CONSIDERING HOW AND WHY DETERRENCE WORKS IN PUBLIC HEALTH

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CONSIDERING HOW AND WHY DETERRENCE WORKS IN PUBLIC HEALTH

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Public health experts often approach "deterrence"—or prevention of behaviors and/or decisions that adversely affect health outcomes—by considering the many factors that influence health behaviors and decision-making. These factors, often called "health determinants," can be divided into three levels: micro- (individual), meso- (social/community), and macro- (systems). Interventions to influence health-related decision-making at each level have been developed, tested, and refined for a variety of public health deterrence efforts. Successful deterrence in public health often requires recognizing the interdependence of multiple factors within these levels and developing adaptive interventions to impact individual and group behavior. This paper describes several academic models and tools for understanding public health deterrence and then examines how those resources have been successfully utilized in an iterative, evidence-informed, adaptive approach to ultimately reduce tobacco smoking in the United States.

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People working in the field of public health are focused on improving population health outcomes. In many instances, this goal includes trying to influence the behavior and health-related decision-making of individuals, groups, or both. Sometimes, influencing behavior to improve public health outcomes involves convincing people to *do* something, like get vaccinated; other times, it involves convincing people *not* to do something, like start smoking. Most public health professionals would likely not use the term *deterrence* to describe their efforts, although the history and context of efforts to influence health behaviors and stop harmful health practices has long included intentional efforts to discourage certain actions, sometimes by instilling doubt or fear of consequences. This paper explores common concepts and insights that can be gained from the field of public health for deterrence generally, and thus the term *deterrence* will be utilized to emphasize these connections throughout.

Public health experts often approach deterrence by considering the many factors that influence health behaviors and decision-making. As shown in Figure 1, an often-utilized model for these factors, first proposed by Dahlgren and Whitehead in 1991, indicates that the multiple factors that influence health, often called "health determinants," can be divided into three levels: 1) micro- (individual), 2) meso- (social/community), and 3) macro- (systems). At the micro-level are demographic and biological factors that influence health, such as age and genetics, as well as psychological and personal factors specific to the individual that influence health, such as individual behaviors or choices. At the next level, the meso-level, are factors around—but outside of—the individual that also impact that person's health outcomes, such as social connections (e.g., friends, family, community, neighborhood), as well as structural factors, such as access to transportation, etc. Finally, the macro-level factors that influence health indicate larger systems and forces, such as political structures, legal systems, access to water and sanitation, health care systems, etc.[1-2]

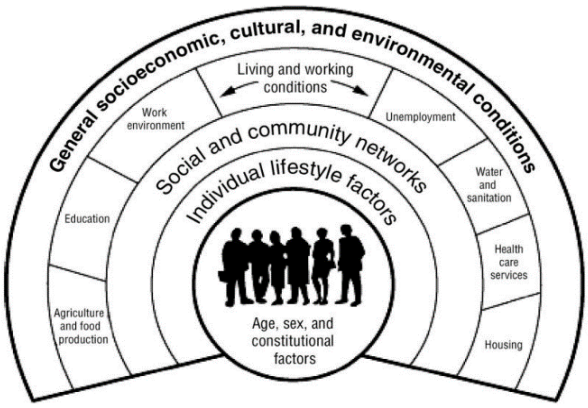

Figure 1. The Dahlgren-Whitehead Model of Health Determinants. Source: Dahlgren, G., & Whitehead, M. (1991). *Policies and strategies to promote social equity in health*. Stockholm, Sweden: Institute for Futures Studies.[1]

When considering when and how to deter or prevent certain behaviors, public health professionals often consider the influence of health determinants at micro-, meso-, and macro-levels. For example, when trying to deter people from smoking, health professionals will consider micro-factors, such as age; meso-factors, such as social networks; and macro-factors, such as laws and taxes. Many such examples of deterrence at micro-, meso-, and macro-levels exist in the public health literature and will be explored later in this paper.

First, however, it is also important to consider how public health experts understand healthy behaviors, especially because people do not always make choices related to their health that follow the best available rigorous evidence. One common model that is widely used to

understand individuals' health decisions to inform public health deterrence (or prevention) efforts is the Health Belief Model, shown in Figure 2. Developed in the 1950s, the Health Belief Model intended to explore a common—and frustrating—problem in public health, which was "the widespread failure of people to accept disease preventives or screening tests for the early detection of asymptomatic disease."[3] In some ways, public health officials intent on improving population health outcomes are actually trying to overcome individuals' own decision-making inclinations and instead influence them to make different decisions that are better for their health outcomes and grounded in high-quality evidence. To do this, public health professionals need to understand *why* individuals do not always make decisions in the interests of improving their own health and preventing disease. The Health Belief Model helps public health experts develop that understanding.

Initially developed with four tenets, the Health Belief Model has been updated in subsequent decades and now includes six tenets that collectively explore a person's perceptions related to health behaviors and the impact of those behaviors on health outcomes.[4] The six tenets are "perceived susceptibility," "perceived severity," "perceived benefits," "perceived barriers," "cues to action," and "self-efficacy." As shown in Figure 2, "perceived severity" and "perceived susceptibility" collectively help describe how much of a threat a person believes a given health issue (e.g., an illness) to be. "Perceived benefits" and "perceived barriers" collectively influence whether and how much a person believes that taking protective or preventive action may protect against the health threat. The tenets of "cues to action" and "self-efficacy" attempt to capture other factors that influence whether a person undertakes a specific health behavior. The "cues to action" component incorporates different types of "cues," or prompts, that stimulate individual decision-making. These can either be internal, such as the development of symptoms, or external, such as advice from a trusted family member. Self-efficacy essentially captures a person's confidence in their own ability to make health-related decisions. All the tenets of the Health Belief Model can be modified, or affected, by individual characteristics, such as age, personality, susceptibility to peer pressure, etc., as shown to the left of Figure 2.[4-7]

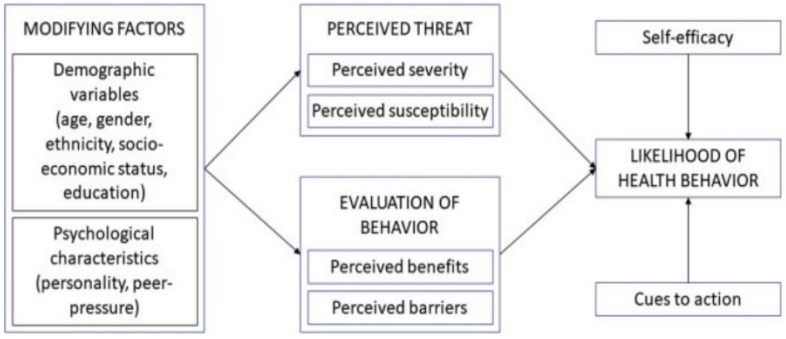

Figure 2. Schematic of the Health Belief Model. Source: Etheridge, J. C., Sinyard, R. D., & Brindle, M. E. (2023). Chapter 90 – implementation research. In A. E. M. Eltorai, J. A. Bakal, P. C. Newell, & A. J. Osband (Eds.), *Translational Surgery: A volume in handbook for designing and conducting clinical and translational research* (pp. 563-573). Academic Press.

Grounded in psychological and behavioral theory and research, the six tenets of the Health Belief Model can help inform intentional efforts to deter or otherwise influence health-related behaviors. Understanding how and why someone might choose not to get screened for disease,

for example, or might not take preventive action when experiencing symptoms of disease helps public health officials deter unhealthy choices and the resultant poor health outcomes.

Although the Health Belief Model has been effectively used in public health for decades,[5-6] its focus is mainly on factors and influences at the micro- (individual) and meso- (social/community) levels that influence health behaviors and outcomes. The Health Belief Model offers less explanation of the influence of macro-level factors on health-related decision-making, even though political, legal, economic, and other systems can have a major impact on who is healthy, when, and why. Many models and frameworks have been developed to try to capture the macro-, or system-level, factors that can impact health-related behaviors and choices of individuals or groups. Macro-level factors are important for deterrence in public health because acting at this level can have a powerful and significant impact on individual behaviors and choices, often without the conscious awareness of those individuals. One framework that captures many elements of the macro-context and is highly relevant to the concept of deterrence in public health is the Context and Implementation of Complex Interventions (CICI) framework, shown in Figure 3. This framework was developed after extensive review of the peer-reviewed literature exploring effectiveness (or lack thereof) of implementing complex interventions to improve health. The CICI framework defines context in a way that can help explain how public health experts can (and do) leverage macro-level system determinants to influence health behaviors and outcomes. As Figure 3 indicates, the CICI framework defines context in seven domains: geographical, epidemiological, socio-cultural, socio-economic, ethical, legal, and political.[8] Table 1 summarizes the authors' definitions of these different context domains.

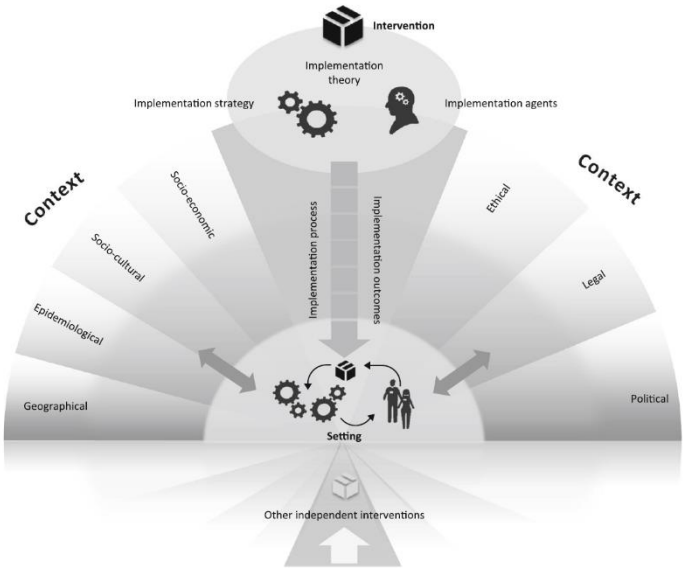

Figure 3. The Context and Implementation of Complex Interventions (CICI) Framework. Source: Pfadenhauer, L. M., Gerhardus, A., Mozygemba, K., Lysdahl, K. B., Booth, A., Hofmann, B., Wahlster, P., Polus, S., Burns, J., Brereton, L., & Rehfuess, E. (2017). Making sense of complexity in context and implementation: The Context and Implementation of Complex Interventions (CICI) framework. *Implementation Science, 12*(21).

Table 1. Definition of Context Domains from the CICI Framework.[8]

Context Domain	Definition*
Geographical	The broader physical environment, landscapes, and resources, both natural and transformed by humans (e.g., infrastructure), available in each setting.
Epidemiological	The distribution of diseases or conditions, the attributable burden of disease, as well as determinants of needs in populations.

Socio-cultural	The conditions in which people are born, grow, live, work, and age, as well as the social roles a human being takes on as a family member, community member, or citizen and the relationships inherent to these roles. Constructs, such as knowledge, beliefs, conceptions, customs, institutions, and any other capabilities and habits acquired by a group, are also included in this domain.
Socio-economic	The social and economic resources of a community and the access of a population to these resources.
Ethical	Reflections of morality, which encompasses norms, rules, standards of conduct, and principles that guide the decisions and behavior of individuals and institutions.
Political	The distribution of power, assets, and interests within a population, as well as the range of organizations involved, their interests, and the formal and informal rules that govern interactions between them.
Legal	The rules and regulations that have been established to protect a population's rights and societal interests.
***Adapted from reference 8**	

All the domains described in the CICI framework speak to elements of the macro-level of health determinants. As an example of how context can inform deterrence in public health at the macro-level, consider an attempt to reduce the rate of sexually transmitted infections (STIs) in a given population. Effective deterrence would require understanding the *epidemiological* context of the target STIs in the population: Who is getting infected? When? How? *Geographical* considerations would also play a role: Are those most at risk of contracting specific STIs living in more rural or urban areas? What type of access do those individuals have to health clinics and/or health care providers? Both *socio-cultural* and *socio-economic* domains would have a major impact on whether efforts to deter behaviors related to STI risk are successful: How is sexual behavior viewed in this social and cultural context? Are those most at risk of contracting these diseases socially vulnerable in some ways, e.g., are they women? Young women? Men who have sex with men? People with low literacy rates? Are behaviors that put people at highest risk of contracting STIs—behaviors that public health officials may actively want to deter—socially stigmatized? Are those behaviors illegal? If such behaviors are illegal, should they be legalized so that those at highest risk can receive care without fear of prosecution? Do elected officials feel pressure to address—or avoid—taking recommended actions that can help reduce STI rates in this specific population? Who stands to gain or lose politically by addressing this public health problem? These questions obviously speak to both *political* and *legal* contexts, as well as socio-cultural and socio-economic, indicating how these context domains often intersect with each other. Finally, the *ethical* considerations related to deterrence of STIs should include awareness of whether proposed public health deterrence interventions may expose high-risk individuals to some further harm, such as social or legal consequences, or if there are social norms and values that influence risk of acquiring STIs among the target population. Considering the influence of each domain independently, as well as how the domains interact with each other, can help inform interventions to deter, or prevent, harmful health behaviors and influence population health outcomes.

The three different academic models and frameworks shown in Figures 1-3 are useful tools to help public health professionals identify opportunities to deter adverse health behaviors and outcomes at the micro- (individual), meso- (social/community), and macro- (systems) level. At the micro- and meso-levels are many individual and social factors that influence the choices and behaviors of individuals (such as self-efficacy, perception of risk, susceptibility to peer pressure, and other elements captured in the Health Belief Model), and at the macro-level, a variety of interweaving and often interdependent contextual factors described in the CICI framework (e.g., legal, political, socio-cultural), that collectively come into play in major public health deterrence efforts. Below, we apply all these academic tools to a specific example of successful deterrence in public health: smoking prevention.

Tobacco Smoking: An Example of Effective Public Health Deterrence in the United States

Although evidence indicating clear connections between cigarette smoking and lung cancer first emerged in the United States in the 1950s, tobacco smoking has been a widespread practice, with many population-wide ill health effects, for decades. Implementation of smoking control policies has led to the steady decline of tobacco smoking in the United States, with only 11.5% of adults aged 18 or older smoking in 2021,[9] down from 42% in 1965.[10] Although a smoking prevalence rate of 11.5% still means that more than 28 million adults are smoking in the United States, the precipitous decline in smoking rates over the past 50 years has been both a major public health victory and a model for deterrence.

Many different types of interventions have been effective in deterring cigarette smoking in the United States, operating at the micro-, meso-, and macro-levels. A large body of research has shown that 90% of people who smoked daily tried their first cigarette before the age of 19. Nearly all the remaining percentage of daily smokers, 9.4%, tried their first cigarette before the age of 26. Preventing smoking among those younger than 26, with a particular emphasis on those 19 and younger, is therefore an effective way to deter people from ever smoking.[10]

Although age is a micro-level determinant of smoking, many effective deterrence efforts have been at the macro-level, such as laws preventing the sale of cigarettes to people under the age of 18. A comprehensive effort by the U.S. government in the early- to mid-1990s to deter smoking among young people involved the utilization of several macro-level factors, including, and extending beyond, federal and state laws regulating the sale of cigarettes. These incorporated multiple elements at the systems level, or macro-context, including political and economic efforts, such as excise taxes;[11] political and legal efforts, such as state tobacco control programs; and socio-cultural efforts, such as media campaigns targeted at children and adolescents, among others.[10-11] These macro-level deterrence efforts were successful, and smoking decreased among high school students from 43.4% in 1997 to 23.4% in 2011. Another macro-level effort to deter cigarette smoking has been comprehensive smoke-free laws, defined by the United States Centers for Disease Control and Prevention (CDC) as laws that “completely prohibit smoking in private-sector worksites, restaurants, and bars.” In December 2000, zero U.S. states had enacted comprehensive smoke-free laws; by December 2010, this number had risen to 26.[12]

Other interventions to deter smoking involve specific types of messaging to current or would-be smokers. Extensive research in psychology has informed the "framing" of those messages, either by suggesting a positive outcome (e.g., *gain framing*) or a negative outcome (*e.g., loss framing*).[13] These messaging approaches are intended to influence decision-making by individuals, and therefore work at the micro-level. Such messages also incorporate learning and concepts from the Health Belief Model, specifically attempting to influence individuals' perceived risk of a bad outcome, perceived benefit of a given decision, and perceived ability to make a decision that will protect themselves from a bad outcome, among others. When considering deterrence, it is important to consider when and how gain-framed versus loss-framed messaging can be most effective in shaping health behaviors. In trying to influence current smokers to quit smoking, for example, evidence indicates that gain-framed messaging—indicating the benefits to the smoker of quitting—are more effective than loss-framed messaging—emphasizing the adverse effects of continuing to smoke.[14] A larger body of evidence further indicates that gain-framed messaging is also effective for many prevention behaviors, including preventing smoking.[15]

Although many interventions to deter smoking have focused at macro- and micro-levels, a major 2008 study indicated that meso-level factors also influence smoking decision-making and provide interesting opportunities for deterrence. Specifically, in exploring a "densely interconnected social network of 12,067 individuals," study authors determined that the decision to quit smoking by a spouse, a sibling, a friend, and even a coworker can have a significant impact on an individual's decision to quit smoking,[16] an observation that has been substantiated in subsequent studies.[17-18] Therefore, the influence of social connections among people provides another potential leverage point for deterrence. This observation has generated additional research exploring how social connections influence decisions related to smoking[19] and how those connections can be leveraged and/or influenced to encourage people not to smoke or to quit smoking.[20-21]

The story of sustained reductions in tobacco smoking rates among people both under and over the age of 18 in the United States is a story of successful deterrence in public health. By developing, studying, testing, and refining interventions at micro-, meso-, and macro-levels that specifically influence individual decision-making, public health professionals have effectively changed behaviors and deterred people from making choices that have adverse individual- and population-level effects. The Health Belief Model is a valuable, long-used resource for public health professionals to understand how and why individual people make specific decisions about their health and how to influence those decisions, often through gain-framed or loss-framed messaging. Analysis of social connections between people and the influence exerted on a given individual by friends, loved ones, peers, and even coworkers has provided new insights into when and how to intervene in a connected social network to change behavior, and consequently, population health outcomes. The CICI framework identifies seven distinct domains of systems-level context that, when leveraged, provide mechanisms to deter certain, specific behaviors, often without the conscious awareness of those affected.

Although public health professionals generally describe their work in the context of prevention and not deterrence, successful efforts to influence health-related decision-making for better health outcomes may provide valuable insights into deterrence efforts in other contexts. One key insight from public health is that intervening in a system to influence individuals' behavior toward a specific outcome often requires awareness of complexity and interdependence among elements of that system. In smoking cessation efforts, for example, successes in the United States have resulted from a combination of interventions, acting at multiple levels of the system, such as laws (macro-), changing social norms (macro-/meso-), gain-framed messaging that targets the individual (micro-), specific efforts to influence adolescents' parents (meso-/micro-) and peer networks (meso-/micro-), and others. Many of these factors are interdependent and adaptive, and changes to one can influence *and* be influenced by others. Recognizing this complexity, interdependence, and the simultaneous influence of factors at multiple levels in a system on individual and group behavior, as well as the nuanced interactions of those factors, is often important for developing effective interventions to change behavior in public health.[22]

Another insight from public health for the broader field of deterrence is the importance of taking a dynamic, iterative approach to intervention, with continuous adaptation arising from the incorporation of new, robust evidence. Smoking cessation efforts in the United States have evolved over time and have continuously been informed by ongoing research. For example, gain-framed versus loss-framed messaging has been tested in various empirical studies, with the body of resulting evidence indicating that gain-framed messaging is more effective for prevention of smoking and other behaviors.[16] Many other smoking cessation efforts at micro-, meso-, and macro-levels have been adapted and changed over time in response to a growing body of research studies indicating what is most effective to target populations. This iterative, evidence-informed, adaptive approach to deterrence is a consistent best practice in public health and could provide an effective model for deterrence efforts in other contexts.

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