

Washington State Population Survey

Nonresponse Bias Analysis on the 2006 Survey

Authors:

David Ferraro
Tom Krenzke

August 22, 2007

Prepared for:

Washington State Office
Of Financial Management
Olympia,
Washington 98504

Prepared by:

WESTAT
1650 Research Boulevard
Rockville,
Maryland 20850

TABLE OF CONTENTS

<u>Chapter</u>		<u>Page</u>
1.	Introduction.....	1
2.	Methodology.....	2
3.	Auxiliary Data.....	3
4.	Weighted Response Rates.....	5
5.	Bivariate Analysis	6
6.	Multivariate Analysis	7
7.	Weighted Totals Comparison to Other Data Sources.....	9
8.	Medical Assistance.....	10
9.	Summary of the Nonresponse Bias Analysis	11
10.	Weighting Recommendations	13
	References.....	17

List of Appendices

<u>Appendix</u>		
A	Descriptions of Procedures	A
	Base Weight Computations.....	A-1
	Variance Estimation Computation	A-1
	Software.....	A-3
B	Bivariate Analysis Table.....	B
C	Multivariate Analysis Tables	C
D	Comparison to External Sources	D

List of Tables

<u>Table</u>		<u>Page</u>
1.	Analysis variable and data sources.....	4
2.	Unweighted and weighted response rates and the estimated percentages of ineligible and non-residential, overall: 2006.....	5
3.	Characteristics with large ¹ bias potential, by region	7
4.	Percent distribution of uninsured, by age, for the WSPS and NHIS: 2006	11
5.	Distribution of population weights, by region: 2006.....	15
6.	Distribution of medical assistance weights, by region: 2006.....	15
A-1.	Base Weights	A-1
B-1.	Percentage distribution of eligible and participating households for Washington State, by selected characteristics: 2006	B-1
B-2.	Percentage distribution of eligible and participating households for North Puget region, by selected characteristics: 2006.....	B-5
B-3.	Percentage distribution of eligible and participating households for West Balance region, by selected characteristics: 2006	B-7
B-4.	Percentage distribution of eligible and participating households for King region, by selected characteristics: 2006	B-9
B-5.	Percentage distribution of eligible and participating households for Other Puget Metro region, by selected characteristics: 2006	B-11
B-6.	Percentage distribution of eligible and participating households for Clark region, by selected characteristics: 2006	B-13
B-7.	Percentage distribution of eligible and participating households for East Balance region, by selected characteristics: 2006	B-15
B-8.	Percentage distribution of eligible and participating households for Spokane region, by selected characteristics: 2006	B-17
B-9.	Percentage distribution of eligible and participating households for Tri-cities region, by selected characteristics: 2006	B-19
C-1.	Logistic regression results, by characteristic	C-1

List of Tables

<u>Table</u>		<u>Page</u>
C-2.	Search results	C-2
D-1.	Comparison of population estimates from the Washington State Population Survey, American Community Survey and the Current Population Survey: 2006.....	D-1
D-2.	Comparison of medical assistance estimates from the Washington State Population Survey and the Current Population Survey: 2006.....	D-3

ACKNOWLEDGMENTS

The authors are grateful to the following contributors to this report: Jing Kang for processing WesVar and other software, and gathering of external population estimates; Harold Bobbitt for his computer programming work on creating the analysis files; Daniel Levine and Jill Montaquila for their valuable comments during the review of the report; and David Morganstein and Mike Brick for insightful advice throughout the task.

1. Introduction

The Washington State Population Survey (WSPS) is designed to examine and monitor the health and welfare of all civilian and armed forces household members within the geographic boundaries of Washington state, and is a valuable source of information that serves as a basis for important decisions by state policymakers, in planning, evaluating, and implementing programs to improve the health and welfare of its citizens. The continuing, bi-annual survey is managed by the Office of Financial Management (OFM), and administered by the Gilmore Research Group. Over 7,500 household respondents were interviewed by telephone in the 2006 WSPS, which provided data on over 17,000 persons. The telephone numbers for households were selected using a list assisted random-digit dialing (RDD) method, using differential sampling rates across strata defined by the eight regions of the state.

As is typical with other RDD surveys, the WSPS estimates are subject to potential bias due to nonparticipation, which could affect the quality of the results. Further, in recent years, the WSPS has seen its response rate decline to about 27 percent for the 2006 survey, from 42.5 percent in 2000. As a result, the OFM has initiated the need for a nonresponse bias analysis study and an overall review of the survey procedures, in order to investigate any problem areas and to propose recommendations that might lead to improved response rates and more reliable estimates. The existence of significant bias can mislead data users and lead to wrong decisions or conclusions.

The methodology used to do this analysis is presented in Section 2. Auxiliary data, used to help measure the potential for nonresponse bias, are an important aspect of this analysis, and Section 3 provides information on the sources of the variables and their use in the analysis. Section 4 presents response rates for categories of the analysis variables. Section 5 contains a bivariate analysis using chi-square tests that may detect a significant relationship between a response indicator and the analysis variable of interest. Section 6 describes multivariate analyses that study the relationship between response indicator and the analysis variables as a group. The results of the bivariate and multivariate analyses show categories of auxiliary variables where the most potential for bias exists, prior to the WSPS poststratification adjustment. Using the final WSPS weights, comparisons are made to estimates from other data sources, as discussed in Section 7. Section 8 provides a comparison of the WSPS medical assistance estimates to population estimates from external sources. A summary of the findings are presented in Section 9.

In addition, the WSPS weighting procedure was examined and compared to the generally accepted current best methods used in weighting surveys such as the WSPS. To this end, the potential auxiliary data that could lead to a nonresponse adjustment procedure were examined, along with the

derivation of the WSPS poststratification adjustment factors and their implementation. The weighting process for the medical assistance weights was also examined. Section 10 discusses various possible ways to help reduce the bias in WSPS estimates through weighting adjustments.

2. Methodology

Nonresponse bias is measured by two terms: the nonresponse rate, and differences between respondents and nonrespondents. To explain further, we introduce the following expression for nonresponse bias for a sample mean (\bar{y}_R):

$$Bias(\bar{y}_R) = (1 - W_R)(\bar{Y}_R - \bar{Y}_N),$$

where W_R is the weighted unit response rate, \bar{Y}_R is the population mean of the respondent stratum, and \bar{Y}_N is the population mean for the nonrespondent stratum. The formula shows that there are two components of the bias expression. While the response rate (first component) is universally recognized as a measure of survey quality, it is not by itself a good indicator of nonresponse bias. The difference between participants and nonparticipants (second component) is just as important. Theoretically, even if the response rate is 27 percent, if there is no difference in the mean of the characteristic y between participants and nonparticipants, then bias does not exist. In practice, the second component is unknown; however, proxies (auxiliary data) are used to estimate the difference. Weighting adjustments are used to reduce nonresponse bias; although, it is widely recognized that some nonresponse bias remains in survey estimates.

This report provides the results of a systematic analysis of the potential for nonresponse bias. Using the auxiliary information, the analysis is conducted in three parts:

- First, a bivariate analysis (response indicator versus each auxiliary variable) compares the distribution of the participating households to the distribution of the total eligible sample of households for several auxiliary variables. Survey base weights were computed by Westat to account for the unequal within-household probabilities of selection, and replicate weights were used to adequately reflect the effect of the sample design (stratification of households by regions and clustering of persons within households) on variance estimates. More details about the base weights and replicate weights are provided in appendix A¹.

¹ The appendix also provides a brief discussion of the software used.

- Second, multivariate analyses were conducted to determine the relationship between response status and the set of auxiliary variables (as a group). A main effects logistic regression model was processed as well as a classification analysis, which was used to detect important interaction effects among the auxiliary variables. The multivariate analyses use the base weights.
- Lastly, for select survey items, using the final WSPS weights, comparisons are made to estimates from other data sources. Furthermore, the WSPS medical assistance estimates were compared to population estimates from external sources.

Ideally, this analysis would also include an additional bivariate and multivariate analysis using nonresponse adjusted weights. This additional analysis would indicate the potential for bias after accounting for the mitigating effects of a nonresponse weight adjustment. However, this type of analysis could not be done. For example, a comparison of the set of respondents (using final weights) to the set of eligibles (using base weights) would determine the affect weighting adjustments would have on reducing bias. Nevertheless, this comparison was not done since WSPS adjustments were done at the person level and the set of eligible persons from all eligible households sampled is unknown.

The results of this analysis can be used as a basis for recommendations for the 2008 and 2010 surveys.

3. Auxiliary Data

When attempting to measure bias, it is necessary to have available as much information as possible for survey nonparticipants. Accordingly, sociodemographic characteristics for both participant and nonparticipant households, estimated for each telephone exchange, were obtained through merging telephone exchanges for the WSPS sample with data from a commercial supplier. Variables obtained at the exchange level include the following:

- Age (percent within specified age ranges);
- Race/ethnicity (percent of specified races or ethnicity);
- Income (percent within specified income ranges);
- Housing (percent renting; median home value);
- Education (percent of college graduates); and
- Geography (Metropolitan Statistical Area, County).

The percentages are based on exchange-level estimates updated from Census 2000 data, and data from the American Community Survey. These exchange-level values should be regarded as rough estimates to be used for estimating nonresponse bias, and for nonresponse adjustments in weighting; however, they do not represent reliable figures for estimation purposes. Comparing exchange-level characteristics for participants and the total eligible sample is not an ideal measure of nonresponse bias if the characteristics are unrelated or weakly related to more substantive items in the survey; however, this is often the only approach available.

Table 1 summarizes the analysis variables for each stage of the analysis, along with the source of the data. As shown in the table, data were obtained from a variety of sources for use in the analysis.

Table 1. Analysis variable and data sources

Analysis stage	Auxiliary data	Data source
Bivariate and multivariate analysis	Telephone exchange data	Westat commercial vendor
	Mailing address availability	Gilmore commercial vendor
	Disposition codes	Gilmore survey control files
Comparison to other data sources	WSPS survey items	2006 WSPS public use file
		2005 and 2006 Current Population Survey March Supplement
		2006 National Health Interview Survey
		2005 American Community Survey

The telephone exchange data and the mailing address availability status have practical importance to the WSPS. Since the exchange data variables are available for both participants and nonparticipants, they can be used not only to identify areas with potential for nonresponse bias, but also to potentially reduce nonresponse bias through nonresponse adjustments in the weighting process.

While, for weighting purposes, it would be extremely beneficial to have auxiliary data that have pairwise correlation coefficients with key WSPS variables that are close to 1.0, this situation is very rare. Pairwise correlations between the set of analysis variables and WSPS survey variables (such as income, medical insurance, education, age, gender, own/rent status) are no higher than 0.2 (absolute value). This is moderate at best; however, such variables are still considered useful for evaluating nonresponse bias and for use in nonresponse adjustment. As mentioned earlier, nonresponse bias is a function of the correlation between response propensity and the variable of interest. So, even though the auxiliary data might not be very strongly related to WSPS survey variables, if response propensities are correlated (or associated) with the auxiliary variables (either single variables or adjustment cells formed using these variables), and these response propensities are correlated with WSPS survey variables, then using auxiliary data in a nonresponse adjustment would be expected to reduce the nonresponse bias.

Although the auxiliary variables considered one at a time, have low to moderate correlations with response status (about the same magnitude as the correlations to WSPS survey variables), there is evidence to suggest that adjustment cells formed using the auxiliary variables may be useful in reducing nonresponse. Although the overall unit response rate for the 2006 WSPS was 27 percent, the response rates across cells that might have been used in a unit nonresponse adjustment range from 13 percent to 47 percent, indicating that the variables used to define the cells effectively discriminate groups of cases with varying response propensities.

4. Weighted Response Rates

Weighted response rates estimate the coverage of the target population from the resulting set of participants. To be consistent with published WSPS reports², weighted response rates were computed analogous to the unweighted response rate computation (RR4) described in the 2006 WSPS Data Collection Report³. The RR4 computation adjusts for the estimated percentage of ineligible (respondent too young, deceased) household representatives among the refused and non-contact households, and the estimated percentage of the sample that are non-residential. The weighted and unweighted response rates, along with the percentages of ineligibility are shown in Table 2.

Table 2. Unweighted and weighted response rates and the estimated percentages of ineligible and non-residential, overall: 2006

	Unweighted rate	Weighted rate
Estimated percentage of ineligible households in the refused and non-contact households	0.37%	0.42%
Estimated percentage of the sample that are non-residential	52.34%	51.53%
Response rate (RR4)	27.52%	27.28%

Source: 2006 WSPS survey control files

The weighted response rate for the state was 27 percent. As shown in the overview for the state in Table B-1, the King region has the lowest rate (22%), while the Tri-Cities and Spokane regions have the highest rate (35%). The subgroup with the highest response rate in the state is the set of telephone numbers for which an address was obtained (34%); the lowest rate is when an address is

² It should be mentioned that the approach used in this report for classifying result codes is consistent with how they are classified for the WSPS, and are not completely consistent with classification rules followed by recognized survey methodology. Second, the response rate computation was consistent with the approach used in the WSPS. Recommendations on these and other issues relating to the WSPS will be provided in an upcoming report.

³ There were slight differences between response rates derived from the analysis files and the reported figures in the Data Collection Report, due to some edits (changes to disposition codes) and a small number (about 9%) of purged records that were not retained on the survey control files.

unavailable (22%). Among the telephone exchange data, the categories with the highest response rate (31%) are exchanges with low home values or high concentration of 18-24 year olds. Categories with the lowest response rate (24%) are exchanges with high home values, low concentration of 18-24 year olds or high concentration of Asians. The weighted response rates for each region and for each analysis variable are shown in Tables B-2 through B-9. The response rates are analyzed in the following sections on bivariate and multivariate analysis.

5. Bivariate Analysis

For categorical variables, the distribution of telephone exchange characteristics and the mailing address availability for participants was compared with those for the eligible sample, overall and by region (see Tables B-1 through B-9). The hypothesis of independence between the characteristic and participation status was tested using a Rao-Scott modified Chi-square statistic (Rao and Thomas 2003). The bias and relative bias are also given in each table. The bias is the difference between the respective estimates for the participants and the eligible sample (equivalent to the formula in Section 2). The relative bias is calculated as the bias divided by the estimate from the eligible sample. The relative bias is a measure of the size of the bias compared to the eligible sample estimate.

There were several statistically significant results. As shown in Table B-1, for Washington as a whole, all characteristics are statistically significant, meaning that we reject the hypothesis that response status is independent from the levels of the analysis variable, for each analysis variable. In practical terms, the distribution across analysis variable levels for the participants is different from the distribution for the set of eligible cases, and therefore, this indicates the potential for bias, especially if the weighting process did not address the bias, and to the extent that the auxiliary variables are correlated with key WSPS variables. Tables B-2 through B-9 provide results by region. For each region, several of the characteristics are statistically significant. Many of these differences do not appear substantially large, especially given the large sample size which makes the tests very sensitive.

To help summarize, Table 3 provides the characteristics for each region with relatively high potential for nonresponse bias. These characteristics are defined by being statistically significant and having an absolute bias greater than 2 and an absolute relative bias greater than 10 percent. This rule is merely a guideline to help summarize the results. The availability of a mailing address is a key indicator of bias for all regions (lower participation when mailing address was not available). The percentage of Hispanic in the exchange is a key indicator of bias for three of the eight regions. Furthermore, the region with the most variables with large indications of bias is East Balance, with five variables. The overall

state results show large indications of bias relating to mailing address availability, ages 18 to 24 (lower participation in areas with low concentration), median home value (lower participation in areas with high concentration of high incomes), and the Asian population.

Table 3. Characteristics with large¹ bias potential, by region

Variable	State	North Puget	West Balance	King	Other Puget	Clark	East Balance	Spokane	Tri-cities
Region	X	NA	NA	NA	NA	NA	NA	NA	NA
Mailing address available	X	X	X	X	X	X	X	X	X
Median home value	X			X					
Metro status flag									
Percent of population between 0 & 17 years old (inclusive)					X				
Percent of population between 18 & 24 years old (inclusive)	X								
Percent of population 65 years old & up									
Percent are college graduates				X					X
Percent renters							X		
Percent with income \$100K and up									
Percent with income between \$1K-10K (inclusive)									
Percent White		X					X		
Percent Black							X	X	
Percent Hispanic				X			X		X
Percent Asian	X								

¹ Large bias is defined by being statistically significant and having an absolute bias > 2 and an absolute relative bias greater than 10 percent.

6. Multivariate Analysis

The chi-square tests in the prior section discuss each auxiliary variable independently. In addition to these tests, logistic regression models were used to provide a multivariate analysis in which the conditional independence of these characteristics as main effect predictors of participation was examined as a group. Dummy variables were created for each level of the variables, so that each level was included in the model separately. The last component of each categorical variable is always the reference

category, and is not included in the model explicitly. The p -value of a dummy variable indicates whether there is a significant difference at the 5 percent level from the effect of the (omitted) reference category.

The results of the logistic regression are provided in Table C-1. The approach used captured the key features of the sample design. Using the size of the parameter estimate, the results show that regression coefficients for most variables are statistically significant at the 0.05 level. The largest impact is due to the mailing address availability status, as the odds of participation (as derived from the parameter estimate of -0.58) for no mailing address is 0.56 times lower than if a mailing address was available, given all other variables accounted for in the model. The variables at the exchange level that are not statistically significant, i.e., do not appear to correlate with response to the survey, are the percent Asian, percent Black, percent White, percent Hispanic, percent with income over \$100,000, and the West Balance region.

A classification algorithm, called Search, was used to identify pockets in the population with the lowest response rates. The Search algorithm (Sonquist, Baker, and Morgan 1974) uses the likelihood ratio chi-square to divide a population into homogeneous subgroups with respect to a target characteristic (the dependent variable). When response indicator is used as the dependent variable, the resulting classification categories best explain differential response rates. The analysis in Search begins by dividing the sample into two groups based on categories of the best predictor. Each of these groups is divided into smaller subgroups based on the best available predictor at each level. The splitting process continues until the specified stopping rules are met.

As shown in Table C-2, the four lowest response rates are for groups with no mailing address obtained in King or Clark regions. Two subgroups that have the lowest response rates (about 13%) have no mailing address obtained in King or Clark regions in exchanges with low percent White. One of these two subgroups has a low to medium concentration of high incomes and low percent of renters. The other such subgroup represents areas with a high concentration of low incomes. The subgroup with the highest response rate (47%) has mailing addresses in East Balance, Spokane, Yakima-Tri Cities, a medium to high concentration of persons between 18 to 24 years of age, and a medium concentration of Hispanics.

7. Weighted Totals Comparison to Other Data Sources

Estimates produced from the WSPS were compared to estimates from the American Community Survey (ACS) and the 2006 Current Population Survey (CPS) March Supplement. Large differences between the WSPS estimates (using the final WSPS population) and the ACS/CPS would indicate the potential for nonresponse bias⁴. The characteristics compared were metro status, age, gender, education, race/ethnicity, marital status, household income and home ownership. Confidence intervals WSPS estimates were computed using jackknife replicate weights. For the ACS and CPS, confidence intervals were derived from generalized variance functions provided in their respective technical documentation. The primary comparison is with data from the 2005 ACS (2006 data were not available). The ACS response rate is 97 percent with over 40,000 completed interviews in Washington. Although the size of the CPS sample in Washington State is less than 25 percent the sample size of the WSPS, the unweighted response rate in Washington is on the order of 90 percent and therefore also providing a useful comparison. It is also important to note the differences in the target populations between the three surveys. The 2005 ACS includes the civilian and military noninstitutional population minus any people living in group quarters. For the CPS, it is the civilian noninstitutional population living in housing units or group quarters and members of the Armed Forces living in civilian housing units on a military base or in a household not on a military base. The WSPS covers civilian and armed forces household members.

Table D-1 provides the WSPS, ACS and CPS estimates for several characteristics. The age, gender and race (except Native Hawaiian/Other Pacific Islander) variables showed no statistical difference (overlapping confidence intervals) between the WSPS and ACS. However, there were some differences as shown:

- The WSPS estimated percentage with less than a high school education was lower than for the ACS. It was significantly higher for college grads.
- The estimated percentage for Native Hawaiian/Other Pacific Islander is higher than ACS.
- The estimated percentage for Married is larger for the WSPS than for the ACS and for Never married and Other is less than the ACS.
- The estimated percentage for total household income with less than \$25,000 is lower for WSPS than for the ACS and is higher for greater than \$100,000.
- The estimated percentage that rent is lower for the WSPS than for the ACS.

⁴ Such differences could also be attributable to other such biases (e.g., coverage bias) or to differences in the target population or survey administrations (timing, response categories, context, mode, etc.)

In comparing to the 2006 CPS, the differences were similar except more race categories were different and total household income was not different from WSPS.⁵ In addition, the WSPS estimated percentage in Metropolitan Statistical Areas (MSAs) is significantly lower than for the CPS (it is not available for ACS).

Since WSPS is a telephone survey, and the ACS/CPS are in-person interviews, these are not surprising results. The characteristics shown to have differences are typical characteristics of cell phone only households. The WSPS compares well for the variables available for forecasted estimates (assumed to not be dependent on the RDD survey), but for variables not available, such as education, home ownership, marital status, and income, the WSPS and ACS/CPS show differences. Therefore, it is important to bring in auxiliary data into the estimation (i.e., weighting) process in order to reduce coverage bias due to cell phone only households and to reduce nonresponse bias as well.

In summary, the comparison shows that the WSPS estimates related to education, marital status, total household income and home ownership are different from reliable external sources. Therefore, bias may exist in WSPS estimates related to these variables due to nonresponse or coverage.

8. Medical Assistance

Estimates produced from the WSPS for medical assistance items were compared with estimates from the 2006 Current Population Survey March Supplement. Large differences between the estimates from the survey and the other sources indicate the potential for nonresponse bias⁶. Percentages were compared for Medicare and Medicaid assistance by age categories. For the WSPS, final medical assistance weights were used. Confidence intervals were computed using jackknife replicate weights. For the CPS, confidence intervals were derived from generalized variance functions provided in the CPS technical documentation. Table D-2 provides the WSPS and CPS medical assistance estimates.

As shown in Table D-2, there are no significant differences (overlapping confidence intervals) between the WSPS and CPS for the Medicare estimated percentages, overall for the state, and by age categories. The WSPS estimated percentage with Medicaid (13.9%) is significantly higher than the

⁵ For the CPS, the percentage of households with income less than \$24,999 was 18 percent in 2005 and 15 percent in 2006. This large shift may indicate some instability in the CPS estimate.

⁶ Such differences could also be attributable to other such biases (e.g., coverage bias) or to differences in the target population or survey administrations (timing, response categories, context, mode, etc.)

CPS estimate (9.9%). This difference is attributable to the 0 to 18 age category, as the WSPS percentage (34.1%) is also significantly higher than the CPS (23.6%).

Health care estimates from the American Community Survey are not available at this time. Two other sources (Medicare Current Beneficiary Survey, Medical Expenditure Panel Survey) were considered; however, they are not designed to produce state estimates. The National Health Interview Survey (NHIS) collects data on insurance benefits for the nation. Using the NHIS, the Centers for Disease Control (CDC) produces estimates of health insurance coverage for select states, including Washington. Table 4 contains NHIS estimates for the percent uninsured from Cohen and Martinez (2007). For the total population and all age categories, there are no significant differences in the percent uninsured.

Table 4. Percent distribution of uninsured, by age, for the WSPS and NHIS: 2006

Characteristic	WSPS			NHIS		
	Percent	CI lower bound	CI upper bound	Percent	CI lower bound	CI upper bound
Total population	9.3	8.5	10.2	11.7	8.7	14.7
Under 18 years old	4.2	3.3	5.2	4.4	2.0	6.8
18-64 years old	12.8	11.6	14.0	16.9	12.9	20.9
Under 65 years old	10.4	9.5	11.4	13.0	9.9	16.1

NOTE: 95 percent confidence bounds are shown.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

SOURCE: Family Core component of the 2006 National Health Interview Survey

9. Summary of the Nonresponse Bias Analysis

In a traditional nonresponse bias analysis, the potential for bias is evaluated using auxiliary data available for all eligible records, and results are evaluated to see if the weighting procedures reduce the impact of nonresponse on the survey estimates. Analyses using base weights (prior to weight adjustments), show many indications for the potential for bias. WSPS survey estimates, derived using final weights (after WSPS weight adjustment), were compared to estimates from external sources, and the differences examined. While the WSPS weighting process seemed to have reduced the bias relating for some variables, namely region, age, gender, and some race/ethnicity categories (Hispanic, White, and Black), indications of bias still remain for other variables. For example, subgroups of the following variables demonstrate bias, in that they show significant differences in the estimates from the 2006 WSPS and the 2005 American Community Survey (ACS):

- Metropolitan statistical area status
- Education attainment
- Race/ethnicity
- Marital status
- Household income
- Home ownership

For each of the above variables and subgroups, caution should be used in drawing conclusions based on the variables, since bias may exist in the estimates.

It is also important to include each of the above variables in the weighting process, since each are related to characteristics of cell phone usage. One can also understand how this bias results in another way. For example, the WSPS estimate of the percent of renters is significantly lower than the CPS estimate. The telephone exchange data show that the WSPS had fewer than expected household participants in areas of high concentration of renters, and this under-representation is not corrected in the weighting process. The results from the bivariate chi-square analysis, supported by the logistic regression, also show potential for bias existing for these variables of concern prior to the weighting adjustments. Although it is not so cleanly observed for some of the other variables, the potential exists for reducing these differences in weighting adjustments.

Through the use of a classification approach, certain areas of the population are found to be seriously under-represented, due to low response rates (about 13%). These subgroups are:

- No address available in King or Clark regions in exchanges with low percent White, and a low to medium concentration of high incomes and low percent that rent.
- No address available in King or Clark regions in exchanges with low percent White with a high concentration of low incomes.

The key variable in the above subgroups is whether or not an address exists, which was found to be the variable with the most potential for bias in all eight geographic regions. The percentage of eligible households with a mailing address is 46 percent, and the percentage of participating households with a mailing address is 57 percent. The use of this variable during sampling and weighting activities will result in a more efficient sample design, and a more effective weighting process. More discussion on the use of mailing address in sample selection will be discussed in a later report. The next section discusses use of mailing address availability and other auxiliary data in the weighting process.

The WSPS medical assistance estimates were also evaluated. The WSPS estimates for Medicaid are significantly higher than the CPS estimates for those 18 years of age and under. The WSPS estimates compare well to the NHIS estimates for those less than 18 years of age, and for the 18 to 64 year olds and the total population. It is unclear if the CPS or NHIS estimates are as reliable as the WSPS estimates, since the WSPS relies on administrative record counts to the extent that such records are purged for deaths, out-migration, and institutional status on a timely, basis for the medical assistance weights. With that in mind, the next section discusses how a weighting process can take advantage of this strength to help improve other WSPS estimates.

10. Weighting Recommendations

For WSPS, the weighting process was conducted by first treating each respondent as having a weight equal to one, and then adjusting the weights by calibrating to age by race by sex population forecasts for each region, as estimated by OFM. In a more traditional weighting approach, base weights (the reciprocal of the sampling fraction) are first assigned households, to account for differential sampling rates, and also to facilitate the accepted statistical theory that allows for inferences to be made to the general population. Subsequently, the potential for bias is usually identified with a multivariate approach, prior to weighting the data. That is, a classification algorithm (e.g., Search) is processed on auxiliary data available for both nonrespondents and respondents. The algorithm identifies weighting classes that best explain the variation in response rates. Within each weighting class, the weights of nonrespondents are transferred to the weights of the respondents, so that respondents in that weighting class represent the nonrespondents. In such an approach, the bias is reduced to the extent that the weighting variables are related to the key survey variables. Lastly, the weights are calibrated to known totals from external sources, to reduce sampling variability, and to reduce coverage bias and nonresponse bias.

We also note that the current poststratification process is carried out at a very low level, resulting in extremely small cell sizes involved in the adjustment. In general, this causes unstable adjustments and large variation in weights, which has a disproportionate effect on the sampling error. One immediate improvement would be to ensure that there are at least 30 cases in each cell. Another improvement would be to use raking (iterative poststratification), which allows for weights to be calibrated to more reliable marginal totals while still making use of several variables (discussed in more detail below). The raking procedure and other weighting steps are recommended in the following paragraphs.

Recommendation #1: Create base weights. Creating initial base weights for households in the sample accounts for the differential sampling rates (probabilities of selection) across regions and forms the theoretical basis that allows for inferences to be made to the general population.

Recommendation #2: Nonresponse adjustment. Section 9 discusses variables and subgroups where there is some concern about the existence of nonresponse bias. With the exception of Marital status, there is an exchange-level auxiliary variable counterpart that exists from a commercial vendor, which has potential for reducing bias if included in a weighting process, since the variable exists for both respondents and nonrespondents. In addition, mailing address availability status, a key variable found in the analysis for reducing nonresponse bias, can be incorporated into the weighting process. To reduce nonresponse bias, process a classification algorithm to develop weighting classes on auxiliary variables, and implement the weighting adjustments within each weighting class.

Recommendation #3: Monitor variation in weights and adjust if necessary. The variation in weights, as shown in Tables 5 and 6, contributes to the uncertainty of WSPS estimates. A trimming step can be employed by reducing the dominance of extreme weights and redistributing the weights to non-trimmed records. This can also be accomplished in the current poststratification process (or in the raking adjustment covered in recommendation #4) by collapsing cells with large adjustment factors with similar cells. This creates more stable factors (as mentioned earlier) and reduces the variation due to extreme weights. A related issue can be seen in the Other Puget Metro region. The mean weight is over twice as large as the mean in any other region which increases the variation in state estimates. A more efficient state design would be to add sample to this region. This will be covered more in a later report.

Table 5. Distribution of population weights, by region: 2006

	N	Mean	Min	25th pctl	Median	75th pctl	Max	(CV)	Design effect due to the weighting variation (1+ CV**2)	Ratio of max weight to median
Total	17,584	362.57	22	196	251	367	8,232	92.23	1.85	32.80
North Puget	1,788	218.22	66	165	194	248	994	47.50	1.23	5.12
West Balance	1,791	248.37	46	221	237	264	3,621	51.03	1.26	15.28
King	4,306	426.18	104	307	354	434	3,357	60.38	1.36	9.48
Other Puget Metro	1,926	996.81	239	704	910	1,092	8,232	54.01	1.29	9.05
Clark	1,934	208.75	22	144	203	240	1,377	38.24	1.15	6.78
East Balance	1,918	250.97	37	181	228	311	1,852	44.47	1.20	8.12
Spokane	1,914	231.88	43	192	209	248	1,225	44.23	1.20	5.86
Tri-cities	2,007	227.50	61	151	177	312	1,032	51.10	1.26	5.83

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Table 6. Distribution of medical assistance weights, by region: 2006

	N	Mean	Min	25th pctl	Median	75th pctl	Max	(CV)	Design effect due to the weighting variation (1+ CV**2)	Ratio of max weight to median
Total	17,584	362.59	37	198	264	397	2,616	75.67	1.57	9.91
North Puget	1,788	218.45	37	168	195	234	642	37.63	1.14	3.29
West Balance	1,791	248.35	64	216	243	264	1,819	32.57	1.11	7.49
King	4,306	426.22	272	342	384	436	2,616	33.09	1.11	6.81
Other Puget Metro	1,926	996.63	331	758	958	1,099	1,933	30.26	1.09	2.02
Clark	1,934	208.76	62	169	206	238	1,007	25.53	1.07	4.89
East Balance	1,918	250.86	65	200	232	293	1,062	33.20	1.11	4.58
Spokane	1,914	231.86	82	179	213	250	578	37.26	1.14	2.71
Tri-cities	2,007	227.63	85	175	192	256	997	37.64	1.14	5.19

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Recommendation #4: Raking adjustment. A raking adjustment (or iterative poststratification adjustment) allows for more reliable adjustment factors, and the inclusion of more variables. In addition, if one adds a raking dimension for medical assistance counts, one set of weights, used for both population and medical assistance can be created. Furthermore, the strength of the administrative counts can also provide some benefit to other survey estimates by including it in the

derivation of the weights. This process then eliminates need for a separate set of medical assistance weights.

Recommendation #5: Evaluate the recommended weighting process on 2006 WSPS data and consider other adjustments. The steps in the recommendations can be evaluated with the existing 2006 data to determine their impact on reducing the bias due to nonresponse. One can also explore other improvements, such as an adjustment for multiple phone lines, and adjustments for unknown eligibility status (such as not-at-homes, and answering machines). These are key weighting adjustments that should be considered to improve the quality of the survey estimates.

Recommendation #6: Produce standard errors. To appropriately account for characteristics of the sample design (clustering and stratification) a replication approach, or use of Taylor's Series methodology, can facilitate the production of standard errors associated with WSPS estimates. The standard errors provide data users with a measure of the reliability of the WSPS estimates, and the ability to measure whether changes between variables or over time are significant.

REFERENCES

- Brick, M., Morganstein, D., and Valliant, R. (2000). *Analysis of complex sample data using replication*. Rockville, MD: Westat
- Cohen, R. and Martinez, M. (2007). *Health insurance coverage: Early release of estimates from the National Health Interview Survey, 2006*. Atlanta, GA: Centers for Disease Control. (Available at <http://www.cdc.gov/nchs/data/nhis/earlyrelease/insur200706.pdf>)
- Rust, K.F., and Rao, J.N.K. (1996). Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research*, 5, 282-310.
- Sonquist, J., Baker, E., and Morgan, J. (1974). *Searching for structure: revised edition*. Ann Arbor, MI: Institute for Social Research.
- Westat. (2002). *WesVar 4.2 User's Guide*. Rockville, MD: Westat, Inc.

Appendix A

Descriptions of Procedures

Base Weight Computations

Since base weights were not incorporated into the weighting procedures for WSPS, for this analysis, Westat assigned base weights. Since the WSPS telephone number sample was an equal probability sample within a region (with varying sampling rates across region), the base weight of a telephone number is the ratio of the total number of telephone numbers in the eligible 100-banks in the region to the number of telephone numbers sampled by region. Each 100-bank contains the 100 telephone numbers with the same first eight digits (i.e., the identical area code, telephone exchange, and first two of the last four digits of the telephone number). The number of eligible 100-banks by region was supplied to Westat from Gilmore. For each region, the base weight is

$$BW = \frac{N \cdot 100}{n}$$

where N is the total number of eligible 100-banks in the region and n is the number of sampled telephone numbers in the region. Table A-1 shows the base weight by region.

Table A-1. Base Weights

Region	Total sample	100-banks	Base weight
1	6,147	4,438	72.1978
2	5,458	4,493	82.3195
3	19,016	20,353	107.0309
4	5,559	16,135	290.2500
5	6,973	3,314	47.5262
6	5,449	5,354	98.2566
7	4,706	3,954	84.0204
8	4,897	3,775	77.0880
Total	58,205	61,816	

The initial base weights were adjusted in a manner analogous to the response rate computation (RR4) that is described in the WSPS Data Collection Report.

Variance Estimation – Replication

The precision of the sample estimates derived from a survey can be evaluated by estimating the variances of these estimates. In sample surveys, direct estimates of the variances, assuming a simple random sample, will typically underestimate the variability in the estimates.

The design of WSPS deviates from the assumption of simple random sampling, since households, via telephone numbers, were sampled in a stratified design. Replication was the method used to estimate variances in this analysis.

The idea underlying replication is to draw subsamples from the sample, compute the estimate from each of the subsamples, and estimate the variance from the variability of the subsample estimates. Specifically, subsamples of the original *full* sample are selected to calculate subsample estimates of a parameter for which a *full-sample* estimate of interest has been generated. The variability of these subsample estimates about the estimate for the full sample can then be computed. The subsamples are called *replicates* or replicate subsamples, and the estimates from the subsamples are called *replicate estimates*. Balanced repeated replication (BRR) and jackknife replication are two approaches to forming subsamples. Rust and Rao (1996) discuss these and other replication methods, show how the units included in the subsample can be defined using variance strata and units, and describe how these methods can be implemented using weights. The paired jackknife replication method was used to create the replicate weights for WSPS (Brick, Morganstein, and Valliant 2000).

Typically, to create the variance strata and variance units, sampled telephone numbers are arranged in the same sort order used in sample selection. Since the sort order was not available, the telephone numbers⁷ were arranged by telephone exchange (and randomly within exchange) within a region, to best replicate the actual sort order. Adjacent sampled telephone numbers were paired to establish initial variance estimation strata (the first two sampled phone numbers were the first initial stratum, the third and fourth sampled telephone numbers were the second initial stratum, etc). Each telephone number in the pair was randomly assigned to be either the first or second variance unit within the variance stratum. Each pair was sequentially assigned to one of 60 final variance estimation strata (the first pair to variance estimation stratum 1, the second to stratum 2, ... the 60th pair to stratum 60, the 61st pair to stratum 1, etc.). As a result, each variance stratum had approximately the same number of telephone numbers for each region.

In addition, the weighting adjustments also make the simple random sampling formula assumptions inappropriate and generally are accounted for in the variance estimation. However, the weighting adjustments for this paper were not replicated, and the weighting effects

⁷ Of the 7,503 telephone numbers purged, 710 were not available from Gilmore and were excluded from the variance assignment. This has a small, but likely negligible, effect on the estimated variances.

not captured in the variances. Weighting adjustments generally add to the variance, so the standard errors and confidence intervals shown here are likely to be somewhat understated.

Software

The replicate weights were created using proprietary software. The bivariate analysis and the logistic regression were performed using WesVar (Westat 2002). The replicate weights were used to properly account for the complex sample design. The classification algorithm uses a proprietary SAS macro developed at Westat. The macro uses Search software, which is available at no cost from the Institute for Survey Research – University of Michigan (<http://www.isr.umich.edu/src/smp/search/>)

Appendix B

Bivariate Analysis Tables

Table B-1. Percentage distribution of eligible and participating households for Washington State, by selected characteristics: 2006

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Region							
North Puget	28	6.9	7.1	0.2	0.03	990.60	<0.0001
West Balance	29	7.7	8.1	0.4	0.05		
King	22	31.2	25.4	-5.8	-0.19		
Other Puget Metro	28	28.2	28.8	0.6	0.02		
Clark	26	5.0	4.7	-0.3	-0.06		
East Balance	32	8.4	9.8	1.4	0.17		
Spokane	35	6.6	8.3	1.7	0.26		
Tri-cities	35	6.0	7.7	1.7	0.28		
Mailing address available							
Yes	34	46.2	57.1	11.0	0.24	360.74	<0.0001
No	22	53.8	42.9	-11.0	-0.20		
Median home value							
Low: < \$162,105	31	24.9	28.6	3.7	0.15	442.04	<0.0001
Medium: \$162,105 to \$213,734	28	35.2	36.4	1.2	0.03		
High:> \$ 213,734	24	39.9	35.0	-4.9	-0.12		
Metro status							
In MSA	27	81.6	80.0	-1.6	-0.02	168.95	<0.0001
Outside MSA	30	18.4	20.0	1.6	0.09		
Percent of population between 0 and 17 years old (inclusive)							
Low: less than 23.2	27	32.3	32.1	-0.2	-0.01	29.30	<0.0001
Medium: 23.2 to 26.1	28	35.2	36.6	1.4	0.04		
High: greater than 26.1	26	32.5	31.3	-1.2	-0.04		
Percent of population between 18 and 24 years old (inclusive)							
Low: less than 9.0	24	34.3	29.8	-4.5	-0.13	548.72	<0.0001
Medium: 9.0 to 9.8	28	37.9	38.2	0.3	0.01		
High: greater than 9.8	31	27.7	31.9	4.2	0.15		

Table B-1. Percentage distribution of eligible and participating households for Washington State, by selected characteristics: 2006 (Continued)

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Percent of population 65 years old and up							
Low: less than 10.4	25	36.0	33.4	-2.6	-0.07	118.20	<0.0001
Medium: 10.4 to 13.1	29	34.9	36.6	1.7	0.05		
High: greater than 13.1	28	29.1	30.0	0.9	0.03		
Percent college graduates							
Low: less than 22.9	29	30.9	32.3	1.5	0.05	34.47	<0.0001
Medium: 22.9 to 31.9	27	33.3	33.1	-0.2	-0.01		
High: greater than 31.9	26	35.8	34.5	-1.3	-0.04		
Percent renters							
Low: less than 26.9	27	32.8	32.6	-0.2	-0.01	154.15	<0.0001
Medium: 26.9 to 36.2	30	31.0	33.6	2.5	0.08		
High: greater than or equal to 36.2	26	36.2	33.9	-2.3	-0.06		
Percent with Income \$100K and up							
Low: less than 11.8	30	25.3	27.6	2.3	0.09	133.72	<0.0001
Medium: 11.8 to 18.2	27	36.0	35.7	-0.3	-0.01		
High: greater than 18.2	26	38.7	36.8	-1.9	-0.05		
Percent with Income between \$1K-10K (inclusive)							
Low: less than 5	26	37.8	36.6	-1.2	-0.03	45.50	<0.0001
Medium: 5 to 7.9	27	35.2	35.0	-0.2	-0.01		
High: greater than 7.9	29	27.1	28.4	1.4	0.05		
Percent White							
Low: less than 79.4	25	41.3	38.4	-2.8	-0.07	119.81	<0.0001
Medium: 79.4 to 87.5	28	31.2	32.2	1.1	0.03		
High: greater than 87.5	29	27.6	29.4	1.8	0.06		
Percent Black							
Low: less than 0.7	29	24.2	25.5	1.4	0.06	213.07	<0.0001
Medium: 0.7 to 1.8	29	33.2	35.6	2.4	0.07		
High: greater than 1.8	25	42.6	38.8	-3.8	-0.09		
Percent Hispanic							
Low: less than 4	28	27.5	28.7	1.2	0.04	26.29	<0.0001
Medium: 4 to 6.6	27	41.0	40.8	-0.3	-0.01		
High: greater than 6.6	27	31.4	30.6	-0.9	-0.03		

Table B-1. Percentage distribution of eligible and participating households for Washington State, by selected characteristics: 2006 (Continued)

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative Bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Percent Asian							
Low: less than 1.6	30	23.2	25.5	2.2	0.10	360.37	<0.0001
Medium: 1.6 to 4.8	30	33.0	35.7	2.8	0.08		
High: greater than 4.8	24	43.8	38.8	-5.0	-0.11		

Computation not applicable

† No respondents

NOTE: Detail may not sum to totals because of rounding.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Table B-2. Percentage distribution of eligible and participating households for North Puget region, by selected characteristics: 2006

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Mailing address available							
Yes	37	40.6	52.7	6.6	0.16	88.46	<0.0001
No	23	59.4	47.3	-12.2	-0.20		
Median home value							
Low: < \$162,105	20	2.8	2.0	-0.8	-0.29	40.07	<0.0001
Medium: \$162,105 to \$213,734	30	63.4	66.2	2.8	0.04		
High:> \$ 213,734	27	33.8	31.8	-1.9	-0.06		
Metro status							
In MSA	30	67.8	71.4	3.6	0.05	40.53	<0.0001
Outside MSA	25	32.2	28.6	-3.6	-0.11		
Percent of population between 0 and 17 years old (inclusive)							
Low: less than 23.2	30	50.3	52.9	2.6	0.05	25.96	<0.0001
Medium: 23.2 to 26.1	28	20.9	20.5	-0.4	-0.02		
High: greater than 26.1	26	28.9	26.6	-2.2	-0.08		
Percent of population between 18 and 24 years old (inclusive)							
Low: less than 9.0	27	34.0	32.6	-1.4	-0.04	15.59	0.0003
Medium: 9.0 to 9.8	27	21.0	20.1	-0.9	-0.04		
High: greater than 9.8	30	45.0	47.3	2.3	0.05		
Percent of population 65 years old and up							
Low: less than 10.4	28	7.5	7.5	-0.1	-0.01	13.24	0.0010
Medium: 10.4 to 13.1	29	53.5	55.7	2.1	0.04		
High: greater than 13.1	27	38.9	36.9	-2.0	-0.05		
Percent college graduates							
Low: less than 22.9	28	29.5	29.2	-0.4	-0.01	11.84	0.0026
Medium: 22.9 to 31.9	27	35.4	34.1	-1.3	-0.04		
High: greater than 31.9	30	35.1	36.8	1.6	0.05		

Table B-2. Percentage distribution of eligible and participating households for North Puget region, by selected characteristics: 2006 (Continued)

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Percent renters							
Low: less than 26.9	28	36.0	35.2	-0.9	-0.02	34.88	<0.0001
Medium: 26.9 to 36.2	26	24.6	22.8	-1.8	-0.07		
High: greater than or equal to 36.2	30	39.4	42.1	2.7	0.07		
Percent with Income \$100K and up							
Low: less than 11.8	32	14.3	16.1	1.8	0.13	68.01	<0.0001
Medium: 11.8 to 18.2	28	73.0	73.4	0.4	0.01		
High: greater than 18.2	23	12.7	10.5	-2.2	-0.17		
Percent with Income between \$1K-10K (inclusive)							
Low: less than 5	30	15.0	16.1	1.2	0.08	51.78	<0.0001
Medium: 5 to 7.9	26	55.1	51.1	-4.0	-0.07		
High: greater than 7.9	31	30.0	32.8	2.8	0.09		
Percent White							
Low: less than 79.4	25	16.3	14.5	-1.8	-0.11	85.52	<0.0001
Medium: 79.4 to 87.5	32	42.8	47.8	5.0	0.12		
High: greater than 87.5	26	40.8	37.7	-3.2	-0.08		
Percent Black							
Low: less than 0.7	26	51.7	47.8	-3.9	-0.08	65.24	<0.0001
Medium: 0.7 to 1.8	31	40.8	44.1	3.3	0.08		
High: greater than 1.8	30	7.5	8.1	0.6	0.08		
Percent Hispanic							
Low: less than 4	27	30.9	29.3	-1.6	-0.05	58.54	<0.0001
Medium: 4 to 6.6	31	44.8	48.6	3.8	0.09		
High: greater than 6.6	26	24.3	22.1	-2.2	-0.09		
Percent Asian							
Low: less than 1.6	26	31.8	29.6	-2.2	-0.07	28.69	<0.0001
Medium: 1.6 to 4.8	29	60.7	62.5	1.7	0.03		
High: greater than 4.8	30	7.5	8.0	0.5	0.07		

Computation not applicable

† No respondents

NOTE: Detail may not sum to totals because of rounding.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Table B-3. Percentage distribution of eligible and participating households for West Balance region, by selected characteristics: 2006

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Mailing address available							
Yes	35	45.7	55.3	9.1	0.20	41.60	<0.0001
No	24	54.3	44.7	-9.5	-0.18		
Median home value							
Low: < \$162,105	30	68.6	70.7	2.1	0.03	21.77	<0.0001
Medium: \$162,105 to \$213,734	27	29.4	27.2	-2.2	-0.07		
High: > \$ 213,734	30	2.1	2.1	0.1	0.03		
Metro status							
In MSA	†	†	†.	†	†	#	#
Outside MSA	29	100.0	100.0	0.0	0.00		
Percent of population between 0 and 17 years old (inclusive)							
Low: less than 23.2	28	53.7	52.2	-1.5	-0.03	14.87	0.0006
Medium: 23.2 to 26.1	29	41.7	42.3	0.7	0.02		
High: greater than 26.1	34	4.6	5.5	0.8	0.17		
Percent of population between 18 and 24 years old (inclusive)							
Low: less than 9.0	26	28.8	26.1	-2.7	-0.09	68.11	<0.0001
Medium: 9.0 to 9.8	28	39.0	37.6	-1.4	-0.04		
High: greater than 9.8	32	32.3	36.4	4.1	0.13		
Percent of population 65 years old and up							
Low: less than 10.4	46	1.8	2.9	1.1	0.58	29.67	<0.0001
Medium: 10.4 to 13.1	26	5.8	5.3	-0.5	-0.09		
High: greater than 13.1	29	92.3	91.7	-0.6	-0.01		
Percent college graduates							
Low: less than 22.9	29	80.2	80.6	0.4	0.00	1.99	0.2385
Medium: 22.9 to 31.9	28	14.8	14.4	-0.4	-0.03		
High: greater than 31.9	29	5.1	5.1	0.0	0.00		

Table B-3. Percentage distribution of eligible and participating households for West Balance region, by selected characteristics: 2006 (Continued)

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Percent renters							
Low: less than 26.9	28	47.2	46.6	-0.6	-0.01	1.13	0.4817
Medium: 26.9 to 36.2	29	44.4	45.1	0.7	0.02		
High: greater than or equal to 36.2	28	8.4	8.3	-0.1	-0.01		
Percent with Income \$100K and up							
Low: less than 11.8	29	84.3	85.5	1.2	0.01	12.62	0.0004
Medium: 11.8 to 18.2	27	15.7	14.5	-1.2	-0.08		
High: greater than 18.2	†	†	†	†	†		
Percent with Income between \$1K-10K (inclusive)							
Low: less than 5	31	2.0	2.1	0.1	0.06	13.70	0.0010
Medium: 5 to 7.9	27	23.6	21.8	-1.7	-0.07		
High: greater than 7.9	29	74.4	76.0	1.6	0.02		
Percent White							
Low: less than 79.4	40	2.9	4.0	1.1	0.40	15.88	0.0002
Medium: 79.4 to 87.5	29	27.6	27.4	-0.2	-0.01		
High: greater than 87.5	28	69.5	68.6	-1.0	-0.01		
Percent Black							
Low: less than 0.7	29	72.6	72.0	-0.6	-0.01	1.07	0.4469
Medium: 0.7 to 1.8	29	27.1	27.6	0.5	0.02		
High: greater than 1.8	38	0.3	0.4	0.1	0.31		
Percent Hispanic							
Low: less than 4	27	44.4	41.5	-2.8	-0.06	30.09	<0.0001
Medium: 4 to 6.6	31	29.0	31.0	2.1	0.07		
High: greater than 6.6	30	26.7	27.4	0.7	0.03		
Percent Asian							
Low: less than 1.6	30	65.3	67.8	2.5	0.04	19.49	<0.0001
Medium: 1.6 to 4.8	27	34.7	32.2	-2.5	-0.07		
High: greater than 4.8	†	†	†	†	†		

Computation not applicable

† No respondents

NOTE: Detail may not sum to totals because of rounding.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Table B-4. Percentage distribution of eligible and participating households for King region, by selected characteristics: 2006

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Mailing address available							
Yes	28	42.4	53.0	6.9	0.16	83.93	<0.0001
No	18	57.6	47.0	-10.6	-0.18		
Median home value							
Low: < \$162,105	†	†	†	†	†	59.14	<0.0001
Medium: \$162,105 to \$213,734	19	15.6	13.4	-2.2	-0.14		
High:> \$ 213,734	23	84.4	86.6	2.2	0.03		
Metro status							
In MSA	22	100.0	100.0	0.0	0.00	#	#
Outside MSA	†	†	†	†	†		
Percent of population between 0 and 17 years old (inclusive)							
Low: less than 23.2	23	50.7	53.0	2.3	0.05	58.64	<0.0001
Medium: 23.2 to 26.1	20	19.7	18.0	-1.7	-0.09		
High: greater than 26.1	22	29.6	28.9	-0.6	-0.02		
Percent of population between 18 and 24 years old (inclusive)							
Low: less than 9.0	22	77.9	78.3	0.4	0.01	19.83	<0.0001
Medium: 9.0 to 9.8	21	17.6	16.7	-0.9	-0.05		
High: greater than 9.8	25	4.5	5.0	0.5	0.11		
Percent of population 65 years old and up							
Low: less than 10.4	22	48.8	49.1	0.3	0.01	30.16	<0.0001
Medium: 10.4 to 13.1	23	33.2	34.5	1.3	0.04		
High: greater than 13.1	20	18.0	16.4	-1.6	-0.09		
Percent college graduates							
Low: less than 22.9	22	4.6	4.6	0.0	0.00	147.32	<0.0001
Medium: 22.9 to 31.9	19	24.1	20.1	-4.0	-0.17		
High: greater than 31.9	24	71.3	75.3	4.0	0.06		

Table B-4. Percentage distribution of eligible and participating households for King region, by selected characteristics: 2006 (Continued)

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Percent renters							
Low: less than 26.9	24	22.6	23.9	1.3	0.06	22.90	<0.0001
Medium: 26.9 to 36.2	23	19.9	20.2	0.3	0.02		
High: greater than or equal to 36.2	22	57.5	55.9	-1.6	-0.03		
Percent with Income \$100K and up							
Low: less than 11.8	14	2.9	1.8	-1.1	-0.37	62.19	<0.0001
Medium: 11.8 to 18.2	20	31.3	28.7	-2.6	-0.08		
High: greater than 18.2	24	65.9	69.5	3.7	0.06		
Percent with Income between \$1K-10K (inclusive)							
Low: less than 5	23	44.8	46.2	1.3	0.03	49.20	<0.0001
Medium: 5 to 7.9	23	42.7	43.2	0.6	0.01		
High: greater than 7.9	19	12.5	10.6	-1.9	-0.15		
Percent White							
Low: less than 79.4	21	65.6	62.2	-3.4	-0.05	136.21	<0.0001
Medium: 79.4 to 87.5	24	25.5	27.2	1.7	0.07		
High: greater than 87.5	27	8.9	10.6	1.7	0.20		
Percent Black							
Low: less than 0.7	27	5.6	6.7	1.1	0.20	58.90	<0.0001
Medium: 0.7 to 1.8	23	25.0	26.3	1.3	0.05		
High: greater than 1.8	22	69.4	67.0	-2.4	-0.03		
Percent Hispanic							
Low: less than 4	25	21.2	23.7	2.5	0.12	58.72	<0.0001
Medium: 4 to 6.6	22	45.6	45.0	-0.6	-0.01		
High: greater than 6.6	21	33.2	31.4	-1.8	-0.06		
Percent Asian							
Low: less than 1.6	24	2.2	2.4	0.2	0.09	56.02	<0.0001
Medium: 1.6 to 4.8	25	10.8	12.1	1.4	0.13		
High: greater than 4.8	22	87.0	85.4	-1.6	-0.02		

Computation not applicable

† No respondents

NOTE: Detail may not sum to totals because of rounding.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Table B-5. Percentage distribution of eligible and participating households for Other Puget Metro region, by selected characteristics: 2006

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Mailing address available							
Yes	34	49.5	59.5	13.3	0.27	49.10	<0.0001
No	22	50.5	40.5	-10.0	-0.20		
Median home value							
Low: < \$162,105	26	13.1	12.5	-0.7	-0.05	14.87	0.0006
Medium: \$162,105 to \$213,734	30	53.7	56.8	3.1	0.06		
High:> \$ 213,734	26	33.2	30.7	-2.4	-0.07		
Metro status							
In MSA	28	100.0	100.0	0.0	0.00	#	#
Outside MSA	†	†	†	†	†		
Percent of population between 0 and 17 years old (inclusive)							
Low: less than 23.2	32	18.1	20.8	2.7	0.15	34.35	<0.0001
Medium: 23.2 to 26.1	29	44.8	46.4	1.5	0.03		
High: greater than 26.1	25	37.1	32.8	-4.3	-0.11		
Percent of population between 18 and 24 years old (inclusive)							
Low: less than 9.0	27	12.5	12.1	-0.5	-0.04	12.78	0.0016
Medium: 9.0 to 9.8	27	57.9	55.8	-2.1	-0.04		
High: greater than 9.8	30	29.6	32.2	2.6	0.09		
Percent of population 65 years old and up							
Low: less than 10.4	25	46.9	42.5	-4.4	-0.09	37.59	<0.0001
Medium: 10.4 to 13.1	30	37.3	40.5	3.3	0.09		
High: greater than 13.1	30	15.9	17.0	1.1	0.07		
Percent college graduates							
Low: less than 22.9	27	36.4	34.7	-1.7	-0.05	4.41	0.1022
Medium: 22.9 to 31.9	29	38.4	39.3	1.0	0.03		
High: greater than 31.9	29	25.2	26.0	0.7	0.03		

Table B-5. Percentage distribution of eligible and participating households for Other Puget Metro region, by selected characteristics: 2006 (Continued)

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Percent renters							
Low: less than 26.9	27	41.0	38.9	-2.1	-0.05	16.11	0.0003
Medium: 26.9 to 36.2	31	27.7	30.3	2.6	0.09		
High: greater than or equal to 36.2	27	31.3	30.7	-0.6	-0.02		
Percent with Income \$100K and up							
Low: less than 11.8	25	13.2	11.8	-1.5	-0.11	7.14	0.0210
Medium: 11.8 to 18.2	29	42.5	43.7	1.3	0.03		
High: greater than 18.2	28	44.3	44.5	0.2	0.00		
Percent with Income between \$1K-10K (inclusive)							
Low: less than 5	28	56.5	55.6	-0.8	-0.01	10.55	0.0047
Medium: 5 to 7.9	30	30.7	32.7	2.0	0.06		
High: greater than 7.9	25	12.8	11.7	-1.1	-0.09		
Percent White							
Low: less than 79.4	28	45.5	45.8	0.3	0.01	0.61	0.7347
Medium: 79.4 to 87.5	28	31.6	31.8	0.2	0.01		
High: greater than 87.5	27	22.9	22.4	-0.5	-0.02		
Percent Black							
Low: less than 0.7	27	14.4	13.8	-0.6	-0.04	1.23	0.5384
Medium: 0.7 to 1.8	28	29.8	29.9	0.1	0.00		
High: greater than 1.8	28	55.8	56.3	0.5	0.01		
Percent Hispanic							
Low: less than 4	29	18.8	19.5	0.7	0.04	14.87	0.0005
Medium: 4 to 6.6	29	58.9	60.9	2.0	0.03		
High: greater than 6.6	25	22.3	19.6	-2.7	-0.12		
Percent Asian							
Low: less than 1.6	26	9.2	8.5	-0.7	-0.08	2.61	0.2635
Medium: 1.6 to 4.8	28	42.0	42.6	0.7	0.02		
High: greater than 4.8	28	48.8	48.9	0.0	0.00		

Computation not applicable

† No respondents

NOTE: Detail may not sum to totals because of rounding.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Table B-6. Percentage distribution of eligible and participating households for Clark region, by selected characteristics: 2006

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Mailing address available							
Yes	34	36.9	48.9	2.7	0.07	57.61	<0.0001
No	21	63.1	51.1	-12.0	-0.19		
Median home value							
Low: < \$162,105	22	3.0	2.5	-0.5	-0.16	14.59	0.0006
Medium: \$162,105 to \$213,734	26	62.6	63.3	0.7	0.01		
High:> \$ 213,734	26	34.4	34.2	-0.2	-0.01		
Metro status							
In MSA	26	99.2	99.3	0.2	0.00	2.50	0.1140
Outside MSA	21	0.8	0.7	-0.2	-0.20		
Percent of population between 0 and 17 years old (inclusive)							
Low: less than 23.2	†	†	†	†	†	0.97	0.3238
Medium: 23.2 to 26.1	26	38.0	38.4	0.4	0.01		
High: greater than 26.1	26	62.0	61.6	-0.4	-0.01		
Percent of population between 18 and 24 years old (inclusive)							
Low: less than 9.0	21	3.3	2.6	-0.6	-0.19	9.48	0.0047
Medium: 9.0 to 9.8	26	81.9	82.3	0.4	0.00		
High: greater than 9.8	26	14.8	15.1	0.3	0.02		
Percent of population 65 years old and up							
Low: less than 10.4	26	57.4	57.7	0.3	0.01	0.55	0.4602
Medium: 10.4 to 13.1	26	42.6	42.3	-0.3	-0.01		
High: greater than 13.1	†	†	†	†	†		
Percent college graduates							
Low: less than 22.9	24	21.7	20.0	-1.7	-0.08	20.12	<0.0001
Medium: 22.9 to 31.9	26	75.9	78.0	2.1	0.03		
High: greater than 31.9	21	2.5	2.0	-0.5	-0.19		

Table B-6. Percentage distribution of eligible and participating households for Clark region, by selected characteristics: 2006 (Continued)

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Percent renters							
Low: less than 26.9	25	44.6	44.0	-0.6	-0.01	49.77	<0.0001
Medium: 26.9 to 36.2	28	35.3	37.7	2.5	0.07		
High: greater than or equal to 36.2	23	20.1	18.3	-1.8	-0.09		
Percent with Income \$100K and up							
Low: less than 11.8	24	16.2	14.8	-1.4	-0.08	26.10	<0.0001
Medium: 11.8 to 18.2	27	44.8	46.1	1.3	0.03		
High: greater than 18.2	26	39.0	39.1	0.1	0.00		
Percent with Income between \$1K-10K (inclusive)							
Low: less than 5	27	74.5	77.2	2.7	0.04	48.77	<0.0001
Medium: 5 to 7.9	21	8.6	7.0	-1.6	-0.18		
High: greater than 7.9	24	16.9	15.8	-1.1	-0.07		
Percent White							
Low: less than 79.4	21	2.2	1.7	-0.4	-0.20	29.08	<0.0001
Medium: 79.4 to 87.5	27	70.8	73.0	2.1	0.03		
High: greater than 87.5	24	27.0	25.3	-1.7	-0.06		
Percent Black							
Low: less than 0.7	26	10.8	10.7	0.0	0.00	1.23	0.5293
Medium: 0.7 to 1.8	25	33.0	32.6	-0.4	-0.01		
High: greater than 1.8	26	56.2	56.7	0.5	0.01		
Percent Hispanic							
Low: less than 4	24	26.9	25.0	-1.9	-0.07	79.81	<0.0001
Medium: 4 to 6.6	28	53.0	56.7	3.7	0.07		
High: greater than 6.6	23	20.1	18.3	-1.8	-0.09		
Percent Asian							
Low: less than 1.6	25	20.3	19.6	-0.6	-0.03	12.27	0.0020
Medium: 1.6 to 4.8	25	40.0	39.2	-0.8	-0.02		
High: greater than 4.8	27	39.8	41.2	1.4	0.04		

Computation not applicable

† No respondents

NOTE: Detail may not sum to totals because of rounding.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Table B-7. Percentage distribution of eligible and participating households for East Balance region, by selected characteristics: 2006

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Mailing address available							
Yes	39	47.6	57.9	11.8	0.25	53.96	<0.0001
No	26	52.4	42.1	-10.3	-0.20		
Median home value							
Low: < \$162,105	32	76.3	77.4	1.1	0.01	2.08	0.2428
Medium: \$162,105 to \$213,734	30	23.2	22.1	-1.1	-0.05		
High:> \$ 213,734	38	0.4	0.5	0.1	0.21		
Metro status							
In MSA	33	0.1	0.1	0.0	0.06	0.00	0.9609
Outside MSA	32	99.9	99.9	0.0	0.00		
Percent of population between 0 and 17 years old (inclusive)							
Low: less than 23.2	32	34.5	34.5	0.1	0.00	2.13	0.3262
Medium: 23.2 to 26.1	31	41.1	40.3	-0.8	-0.02		
High: greater than 26.1	33	24.4	25.1	0.7	0.03		
Percent of population between 18 and 24 years old (inclusive)							
Low: less than 9.0	26	10.6	8.7	-1.9	-0.18	22.08	<0.0001
Medium: 9.0 to 9.8	31	29.9	29.4	-0.5	-0.02		
High: greater than 9.8	33	59.5	61.9	2.4	0.04		
Percent of population 65 years old and up							
Low: less than 10.4	33	11.2	11.6	0.4	0.04	18.29	0.0001
Medium: 10.4 to 13.1	36	13.6	15.2	1.6	0.12		
High: greater than 13.1	31	75.2	73.1	-2.0	-0.03		
Percent college graduates							
Low: less than 22.9	31	63.8	62.7	-1.1	-0.02	3.91	0.1127
Medium: 22.9 to 31.9	33	31.4	32.4	1.0	0.03		
High: greater than 31.9	33	4.7	4.9	0.2	0.04		

Table B-7. Percentage distribution of eligible and participating households for East Balance region, by selected characteristics: 2006 (Continued)

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Percent renters							
Low: less than 26.9	25	19.5	15.3	-4.1	-0.21	70.77	<0.0001
Medium: 26.9 to 36.2	33	63.3	66.8	3.5	0.05		
High: greater than or equal to 36.2	33	17.2	17.9	0.7	0.04		
Percent with Income \$100K and up							
Low: less than 11.8	33	77.4	79.5	2.1	0.03	10.05	0.0052
Medium: 11.8 to 18.2	29	20.9	18.9	-2.0	-0.09		
High: greater than 18.2	29	1.8	1.6	-0.2	-0.09		
Percent with Income between \$1K-10K (inclusive)							
Low: less than 5	40	1.4	1.7	0.4	0.27	5.31	0.0366
Medium: 5 to 7.9	30	28.2	26.6	-1.6	-0.06		
High: greater than 7.9	32	70.5	71.7	1.2	0.02		
Percent White							
Low: less than 79.4	33	36.3	37.4	1.1	0.03	66.56	<0.0001
Medium: 79.4 to 87.5	35	29.6	32.9	3.3	0.11		
High: greater than 87.5	28	34.0	29.6	-4.4	-0.13		
Percent Black							
Low: less than 0.7	31	77.4	75.0	-2.4	-0.03	28.24	<0.0001
Medium: 0.7 to 1.8	36	18.0	20.2	2.2	0.12		
High: greater than 1.8	33	4.6	4.8	0.2	0.05		
Percent Hispanic							
Low: less than 4	28	31.4	27.4	-4.1	-0.13	53.22	<0.0001
Medium: 4 to 6.6	36	8.7	9.9	1.3	0.14		
High: greater than 6.6	33	59.9	62.7	2.8	0.05		
Percent Asian							
Low: less than 1.6	31	85.5	84.5	-1.0	-0.01	7.37	0.0198
Medium: 1.6 to 4.8	33	10.9	11.5	0.6	0.05		
High: greater than 4.8	36	3.5	4.0	0.4	0.12		

Computation not applicable

† No respondents

NOTE: Detail may not sum to totals because of rounding.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Table B-8. Percentage distribution of eligible and participating households for Spokane region, by selected characteristics: 2006

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Mailing address available							
Yes	40	55.8	64.4	18.2	0.33	48.39	<0.0001
No	28	44.2	35.6	-8.6	-0.19		
Median home value							
Low: < \$162,105	34	66.6	65.4	-1.2	-0.02	5.56	0.0467
Medium: \$162,105 to \$213,734	36	33.3	34.4	1.1	0.03		
High:> \$ 213,734	50	0.1	0.1	0.0	0.45		
Metro status							
In MSA	35	100.0	100.0	0.0	0.00	#	#
Outside MSA	†	†	†	†	†		
Percent of population between 0 and 17 years old (inclusive)							
Low: less than 23.2	38	12.6	13.8	1.1	0.09	30.11	<0.0001
Medium: 23.2 to 26.1	34	78.9	77.0	-1.9	-0.02		
High: greater than 26.1	38	8.5	9.3	0.8	0.09		
Percent of population between 18 and 24 years old (inclusive)							
Low: less than 9.0	32	13.7	12.6	-1.1	-0.08	12.06	0.0023
Medium: 9.0 to 9.8	35	47.4	48.1	0.7	0.01		
High: greater than 9.8	35	38.9	39.3	0.4	0.01		
Percent of population 65 years old and up							
Low: less than 10.4	39	8.6	9.7	1.1	0.13	18.17	0.0001
Medium: 10.4 to 13.1	34	67.2	66.0	-1.2	-0.02		
High: greater than 13.1	35	24.3	24.4	0.1	0.00		
Percent college graduates							
Low: less than 22.9	31	11.8	10.5	-1.4	-0.12	28.63	<0.0001
Medium: 22.9 to 31.9	35	56.9	57.4	0.4	0.01		
High: greater than 31.9	36	31.2	32.2	1.0	0.03		

Table B-8. Percentage distribution of eligible and participating households for Spokane region, by selected characteristics: 2006 (Continued)

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Percent renters							
Low: less than 26.9	36	33.2	34.3	1.1	0.03	7.63	0.0214
Medium: 26.9 to 36.2	34	39.6	39.2	-0.4	-0.01		
High: greater than or equal to 36.2	34	27.2	26.5	-0.7	-0.02		
Percent with Income \$100K and up							
Low: less than 11.8	34	60.8	59.3	-1.5	-0.02	27.91	<0.0001
Medium: 11.8 to 18.2	38	17.9	19.6	1.7	0.09		
High: greater than 18.2	34	21.3	21.1	-0.2	-0.01		
Percent with Income between \$1K-10K (inclusive)							
Low: less than 5	35	24.3	24.6	0.3	0.01	9.60	0.0067
Medium: 5 to 7.9	36	32.6	33.4	0.8	0.02		
High: greater than 7.9	34	43.1	42.0	-1.2	-0.03		
Percent White							
Low: less than 79.4	33	1.4	1.3	-0.1	-0.05	10.24	0.0040
Medium: 79.4 to 87.5	32	17.6	16.2	-1.5	-0.08		
High: greater than 87.5	35	81.0	82.5	1.5	0.02		
Percent Black							
Low: less than 0.7	38	10.2	11.1	0.9	0.09	36.44	<0.0001
Medium: 0.7 to 1.8	35	71.3	72.5	1.2	0.02		
High: greater than 1.8	31	18.5	16.4	-2.1	-0.11		
Percent Hispanic							
Low: less than 4	35	92.2	92.6	0.4	0.00	1.08	0.5757
Medium: 4 to 6.6	33	6.4	6.1	-0.3	-0.05		
High: greater than 6.6	33	1.4	1.3	-0.1	-0.05		
Percent Asian							
Low: less than 1.6	37	12.2	13.0	0.8	0.06	7.30	0.0069
Medium: 1.6 to 4.8	34	87.8	87.0	-0.8	-0.01		
High: greater than 4.8	†	†	†	†	†		

Computation not applicable

† No respondents

NOTE: Detail may not sum to totals because of rounding.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Table B-9. Percentage distribution of eligible and participating households for Tri-cities region, by selected characteristics: 2006

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Mailing address available							
Yes	43	52.2	64.1	17.9	0.34	53.72	<0.0001
No	26	47.8	35.9	-11.9	-0.25		
Median home value							
Low: < \$162,105	35	78.4	77.9	-0.5	-0.01	4.65	0.0310
Medium: \$162,105 to \$213,734	36	21.6	22.1	0.5	0.03		
High:> \$ 213,734	†	†	†	†	†		
Metro status							
In MSA	35	100.0	100.0	0.0	0.00	#	#
Outside MSA	†	†	†	†	†		
Percent of population between 0 and 17 years old (inclusive)							
Low: less than 23.2	39	1.5	1.7	0.2	0.12	2.54	0.2012
Medium: 23.2 to 26.1	35	20.1	20.4	0.3	0.01		
High: greater than 26.1	35	78.3	77.9	-0.4	-0.01		
Percent of population between 18 and 24 years old (inclusive)							
Low: less than 9.0	†	†	†	†	†	61.63	<0.0001
Medium: 9.0 to 9.8	38	31.9	34.6	2.6	0.08		
High: greater than 9.8	33	68.1	65.4	-2.6	-0.04		
Percent of population 65 years old and up							
Low: less than 10.4	35	42.5	42.6	0.1	0.00	3.79	0.1452
Medium: 10.4 to 13.1	34	36.2	35.6	-0.6	-0.02		
High: greater than 13.1	36	21.3	21.7	0.5	0.02		
Percent college graduates							
Low: less than 22.9	34	61.9	59.9	-2.0	-0.03	114.59	<0.0001
Medium: 22.9 to 31.9	33	20.0	18.8	-1.2	-0.06		
High: greater than 31.9	41	18.1	21.3	3.2	0.18		

Table B-9. Percentage distribution of eligible and participating households for Tri-cities region, by selected characteristics: 2006 (Continued)

Characteristic	Weighted response rate (pct)	Sample of households		Bias	Relative bias	Chi-square	
		Eligibles (percent)	Participating (percent)			Statistic	P value
Percent renters							
Low: less than 26.9	35	32.8	33.4	0.5	0.02	6.19	0.0409
Medium: 26.9 to 36.2	35	36.5	36.7	0.2	0.01		
High: greater than or equal to 36.2	34	30.7	29.9	-0.8	-0.03		
Percent with Income \$100K and up							
Low: less than 11.8	32	31.4	28.7	-2.7	-0.09	45.13	<0.0001
Medium: 11.8 to 18.2	36	47.3	48.3	1.0	0.02		
High: greater than 18.2	38	21.2	22.9	1.7	0.08		
Percent with Income between \$1K-10K (inclusive)							
Low: less than 5	37	20.1	21.2	1.1	0.06	22.70	<0.0001
Medium: 5 to 7.9	35	44.2	44.9	0.7	0.02		
High: greater than 7.9	33	35.7	33.9	-1.8	-0.05		
Percent White							
Low: less than 79.4	34	56.0	54.7	-1.3	-0.02	83.70	<0.0001
Medium: 79.4 to 87.5	34	33.4	32.5	-0.9	-0.03		
High: greater than 87.5	42	10.7	12.8	2.2	0.20		
Percent Black							
Low: less than 0.7	34	24.8	24.0	-0.8	-0.03	32.29	<0.0001
Medium: 0.7 to 1.8	35	70.5	70.2	-0.3	0.00		
High: greater than 1.8	43	4.7	5.8	1.1	0.25		
Percent Hispanic							
Low: less than 4	†	†	†	†	†	127.04	<0.0001
Medium: 4 to 6.6	41	17.9	21.2	3.3	0.19		
High: greater than 6.6	33	82.1	78.8	-3.3	-0.04		
Percent Asian							
Low: less than 1.6	33	61.8	58.8	-3.0	-0.05	20.37	<0.0001
Medium: 1.6 to 4.8	37	36.5	39.3	2.8	0.08		
High: greater than 4.8	40	1.6	1.9	0.2	0.14		

Computation not applicable

† No respondents

NOTE: Detail may not sum to totals because of rounding.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Appendix C

Multivariate Analysis Tables

Table C-1. Logistic regression results, by characteristic

Parameter	Parameter Estimate	Standard Error Of Estimate	P value
Intercept	-0.520	0.096	<0.0001
Mailing address unavailable	-0.583	0.033	<0.0001
Median home value			
Low: less than 162105	0.242	0.053	<0.0001
Medium: 162105 to 213734	0.165	0.033	<0.0001
Non-metropolitan statistical area	-0.242	0.046	<0.0001
Percentage in exchange that are between 0 and 17 years old (inclusive)			
Low: less than 23.2	0.163	0.031	<0.0001
Medium: 23.2 to 26.1	0.091	0.025	0.0006
Percentage in exchange that are between 18 and 24 years old (inclusive)			
Low: less than 9.0	-0.193	0.030	<0.0001
Medium: 9.0 to 9.8	-0.131	0.021	<0.0001
Percentage in exchange that are 65 years old and up			
Low: less than 10.4	0.046	0.036	0.2051
Medium: 10.4 to 13.1	0.098	0.022	<0.0001
Percentage Asian			
Low: less than 1.6	-0.022	0.048	0.6448
Medium: 1.6 to 4.8	0.001	0.037	0.9866
Percentage Black			
Low: less than 0.7	0.074	0.043	0.0939
Medium: 0.7 to 1.8	0.025	0.029	0.3865
Percentage in exchange that are college graduates			
Low: less than 22.9	-0.155	0.045	0.0012
Medium: 22.9 to 31.9	-0.121	0.031	0.0003
Percentage income 100K and up			
Low: less than 11.8	-0.075	0.047	0.1171
Medium: 11.8 to 18.2	-0.048	0.032	0.1415
Percentage income between 1K and 10K (inclusive)			
Low: less than 5	0.075	0.034	0.0312
Medium: 5 to 7.9	0.061	0.024	0.0151
Percentage renters			
Low: less than 26.9	0.040	0.025	0.1083
Medium: 26.9 to 36.2	0.097	0.018	<0.0001
Percentage White			
Low: less than 79.4	-0.075	0.039	0.0587
Medium: 79.4 to 87.5	-0.043	0.030	0.1610
North Puget	-0.161	0.044	0.0005
West Balance	0.009	0.062	0.8801
King	-0.432	0.049	<0.0001
Other Puget Metro	-0.269	0.043	<0.0001
Clark	-0.242	0.040	<0.0001
East Balance	0.122	0.056	0.0343
Spokane	-0.118	0.043	0.0079
Percentage Hispanic			
Low: less than 4	-0.011	0.033	0.7481
Medium: 4 to 6.6	0.039	0.029	0.1818

Table C-2. Search results

Response cell	Description	Weighted response rate (%)
Overall		27.28
1	No mailing address, King, Clark, low white, low and medium concentration of low income, low renter	13.18
2	No mailing address, King, Clark, low white, low and medium concentration of low income, medium and high renter, low Hispanic	22.69
3	No mailing address, King, Clark, low white, low and medium concentration of low income, medium and high renter, medium and high Hispanic	18.18
4	No mailing address, King, Clark, low white, high concentration of low income	13.32
5	No mailing address, King, Clark, medium and high White, low and medium Asian	21.59
6	No mailing address, King, Clark, medium and high White, high Asian	19.15
7	No mailing address, North Sound, West Balance, low and medium median home value, low and medium college graduate, low and medium renter, low white	28.32
8	No mailing address, North Sound, West Balance, low and medium median home value, low and medium college graduate, medium and high White, low renter	22.72
9	No mailing address, North Sound, West Balance, low and medium median home value, low and medium college graduate, medium and high White, medium renter	25.66
10	No mailing address, North Sound, West Balance, low and medium median home value, low and medium college graduate, high renter	21.68
11	No mailing address, North Sound, West Balance, low and medium median home value, high college graduate	29.61
12	No mailing address, North Sound, West Balance, high median home value	19.37
13	Have mailing address, King, low and medium college graduate	23.37
14	Have mailing address, King, high college graduate, low and medium age 65 and older, low white	28.99
15	Have mailing address, King, high college graduate, low and medium age 65 and older, medium and high White	31.89
16	Have mailing address, King, high college graduate, high age 65 and older	26.48
17	Have mailing address, East Balance, Spokane, Yakima-Tri Cities, low age between 18 and 24	34.50
18	Have mailing address, East Balance, Spokane, Yakima-Tri Cities, medium and high age between 18 and 24, low Hispanic	38.88
19	Have mailing address, East Balance, Spokane, Yakima-Tri Cities, medium and high age between 18 and 24, medium Hispanic	47.24
20	Have mailing address, East Balance, Spokane, Yakima-Tri Cities, medium and high age between 18 and 24, high Hispanic	40.94
21	Have mailing address, Sound, West Balance, Other Puget Sound Metro, Clark, low age 65 and older, low and medium age between 18 and 24	28.73
22	Have mailing address, Sound, West Balance, Other Puget Sound Metro, Clark, low age 65 and older, high age between 18 and 24	38.03
23	Have mailing address, North Sound, West Balance, Other Puget Sound Metro, Clark, medium and high 65 and older, low college graduate	32.88
24	Have mailing address, North Sound, West Balance, Other Puget Sound Metro, Clark, medium and high 65 and older, medium and high college graduate, non MSA	32.71
25	Have mailing address, North Sound, West Balance, Other Puget Sound Metro, Clark, medium and high 65 and older, medium and high college graduate, MSA, low age between 18 and 24	35.28
26	Have mailing address, North Sound, West Balance, Other Puget Sound Metro, Clark, medium and high 65 and older, medium and high college graduate, MSA, medium and high age between 18 and 24	39.86

Note: descriptions of subgroups are abbreviated. See Appendix B for full labels.

Appendix D

Comparisons to External Sources

Table D-1. Comparison of population estimates from the Washington State Population Survey, American Community Survey and the Current Population Survey: 2006

Characteristic	WSPS			Population control					
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
		LB	UB		LB	UB		LB	UB
Overall	6,375,492	*	*	6,249,888	*	*	6,146,338	*	*
Region									
North Puget	6.1	5.7	6.5	†	†	†	†	†	†
West Balance	7.0	6.5	7.4	†	†	†	†	†	†
King	28.8	27.8	29.8	27.9	26.0	29.9	28.6	†	†
Other Puget									
Metro	30.1	28.7	31.5	†	†	†	29.9	†	†
Clark	6.3	6.0	6.7	†	†	†	6.5	†	†
East Balance	7.6	7.1	8.0	†	†	†	†	†	†
Spokane	7.0	6.5	7.4	7.3	6.1	8.4	6.9	†	†
Tri-cities	7.2	6.7	7.6	†	†	†	†	†	†
Metro Status									
Metro	87.4	86.8	88.0	91.9	90.7	93.1	†	†	†
Non Metro	12.6	12.0	13.2	8.1	6.9	9.3	†	†	†
Age 1									
Less than or equal to 18	26.4	25.5	27.3	25.7	23.5	27.9	†	†	†
19-34	20.9	19.8	22.0	21.5	19.7	23.2	†	†	†
35-64	41.4	40.4	42.4	41.6	39.4	43.7	†	†	†
65 and over	11.3	10.4	12.2	11.3	10.1	12.4	†	†	†
Age 2									
Less than or equal to 14	20.7	19.9	21.6	19.3	17.4	21.3	19.8	19.4	20.1
15-34	26.6	25.4	27.8	27.8	25.9	29.8	27.6	27.2	28.0
35-64	41.4	40.4	42.4	41.6	39.4	43.7	41.5	41.0	42.0
65 and over	11.3	10.4	12.2	11.3	10.1	12.4	11.1	10.8	11.4
Sex									
Male	49.8	48.9	50.7	49.6	48.2	51.0	49.7	48.9	50.4
Female	50.2	49.3	51.1	50.4	49.0	51.8	50.3	49.6	51.1
Highest education ¹									
Less than high school	6.4	5.7	7.2	8.9	8.1	9.7	11.2	10.7	11.6
High school	24.0	22.9	25.1	25.5	24.3	26.6	25.1	24.5	25.8
Some college	29.7	28.5	30.9	34.2	32.9	35.5	33.6	32.9	34.3
College graduate	39.8	38.4	41.2	31.4	30.1	32.7	30.1	29.4	30.8

Table D-1. Comparison of population estimates from the Washington State Population Survey, American Community Survey and the Current Population Survey: 2006 (Continued)

Characteristic	WSPS			Population control					
				CPS (2006)			ACS (2005)		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
		LB	UB		LB	UB		LB	UB
Race/ethnicity									
Hispanic	8.9	7.8	9.9	6.8	5.7	7.9	8.8	8.3	9.3
White	76.8	74.9	78.6	76.8	75.0	78.6	76.9	75.7	78.0
Black	3.4	2.4	4.3	3.1	2.4	3.9	3.2	2.9	3.5
American Indian/ Alaskan Native	1.4	1.0	1.9	0.6	0.3	0.9	1.2	1.0	1.4
Native Hawaiian/ Other PI	1.5	0.9	2.1	0.3	0.1	0.5	0.4	0.3	0.5
Asian	5.2	4.3	6.2	8.1	6.9	9.3	6.5	6.1	6.9
Others	2.8	2.4	3.2	4.3	3.4	5.2	3.0	2.7	3.2
Marital status²									
Married	60.8	59.2	62.5	55.1	52.6	57.6	56.1	55.5	56.7
Never married	22.0	20.6	23.4	26.7	24.5	28.9	24.9	24.4	25.4
Other	17.2	16.3	18.0	18.2	16.3	20.1	19.0	18.5	19.4
Total household income									
Less than or equal to 24999	15.2	13.8	16.5	15.2	14.2	16.2	18.2	17.7	18.6
\$25,000 to \$99,999	60.7	59.0	62.3	59.6	58.3	61.0	60.4	59.8	61.0
Greater than and equal to \$100,000	24.2	22.7	25.7	25.2	24.0	26.4	21.5	21.0	22.0
Own/rent									
Rent	23.7	22.2	25.2	30.3	28.3	32.3	31.8	31.2	32.4
Own	76.3	74.8	77.8	69.7	67.7	71.7	68.2	67.6	68.8

† Not applicable.

* An '*' entry in the confidence interval column indicates that the estimate is controlled.

¹ Estimation of Highest education for WSPS, ACS and CPS is based on population 25 years and over.

² Estimation of Marital Status for WSPS, ACS and CPS is based on population 15 years and over.

NOTE: Detail may not sum to totals because of rounding.

The population controls are from Annual Social and Economic (ASEC) Supplement for Current Population Survey (CPS): March 2006, and the American Community Survey 2005.

All adults of Hispanic origin are classified as Hispanic regardless of race. Those classified as White are non-Hispanic White only. Those classified as Black are non-Hispanic Black only. Those classified as American Indian/Alaskan Native are non-Hispanic American Indian/Alaskan Native only. Those classified as Native Hawaiian/Other PI are non-Hispanic Native Hawaiian/Other PI only. Those classified as Asian are non-Hispanic Asian only. Those classified as Other include non-Hispanics of all other races.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.

Table D-2. Comparison of medical assistance estimates from the Washington State Population Survey and the Current Population Survey: 2006

Characteristic	WSPS			Population control		
	Estimate	95% CI		Estimate	95% CI	
		LB	UB		LB	UB
Overall	6,375,492	*	*	6,249,888	*	*
Medicare ¹						
Overall						
Yes	13.0	12.3	13.7	12.3	11.0	13.6
No	87.0	86.3	87.7	87.7	86.4	89.0
Less than or equal to 18						
Yes	†	†	†	0.5	-0.1	1.1
No	100.0	†	†	99.5	98.9	100.1
19-34						
Yes	1.0	0.5	1.5	1.1	0.2	2.1
No	99.0	98.5	99.5	98.9	97.9	99.8
35-64						
Yes	4.1	3.6	4.6	2.8	1.8	3.8
No	95.9	95.4	96.4	97.2	96.2	98.2
65 and over						
Yes	97.3	96.3	98.3	95.6	94.7	96.4
No	2.7	1.7	3.7	4.4	3.6	5.3
Medicaid ¹						
Overall						
Yes	13.9	12.7	15.2	9.9	8.7	11.1
No	86.1	84.8	87.3	90.1	88.9	91.3
Less than or equal to 18						
Yes	34.1	30.6	37.6	23.6	20.2	26.9
No	65.9	62.4	69.4	76.4	73.1	79.8
19-34						
Yes	8.7	7.1	10.3	6.2	4.1	8.3
No	91.3	89.7	92.9	93.8	91.7	95.9
35-64						
Yes	5.5	4.9	6.2	4.3	3.0	5.6
No	94.5	93.8	95.1	95.7	94.4	97.0
65 and over						
Yes	8.8	6.8	10.8	6.4	5.4	7.4
No	91.2	89.2	93.2	93.6	92.6	94.6

† Not applicable.

* An '*' entry in the confidence interval column indicates that the estimate is controlled.

¹The estimates for Medicare and Medicaid are weighted by the medical weights.

NOTE: Detail may not sum to totals because of rounding.

The population control is from Annual Social and Economic (ASEC) Supplement for Current Population Survey (CPS): March 2006.

SOURCE: Office of Financial Management, Washington State Population Survey (WSPS) 2006.