11. The ASSIST Evaluation: Contributions to Evaluation of Complex Public Health Initiatives

Frances A. Stillman and Carol L. Schmitt

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The evaluation of the American Stop Smoking Intervention Study (ASSIST) successfully documented public health outcomes attributable to ASSIST, an 8-year publicly funded partnership between the National Cancer Institute (NCI) and the American Cancer Society, implemented through cooperative agreements with 17 state health departments. Because ASSIST was designed to change tobacco use by changing the social and physical environments that promoted such use, ASSIST's efforts focused on building state capacity to deliver comprehensive tobacco use prevention and control, promoting public and private policy change, using well-designed media campaigns, and advocating for media coverage of tobacco control issues. The inherent complexity of this large-scale public health approach to tobacco use prevention and control raised significant challenges for the evaluation of the program. These challenges were met with the novel approach described in this monograph.

The ASSIST evaluation documented the association between "upstream" changes attributable to ASSIST and subsequent reductions in tobacco use prevalence and cigarette consumption. In the process, this evaluation broke new ground in several key areas:

- *It successfully documented the effectiveness of a large-scale demonstration project in a rigorous and statistically valid manner, even though the project interventions were uniquely adapted to each ASSIST state and were also widely adopted outside the bounds of the ASSIST states.*
- *The evaluation team developed a methodology that included empirically validated, aggregate measures of tobacco control inputs and intermediate policy outcomes, which were found to be related to two long-term outcomes: tobacco use prevalence rates and cigarette consumption rates.*
- *The evaluation represented an early systems-based approach to evaluation, including the construction of logic models, the use of a network of stakeholders for model validation, and the development of a prototype knowledge base in the specific area of newspaper coverage of tobacco issues.*
- *The evaluation validated the importance of upstream interventions in future tobacco control and other public health efforts.*

The ASSIST evaluation leaves an important legacy of methods and measures that will guide the field for years to come, and the evaluation itself serves as a roadmap for future assessments of population-level public health efforts.

Introduction

Politics is essential for effective public health, and thus is the inescapable context of public health interventions. To disregard sociopolitical determinants of health is to relegate public health to prevention and promotion of individual risk behaviors.[1(p49)]

—John B. McKinlay and Lisa D. Marceau,"Upstream Healthy Public Policy: Lessons from the Battle of Tobacco"

The ASSIST evaluation measured the success of a project that was based on a bold hypothesis—that interventions aimed at the individual alone would not result in substantive changes in tobacco use and health outcomes. Rather, ASSIST incorporated decades of tobacco control research that strongly suggested that the highest possible level of tobacco use prevention and control could be achieved through interventions that altered a social environment that supported tobacco use. The ASSIST project was an ambitious, publicly funded effort that used upstream tobacco control interventions—efforts that would yield changes in the social environment of tobacco use and subsequently affect smoking prevalence and cigarette consumption rates. Its evaluation was an equally ambitious endeavor that measured the impact of those interventions on the public health outcomes of tobacco use prevalence and cigarette consumption. This evaluation broke new ground in the assessment of complex public health initiatives while documenting the success of ASSIST.

Challenges to Evaluating ASSIST

The ASSIST evaluation was one of the first large-scale studies of upstream interventions for tobacco control, focusing on policy advocacy, media, and capacity building. ASSIST's goal was to change policies, regulations, and social norms so that nonsmoking became the norm. The program accomplished its goals by providing states with a modest level of funding to develop the unified network of national, state, and local organizations needed to deliver tobacco control (i.e., capacity), thus using the state's policy environment to change tobacco use. The ASSIST evaluation team faced challenges as a result of the nature of the intervention itself, thus precluding the original evaluation plan of comparing ASSIST states with non-ASSIST states. In addition, operational and practical challenges needed to be overcome: the evaluation effort did not begin until several years after the project was underway, the budget for the evaluation was limited, and significant effort was expended to assemble the final evaluation team. Therefore, the evaluation had to be focused and parsimonious. As a result, only those evaluation factors that were judged essential and that could be feasibly measured were included.

ASSIST was never envisioned as a randomized trial, and states were not randomly selected for the evaluation. Each state adapted the protocol to its unique political, social, and cultural context. ASSIST did not collect information

from the individual states on how each implemented its programs. Therefore, the evaluation team could not evaluate overall implementation of the interventions. In addition, data collected were available only from ASSIST states and were not available from non-ASSIST states. Finally, ASSIST targeted a much larger and more diverse population than any previous community-based tobacco control intervention, and no attempt was made to prevent ASSIST-like interventions from being adopted in non-ASSIST states. ASSIST states had a combined population of 91 million people, more than one-third the population of the United States, including more than 10 million African Americans and 7 million people of Hispanic and other racial/ethnic minority groups.[2] The combination of these features made it difficult to assess ASSIST with standard outcome[3] or process evaluation methods.[4]

Response to Evaluation Challenges

In response to these challenges, the central issue of the ASSIST evaluation (and a broader issue for the evaluation of upstream interventions in general) became how to measure and document the causal relationships among broad, population-based measures and public health outcomes. What had been originally envisioned as a simple evaluation of a demonstration project became a complex evaluation effort that engaged a diverse group of scientists and practitioners and involved extensive data sources.

The evaluation was guided by an a priori conceptual model that represented the sequential process of change hypothesized to occur in response to ASSIST.[5] This model was based on ecological theory (see sidebar, "ASSIST and Systems Methods in Tobacco Control") and included those factors identified as essential and measurable, while acknowledging that many important political, economic, and social factors could not be consistently or accurately measured across all states.

The ASSIST evaluation model included components that had never been used before, such as Strength of Tobacco Control (SoTC) and the Initial Outcomes Index (IOI). These measures had to be defined, measured, and quantified before they could be incorporated into the statistical models used in the evaluation. As the chapters in this monograph describe, the extant literature and the expertise of researchers and practitioners were used to define these components. In many cases, new measures and data-collection systems were created to collect this information at the state level. For example, the Tobacco Use Supplement for the Current Population Survey (TUS-CPS) was developed with the assistance of the United States Census Bureau to measure state factors (see chapter 5). Methods were devised to measure newspaper coverage of tobacco-related issues (see chapter 7), to measure legislative action (see chapter 3), and to measure the "dose" of tobacco use control and prevention at the state level (see chapter 2).

The ASSIST evaluation team had to meet an additional challenge before

ASSIST and Systems Methods in Tobacco Control

Ecological theories guided the design of many current public health programs during the 1990s,[a] and ecological theory was the basis for the ASSIST conceptual framework (see Monograph 16, chapter 11). However, before the ASSIST evaluation, there was little guidance for evaluating these programs.[b] The ASSIST evaluation was among the first to define the models, linkages, and appropriate measurement strategies for an ecologically based intervention by identifying constructs and relationships hypothesized to account for any reductions in smoking prevalence and cigarette consumption that might be attributable to a state tobacco control program.[c]

During the later stages of the ASSIST evaluation, the ecological perspective was widened to include a focus on systems methods applied to public health areas such as tobacco control. Within NCI, for example, the Initiative for the Study and Implementation of Systems (ISIS) is currently researching methodological areas such as systems modeling, network analysis, knowledge management, and large-scale organizational change within a context of complex, interrelated systems of behavior—exactly the kind of environment that is now seen within tobacco control, with multiple stakeholders, countervailing forces from the tobacco industry, complex models of behavior, and other factors.[d] This systems view of the world represents a potentially important way of understanding and managing the kinds of upstream public health interventions that could evolve in the future.

Although the ASSIST evaluation concluded at about the same time that efforts such as ISIS were beginning, ASSIST provided some of the first evidence that systems methods could feasibly be used to evaluate complex public health programs. The systems methods used in ASSIST were the following:

- Concept mapping—a participatory, multi-stakeholder approach to decision making within groups— was used as part of the validation of SoTC criteria and was used to identify potential measures of tobacco industry tactics. Concept mapping applies a mixed-methods analysis to produce visual maps of participant ideas and their relationships, to aid planning and evaluation activities within groups.[e]
- Tobacco control professionals and researchers were involved at the national, state, and local levels to participate in the validation of the SoTC measure.

these new components could be used in the evaluation. The fact that only 50 states and the District of Columbia could be included as "observations" created statistical limits on how many factors could be included in the analysis. For example, this meant that instead of being able to include all of the individual measures of intermediate outcomes, such as policy measures and state excise taxes, in the statistical models, one measure or number that represented all of these outcomes had to be created for each state. The process that resulted in the IOI is documented in chapter 4, and the process that resulted in the SoTC score is documented in chapter 2. In addition, although many state-level factors could have affected the implementation and effects of a comprehensive tobacco control program, only a few could be included in the analysis. State-level factors considered for inclusion in the analysis and those selected for the analysis are discussed in chapter 5, along with the data sources for these factors.

- The development of SoTC involved the creation and validation of a logic model across multiple interrelated factors, a precursor to many of the systems dynamics methods used for simulation of complex behavior.
- A database of newspaper coverage of tobacco issues, described earlier in this volume as a demonstration project, parallels the development of knowledge bases for decision support within a systems environment.

All of these factors suggest that the future of public health lies in programs that can be implemented upstream and subsequently measured in complex environments—an approach with the potential to yield great advances in public health. This environment was the context within which the ASSIST evaluation was designed and implemented. In the words of McKinlay and Marceau, "The perspectives and methods developed during the infectious and chronic disease eras have limited utility in the face of newly emerging challenges to public health."[f(p25)] Efforts such as the ASSIST evaluation were designed to address this new reality.

[a]Sallis, J. F., and N. Owen. 1997. Ecological models. In *Health behavior and health education: Theory, research, and practice,* eds. K. Glanz, F. Lewis, and B. Rimer, 2nd ed., 403–24. San Francisco: Jossey-Bass.

[b]Green, L. W., L. Richard, and L. Potvin. 1996. Ecological foundations of health promotion. *American Journal of Health Promotion* 10 (4): 270–81.

[c]Stillman, F., A. Hartman, B. Graubard, E. Gilpin, D. Chavis, J. Garcia, L-M. Wun, W. Lynn, and M. Manley. 1999. The American Stop Smoking Intervention Study: Conceptual framework and evaluation. *Evaluation Review* 23 (3): 259–80.

[d]Best, A. L., R. V. Tenkasi, W. Trochim, F. Lau, B. Holmes, T. Huerta, G. Moor, S. Leischow, and P. Clark. 2005. Systemic transformational changes in tobacco control: An overview of the Initiative for the Study and Implementation of Systems (ISIS). In *Innovations in health care: A reality check,* ed. A. Casebeer, A. Harrison, and A. E. Mark. New York: Palgrave Macmillan.

[e]Trochim, W., and R. Linton. 1986. Conceptualization for evaluation and planning. *Evaluation and Program Planning* 9:289–308.

[f]McKinlay, J. B., and L. D. Marceau. 2000. To boldly go... *American Journal of Public Health* 90 (1): 25–33.

Key Findings of the ASSIST Evaluation

The ASSIST evaluation effort documented the following key findings that associated ASSIST intervention factors with public health outcomes:

- ASSIST states had a greater decrease in adult smoking prevalence than non-ASSIST states.

- States that experienced greater improvement in tobacco control policies had larger decreases in per capita cigarette consumption than states that had experienced less improvement in tobacco control policies.
- States with higher policy scores also had lower smoking prevalence and lower cigarette consumption.[*]

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[*]This finding was significant only when the District of Columbia was not included as a "state" in the analysis. Chapter 9 discusses the challenges associated with equating District-level tobacco control programs and outcomes with state-level ones.

- States with greater "capacity," or ability to implement tobacco control activities—such as states with highly functioning tobacco control infrastructures in the health department, staff experience in tobacco use control and prevention, and strong interagency and statewide relationships—had lower per capita cigarette consumption.
- The cost-effectiveness of ASSIST— the cost per life-year gained— compares favorably with other accepted preventive public health interventions.

Appendix 11.A summarizes several major findings of the ASSIST evaluation. It includes ASSIST versus non-ASSIST state means and standard errors for smoking prevalence rates and IOI scores at baseline and at the end of ASSIST (1999), along with SoTC scores for 1999. The appendix also includes the same information for each of the 50 states and the District of Columbia.

What Do These Results Mean?

The results from the ASSIST evaluation provide evidence that investment in state tobacco control programs that focus on strong tobacco control regulations and policies is an effective strategy for reducing tobacco use. The small but statistically significant differences in the reduction of adult smoking prevalence in ASSIST states, when applied on a population basis, could be expected to have a large impact on the public's health. If all 50 states and the District of Columbia had implemented ASSIST, there would have been approximately 1,213,000 fewer smokers nationally.

States with stronger tobacco control policies also had larger decreases in per capita cigarette consumption. This suggests that policy-focused tobacco interventions can have a strong and sustained effect on the number of cigarettes smoked. More recent analyses support the effectiveness of policy interventions to decrease tobacco use. Smoke-free workplace policies have been associated with reduced daily cigarette consumption,[6–8] higher quit rates,[8–10] lower smoking prevalence rates,[6,7,9,10] and longer sustained cessation.[10] Although policy efforts take time, they can bring about major changes in social norms, including smoking behavior.

The ASSIST evaluation went beyond simply reporting aggregate serial trend data; it is the first such study to link these outcomes to tobacco control program components. This linkage was accomplished by systematically assessing states' capacities to implement tobacco control programs and determining how these capacities were related to smoking prevalence and cigarette consumption. The ASSIST evaluation was the first time that state capacity for tobacco control was measured and subsequently associated with decreased tobacco use. States with stronger infrastructures or capacities (ability to implement tobacco control activities) had lower per capita cigarette consumption, serving as evidence that when tobacco control programs are strong and well supported, a decrease in the amount of smoking can be achieved.

Measuring Capacity

The ASSIST evaluation was the first time that the components of the tobacco control infrastructure at the state level had been defined and its capacity (its ability to perform or produce) successfully measured and subsequently linked to outcomes within a conceptual model.[a] Including capacity in the evaluation model was essential because one of the major legacies of ASSIST was the creation of "an evolving infrastructure for implementing comprehensive tobacco prevention and control initiatives" (see Monograph 16, chapter 11, p. 480). This infrastructure provides the capacity to conduct modern tobacco use prevention and control efforts.

Both before and since the ASSIST evaluation, a large body of literature has accumulated regarding developing capacity for public health efforts.[b,c,d,e,f,g,h,i] However, at the time of the ASSIST evaluation, there were few published papers on measuring capacity, and those studies were mainly at the community level.[j] Since the ASSIST evaluation, the literature on measuring capacity has grown. Currently researchers have documented measures for capacity components including leadership,[k] coalitions,[l,m] and interagency relationships.[n,o,p] Evaluating changes in capacity will be especially important as tobacco use prevention and control programs face funding shortages, which in some states have resulted in the elimination of many program activities[q] and in measurable threats to capacity, including weakened interagency relationships.[r] Maintaining capacity for tobacco control—including a sufficient number of skilled staff and strong interagency relationships—has been identified as key to continuing gains in tobacco use prevention and control goals.[s]

[a]Stillman, F. A., A. M. Hartman, B. I. Graubard, E. A. Gilpin, D. M. Murray, and J. T. Gibson. 2003. Evaluation of the American Stop Smoking Intervention Study (ASSIST): A report of outcomes. *Journal of the National Cancer Institute* 95 (22): 1681–91.

[b]Jensen, M., and W. Meckling. 1976. Theory of the firm: Managerial behaviour, agency costs, and ownership structure. *Journal of Financial Economics* 3:305–60.

[c]Roper, W. L., E. L. Baker, W. W. Dyal, and R. M. Nicola. 1992. Strengthening the public health system. *Public Health Reports* 107:609–15.

[d]Meissner, H. I., L. Bergner, and K. M. Marconi. 1992. Developing cancer control capacity in state and local public health agencies. *Public Health Reports* 107:15–23.

[e]Schwartz, R., C. Smith, and M. A. Speers. 1992. Capacity-building resource needs of state health agencies to implement community-based cardiovascular disease prevention programs. *Journal of Public Health Policy* 14:480–94.

[f]King, L., and M. Wise. 2000. Building capacity for public health. *New South Wales Public Health Bulletin* 11:1–2.

[g]Beaglehole, R., and M. R. Dal Poz. 2003. Public health workforce: Challenges and policy issues. *Human Resources for Health* 1:4.

[h]Potter, C., and R. Brough. 2004. Systemic capacity building: A hierarchy of needs. *Health Policy and Planning* 19:336–45.

[i]Gonzalez-Block, M. A. 2004. Health policy and systems research agendas in developing countries. *Health Research Policy and Systems* 2:6.

[j]Goodman, R. M., M. A. Speers, K. McLeroy, S. Fawcett, M. Kegler, E. Parker, S. R. Smith, T. D. Sterling, and N. Wallerstein. 1998. Identifying and defining the dimensions of community capacity to provide a basis for measurement. *Health Education and Behavior* 25:258–78.

[k]Lempa, M., R. M. Goodman, J. Rice, and A. B. Becker. Forthcoming. Development of scales measuring the capacity of community-based initiatives. *Health Education and Behavior*.

[l]Berkowitz, B. 2001. Studying the outcomes of community-based coalitions. *American Journal of Community Psychology* 29:213–27.

[m]Granner, M. L., and P. A. Sharpe. 2004. Evaluating community coalition characteristics and functioning: A summary of measurement tools. *Health Education Research* 19:514–32.

[n]Provan, K. G., and H. B. Milward. 2001. Do networks really work? A framework for evaluating public sector organizational networks. *Administration Review* 61:400–09.

[o]Provan, K. G., M A. Veazie, N. I. Teufel-Shone, and C. Huddleston. 2004. Network analysis as a tool for assessing and building community capacity for provision of chronic disease services. *Health Promotion Practice* 5 (2): 174–81.

[p]Krauss, M., N. Mueller, and D. Luke. 2004. Interorganizational relationships within state tobacco control networks: A social network analysis. *Preventing Chronic Disease* 1 (4): A08.

[q]Hamilton, W. L., C. N. Rodger, X. Chen, T. K. Njobe, R. Kling, and G. Norton. 2003. Independent evaluation of the Massachusetts Tobacco Control Program. Eighth Annual Report. January 1994-June 2001. http://www.mass.gov/dph/mtcp/reports/2002/abt8th.htm.

[r]Center for Tobacco Policy Research. 2004. Florida's challenge to maintain its tobacco control program: A rapid response report about Florida's tobacco control program. http://ctpr.slu.edu/documents/FLRRR.pdf.

[s]Center for Tobacco Policy Research. 2004. Turning the tide: North Carolina's tobacco prevention and control efforts. http://ctpr.slu.edu/documents/NCRRR.pdf.

A subsequent cost-effectiveness analysis (see chapter 10) confirmed that the ASSIST interventions were economically competitive with other population-level interventions as well as with intensive individual interventions.

The Legacy of the ASSIST Evaluation

ASSIST was a quasi- or natural experiment, not a randomized experiment and, as such, presented the evaluation challenges described earlier in this chapter: states were not randomly selected for the evaluation; implementation standardization was not a core feature of ASSIST; ASSIST targeted a much larger and more diverse population than any previous community-based intervention; and other tobacco control initiatives,

such as SmokeLess States and the Initiatives to Mobilize for the Prevention and Control of Tobacco Use (IMPACT), were fielded during the ASSIST period. In addition, the number of "observations" (states) to be evaluated placed statistical restrictions on how many factors could be included in the analyses.

ASSIST also epitomized Rogers's "diffusion of innovation." "Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system."[11(p115)] Diffusion studies describe trends of successive or sequential adoption of programs or policies. ASSIST practices were diffused formally and informally into all 50 states and the District of Columbia. The ASSIST coordinating center held 17 national training workshops—information exchanges and conferences where strategy, technology,

resources, and technical assistance were shared. Although some of these events were limited only to ASSIST states, non-ASSIST states were included in others, including the first national tobacco control conference meeting in 1997. In this way diffusion occurred both between ASSIST states and consequently into non-ASSIST states.

Stillman et al.[12] provide an early indication that these new and effective techniques diffused into non-ASSIST states, resulting in changes subsequently associated with decreases in tobacco use. ASSIST states had greater increases in IOI scores, a measure of tobacco control policy implementation, than non-ASSIST states only in the first years of the program, 1993 through 1994. Thereafter, IOI scores increased for both groups of states at a similar rate (see chapter 9, figure 9.3).

The ASSIST evaluation legacy includes the successful development of several new measures, including the TUS-CPS, and methods and measures to track legislative change (see chapter 3), state tobacco dependence on tobacco growing and manufacturing (see chapter 6), and exposure to tobacco control programs (SoTC, chapter 2). The legacy also includes substantial progress on other measures. These include methods and measures to track changes in media coverage of tobacco control topics (chapter 7) and tobacco industry actions that counter public health programs (chapter 8).

A number of the components created for the ASSIST evaluation have been institutionalized at the national level. NCI also continues to sponsor the TUS-CPS, a key source of national- and state-level data on smoking and other tobacco use.[13] NCI also continues to support the update of two legislative indices developed under the ASSIST evaluation—the extensiveness of state tobacco control laws related to youth access to tobacco and clean indoor air.[14] The SmokeLess States initiative adopted the ASSIST evaluation conceptual framework, including the media coverage of tobacco control issues, policy scores, and the Strength of Tobacco Control. The Robert Wood Johnson Foundation (RWJF) will continue to support administration of the SoTC survey in 2006 and 2008.

In addition to new data collection methods and systems, the ASSIST evaluation informed and influenced changes in how states evaluate their tobacco control programs. These changes include a move toward evaluating programs in context,[15,16] linking state and local data,[17] and accounting for factors such as the state political environment[18] and tobacco industry activities.[19–25]

Likewise, the sequential process of change depicted in the ASSIST evaluation conceptual model endures as the basis for current tobacco use prevention and control programs. This process and its components and measures are represented in the evidence-based logic models of the three goal areas for the Office on Smoking and Health at the Centers for Disease Control and Prevention[26,27] and are the basis for the current SmokeLess States evaluation.[28] Research has continued to support the causal relationships between components of the conceptual model. This research includes

analyses of media coverage[29–35] and policy outcomes.[36,37]

Research on tobacco industry efforts to counter public health initiatives has grown since the ASSIST evaluation, and initiatives such as the digital tobacco industry library at the University of California San Francisco[38] have made searching and obtaining these documents significantly more reliable and productive. Although an analysis of Tobacco Institute budgets was funded by NCI for the ASSIST evaluation,[39] these budgets were not comprehensive and could not be used to consistently measure these efforts across all states. In addition, the budgets were available only until 1997. Despite these significant advances in document accessibility, the successful documentation of tobacco industry efforts to thwart ASSIST[40] (see Monograph 16, chapter 8), and the progress made toward a measure of protobacco efforts (see chapter 8, this monograph), publicly available data (at both the federal and state level) for such a score remain difficult to standardize at the state level. Developing this score remains a challenge for future research.

The ASSIST evaluation legacy includes the tools to measure the milestones and upstream markers of success that allow researchers and practitioners to document the presence, outcomes, and benefits of tobacco control initiatives. Building on the ASSIST evaluation legacy and addressing the remaining challenges in tobacco control will require a long-term commitment. The following section describes some potential approaches to ensure that this commitment is met.

The Future of Tobacco Control

The ASSIST evaluation provided evidence that the "blueprint" for tobacco control detailed in NCI Smoking and Tobacco Control Monograph 1[41] and implemented for ASSIST was feasible and effective and that the sequential processes of change described were valid. Much still needs to be changed—policies that do not protect people from secondhand smoke; low taxes on tobacco products that keep them affordable; barriers to effective cessation aids that help smokers quit; and tobacco product advertising that promotes these products as attractive and normative, and minimizes their risk. Despite continued progress toward these changes, in early 2005 adult smoking prevalence was 20.9%, and reaching the U.S. Surgeon General's *Healthy People 2010*[42] goal of reducing adult smoking prevalence in the United States to 12% by 2010 appears unlikely.[43,44]

Renewed progress toward these goals requires a better understanding of the magnitude of interventions, the relative contributions of their program components, and their impact on at-risk populations.[45] This better understanding will come from new surveillance and methodological strategies that can delineate the biological, behavioral, and social influences underlying tobacco use, with emphasis on groups that exhibit health-related disparities. These new surveillance measures should include the environmental factors that lead to tobacco experimentation and subsequent addiction, and expanded data on attitudes and beliefs about "smoke-free" accommodations and workplaces. As

tobacco control initiatives increasingly move to the state and local levels, we need to expand capabilities to monitor the dissemination, quality, and outcomes of those efforts. The TUS-CPS tobacco use questionnaire should be modified to incorporate new measures of tobacco-use behaviors, and new supplements should be commissioned to cover new and emerging areas of importance.

Data are currently being collected by multiple entities: individual states collect data,[15,17,46–50] research groups such as the Center for Tobacco Policy Research[51] and ImpacTeen[52] collect data, and the federal government collects data. These data are used for individual state evaluations, evaluations of initiatives (e.g., SmokeLess States), and monitoring of individual factors (e.g., prevalence). However, national leadership is needed to engage stakeholders and build a comprehensive surveillance plan at the federal level. A comprehensive tobacco control surveillance network could begin to integrate available data, help create a more comprehensive data system that could track state tobacco control program development, help in the observation of patterns, and provide the essential data needed to test effectiveness at the societal level. These data could be used to assess all of the different tobacco control programs in the United States and would be useful for ranking states and reporting on their progress.

In addition, new public access databases need to be established to make these critically important state-level factors available to federal and other researchers. These data would greatly expand the current capacity of states to evaluate their own tobacco control programs. Such data would also help researchers develop more comprehensive models to document the relationships between the factors that promote or impede tobacco use, and ultimately establish an association between these factors and reduction in the tobacco-related cancer burden.

Key Questions for Tobacco Control

Tobacco control efforts must continue to address different types of questions, and to do so will require different but overlapping data as well as different methods. For example, program administrators at the state, local, and national levels want to know the optimal mix of interventions and funding levels to reduce the burden of tobacco use. This is extremely important because funding for tobacco control is currently decreasing and program administrators must make important decisions concerning the health of their populations. The key issues are how effective interventions are in terms of magnitude of change, relative contribution of program components, and relative impact for different target populations:

- Do specific components matter in the real context?
- How do we translate clinical trial results into other, less controlled, settings?
- What should a practitioner do in his or her state?
- Has the program been implemented effectively?
- Does the cost effectiveness of this program compare favorably with other interventions?
- Are trends moving in the anticipated directions?

It is also important to understand the research resources needed to provide support to answer these important questions.

Finally, sufficient funding for tobacco use prevention and control is necessary for continued progress in reducing tobacco use. Recent reductions in funding represent one of the greatest threats to the capacity that ASSIST built. Only four states (Colorado, Delaware, Maine, and Mississippi) funded their programs in fiscal year 2005 at even the minimal levels recommended by the Centers for Disease Control and Prevention. Preliminary evidence suggests that as a result fewer mass media campaigns have been fielded and that decreases in youth smoking have stalled.[53]

Using the ASSIST Evaluation Approach for Other Public Health Initiatives

In 1991, the ASSIST focus on changing the social environment of smoking to address what is an individual behavior—smoking—was a revolutionary concept.[54] Today, this approach is being applied to our nation's most pressing health risk behaviors. For example, environmental factors that promote cardiovascular disease have been identified, as have potential environmental interventions to modify them.[55–57] However, cardiovascular disease and obesity share behavioral determinants with environmental influences—physical activity and food intake—and the majority of the research in these areas has focused on obesity. While some research on obesity addresses genetic and individual influences, much of the current research focuses on the interactive environmental determinants of food intake and physical activity.[58–81] The comprehensive tobacco use prevention and control model has been identified as an appropriate guide to obesity prevention,[82] and tobacco control researchers will recognize many current themes in the obesity research; policy change can be used to address both environmental determinants of overeating and underexercising,[69,75,81,83] comprehensive models need to be articulated so that interventions can be implemented,[84] and states need capacity to deliver these interventions and monitor their effects.[83]

The ASSIST evaluation strategy is extremely relevant to the analysis of these so-called "new public health" programs. These large-scale, nonrandomized studies are better assessed by a real-world perspective that moves beyond the study of risk factors and interventions directed solely at changing the behavior of individuals. Evaluations of large-scale studies historically focus on analytical techniques at the expense of study design. For example, community intervention trials in cardiovascular disease and evaluations of state interventions suggest that similar to tobacco use control and prevention interventions, realistic effects are modest changes, over a long time frame, that are difficult to distinguish from secular trends. These programs would also benefit from continuous data collection that includes upstream factors such as infrastructure, policies, and program components.

If public health interventions continue to address complex social phenomena, they will, like ASSIST, require more sophisticated evaluation designs: A traditional before-and-after comparison group design with the intervention represented

by a single variable is inadequate in this context and would surely mask important effects. Studies of social phenomena must go beyond the "black box approach," in which the focus is only on the outcome and the inner processes are hidden. Most studies relate exposures to outcomes without actually describing the process used to achieve their stated goals.

This need mirrors a growing systems view of the world, where outcomes cannot just be described by cause-and-effect observation from simple logic models. As our ability to model increasingly complex phenomena grows, we are finding that the interrelationship and feedback between factors have an increasing role in outcomes—from general cases of how behavior leads to unintended outcomes, to specifics such as how the countervailing efforts of the tobacco industry affect interventions like the ASSIST project. This trend points to the need for evolving, dynamic models of behavior as well as an evaluation methodology that links these dynamic factors to measurable outcomes.

Tobacco use, like many of our current public health challenges, is a complex societal problem that involves individual behavioral factors, economic factors, political factors, and sociocultural factors, as well as vested interests of U.S. and transnational corporations. Successful public health interventions must continue to focus on development of appropriate public health policies, as well as educating governments to take appropriate steps to protect their populations. This is clearly stated by McKinlay and Marceau[85(p29)] in their article "To Boldly Go…": "The success of public health in the 21st century, especially interventions at the level of social policy, will depend in large part on the role of the state."

Summary

The ASSIST evaluation effort broke new ground on several fronts. It provided (1) a rigorous, validated assessment of a large-scale, upstream tobacco control initiative with interventions that led to successful outcomes in tobacco consumption; and (2) evidence that specific factors affect tobacco prevalence. It serves as a model that can be used to guide future evaluation efforts in evidence-based public health, which by nature does not always lend itself to the randomized controlled trial model used in other areas, such as medicine.

Perhaps most important, this evaluation helped establish the broader legitimacy of upstream public health interventions, using tobacco control as a proof of concept. Tobacco use remains the country's leading cause of preventable death, despite substantial reductions in individual use of tobacco in the decades since the release of the first Surgeon General's Report on smoking and health in 1964. In the eyes of many public health professionals, our best hope for significant further reductions in the disease burden of tobacco is encompassed in the quote from McKinlay and Marceau[1] that begins this chapter and points us beyond the traditional public health focus on individual behavior, toward upstream measures that take place at a societal level. The ASSIST project and its subsequent evaluation served as important milestones in validating the

hypothesis that the key to a smoke-free society is an environment where smoking is viewed as non-normative.

Upstream measures are seen as a fairly recent trend in tobacco control (the early discussions leading to the ASSIST project took place in the late 1980s), yet in many ways these efforts also connect with the original activism of early public health efforts to confront death and disease. From the yellow fever epidemic of the early nineteenth century, which was managed in part by policy measures ranging from ship inspections to citywide quarantines,[86] to John Snow's intervention against contaminated water sources in nineteenth-century London,[1] to social activist Jacob Riis's call in the early twentieth century to pass laws affecting New York City tenement life,[87] there is a direct link to modern-day, upstream interventions such as clean-air laws and restrictions on tobacco advertising. Moreover, most of these efforts were opposed by the same kinds of powerful social forces discussed in the preceding section. This means, in a very real sense, that history is teaching us once again that a move toward upstream public health efforts requires a new approach to implementation and evaluation, from a purely scientific examination of causes and effects, to a living, breathing process that evolves as a system.

Both ASSIST and its evaluation represent a growing trend within public health to move beyond its historical base of disease control and prevention into advocacy for policy and infrastructure changes that could drive more permanent and far-reaching changes in health outcomes. Moreover, these projects represent a milestone within the broader area of evidence-based public health by not only funding promising interventions but also developing unique measures that correlate a composite dose level of intervention strength with outcomes in prevalence and consumption. In using a participatory, expert-based approach to develop and validate indirect criteria that were ultimately correlated to outcomes, the ASSIST evaluation effort made an important contribution to the measurement of tobacco control efforts and to the advancement of tobacco control as a discipline.

Looking to the future, the ASSIST evaluation represents a starting point for further research into the refinement and evolution of its own criteria, based on factors such as the interplay between tobacco control constructs (resources, capacity, and efforts) and countervailing forces such as the efforts of the tobacco industry. As such, it represents an important step toward a growing systems view of the world, which takes a more ecological approach to the dynamics of how public behavior and public health are changed. This, in turn, holds the promise that future public health efforts will result in a better quality of life for all people.

Conclusions

1. ASSIST was an ambitious, 8-year project designed to reduce tobacco use prevalence and consumption at the state level by changing the social, political, and media environment surrounding tobacco use. Its evaluation

required the assessment of a complex network of interventions, many of which became widely adopted in other states over the course of the project.

2. Originally designed as a state-by-state comparison of a demonstration project, the ASSIST evaluation methodology evolved to assess a broad range of upstream, population-level tobacco control practices and their outcomes. This effort eventually produced metrics such as the Strength of Tobacco Control index for state-level tobacco control effectiveness and the Initial Outcomes Index for preliminary outcomes in policy and legislative issues, as well as promising efforts in areas such as tracking media coverage.

3. The ASSIST evaluation serves as a promising model for other complex, population-level public health initiatives that do not fit other evaluation models such as randomized controlled trials.

4. The ASSIST evaluation established the effectiveness of the ASSIST interventions, including lower adult smoking prevalence in ASSIST states, greater decreases in per capita cigarette consumption in states with stronger tobacco control, and significant correlations between specific evaluation components and reductions in tobacco use.

5. Future directions in upstream tobacco control include improved data sources and evaluation metrics, stronger assessment of tobacco industry counterefforts, and a growing need to address tobacco control efforts from a systems perspective.

Appendix 11.A. Crude Prevalence, Initial Outcomes Index (IOI), and Strength of Tobacco Control Index (SoTC), by State

	Prevalence (%)						IOI (%)						SoTC (%)	
States	Baseline	SE	Final	SE	Final–baseline	SE	Baseline	SE	Final	SE	Final–baseline	SE	Only at final	SE
ASSIST														
Colorado	24.16	0.96	20.20	0.74	-3.96		-0.90		2.75		3.65		-0.40	
Indiana	27.81	1.34	27.03	1.19	-0.78		-3.14		1.42		4.56		-1.08	
Maine	28.52	1.08	23.51	1.29	-5.01		1.87		6.96		5.09		-1.25	
Massachusetts	21.40	0.64	19.34	0.81	-2.06		1.66		8.63		6.97		0.46	
Michigan	27.20	0.59	23.36	0.69	-3.84		0.76		6.64		5.88		0.90	
Minnesota	25.11	1.31	21.19	0.94	-3.92		3.83		5.96		2.13		1.74	
Missouri	26.24	1.47	23.49	1.10	-2.75		-1.01		3.38		4.39		-0.79	
New Jersey	20.38	0.51	19.84	0.75	-0.54		1.92		7.93		6.01		1.12	
New Mexico	23.99	1.00	20.93	0.94	-3.06		0.17		2.70		2.52		-0.53	
New York	21.52	0.42	20.54	0.47	-0.98		2.18		8.03		5.85		0.69	
North Carolina	26.93	0.71	22.98	0.68	-3.95		-4.26		0.41		4.67		-0.15	
Rhode Island	23.20	0.63	19.87	0.97	-3.33		1.61		6.88		5.28		1.09	
South Carolina	25.71	1.00	22.73	1.20	-2.98		-1.91		0.47		2.38		-0.48	
Virginia	25.47	1.17	20.77	0.69	-4.70		-2.37		1.44		3.81		0.07	
Washington	24.14	0.97	20.13	0.92	-4.01		4.40		8.45		4.05		0.23	
West Virginia	30.25	1.33	26.38	1.37	-3.87		-2.48		1.77		4.24		-0.53	
Wisconsin	26.15	1.34	24.54	1.19	-1.61		1.20		5.74		4.54		-0.04	
Overall average	25.19	0.64	22.17	0.57	-3.02	0.33	0.21	0.60	4.68	0.73	4.47	0.32	0.06	0.20
Non–ASSIST														
Alabama	25.74	0.74	22.29	1.13	-3.45		-2.62		0.89		3.51		-0.18	
Alaska	27.61	1.40	26.69	1.69	-0.92		4.57		10.55		5.99		0.30	
Arizona	22.37	0.87	19.86	0.78	-2.51		1.06		5.25		4.20		4.04	
Arkansas	28.73	1.19	25.99	1.19	-2.74		-2.20		1.99		4.19		0.08	
California	18.94	0.34	16.59	0.43	-2.35		4.25		6.74		2.48		3.73	
Connecticut	22.31	0.83	20.56	1.37	-1.75		0.44		4.22		3.78		0.37	

States	Prevalence (%)						IOI (%)						SoTC (%)	
	Baseline	SE	Final	SE	Final–baseline	SE	Baseline	SE	Final	SE	Final–baseline	SE	Only at final	SE
Delaware	23.30	1.38	23.34	1.06	0.04		-1.31		2.07		3.38		-1.07	
District of Columbia	23.23	0.85	23.54	1.14	0.31		3.10		6.85		3.76		-0.87	
Florida	23.89	0.57	20.66	0.51	-3.23		1.23		3.53		2.30		1.70	
Georgia	24.32	1.18	19.89	0.77	-4.43		-1.87		1.73		3.61		0.34	
Hawaii	22.18	1.18	18.34	1.03	-3.84		3.10		9.04		5.93		0.96	
Idaho	23.61	1.10	21.84	1.52	-1.77		1.02		3.78		2.76		0.13	
Illinois	24.47	0.56	22.92	0.49	-1.55		-1.13		4.61		5.75		-0.71	
Iowa	23.50	0.93	22.37	0.98	-1.13		-1.24		2.17		3.42		0.41	
Kansas	24.22	1.26	22.45	1.07	-1.77		0.93		4.90		3.95		0.47	
Kentucky	31.98	1.07	29.81	1.22	-2.17		-4.81		-1.09		3.72		-0.19	
Louisiana	25.37	1.32	22.74	1.10	-2.63		-1.99		2.64		4.63		-2.30	
Maryland	23.59	1.08	19.46	1.09	-4.13		0.65		8.24		7.59		0.97	
Mississippi	25.46	0.96	21.53	1.23	-3.93		-2.37		0.76		3.13		1.28	
Montana	23.53	1.12	23.29	0.99	-0.24		-0.40		2.88		3.28		-1.60	
Nebraska	21.97	0.99	21.18	0.91	-0.79		-0.33		3.61		3.94		-0.31	
Nevada	28.37	1.03	24.06	1.12	-4.31		-1.12		1.27		2.39		-1.42	
New Hampshire	24.69	1.21	22.04	1.08	-2.65		1.39		5.42		4.03		-0.45	
North Dakota	22.18	1.53	20.47	1.21	-1.71		1.10		5.04		3.94		-0.93	
Ohio	25.96	0.48	24.01	0.77	-1.95		-1.96		2.40		4.36		-1.05	
Oklahoma	26.74	1.34	27.52	0.70	0.78		-2.13		1.46		3.58		0.84	
Oregon	22.93	0.95	21.16	0.96	-1.77		1.68		4.96		3.28		0.90	
Pennsylvania	23.34	0.54	22.88	0.50	-0.46		-1.87		1.79		3.66		-0.68	
South Dakota	25.51	1.12	24.08	1.24	-1.43		-1.40		0.75		2.14		-1.20	
Tennessee	28.53	1.13	25.99	0.98	-2.54		-3.08		0.58		3.66		-1.28	
Texas	23.45	0.60	20.89	0.52	-2.56		1.54		3.75		2.22		-0.61	
Utah	16.90	0.95	13.73	1.11	-3.17		3.68		7.77		4.09		-0.29	
Vermont	26.26	1.45	22.34	0.97	-3.92		1.09		6.37		5.28		-1.50	
Wyoming	24.82	1.02	23.70	1.08	-1.12		-2.51		0.33		2.84		-0.92	
Overall average	24.41	0.48	22.30	0.52	-2.11	0.33	-0.10	0.39	3.74	0.47	3.85	0.20	-0.03	0.23

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