-incentive mail and Internet respondents?

Cash incentives can increase response rates by recompensing the respondent for their time and effort and also by symbolizing a token of exchange. As shown in Table 3, the $5 incentive mail preference and Internet preference groups each obtained response rates significantly higher than the corresponding non-incentive groups. In the mail groups, the difference was 15.0%, with 53.6% for the incentive group and 40.1% for the group without the incentive. The incentive appears to have an even larger impact on Internet respondents. The average response rate for the $5 Internet groups was 44.4% and the rate for the non-incentive group was only 25.7%, 18.7 percentage points lower. Table 3 also reports that these differences are statistically significant ($p \leq .10$). Moreover, the relative impact of the incentive on mail and Internet groups was also greater for Internet groups. Between the Internet groups, 16.4% more people responded over the Internet in the incentive Internet groups (Treatments 4 & 5, averaged at 29.8%) compared to the non-incentive Internet group (Treatment 2, at 13.4%) while in the mail groups the difference was 13.3% between mail respondents, with 52.5% responding to mail in the incentive mail group (Treatment 2) and 39.2% responding to mail in the non-incentive mail group (Treatment 3).

4.2 Non-response Error

Non-response error can introduce bias in the results due the absence of responses from different subgroups of the target population. To determine levels of non-response error, demographic comparisons were made between various treatment groups and combinations of treatment groups, as detailed in Table 2. First, comparisons are made between Internet preference groups to determine whether the inclusion of the Internet card affected non-response error. Second, mail, Internet, and mail and Internet combined respondents are compared to find in what ways they differ. Third, mail incentive and non-incentive and Internet incentive and non-incentive groups are contrasted to evaluate the impact of the incentive on non-response error.

4.2.1 Does the inclusion and/or timing of an Internet instruction card reduce non-response error?

The Internet card did not seem to significantly increase response rates but it could still be effective at reducing non-response error, particularly between Internet respondents. However, Table 4 indicates that very few significant differences exist ($p \leq .10$) between Internet respondents to the Internet card and No Internet card groups in either wave of the survey. Those differences greater than 5.0 percentage points are indicated in bold in Table 4. The only significant differences in Wave 1 were that a greater proportion of Internet card respondents were female, had landline telephone service in the household, and communicated with others more often face-to-face or over the Internet (as opposed to phone). In Wave 2, more Internet card respondents had a college degree, communicated most often with others face-to-face, and did not need assistance with using the Internet, which seems rather counterintuitive since the Internet card was designed to attract these types of people. Moreover, the demographic differences in the groups between the two waves appear to occur at random, without any consistency in the results. For example, in Wave 1 the Internet card group obtained fewer respondents with a college

TABLE 4: Characteristics of WCS Respondents to the Internet Card vs. No Internet card $5 Internet Preference Groups in Waves 1 & 2 and to the Internet card Groups between Waves 1 vs. 2

	$5 Internet Preference Groups											
	Wave 1				Wave 2				Wave 1 vs. Wave 2			
	(4) No Int. Card	(5) Int. Card	Diff.	x^2 (p)	(7) No Int. Card	(8) Int. Card	Diff.	x^2 (p)	(5) Int. Card	(8) Int. Card	Diff.	x^2 (p)
Gender (%)												
Male	50.2	40.2	**-10.0**	2.65	42.9	39.6	-3.3	0.37	40.2	39.6	-0.6	0.03
Female	49.8	59.8	**+10.0**	(.104)	57.1	60.4	+3.3	(.543)	59.8	60.4	+0.6	(.870)
Education (%)												
High school or less	10.7	14.8	+4.1		12.5	10.9	-1.6		14.8	10.9	-3.9	
Some college, no degree	24.7	33.8	**+9.1**	1.60	32.0	21.9	**-10.1**	2.05	33.8	21.9	**-11.9**	2.73
Coll degree (2yr or 4yr)	44.7	36.4	**-8.3**	(.187)	36.1	48.4	**+12.3**	(.105)	36.4	48.4	**+12.0**	(.043)
Prof/Grad degree	19.9	15.0	-4.9		19.4	18.8	-0.6		15.0	18.8	+3.8	
Age (%)												
18-34	24.9	21.9	-3.0		26.5	22.5	-4.0		21.9	22.5	+0.6	
35-54	41.5	33.6	**-7.9**	1.87	41.5	40.1	-1.4	0.49	33.6	40.1	**+6.5**	0.79
55-64	21.4	21.8	+0.4	(.133)	16.3	20.6	+4.3	(.688)	21.8	20.6	-1.2	(.500)
65+	12.2	22.7	**+10.5**		15.7	16.8	+1.1		22.7	16.8	**-5.9**	
Race (%)												
Non-Hispanic Whites	77.1	80.4	+3.3	0.37	88.3	84.0	-4.3	1.16	80.4	84.0	+3.6	0.55
All Others	22.9	19.6	-3.3	(.541)	11.7	16.0	+4.3	(.282)	19.6	16.0	-3.6	(.460)
Children in Household (% Yes)	44.9	38.4	**-6.5**	0.90 (.345)	40.0	42.3	+2.3	0.14 (.712)	38.4	42.3	+3.9	0.45 (.506)
Number in Household (%)												
1 person	20.6	24.9	+4.3		18.5	15.9	-2.6		24.9	15.9	**-9.0**	
2 persons	31.3	35.0	+3.7	1.23	33.6	42.1	**+8.5**	0.78	35.0	42.1	**+7.1**	1.35
3 persons	13.7	20.1	**+6.4**	(.295)	13.7	12.3	-1.4	(.603)	20.1	12.3	**-7.8**	(.228)
4 persons	26.1	15.2	**-10.9**		20.6	22.1	+1.5		15.2	22.1	**+6.9**	
5+ persons	8.3	4.8	-3.5		13.6	8.6	**-5.0**		4.8	8.6	+3.8	
Married (%Yes)	60.3	58.9	-1.4	0.05 (.828)	62.1	70.0	**+7.9**	2.29 (.131)	58.9	70.0	**+11.1**	3.74 (.054)
Employed (%Yes)	73.7	65.9	**-7.8**	2.03 (.156)	66.0	67.8	+1.8	0.12 (.734)	65.9	67.8	+1.9	0.13 (.724)
Urban[1] (%Yes)	68.4	67.5	-0.9	3.87 (.858)	70.5	65.1	-2.8	1.40 (.237)	67.5	65.1	-2.4	0.01 (.935)

TABLE 4, cont.

Household Income (%)												
< $10K/year	2.0	1.1	-0.9		2.1	2.8	+0.7		1.1	2.8	+1.7	
$10K to < $25K/year	11.0	10.0	-1.0		10.8	6.3	-4.5		10.0	6.3	-3.7	
$25K to < $50K/year	20.7	29.2	**+8.5**	0.87	22.8	20.7	-2.1	0.55	29.2	20.7	**-8.5**	1.15
$50K to < $75K/year	25.1	17.4	**-7.7**	(.500)	24.2	24.0	-0.2	(.740)	17.4	24.0	**+6.6**	(.311)
$75K to < $100K/year	17.6	22.2	+4.6		17.4	20.9	+3.5		22.2	20.9	-1.3	
$100K/year or >	23.6	20.1	-3.5		22.7	25.3	+2.6		20.1	25.3	**+5.2**	
Computer/Internet Status (%Yes)												
Assistance w/Internet[2]	20.4	14.3	**-6.1**	1.93 (.166)	21.1	11.7	**-9.4**	5.45 (.020)	14.3	11.7	-2.6	0.50 (.478)
Internet in Household	93.6	95.7	+2.1	0.56 (.457)	97.9	97.7	-0.2	0.03 (.870)	95.7	97.7	+2.0	1.00 (.318)
High-speed Internet[3]	91.3	90.3	-1.0	0.07 (.793)	89.6	86.7	-2.9	0.63 (.428)	90.3	86.7	-3.6	0.70 (.402)
Telephone Status (%)												
No Phone	0.4	1.9	+1.5		0.0	0.0	0.0		1.9	0.0	-1.9	
Cell-only	29.0	17.6	**-11.4**		22.4	19.6	-2.8		17.6	19.6	+2.0	
Landline-only	8.9	6.7	-2.2	2.58	5.6	6.6	+1.0	0.39	6.7	6.6	-0.1	0.95
Landline and Cell	61.7	72.9	**+11.2**	(.039)	70.9	73.4	+2.5	(.752)	72.9	73.4	+0.5	(.431)
Unknown	0.0	0.9	+0.9		1.1	0.4	-0.7		0.9	0.4	-0.5	
Communicate with Others[4] (%)												
Face to face	8.6	14.3	**+5.7**		10.8	15.9	**+5.1**		14.3	15.9	+1.6	
Phone	70.0	48.4	**-14.6**	2.07	50.2	52.9	+2.7	2.45	48.4	52.9	+4.5	1.56
Internet	24.1	33.1	**+9.0**	(.103)	34.1	30.3	+3.8	(.064)	33.1	30.3	-2.8	(.200)
Other	4.3	4.2	-0.1		4.8	0.8	-4.0		4.2	0.8	-3.4	
Community Satisfaction[5] (%)												
Complete/Mostly Satisfied	87.8	89.9	+2.1	0.21 (.810)	90.2	85.9	-4.3	0.83 (.436)	89.9	85.9	-4.0	0.75 (.474)
Somewhat/Not at all Satisfied	12.2	10.1	-2.1		9.8	14.1	+4.3		10.1	14.1	+4.0	

Notes: [1]Urban respondents had a postal address in one of the five most populous counties in Washington; [2]Respondents reporting needing assistance with the Internet chose "All the time," "Frequently," or "Occasionally" on a scale of "All the time, Frequently, Occasionally, Rarely, Never," and also reported using the Internet at some place and time; [3]Respondents reported having Internet access in the household. [4]Respondents reported the method of communication most often used to communicate with others inside and outside of the respondent's community. The most common method for both is reported; [5]Respondents reported overall satisfaction with their community on a scale of "Completely, Mostly, Somewhat, and Not at all" satisfied.

degree, by 8.3 percentage points, whereas the Internet card group in Wave 2 obtained more respondents with a college degree, by 12.3 percentage points. As seen in Table 4, this occurs across several demographic and technological characteristics.

In addition, delaying the mailing of the Internet card in Treatment 8 did not obtain respondents much different than when including the Internet card with the survey request mailing (2nd contact) in Treatment 5. Table 4 shows that the only significant differences were in terms of age and marital status, although differences in household income were also quite large but not significant. When the Internet respondents to the Internet card and No Internet card groups are combined in each wave, and compared across waves, the differences become much less pronounced. The only significant difference between waves is that a higher proportion of minorities responded to the Internet in Wave 1 (not shown in a table).

The same three comparisons reported in Table 4 were also conducted for mail respondents to each $5 Internet preference group and the combined mail and Internet respondents to the $5 Internet preference groups. Although the card does not appear to affect Internet respondents, it could possibly have had an indirect effect by steering different types of people away from or towards mail. However, no significant differences ($p \leq .10$) were found between mail respondents to the Internet card vs. No Internet card groups in Wave 1 (Treatments 4 vs. 5). In Wave 2 comparisons (Treatments 7 vs. 8), the only differences were that Internet card respondents were less likely to have children in the household or be employed and were more likely to have Internet service in the household, although, for the latter, both were greater than 85%. When mail respondents to the $5 Internet preference groups are combined and compared across waves (Treatments 4&5 vs. 7&8), there were no significant differences between Wave 1

and Wave 2 respondents. These results are also not reported in a table due to lack of significant differences.

Furthermore, even combining respondents to both the mail and Internet across groups and waves resulted in few disparities. For example, in Wave 1 (Treatments 4 vs. 5), a smaller proportion of total mail and Internet respondents in the Internet card group were employed in a job, compared to the No Internet card group, while in Wave 2 (Treatments 7 vs. 8) more Internet card respondents had higher levels of education and Internet service in the home compared to No Internet card respondents. These disparities, however, are mitigated when mail and Internet combined respondents are compared between Wave 1 vs. Wave 2 groups (Treatments 4&5 vs. 7&8). The only significant discrepancy in this comparison is that the Wave 1 groups comprised a higher proportion of minorities than Wave 1 groups, by about 7.5 percentage points. These results are not reported in a table but with the few differences in the multiple comparisons, it is apparent that the Internet card had an inconsequential impact on non-response. However, due to the small sample sizes, results are not conclusive. In further analyses, the $5 Internet preference groups 4, 5, 7, & 8 will remain combined and will be referred to as the $5 Internet groups, unless otherwise indicated.

4.2.2 Are Internet respondents different types of people than mail respondents?

Before examining non-response error between mail and Internet modes, it was first necessary to combine respondents to the $5 mail-only and mail preference groups in Waves 1 & 2, if possible. As in the Internet card analysis discussed above, three different comparisons were performed to justify combining respondents across the mail groups: Treatment 1 vs. 2, 1 vs. 9, and 2 vs. 9. In terms of non-response error, respondents to all the $5 mail groups (Treatments 1 vs. 2, 1 vs. 9, and 2 vs. 9) are similar across several demographic characteristics and no table is provided due

to the absence of any significant differences. Without any differences between different mail group respondents, it seems reasonable these mail groups can be combined for further analyses. The combined groups will be referred to as the $5 mail groups.

The first test of non-response error between mail and the Internet was conducted by comparing Internet respondents to the $5 Internet groups with follow-up mail respondents to the $5 Internet groups. This test established whether respondents to the mail, which was sent three weeks after the Internet, were different than respondents to the Internet. As reported in Table 5, this appears to be the case. Mail respondents are significantly more likely ($p \leq .10$) to be older, unmarried, and unemployed with lower levels of education and income, have no children in the household, share the household with fewer people, live in rural counties, use the computer and Internet less often and require assistance with the Internet more often, lack Internet access, and high-speed access, in the household, have landline phone service and no cell phone service, communicate with others most often over the phone, and are less satisfied overall with their community compared to Internet respondents. Of particular importance, only about 60% of mail respondents reported having Internet access in the household, which is close to the national average, while nearly all Internet respondents (96.4%) reported Internet in the household. Differences greater than 5.0 percentage points are in bold in Table 5. These multiple differences indicate that a mail follow-up can reduce non-response error by obtaining very different types of people. It may also be necessary to use mail as a follow-up to ensure that potential respondents without Internet access can actually respond to the survey.

In a second test of non-response error, Internet respondents to the $5 Internet groups are compared with mail respondents in the $5 mail groups to establish whether respondents to either mode are different, regardless of whether a follow-up mode is provided. In this comparison, both

TABLE 5: Characteristics of WCS Respondents to Internet vs. Mail in the $5 Internet Preference Groups, to Internet vs. Mail between $5 Internet Preference Groups and $5 Mail Preference Groups, and to Internet & Mail combined $5 Internet Preference Groups vs. $5 Mail Preference Groups

	$5 Internet Pref. Internet-only vs. Mail-only				$5 Internet Pref. (Internet-only) vs. $5 Mail Pref. (Mail-only)				$5 Internet Pref. (Mail & Internet) vs. $5 Mail Pref. (Mail-only)			
	Internet	Mail	Diff.	X^2 (p)	Internet	Mail	Diff.	x^2 (p)	Internet Pref.	Mail Pref.	Diff.	x^2 (p)
Gender (%)												
Male	43.2	38.2	**-5.0**	1.07	43.2	39.2	-4.0	2.00	40.2	39.7	-0.5	0.03
Female	56.8	61.8	**+5.0**	(.304)	56.8	60.8	+4.0	(.156)	59.8	60.3	+0.5	(.858)
Education (%)												
High school or less	12.1	37.2	**+25.1**		12.1	20.6	**+8.5**		18.3	20.0	+1.7	
Some college, no degree	27.9	25.0	-4.9	15.91	27.9	28.2	+0.3	5.90	27.7	27.9	+0.2	0.32
Coll degree (2yr or 4yr)	41.4	26.9	**-14.5**	(.000)	41.4	35.5	**-6.9**	(.001)	37.8	36.1	-1.7	(.807)
Prof/Grad degree	18.6	10.9	**-7.7**		18.6	15.7	-2.9		16.2	16.0	-0.2	
Age (%)												
18-34	24.1	11.0	**-13.1**		24.1	13.6	**-10.5**		18.9	14.1	-4.8	
35-54	39.7	19.1	**-20.6**	20.24	39.7	36.2	-3.5	11.34	36.2	36.2	0.0	3.11
55-64	19.7	25.2	**+5.5**	(.000)	19.7	25.4	**+5.7**	(.000)	20.6	25.5	+4.9	(.026)
65+	16.5	44.7	**+28.2**		16.5	24.8	**+8.3**		24.3	24.2	+0.1	
Race (%)												
Non-Hispanic Whites	82.6	79.1	-0.2	0.80	82.6	82.4	-0.2	0.01	82.8	82.4	-0.4	0.04
All Others	17.4	20.9	+0.2	(.371)	17.4	17.6	+0.2	(.919)	17.2	17.6	+0.4	(.835)
Children in Household (% Yes)	41.5	20.6	**-20.9**	12.68 (.000)	41.5	37.5	-4.0	1.64 (.201)	38.1	38.0	+0.1	0.00 (.958)
Number in Household (%)												
1 person	19.8	32.1	**+8.3**		19.8	28.1	**+8.3**		23.3	28.3	**+5.0**	
2 persons	35.6	47.2	**+11.6**	2.89	35.6	32.0	-3.6	2.42	36.0	31.2	-4.8	1.46
3 persons	14.8	9.8	**-5.0**	(.004)	14.8	17.2	+2.4	(.014)	13.9	17.4	+3.5	(.161)
4 persons	21.2	6.3	**-14.9**		21.2	13.5	**-7.7**		18.1	13.9	-4.2	
5+ persons	8.6	4.6	-4.0		8.6	9.2	-0.6		8.7	9.2	+0.5	
Married (%Yes)	63.0	45.8	**-17.2**	12.81 (.000)	63.0	56.0	**-7.0**	6.22 (.013)	57.4	56.0	-1.4	0.33 (.565)
Employed (%Yes)	68.5	43.4	**-25.1**	27.81 (.000)	68.5	59.4	**-9.1**	11.11 (.001)	61.5	59.7	-1.8	0.51 (.474)
Urban[1] (%Yes)	69.4	61.2	**-8.2**	3.87	69.4	66.6	-2.8	1.49 (.223)	67.6	68.4	+0.8	0.13 (.714)

TABLE 5, cont.

Household Income (%)											
< $10K/year	2.0	5.6	+3.6		2.0	4.9	+2.9		3.3	4.7	+1.4	
$10K to < $25K/year	9.5	24.0	**+14.5**		9.5	13.0	+3.5		13.6	13.0	-0.6	
$25K to < $50K/year	23.0	32.4	**+9.4**	6.59	23.0	24.9	+1.9	2.89	25.5	25.2	-0.3	0.58
$50K to < $75K/year	22.8	15.7	**-7.1**	(.000)	22.8	22.3	-0.5	(.013)	20.5	22.2	+1.7	(.717)
$75K to < $100K/year	19.4	8.9	**-10.5**		19.4	16.0	-3.4		17.5	15.7	-1.8	
$100K/year or >	23.2	13.5	**-9.7**		23.2	18.9	-4.3		19.6	19.2	-0.4	
Computer/Internet Status (%Yes)												
Use Computer	98.6	53.5	**-45.1**	73.65 (.000)	98.6	84.6	**-14.0**	73.65 (.000)	86.4	85.2	-1.2	0.51 (.474)
Use Internet	99.2	57.9	**-41.3**	261.14 (.000)	99.2	85.1	**-14.1**	90.43 (.000)	87.9	85.7	-2.2	1.65 (.199)
Assistance w/Internet[2]	16.9	39.5	**+22.6**	23.54 (.000)	16.9	25.1	**+8.2**	11.95 (.001)	21.6	24.6	+3.0	1.80 (.180)
Internet in Household	96.4	59.8	**-36.6**	149.81 (.000)	96.4	83.6	**-12.8**	53.11 (.001)	86.1	84.0	-2.1	1.29 (.256)
High-speed Internet[3]	89.4	70.3	**-19.1**	19.23 (.000)	89.4	85.5	-3.9	3.83 (.051)	84.8	86.1	+1.3	0.43 (.511)
Telephone Status (%)												
No Phone	0.5	3.7	+2.2		0.5	1.2	+0.7		1.2	1.1	-0.1	
Cell-only	22.3	13.7	**-8.4**	19.28 (.000)	22.3	16.4	**-5.9**		18.9	16.4	-2.5	0.61 (.655)
Landline-only	6.8	24.8	**+18.0**		6.8	13.2	**+6.4**	8.79 (.000)	11.9	12.9	+1.0	
Landline and Cell	69.8	52.0	**-19.8**		69.8	66.0	-3.8		63.9	66.0	+2.1	
Unknown	0.6	5.5	+4.9		0.6	3.3	+2.7		4.1	3.5	-0.6	
Communicate with Others[4] (%)												
Face to face	13.0	12.3	-0.7		13.0	11.6	-1.4		12.5	11.5	-1.0	
Phone	53.1	76.5	**+23.4**	10.42	53.1	64.6	**+11.5**	6.03	60.7	64.1	+4.4	0.68
Internet	30.4	10.8	**-19.6**	(.000)	30.4	21.2	**-9.2**	(.000)	24.0	21.7	-2.3	(.567)
Other	3.5	0.4	-3.1		3.5	2.6	-0.9		2.7	2.9	+0.2	
Community Satisfaction[5] (%)												
Complete/Mostly Satisfied	88.5	78.3	**-10.2**	5.83 (.003)	88.5	81.5	**-7.0**	7.12 (.001)	85.7	82.1	-3.6	3.39 (.034)
Somewhat/Not at all Satisfied	11.5	21.7	**+10.2**		11.5	18.5	**+7.0**		14.3	17.9	+3.6	

Notes: [1]Urban respondents had a postal address in one of the five most populous counties in Washington; [2]Respondents reporting needing assistance with the Internet chose "All the time," "Frequently," or "Occasionally" on a scale of "All the time, Frequently, Occasionally, Rarely, Never," and also reported having access to the Internet at some place; [3]Respondents reported having Internet access in the household. [4]Respondents reported the method of communication most often used to communicate with others inside and outside of the respondent's community. The most common method for both is reported; [5]Respondents reported overall satisfaction with their community on a scale of "Completely, Mostly, Somewhat, and Not at all" satisfied.

types of respondents received the corresponding mail or Internet survey first, and not as the follow-up mode. Table 5 shows that similar differences exist as those found between Internet respondents and follow-up mail respondents. The differences are in the same direction but are much less pronounced. For example, "children in household" and "urban" completely lose statistical significance ($p \leq .10$) while other differences between education, age, household size, marital status, employment status, household income, computer & Internet status, telephone status, communication with others, and community satisfaction maintain statistical significance at the $p \leq .10$ level but are much smaller absolute differences overall.

Finally, in a third test of non-response error, $5 mail group respondents were compared with mail and Internet combined respondents to the $5 Internet groups. This assesses whether a mail follow-up to an Internet survey reduces non-response relative to a mail-only survey. The third main column in Table 5 reports only two significant differences at the $p \leq .10$ level: age and community satisfaction. $5 mail respondents were slightly older and more satisfied with their communities compared $5 Internet respondents. All other differences are relatively much smaller and lose statistical significance. In sum, Internet respondents are very different types of people compared to mail respondents, either when mail is used alone or as a follow-up to the Internet. Combining mail and Internet respondents, however, seems to obtain respondents approximately similar to those obtained via mail-only. Thus, while mail adds value to the Internet surveys by reducing non-response, the opposite does not seem as assuring.

4.2.3 Are mail, Internet, or mail and Internet combined respondents representative of the general public?

Mail and Internet respondents may be different types of people, but which are most representative of the general population in Washington? Mail respondents? Internet respondents?

A combination of mail and Internet respondents? To arrive at an answer, three comparisons were made between WCS data and the 2007 annual estimates for Washington provided by the American Community Survey (ACS) and Current Population Survey (CPS). There are some small disparities between the ACS and CPS estimates, as shown in Table 6. Only one of the discrepancies, number in household, was greater than 3.0 percentage points and this difference occurred between 1- and 2-person households. Moreover, the overall average of differences between the ACS and CPS data was less than 2.5%. Small differences were to be expected since the ACS and CPS used different survey modes (i.e. mail, CATI, & CAPI for the ACS and CATI & CAPI for the CPS) and sample sizes (3 million for the ACS and 72,000 for the CPS, in the total U.S.), and structured demographic and attribute questions slightly differently. Nevertheless, the ACS and CPS provide the most current and reliable demographic estimates for the general population of Washington (and the U.S. in general) and, also noteworthy, use an address-based sample frame from the U.S. Census Bureau (ACS, 2007; CPS, 2007). The ACS and CPS figures reported in Table 6 are also averaged for comparisons with the WCS data. Doing this increases the margin of error in each estimate but sample sizes are also relatively large (N > 1200). To be conservative, however, only differences of 7.0 and greater between the WCS and the corresponding ACS *or* CPS estimates are indicated in bold in Table 6.

The results were mixed for which respondents were most representative of the general population, as demonstrated in Table 6. For example, Internet-only, mail-only, and combined mail and Internet respondents all had higher levels of education compared to ACS and CPS estimates, although the Internet-only respondents were more similar than mail and mail and mail/ Internet respondents. On the other hand, Internet-only respondents greatly over-represented

TABLE 6: Comparison of WCS Internet-only, Mail-only, and Combined Mail & Internet respondents to 2007 American Community Survey (ACS) and Current Population Survey (CPS) data for Washington

	$5 Mail Pref. (Mail-only) vs. 2007 ACS & CPS				$5 Internet Pref. (Internet-only) vs. 2007 ACS & CPS				$5 Internet Pref. (Mail & Internet) vs. 2007 ACS & CPS			
	Mail	ACS	CPS	Avg. Diff.	Internet	ACS	CPS	Avg. Diff.	Mail/ Internet	ACS	CPS	Avg. Diff.
Gender[1] (%)												
Male	39.2	49.4	48.5	**+9.75**	43.2	49.4	48.5	+5.75	40.2	49.4	48.5	**-8.75**
Female	60.8	50.6	51.5	**-9.75**	56.8	50.6	51.5	-5.75	59.8	50.6	51.5	**+8.75**
Education[1] (%)												
High school or less	20.6	38.1	39.6	**+18.25**	12.1	38.1	39.6	**+26.75**	18.3	38.1	39.6	**+20.55**
Some college, no degree	28.2	25.3	22.2	-4.45	27.9	25.3	22.2	-4.15	27.7	25.3	22.2	-3.95
Coll degree (2yr or 4yr)	35.5	27.1	29.4	**-7.25**	41.4	27.1	29.4	**-13.15**	37.8	27.1	29.4	**-9.55**
Prof/Grad degree	15.7	9.5	8.8	**-6.55**	18.6	9.5	8.8	**-9.45**	16.2	9.5	8.8	**-7.05**
Age[1] (%)												
18-34	13.6	30.4	30.3	**+16.75**	24.1	30.4	30.3	+6.25	18.9	30.4	30.3	**+11.45**
35-54	36.2	39.1	38.4	+2.55	39.7	39.1	38.4	-0.95	36.2	39.1	38.4	+2.55
55-64	25.4	15.2	16.6	**-9.5**	19.7	15.2	16.6	-3.8	20.6	15.2	16.6	-4.7
65+	24.8	15.3	14.7	**-9.8**	16.5	15.3	14.7	-1.5	24.3	15.3	14.7	**-9.3**
Race[1] (%)												
Non-Hispanic Whites	82.4	78.8	79.3	-3.35	82.6	78.8	79.3	-3.55	82.8	78.8	79.3	-3.75
All Others	17.6	21.2	20.7	+3.35	17.4	21.2	20.7	+3.55	17.2	21.2	20.7	-3.75
Children in Household (% Yes)	37.5	33.1	32.9	-4.5	41.5	33.1	32.9	**-8.5**	38.1	33.1	32.9	-5.1
Number in Household (%)												
1 person	28.1	27.8	34.9	+3.25	19.8	27.8	34.9	**+11.55**	23.3	27.8	34.9	**+8.05**
2 persons	32.0	34.8	31.2	+1.0	35.6	34.8	31.2	-2.6	36.0	34.8	31.2	-3.0
3 persons	17.2	15.3	14.7	-2.2	14.8	15.3	14.7	+0.2	13.9	15.3	14.7	+1.1
4 persons	13.5	13.3	13.2	-0.25	21.2	13.3	13.2	**-7.95**	18.1	13.3	13.2	-4.85
5+ persons	9.2	8.8	6.0	-1.8	8.6	8.8	6.0	-1.2	8.7	8.8	6.0	-1.3
Married[1] (%Yes)	56.0	54.7	56.3	-0.5	63.0	54.7	56.3	**-7.5**	57.4	54.7	56.3	-1.9
Employed[1] (%Yes)	59.4	--[2]	65.9	+6.5	68.5	--[2]	65.9	-2.6	61.5	--[2]	65.9	+4.4
Household Income (%)												
< $10K/year	4.9	6.3	5.4	+0.95	2.0	6.3	5.4	+3.85	3.3	6.3	5.4	+2.55
$10K to < $25K/year	13.0	14.0	15.1	+1.55	9.5	14.0	15.1	+5.05	13.6	14.0	15.1	+0.95
$25K to < $50K/year	24.9	24.3	25.8	+0.15	23.0	24.3	25.8	+2.05	25.5	24.3	25.8	-0.45
$50K to < $75K/year	22.3	20.1	17.7	-3.4	22.8	20.1	17.7	-3.9	20.5	20.1	17.7	-1.6
$75K to < $100K/year	16.0	13.4	14.4	-2.1	19.4	13.4	14.4	-5.5	17.5	13.4	14.4	+3.6
$100K/year or >	18.9	21.9	21.6	+2.85	23.2	21.9	21.6	-1.45	19.6	21.9	21.6	+2.15

Notes: [1]Figures reported for population aged 18+; [2]Employment figures were unavailable for population aged 18+ (only for 16+ & 21+).

married people with children in the household and with larger household sizes. Mail-only respondents to the $5 mail groups and combined Internet and mail respondents to the $5 Internet groups were only over-representative of older females. Internet and mail combined respondents also had slightly larger household sizes. Relative to the other groups, Internet-only respondents were most representative of the general population in terms of age and gender while mail-only and combined mail and Internet respondents better approximated the general population in terms of marital and employment status. All three types of respondents were relatively similar in regards to race and income. Thus, none of the respondents to any of the three survey methods were completely representative of the Washington population and each method performed better in some respects compared to the others.

Other important indicators of non-response error include telephone and Internet status. These data are unavailable from the ACS or CPS but are provided from other sources. As demonstrated above, Internet and mail respondents are different in regards to telephone and Internet status but it is unclear as to whether they are representative of the general population. Link et. al. (2008) and Blumberg & Luke (2008) estimated that about 15-20% of U.S. households are cell-only or no-phone households, without landline telephone service and Blumberg et. al. (2009) estimate that 16.3% of households in Washington are cell-only. As reported in Figure 4, 17.8% of WCS mail and Internet respondents live in cell-only households and an additional 1.2% live in a household without any type of telephone, for a total of 19% without landline telephone service. WCS respondents were slightly overrepresentative of cell-only households in Washington by 1.5 percentage points.

FIGURE 4: Telephone Status of WCS Respondents

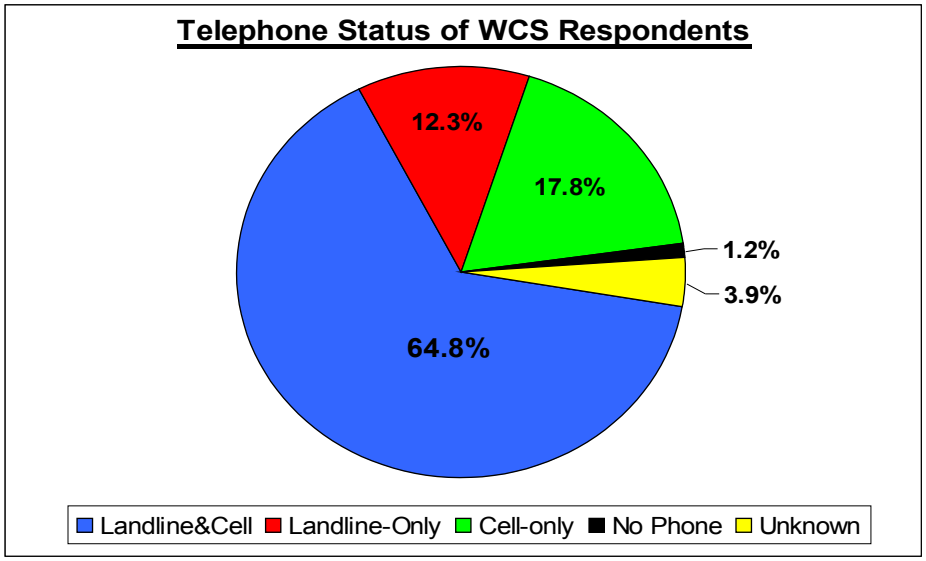


Table 7, on the other hand, demonstrates that WCS mail and Internet respondents are over-representative of the general Washington population with Internet access in the household, and especially high-speed access, as measured by the National Telecommunications and Information Administration (NTIA) (2008). Internet-only respondents, as could be expected, were the most disparate in terms of both access and high-speed access. Mail and combined mail and Internet respondents are slightly more similar but still over-represent those with household Internet access by at least 11.6 percentage points (mail-only) and high-speed access household by at least 26.8% (Internet and mail).

TABLE 7: Comparisons of Internet Status of WCS Mail, Internet, and Combined Mail & Internet Respondents vs. 2008 NTIA Internet Status Data for Washington

	$5 Mail Pref. vs. 2008 NTIA			$5 Internet Pref. (Internet-only) vs. 2008 NTIA			$5 Internet Pref. (Mail & Internet) vs. 2008 NTIA		
	Internet	NTIA	Diff.	Internet	NTIA	Diff.	Internet Pref.	NTIA	Diff.
Internet Status									
No Internet	16.4	28.0	**+11.6**	3.6	28.0	**+24.4**	13.9	28.0	**+14.1**
Internet	83.6	72.0	**-11.6**	96.4	72.0	**-24.4**	86.1	72.0	**-14.1**
High-speed	85.5	58.0	**-27.5**	89.4	58.0	**-31.4**	84.8	58.0	**-26.8**
Dial-up	14.5	42.0	**+27.5**	11.6	42.0	**+31.4**	15.2	42.0	**+26.8**

4.2.4 Do cash incentives reduce non-response error between incentive vs. non-incentive mail and Internet respondents?

Given the large disparities in response rates between incentive and non-incentive groups, it is very likely that non-incentive group respondents are also different types of people compared to corresponding incentive group respondents. As shown in Table 7, however, very few significant differences exist. In the mail group comparisons, more non-incentive respondents earned higher levels of income, use the computer and Internet, and have Internet in the household compared to incentive mail respondents. Mail non-incentive respondents also have slightly higher levels of education and children in the household, but these differences are not statistically significant, possibly due to smaller sample sizes. For the Internet groups, a greater proportion of non-incentive respondents had higher levels of education and Internet in the household compared to incentive Internet respondents. Non-incentive Internet respondents also appear to be older and require less assistance with the Internet, although these comparisons are not significant either. Interestingly, levels of income were very similar between Internet incentive and non-incentive respondents. Overall, non-incentive mail and Internet respondents seem more similar to incentive respondents than they are different. Thus, while the incentive considerably increases response rates, it may not as noticeably reduce non-response error.

TABLE 8: Characteristics of WCS Respondents to the Mail Incentive vs. No Incentive Groups and Internet Incentive vs. No Incentive Groups

	1&2: $5 Mail Pref. vs. 3: Mail Pref., No $5				4&5: $5 Internet Pref. vs. 6: Internet Pref., No $5			
	$5	No $5	Diff.	x^2 (p)	$5	No $5	Diff.	x^2 (p)
Gender (%)								
Male	38.8	41.0	+2.2	0.30	43.1	41.7	-1.4	0.02
Female	61.2	59.0	-2.2	(.585)	56.9	58.3	+1.4	(.884)
Education (%)								
High school or less	20.8	14.3	**-6.5**		20.2	10.8	**-9.4**	
Some college, no degree	26.1	25.5	-0.6	0.97	27.9	17.2	**-10.7**	6.11
Coll degree (2yr or 4yr)	36.2	38.0	+1.8	(.131)	36.4	53.1	**+16.7**	(.000)
Prof/Grad degree	16.9	22.2	**+5.3**		15.5	18.9	+3.4	
Age (%)								
18-34	13.3	16.1	+2.8		19.7	15.0	-4.7	
35-54	37.4	34.8	-2.6	0.96	32.1	37.4	**+5.3**	1.61
55-64	23.5	27.3	+1.8	(.408)	22.5	16.7	**-5.8**	(.185)
65+	25.8	21.8	-4.0		25.7	30.9	**+5.2**	
Race (%)								
Non-Hispanic Whites	82.5	83.3	+0.8	0.06	78.5	80.9	+2.4	0.25
All Others	17.5	16.7	-0.8	(.812)	21.5	19.1	-2.5	(.619)
Children in Household (% Yes)	38.3	45.3	**+7.0**	2.28 (.131)	36.6	33.2	-3.4	0.25 (.460)
Number in Household (%)								
1 person	26.3	18.9	**-7.4**		24.9	32.2	**+7.3**	
2 persons	33.7	34.0	+0.3	0.97	36.5	32.2	-4.3	0.83
3 persons	17.0	19.1	+2.1	(.457)	15.3	10.7	-4.6	(.541)
4 persons	13.2	18.0	+4.8		17.4	19.1	+1.7	
5+ persons	9.8	10.0	+0.2		5.9	5.8	-0.1	
Married (%Yes)	57.4	61.5	+4.1	0.97 (.325)	55.2	51.5	-3.7	0.47 (.469)
Employed (%Yes)	59.0	61.5	+2.5	2.40 (.122)	62.1	63.0	+0.9	0.04 (.842)
Urban[1] (% Yes)	68.1	67.6	-0.5	0.02 (.884)	68.3	66.8	-1.5	0.14 (.713)
Household Income (%)								
< $10K/year	4.8	1.7	-3.1		2.7	6.0	+3.3	
$10K to < $25K/year	13.2	7.9	-4.7		14.3	10.8	-3.5	
$25K to < $50K/year	22.4	22.2	-0.2	1.91	26.9	24.5	-2.4	0.79
$50K to < $75K/year	21.1	22.0	+0.9	(.092)	19.7	20.6	-0.9	(.557)
$75K to < $100K/year	17.7	18.9	+1.2		16.7	16.6	-0.1	
$100K/year or >	20.8	27.4	**+6.6**		19.7	21.5	+1.8	
Computer/Internet Status (%Yes)								
Use Computer	84.2	89.8	**+5.6**	4.04 (.045)	84	87.4	+3.4	0.98 (.324)
Use Internet	84.6	89.7	**+5.1**	3.58 (.059)	86.0	89.0	+3.0	0.83 (.362)
Assistance w/Internet[2]	25.1	22.0	-3.1	0.67 (.414)	22.4	17.0	**-5.4**	1.61 (.205)
Internet in Household	83.5	88.3	+4.8	2.88 (.090)	83.9	89.7	**+5.8**	2.70 (.101)
High-speed Internet[3]	86.6	83.0	-3.6	1.27 (.259)	86.5	85.9	-0.6	0.03 (.864)

TABLE 8, cont.

Telephone Status (%)								
No Phone	0.9	2.1	+1.2		1.9	0.4	-1.5	
Cell-only	15.9	16.5	+0.6	1.07	20.8	17.6	-3.2	1.39
Landline-only	12.7	9.4	-3.3	(.371)	13.0	13.3	+0.3	(.236)
Landline & Cell	66.7	69.6	+2.9		62.3	64.2	+1.9	
Unknown	3.8	2.4	-1.4		2.0	4.5	+2.5	
Communicate w/Others[4] (%)								
Face to face	8.3	6.1	-2.2		10.5	8.4	-2.1	
Phone	65.6	68.2	+2.7	0.40	63.1	62.5	-0.6	0.30
Internet	22.8	23.1	+0.3	(.755)	23.3	26.4	+3.1	(.828)
Other	3.2	2.6	-0.6		3.1	2.7	-0.4	
Community Satisfaction[5] (%)								
Complete/Mostly Satisfied	82.7	83.3	+0.6	0.76	85.6	84.1	-1.5	0.94
Somewhat/Not at all	17.3	16.7	-0.6	(.469)			+1.5	(.384)
Satisfied					14.4	15.9		

Notes: [1]Urban respondents had a postal address in one of the five most populous counties in Washington; [2]Respondents reporting needing assistance with the Internet chose "All the time," "Frequently," or "Occasionally" on a scale of "All the time, Frequently, Occasionally, Rarely, Never," and also reported using the Internet at some place; [3]Respondents reported having Internet access in the household. [4]Respondents reported the method of communication most often used to communicate with others inside and outside of the respondent's community. The most common method for both is reported; [5]Respondents reported overall satisfaction with their community on a scale of "Completely, Mostly, Somewhat, and Not at all" satisfied.

4.2.5 Are there significant differences in item non-response between mail and Internet modes for different types of questions?

A final measure of non-response error examined in this study is the levels of item non-response between mail and Internet respondents to different types of questions in the WCS. As reported in Table 8, the hypothesis that negligible differences will occur between mail and Internet methods appears to receive support. Slight differences (≤ 3.3 percentage points) existed between mail and the Internet method in both waves of the WCS for open-ended attitudinal and behavioral type questions but, for close-ended questions, differences were very marginal. Overall, the mail and Internet methods produced no differences in Wave 1 and less than a 1.0 percentage point difference in Wave 2. This could, in part, be a result of using a uni-mode construction in which differences between modes where minimized as much as possible.

TABLE 9: Mean Item Non-response Rates between Internet vs. Mail Modes in WCS Waves 1 & 2

	Wave 1			Wave 2		
Questions/Items (N)[1]	**Internet (4,5,7,8)**[2]	**Mail (1&2)**[3]	**Diff.**	**Internet (7&8)**[2]	**Mail (9)**[3]	**Diff.**
Attitudinal (Mean %)						
Close-ended (34)	2.9	2.1	-0.8	2.0	3.2	+1.2
Open-ended (1)	11.8	15.1	+3.3	11.4	14.7	+3.3
Behavioral (Mean %)						
Close-ended (16)	1.7	4.1	+2.4	1.9	3.5	+1.6
Factual/Demographics (Mean %)						
Close-ended (11)	4.4	3.3	-1.1	4.6	4.0	-.06
Open-ended (8)	9.8	9.4	-0.4	9.8	10.1	+0.3
Total Questions (70)	3.8	3.8	0.0	3.4	4.3	+0.9

[1] Branching questions not included in results.
[1] Figure reported = sum of the % of web non-respondents to each item/number items
[2] Figure reported = sum of the % of mail non-respondents to each item/number items

CHAPTER FIVE

DISCUSSION & CONCLUSION

Overall, the results suggest that using mail and Internet methods with the DSF and a mail contact is a practical strategy for conducting statewide general public household surveys. However, it is also apparent that different modes and implementation procedures do produce mixed results in terms of non-response. For example, total response rates in the WCS mail and Internet groups were somewhat lower than those achieved by Smyth et. al. (Forthcoming) using a similar methodology in a small rural region or by Israel (2009) in his mail and Internet survey of Florida extension clients. This could be because the WCS was conducted in a much larger population and during a presidential election year but the effects of these factors are difficult to determine. More in line with these other studies, however, this research demonstrates that when mail is the contact method, offering a follow-up mode, whether mail or Internet, appears to produce lower overall response rates compared to offering mail alone. The highest response rate in this study was obtained by a traditional mail-only method. The rates of the $5 mail preference groups were not significantly lower than the mail-only group but the Internet follow-up in these groups added little value and resulted in marginal improvements when presented 3 weeks after the initial survey request.

This may lend some support to the notion that it is difficult to contact respondents via one mode and convince them to respond via another mode. However, while the response rates from the WCS $5 Internet preference groups were lower overall compared to the $5 mail groups, using a mail contact method to convince people to respond to the Internet does appear promising when it is offered first to respondents, and also when followed by a mail method to those who do not have access to the Internet or who simply prefer the mail method. For example, the Internet

method used in the WCS $5 Internet preference groups obtained between 1/4 and 1/3 of total sampled population who comprised a majority proportion of total respondents in each group. The mail follow-up sent three weeks later also substantially increased response rates in each group by at least 15 percentage points and seems a necessary method to use given that 28% of the Washington population (and about 35% of the U.S. population) does not have Internet access in the household.

The $5 Internet preference groups also appeared to utilize the mail and Internet mixed-mode method effectively for reducing non-response error but the results were somewhat mixed compared to the mail-only method. Along the lines of other studies, WCS Internet-only respondents were very different from both mail follow-up and mail-only respondents on a number of characteristics, suggesting that using either method alone will result in higher non-response error. However, combining Internet and mail follow-up respondents resulted in a sample very similar to mail-only respondents, indicating that the Internet may not add value in terms of reducing overall non-response error. Concurrently, whether this is actually the case is difficult to determine. Internet-only, mail-only, or Internet and mail combined respondents were not consistently representative of the general population in Washington. This may cast some doubt over whether response rates were "reasonable" enough and will likely involve some tradeoffs for reducing non-response error when any of these methods are used. For example, including Internet respondents may reduce non-response in terms of gender and age but could increase non-response in regards to marital and employment status, and certain technological attributes, such as household Internet access and telephone status. However, it is possible that using weighting techniques with any of these methods will offset the differences and allow for more representativeness in the data, but more research is needed on this subject.

In addition, the inclusion of an Internet instruction card and a $5 incentive produced mixed results. The Internet card did not have the intended effect of reducing non-response or complexity among Internet respondents. Perhaps unfortunately, it was ineffective at steering more and different types of people to the Internet or away from mail, even when presented singularly to respondents in a separate mailing. However, it may be comforting to note that not using an Internet card will most certainly reduce survey costs. The $5 incentive, on the other hand, did significantly increase response rates, particularly among Internet respondents. Neither mail nor Internet non-incentive respondents were very different from corresponding incentive respondents but the absolute increase in the number of responses seemed worth it in order to keep low the sampling error in estimates made about the target population. Also, in regards to data quality, item non-response error was not an issue between mail and Internet modes. Great care was taken to ensure the mail and Internet versions of the questionnaire were as visually similar as possible and this may have had some impact on item non-response rates.

Finally, using the DSF with mail and Internet survey modes seems to provide some advantages over RDD telephone and/or Internet-only surveys. A substantial proportion of WCS respondents (17.8%) lived in cell-only households, which would have been excluded from RDD-based sampling, and about 17% of WCS respondents reported not having Internet access in the household, which would have excluded these households from responding to an Internet-based survey. Moreover, only a small proportion of sampled addresses were returned as "underliverable" in the WCS, indicating that DSF statewide samples have high overall occupancy rates, even in larger geographical areas, which are important for reducing the non-response and sampling errors. These figures demonstrate that the DSF with mail contacts may

indeed pose as a superior sampling frame and contact method for general public household surveys in at least the short-term future.

The changes currently occurring across the survey landscape have presented survey researchers with numerous methodological opportunities and challenges. The increase in non-response in RDD, the shortage of Internet access across the U.S., among other problems associated with Internet methods, and the advent of the DSF have all contributed to mail becoming a viable alternative, at least as a contact method. It is important to take advantages of this opportunity and determine how to use it most effectively in order to avoid, where possible, the costs associated with the growth of survey errors currently hampering other methods. This research has demonstrated that when mail is used as the contact method in statewide general public household surveys, a mail-only strategy with an incentive seems the most effective but is not free of non-response error. An Internet mixed mode strategy also appears to be desirable with the cost and time savings associated with using the Internet (not reported in this study) and the relatively comparable levels of non-response error as obtained by the mail-only strategy. Moreover, using the Internet with mail should become even more effective in the future with Internet penetration gradually increasing throughout the U.S.

Important questions still remain for future research, however. For example, can using a mail and Internet methodology produce similar results in a nationwide general public household survey, such as the ACS or CPS? Or an international survey, such as those conducted by the European Union? It is problematical to generalize the results from this study to such broad populations, as Washingtonians are different in some ways from Georgians or New Yorkers, and most certainly from French or Albanians. It is also unclear as to how the Internet and mail can be used most effectively at the *lowest cost*? Israel found that with the additional postage and

materials to mail Internet survey requests, the cost benefits between mail and the Internet were somewhat marginal. Also, it is uncertain as to whether the timing of the mail or Internet follow-up contact impacts non-response for each mode. Each follow-up contact in the WCS was mailed three weeks after the initial survey request contact (the 2nd contact) and it would be valuable to know if sending it sooner or later could increase or decrease non-response in significant ways. Also, weighting techniques need further testing with using mail and the Internet to determine if non-response error can be offset in meaningful ways.

Furthermore, little is known about whether the personalization procedures used in the survey materials affect non-response levels. Link et. al. (2008) found that including surnames on letters and envelopes did not significantly improve response rates compared to addressing "*X*" city/town resident. If these and other personalization techniques are not necessary, survey and printing costs could be greatly reduced. The types of envelopes used may also have an effect on non-response. People receive "junk" in the mail just as they receive "junk" telephone calls. Thus, mailing the survey in an envelope that appears more significant or legitimate, such as a FedEx or USPS Priority envelope, may prompt more people to at least open the envelope and browse its contents.

In sum, general public telephone surveys are certainly not likely to cease despite survey error issue and Internet surveys are also likely to increase in use, but mail alone and using mail to invite respondents to the Internet could be viable substitutes or alternative methodologies for social scientists who need to survey the general public. This research has made clear that mail and Internet methods using the DSF are feasible but more research is needed to improve the effectiveness of mail and Internet survey methodologies so that social scientists can minimize errors and obtain reliable and valid measures of human behavior and many other characteristics.

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