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Public Health Surveillance for Behavioral Risk Factors in a Changing Environment

**Recommendations from the
Behavioral Risk Factor Surveillance Team**

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Public Health Surveillance for Behavioral Risk Factors in a Changing Environment

Recommendations from the Behavioral Risk Factor Surveillance Team

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Summary

The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based system of health surveys. Information regarding health risk behaviors, clinical preventive health practices, and health-care access, primarily related to chronic disease and injury, is obtained from a representative sample of adults in each state. Approximately 200,000 adult interviews are completed each year in all 50 states, the District of Columbia, Puerto Rico, the Virgin Islands, and Guam. The challenge for BRFSS is how to effectively manage an increasingly complex surveillance system that serves the needs of numerous programs while facing changing telecommunication technology and the greater demand for more local-level data. To determine options and recommendations for how best to meet BRFSS future challenges, CDC's Behavioral Surveillance Branch conducted a 2-day strategy workshop, attended by survey-research specialists. The workshop featured presentations on the current system; emerging technologic challenges; telephone-surveying techniques; program perspectives of CDC, partner organizations, and states; and recommendations for change. This report summarizes the recommendations resulting from that workshop.

Introduction

Background

The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based system of health surveys that was established in 1984 by CDC and state health departments. Information regarding health risk behaviors, clinical preventive health practices, and health-care access, primarily related to chronic disease and injury, is obtained from a representative sample of adults in each state. For the majority of states, BRFSS is the only source for this type of information. Data are collected monthly in all 50 states, the District of Columbia, Puerto Rico, the Virgin Islands, and Guam. Approximately 200,000 adult interviews are completed each year, making BRFSS the largest health survey conducted by telephone in the world. Not only is BRFSS a unique source of risk behavior data for states, but the system is also useful in measuring progress toward *Healthy People 2010* (1) objectives for the states and the nation. Multiple leading health indicators for 2010 can be

assessed through BRFSS (e.g., cancer screening, diagnosed diabetes, influenza or pneumococcal vaccination, obesity, smoking, and binge drinking).

In 1984, BRFSS began with 15 states collecting data concerning the six individual-level risk factors associated with the leading causes of premature mortality among adults,

- cigarette smoking,
- alcohol use,
- physical inactivity,
- diet,
- hypertension, and
- safety belt use.

From its inception, BRFSS was designed to allow states to add questions of their own choosing to their surveys. Beginning in 1988, optional, standardized sets of questions regarding specific topics (optional modules) were made available to states. The survey was redesigned in 1993 to include certain questions every year (i.e., a fixed core) and others in alternate years (i.e., a rotating core). As part of the 1993 redesign, ≤5 emerging core questions for newly arising topics were included for all states (Table).

By collecting behavioral data at the state level, BRFSS has proven to be a powerful tool for building health-promotion activities (2). Demand for data has increased, as has the number of requests to add questions to the survey (Table). The majority of divisions within the National Center for Chronic

The material in this report originated in the National Center for Chronic Disease Prevention and Health Promotion, James S. Marks, M.D., M.P.H, Director, and the Division of Adult and Community Health, Virginia S. Bales, Director.

TABLE. Behavioral Risk Factor Surveillance Summary questions by category and number of questions per category — 1993 versus 2001

Category	Number of questions, 1993	Number of questions, 2001
Core section		
Health Status	4	4
Health-care access	5	3
Exercise	—*	1
Asthma	—	2
Cholesterol awareness	3	—
Diabetes	1	1
Arthritis	—	6
Tobacco use	6	3
Alcohol consumption	—	3
Demographics	13	17
Physical activity	—	7
Women's health	11	—
Human immunodeficiency virus/ acquired immunodeficiency syndrome	13	9
Emerging core section		
Firearms	—	1
Disability	—	2
Prostate cancer screening	—	6
Rotating core section		
Hypertension awareness	3	2
Cholesterol awareness	—	3
Injury control	6	—
Alcohol consumption	6	—
Immunization	2	2
Colorectal cancer screening	4	4
Optional modules		
Smokeless tobacco use	2	—
Radon testing	7	—
Dietary fat	13	—
Fruits and vegetables	6	6
Diabetes	5	12
Exercise	10	—
Weight control	3	6
Activity limitations	13	—
Sexual behavior	—	12
Quality of life and care giving	—	13
Health-care coverage and use	—	8
Women's health	—	10
Oral health	—	5
Asthma history	—	11
Heart attack and stroke	—	13
Cardiovascular disease	—	17
Folic acid	—	5
Tobacco indicators	—	9
Other tobacco products	—	8

* Not included in that year's survey.

Disease Prevention and Health Promotion (NCCDPHP) and other CDC centers, institute, and offices (CIOs) have questions on BRFSS. Other federal agencies (e.g., the Health Resources and Services Administration [HRSA], National Institute of Health [NIH], the Administration on Aging [AoA], and the Veterans Administration [VA]), have added questions

to the survey. In addition, CDC has provided technical assistance to countries developing similar surveillance systems (e.g., China, Australia, Canada, and Russia). The World Health Organization (WHO) is developing a model surveillance system based on BRFSS for export to other countries.

With the growth in scope and influence of the system, certain successes have been realized by the BRFSS program. All states use BRFSS data to establish and track state health objectives, plan and evaluate health programs, or implement multiple disease-prevention activities. Approximately two thirds of states use BRFSS data to support health-related legislative efforts. For example, in Delaware, data were used to support legislation to create the Healthy Lifestyle and Tobacco-Related Disease Prevention Fund (2). In Illinois, two successful legislative initiatives to ban smoking in public buildings and to include coverage for mammography screening in all health insurance coverage were supported by BRFSS data (2). In Nevada, BRFSS data documenting the state's high rates of chronic and binge drinking were used to support legislation to place a per-gallon tax at the wholesale level on distilled alcohol. Only because the data were state-specific could these efforts succeed (2).

Since 1984, demand for more behavioral risk factor data has increased at the district, county, or city level. Although BRFSS was designed to produce state-level estimates, growth in the sample size has facilitated production of representative smaller area estimates. In 1997, the need for prevalence estimates at the local level led to the Selected Cities Project. Data from BRFSS were used to calculate estimates for selected cities in the United States with ≥ 300 respondents. In 2000, this use of BRFSS data yielded estimates of health risk behaviors for 99 cities to support targeted program implementation and evaluation, which should help cities better plan and direct their prevention and health promotion efforts.

BRFSS Operation

BRFSS field operations are managed by health departments with assistance from CDC. These health departments participate in developing the survey instrument and conducting the interviews either in-house or by using contract labor. Data are transmitted to NCCDPHP's Behavioral Surveillance Branch for editing, processing, weighting, and analysis. An edited and weighted data file is provided to each participating health department for each year of data collection, and summary reports of state-specific data are prepared by CDC staff.

The health characteristics estimated from BRFSS pertain only to the adult population aged ≥ 18 years, living in households. Respondents are identified by using telephone-based methods. Although approximately 95% of U.S. households

have telephones, coverage ranges from 87% to 98% across states and varies for subgroups as well (3). For example, persons living in the South, minorities, and those in lower socioeconomic groups typically have lower telephone coverage (3). No direct method of compensating for nontelephone coverage is employed by BRFSS; however, poststratification weights are used and might correct for any bias caused by nontelephone coverage. These weights adjust for differences in probability of selection and nonresponse, as well as noncoverage, and must be used for deriving representative population-based estimates of risk-behavior prevalence.

BRFSS Limitations

As a telephone survey, BRFSS has certain limitations. First, the survey is based on noninstitutionalized populations and excludes persons residing elsewhere (e.g., nursing homes or long-term-care facilities). Second, the data are based on self-reports, which can be subject to recall bias. Third, persons without a residential telephone are not included; therefore, BRFSS might exclude certain persons of lower socioeconomic status or households with cellular phones only. In contrast, the data are based on the largest telephone survey in the world. BRFSS is an ongoing state-based survey that provides program planners with a unique opportunity to compare changes in risk behaviors at the local, state, and national levels. Furthermore, the substantial sample size allows for stratification to further examine the risk by selected variables of interest.

Designing BRFSS

Each year, the states agree on the content of the core component and optional modules. For comparability, certain questions are taken from established national surveys (e.g., the National Health Interview Survey or the National Health and Nutrition Examination Survey). This practice allows BRFSS to use questions that might have been tested and allows states to compare their data with those from other surveys. Any new questions proposed as additions to BRFSS must be cognitive and field-tested before their inclusion on the survey. BRFSS protocol specifies that all states ask the core component questions without modification. They may choose to add any, all, or none of the optional modules, and they may add questions of their choosing at the end of the questionnaire.

States are selective in their choices of modules and state-specific questions to keep the questionnaire at a reasonable length, although wide variation exists from state to state in the total number of questions for a given year, ranging from a low of approximately 90 to ≥ 150 . New questionnaires are

implemented in January and usually remain unchanged throughout the year. However, the flexibility of state-added questions does permit additions, changes, and deletions at any time during the year.

Annual Questionnaire Development

Before the beginning of the calendar year, states decide on the text of the core component and the optional modules that will be asked for the coming year. States select their optional modules and choose any state-added questions. Then, each state constructs its questionnaire. The core component is asked first; optional modules are asked next; and state-added questions last. This ordering ensures comparability from state to state and follows standard protocol. Typically, the only changes allowed are the limited insertion of state-added questions regarding topics related to core questions. Such exceptions must be agreed upon in consultation with all partners.

After the content (i.e., core, modules, and state-added questions) of the questionnaire is determined by a state, a paper version of the instrument is constructed, and a paper or electronic copy is sent to CDC. The questionnaire is used without changes for one calendar year. If a substantial portion of the state population does not speak English, states have the option of translating the questionnaire into other languages (e.g., Chinese in California). CDC only provides a Spanish translation of the core questionnaire and optional modules.

Sample Description

To meet BRFSS standard for the participating states' sample, designs must be justifiable as a probability sample of all households with telephones in the state. All states and the District of Columbia use a disproportionate stratified sample (DSS) design.

In the BRFSS DSS design, a common practice is to divide telephone numbers into two groups, or strata, which are sampled separately. One group, the high-density stratum, contains telephone numbers that are expected to contain a substantial proportion of households. The low-density stratum contains telephone numbers that are expected to contain a limited proportion of households. Whether a telephone number goes into the high-density or low-density stratum is determined by the number of listed household numbers in its hundred block. A hundred block is a set of 100 telephone numbers with the same area code, prefix, and first two digits of the suffix and all possible combinations of the last two digits. Numbers that come from hundred blocks with ≥ 1 listed household number (i.e., 1 + blocks or banks) are put in the high-density stratum. Numbers that come from hundred blocks

"The important thing is not to stop questioning."

Albert Einstein

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with no listed household numbers (i.e., zero blocks or banks) are put in the low-density stratum. Both strata are sampled to obtain a probability sample of all households with telephones. The high-density stratum is sampled at a higher rate than the low-density stratum (i.e., disproportionately) to obtain a sample that contains a larger proportion of household numbers than would be the case if all numbers were sampled at the same rate. In the majority of cases, each state constitutes a single stratum. However, to provide adequate sample sizes for smaller geographically defined populations of interest, 25 states are sampled disproportionately from strata defined to correspond to substate regions.

Data for a state can be collected directly by the state health department or through a contractor. In 2001, a total of 14 state health departments collected their data in-house, and 40 contracted data collection with university survey research centers or commercial firms. The Behavioral Surveillance Branch provided a sample of telephone numbers to 53 states or territories purchased from Genesys (Marketing Group Systems, Fort Washington, Pennsylvania; available at <http://www.m-s-g.com>). Nevada purchased their sample from Survey Sampling International, Inc. (Fairfield, Connecticut; available at <http://www.surveysampling.com>).

Data Collection

Interview Procedures

Interviews are conducted by using computer-assisted telephone interview systems (CATI), and CDC supports CATI programming by using the Ci3 CATI software package (Sawtooth Technologies, Inc., Northbrook, Illinois; available at <http://www.sawtooth.com>). This support includes programming of the core and module questions, providing questionnaire scripting of state-added questions through a contract with a commercial firm for states requiring assistance, and contracting with a Ci3 consultant to assist states. By following specifications provided by CDC, state health personnel or contractors conduct interviews. The core portion of the questionnaire takes an average of 10 minutes to conduct. Interview time for modules and state-added questions is dependent upon the number of questions used, but typically extend the interview period by an additional 5–10 minutes.

Interviewer retention is high among states that conduct the survey in-house. The state coordinator or interviewer supervisor usually conducts the training by using materials developed by CDC that cover seven basic areas, as follows:

- overview of BRFSS,
- role descriptions for staff involved in the interviewing process,
- the questionnaire,
- sampling,
- codes and dispositions,
- survey follow up, and
- practice sessions.

Contractors typically use interviewers who have experience conducting telephone surveys, but these interviewers are given additional training on the BRFSS questionnaire and procedures before they are certified to work on BRFSS. More specific information regarding interviewer training and procedures is available at the BRFSS website (<http://www.cdc.gov/brfss>).

In 2001, all surveillance projects had the capacity to monitor their interviewers, as is expected of telephone-interviewing surveys. The system used for monitoring interviewers varied from listening to the interviewer only at an on-site location to listening to both the interviewer and respondent at a remote location. Verification callbacks were also used by certain states in lieu of direct monitoring. Contractors typically conducted systematic monitoring by monitoring each interviewer for a certain amount of time each month. All states had the capability to tabulate disposition code frequencies by interviewer. These data were the primary means for quantifying interviewer performance. All states were required to do verification callbacks for a sample of completed interviews as part of their quality-control practices.

Telephone interviewing was conducted during each calendar month, and calls were made 7 days/week, during both day and evening hours. Standard procedures in the interview were followed for rotation of calls during days of the week and times of the day. A summary of rules for respondent selection, callbacks per sample piece, refusal conversion, answering machines, and monthly interviewing periods are available at the BRFSS website (<http://www.cdc.gov/brfss>).

Data Processing

Preparing for Data Collection and Data Processing

Data processing is an integral part of any survey. Because data are collected and sent to CDC during each month of the year, routine data-processing tasks need attention at all times throughout the year. In addition, certain tasks need to be conducted at different points in the annual BRFSS cycle. The preparation for the survey involves multiple steps that occur after the new questionnaire is finalized. This process includes

developing the edit specifications, programming portions of the Ci3 CATI software, programming the PC-EDITS software, and producing telephone sample estimates for states that require them and then ordering the sample estimates from the contract vendor. A Ci3-CATI data-entry module for each state that uses this software is produced. Skip-patterns, together with certain consistency edits, and response-code range checks are incorporated into the CATI system. Incorporating edits and skip-patterns into the CATI instrument reduces interviewer errors, data-entry errors, and skip errors. Data-conversion tables are developed to read the survey data from the entry module and call information from the sample-tracking module and to combine information into the final format specified for the data year. CDC also creates and distributes a Windows[®]-based editing program that can perform data validations on correctly formatted survey results files. This program is used to output lists of errors or warning conditions encountered in the data.

CDC begins to process data for the survey year as soon as states or their contractors begin submitting data to the data-management mailbox, and continues processing data throughout the survey year. CDC receives and tracks monthly data submissions from the states. After data are received from the state, editing programs and cumulative data-quality checks are run against the data. Any problems in the file are noted, and a CDC programmer works with the state until the problems are resolved or agreement is reached that no resolution is possible. Response-rate data-quality reports are produced and shared with the project officers and state coordinators, who review the reports and discuss any potential problems with the state.* After the entire year of data for a state has been received and validated, multiple year-end programs are run for additional, limited data cleanup specific to the state and data year, and reports are produced that identify potential analytic problems with the data set. When these programs are complete, the data are ready for assigning weights and adding new variables.

Not all of the variables that appear on the public-use data set are taken directly from the state files. CDC prepares a set of SAS programs (4) that implement the end-of-year data processing. These programs prepare the data for analysis and add weighting and risk-factor calculations as variables to the data file. To create these variables, multiple variables from the data file are combined. Creation of the variables vary in complexity; certain ones only combine codes, whereas others require sorting and combining selected codes from multiple variables.

* Data-quality checks include a comparison with census data and the disposition-codes assignment.

Approximately all the variables derived from the BRFSS interview have a code category labeled “refused” and assigned a value of A9, A99, or A999. Typically, the category consists of noninterviews and persons for whom the question was not applicable because of a previous response or a personal characteristic (e.g., age). However, this code might capture certain responses that were supposed to be answered, but for a certain reason were not, and appeared as a blank or other symbol. The combination of these types of responses into a single code requires vigilance on the part of data-file users who wish to separate respondents who were skipped on one question from those who were asked, but whose answer was unknown or who refused to answer a particular question.

Weighting the Data

When data are used without weights, each record counts the same as any other record. Implicit in such use are the assumptions that each record has an equal selection probability and that noncoverage and nonresponse are equal among all segments of the population. When deviations from these assumptions are substantial enough to affect the results obtained from a data set, then weighting each record appropriately can help adjust for assumption violations. An additional, but conceptually unrelated, reason for weighting is to make the total number of cases equal to a certain desired number; for state BRFSS data, this is the state’s population aged ≥ 18 years. In BRFSS, poststratification serves as a blanket adjustment for noncoverage and nonresponse and forces the total number of cases to equal population estimates for each geographic stratum, which for BRFSS is usually a state.

Data Quality

Annually, CDC produces a BRFSS data-quality-control report, which enables the state BRFSS coordinator to monitor and improve data quality. The report is intended also to assist with the following questions:

- Does evidence exist of a statistically significant bias in the data?
- Are the telephone numbers being called frequently enough and according to the BRFSS callback rules?
- How consistent is the data-collection effort from month to month?
- Are telephone numbers being assigned standard disposition codes according to the code definitions?
- Are the interviewers adequately trained, supervised, and monitored?

In certain cases, the standard is defined by BRFSS protocol. For example, 100% of records dispositioned as “no answer” should have received ≥ 15 call attempts. In other cases, the standard might be defined by the variability in state-by-state data, with outliers indicating states that should receive special attention. An outside standard is used in bias measures (e.g., census data). Bias is measured by the difference between a sample value and a population value. For example, a sample with 60% female respondents drawn from a population that is 52% female indicates a selection bias of 8%. Finally, consistency is a key concern. A measure might be consistent at an acceptable level, but inconsistency might be an indicator of lower quality data-collection practices.

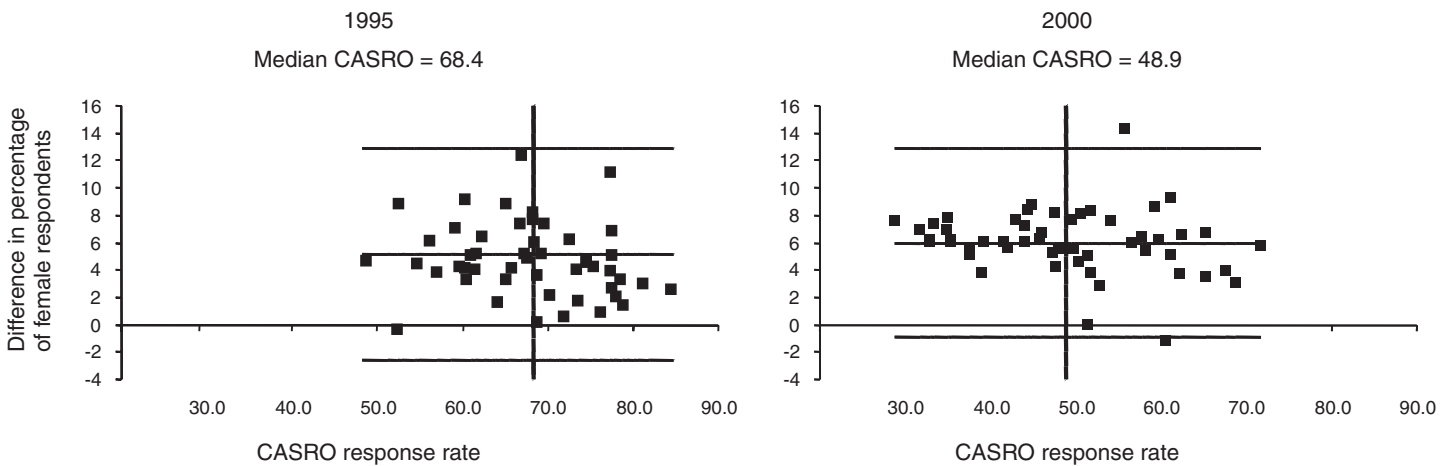
BRFSS data quality (i.e., comparing BRFSS data with census data and the frequency of disposition codes) has always been optimal. When compared with other national surveys, BRFSS data have been reported to be valid and reliable (5). In 2000, the data quality reports for all 50 states, the District of Columbia, and the territories, demonstrate minimum bias when BRFSS data is compared with census data. In 2001, bias in BRFSS data was not associated with response rate. Moreover, when bias is compared between 1995, when the median CASRO (i.e., definition of response rates issued by the Council of American Survey Research Organizations) response rate was 68.4, and 2000, when the median CASRO response rate is 48.9, the bias in 2000 is lower because it indicates a random variation that is not associated with response rate (Figure). Perhaps this is a result of the strict standards applied by BRFSS in computing response rates. The challenge for BRFSS is effectively managing an increasingly complex surveillance system that serves the needs of multiple programs while telecommunication technology is ever-changing. In addition, demand for more local-level data is increasing.

Strategic Vision Process

To find ways to meet the challenges for BRFSS in the future, CDC’s Behavioral Surveillance Branch staff conducted a 2-day strategy meeting with survey-research specialists; their goal was to develop options and recommendations for behavioral surveillance to meet future challenges. During the workshop, presentations were made by survey methodology specialists and persons knowledgeable in emerging technologic challenges. Their presentations included such topics as the current data-collection system and telephone surveying, and CDC, partner, and state program perspectives.

After the presentations, the larger working group divided into three subgroups to develop options for meeting future

FIGURE. Difference in percentage of female respondents between Behavioral Risk Factor Surveillance System (BRFSS) and population by state-specific CASRO* response rate, 1995–2000



* Definition of response rates issued by the Council of American Survey Research Organization.

challenges. The three subgroups addressed technology, methodology, and system challenges. The initial options from the subgroups were offered to a review panel for their reactions and then to the larger group of workshop attendees. After discussion with the review panel and the larger group, the subgroups reconvened to draft final recommendations with advantages and disadvantages. The final recommendations were presented and discussed with the larger group and a review panel and are described in the following sections.

Technology Challenges

Rapid changes in telecommunication technology have led to problems for all telephone-surveying systems. With the recent increase in the number of area codes and central office codes, the population of telephone numbers has grown substantially. Therefore, the proportion of telephone numbers that are working residential telephone numbers has decreased, resulting in an increase in the number of dial attempts required to complete one survey. Moreover, with the growing use of the Internet, households are spending more time online, which leads to more busy signals. Use of answering machines and caller-identification technology means that households are screening more calls and refusing to answer. Owned numbers that go with a person when he or she moves can also make state and local area surveys more challenging. Devices and services that screen and block calls to households (i.e., a device that sends a signal indicating that the number is not in service), automatic call-blocking (i.e., a household selects which

numbers it chooses to receive calls from), the phone butler (i.e., a relatively new service for screening calls), state do-not-call lists (i.e., a list of telephone numbers that do not accept telemarketing calls), and mobile-only households (MOHs), which use cellular phones exclusively, have also contributed to the decline in telephone-survey response rates and their representativeness of the general population.

A random-digit-dialing (RDD) approach is viable, except for owned numbers, but certain problems need to be addressed to sustain BRFSS at a high-quality level. These concerns include the declining response rates, coverage, and problems with standardization across states. BRFSS has unique characteristics (e.g., decentralized data collection); therefore, ongoing research regarding methodology and technology concerns is needed for continuous improvement in the survey system and to assess the effects of changes in telecommunication technology on the survey.

The technology and methodology challenges subgroup provided short, intermediate, and long time-frame estimates for their initial recommendations. They also added priorities to the items as well as justifications for their recommendations.

Technology Challenges Recommendations

Response Rate.

- High priority, short time frame
 - Evaluate use of advance letter and telephone number reverse matching. Use available commercial services to obtain the addresses of selected households. Prepare and mail standardized letters to inform residents about

the survey. These advance letters have demonstrated an increase in response rates (6). Then, evaluate whether these advance letters increase the response rate of BRFSS.

- Evaluate using answering machine messages and providing a toll-free number to return calls. Prepare a standard message for interviewers to leave on answering machines of selected households. These messages should briefly describe the survey and its significance to public health. The message should include a toll-free number for respondents to use for calling back to obtain additional information regarding the survey. In addition, the subgroup members recommended that BRFSS have a toll-free number available for respondents; this number would need to be staffed by persons who can vouch for the survey authenticity and provide additional information concerning the survey. Evaluate the effect of these measures on BRFSS response rates.
- Exclude zero banks from samples. BRFSS uses zero banks in its sample (i.e., a block of telephone numbers labeled by the vendor with no directory-listed telephone numbers). The subgroup members recommended excluding these banks from the sample to decrease the efforts and cost of reaching a household because a limited number of households are located in the zero blocks. In addition, they recommended that BRFSS staff examine previous years' data (i.e., zero banks versus other banks) to determine the effect of excluding zero banks on cost and mean-squared error.
- Decompose CASRO response rate (7). The subgroup members recommended decomposing the CASRO response rate into resolution, screen completion, and interview completion rates to identify the different obstacles for the survey. This will allow BRFSS to track performance before and after reaching a household (i.e., problems with reaching a household or problems with respondents declining to be interviewed). BRFSS staff will then be able to design appropriate protocols to address each of these problems.
- Explore Internet tools. Provide links to CDC's and states' websites for frequently asked questions. Interviewers can refer respondents to these websites for more in-depth information regarding the survey and its use. BRFSS staff need to monitor the traffic on these websites for further improvements.
- Intermediate priority, intermediate time frame
 - Use a do-not-call or privacy-manager list. Multiple states maintain lists of household telephone numbers

that have elected not to be called by telemarketers. BRFSS staff need to match its selected telephone numbers with these lists to mail a customized advance letter explaining the purpose of the survey and invite potential respondents to participate in the survey. Specially trained interviewers should call these numbers and perhaps use a customized introduction to conduct the interview. The sample should also be matched with privacy-manager lists (i.e., households with call-screening services) to determine if advance letters or customized introductions can increase response rates (6). BRFSS staff should evaluate the effectiveness of these measures by monitoring the improvement in response rates among households on the list who receive a letter compared with those who do not.

- Low priority, long time frame
 - Use Cox survival regression analysis to yield better estimates of unresolved numbers.
 - Administer the survey in other languages in addition to English and Spanish.[†]

Coverage Rate.

- High priority, short time frame
 - Apply a nontelephone adjustment. Use the interruption in telephone service methodology[§] to adjust BRFSS estimates for nontelephone households (8). The technology subgroup recommended adding a question to BRFSS regarding interruption in telephone service and using the information to create new sampling weights to adjust for households with no telephone service.
 - Implement research concerning the growing population of MOHs. Evaluate the extent of MOHs in the United States and its effect on telephone surveys. BRFSS staff should consider adding questions related to cellular phone use in a national household area probability sample survey to develop a weighting methodology similar to the interruption in telephone service.
- Intermediate priority, intermediate time frame
 - Implement research concerning cellular phone exchange sampling. Examine the feasibility of including cellular phones in BRFSS. Evaluate the

[†] Those households where neither English nor Spanish are spoken are counted against the rate in the response rate formula; however, after other languages are added, the response rate will increase.

[§] During the survey, respondents are asked if they have had an interruption in their telephone service. Those persons who have had an interruption that was not caused by inclement weather are regarded in the same manner as those who do not have a telephone. Adjustments in the data are made to account for households not having telephones by using the data from persons who have had an interruption in telephone service.

possibility of cellular phone exchange sampling and its methodology.

- Evaluate language isolation by state by using the 2000 U.S. census data. Findings from this research will enable BRFSS staff to assess the noncoverage of language-isolated households.

Standardization.

- High priority, short time frame
 - Provide states with CATI support. CATI screen layouts should be standardized, because variability in layouts could affect the administration of the survey.
 - Use a standard output for the record of calls (i.e., call attempts) to measure quality indicators. Design and implement programs to monitor disposition codes of call attempts. Provide states with timely feedback regarding quality of indicators to improve data quality.
 - Implement a standard Internet-based training that can be used by all data collectors. Training should include information regarding the different collection systems in use.
- Intermediate priority, intermediate time frame
 - Expand Internet-based analysis capabilities. Develop an Internet-based program to allow the tabular analyses of BRFSS data. The system should enable a person with limited statistical knowledge to explore and analyze BRFSS data.
 - Consider other alternatives for RDD surveys for the future. Multimodal multiframe designs (e.g., a mailed survey or a survey conducted on the Internet), rotating panel sample designs (e.g., contacting a group of previous respondents with follow-up questions regarding a certain health characteristic), and designs that incorporate portable medical devices (e.g., asking respondents to use their home medical devices to test their blood pressure or blood glucose levels during the survey for direct examination of certain health characteristics) are possible design alternatives. The subgroup reiterated its recommendation to evaluate cellular phone use, Internet access, and languages spoken at home to make adjustments for dual-frame estimations. They further recommended working with the U.S. Census Bureau regarding the American Community Survey. Research into rotating panel sample designs should also be examined. The members recommended that BRFSS staff maintain a knowledge of future development in portable medical devices for potential use in the survey.

Methodology Challenges

The methodology subgroup stressed the importance and successes of BRFSS, despite the resource limitations. Needed changes should be addressed while maintaining the BRFSS state focus and sound science. Their recommendations were grouped into five categories: 1) strengthening core operations at CDC to better assist the states, 2) strengthening core operations at the state directly, 3) employing continuous survey operations, 4) implementing continuous quality improvement, and 5) applying certain immediate fixes that could be achieved while longer term efforts are introduced.

Methodology Challenges Recommendations

Strengthening CDC Core Operations. Core capacity at CDC for statistical analysis, content development, and technical assistance should be increased.

- High priority, short time frame
 - Gradually improve the BRFSS methodology by focusing on five research-improvement goals per year based on comparative data from all states. Monitor data quality and set action goals for improvement. Develop methods to make changes to BRFSS methodology based on routine data-quality indicators. This could be accomplished by creating an ongoing data-quality monitoring system that allows for routine improvement based on findings.
 - Monitor ongoing developments in data-collection technology.
- High priority, long time frame
 - Develop capability for monitoring changes in telephone systems, including use of cellular phones, for frame construction and sampling. Given the size of BRFSS and the number of public health professionals who use BRFSS data, the surveillance system is considered the center of expertise in telephone-survey methodology.
 - Expand quality assessment to include statistics other than response rates. Move toward quality assurance rather than relying entirely on response rates.
 - Test introduction of proven alternative modes of data collection.

Strengthening State Core Operations. States need increased capacity to respond to changes introduced by CDC or requested by states.

- High priority, short time frame

- Work with the states to develop standardized training modules to supplement existing training of interviewers in each state.
- Address the reasons for the substantial variation in response rates between the states to ameliorate differentials.
- Encourage states to revisit the utility of stratifying states by region or other demographics to determine whether to keep this methodology.
- Encourage states to examine oversampling of key subgroups (e.g., older persons or minorities). Such techniques will enable states and BRFSS to provide valid and reliable estimates for minority groups within a state or across the United States.
- Develop and test tracking questions in BRFSS to identify persons with specific conditions for follow up to gain additional data. Examine the possibility of using BRFSS to identify persons with certain conditions (e.g., diabetes or cancer) and call them back with further questions related to those conditions. This will allow the BRFSS program to increase the number of questions asked by BRFSS and to develop a panel of persons to help track long-term changes in health behaviors.
- Incorporate model-assisted indirect methods for local area estimates, including integrating data from outside sources. This can permit BRFSS to provide valid and reliable estimates at the county or census tract level.

Employing Continuous Survey Operations. Continuous survey operations are best practices proven to work elsewhere.

- High priority, intermediate time frame
 - Adopt continuous survey operations by employing an overlapping release of sample records. For example, release samples weekly and keep samples available for 4 weeks.
 - Data should be cleaned as it is produced. Full editing should be part of the questionnaire and should be tested before implementation.
 - Data should be received as replicates are completed.
- Intermediate priority, short time frame
 - Problems with missing item and unit data should be dealt with in the estimation process (e.g., imputation techniques for income). Data imputation should be viewed as an integral part of the estimation system. Explore alternative imputation procedures for item nonresponse and for testing validity of imputation. Imputation procedures should ordinarily be in place by the end of March for a data year.

- Change existing activities of the system (e.g., making PC-EDITS [i.e., the program provided to states to edit their data] early in the calendar year) and perform distribution checks as soon as data have been submitted from the states.

Implementing Continuous Improvement Efforts. BRFSS operations need to enhance its quality-improvement practices (e.g., by making data adjustments monthly) and to make those improved practices continuous.

- High priority, short time frame
 - Develop a reporting system to CDC to ensure that callback rules and other data-quality standards are being followed.
 - Require monitoring for every call, including time of call, disposition of call, and results of calls that are monitored.
 - Data collectors should adopt real-time interviewer monitoring systems and make monitoring available to state coordinators and CDC. Require standardized data elements for process monitoring. Work toward continuous substantive monitoring in real time by encouraging more direct contact between data collectors and states (i.e., producers and clients).
- Intermediate priority, short time frame
 - BRFSS staff should be encouraged to incrementally begin examining interviewer-level quality assessment.

Applying Immediate Fixes Selectively. Certain items can be implemented immediately to ease resources for other activities.

- High priority, short time frame
 - Evaluate and examine mean-square error trade-offs associated with zero banks (i.e., examine the effects of keeping zero blocks in the sample). Examine BRFSS data from previous years (zero banks versus other banks) to determine the effect of excluding zero banks on cost and selection bias.
 - Question developers should specify cleaning rules. Ask the agency or persons adding new questions to BRFSS to provide specifications for editing and cleaning data.
 - Explore how to introduce new response rates weighted by selection probability. Compute weighted response rates for BRFSS and examine the difference between the weighted and the nonweighted response rates. Develop a strategy to introduce the new methodology for response-rate computation.
 - Implement, after testing and refinement, using interruption of telephone service questions for adjusting for nontelephone household bias (same as a previous technology subgroup recommendation).

- Develop or acquire a data-dissemination system that allows customized tabulations with coefficients of variation (same as a previous recommendation by the technology subgroup for Internet-based analysis capability).

System Challenges

In the past, funding restrictions for BRFSS have required the BRFSS program to charge other CDC organizations and external programs for adding questions to the survey. This strategy enabled the system to continue but resulted in a questionnaire content determined by the ability to pay, with public health and state priorities sometimes being a secondary consideration. In addition, this system hampered long-term questionnaire development and planning. However, in the fiscal year 2003 budget, the U.S. Congress appropriated an increase for BRFSS that will allow CDC to begin implementing the changes recommended in this report.

The system challenges subgroup affirmed the importance of partnerships between CDC and the states. BRFSS provides state- and substate-level data and builds state capacity. States seek standardization from CDC for BRFSS. Program input from CDC is also critical to states and to the state-level programs that use BRFSS data (e.g., state diabetes programs).

System Challenges Recommendations

- Discontinue selling space on the core portion of the survey. The system challenges subgroup recommended that a secured funding should be provided to BRFSS for its core questions and operation. This funding for the survey should include funds to meet ongoing needs for data collection, quality assurance, and technical assistance for both CDC staff and states. In addition, funds should be available for BRFSS for research and development regarding survey methodology. This stream funding should be a dedicated percentage of the overall budget of the Division of Adult and Community Health, NCCDPHP, or CDC.
- The committee also recommended that the questionnaire's funding structure and its content should be separated. Core-level funding should be stable (i.e., a minimum amount of funding should be guaranteed for BRFSS). Funding should be structured for the long term rather than from year to year to facilitate long-term planning in states. By securing the funding for the core level, scientists at CDC and the state health departments could

decide on questions to be added to the survey. BRFSS users would be able to monitor health-risk factors associated with leading causes of mortality in the United States. BRFSS staff and their state partners will be able to better plan future activities. Programs at CDC will be able to determine earlier what questions will be added to the survey, allowing for better planning for prevention programs at the local and national level.

Conclusion

BRFSS is a powerful tool for building health-promotion activities, and the system is a critical part of public health in the United States. Implementing the recommendations made by the three subgroups will ensure that BRFSS continues providing valuable information for action at the local, state, and national levels. In the fiscal year 2003 budget, the U.S. Congress appropriated an increase for BRFSS that will allow CDC to begin implementing the changes recommended in this report.

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Behavioral Risk Factor Surveillance System

May 22–23, 2002

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dis·patch: *n*

(dis-'pach) 1 : a written message,
particularly an official communication,
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