

## METHODS

### Sampling Design

Since 2000, Montana's BRFSS sample has been stratified based on county population size and proportion of American Indians, Montana's largest minority population. Stratum I consists of seven counties containing a high proportion of American Indians, Stratum II consists of 41 counties with relatively low population size and low proportion of American Indians, and Stratum III consists of eight counties with relatively high population size and low proportion of American Indians. These three strata allow the potential for oversampling households of American Indians and are used strictly for sampling, rather than analytical purposes.

In 2002, CDC began the Selected Metropolitan/Micropolitan Area Risk Trends (SMART) BRFSS in order to analyze the data from selected metropolitan and micropolitan statistical areas (MMSAs) with 500 or more respondents. The Montana BRFSS, therefore, added a fourth stratum in 2004 that includes Yellowstone and Carbon Counties – Billings, Montana's largest MMSA<sup>1</sup>. Starting in 2006 Montana BRFSS added two additional strata to the sampling frame to be rotated between Montana's other MMSAs so that each MMSA will have 2 consecutive years of data every 4 to 5 years. In 2010, the MMSAs that achieved a sample size of at least 500 included: Billings, Helena, and Kalispell.

Beginning in 2003, Montana's dataset has been weighted for regional analyses based on the state's five health planning regions (HP1 – HP5) for regional health information and public health planning purposes (see Appendix A for map of health planning regions). Appendix B contains a summary of selected 2010 health indicators for the nation, state, MMSAs, and health planning regions in Montana.

According to national BRFSS protocol, Montana used a disproportionate stratified sampling design (DSS)<sup>2</sup> for the BRFSS survey. In the DSS design, the universe of all Montana telephone numbers was disproportionately stratified by telephone blocks. A block consists of 100 phone numbers with consecutive four-digit telephone suffixes (e.g., 406-443-1100 to 406-443-1199). Beginning in 2003, the CDC protocol for selecting household telephone numbers discontinued the inclusion of "0" blocks in the sampling frame; "0" blocks are computer generated listings of 100 consecutive phone numbers that contain *no* published household telephone numbers. Now, only "1+" blocks are sampled; these are also computer generated listings of 100 consecutive phone numbers, but they contain *at least one* published household telephone number. These "1+" blocks are then assigned to two strata: 1) high density or listed numbers and 2) low density or unlisted numbers. To be representative, the sampling ratio for these two strata is 1.5:1, in which the high density stratum (listed) is sampled at the rate of 1.5 times that of the low density stratum (unlisted). This approach has served to lower cost and improve interviewer efficiency.

Once a residence was successfully contacted, individual respondents were randomly selected from all adults aged 18 and older living in the household. The selected adult was then interviewed in accordance with the BRFSS protocol (CDC 2006). In 2010, although our sample size goal indicated completing 500 interviews per month, approximately 608 interviews were completed each month, for a yearly total of 7304 interviews.

Interviews were conducted by University of Nebraska Medical Center with headquarters in Omaha and the call center in Lincoln. Interviews were conducted during daytime and evening hours on Monday through Friday and on weekends to ensure that selected individuals had ample opportunity to participate in the survey. Fifteen efforts were made to reach a phone number at different times of the day and evening and on different days before being classified as an unreachable number. The Council of American Survey Research Organizations (CASRO) response rate, which includes a portion of the dispositions with unknown eligibility in the denominator of the rate, for Montana in 2010 was 65%. Of all contacted selected respondents, 81% resulted in completed interviews (cooperation rate). At least 10 percent of all interviews were monitored and validated by the quality assurance section of the call center, using the system's monitoring function to observe and score interviews in progress for quality improvement purposes.

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1 These geographic subdivisions are designated by the U. S. Office of Management and Budget and used by the U. S. Census Bureau as of June 2003. See <http://www.cdc.gov/brfss/smart/faqs.htm#2> for frequently asked questions and answers about SMART BRFSS and MMSAs.

2 For a detailed description of BRFSS methodology, see the BRFSS User's Guide, an online version at: <http://www.cdc.gov/brfss/training.htm>

## Data Weighting and Analysis

Once BRFSS data are collected, statistical procedures are undertaken to make sure the data are representative of the population for the state or the local area. Data were weighted to account for the design of the survey and differences in the probability of selection due to the disproportionate sampling method and due to households with different number of adults and different numbers of telephones (e.g., households with more than one telephone number were more likely to be called). This adjustment is intended to reduce biases that may result from excluding Montanans without telephone service (non-coverage) or from the varying characteristics of those that choose not to participate in the survey (non-response). Post-stratification is a computational procedure that adjusts the responders sampling weights, so that the totals over various demographic categories match known population totals. Post-stratification weighting for the 2010 Montana survey was based on the gender and age distribution in each health planning region and was used to ensure that the results more closely reflected the adult population of Montana. Prevalence estimates presented throughout this report are based on this weighting methodology.

Beginning in 2007, CDC's Division of Behavioral Surveillance started development of an alternative weighting method for BRFSS data in order to more closely match a more complete demographic make-up within each state. This alternative post-stratification method of raking weights<sup>3</sup> replaces the current post-stratification method to adjust the data so that groups which are under- or over- represented in the sample can be accurately represented in the final data set. Through an iterative process the weighted sample totals are made to agree with the corresponding totals for the population characteristic (or dimension) in each cell. In other words, the weights are proportionately adjusted to one set of control totals then those adjusted weights are proportionately adjusted to another set of control totals. For example, when weighting by age and gender, weights would first be adjusted for gender groups, then those estimates would be adjusted by age groups. The procedure would continue in an iterative process until all group proportions in the sample approach those of the population (or after 75 iterations or some preset tolerance level). Using the raking methodology will allow the distribution of the sample to properly represent state distributions with respect to: telephone source, age group by gender, detailed race and ethnicity, educational level, marital status, gender by race/ethnicity, age group by race/ethnicity, geographic region within the state, and renter/owner status.

CDC released the 2010 survey data with both the current post-stratification weights and the new raking weights in order to allow states to see how estimates may change based on the raking weights. There will be a forthcoming report entitled, *New Weighting Methods in BRFSS*. It contains a more complete discussion of raking weights and a comparison of survey results with the current weighting methodology and with the alternative raking weight methodology. *Starting with the 2011 dataset release, raking will become the standard weighting method for all BRFSS data.*

The demographic characteristics of the 2010 survey respondents are presented in Table C. This table describes the 2010 survey population, including the un-weighted number of respondents, the population estimate, and the weighted percent of respondents by selected demographic characteristics. Respondents who indicated "don't know," "not sure," or "refused" were excluded from the calculation of prevalence estimates. Therefore, the sample sizes used to calculate the estimates in this report vary. The SPSS for Windows Complex Survey Samples™ statistical software package was used to compute prevalence estimates (expressed as percentages) and associated 95% confidence intervals using sample weights provided by CDC. Prevalence estimates based on denominators with fewer than 50 respondents or half-width confidence intervals greater than 10 percent were not reported due to their inherent low precision.

## Data Reliability and 95% Confidence Intervals

As noted previously, the BRFSS data provides a disproportionate stratified statewide random sample of telephone-equipped households in Montana. The precision of a sample statistic (e.g., prevalence) can be estimated by calculating the confidence interval of the statistic; 95% confidence intervals (CI) are presented with the prevalence estimates in this report.

As an example, a prevalence estimate for cigarette smoking of 20 percent with a computed 95% confidence interval

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<sup>3</sup> Raking, also called Automated Sample Weighting System methodology or Iterative Proportional Fit, credited to W.E. Deming and F. Stephan, was first used to estimate U.S. Census population totals in 1940. Raking is commonly used when only the marginal population totals of the adjusted weights are known and the joint population distributions of post-strata are unknown. Raking is preferable as a post-stratification method when the cell counts of the responders within each demographic combination are too small to produce stable estimates. It is equivalent to log-linear regression expected totals.

**Table C. Demographic Characteristics of Montana Adults in the 2010 Behavioral Risk Factor Surveillance System (BRFSS) Survey.**

2010 BRFSS Sample			
Demographic Group	Sample Size (N)	Population Estimate	Weighted Percent†
<b>All Adults:</b>	<b>7,304</b>	<b>761,000</b>	<b>100.0</b>
<b>Sex:</b>			
Male	3,044	378,000	49.7
Female	4,260	383,000	50.3
<b>Age:</b>			
18 - 24	196	90,000	11.9
25 - 34	567	127,000	16.8
35 - 44	864	116,000	15.3
45 - 54	1,375	149,000	19.7
55 - 64	1,801	131,000	17.2
65+	2,466	145,000	19.1
Unknown§	35		
<b>Education:</b>			
<High School	552	62,000	8.2
High School	2,273	242,000	31.8
Some College	2,181	223,000	29.3
College Degree	2,287	233,000	30.7
Unknown§	11		
<b>Income:</b>			
<\$15,000	910	80,000	11.5
\$15,000 - \$24,999	1,294	122,000	17.6
\$25,000 - \$49,999	2,108	211,000	30.3
\$50,000 - \$74,999	1,086	127,000	18.2
\$75,000+	1,244	156,000	22.5
Unknown§	662		
<b>Race/Ethnicity:</b>			
White, non-Hispanic	6,313	674,000	89.2
AI/AN*	600	36,000	4.7
Other or Hispanic**	334	46,000	6.1
Unknown§	57		
<b>Disability:</b>			
Disability	2,264	197,000	26.0
No Disability	5,014	561,000	74.0
Unknown§	26		
<b>Region:</b>			
1- Eastern MT	931	60,000	8.0
2- N Central MT	1,440	118,000	15.7
3- S Central MT	1,001	152,000	20.2
4- Southwest MT	1,483	188,000	24.9
5- Northwest MT	2,383	236,000	31.3
MMSA-Billings	537	118,000	
MMSA-Helena	642	57,000	
MMAS-Kalispell	701	70,000	
Unknown§	66		

† Weighted percentages are based on CDC's 2010 pop. estimate of 761,000 adult Montanans.

\* American Indian or Alaska Native only.

\*\* All other non-White (including multiracial) or Hispanic.

§ Cases with unknown values are excluded from relevant analyses.

of  $\pm 2\%$ , translates to a lower limit of 18 percent and an upper limit of 22 percent. We are 95% confident that the interval 18% to 22% includes the true percentage of smokers in the Montana population.

The width of a confidence interval (e.g.,  $\pm 2\%$ ) using weighted data is dependent upon sample size and the design effect of the survey. Generally, estimates based on large samples have narrower confidence intervals and are more precise than are estimates based on small samples. Confidence intervals must be considered when making comparisons among subgroups of the population (e.g., among age classes). Percentages for different subgroups of the population can be determined to be significantly different if their confidence intervals do not overlap. A statistical test is needed to determine if estimates are different when the confidence intervals overlap.

Analysis of subpopulations results in a concomitant lowering of sample size. The more subgroups into which the data are partitioned, the smaller the sample size per subgroup. The results include some instances where sample sizes for subgroups within select populations are too small (denominator  $<50$ ), or the associated 95% confidence intervals width too broad (half-width confidence interval  $>10$  percentage points), to yield meaningful comparisons. For Montana reports and website information, all data where the cell size numerator is less than 3 and denominator is less than 300 are also suppressed. In these instances the estimates are not reported and are labeled NSD (not sufficient data) within every table.

## Questionnaire

The BRFSS questionnaire has three parts:

1. the core, consisting of the fixed core questions (asked every year), rotating core questions (asked in alternating years), and emerging core questions (asked for only one year);
2. optional modules provided by CDC, any number of which can be selected by individual states for inclusion; and
3. state-added questions (additional questions of specific interest to individual states).

All states must ask the core questions without modification in wording. As part of the core, respondents are asked to provide demographic information including such indicators as sex, age, race, marital status, annual household income, employment status, and education level. Optional modules and state-added questions may be added by individual states to their respective questionnaires. Montana's BRFSS Working Group, consisting of state data analysts and users, helps to establish the state questionnaire content each year using the "Criteria for Adding Questions to the MT BRFSS," which can be found at the Montana BRFSS website: [www.brfss.mt.gov](http://www.brfss.mt.gov).

The 2010 Montana BRFSS questionnaire consisted of 176 questions. Not all respondents were asked all questions, since some questions pertained to a specific age group or sex or persons with a particular health condition (e.g., diabetes). The average length of time to complete the survey was 26.5 minutes in 2010.

## Survey Limitations

Surveys that require self-reporting of data have limitations and should be interpreted with caution. Respondents may have a tendency to under-report behaviors that are socially undesirable, unhealthy, or illegal (e.g., drinking and driving or smoking), while over-reporting desirable behaviors (e.g., amount of exercise or regular health screening). The accuracy of self-reported information also is affected by the ability of respondents to fully recall past behaviors or health screening results.

Telephone surveys exclude households without telephones, which may result in a biased survey population due to under-representation of certain segments of the population. In 2010, based on ACS 2005-2009 estimates, 4.7 percent of Montana households did not have telephone service. The homes without telephone service may have represented a population segment at high risk for preventable diseases associated with low socioeconomic status. The 2010 survey prevalence estimates include only respondents from households with land-line telephone service, though Montana has been surveying cell-phone only users as part of a cell-phone pilot study since 2007. In 2010, datasets have weighted cell-phone data to be analyzed with the land-line data. The effect of included cell phone sample data will be further discussed in the forthcoming report, *New Weighting Methods in BRFSS*. Also starting with the 2011 survey, cell phone only households will become part of the regular sampling strategy for all BRFSS surveys.