Closing the Gap Between Injury Prevention Research and Community Safety Promotion Practice: Revisiting the Public Health Model

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Injury is one of the most underrecognized public health problems in the world, with nearly 16,000 people dying from injuries each day. Together, unintentional injury and violence cause more than five million deaths per year, or 9% of the total global mortality—as many deaths as those caused by acquired immunodeficiency syndrome, malaria, and tuberculosis combined. Injury and violence account for eight of the 15 leading causes of death: road traffic injuries, suicides, homicides, drowning, burns, war injuries, poisonings, and falls.¹ These alarming statistics are all the more tragic because injury is preventable.

The Centers for Disease Control and Prevention advocates applying the Public Health Model to injury prevention.^{2,3} This structured approach advocates a continuum of research that progresses in a stepwise manner from problem identification to implementing effective interventions as follows (Figure 1):

1. Define the problem: By accessing the best available surveillance data, it is possible to identify issues of epidemiologic importance to ensure that scientific and social attention is focused on issues of consequence.
2. Identify causes: Identify the most strategic causes of the problem—those that are both substantively important and amenable to change.
3. Develop and test interventions: Design interventions that are capable of overcoming the problem, and prove that these interventions are efficacious and effective using the best available scientific evidence.
4. Disseminate and ensure widespread adoption: Having identified effective interventions, disseminate and implement best practices in the community, and encourage widespread adoption of these evidence-based practices.

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Figure 1. The Public Health Model^a

Adapted from Sleet DA, Hopkins KN, Olson SJ. From discovery to delivery: injury prevention at the CDC. *Health Promot Pract* 2003;4:98-102. Used by permission from the Society for Public Health Education.

Unfortunately, the process frequently falters at the dissemination and implementation phase, when researchers either attempt or neglect to disseminate their findings among policy makers, health practitioners, and the community in the hope that widespread adoption will occur.⁴⁻⁶

IDENTIFYING THE GAPS

Numerous gaps have been identified separating academic researchers, policy makers, health practitioners, and the community. There are three important threads to this discourse:

1. The research-to-practice gap^{3,7-10}
2. The efficacy-to-effectiveness gap^{11,12}
3. The injury-prevention-to-safety-promotion gap^{3,5}

The research-to-practice gap

Despite our best efforts in public health, a diffusion problem persists. A review of 1,210 articles published in 12 leading public health and health promotion journals found that 63% of publications were descriptive (stages one and two of the Public Health Model), 11% were concerned with method development, and

16% were intervention based (stage three of the Public Health Model), while only 5% were concerned with institutionalization or policy implementation research, and fewer than 1% contained diffusion research (stage four of the Public Health Model).¹³ The field of injury prevention has generated plenty of knowledge from surveillance, risk factor, and intervention research, but this knowledge will not have a population impact unless it is transmitted to those who need it (i.e., the practitioners, policy makers, and community groups who have the potential to implement the intervention in the wider community).^{5,6}

Many researchers believe that the major barrier to effective diffusion is poor translation of research evidence into practice. They suggest that there is an acute need for more translation research.¹⁴ This new research discipline aims to lay a scientific foundation for the process by which basic science (e.g., the epidemiologic definition of a public health problem and its antecedent causes) is progressively “translated” into controlled clinical research (efficacy research), population-based research (effectiveness research), and practice-based research, which is finally translated into everyday public health policy and practice.¹⁴ While translation researchers undoubtedly advocate a more

nuanced view, there is a temptation for less informed researchers to dismiss the research-to-practice gap as a simple communication problem.^{14,15} Unfortunately, the gap between research and practice is more insidious. Health and safety practitioners typically hold a tertiary qualification, many a postgraduate degree. They are trained to undertake literature reviews of the scientific evidence while designing and implementing community interventions.¹⁶ Translation is not the only problem. Practitioners and policy makers do access research evidence and they are qualified to interpret and understand it. Sadly, they are not always persuaded by it.^{8,17}

While researchers commonly report the individual impact of an intervention, measures of the process of implementation, sustainability, and population impact are frequently overlooked.¹⁸ In a systematic review of 27 articles of community-based interventions identified in 11 leading health journals,¹⁸ efficacy was reported in 100% and reach in 88% of articles. In contrast, implementation was reported in only 59%, adoption in 11%, and behavioral maintenance in 30% of articles. No articles reported institutional maintenance. Not surprisingly, practitioners argue that published research is difficult to apply, is irrelevant to their needs, and does not address the implementation issues necessary to ensure success.¹³

Glasgow and colleagues have proposed the RE-AIM framework (Reach, Effectiveness, Adoption, Implementation, and Maintenance) as a reporting template to encourage researchers to document their research in a way that enables practitioners, policy makers, and communities to use such research effectively.^{4,11,12} In addition to the commonly reported measures of the impact of an innovation at the individual level (reach and effectiveness), they proposed three measures of population impact: (1) adoption: the proportion of settings, practices, and programs that adopt the intervention; (2) implementation: the extent to which the intervention is implemented as intended in a real-world context; and (3) maintenance: the extent to which the program is sustained over time. The RE-AIM framework has been applied to an exercise intervention for falls prevention in older people¹⁹ and to sports injury interventions.^{20,21}

The efficacy-to-effectiveness gap

The transition from researching what works (i.e., efficacy research) to how to make it work (i.e., implementation research) is not as straightforward as many assume.²² Interventions shown to be efficacious under controlled experimental conditions may not be effective in real-world settings.^{11,12} The problem emanates

from the way researchers approach the problem of contextual complexity.^{11,23,24} Efficacy trials test whether an intervention works under optimum scientific conditions.¹⁵ To ensure internal validity, contextual factors are carefully controlled. Effectiveness trials, on the other hand, test whether an intervention works in real-world conditions.²⁵ The external validity of an intervention in the face of the uncontrolled influence of environmental, psychological, and sociological contextual factors is under scrutiny.

Success at a population level, or effectiveness, is not determined solely by the efficacy of the intervention; it is also determined by multiple interrelated contextual factors within the target community.^{24,26–30} There is an innate tension between efficacy and effectiveness research.^{4,11,12} Within efficacy trials, participants are relatively homogenous and the settings are highly controlled. To optimize the chance of proving an effect, study regimens are necessarily intensive, expensive, and often demanding for both participants and providers. Unfortunately, strategies used to ensure internal validity may compromise external validity. Participants may not be truly representative of the target population. Study regimens are more time-intensive and expensive than possible in the context of a busy, underresourced health or service department or in community groups with a large volunteer base.^{4,11,12,20}

Efficacy research may offer little insight into the practical challenges that must be surmounted in effectiveness research, especially if trials have conceptually avoided the contextual determinants of success.²³ Green concludes, “Where did the field get the idea that evidence of an intervention’s efficacy from carefully controlled trials could be generalized as ‘best practice’ for widely varied populations and situations?”⁸

Intervening within social systems while remaining true to scientific principles is a challenge for injury researchers.^{20,23} Injury is a complex problem that involves not only human behavior, but also behavior that occurs in the context of natural, physical, and social environments.^{20,31–33}

In reductionist science, contextual complexity is minimized by isolating the different components of a problem and studying each component independently. A key assumption is that these determinants are statistically independent.³⁴ When researchers are confronted with interdependent observations, they either seek to remove them from the study design or adjust for them statistically. These “confounding variables” can undermine the internal validity of the study results. Unfortunately, in human systems, the interdependence of people and their physical and social environment (i.e., the capacity of individuals to influence each other,

modify their environment, and be influenced by their environment) is more than a statistical inconvenience; it is an essential characteristic of human social systems.³⁵

Injury is a complex problem; however, complex is not a synonym for complicated.³⁶ Complex systems consist of multiple interdependent causal determinants that have unique scientific properties (e.g., nonlinear dynamics, self-organization, and phase transitions).³⁷ The efficacy-to-effectiveness gap marks the paradigm frontier separating reductionist science and complexity science. Complex systems require a different scientific approach.^{24,26–30} Innovative health researchers are beginning to demonstrate promising results using multilevel analysis,^{29,38,39} network analysis,^{40–44} systems thinking and modeling,^{23,45–48} and agent-based modeling.^{46,49–51}

The injury-prevention-to-safety-promotion gap

The injury-prevention-to-safety-promotion gap is arguably the most challenging for researchers, as it confronts their most cherished scientific principles. The transition from stage three (scientific development and testing of interventions) to stage four (dissemination and widespread adoption) of the Public Health

Model necessitates crossing a paradigm frontier that challenges the philosophical foundations and values of the science of injury prevention—politics.

The dissemination and widespread adoption of an intervention are social objectives that can only be realized in the context of a community and the organizational and political processes that shape it. Public policy is set by those who build enough consensus to intervene, not necessarily by proponents of “best evidence.”⁵² Evidence that is compelling for researchers may not be automatically accepted by those with the power to implement the intervention.^{52,53} To fuel political debate, tenacious journalists and politicians can—and do—find scientific experts who passionately and articulately argue almost any proposition imaginable. The community is well aware that scientific credentials offer little assurance of “truth.”⁵⁴ Indeed, the robust academic debate in which researchers engage to identify, refine, and test truth may undermine the acceptance of truth in the public domain. How can the general public be reasonably expected to accept something as fact if the experts disagree?

As shown in Figure 2, injury prevention researchers and safety promotion practitioners take very different

Figure 2. The injury-prevention-to-safety-promotion gap

approaches to ameliorating the harm caused by injury. Injury prevention researchers seek to scientifically control the problem through empirical research and the implementation of proven interventions. Safety promotion practitioners seek to socially control the problem through a communitarian process. Wandersman et al.¹⁰ characterized these two complementary approaches as either “source-based” or “user-based.”

Top-down, source-based, or science-push models are derived from the perspective of the researcher. Injury researchers often proceed through stages one, two, and three of the Public Health Model without reference to context. Their purpose is to exclude any external confounding variables to arrive at internally valid conclusions. Having proven that an intervention works under scientifically controlled conditions, researchers seek to disseminate their findings through scientific publications. They expect practitioners, administrators, and communities to locate and implement their findings.⁷ If the innovation is implemented as designed, it should work. If the innovation fails to work, then researchers generally think of the problem as one of implementation failure (i.e., good research that is improperly applied).

Bottom-up, user-based models^{33,42,55} start with a community’s perception of need and attempt to engage experts (e.g., researchers and practitioners), solutions (e.g., interventions tried elsewhere), and resources (e.g., national, state, and local government agencies; nongovernmental agencies; and other community groups) to solve the problem.⁵⁶ Success is achieved by empowering the community to solve its own problems.^{15,42} Engaging the community at its point of perceived need is necessary to build a coalition of the willing with sufficient capacity to address the problem. Success is determined by a community’s capacity to work together to solve the problem.^{42,57} Thus, effective intervention approaches are those that display a good fit to the contextual needs of the community.^{21,58}

As long as the protagonists of the different approaches remain disconnected, success is likely to be evasive. The key barriers to success are the different perspectives that researchers, practitioners, policy makers, and the community bring to the problem of managing the scientific, environmental, economic, and social determinants of injury. The key determinant of success is the ability of the different stakeholders to work together to generate a common understanding of the problem and to design scientifically rigorous interventions that are practical and relevant to the needs of the target community.

Injury is a wicked problem—the social manifestation of scientific complexity. Rittel and Webber were the first

to describe these complex suites of interrelated social problems that are notoriously difficult to solve.⁵⁹ The importance ascribed to the different subcomponents of the problem is more a matter of perspective than knowledge, and it is frequently unclear where the causal chain begins or ends.^{59,60} Diverse stakeholders bring different, sometimes contradictory, “facts” to the discourse. More importantly, conflicting worldviews (paradigms) concerning the nature of reality (ontology) and the nature of knowledge (epistemology) mean that they generate, test, and understand these facts in different ways.^{61,62} It is not just that we do not understand each other, it is that we are at cross-purposes. The core challenge is to get the different stakeholders to agree on what comprises the problem.⁶³ Stone et al. observed, “The main concern is how to bring about enough cooperation among disparate community elements to get things done. This is a ‘power to’ that under many conditions of ultra complexity characterizes the situation better than ‘power over.’”⁶⁴ If a sufficiently comprehensive definition of the problem and its key subcomponents can be established by pooling the expertise of different disciplines or professional groups, and a socially acceptable solution can be negotiated by politicians, bureaucrats, and the community, then the problem can be productively addressed.⁵⁹

This process of advocacy and community engagement is an intervention in itself, which is critical to the ultimate success of an injury prevention program.^{15,28,42,65} Safety promotion practitioners are skilled in this process of engaging diverse stakeholders to build sufficient consensus to act.¹⁵ If injury prevention is the science of controlling context, safety promotion is the art of managing context.

BRIDGING THE GAP

We began by asserting that there is a diffusion gap separating research, practice, and policy. This problem is typically portrayed as a unidirectional failure to diffuse research evidence into practice.^{11–13} It is evident that there is equally a problem of diffusing evidence and expertise from the practice and policy communities to inform and channel research.^{8,16,23} Green asks, “To advance our evidence-based practice, can you help us get more practice-based evidence?”¹⁶

The research-to-practice gap will not be overcome by a monologue from researchers to practitioners, policy makers, and the community. Rather, a dialogue is required, one in which there is a mutual exchange of evidence that ultimately achieves new understandings of the injury problem and how it is best addressed in the real world.

Applying the Public Health Model demands a journey that traverses frontiers separating many different stakeholders—researchers, practitioners, policy makers, and the wider community—all of whom interpret the phenomenon of injury from different worldviews or paradigms.^{61,62} Innovation occurs at the interface between paradigms and the knowledge communities that champion them.^{42,61,66,67} Innovations are rarely new per se; rather, they are modifications or adaptations of preexisting ideas transported from one social system into another.^{28,42,44} Diffusion of innovation also occurs at the interface between knowledge communities.^{28,42,44,68} Information exchanged within academic or practice communities may consolidate what is already known by that group, but this internal exchange does nothing to transmit this information into other social systems.^{42,69,70} At the most basic level, unless a social link exists, diffusion cannot occur. Academic and practice communities are poorly connected.⁹ Researchers who are frustrated by their inability to get communities to adopt their interventions would do well to ask themselves if they have the interpersonal links required to transmit information to the practitioner, policy maker, and community at large.

Arriving at a shared understanding of the problem requires a dialogue that cannot be facilitated by simply cultivating social connections. Academic and professional communities are defined by their underlying ontological, epistemological, and theoretical worldviews.^{61,62,66} The worldview embraced by researchers compels them to try to solve injury problems using scientifically proven interventions (i.e., best evidence). The worldview embraced by practitioners compels them to try to solve the same problems using socially proven processes (i.e., best practice). Paradigms determine the type of research undertaken, the nature of the knowledge generated, and the way this knowledge is interpreted.^{61,62} Editors of textbooks and journals are the custodians of the paradigms, endowed with the responsibility to promote and defend the knowledge base.⁶¹ By defining the underlying theoretical framework and acceptable modes of inquiry, they can also exclude alternative approaches to the problem.^{61,62} This omission results in a compartmentalization of scientific and professional knowledge that suppresses the full exchange of information and stifles the emergence of creative solutions.^{62,67} We are locked in a best evidence vs. best practice stalemate. We need the maturity to move beyond this counterproductive debate. Obviously, both best evidence and best practice are required.

We must begin by understanding each other. Translation helps, but it is not sufficient. While the words may be different, so are the values, theoretical

systems, research techniques, and, as a consequence, the facts observed and promulgated by the different knowledge communities.⁶¹ We need to move beyond the technical translation of the words to seek out the underlying ontological and epistemological dissonance. Driving the gap in values, worldview, and objectives that separates injury prevention researchers from safety promotion practitioners, policy makers, and the wider community is the problem of context.^{24,29} The research-to-practice gap exists because of the complexity of applying knowledge in context; the efficacy-to-effectiveness gap is a result of the scientific complexity of generating knowledge in context;^{24,29} and the injury-prevention-to-safety-promotion gap persists because of the social complexity of building consensus across research, policy, and practice communities.^{59,63} Context is both the source of the gap and the pathway to bridging it.

The approach that is required cannot be interdisciplinary (i.e., working in the uncontested common ground between disciplines) or multidisciplinary (i.e., combining the expertise of a number of disciplines). Rather, an integrated, open, transdisciplinary approach^{14,67,69} (i.e., integrating the expertise of different disciplines to arrive at new and novel shared understandings of the problem)⁷¹ must be used.

Integrating expertise from these different paradigms requires researchers, practitioners, policy makers, and the community to engage in conversation with humility and an open mind. Occasionally, consensus will identify areas of productive joint endeavor. On other occasions, paradoxes will emerge to highlight the points at which current thinking is so locked in conflict that it cannot progress. In a closed dialogue, constrained by underlying paradigmatic assumptions, a paradox is treated as a set of incompatible opposites. In contrast, in open, transdisciplinary dialogue, a paradox identifies complementary truths and is a useful signpost pointing to the heart of the issue.⁶⁷

Science can make a difference provided that research evidence is injected into public discourse in a way that is meaningful to policy makers, politicians, and the general public. The mere translation of existing evidence may not be sufficient. New research evidence may be required to specifically address the issues of public concern and debate.⁵³

Kuhn reminds us that a paradigm shift is a revolutionary process in which the historic framing of scientific problems is exposed to the scrutiny of new observations, challenges, and insights.⁶¹ Acknowledging that historic approaches to injury prevention do not always work when implemented at a population level offers an opportunity to discover new approaches to

the problem. Like all revolutions, we require leaders (e.g., editors, conference conveners, researchers, and program directors) with the vision to entertain the possibility of alternative approaches to old problems and a willingness to promote the revolutionary, transdisciplinary scientific discourse that is the pathway to discovery.

THE PUBLIC HEALTH MODEL REVISITED

There is nothing wrong with the Public Health Model proposed by Mercy et al.;² however, it has been misapplied by some researchers. When Mercy et al. first proposed the Public Health Model for injury prevention, they advocated a bottom-up approach (Figure 1) that engaged practitioners, policy makers, and the community as important stakeholders in the process of defining the problem (stage one), identifying causes (stage two), and developing and testing interventions (stage three). Contrary to Mercy et al.'s advice, some researchers adopted a top-down approach (Figure 2), believing that stages one, two, and three of the Public Health Model are the province of scientific experts, while stage four (dissemination, implementation, and adoption) can essentially be delegated to community practitioners who merely take efficacious interventions and apply them. This science-push misapplication of the Public Health Model ignores the importance of engaging practitioners, policy makers, and the target community in the process of designing, researching, and implementing effective interventions, thereby falsely assuming that efficacious interventions can be automatically adopted and effectively implemented at a population level.^{5,30}

Researchers who either by design, training, or predisposition ignore the contextual, implementation, and process determinants of success, seeking to impose their solutions on communities, should not be surprised if practitioners and the target community are unwilling to engage in their solution, or if their interventions fail when external contextual or process determinants conspire to resist change. Three complementary types of experts are necessary to design efficacious and effective interventions capable of dissemination into the wider community: researchers (i.e., content experts), practitioners and policy makers (i.e., process experts), and the community (i.e., context experts). All three parties are required to ensure success. All three elements must be researched and documented to evaluate success. Like a three-legged stool, the Public Health Model will only have a stable footing when all three elements are addressed in concert.

Most injury researchers have formal training in epidemiology or the design and evaluation of interventions. Members of the community, although not formally trained, are experts in the social context of the community in which they live. Health and safety promotion practitioners are experts in process. They are trained in best-practice community engagement that empowers communities to solve their own health and safety problems.¹⁵

Bonnie et al. observed that, "The determinants of health are beyond the capacity of any one practitioner or discipline to manage. . . . We must collaborate to survive."⁷² From the very beginning, the combined expertise of researchers, practitioners, and the target community itself are required if the Public Health Model is to produce solutions capable of application within the wider community.

CONCLUSION

Injuries are preventable; however, the discrepancies among academic, practitioner, and community and political perceptions of injury causation remain important barriers to mounting an effective response. It is not enough to understand what should be done; rather, it is necessary to understand what can be done and how it needs to be done.

Rigorous epidemiologic and intervention research must be complemented by practice-based research that embraces and manages the contextual determinants of success. Injury prevention research that does not connect with the practical realities of implementation and does not obtain sufficient consensus to allow for effective implementation will not save lives or prevent injury.^{5,6}

Because injury is a wicked problem, complexity and context matter. However, different styles of managing complexity and context have resulted in a false dichotomy that has separated injury prevention research from safety promotion practice. An integrated, open, transdisciplinary collaborative approach is required to break down the barriers separating these two complementary approaches.⁶³

In revisiting the Public Health Model for injury prevention, our goal is to generate scientifically rigorous interventions that are practical, relevant to the needs of the community, and capable of widespread adoption. To succeed in this endeavor, we need the combined expertise of researchers, policy makers, practitioners, and the community from the outset and throughout the process. If injury prevention is the science of controlling context, safety promotion is the art of managing context.

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