National Cancer Institute

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Greater Than the Sum

Systems Thinking in Tobacco Control

Executive Summary

Foreword

As we have come to see time and time again, complexity is the hobgoblin of health policy. This is of course no surprise to biologists. During a time in the mid-twentieth century when penicillin was driving pneumonia and wound infection into retreat, and when vaccine was beginning to stop the polio epidemic in its tracks, the biologist Ludwig von Bertalanffy was proposing what came to be called "systems theory." In some respects a direct reaction to the reductionist single organ system or "silver bullet" notions of disease and its control, systems theory emphasizes that the behavior of any entity—be it an organization, an individual, a human body—can only be truly understood not by focusing on the properties of its component parts, but by examining and characterizing the collective nature of the positions and relationships among the parts.

Tobacco—and the control of its use and impact—offers a splendid model for using a systems perspective to advantage and gleaning insights about potentially broader applications in health. We have for some time known that health status is the product of the dynamics at play within several domains of influence: our genetic predispositions, our social circumstances, the physical environments within which we live, the behavior patterns we choose, and the medical care we receive. We are also learning that often more important than what happens *within* any given domain is what happens *between* and *among* domains. How does the interplay of our genetic predispositions with our physical environments or behavior choices influence our risk for disease? How do social circumstances affect the medical care we receive and our responses to it? How are our behavioral choices influenced by our social and physical environments?

In tobacco, some of the answers to these questions are coming into closer focus—certainly that is the case for a stronger appreciation of the complexity. We are long past the time that tobacco use is purely a matter of "individual choice" and its control dependent on a strategy of "one-person-at-a-time." Tax policy, school interventions, clean indoor air regulations, agricultural initiatives, advertising campaigns, medical care initiatives, community mobilization, and political action are all among the elements at work to reduce the use of tobacco among Americans. The results have been impressive, deriving from the loosely coordinated contributions of often disparate players. The challenge now is to better understand how these efforts work best in concert under different circumstances. If, through accurate characterization of the nature of the relationships at work, we can develop testable hypotheses about the circumstances in which elements of tobacco control are more, or less, effective, we can accelerate the push to the next level of tobacco control.

The Initiative on the Study and Implementation of Systems (ISIS), a four-year project sponsored by the National Cancer Institute (NCI), represents an innovative and potentially important contribution in that respect. Through ISIS, NCI has supported a careful exploration of four elements of systems approaches to improving tobacco control: systems organizing, system dynamics, system networks, and systems knowledge. This monograph reflects the first two years of the project. Beginning with the identification of key stakeholder groups—practitioners, leaders, advocates, and researchers—ISIS has carefully worked to

identify characteristics, apparent and subtle, that shape, and are shaped by, the characteristics of the interactions and networks both within and among stakeholder groups; the structure of the feedback loops involved in fostering synergy; and the role of learning as an integral feature of the systems at play. The lessons of that exploration are presented in this monograph as potential insights for the ways organization, management, adaptation, and learning might be enhanced for tobacco control and, by reflection, for work in other areas.

The possibilities for application to a broad range of public health challenges are clear. Complexity is simply the central feature to be addressed in the terms of effective engagement for any public health initiative. What we used to think of as the products of personal behavior—diet, physical activity, obesity, substance abuse, teen pregnancy, violence—we now know to be the dynamic results of complex physiologic, social, and environmental influences. Whereas we formerly thought of social circumstances as simply shaping exposures to health risks and complicating the ability to defend against them, we are now beginning to understand that they may in fact be integral components in the etiology of disease and disability. And rapidly occurring climate changes that interact with urbanization and population growth to accelerate altered ecological equilibrium, with potentially dramatic and irreversible implications for human health, underscore the necessity to better understand not only the system dynamics, but also the urgency of the mandate.

As important as are the issues presented in this monograph, equally compelling is the need to keep the concepts accessible and to guard against the creation of a new guild of systems theorists. The ISIS project has performed an important service by giving emphasis and structure to the reality, embodied in both physics and philosophy, that entities and actions interrelate, and that true understanding derives from understanding the nature of the relationships. This is a notion so fundamental that it must be a central feature of problem analysis, strategy formulation, program development, and research design in every social endeavor—not cordoned off as the province of those who have access to the credentials and the thesaurus.

The times are different now from when elements of systems theory were initially advanced. Now we have the tools from epidemiology, statistics, large-scale databases, and computational science that allow more structured exploration of the dynamics. But an impedance to progress when various academic disciplines were beginning to explore systems theory in the 1960s may have been the inclination—typical of many academic pursuits of the time—to construct structures and terms that defined its separateness and limited its accessibility. The irony is obvious for a concept rooted in commonality.

Laudably, the ISIS project and this monograph give emphasis to the importance of translation, linkages, synergies, and common perspectives, as work proceeds. We should be grateful to NCI and the ISIS leadership for this insightful contribution.

J. Michael McGinnis, M.D., M.P.P.
Senior Scholar
Institute of Medicine
National Academy of Sciences

Message from the Series Editor

The evolution of the Tobacco Control Monograph Series underscores its growing importance as a resource for researchers, practitioners, and policy makers in tobacco control as well as in other areas of public health. Lessons learned from tobacco prevention and control can be applied to a variety of public health issues, including physical activity, diet and nutrition, overweight and obesity, and substance abuse. The National Cancer Institute (NCI) is committed to disseminating this cross-cutting knowledge to the widest possible audience so that others can benefit from the experience of the tobacco prevention and control community. By so doing, NCI is increasing the evidence base for effective public health interventions and improving the translation of research to practice and policy.

In 1991, NCI published the first monograph in a series designed to address cutting-edge issues and research on tobacco control. That monograph, *Strategies to Control Tobacco Use in the United States: A Blueprint for Public Health Action in the 1990's,* was visionary in its scope and focus: not only did it acknowledge that tobacco use was a complex problem that demanded new ways of thinking and acting, but it also encouraged expanded exploration of tobacco use issues by the tobacco control community. The three-axis model for the American Stop Smoking Intervention Study for Cancer Prevention (ASSIST), described in Monograph 1, was designed to address the complex interplay of varied target populations, critical channels for intervening (e.g., health care, schools, worksites, and community groups), and intervention types (e.g., mass media, program services, and policy). (See Monograph 16: *ASSIST: Shaping the Future of Tobacco Prevention and Control* and Monograph 17: *Evaluating ASSIST: A Blueprint for Understanding State-level Tobacco Control* for more details.)

Although it did not adopt the "systems" nomenclature, Monograph 1 laid the foundation for this monograph (Monograph 18), which provides a new and expanded vision of tobacco control as a complex adaptive system. This new model encourages the tobacco control community to (1) collect and use vast arrays of data more effectively; (2) develop and optimize networks to enable the community to more efficiently address varied populations, critical channels for intervention, and intervention types; and (3) support the analysis of complex systems so that more effective strategic decisions are made. Monograph 18 builds on the foundation laid by Monograph 1 by explicitly encouraging (1) the development of informatics infrastructures and collaborative networks, (2) analysis of complex interacting variables, and (3) adoption of new interventions that can speed research to practice (and practice to research). Monograph 18, as the conceptual heir to Monograph 1, provides a new framework for thinking about and acting on the complex relationships among causal factors of public health threats, and it challenges us to consider not just whether we can more effectively use our knowledge of informatics and information management, networks, and complex systems, but whether we will use those essential tools to more rapidly benefit the public's health.

Stephen E. Marcus, Ph.D.
Monograph Series Editor
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Preface

> *There is always an easy solution to every human problem—neat, plausible, and wrong.*
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> —H. L. Mencken (1880–1956)

The world of tobacco control has become increasingly complex over the past several decades. It involves more extensive collaborations; new structures and configurations for coordinating efforts; and multilevel social, professional, and knowledge networks to improve information sharing for public health. Given such complexity, there has been a corresponding increased need to address tobacco control issues using a systems perspective that enables one to better understand and navigate the dynamic and evolving nature of the terrain to achieve the next generation of improved health outcomes.

This monograph describes the results of the initial two years of the Initiative on the Study and Implementation of Systems (ISIS), a four-year project. This initiative is one of the first major coordinated efforts to study and implement a systems thinking perspective using several systems approaches and methodologies that appeared to be promising for tobacco control in itself and as an exemplar for other complex issues in today's public health environment. In the ancient, revered Egyptian myth, the goddess Isis breathed clean air into her late husband Osiris to restore him to life. In analogous fashion, the ISIS project hopes to contemporize the myth in a tobacco control context and encourage systems perspectives that have the potential to help people breathe cleaner air and be restored to a smoke-free life.

Although this work is aimed at the efforts of the tobacco control community, the word "tobacco" intentionally appears only in the subtitle of this monograph. That is because ISIS was a research effort that focused on the tobacco control environment to examine how to apply systems approaches to issues that have become endemic throughout public health, including the need for

- Better understanding of outcomes, including the unintended consequences of complex interventions and events

- Effective capture, dissemination, and management of knowledge throughout the multilayered public health system

- More efficient organization and linkage of the efforts of multiple, diverse stakeholders

- Adoption of evidence-based practices that inform practice and improve outcomes

- Strengthening of collaborative networks of scientists, policy makers, government and foundation managers, practitioners, and the public

This work was undertaken to help address some of the fundamental organizational issues in tobacco control and, by corollary, much of public health. The goal was to investigate the potential

of integrated, systems-based approaches to facilitate the efforts of all stakeholders to make substantive changes in public health outcomes. The lack of such linkages poses a particularly serious challenge to the public health system. For example, a 2001 Institute of Medicine report, *Crossing the Quality Chasm,* points to "a health care system that frequently falls short in its ability to translate knowledge into practice…"*[(p3)] In this view, the lack of progress is due to (1) a system that fosters research that does not always translate directly into outcomes in patients and (2) practitioners who do not often have a voice in this research community. These types of disconnections illustrate the need for more synergistic teamwork, within a system of systems, that has the potential to dramatically improve public health outcomes.

In ISIS, the term *systems* plays a central role. However, its definition remains elusive. The term has multiple manifestations and meanings in the world of tobacco control, encompassing everything from the structure of organizations, to the arrangement of networks, to the dynamics of change, to the patterning of information. The evolution of this project puts it squarely in the trajectory of some of the key trends in contemporary public health, all of which can be viewed as essentially "systems" issues:

- **There is a growing macro-level focus in tobacco control and public health.** A review of the history of tobacco control efforts shows that the earliest initiatives were aimed at the individual and cessation; intermediate efforts increasingly focused on the community level and collaborative interventions; and subsequent efforts emphasized larger population groups and more broad-based interventions, such as legislative changes, taxation, and media advocacy. A systems-level focus on tobacco control is a logical next step in understanding and managing the complex nature of tobacco use, as both an epidemiological and a personal health issue.

- **There is a growing need to better integrate research and practice.** The core concerns of putting evidence-based knowledge about tobacco control into practice and giving practitioners a voice in the research agenda point to a need to re-examine the basic paradigms of science, how it interfaces with society, and how society's investment in research and development is understood.

- **The tobacco control environment has, in and of itself, become a system of systems.** Understanding and navigating a landscape that includes national organizations, community-based advocacy groups, health practitioners, public health officials, researchers, funding sources, and the community itself have become the next major challenge in creating and implementing evidence-based practice that changes public health outcomes.

- **The systems of systems that now characterize tobacco control are embedded within a larger public health context with important focal outcomes such as reduced morbidity and mortality.** Tobacco control has had tremendous successes in reducing

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*Committee on Quality of Health Care in America, Institute of Medicine. 2001. *Crossing the quality chasm: A new health system for the 21st century. Executive summary.* Washington, DC: National Academies Press. http://books.nap.edu/execsumm_pdf/10027.pdf.

consumption, prevalence, morbidity, and mortality. Universally applying what we know would have a tremendous impact on tobacco control and disease reduction. Being able to do so and reaching the next level of achievements in outcomes, however, require a better understanding of the complex interrelationships and dynamics of the tobacco control system, its connections to both the public health system and the public, and its dynamic relationships with the industry that continues to generate both products and profits.

These trends, at many levels, reflect the evolution of public health itself—from treatment of specific diseases, to prevention, to social and policy movements, to the study of interrelated factors and beyond. This monograph is the result of that evolution; its aim is to contribute to continued evolution by encouraging consideration and use of systems thinking in tobacco control and potentially in public health in general.

Executive Summary

Tobacco use remains a leading cause of preventable death. Even though reductions in the prevalence of tobacco use and cigarette consumption over the past four decades have been substantial, tobacco use continues to be a major challenge for public health.[1–3] With the recent development of clear, evidence-based best practices in tobacco control, along with funding new research to better understand the complex and changing tobacco control environment, the potential exists to improve public health outcomes substantially in the future.

However, the promise of implementing demonstrably effective tobacco control initiatives to achieve greater gains in health outcomes remains only partly realized. Strong scientific evidence exists for effective tobacco control practices. Nonetheless, desired outcomes remain at levels far lower than what is achievable in areas such as the prevalence of tobacco use and product consumption and related morbidity and mortality.[2,4] This situation is attributable to numerous factors, ranging from multiple diverse stakeholders, to declining funding, to the systematic efforts of the tobacco industry to undermine the efforts of the tobacco control community.

It is increasingly apparent that the implementation and, more important, the integration of systems approaches (e.g., systems organization, system dynamics, system networks, and systems knowledge) have the potential to significantly enhance the efforts of groups of tobacco control stakeholders to improve outcomes associated with tobacco control initiatives (e.g., increased smoking cessation, reduced initiation to tobacco use, and above all, reduced morbidity and mortality associated with smoking).[5] These efforts, applied to tobacco control practices, can be an essential foundation for creating a new, scientifically credible framework for future public health efforts.
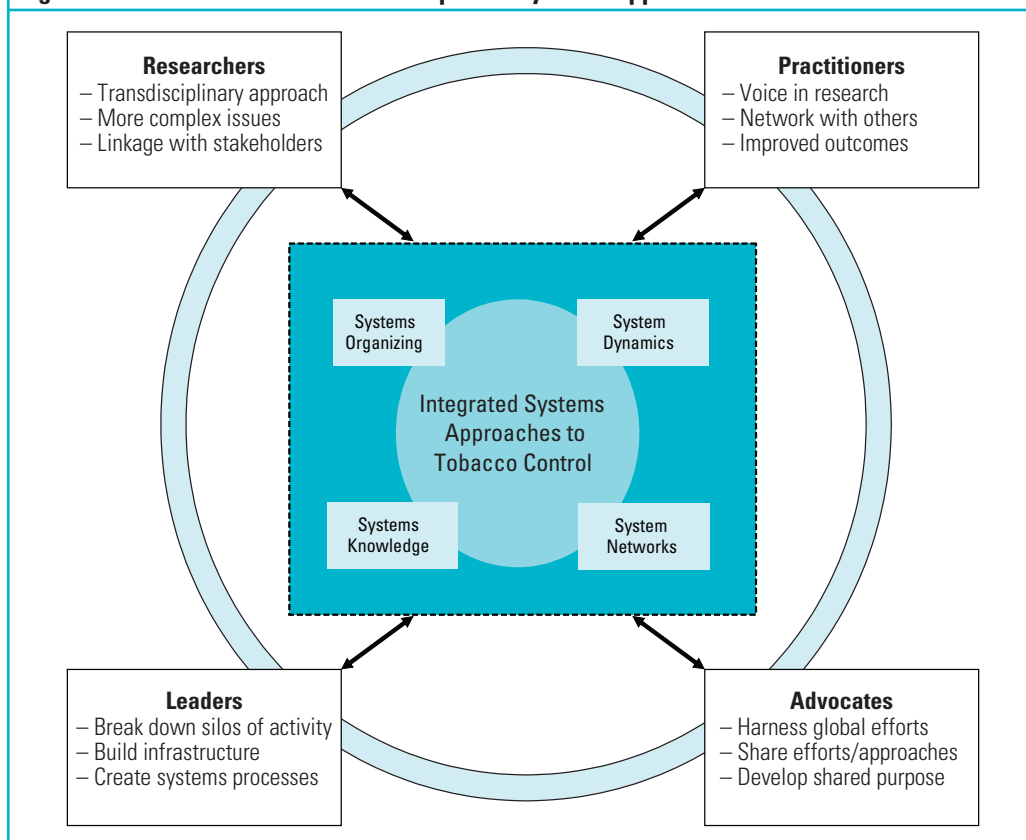
The Initiative on the Study and Implementation of Systems (ISIS) project was undertaken to examine the value and potential impact of systems thinking for tobacco control, both to improve its outcomes and as a template for strategies to apply these methods to other public health issues. This monograph describes the findings of the first two years of this project and their potential implications for tobacco control and public health. The monograph examines the synthesis of four key systems approaches applied to the fundamental problems of tobacco control (figure 1):

1. **Systems organizing** to understand and foster the development of participatory, complex, and adaptive collaborative systems in tobacco control; ensure their effective facilitation and management; and encourage productive system action and learning

2. **System dynamics** to understand and model the complex dynamic interactions involved in the tobacco control system and among the factors influencing tobacco use, including political actions such as taxes and legislation, research advances, tobacco control activities, industry forces, and social and cultural factors

3. **System networks** to understand and analyze effective collaborative relationships among stakeholders, improve collaboration strategies, and help reduce duplication of effort

4. **Systems knowledge** to develop and manage the knowledge infrastructure required for effective dissemination and evolution of scientifically credible, evidence-based practices, together with an effective strategy to package, deliver, and maintain this knowledge

Most important, integration of these systems approaches promises to help in the creation

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Figure 1   Model of Stakeholder Groups and Systems Approaches in Tobacco Control

Researchers
– Transdisciplinary approach
– More complex issues
– Linkage with stakeholders

Practitioners
– Voice in research
– Network with others
– Improved outcomes

Systems Organizing

System Dynamics

Integrated Systems Approaches to Tobacco Control

Systems Knowledge

System Networks

Leaders
– Break down silos of activity
– Build infrastructure
– Create systems processes

Advocates
– Harness global efforts
– Share efforts/approaches
– Develop shared purpose

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of a more consistent and adaptive research-based infrastructure for effective tobacco control and, by corollary, for public health in general. The ISIS project is an important step in bringing such an environment to fruition and, in turn, changing the practice of tobacco control to take the next step to improve health outcomes.

Monograph Framework

This monograph is structured as a discussion of the core issues in systems thinking for tobacco control, followed by detailed consideration of specific systems approaches and their potential synthesis, together with consensus guidelines for future systems efforts in tobacco control and public health. The monograph's core areas include

- An overview of the state of tobacco control and the potential for using systems thinking approaches to address future tobacco control issues;

- A detailed examination of four initial systems thinking approaches chosen for potential applicability to tobacco control and public health: systems organizing and management, system dynamics and its modeling, system network analysis, and systems knowledge management and translation; and

- A look at the potential areas of synthesis among these and other systems approaches and methods. The general rubric of systems thinking is used, together with guidelines for exploring how a future systems thinking environment for tobacco control can affect each of the major stakeholders

in tobacco control and potentially improve public health outcomes.

Chapter 1, "Overview," provides the introduction and framework of the monograph.

Chapter 2, "Tobacco Control at a Crossroads," examines the state of tobacco control, the immediate context for exploring systems thinking within this area, and the evolution of tobacco control efforts. It tracks the development of current views of tobacco use and discusses systems approaches as the logical next step in addressing tobacco use.

Chapter 3, "Systems Thinking: Potential to Transform Tobacco Control," then lays out the case for the four broad systems thinking approaches examined within this project. The chapter summarizes the value of systems thinking, the approaches and issues that drive systems thinking, and the potential of systems thinking to change outcomes in tobacco control. In the process, the chapter examines the research underpinnings of a variety of systems thinking methods, including system dynamics modeling, network analysis, knowledge management, systems organizing and management, and the synthesis of these and other approaches.

Chapter 4, "How to Organize: Systems Organizing," examines the management, operational, and logistic aspects of working in a diverse systems environment involving multiple stakeholders. This section explores the view that systems thinking is becoming an integral feature of contemporary management. It presents a model for systems organizing that encompasses and extends the traditional management model around a systems framework of vision, structure, action, and learning. It also examines current thinking in cross-organizational systems, including the use of participatory mixed methods for planning and evaluation that integrate with a systems approach, together with the concept of effective complex adaptive systems for tobacco control and

public health, illustrating systems organizing principles with several empirical case studies.

Chapter 5, "How to Anticipate Change in Tobacco Control Systems," follows this organization framework with a look at the specifics of modeling public health issues as a system to better understand them and plan more effective interventions. This chapter focuses on understanding the nature of system dynamics, including the development of dynamic models that include feedback processes and the use of system dynamics modeling as a technology for understanding tobacco control outcomes, together with results from a study developing a system dynamics representation of tobacco control variables and simulation of the aging chain of smokers.

Chapter 6, "Understanding and Managing Stakeholder Networks," explores system network theory and methods, examining the question of "who works with whom" in a system and how organizations are brought together based on concepts of network analysis and related approaches. It also examines applications of network analysis to improve community and public health collaboration, including a case study of network analysis for evaluation of tobacco control.

Chapter 7, "What We Know: Managing the Knowledge Content," focuses on the role of managing systems knowledge content, including research findings on knowledge management issues for health care environments, the results of a knowledge management review project to evaluate existing research dissemination efforts at the National Cancer Institute, recommendations for a general knowledge infrastructure for tobacco control efforts, and a systems-oriented conceptual modeling project used to develop the taxonomy for a tobacco control knowledge base.

The monograph closes in chapter 8, "Synthesis and Conclusions," by examining

the critical issue of integrating component systems thinking disciplines within a broader framework of systems thinking in tobacco control. The chapter explores synergies across the areas studied in this project, existing trends toward systems approaches, and common methodological elements, together with consensus guidelines summarized in the "Major Conclusions."

Two appendices describe the project's history and its formative decisions, as well as a potential framework for implementing systems thinking approaches in the real world of tobacco control.

Summary

To work efficiently and effectively in today's tobacco control environment, the tobacco control community must explore the systems methodologies that drive the competitiveness of the private sector. Such methodologies have strong potential for successful translation of science into practice and the achievement of desired outcomes. The goal of the first two years of the ISIS project was to take a critical first step toward bringing this potential to fruition.

The ISIS project represents a significant step in investigating approaches for systems thinking to improve outcomes of tobacco control efforts. It also serves as the framework for a new, rigorous approach to other public health issues. The findings and lessons learned in the first two years of this project were synthesized by its core members as a set of consensus guidelines for the future exploration and implementation of systems thinking approaches in tobacco control. The following "Major Conclusions" section and chapter 8 summarize these guidelines, which emphasize systems thinking as an ecological process rather than a cluster of methodologies.

The benefits of an integrated systems approach to tobacco control can go far

beyond dollars and cents, to the estimated 1,200 people per day in the United States who die prematurely from smoking-related causes, according to the Centers for Disease Control and Prevention.[2] The vision is that by integrating technologies that address systems organizing, system dynamics, system networks, and systems knowledge in a framework of systems thinking, tobacco control organizations will be able to work more effectively and collaboratively and use evidence-based best practices more effectively in the field. More important, this effort leverages current systems research to create a bold new approach to integrating science and practice to achieve desired health outcomes.

Major Conclusions

1. Tobacco control is at a crossroads because tobacco use is increasingly recognized as a complex adaptive system involving biological, behavioral, and environmental influences.

2. Systems thinking has the potential to transform tobacco control research, practice, and policy by improving collaboration and by providing a more dynamic and adaptive evidence base for practice and a deeper knowledge about the impact of tobacco prevention and control activities.

3. Systems organizing encourages the transformation to a systems culture by addressing the core issues: vision and paradigm, barriers, leadership, and the need for an ongoing learning environment for systems thinking. Such an environment encompasses a wide variety of structured group processes, many of which may involve quantitative frameworks. Systems organizing implies a synthesis of the classic linear management processes of planning, organizing, leading, and controlling with a more adaptive environment expressed

around concepts of vision, structure, action, and learning.

4. System dynamics encompasses qualitative and mathematical simulation approaches to model dynamic relationships that evolve over time, and can simulate behavior including possible unintended consequences and long-term effects. Efforts to develop and apply systems methods and processes involve theory and research development, mixed-methods systems thinking, and participatory assessment of systems needs. At a practical level, the infrastructure for system dynamics is addressed by fostering an ecological perspective on implementation, as well as a systems approach to evaluation.

5. System networks of tobacco control stakeholders form a foundation for a systems environment in tobacco control, replacing "silos" with linkages of people and resources that transcend geography and discipline. This process involves building and maintaining stakeholder relationships by creating networks of stakeholders for systems thinking, studying the dynamics and effects of these networks, linking disciplines of stakeholders in tobacco control, and preparing for the impact of demographic change.

6. Systems knowledge management and translation form a key component of systems approaches for tobacco control, examining purpose, people, process, and products within a broader knowledge infrastructure. This involves building system and knowledge capacity by expanding public health data, integrating information silos, fostering the skills and culture to affect processes and outcomes, and creating networks for knowledge translation.

7. Integration and synthesis of systems approaches are key to a systems thinking environment for tobacco

control, moving toward a more adaptive system that changes public health outcomes. Approaches such as systems organizing, system dynamics modeling, network methods, and knowledge management contain synergies in areas ranging from participatory stakeholder networks to simulation and knowledge environments. Achievement of this goal involves creating a vision, developing capacity, building planning models, and establishing meaningful and adaptive evaluation measurements.

8. Capacity building for systems thinking touches on the resources needed for bringing a systems thinking environment to fruition in tobacco control. These include fundamental infrastructure issues such as creating networks and linking them with systems knowledge in other fields, as well as specific action items such as creating systems curricula for academia and national professional associations, and holding conferences for systems thinking in public health.

Chapter Conclusions

Chapter 2. Tobacco Control at a Crossroads

1. The prevalence of smoking among adults has been reduced by approximately one-half since 1950. However, tobacco use remains the nation's leading cause of premature preventable death. The success of efforts to reduce the prevalence of adult smoking to the Healthy People 2010 goals of 15% or less remains elusive.

2. Increasingly, tobacco use is seen as a population-level health problem that involves forces from the tobacco industry, current tobacco users and nonusers, and the environment.

3. Tobacco control efforts have evolved from a focus on individual interventions

toward population-level interventions, as the nature of tobacco use has become better understood. These efforts have evolved into a complex system involving multiple stakeholders and environmental factors, ranging from social attitudes toward smoking to the countervailing efforts of the tobacco industry.

4. Some research findings suggest that systems approaches are critical to further substantive gains in tobacco control. The success of early tobacco control efforts at the population level gives impetus to further exploration of this hypothesis.

Chapter 3. Systems Thinking: Potential to Transform Tobacco Control

1. The key challenges in tobacco control and public health today are fundamentally systems problems, involving multiple forces and stakeholders. Systems thinking is an innovative approach to address these challenges and improve health outcomes.

2. Numerous frameworks exist for systems thinking, a concept that encompasses a broad synthesis of systems approaches. These approaches provide a theoretical basis for applying specific systems methods, such as system dynamics modeling, structured conceptualization, and network analysis.

3. The Initiative on the Study and Implementation of Systems encompasses four key areas of systems thinking, and their integration: how people organize (managing and organizing as a system); how people understand dynamic complexity (system dynamics modeling); who people are (network analysis); and what people know (knowledge management and knowledge transfer).

4. Examination of systems approaches has the potential to address key questions and problems faced by the various stakeholder groups involved in tobacco control.

5. Potential benefits of systems thinking in tobacco control include improving collaboration among stakeholders; harnessing resources toward evidence-based practice; eliminating duplication of effort; and gaining deeper knowledge about the impact of tobacco control activities.

Chapter 4. How to Organize: Systems Organizing

1. Systems organizing implies a move away from the classical linear management processes of planning, organizing, leading, and controlling toward a more adaptive, participatory environment expressed here around the concepts of vision, structure, action, and learning:

   - Vision encompasses a move from an environment of leading and managing to one of facilitating and empowering.

   - Structure encompasses a move from organizing to self-organizing.

   - Action encompasses a move from delegation to participation.

   - Learning encompasses a move from discrete evaluation to continuous evaluation.

2. Two concept-mapping projects explored key areas of organizing as a system. One project, examining issues in accelerating the adoption of cancer control research into practice, yielded clusters of action items in areas of research, practice, policy, and partnerships. The other project examined components of strong local and state tobacco control programs and provided the framework for a logic model of process and outcome ranging from near-term to long-term objectives.

Chapter 5. How to Anticipate Change in Tobacco Control Systems

1. Tobacco control consists of dynamic relationships over time and requires

approaches, such as system dynamics modeling, that can address such dynamics.

2. Understanding of tobacco control and public health issues has evolved from simple cause-and-effect studies and logic models to more complex, ecological problems that involve feedback and evolving behavior.

3. System dynamics uses mathematical simulation approaches based on stocks, flows, and feedback loops, which can model system structures and simulate future system behavior, including possible unintended consequences and long-term effects.

4. Demonstration projects, such as the system dynamics simulation of tobacco prevalence and consumption developed for the Initiative on the Study and Implementation of Systems, show the potential to model and simulate future tobacco issues to design more effective interventions.

5. Opportunities are likely to surface for integrating system dynamics modeling and other systems thinking approaches at epistemological and methodological levels. Systems approaches can and should integrate within a larger systems thinking environment encompassing components such as systems organizing, networks, and knowledge management.

Chapter 6. Understanding and Managing Stakeholder Networks

1. Solving complex future issues in tobacco control will require replacing silos of information and activity with greater linkage of tobacco stakeholders through networks.

2. Networks of tobacco control stakeholders form a foundation of the systems environment envisioned for the future of tobacco control. Many components of a systems approach are built around the presumption of stakeholder networks

that span multiple levels of tobacco control activity and transcend geography and discipline. These components include building organizational capacity; participatory approaches to planning, implementation, and evaluation; optimization of resources and effort; and dissemination of knowledge and best practices.

3. Network analysis holds the potential for facilitating understanding and strategic management of linkages between stakeholder groups.

4. Numerous theories of network behavior currently coexist, and core concepts that describe networks now have broad acceptance, particularly those related to network attributes and behavior.

5. Network applications in public health are at an early stage. However, they have shown promise in recent studies, particularly in areas where disparate organizations have a common goal. Recent tobacco control applications of networks include the North American Quitline Consortium and Global Tobacco Research Network.

6. Network attributes potentially serve as a measure of the health of tobacco control efforts, as evidenced by a case study correlating network centrality with the strength of political and financial support for tobacco control.

7. In the future, tobacco control programs could consist of multiple networks with specific functional objectives, linked in turn as part of a "network of stakeholders."

Chapter 7. What We Know: Managing the Knowledge Content

1. Effective knowledge management is based on a social context revolving around knowledge production, use, and refinement, as well as an ecological context based on audience, motivations, and mechanisms.

2. A formal strategy for knowledge management is essential to the creation of a consistent knowledge environment. One framework defines knowledge capabilities in terms of purpose, people, process, and products, together with a knowledge management and translation infrastructure defined in terms of its underlying organization, technology, information, and finance infrastructures.

3. A review of resources for tobacco control knowledge at the National Cancer Institute confirmed the existence of extensive resources for tobacco control, combined with growth areas for the future, such as integration, visibility among stakeholders, and knowledge gaps.

4. A concept-mapping project that engaged stakeholders to examine specific information needed for tobacco prevention, control, or research yielded clusters of knowledge categories that helped form the taxonomy for a planned knowledge base for tobacco control.

References

1. U.S. Department of Health and Human Services. 2000. *Reducing tobacco use: A report of the Surgeon General.* Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

2. Centers for Disease Control and Prevention. 2002. Annual smoking-attributable mortality, years of potential life lost, and economic costs: United States, 1995–1999. *Morbidity and Mortality Weekly Report* 51 (14): 300–303.

3. U.S. Department of Health and Human Services. 2004. *The health consequences of smoking: A report of the Surgeon General.* Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

4. Centers for Disease Control and Prevention. 2004. Cigarette smoking among adults—United States, 2002. *Morbidity and Mortality Weekly Report* 53 (20): 427–31.

5. Best, A., R. Tenkasi, W. Trochim, F. Lau, B. Holmes, T. Huerta, G. Moor, S. Leischow, and P. Clark. 2006. Systemic transformational change 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. L. Casebeer, A. Harrison, and A. L. Mark, 189–205. New York: Palgrave Macmillan.