



## SAMPLE LESSON PLANS

### Grade 10- Safety and Injury Prevention

#### SOLs:

	Identify behaviors that result in intentional and unintentional injury.
	Explain the role of the environment, individual behavior, social norms, legislation, and policies in preventing intentional and unintentional injuries.
	Describe rules and laws intended to prevent intentional and unintentional injuries.
	Research and develop an education campaign to encourage positive health choices and discourage risky choices (e.g., body piercing, tattooing, exposure to sun and loud noise, drinking, texting while driving, driving while drowsy)

#### Title: Injury and Violence Prevention Research and Education Project

#### Objectives/ Goals:

1. Students will gain an understanding of injury and violence as *preventable* public health problems; identify behaviors that result in injury; and explain the contributions of the environment, behavior, social norms, legislation and policies to injury.
2. Students will work in teams to encourage injury or violence prevention on a selected topical area.

#### Materials:

- Internet Access to national injury and violence prevention sites.
- Presentation materials (video, powerpoint, poster etc.).
- Attached articles on injury, violence, socioecological prevention approaches (*Application of Behavior Change Theory, ASTHO Injury and Violence Prevention, ASTHO Preventing Motor Vehicle Injury, Health Impact Pyramid, SEM Framework for Violence Prevention, Injury Prevention at Home Using the Health Impact Pyramid, Injury Prevention as Social Change*)

## Procedure:

- Play the attached video, *PHI Episode 35\_Injury and Violence Prevention* as an introduction to injury and violence prevention.
- Visit key national sites (see reference list) for students to understand the public health burden of injuries and violence and that the behaviors and factors that contribute to injuries and violence can be prevented.
- Break students into small groups to research and present on the behavioral and socioeconomic contributors to injury and violence and how these can be harnessed for the prevention of injury and violence (i.e., individual behavior, family and social environment, policies and legislation). The attached site reference links and PDFs should provide a good foundation for this research.
- Assign groups of students to an area of injury and violence, and have them develop an infographic education campaign to discourage risky injury behaviors. Infographics allow a concise visual depiction of a significant amount of information- some attached examples are: *Disparities in Child Passenger Safety*, *The Facts on Childhood Drowning*, but numerous examples are available on the internet. One of several sites where students can develop infographics for free is [www.piktochart.com](http://www.piktochart.com)

## Assessment Ideas:

- Are students able to explain the behavioral and socioeconomic contributors to injury and violence in their participation, presentations or infographics?
- Are students' infographics persuasive about preventing injury and violence?

## References:

National Center for Injury Prevention and Control [www.cdc.gov/injury](http://www.cdc.gov/injury)

National Injury and Violence Data Site <http://www.cdc.gov/injury/wisqars/>

Virginia Injury and Violence Data Site

<http://www.vdh.virginia.gov/livewell/data/interactive/applications/voirs>

Healthy People 2020 Injury and Violence <https://www.healthypeople.gov/2020/topics-objectives/topic/injury-and-violence-prevention>

Teach-VIP E Violence and Injury Prevention Comprehensive Curriculum

[http://www.who.int/violence\\_injury\\_prevention/capacitybuilding/teach\\_vip/e-learning/en/](http://www.who.int/violence_injury_prevention/capacitybuilding/teach_vip/e-learning/en/)

Overview of Science of Injury Prevention and Public Health Approaches to Violence

<http://genderandhealth.ca/en/modules/trauma/module-map.jsp>

Social Ecology of Health <http://www.cdc.gov/violenceprevention/overview/social-ecologicalmodel.html>

States' Legislation and Policy for Injury Prevention

<http://www.ncsl.org/research/health/injury-and-violence-prevention.aspx>

Overview of national injury and violence prevention areas

<http://www.astho.org/programs/prevention/injury-and-violence-prevention/>

Injury Prevention Research Centers

Columbia University <http://www.cdc.gov/injury/erpo/icrc/columbia.html>

Johns Hopkins University <http://www.cdc.gov/injury/erpo/icrc/jhopkins.html>

University of Iowa <http://www.cdc.gov/injury/erpo/icrc/uiowa.html>

University of Michigan <http://www.cdc.gov/injury/erpo/icrc/umichigan.html>  
Mount Sinai <http://www.cdc.gov/injury/erpo/icrc/mtsinai.html>  
Nationwide Children's [http://www.cdc.gov/injury/erpo/icrc/childrens\\_oh.html](http://www.cdc.gov/injury/erpo/icrc/childrens_oh.html)  
UNC Chapel Hill <http://www.cdc.gov/injury/erpo/icrc/unc.html>  
University of Pennsylvania <http://www.cdc.gov/injury/erpo/icrc/upenn.html>  
University of Rochester <http://www.cdc.gov/injury/erpo/icrc/rochester.html>  
West Virginia University <http://www.cdc.gov/injury/erpo/icrc/wvau.html>  
Harborview <https://depts.washington.edu/hiprc/>  
Southern California <http://www.ph.ucla.edu/sciprc/>

Suicide Prevention Resource Center [www.sprc.org](http://www.sprc.org)  
National Highway Traffic Safety Administration [www.nhtsa.gov](http://www.nhtsa.gov)  
Substance Abuse and Mental Health Services Administration [www.samhsa.gov](http://www.samhsa.gov)  
Safe Kids World Wide <https://www.safekids.org>  
Think First: National Head and Spinal Cord Injury Prevention Program <http://thinkfirst.org/teens>  
Cure Violence <http://cureviolence.org>  
Virginia Rules - Juvenile Violence Related Laws -<http://www.virginiarules.com/virginia-rules/>

# Analyzing Influences Violence, Weapons & You

**Directions:** Create a web with your name and health issue in the center. Each spoke signifies an influence in your life (i.e. family, peers, social media, video games, yourself, etc.) that impacts you in a positive or negative way in regard to violence and weapon use..

1. Identify at least 5 influences. Is it positive or negative? Is it Internal (you control) or something External (out of your control)?
2. Describe the message that you receive from each of those influences about drug use. Discuss HOW and WHY it influences you.
3. Draw a line connecting the source to yourself – the thicker and bolder the line, the more powerful you feel that influence is on your decisions and behaviors about this topic.

**Influence:**  
*Positive or Negative?*  
*Internal or External?*

**Message:**

**Influence:**  
*Positive or Negative?*  
*Internal or External?*

**Message:**

**Influence:**  
*Positive or Negative?*  
*Internal or External?*

**Message:**

**Influence:**  
*Positive or Negative?*  
*Internal or External?*

**Message:**

**Influence:**  
*Positive or Negative?*  
*Internal or External?*

**Message:**

**Influence:**  
*Positive or Negative?*  
*Internal or External?*

**Message:**

**Your Name**

**Reflection** - Complete this after filling out the Web of Influence above...

*After completing this activity, what is one thing you learned about influences impacting you in terms of violence and/or weapon use? What did you learn (if anything)?*



## Analyzing Influences Web Assessment Rubric

<b>Number of Connections</b>	I made 5 or more connections. (5 or more lines)	I made 4-5 connections. (4-5 lines)	I made 3 connections. (3 lines)	I made 2 or fewer connections. (0, 1, 2, lines)
<b>Quality and Depth of Connections</b>	<p>The connections I created are explained thoroughly. The HOW and WHY are described and the message is evident.</p> <p>I am able to “think outside the box” and make thoughtful connections to the influence and how it impacts me</p> <p>Reflection is thorough with specific example(s)</p>	<p>My connections are accurately explained The HOW and WHY are described in each connection and the message is mostly clear/evident.</p> <p style="text-align: center;">AND...</p> <p>Reflection is thorough with specific example</p>	<p>My connections are accurate, but are not explained in complete sentences. The how and why are not clear in most cases. The message is clear in some cases and lacking in some.</p> <p style="text-align: center;">AND/OR...</p> <p>Reflection is vague or not evident</p>	<p>My connections are inaccurate and are not clearly explained. Or, lacking evidence.</p>
<b>Assessment Level →</b>	<b>Wow! (10 pts)</b>	<b>Got It! (9 pts)</b>	<b>Getting There! (8 pts)</b>	<b>Not Yet! (5-6 pts)</b>

## Application of Behavior-Change Theories and Methods to Injury Prevention

Andrea Carlson Gielen<sup>1</sup> and David Sleet<sup>2</sup>

<sup>1</sup> Center for Injury Research and Policy, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD.

<sup>2</sup> Division of Unintentional Injury Prevention, National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, GA.

Received for publication August 29, 2002; accepted for publication February 24, 2003.

Abbreviation: HIV, human immunodeficiency virus.

### INTRODUCTION

Reducing the burden of injury is an international health goal, one that requires an interdisciplinary perspective. Injuries, whether self-inflicted, inflicted by others, or unintentional, have one thing in common: They are largely preventable. Behaviors that give rise to violence and injury are amenable to preventive intervention, just as are many of the behaviors that give rise to diseases. Thus, behavioral science is an integral part of a comprehensive injury prevention strategy.

Applications of behavioral science to injury prevention lagged behind other approaches during the last half of the 20th century. Despite recognition by injury control professionals of the importance of behavioral research in injury prevention, behavioral solutions to preventing injury were deemphasized until recently (1, 2). Historically, little scholarly attention has been paid to understanding determinants of injury-related behaviors or how to initiate and sustain behavioral changes. Interventions often seemed to have been based on simplistic assumptions that changing people's awareness about the injury problem would change their behavior. Many authors have noted the need to improve behavioral interventions by using better empirical data about determinants of behavior as well as theories and frameworks pertaining to change in health behavior (3–6). A growing body of work is emerging that demonstrates the positive impact of using behavioral science approaches in order to both understand and reduce injury risk behaviors (6–10). In this paper, we describe the role of behavior change in injury prevention and illustrate how the application of selected behavior-change theories to injury problems, within the context of a health promotion framework, can contribute to the enhancement of injury prevention programs.

### ROLE OF BEHAVIOR CHANGE IN INJURY PREVENTION

In planning for injury prevention and control, there has been a historical tension between the use of "active" (behavioral) strategies and "passive" (structural) strategies (1). The notion of passive protection arose from the great success of public health measures such as immunization and water fluoridation, which has been unparalleled. Passive approaches rely on changing products or environments to make them safer for all, irrespective of the behavior of individuals. Active approaches encourage or require people to take an active role in protecting themselves, despite hazards in their environments. Adding to the controversy has been the opinion of some that a focus on individual behavior could be interpreted as "blaming the victim" (11–14). However, in response to the victim-blaming assertion, it is also apparent that empowering individuals can lead to the political or social action necessary to achieve structural changes (6, 15).

#### Need for integrating passive and active strategies

It is rarely feasible to achieve injury reduction without some element of behavior change. In fact, while the structural intervention paradigm might seem straightforward, there is rarely an environmental change that does not require human adaptation. For every technologic advance, there are behavioral components that must be addressed. Children need to wear helmets while bicycling; parents need to correctly install child safety seats and booster seats; homeowners need to check their smoke alarms and change the batteries; parents with four-sided fences around their backyard pool need to ensure that the gate to the pool is always closed; occupants alerted by a smoke alarm still need to find their way to safety. Even the more passive approach to poison prevention through the use of child-resistant

Reprint requests to Dr. Andrea Carlson Gielen, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD 21205 (e-mail: agielen@jhsph.edu).

closures—one of the great successes in injury control—requires active individual effort in replacing lids correctly (16, 17).

In road safety, for example, it is clear that behavioral countermeasures lagged behind the development of safer, more crashworthy vehicles, road engineering measures, and road safety education. However, it has been asserted that the failure of many early educational programs may have led to unwarranted conclusions that the use of behavior-change interventions for injury control is futile (17, 18). Lonero et al. point out that although weak and ineffective attempts to influence road safety behavior have led to widespread discouragement about the use of active safety measures, “effective and lasting modification of behavior is essential to effective road safety management” (19, p. 1). A recent example is the passive protection provided by passenger-side air bags. Once considered a panacea for injury prevention in crashes, the unexpected deaths of children and small adults from air bag deployment have resulted in a growing recognition of the need for education and behavioral change. Public health professionals are now educating parents to place children in the back seat, away from the passenger-side air bag, and educating drivers about air bag on-off switches so they remember to reactivate them when an adult is seated in the passenger compartment. We call this the active approach to passive protection.

The above examples underscore the necessity of combining behavioral and environmental approaches to injury prevention (6, 20–22). Green and Kreuter (23) and McGinnis et al. (24) have provided informative historical reviews that include many examples of improvements in population health that were achieved through a combination of educational and policy interventions focused on lifestyle changes. Successes in both tobacco control and motor vehicle safety in the United States also illustrate the point that an informed and supportive electorate facilitates the process by which legislative and other environmental strategies are adopted (25; L. W. Green et al., unpublished manuscript).

### Need for new models

The complexity of injury problems demands complementary rather than competitive prevention strategies. Integration of knowledge about behavioral science into the mainstream of injury prevention research and practice will help researchers avoid the false dichotomy between active strategies and passive strategies and reduce the tendency to choose one over the other. The simplicity of early heuristics, such as the “three E’s” model (engineering, education, and enforcement), may no longer be viable (19). Our understanding of injury is now more complex and dynamic. Even the Haddon model, which has guided the field into a long and fruitful period of countermeasure conceptualization, may need to be extended and enriched (19, 21, 26). According to Lonero et al., “While the [Haddon] model does not exclude behavioral factors, it fails to highlight them” (19, p. 3).

In Haddon’s epidemiologic approach to injury, the host’s role in injury reflects only personal risk at the level of the

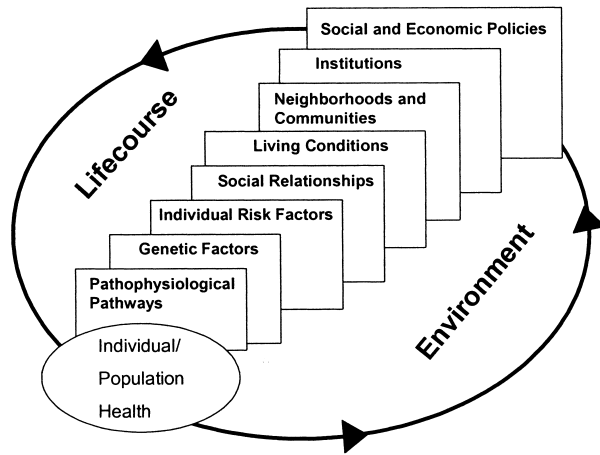
individual. Much of the research on behavior as it relates to injury has been on people whose behavior puts them at risk, such as the person who drinks too much alcohol and then drives (27). However, because so many of the effective injury countermeasures are policy-oriented in nature, it may be helpful to consider the host’s role as an advocate for change in injury prevention at the community level (6). For example, Girasek et al. (28) found in a national survey that the public was generally unaware of the effectiveness of specific alcohol policies in reducing injuries, which may imply a need for injury control professionals to do a better job educating the public about prevention strategies other than individual risk reduction. Finding effective ways to activate the host to become an ally in efforts to make products and environments safer represents a new opportunity for behavioral science to contribute to injury prevention.

The creation of safer products and environments requires behavior change on the part of manufacturers of motor vehicles, toys, and other items that pose environmental hazards, as well as action by policy-makers who regulate exposure to hazards or mandate safety behaviors such as use of auto restraints (6, 29). Cataldo et al. emphasize this point with regard to childhood injury prevention: “Ultimately, injury control must entail some degree of behavior change, requiring the establishment and maintenance of appropriate safety behavior—by parents, legislators, judges and juries, police, health educators, physicians, reporters and the like” (30, p. 233). Below, we discuss theories and examples that can help facilitate the change process among persons at risk as well as among other audiences who influence policy and environmental change.

### ROLE OF THEORY IN BEHAVIOR CHANGE

The limited success of behavior-change efforts in modifying injury-related behaviors can be traced, in part, to failure to fully understand the determinants of the behaviors and a failure to properly apply health behavior theory to the development and implementation of effective interventions. Glanz et al. (31) described theory as a set of interrelated propositions including concepts that describe, explain, or predict a phenomenon.

In this case, the phenomenon of interest is human behavior, specifically injury-related behavior (e.g., risk behavior, safety practices). Concepts or constructs are the component parts or “building blocks” of a particular theory (e.g., self-efficacy, social support, perceived susceptibility). Theories are important not simply because they help us understand causes of problems but because they also allow us to identify mechanisms of change, determine why programs succeed or fail, and, perhaps most importantly, guide us to build better prevention programs. Selection of the most appropriate theory is situation-specific and depends on the specific audience, the setting, and the characteristics of the behavior to be changed. A thorough discussion of the use and benefits of theory in health promotion research and program development is beyond the scope of this article, but interested readers are referred to several texts for more information (31–33).



**FIGURE 1.** Multiple levels of influence on health. Reproduced with permission from Kaplan et al. (39).

### New emphasis on ecologic models in public health

In the past few years, there has been growing national interest in the contributions of theoretical models from the behavioral sciences to public health. The Institute of Medicine of the US National Academy of Sciences recently commissioned two committees, one of which produced the report *Health and Behavior: The Interplay of Biological, Behavioral and Societal Influences* (34) and the other of which produced the report *Promoting Health: Intervention Strategies from Social and Behavioral Research* (35). Both documents emphasize the importance of taking an ecologic perspective. Together, these two documents offer a blueprint for social and behavioral science research in public health.

In 1998, the Centers for Disease Control and Prevention and the American Psychological Association cosponsored a national conference on integrating behavioral and social science with public health and subsequently published a book on the topic (36). Although only this latter document contained individual chapters on violence and unintentional injury prevention (6, 37, 38), there was consistency across all three reports (34–36) about the importance of an ecologic model in understanding and intervening in contemporary public health problems. The Institute of Medicine report *Promoting Health* stated, “Perhaps the most significant contribution of behavioral and social sciences to health research is the development of strong theoretical models for interventions” (35, p. 9). “The committee ... found an emerging consensus that research and intervention efforts should be based on an ecological model” (35, p. 2).

The ecologic model states that health and well-being are affected by a dynamic interaction among biology, behavior, and the environment, and this interaction changes over the life course (39–41). This definition conveys the notion of multiple levels of influence on health (figure 1) and makes clear the importance of both individual-level and community-level factors in shaping health and health-related behaviors. According to McGinnis et al. (24), on a population basis, genetic predisposition accounts for approximately 30

percent of early deaths in the United States; social circumstances such as educational level, income, and social cohesion account for 15 percent; environmental exposures to toxic and microbial agents and structural hazards account for 5 percent; behavioral patterns such as lifestyle and safety practices account for 40 percent; and shortfalls in medical care account for 10 percent. Reductions in motor vehicle deaths and in tobacco use in the United States are examples of improved health outcomes that were achieved on a population basis through interventions at multiple levels of influence (25). Legislative policies, educational programs, and changes in the physical and social environment all contributed to changes in smoking and driving behaviors (i.e., restraint use, drunk driving), resulting in improved health outcomes (L. W. Green et al., unpublished manuscript). Thus, an ecologic model has utility in both describing influencing factors and developing prevention programs.

### Levels of influence and intervention

In translating an ecologic model into action programs, Glanz and Rimer (42) describe three levels and the theories that are useful at each. First is the intrapersonal level, which refers to the influence of an individual’s knowledge, attitudes, and beliefs on his or her behavior. Theories of cognition, perception, and motivation are relevant at the intrapersonal level. Second is the interpersonal level, which refers to how significant other people such as family members, friends, and coworkers influence an individual’s behavior. Theories particularly relevant to interpersonal relationships include those related to social influence and social norms. The intra- and interpersonal levels are sometimes designated simply the “individual level.” The third level is the community level, at which are considered organizational settings and their influences (e.g., workplaces, schools, churches), social and health policies (e.g., welfare reform), and other societal influences, such as poverty. Examples of models applied at the community level include community mobilization, organizational change, and intersectoral action. Institutions can influence individual behavior and community norms through expectations and sanctions. Macro-level societal policies can affect access to resources as well as sanction behaviors and shape community norms (24, 43). Patterns of community zoning and urban planning, for example, can dramatically affect the safety and health of communities and have an impact on behaviors ranging from youth violence and crime to physical activity, like walking and bicycling.

Theories and models can help explain community and individual change processes so that we are better able to facilitate and support changes in communities and among their residents. Different intervention strategies and methods are available for working with individuals and communities (44–46). For example, at the individual level, typical intervention strategies include a variety of behavioral, education, counseling, skill development, and training methods. Innovative new technologies such as computer-tailored messaging and behavioral prescriptions, Web-based learning, and motivational interviewing are promising approaches toward strengthening the impact of individual-level interventions

(47–49). When interventions focus on organizations, communities, and policies, the use of social marketing, mass media, and media advocacy are important, as well as coalition building, social planning, and community development (50–52).

## APPLICATION OF THEORY TO INJURY PREVENTION

A complete enumeration of the theories used in the field of health behavior change to address other health problems is beyond the scope of this paper, although interested readers are referred to recently published textbooks (31, 33) and the Institute of Medicine reports (34, 35). Instead, we describe here several examples of well-respected behavior-change theories or models that have been applied to an injury problem. The extent to which behavior-change models have been applied to injury prevention has yet to be systematically reviewed, although such work is under way (4, 10, 53–55).

### Individual-level theories and methods

The health belief model (56), the theory of reasoned action (57), the stages of change model (58), and applied behavioral analysis (30, 59) have an extensive body of literature supporting their utility, and each has been used for understanding an injury problem. Below, we briefly describe the key constructs of each of these models and provide an example of their application to an injury problem.

**Health belief model.** The health belief model states that preventive behaviors are a function of people's beliefs about their susceptibility to the health problem, the severity of the health problem, and the benefits versus costs of adopting the preventive behavior, as well as whether people experience a cue to action (56). In recent years, the concept of self-efficacy was added to the model. Self-efficacy, a concept originally taken from Bandura's work (60), is one's confidence in one's ability to perform a specific behavior. An illustration of the application of this model in injury prevention comes from Peterson et al.'s (61) study of the beliefs and safety practices of 198 parents with children aged 8–17 years. Peterson et al. used a variation of the health belief model to build formal predictions about how parents' attitudes would influence their injury prevention teaching and environmental modifications. Parents were generally not very worried about injuries to their child (i.e., low perceived susceptibility). The health belief model constructs most strongly associated with parental safety efforts were beliefs that their actions would be effective (i.e., benefits), a realistic appraisal of the costs of action (i.e., costs), and feeling knowledgeable about and competent to perform the behaviors (i.e., efficacy). These results can be used to target educational messages and strategies toward those variables associated with the desired behavioral outcomes. In this case, the authors suggested that interventions be directed toward increasing parents' belief in their child's susceptibility to injury while simultaneously increasing their competency to intervene. Health education methods and strategies for such interventions are widely available, and in this case might include direct communication via the mass media and smaller media to address the

issue of susceptibility and skills training and access to needed safety products to address the issue of competence.

**Theory of reasoned action.** The theory of reasoned action characterizes behavior as a function of behavioral intention, subjective norms, and attitudes (57). The model says that people's intention to perform a behavior predicts their actual behavior. Intention is a function of attitudes and subjective norms. Attitudes are derived from measures of beliefs about the consequences of the behavior in question and the relative importance of these consequences to the individual. Subjective norms are derived from measures of beliefs about significant others' preferences and the individual's motivation to comply with their wishes. Ajzen (62) later modified the theory of reasoned action, calling the modified version the theory of planned behavior, and included the concept of perceived behavioral control, which reflects how easy or difficult the individual perceives the behavior to be. In 1984, the theory of reasoned action was used in a survey of parents' beliefs and practices regarding the use of car safety seats (63). A statewide random digit dialing survey of 406 parents of children aged 5 years or less was completed in an effort to obtain a better understanding of parents' use of car safety seats. The theory of reasoned action was used as the conceptual framework for the survey instrument. The construct of "attitude toward car-seat use" was found to be the single best variable for distinguishing between car-seat users and nonusers. This variable consisted of responses to six questions measuring beliefs about the consequences of the behavior (e.g., using a car seat would be a hassle; your child would be better behaved in a car seat). Respondents who believed that their spouse would approve of using a car seat (a measure of subjective norms) were also more likely to report using one. These results can help inform the development of public and patient education materials by identifying salient messages and credible sources for delivery of those messages. For example, media messages might communicate the ease with which car-seat use becomes a habit with positive consequences such as child comfort and spousal approval.

**Stages of change.** The stages of change model is a relatively newer model of behavior change. It is also called the transtheoretical model, because it incorporates constructs from several older models (58). This model is distinguished from the previous ones because it conceptualizes behavior change as a dynamic process rather than a static process, acknowledging that people differ in their readiness to change a behavior and that changes occur in discrete steps over time. There are typically five stages in this model: 1) precontemplative—not thinking about changing; 2) contemplative—aware and thinking about changing; 3) preparation—taking steps necessary for changing; 4) action—making the change for a short period of time; and 5) maintenance—successfully maintaining the change in behavior, usually measured as maintaining the change for 6 months or longer. This model includes the possibility of relapse to earlier stages, noting that maintained behavior change often occurs after a cyclical process of progressing and relapsing. The most obvious example of the utility of the stages of change model is the experience of many smokers who are trying to quit; and in fact, this model was developed from studies of how smokers

stopped smoking on their own. The stages of change model has been used to describe abusive men's ability to change their abusive behaviors (64) and to describe abused women's safety behaviors and ability to end their abuse (65, 66). In Burke et al.'s (66) qualitative study of women's descriptions of how they coped with and ended their abuse, there were clear examples of women moving from precontemplation (e.g., not considering their partner's behavior a problem, not labeling their experiences as abuse), to action (e.g., recognizing the abuse as a problem and taking some protective action, such as calling a shelter, contacting legal assistance, or moving out), to maintenance (e.g., having experienced no abuse or having been away from the partner for 6 months or more). The point of knowing what stage an individual is in with regard to a desired outcome is that it allows the interventionist to select and apply the most appropriate, stage-matched intervention. For example, to assist someone in moving from precontemplation to contemplation, strategies for raising awareness are recommended (e.g., distribution of information). Helping a person move from contemplation to the stages of preparation and action requires identifying and facilitating skills and access to the necessary resources.

*Applied behavioral analysis.* The term "applied behavioral analysis" identifies a specific subfield within psychology that uses the technology of behavior modification and operant conditioning to facilitate change. Behavior is viewed as learned, and principles of stimulus control, feedback, reinforcement, and punishment shape the acquisition, maintenance, and extinction of behavior (59). This model has a richer body of literature than the theories examined above. Multiple studies using applied behavioral analysis to address safety behaviors have produced fairly consistent and positive results. Application of these strategies in road safety interventions has effectively increased the use of safety belts (67–69) and child restraints (19, 30, 69), reduced vehicle speeding (70, 71), improved child pedestrian safety (72) and bicycle helmet use (4), reduced impaired driving (27), improved the safe driving practices of pizza deliverers (73), and reduced driver errors (74). In other areas relevant to injury prevention, applied behavioral analysis has been used to reduce children's fall-related behavior on playgrounds (75), improve fire escape behaviors and emergency response skills in the event of a residential fire (76–78), change safety behaviors during fires in public buildings (79), and modify other injury control behaviors (5, 9, 80).

Applied behavioral analysis seeks to understand and modify behavior by addressing the "ABCs" of behavior (antecedents, behavior, consequences). For example, in studying drinking and driving behavior, behaviorists are interested in analyzing: 1) antecedents to the behavior, such as cues in the environment, social pressure exerted by friends, or the practice of driving alone to a social function; 2) the behavior itself, such as frequency of drinking, size of the typical drink consumed, and amount of time between drinking and driving; and 3) the consequences that follow the behavior (both positive and negative), such as social attention or punishment for drinking and driving (27).

Understanding the ABCs that control a behavior can help the behaviorist intervene by shaping behavior and the environment to yield change. For example, removing roadside

billboards that remind drivers of drinking, increasing the number of prompts and cues in the drinking environment that discourage drinking and driving, and encouraging the selection of a designated driver can be used to modify the antecedents. Slowing the rate of alcohol consumption, enhancing patron refusal skills, promoting server intervention in the drinking environment, and obtaining feedback from blood alcohol consumption meters can be used to modify the behavior. Social and peer support for not drinking and driving, positive feedback from bartenders or friends, and punishment for being caught drinking and driving can be used to modify consequences (9, 27, 81). This behavioral safety approach also has a strong history of use and success in promoting occupational health and safety (82), and it has been successfully applied to increase the use of personal protective devices such as hard hats and ear protection, to reduce injuries on the job, and to increase worker productivity and morale (83, 84).

These methods can be applied to change one person's behavior (such as a juvenile's fire-starting behavior), to change the behavior of a specific group at risk (such as factory workers), or to change the behavior of an entire community (such as the behavior of accessing emergency services by telephoning 911). Brief interventions in counseling/feedback sessions, together with the application of sound behavior modification strategies, have also been successfully used to change injury-related risk behaviors and the risk of reinjury (49, 85, 86). However, the target audience is not limited to persons at risk. These approaches may also be usefully applied to modifying the behavior of parents, legislators, medical personnel, managers, inventors, policy-makers, and enforcers whose behavior influences large segments of the public (8).

*Integrating models at the individual level.* The paucity of behavioral theories and models pertaining to injury problems is a dilemma similar to the one that was faced by health practitioners attempting to respond to the human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome crisis in the 1980s. At that time, the lack of attention to theory often led to the implementation of ineffective prevention programs in response to the pressing need for behavior modification among persons at greatest risk for HIV infection (87, 88). We can draw lessons from this early experience with HIV that may help in shaping behavioral interventions for injury control.

In 1991, the National Institute of Mental Health convened a theorists' workshop that brought together creators of behavioral theory to develop a unifying framework for applying behavioral theory to the prevention of HIV infection and acquired immunodeficiency syndrome (89). The discussions led to the enumeration of five theories that, taken together, contain virtually all of the variables that have been utilized in attempts to understand and change a wide variety of human behaviors: the health belief model (56), the social cognitive theory (60), the theory of reasoned action (57), the theory of self-regulation and self-control (90), and the theory of subjective culture and interpersonal relations (91). When all five theories and their many variables had been considered, consensus was reached on eight factors that appear to account for most of the variation in health-related behaviors:

1) intentions, 2) environmental barriers, 3) skills, 4) outcome expectancies (or attitude), 5) social norms, 6) self-standards, 7) emotional reactions, and 8) self-efficacy. These same eight factors might also regulate and predict change in injury risk behavior (Dr. Martin Fishbein, University of Pennsylvania, personal communication, 2003).

Translating this guidance into action, Fishbein et al. (92, 93) concluded that, generally speaking, in order for a person to perform a given behavior, one or more of the following must be present:

1. The person forms a strong positive intention or makes a commitment to perform the behavior.
2. There are no environmental barriers that make it *impossible* to perform the behavior.
3. The person possesses the skills necessary to perform the behavior.
4. The person believes that the advantages of performing the behavior outweigh the disadvantages.
5. The person perceives more normative pressure to perform the behavior than to not perform it.
6. The person perceives that performance of the behavior is consistent with his or her self-image or values.
7. The person's emotional reaction to performing the behavior is more positive than negative.
8. The person perceives that he or she has the capabilities to perform the behavior under different circumstances.

The first three factors are viewed as necessary and sufficient for producing any behavior, while the remaining five are viewed as modifying variables influencing the strength and direction of intentions. By way of a hypothetical example, we can apply these notions to a specific injury control behavior: testing the functionality of a residential smoke alarm. If a homeowner is committed to testing the smoke alarm every month, has access to the smoke alarm, and has the skills necessary to successfully test the alarm, we can predict that there is a high probability he or she will perform the behavior. The probability that the individual will test his or her smoke alarm monthly would be predicted to increase even more if the homeowner also believes that testing is worth the time and trouble, knows that his/her neighbors all test their alarms, believes that testing is consistent with his/her values as a responsible homeowner, has no negative emotional reaction to testing, and can test the alarm under different conditions in the home. Under these conditions, the probability of the homeowner's testing the alarm monthly would be predicted to reach nearly 1.0. To date, this integrated model has not been applied to this or any other injury-related behavior, but it holds promise as an innovative approach. We are just beginning to adapt and integrate models such as these at the individual level for injury prevention behavior, and more work is needed to design, test, and evaluate interventions based on these behavioral models.

### Community-level theories and methods

**Community organization.** The community organization approach focuses on the active participation and development of communities to enable them to better evaluate and solve

health and social problems (51). Bracht et al. define community organization as purposeful effort to "activate a community to use its own social structures and any available resources that are decided on primarily by community representatives and that are generally consistent with local values" (52, p. 86) in order to accomplish community goals. Early commentaries on the importance of community interventions in injury control described the difference between "community-wide" interventions and "community-based" programs (94), and it was suggested that the effectiveness of community-wide programs could be enhanced by treating the community "as the source and not simply the site" of prevention programs (95).

One example of a successful community organization effort in injury control is the Injury Free Coalition for Kids initiative, which started with the Harlem Hospital Injury Prevention Program in New York City (96, 97). In the mid-1980s, injury surveillance was used to identify the causes of injury to children and adolescents living in the low-income neighborhoods surrounding Harlem Hospital. In response to compelling evidence of an injury problem, a multidisciplinary lay-professional coalition was formed to develop and implement prevention programs, which included new educational programs, safe play areas, and supervised activities for children. Some of the specific program components were playground renovations; a Safety City, where children are given safety lessons; window guard legislation for high-rise apartments; art, dance, and sports programs; and free bicycle helmets. From 1983 to 1995, hospital admissions due to injury decreased by 55 percent overall, by 46 percent for pedestrian injuries, by 50 percent for playground injuries, and by 46 percent for violence-related injuries (98). Although the total number of injuries also declined in the comparison community, the declines in the intervention community were most noticeable for the specific injuries and age groups targeted by the program (96).

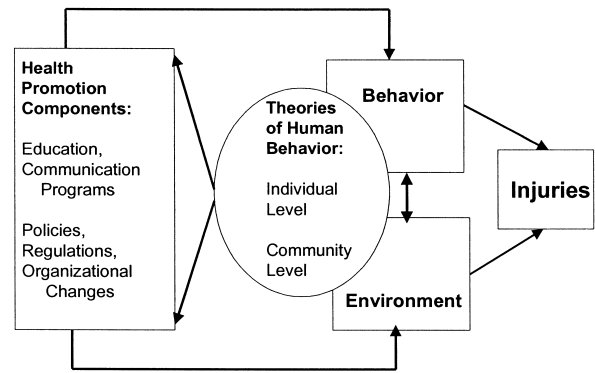
**Community mobilization.** The term "community mobilization" has been used to refer to efforts to involve community members in activities ranging from defining prevention needs to obtaining community support for a predesigned prevention program (99). Community mobilization emphasizes changing the social and economic structures that influence injury risk. Treno and Holder (99) noted that mobilization can include elements of both "bottom-up" (or grassroots) and "top-down" (leader-initiated) strategies, the difference being who defines the problems and who decides on solutions. In the former, it is the community members themselves, and in the latter it is an outside expert (an external or self-appointed community leader). According to these authors, there are limitations to using either strategy exclusively. Grassroots involvement is essential, but it may not be sufficient if, for example, community organizations have competing priorities or lack expertise in defining effective interventions. Alternatively, top-down approaches may have limited sustainability if community organizations and leaders are not supportive and engaged (99). Because community leaders understand their local culture, politics, and traditions better than outsiders, their participation is essential for tailoring imported prevention programs to local needs. The balance between bottom-up and top-down

approaches can be situation-specific, as Green noted in his reflections on the contributions of health education to public health: “Community is, ideally, a level of collective decision-making appropriate to the urgency and magnitude of the problem, the cost and technical complexity of the solutions required, the culture and traditions of shared decision-making, and the sensitivity and consequences of the actions required of people after the decision is made” (100, p. 82).

In Treno and Holder’s Community Trials Project, mobilization was defined as “the purposeful organization of community members to implement and support policies that will reduce alcohol-involved trauma” (99, p. S175), and a community-science partnership was formed. The overarching conceptualization of how this project addressed the alcohol-injury connection was environmental; it focused on “changes in the social and structural contexts of alcohol use that can alter individual behavior” (101, p. S161). Prevention policies and activities that were to be implemented were those supported by research evidence, and communities were asked to customize and prioritize their initiatives depending on local concerns and interests. Specific components of the mobilization effort were directed toward responsible beverage service, drinking and driving, underage drinking, and alcohol access. Coalitions, task forces, and media advocacy were used to raise awareness and support for effective policies among the public and relevant decision-makers (101). In an evaluation of the impact of the mobilization efforts, Holder et al. (102) compared intervention communities with control communities and demonstrated significant reductions in the following indicators: 6 percent in the reported quantity of alcohol consumed; 51 percent in driving with a blood alcohol level over the legal limit; 10 percent in nighttime injury crashes; 6 percent in alcohol-related crashes; and 43 percent in alcohol-related assault injuries seen in emergency departments.

**Empowerment.** The concept of empowerment was demonstrated in these programs through their use of coalitions and task forces to foster community ownership and participatory problem-solving (51). Principles that are derived from a community organization model and are reflected by the experience of the Harlem program and the alcohol and trauma program include the principles of participation and relevance (23). The principle of participation states that behavior change will be greatest when those whose behaviors or circumstances are to be changed are directly involved in intervention planning and decision-making, and the principle of relevance states that change will be greatest when community organizers “start where the people are” and engage community members for their knowledge of what matters to the population at risk. By working with coalitions and task forces and supporting community tailoring of program components, the organizers observed both of these principles.

**Community-based participatory research.** These examples also provide compelling support for another relatively new movement in public health research and practice: community-based participatory research (103, 104). While participatory research is increasingly being advocated for dealing with a multitude of public health problems, it is perhaps especially important for problems that relate to indi-



**FIGURE 2.** Health promotion framework for injury prevention. Adapted from Green and Kreuter (23).

vidual behavior. Implementation and evaluation of policies and programs that attempt to change personal behavior requires extreme sensitivity to the ethical issues surrounding the protection of individual autonomy. By engaging our communities in needs assessment and decision-making about program design and evaluation, which is at the heart of community-based participatory research, we are more likely to adopt strategies that are consistent with the core values of the community and society.

## THE HEALTH PROMOTION FRAMEWORK

The use of behavioral and social sciences to achieve the goals of health promotion has had a long tradition in public health and a strong base in theory and practice (15). Injury prevention can benefit from this legacy. Translating health behavior theories and models into action programs is essential for injury prevention. The health promotion framework of Green and Kreuter (23) is derived from an ecologic model and assists in this translation process. A health promotion approach is particularly useful for injury prevention because it specifically facilitates both behavioral and environmental change. Health promotion includes “the combination of educational and environmental supports for actions and conditions of living conducive to health” (23, p. 14). This widely recognized definition acknowledges the importance of taking behavioral, environmental, and policy approaches to the prevention of injury. The conditions of living that health promotion interventions seek to change are those social and environmental factors that influence injury-related behaviors and give rise to injury. Individual and community actions fostered by education, stimulated by social norms, and encouraged through public policy are the immediate objectives of a health promotion approach to injury prevention (20, 105). Theories provide the bridge from understanding which behaviors and environmental factors are responsible for an injury problem to deciding on and developing appropriate interventions (figure 2). This approach is clearly consistent with the position that effective injury prevention programs must utilize interventions that change environments and products as well as individuals and communities.



In support of the health promotion approach, we are reminded by Mason and Tolsma that “persons can hardly be expected to avoid the risks imposed by personal choices when they do not know or understand these risks, when they lack the knowledge or skills needed to choose a healthier lifestyle, or worst of all, when they seek guidance or support from their community and it is unavailable to them” (106, p. 772). These are conditions that favor a health promotion approach. In injury prevention, perhaps more than with other health problems, there is a strong need for community support, obviously necessary for legislative initiatives but equally important for personal safety behaviors. For example, convenient access to reasonably priced safety products has been repeatedly described as a necessary component of injury prevention programs focused on such issues as car safety seat use, bicycle helmet use, and home safety for children (107, 108). Towner et al. concluded from their systematic review of injury prevention interventions for children and young adults that what is needed is the synergism resulting from the use of “a variety of approaches including education and training, accessible protective devices and safety equipment, environmental change and legislation and its enforcement” (109, p. 97). This is the health promotion approach to injury prevention. Theories pertaining to the individual and community levels should help in clarifying assumptions on which interventions are selected, and when used in conjunction with thorough needs assessments, they should contribute to the building of comprehensive injury prevention programs. Behavior-change theories and methods have become integral to much of health promotion, and they can be beneficially applied to the modification of both individual and social or environmental factors that influence injury risk.

## CONCLUSIONS

A significant behavioral science knowledge base about how to promote individual and community health has developed over the past half century, and it is relevant to injury prevention and control (31–36). However, the behavior-change theories and methods that have been successful in addressing other public health problems have been underrepresented in the injury literature (10, 55), and their application has been underfunded by government agencies and private donors (2, 110). Because academic research in behavioral science is just beginning to address injury issues, more time will be needed to realize the full potential of its contributions to injury prevention and control.

Much is currently being done to facilitate behavioral science research in this field. For example, the Centers for Disease Control and Prevention recently released requests for proposals related to theory-based approaches to injury prevention, and the agency actively promotes research into behavioral safety (111). In 2001, the Centers for Disease Control and Prevention provided funds to each of its 10 injury control research centers to conduct training and research specifically related to behavioral science and injury prevention. The theme of the American Psychological Association’s 2001 initiative “Psychology Builds a Healthy World” focused on the opportunity to improve health *and*

*prevent injury* through the contributions of psychology. The initiative presents new opportunities and new challenges to psychologists to apply their tools, skills, and concepts to injury prevention. Proceedings of the initiative will soon be released in a textbook (112). At the 2002 World Conference on Injury Prevention and Control in Montreal, Canada, a special session on integrating behavioral sciences into injury and violence prevention was held for the first time (55). The session was well attended and generated scholarly discussion of needs and future directions. A similar session is planned for the 2004 conference in Vienna, Austria.

Training workshops on behavioral approaches to injury prevention and control have recently been held under the sponsorship of the Centers for Disease Control and Prevention (53) and in collaboration with the Harborview Injury Prevention and Research Center (54). The National Science Foundation held a workshop on risk analysis and decision-making in 2002, with implications for injury control (113), and major initiatives are under way at the National Institutes of Health to promote behavior-change research in the Office of Behavioral and Social Science Research (114).

Special issues of scholarly journals have been devoted to behavioral and health promotion aspects of injury and violence prevention (8, 73, 115–117). Systematic reviews of prevention strategies have highlighted the need for more effective educational approaches and behavioral change applications to injury control (49, 107, 118).

As behavioral scientists have become more involved in research in public health, there has been greater general acceptance of their contributions (119, 120). Behavioral scientists can complement the work of epidemiologists and other public health practitioners working on injury problems in health care settings, schools, workplaces, and communities. Use of behavior-change theory and methods should also facilitate change among the people who make laws and design products, such as legislators and engineers, in ways that can ultimately protect entire populations.

## FUTURE NEEDS

To further advance the contributions of the behavioral sciences in injury prevention, more attention should be paid to issues of training, research, and practice. Training more behavioral scientists in the epidemiology of injury and the science of injury control is an urgent first step. Likewise, enhancing the behavioral science training of public health students focusing on injury control is essential. Key injury research areas that would benefit from behavioral science investigation include: foundational research on psychological and behavioral aspects of child supervision; the psychology of evacuation; motivating people to engage in personal protective behaviors; applying behavior-change theory to injury prevention interventions; communications and diffusion research to increase the acceptance of effective interventions; theoretical research to clarify the mechanisms by which change occurs across levels of ecologic models; applied research to understand and modify risk perceptions, social norms, and other psychosocial factors associated with behavior and behavior change; developmental research addressing child and adolescent injuries; and intervention

research on psychological factors in human trauma and rehabilitation. Many of these research themes are consistent with recent federal government funding priorities, as described in the Centers for Disease Control and Prevention research agenda on injury prevention (111). In the practice arena, there is a need for partnerships with academic researchers to enhance the applicability of research to practice and vice versa, as well as to increase the use of community-based participatory research methods and behavioral epidemiology in injury prevention and control. We believe these are important steps for strengthening the application of behavioral science to injury control, which in turn can contribute to changing individual behaviors, environmental conditions, and social structures to prevent injuries.

## ACKNOWLEDGMENTS

The authors thank Drs. Ellen Sogolow, Lynda Doll, and Christine Branche at the Centers for Disease Control and Prevention for helpful comments on the original draft of the manuscript.

## REFERENCES

- National Committee for Injury Prevention and Control. Injury prevention: meeting the challenge. *Am J Prev Med* 1989; 5(suppl):1–303.
- Bonnie RJ, Fulco CE, Liverman CT. Reducing the burden of injury: advancing prevention and treatment. Washington, DC: National Academy Press, 1999.
- Runyan CW. Progress and potential in injury control. *Am J Public Health* 1993;83:637–9.
- Thompson NJ, Sleet D, Sacks JJ. Increasing the use of bicycle helmets: lessons from behavioral science. *Patient Educ Couns* 2002;46:191–7.
- Geller ES, Berry T, Ludwig T, et al. A conceptual framework for developing and evaluating behavior change interventions for injury control. *Health Educ Res* 1990;5:125–37.
- Gielen AC, Girasek DC. Integrating perspectives on the prevention of unintentional injuries. In: Schneiderman N, Speers MA, Silva JM, et al, eds. Integrating behavioral and social sciences with public health. Washington, DC: American Psychological Association, 2001:203–30.
- Rothengatter T, Vaya EC. Traffic and transport psychology: theory and application. New York, NY: Pergamon Press, 1997.
- Gielen AC, ed. Injury and domestic violence prevention. (Special issue). *Patient Educ Couns* 2002;46:161–232.
- Sleet DA, Lonero L. Behavioral strategies for reducing traffic crashes. In: Breslow L, ed. *Encyclopedia of public health*. New York, NY: McGraw-Hill, 2002:105–7.
- Sleet DA, Hopkins K, Singer HH. Bibliography of behavioral science research in unintentional injuries. Atlanta, GA: National Center for Injury Prevention and Control, 2003.
- Baker SP. Childhood injuries: the community approach to prevention. *J Public Health Policy* 1981;2:235–46.
- Robertson LS. Behavior and injury prevention: whose behavior? In: Matarazzo JD, Weiss SM, Herd JA, et al, eds. *Behavioral health: a handbook of health enhancement and disease prevention*. New York, NY: John Wiley and Sons, Inc, 1984: 980–9.
- Crawford R. You are dangerous to your health: the ideology and politics of victim blaming. *Int J Health Serv* 1977;7:663–80.
- Ryan W. Blaming the victim. New York, NY: Vintage Books, 1976.
- Bennett P, Murphy S. Psychology and health promotion. Philadelphia, PA: Open University Press, 1997.
- Harborview Injury Prevention and Research Center. Systematic review of childhood injury prevention interventions. Seattle, WA: Harborview Injury Prevention and Research Center, 2002. (World Wide Web URL: [depts.washington.edu/hiprc/childinjury](http://depts.washington.edu/hiprc/childinjury)). (Last accessed August 19, 2002).
- DiLillo D, Peterson L, Farmer J. Injury and poisoning. In: Boll TJ, Johnson SB, Perry NW, et al, eds. *Handbook of clinical health psychology*. Vol 1. Medical disorders and behavioral applications. Washington, DC: American Psychological Association, 2002.
- Shields J. Have we become so accustomed to being passive that we've forgotten to be active? *Inj Prev* 1997;3:243–6.
- Lonero LP, Clinton KM, Wilde GJ, et al. The roles of legislation, education and reinforcement in changing road user behaviour. Toronto, Ontario, Canada: Safety Research Office, Safety Policy Branch, Ministry of Transportation, 1994. (Publication no. SRO-94-102).
- Sleet DA, Gielen AC. Injury prevention. In: Gorin SS, Arnold J, eds. *Health promotion handbook*. St. Louis, MO: Mosby, Inc, 1998:247–75.
- Gielen AC. Health education and injury control: integrating approaches. *Health Educ Q* 1992;19:203–18.
- Towner E, Dowswell T, Simpson G, et al. Health promotion in childhood and young adolescence for the prevention of unintentional injuries. London, United Kingdom: Health Education Authority, 1996.
- Green LW, Kreuter M. Health promotion planning: an educational and environmental approach. 3rd ed. Mountain View, CA: Mayfield Press, 1999.
- McGinnis JM, Williams-Russo P, Knickman JR. The case for more active policy attention to health promotion. *Health Affairs* 2002;21:78–93.
- Motor vehicle safety: a 20th century public health achievement. *MMWR Morb Mortal Wkly Rep* 1999;48:369–74.
- Runyan CW. Using the Haddon matrix: introducing the third dimension. *Inj Prev* 1998;4:302–7.
- Geller ES, Elder JP, Hovell MF, et al. Behavior change approaches to deterring alcohol-impaired driving. In: Ward WB, Lewis FM, eds. *Advances in health education and promotion: a research annual*, 1991. Vol 3. London, United Kingdom: Jessica Kingsley Publishers Ltd, 1991:45–68.
- Girasek DC, Gielen AC, Smith GS. Alcohol's contribution to fatal injuries: a report on public perceptions. *Ann Emerg Med* 2002;39:622–52.
- Wilson MH, Baker SP, Teret SP, et al. Saving children: a guide to injury prevention. New York, NY: Oxford University Press, 1991.
- Cataldo MF, Dershewitz RA, Wilson M, et al. Childhood injury control. In: Krasnegor NA, Arasteh JD, Cataldo MF, eds. *Child health behavior: a behavioral pediatrics perspective*. New York, NY: John Wiley and Sons, Inc, 1986.
- Glanz K, Rimer BK, Lewis FM, eds. *Health behavior and health education: theory, research, and practice*. 2nd ed. San Francisco, CA: Jossey-Bass, Inc, 1997.
- Nutbeam D, Harris E. Theory in a nutshell: a guide to health promotion theory. New York, NY: McGraw-Hill, Inc, 1999.

33. DeClemente RJ, Crosby RA, Kegler MC, eds. *Emerging theories in health promotion practice and research*. San Francisco, CA: Jossey-Bass, Inc, 2002.
34. Institute of Medicine, Committee on Health and Behavior. *Health and behavior: the interplay of biological, behavioral and societal influences*. Washington, DC: National Academy Press, 2001.
35. Smedley BD, Syme SL, eds. *Promoting health: intervention strategies from social and behavioral research*. Washington, DC: National Academy Press, 2000.
36. Schneiderman N, Speers MA, Silva JM, et al, eds. *Integrating behavioral and social sciences with public health*. Washington, DC: American Psychological Association, 2001.
37. Lorion R. Exposure to urban violence: shifting from an individual to an ecological perspective. In: Schneiderman N, Speers MA, Silva JM, et al, eds. *Integrating behavioral and social sciences with public health*. Washington, DC: American Psychological Association, 2001:97–114.
38. Cook SL, Koss MP. Action research: informing interventions in male violence against women. In: Schneiderman N, Speers MA, Silva JM, et al, eds. *Integrating behavioral and social sciences with public health*. Washington, DC: American Psychological Association, 2001:115–40.
39. Kaplan GA, Everson SA, Lynch JW. The contribution of social and behavioral research to an understanding of the distribution of disease: a multi-level approach. In: Smedley BD, Syme SL, eds. *Promoting health: intervention strategies from social and behavioral research*. Washington, DC: National Academy Press, 2000:37–80.
40. Sallis JF, Owen N. Ecological models. In: Glanz K, Lewis FM, Rimer BK, eds. *Health behavior and health education: theory, research, and practice*. 2nd ed. San Francisco, CA: Jossey-Bass, Inc, 1997:403–24.
41. McLeroy KR, Bibeau D, Steckler A, et al. An ecological perspective on health promotion programs. *Health Educ Q* 1988; 15:351–77.
42. Glanz K, Rimer BK. *Theory at a glance: a guide for health promotion practice*. Bethesda, MD: National Cancer Institute, 1995. (Publication no. 95-3896).
43. Green LW, Richard L, Potvin L. Ecological foundations of health promotion. *Am J Health Promot* 1996;10:270–81.
44. Orleans CT, Gruman J, Ulmer C, et al. Rating our progress in population health promotion: report card on six behaviors. *Am J Health Promot* 1999;14:75–82.
45. Bensley RJ, Brookins-Fisher J. *Community health education methods: a practical guide*. 2nd ed. Mount Pleasant, MI: Central Michigan University, 2003.
46. Bartholomew LK, Parcel GS, Kok G, et al. *Intervention mapping book*. Mountain View, CA: Mayfield Publishing Company, 2001.
47. Nansel TR, Weaver N, Donlin M, et al. Baby, be safe: the effect of tailored communications for pediatric injury prevention provided in a primary care setting. *Patient Educ Couns* 2002;46:175–90.
48. Kreuter MW, Jacobsen HA, McDonald EM, et al. Developing computerized tailored health messages. In: Bensley RJ, Brookins-Fisher J, eds. *Community health education methods: a practitioner's guide*. 2nd ed. Boston, MA: Jones and Bartlett Publishers, Inc, 2003:255–89.
49. Dunn C, DeRoo L, Rivara F. The use of brief interventions adapted from motivational interviewing across behavioral domains: a systematic review. *Addiction* 2001;96:1725–42.
50. Themba-Nixon M, Wallack L, Dorfman L, et al. *Media advocacy and public health: power for prevention*. Thousand Oaks, CA: Sage Publications, 1993.
51. Minkler M, Wallerstein N. Improving health through community organization and community building. In: Glanz K, Lewis FM, Rimer BK, eds. *Health behavior and health education: theory, research, and practice*. 2nd ed. San Francisco, CA: Jossey-Bass, Inc, 1997:241–69.
52. Bracht N, Kingsbury L, Rissel C. A five-stage community organization model for health promotion, empowerment and partnership strategies. In: Bracht NF, ed. *Health promotion at the community level: new advances*. 2nd ed. Thousand Oaks, CA: Sage Publications, 1999:83–104.
53. Sleet D, Hopkins K. Working group on behavioral science and unintentional injury prevention: participant's notebook and workshop materials. Atlanta, GA: Centers for Disease Control and Prevention, 1998.
54. Grossman D, Johnston B. Behavioral approaches to injury control: participant's notebook and workshop materials. Seattle, WA: Harborview Injury Prevention and Research Center, January 23, 2003.
55. Gielen A, Trifiletti L, Stallones L, et al. Application of behavioral sciences to injury control. Workshop. In: *Proceedings book of abstracts of 6th World Conference on Injury Prevention and Control*, May 12–15. Montreal, Canada: University of Montreal Press, 2002:1221.
56. Janz NK, Becker MH. The health belief model: a decade later. *Health Educ* 1984;11:1–47.
57. Fishbein M, Ajzen I. *Belief, attitude, intention, and behavior: an introduction to theory and research*. Reading, MA: Addison-Wesley Publishing Company, 1975.
58. Prochaska JO, DiClemente CC. Stages and processes of self change of smoking: toward an integrative model of change. *J Consult Clin Psychol* 1983;51:390–5.
59. Hovell MF, Elder JP, Blanchard J, et al. Behavior analysis and public health perspectives: combining paradigms to effect prevention. *Educ Treatment Children* 1986;9:287–306.
60. Bandura A. Perceived self-efficacy in the exercise of personal agency. *Psychol Bull Br Psychol Soc* 1989;10:411–24.
61. Peterson L, Farmer J, Kashani JH. Parental injury prevention endeavors: a function of health beliefs? *Health Psychol* 1990; 9:177–91.
62. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decision Processes* 1991;50:179–211.
63. Gielen AC, Eriksen MP, Daltroy LH, et al. Factors associated with the use of child restraint devices. *Health Educ Q* 1984; 11:195–206.
64. Daniels JW, Murphy CM. Stages and processes of change in batterers' treatment. *Cognit Behav Pract* 1997;4:123–45.
65. Brown J. Working toward freedom from violence: the process of change in battered women. *Violence Against Women* 1997;3:5–26.
66. Burke JG, Gielen AC, McDonnell KA, et al. The process of ending abuse in intimate relationships. *Violence Against Women* 2001;7:1144–63.
67. Streff FM, Geller ES. Strategies for motivating safety belt use: the application of applied behavior analysis. *Health Educ Res* 1986;1:47–59.
68. Williams AF, Wells JK, Farmer CM. Effectiveness of Ford's belt reminder system in increasing seat belt use. *Inj Prev* 2002;8:293–6.
69. Sleet DA, Hollenbach K, Hovell M. Applying behavioral principles to motor vehicle occupant protection. *Educ Treatment Children* 1986;9:320–33.
70. Van Houten R, Nau PA. Feedback interventions and driving speed: a parametric and comparative analysis. *J Appl Behav Anal* 1983;16:153–281.

71. Ragnarsson RS, Bjorgvinsson T. Effects of public posting on driving speed in Icelandic traffic. *J Appl Behav Anal* 1991;24:53–8.
72. Thomson JA, Ampofo Boateng K, Lee DN, et al. The effectiveness of parents in promoting the development of road crossing skills in young children. *Br J Educ Psychol* 1998;68:475–91.
73. Ludwig TD, Geller ES, Mawhinney TC, eds. Intervening to improve the safety of occupational driving: a behavior change model and review of empirical evidence. *J Organ Behav Management* 2000;19:1–124.
74. Hutton KA, Sibley CG, Harper DN, et al. Modifying driver behavior with passenger feedback. *Transport Res Part F: Traffic Psychol Behav* 2001;4:257–69.
75. Heck A, Collins J, Peterson L. Decreasing children's risk taking on the playground. *J Appl Behav Anal* 2001;34:349–52.
76. Holmes GA, Jones RT. Fire evacuation skills: cognitive behavior versus computer-mediated instruction. *Fire Technol* 1996;32:51–64.
77. Jones RT, Ollendick TH, McLaughlin KH, et al. Elaborative and behavioral rehearsal in the acquisition of fire emergency skills and the reduction of fear of fires. *Behav Ther* 1989;20:93–101.
78. Jones RT, Van Hasselt VB, Sisson LA. Emergency fire safety skills: a study with blind adolescents. *Behav Modif* 1984;8:59–78.
79. Leslie J. Behavioural safety: extending the principles of applied behavioral analysis to safety in fires in public buildings. In: *Proceedings of the 2nd International Symposium on Human Behavior in Fire*. London, United Kingdom: Interscience Communications, 2001:1–10.
80. Roberts MC, Fanurik D, Layfield DA. Behavioral approaches to preventing childhood injuries. *J Soc Issues* 1987;43:105–18.
81. McKnight AJ. Intervention with alcohol-impaired drivers by peers, parents and purveyors of alcohol. *Health Educ Res* 1990;5:225–36.
82. Margolis BL, Kroes WH, eds. *The human side of accident prevention: psychological concepts and principles which bear on industrial safety*. Springfield, IL: Charles C Thomas, Publisher, 1975.
83. Krause TR, Hidley JH, Hodson SJ. *The behavior-based safety process*. New York, NY: Van Nostrand Reinhold Company, 1990.
84. Geller ES. *The psychology of safety*. Boca Raton, FL: CRC Press, 1998.
85. Johnston BD, Rivara FP, Droesch RM, et al. Behavior change counseling in the emergency department to reduce injury risk: a randomized, controlled trial. *Pediatrics* 2002;110:267–74.
86. Hungerford DW, Pollock DA, eds. *Alcohol problems among emergency department patients: proceedings of a research conference on identification and intervention*. Atlanta, GA: National Center for Injury Prevention and Control, 2002.
87. Kelly JA, Murphy DA, Sikkema KJ, et al. Psychological interventions to prevent HIV infection are urgently needed: new priorities for behavioral research in the second decade of AIDS. *Am Psychol* 1993;48:1023–34.
88. Mantell JE, DiVittis AT, Auerbach MI. *Evaluating HIV prevention interventions*. New York, NY: Plenum Press, 1997.
89. Fishbein M, Bandura A, Triandis HC, et al. *Factors influencing behavior and behavior change*. Final report—theorists workshop. Washington, DC: National Institute of Mental Health, 1991.
90. Kanfer R, Kanfer FH. Goals and self-regulation: applications of theory to work settings. In: Machr ML, Pintrich PR, eds. *Advances in motivation and achievement*. Vol 7. Greenwich, CT: JAI Press, 1991:287–326.
91. Triandis HC. Values, attitudes and interpersonal behavior. In: Howe HE, Page MM, eds. *Nebraska Symposium on Motivation 1979*. Lincoln, NE: University of Nebraska Press, 1980:197–259.
92. Fishbein M. Developing effective behavior change interventions: some lessons learned from behavioral research. In: Backer TE, David SL, Soucy G, eds. *Reviewing the behavioral science knowledge base on technology transfer*. (NIDA research monograph no. 155). Bethesda, MD: National Institute on Drug Abuse, 1995.
93. Fishbein M, Triandis HC, Kanfer FH, et al. Factors influencing behavior and behavior change. In: Baum A, Tevenson TA, Singer JE, eds. *Handbook of health psychology*. Mahwah, NJ: Lawrence Erlbaum Associates, 2001.
94. Gielen AC, Collins B. Community-based interventions for injury prevention. *Fam Community Health* 1993;15:1–11.
95. McLoughlin E, Vince C, Lee A, et al. Project Burn Prevention: outcome and implications. *Am J Public Health* 1982;72:241–7.
96. Davidson LL, Durkin MS, Kuhn L, et al. The impact of Safe Kids/Healthy Neighborhoods injury prevention program in Harlem, 1988–1991. *Am J Public Health* 1994;84:580–6.
97. Durkin MS, Laraque D, Lubman I, et al. Epidemiology and prevention of traffic injuries to urban children and adolescents. *Pediatrics* 1999;103:1–8.
98. Injury Free Coalition for Kids. (World Wide Web URL: <http://www.injuryfree.org>). (Accessed August 19, 2002).
99. Treno AJ, Holder HD. Community mobilization: evaluation of an environmental approach to local action. *Addiction* 1997;92(suppl 2):173–87.
100. Green LW. Health education's contributions to public health in the twentieth century: a glimpse through health promotion's rear-view mirror. *Annu Rev Public Health* 1999;20:67–88.
101. Holder HD, Saltz RF, Grube JW, et al. A community prevention trial to reduce alcohol-involved accidental injury and death: overview. *Addiction* 1997;92(suppl 2):155–71.
102. Holder HD, Gruenewald PJ, Ponicki WR, et al. Effect of community-based interventions on high-risk drinking and alcohol related injuries. *JAMA* 2000;284:2341–7.
103. Green LW, Mercer SL. Can public health researchers and agencies reconcile the push from funding bodies and the pull from communities? Community-based participatory research. *Am J Public Health* 2001;91:1926–43.
104. Minkler M, Wallerstein N. *Community-based participatory research for health*. San Francisco, CA: Jossey-Bass, Inc, 2003.
105. Sleet DA, Wagenaar A, Waller P. Drinking, driving and health promotion. *Health Educ Q* 1989;16:329–33.
106. Mason JO, Tolsma D. Personal health promotion. *West J Med* 1984;141:772–6.
107. DiGiuseppi C, Roberts IG. Individual-level injury prevention strategies in the clinical setting. *Future of Children* 2000;10:53–82.
108. Gielen AC, McDonald EM, Wilson ME, et al. Effects of improved access to safety counseling, products, and home visits on parents' safety practices: results of a randomized trial. *Arch Pediatr Adolesc Med* 2002;156:33–40.
109. Towner E, Dowswell T, Mackereth C, et al. What works in preventing unintentional injuries in children and young adolescents? An updated systematic review. London, United Kingdom: Health Development Agency, 2001.
110. *Injury in America: a continuing public health problem*. Washington, DC: National Academy Press, 1985.

111. National Center for Injury Prevention and Control. CDC injury research agenda. Atlanta, GA: Centers for Disease Control and Prevention, 2002.
112. Rozensky RH, Johnson NG, Goodheart CD, et al, eds. Psychology builds a healthy world: opportunities for research and practice. Washington, DC: American Psychological Association (in press).
113. Consortium of Social Science Associations. NSF holds workshop on risk analysis and decision making. In: COSSA Washington update, July 22, 2002. Washington, DC: Consortium of Social Science Associations, 2002:4–5. (World Wide Web URL: [www.cossa.org/21.14.htm#nsf](http://www.cossa.org/21.14.htm#nsf)).
114. Solomon S, Kington R. National efforts to promote behavior change research: views from the Office of Behavioral and Social Sciences Research. *Health Educ Res* 2002;17:495–9.
115. Liller K, Sleet DA, eds. Health behavior and injury control. (Special issue). *Am J Health Behav* (in press).
116. Schwartz R, ed. Focal point issue: injury prevention and control. *Health Promot Pract* 2003;4:85–196.
117. Sleet DA, Bryn S, eds. Health education, health promotion and injury control. (Special issue). *J Health Educ* (in press).
118. Zaza S, Thompson RS, eds. The Guide to Community Preventive Services. Reducing injuries to motor vehicle occupants: systematic reviews of evidence, recommendations from the Task Force on Community Preventive Services, and expert commentary. *Am J Prev Med* 2001;21(suppl):1–90.
119. Holtgrave DR, Doll LS, Harrison J. Influence of behavioral and social science on public health policy making. *Am Psychol* 1997;52:154–66.
120. Snider DE, Satcher D. Behavioral and social sciences at the Centers for Disease Control and Prevention. *Am Psychol* 1997;52:140–2.

# Preventing Injuries and Violence

AN UPDATED GUIDE FOR STATE AND TERRITORIAL  
HEALTH OFFICIALS







# Table of Contents

- Foreword – To Our Members ..... 1
- Preventing Injuries Through Policy Change ..... 2
- Progress in Injury and Violence Prevention ..... 3
- Priorities in Injury and Violence Prevention: An Overview ..... 3
- SECTION I. Motor Vehicle Injuries ..... 4
- SECTION II. Prescription Drug Overdose ..... 13
- SECTION III. Preventing Child Abuse and Neglect ..... 19
- SECTION IV. Older Adult Falls ..... 23
- SECTION V. Preventing Sexual Violence ..... 26
- SECTION VI. Youth Sports Concussions and Traumatic Brain Injury ..... 32
- References ..... 36

# Acknowledgments

This report was made possible through funding from CDC’s National Center for Injury Prevention and Control under cooperative agreement U38OT000161. ASTHO is grateful for this support. The contents of this report are solely the responsibility of the authors and do not necessarily represent the official views of CDC.

## Foreword – To Our Members

Injuries and violence affect everyone, regardless of race, sex, or economic status. More Americans die in the first half of life from violence and injuries, including motor vehicle crashes, falls, and homicides, than from any other cause, including cancer, HIV, and influenza. Each year, more than 3 million people are hospitalized, 27 million people are treated in emergency departments and released, and more than 192,000 people die as a result of unintentional and violence-related injuries.<sup>1</sup>

In 2013, the total cost of injuries and violence in the United States was \$671 billion.<sup>2</sup>

Injuries and violence are also responsible for lost years of productive life when one considers the millions of people who survive injuries each year with resulting persistent, lifelong challenges that ultimately affect their health, including physical pain, disability, and emotional and financial problems. The United States needs effective prevention strategies in order to lift the immense health and societal burden of injuries and violence and create a society where people can live to their full potential.

Extensive research shows that a science-based approach is an effective way to prevent injuries: injuries are no longer simply considered “accidents,” because there are identified risk and protective factors that make them preventable. In addition, comprehensive approaches involving policy implementation, environmental changes, and education are necessary in order to effectively prevent injuries.

Similarly, violence can no longer be viewed as solely a “police or criminal justice problem.” The communities people live in can both protect them from violence or increase their risk of violence.

We’ve learned that efforts to prevent all forms of violence must address social, emotional, and behavioral elements, as well as family and community environments.

The field of injury and violence prevention has seen remarkable progress. Many important medical, scientific, and public health advances in recent years were made possible by credible science, strong leadership, and committed partners.

State and territorial health departments have an opportunity to improve health and strengthen prevention efforts by integrating health into the work of other sectors. By helping agencies incorporate what is known about injury and violence prevention strategies into effective policies, together we can help ensure the health and safety of individuals, families, and communities nationwide.





# Preventing Injuries Through Policy Change

State health departments are frequently called upon to support different types of policy initiatives, including organizational, regulatory, and legislative policies. From child safety to occupational health to traffic laws, we're all familiar with injury prevention policies. But how do you determine the best policy approach for your jurisdiction?

Equipped with a comprehensive understanding of both the burden of injuries in their states and where the opportunities for positive change lie, state health departments can focus their efforts on pursuing the most needed, evidence-based injury prevention policies. Partnerships, such as those with public safety officials, healthcare providers, transportation officials, social services, businesses, and faith-based organizations can help identify and build support for policy, regulatory, and programmatic strategies for preventing and reducing injuries.

When surveying the context of injury prevention in your state, include assessments of potential champions and potential barriers. What have other states experienced? Ask and resolve as many tough questions as you can before determining your course and taking action:

- *How feasible is it to implement this strategy in your state?*
- *Are there resources available to implement it or political will to support it?*
- *Are local communities prepared for the strategy? Will they support it?*
- *Does the strategy address health inequities?*
- *How will the strategy influence the environmental, social, and economic conditions that impact health?*

Many factors influence a policy intervention's effectiveness, such as public awareness and compliance and adequate financial and other resources to support the policy's implementation (e.g., enforcement capacity, education and training, and availability of programs to support and enhance the policy).

Public policies—even those grounded in seemingly popular, scientifically-supported principles—are frequently met with challenges. However, the likelihood of facing challenges doesn't make a public health problem any less worthy of becoming a top priority. It is important to consider your state's priorities and resources along with evidence of the potential solution's effectiveness. Involving a broad group of stakeholders, including local data and subject matter experts and members of the community you want to serve, can help you select the most optimal strategy for your state.

An excellent way to start planning a policy strategy is by contacting the division in your state health department that oversees and administers injury and violence prevention programs. Injury prevention coalitions or networks can also be key collaborators, as many states already have planning groups that engage communities in injury and violence prevention efforts. ASTHO partners with affiliate organization Safe States Alliance, which is the only national nonprofit organization representing state-level injury and violence prevention professionals.

## State health departments participate in all of the following aspects of the policy change process:

- Identifying problems or issues.
- Identifying appropriate policy solutions:
  - » Identifying and describing policy options.
  - » Assessing policy options.
  - » Prioritizing policy options.
- Developing strategies for further adoption of policy solutions.

# Progress in Injury and Violence Prevention

Over the last several years, injury and violence prevention has become an increasingly integral part of the national public health dialogue. Injury and violence prevention goals fit nicely with other public health priorities, including maternal and child health, the built environment, transportation, and healthy communities. Injury prevention is a priority for CDC, which provides significant resources for researching, translating, disseminating, and evaluating interventions that work.



It stands as an indication of progress that injury and violence prevention is being incorporated into large, cross-sector initiatives to improve population health. For example, the [National Prevention Strategy](#) was developed through the Affordable Care Act and is a blueprint for federal agencies to work across sectors to address health and safety. “Injury and Violence Free Living,” a chapter within the National Prevention Strategy, presents strategies being used across the transportation, justice, health, education, and many other sectors to address injuries and violence. Other chapters within the overall strategy also address injuries and violence, and this has provided an increasing opportunity for cross-agency and cross-departmental collaboration around shared health and safety goals.

Violence prevention collaborative efforts have included work with the U.S. Department of Justice, which has aligned resources and strategies to prevent youth violence (instead of just responding to violence) by increasing positive opportunities for young people. Today, violence is recognized as a major public health problem. These collaborative efforts have also assisted in the development of uniform definitions for topics such as child maltreatment, sexual violence, and suicide in order to improve data collection.

## Priorities in Injury and Violence Prevention: An Overview

Policy interventions are important and effective community and societal level strategies for improving the public’s health. ASTHO is releasing this new guide as an update to its 2011 report [Spotting Injury and Violence Prevention on Your Radar Screen: Creating a Legacy in Public Health--A Guide for State and Territorial Health Officials](#). It includes new data and state examples that can be used to affect policy to prevent injuries and violence.

### **This document will discuss strategies to:**

- Assess community needs surrounding injury and violence prevention priority areas and related data.
- Increase the use of evidence-based injury and violence prevention interventions statewide.
- Strengthen state and community level infrastructure, partnerships, and competencies for injury and violence prevention.
- Improve the capabilities of states, local coalitions, and formal alliances to support policies that prevent injuries and violence.

In 2015, CDC’s National Center for Injury Prevention and Control revisited its focus areas and potential opportunities for growth, considering several factors including capability for impact, scalability, external support, and existing evidence-based interventions.

Two issues remain CDC-wide priorities and will continue to be top priorities for the injury center:

- [Motor vehicle injuries](#)
- [Prescription drug overdose](#)

In addition, the injury center identified several areas for increased growth and development:

- [Child abuse and neglect](#)
- [Older adult falls](#)
- [Sexual violence](#)
- [Youth sports concussions and traumatic brain injury](#)

These areas present immediate opportunities for state health officials to begin to reduce the burden of injuries and violence in their states. Within each of these six topic areas, we'll examine what works and identify approaches that states can take to keep people safe, healthy, and productive.

## SECTION I. Motor Vehicle Injuries

### BACKGROUND

Each year, motor vehicle crashes claim the lives of more than 32,000 people in the United States. More than 2.5 million Americans went to the emergency department and nearly 200,000 were then hospitalized for crash injuries in 2012.<sup>3</sup>

The economic cost of motor vehicle crashes is estimated at \$242 billion—or roughly \$784 for every person living in the United States—a figure that takes into account lost productivity, property damage, and costs associated with medical care, legal fees, emergency services, and insurance.<sup>4</sup>

Many environmental, behavioral, and medical factors have contributed to declining motor vehicle crash death rates, including technological changes and engineering efforts that improved the safety of vehicles and highways. Federal transportation laws require each state to develop a strategic highway safety plan that focuses the efforts of all state agencies and partners on the highest priority traffic safety needs statewide. Although many lives have been saved due to these advances, individuals who survive crashes may still experience physical pain, disability, and emotional impacts that greatly reduce the quality of their lives.

Fortunately, thanks to decades of research, programs, evaluation, and changes in governmental policies, today we have a much greater understanding of who is most at risk of being involved in crashes and what strategies work to help keep drivers, passengers, bicyclists, motorcyclists, and pedestrians safe.

### CREATING A CULTURE OF SAFETY

Although motor vehicle crashes clearly have a health impact on individuals and society, traffic safety has often been considered an issue for the transportation sector. However, CDC has been working with transportation safety as a public health issue for more than 20 years. Collaboration between traffic safety and public health has been successful in framing motor vehicle injuries in the context of other preventable causes of death and disease and in influencing the notion of a “culture of safety.”



Policy changes are most effective when they take place within a culture of safety, which state health departments can help create by working with state department of transportation and state highway safety offices, law enforcement, advocates, and community partners to support programs, raise awareness, and change the behaviors that contribute to reducing motor vehicle-related injuries. Health departments can help educate the community about the importance and effectiveness of the laws and their enforcement.

## MOTOR VEHICLE INJURY PREVENTION: A WINNABLE BATTLE

Motor vehicle injury prevention is recognized as one of CDC’s Winnable Battles.<sup>5</sup> Each Winnable Battle priority has a clear set of targets and a method to track and measure progress. The Winnable Battle targets also support related federal priorities and initiatives, such as Healthy People 2020.

### Winnable Battles-Related Healthy People 2020 Objectives: Motor Vehicle Safety<sup>6</sup>

**IVP 13.1** Reduce motor vehicle crash-related deaths

2020 Target: 12.4 deaths per 100,000 population

Baseline: 13.8 deaths per 100,000 population (2007)

**IVP 14** Reduce nonfatal motor vehicle crash-related injuries

2020 Target: 694.3 nonfatal injuries per 100,000 population

Baseline: 771.4 nonfatal injuries per 100,000 population (2008)

## KEY STRATEGIES

There are several types of prevention strategies and policies that states may consider to reduce motor vehicle crash injuries and death.

**Strategy #1:** Reduce injuries and deaths in motor vehicle crashes by increasing the use of seat belts and child safety seats and booster seats.

**Strategy #2:** Protect teen drivers with comprehensive graduated driver licensing systems and parental monitoring.

**Strategy #3:** Reduce alcohol-impaired driving with evidence-based prevention strategies, such as ignition interlock programs.

Each of these strategies is discussed in the following sections.

**Strategy #1:** Reduce injuries and deaths in motor vehicle crashes by increasing the use of seat belts and child safety seats and booster seats.

The strategies presented below are effective for increasing seat belt, car seat, and booster seat use. They are recommended by [The Community Guide](#) or have been demonstrated to be effective in reviews conducted by the National Highway Traffic Safety Administration.<sup>7</sup> In 2013, the Obama administration released [Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices](#), which helps select effective, science-based traffic safety countermeasures for major highway safety problem areas.





## (1) Seat Belts

Seat belts reduce serious crash-related injuries and deaths by approximately half. In 2013, seat belts saved an estimated 12,584 lives among passenger vehicle occupants ages 5 and older. The national seat belt use rate in 2013 was 87 percent, up slightly from 86 percent in 2012.<sup>8</sup> However, among those who died in motor vehicle crashes, nearly half were not buckled up.

Primary enforcement laws have been shown to do more to increase seat belt use and reduce deaths than secondary enforcement laws. States that switch from secondary to primary seat belt enforcement laws have increased their rates of seat belt use after primary enforcement laws went into effect.

A 2015 study published in the *Annals of Internal Medicine* compared motor vehicle-related fatality rates among persons age 10 or older between 2001-2010 in states with primary seat belt laws and in states with secondary laws. The fatality rate was 17 percent lower in states with primary seat belt laws.<sup>9</sup> Another study published in *The Journal of Safety Research* found that primary enforcement covering all seating positions is an effective intervention that can be employed to increase seat belt use and, in turn, prevent motor vehicle injuries to rear-seated occupants.<sup>10</sup>

The most comprehensive policies are primary seat belt laws that cover all occupants regardless of where they are sitting in the vehicle.

According to CDC, to increase seat belt use among adults, states can:<sup>11</sup>

- Make sure that police and state troopers enforce all seat belt laws. Consider steeper penalties, like higher fines. Excessively low penalties may have little effect.
- Support seat belt laws with visible police presence and awareness campaigns for the public. Studies show that publicized enforcement campaigns such as “Click It or Ticket” can help sustain high levels of compliance over time.
- Educate the public to make seat belt use a social norm.

As of October 2015:<sup>12</sup>

- Thirty-four states, Washington, D.C., American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, and the Virgin Islands have primary seat belt laws for front seat occupants.
- Fifteen states have secondary laws. In many of these states, the law is primary for younger drivers and passengers.
- Twenty-eight states, Washington, D.C., Guam, and the Northern Mariana Islands have laws requiring belt use for all rear seat passengers. The law is primary in 17 of these states, Washington, D.C., Guam, and the Northern Mariana Islands.

In some states, there is substantial opposition to changing a secondary law to a primary belt use law. Some opponents claim that primary laws impinge on individual rights and provide opportunities for law enforcement to single out certain groups on the basis of race. However, studies that have examined this issue have found no evidence of racial profiling with respect to primary belt laws.<sup>13, 14</sup> States have also added anti-harassment language to their primary seat belt laws to reduce the risk of differential enforcement.<sup>15, 16</sup>

### Rhode Island's Primary Seat Belt Law

Rhode Island enacted a primary seat belt law in June 2011. Although the initial law had a two-year sunset provision, it was made permanent in 2013 with a \$40 fine for offenders. The 2014 seat belt use rate for Rhode Island was 87.4 percent for drivers and passengers combined.<sup>17</sup> These rates have fluctuated over time, but have shown an overall upward trend in seat belt use. The largest increase (from 77.5 percent in 2012 to 85.6 percent in 2013) was likely due to the law becoming permanent and the presence of enforcement-based messaging around the state.<sup>18</sup>

Enactment of the law made Rhode Island eligible for an additional \$3.7 million in federal funding for incentive grants to increase seat belt use. Rhode Island has increased statewide awareness of the law through media campaigns and committed one million dollars to support minority community education on seat belt use.

## (2) Child Passenger Safety

Any restraint is better than none at all, but when correctly used child restraints provide the best protection in a crash until children are large enough for adult seat belts to fit properly.<sup>19</sup> Buckling children in age- and size-appropriate car seats, booster seats, and seat belts reduces serious and fatal injuries.<sup>20</sup> Child restraints also reduce fatalities in passenger cars by 71 percent for infants younger than 1 and by 54 percent for children 1 to 4 years old.<sup>21</sup>

In 2011, the American Academy of Pediatrics released its updated child passenger safety recommendations, which call for children to remain in rear-facing child safety seats until they reach age 2 or until they outgrow the height and weight limits determined by the manufacturer of their rear-facing child safety seat. Although intended to educate parents on the best practices to protect their children from death or injury while traveling in a vehicle, these recommendations also provide guidance to state policymakers.<sup>22</sup>

Today, all states and territories have child passenger safety laws, although requirements of the laws vary widely. State laws and regulations generally use a child's age, height, and weight to determine whether a car seat, booster seat, or seat belt should be used.

Child passenger restraint laws that increase the age for car seat or booster seat use result in more children being buckled up. Among five states that increased the required car seat or booster seat age to 7 or 8 years, car seat and booster seat use tripled, and deaths and serious injuries decreased by 17 percent.<sup>23</sup>

Many state child restraint laws contain gaps in coverage or provide exemptions that allow children to go unrestrained in certain circumstances. For example, even when states have laws covering older children, many of them fail to distinguish child passengers in need of rear-facing infant seats from those who should use booster seats.

States can support child passenger restraint laws that require car seat or booster seat use for children ages 8 and under or until seat belts fit properly (lap belt lays across upper thighs and shoulder belt lays across the shoulder, not the neck or face).<sup>24</sup>

As of October 2015:<sup>25</sup>

- All states and territories require child safety seats for infants and children fitting specific criteria, but requirements vary based on age, weight, and height.
- Forty-eight states, Washington, D.C., and Puerto Rico require booster seats or other appropriate devices for children who have outgrown their child safety seats but are still too small to use an adult seat belt safely.
- Three states (California, New Jersey, and Oklahoma) require that children younger than 2 years of age be in a rear-facing child seat.
- Five states (California, Florida, Louisiana, New Jersey, and New York) have seat belt requirements for school buses.

States can take several approaches to keep costs reasonable and help parents obtain restraints. States can also support car seat and booster seat give-away programs that include education for parents or caregivers.

### California's "Who's Got Car Seats?" and Vehicle Occupant Safety Program

California's child passenger safety laws require all children under 8 years old to be buckled in a car seat or booster seat in the rear seat of the vehicle and all children under 16 years old to be in a car seat, booster seat, or vehicular seat belt properly restrained. For each child who is not properly secured, drivers can be fined more than \$475 (minimum fine is \$100) and get a point on their driving records.<sup>26</sup>

The funds from the fines collected under this law are allocated such that 60 percent (and up to 85 percent) goes to local health departments for community education and assistance programs. There is a child passenger safety coordinator in each California county health department who works directly with the court systems, hospitals, law enforcement, and other local agencies and oversees the transfer of funds into the program.

When state or local law enforcement issue child passenger safety citations, the courts have the option to refer drivers to violator education programs, community programs that include education on the proper installation and use of child passenger restraint systems for children of all ages. These programs are managed and supported by the California Department of Public Health's (CDPH) Vehicle Occupant Safety Program (VOSP), which works closely with local health departments, hospitals, community agencies, child care providers, law enforcement, municipal court systems, and other state and local agencies to develop child passenger safety educational programs and offer low cost or loaner car seats for low-income families. VOSP developed violator education program curriculum guidelines to enhance standardization of these programs statewide.

In 2013, California amended its law to require that public or private hospitals, clinics, or birthing centers provide parents or caregivers with information on current child passenger safety state laws, the use of proper child restraints, and transportation of children in the rear seats.

CDPH maintains a list of "Who's Got Car Seats?" which is mandated in statute to be updated annually and posted to the VOSP website. It shows a list of child passenger safety programs and services by county and whether the county has a violator education program. This information is provided to local courts, birthing centers, community child health and disability prevention programs, county clinics, prenatal clinics, agency locations for the Special Supplemental Nutrition Program for Women, Infants, and Children, county hospitals, and the public.<sup>27</sup>

**Strategy #2:** *Protect teen drivers with comprehensive graduated driver licensing systems and parental monitoring.*

## Teen Drivers

Motor vehicle crashes are the leading cause of death for U.S. teenagers.<sup>28</sup> The risk of motor vehicle crashes is higher among 16 to 19-year-olds than among any other age group, and that risk is highest during the first year that a teen has his or her license. Young drivers tend to overestimate their driving abilities and underestimate the dangers on the road. Immaturity leads to speeding and other risky habits, and inexperience means that teen drivers often don't recognize or know how to respond to hazards.<sup>29</sup>

Graduated licensing helps new teenage drivers gain skills under low-risk conditions.<sup>30</sup> Graduated driver licensing (GDL) programs grant driving privileges in three stages: a supervised learner's period, an intermediate license (after passing a road test) that limits driving in high-risk situations except under supervision, and a license with full privileges.

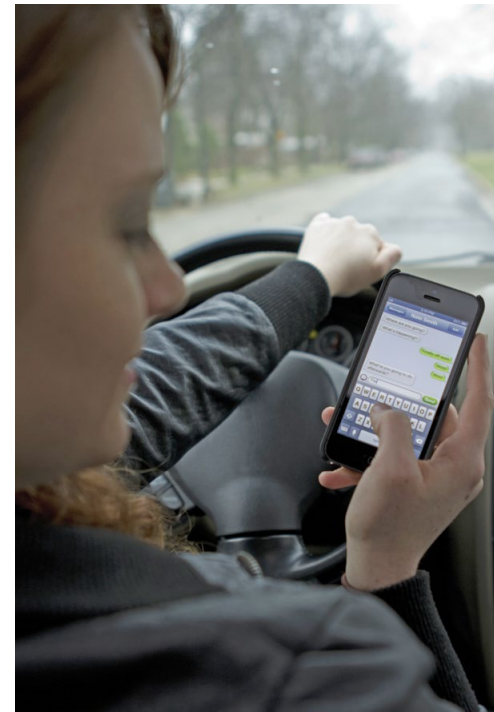
There is no national GDL system, and state laws vary. Research indicates that more comprehensive GDL systems prevent more crashes and save more lives than less comprehensive GDL systems. On the basis of this evidence, research funded by the National Institutes of Health found that the most effective legislation had at least five of the following seven key elements:<sup>31</sup>

- Minimum age of 16 years for a learner's permit.
- Mandatory waiting period of at least six months before a driver can apply for an intermediate license.
- Requirement for 50 to 100 hours of supervised driving before testing for an intermediate license.
- Minimum age of 17 years for an intermediate license.
- Restrictions on nighttime driving.
- Limit on the number of teenage passengers allowed in the car.
- Minimum age of 18 years for licensure with full privileges.

Some states have applied additional restrictions on young drivers, including:

- Cell phone use bans.
- Texting bans.
- Seat belt requirements.
- Zero tolerance for driving under the influence of drugs or alcohol.
- Stronger penalties for offenses that occur during the intermediate licensing stage.
- Minimum standards for driver education.

An online calculator developed by the Insurance Institute for Highway Safety shows how much each state could reduce the fatal crash rate for teens if it adopted the strongest policies in five GDL components, including permit age, practice driving hours, license age, and restrictions on night driving and teen passengers.<sup>32</sup>





CDC's [Parents Are the Key](#) campaign helps parents, pediatricians, and communities keep teen drivers safe on the road.<sup>33</sup>

As of October 2015, states mitigate these risks in the following ways:<sup>34</sup>

- **Cell Phones and Texting:** 38 states and Washington, D.C. ban all cell phone use by novice drivers.
- **Nighttime Driving Restriction:** 48 states and Washington, D.C. restrict nighttime driving during the intermediate licensing stage.
- **Passenger Restriction:** 46 states and Washington, D.C. restrict the number of allowed passengers during the intermediate licensing stage.
- **Novice Driver Decal:** New Jersey is the only state with a measure requiring individuals younger than 21 without full-privilege licenses to display a decal on their vehicle identifying them as new drivers.

The Parents Are the Key campaign identifies the eight major risks affecting teen drivers as:

- Driver inexperience.
- Driving with teen passengers.
- Nighttime driving.
- Not using seat belts.
- Distracted driving.
- Drowsy driving.
- Reckless driving.
- Impaired driving.

### Nebraska's Driver Education Program Results in Fewer Crashes

In Nebraska, driver education appears to be an important tool within the context of GDL, reducing crashes and violations for teen drivers in their first two years of driving.<sup>35</sup> Nebraska has a modified three-stage GDL system where a teen can apply for a provisional operators permit following the one-year learner's permit stage. To apply for the provisional operators permit, the teen must either complete a Department of Motor Vehicles-approved driver education safety course and pass written and driving tests obtain a 50-hour Certification Form log signed by a parent, guardian, or licensed driver who is at least 21 years old.

The Nebraska Prevention Center for Alcohol and Drug Abuse received a grant from the Office of Highway Safety to study Nebraska teen drivers from 2003-2010. The study found that teens who participated in the driver education program had significantly fewer overall crashes, crashes involving injuries or fatalities, traffic violations, and DUIs in both the first and second year of driving than teens who obtained their provisional license by completing 50 hours of adult supervised driving.<sup>36</sup> Driver education appears to enhance the effectiveness of GDL as a complementary strategy, and state policies might consider how to strengthen educational requirements within the GDL environment.

## Utah's Teen Driving Task Force

The Utah Department of Health's Injury Prevention Program, with support from CDC's Core Violence and Injury Prevention Program, analyzed 20 years of data on motor vehicle crashes and found a decrease in teen crash fatalities over the last 20 years, with a 61 percent decrease occurring after the 1998 passing of a GDL policy.<sup>37</sup>

According to a statewide randomized survey, 56 percent of adults in Utah were not aware of nighttime driving restrictions for teen drivers, and 21 percent were not aware of passenger restrictions. A further review of Utah's in-school teen driver education program, overseen by the Utah Office of Education, found that the driver education curriculum was outdated and lacked parental involvement despite national recommendations to the contrary.

Through the Utah Teen Driving Task Force, the Utah Department of Health worked closely with the Office of Education to rewrite Utah's driver education curriculum so that it is now based on evidence, informed by local data, supported by local and national resources, and includes parent classes. The Utah Department of Health also contracted with local health departments and trained staff at each to collaborate with the Zero Fatalities Program and their high school driver education instructors to teach parent classes throughout the state on teen driving and passenger restrictions.

**Strategy #3:** *Reduce alcohol-impaired driving with evidence-based prevention strategies, such as ignition interlock programs.*

## Impaired Driving

In 2013, more than 10,000 people died in alcohol-impaired driving crashes in the United States—one every 51 minutes.<sup>38</sup> Alcohol impairment accounts for nearly one-third (31%) of all traffic-related deaths in the United States. Strategies for reducing alcohol-impaired driving, as well as the associated injuries and deaths, may include legislation and policy approaches, sobriety checkpoints, and school-based programs.

Ignition interlocks, when appropriately used, reduce repeat offenses for driving while intoxicated (DWI) by approximately 70 percent, resulting in increased safety for everyone on the road.<sup>39</sup> All states have enacted legislation requiring or permitting the use of breath alcohol ignition interlock devices to prevent alcohol-impaired driving. An ignition interlock is a device connected to a vehicle's ignition that prevents the vehicle from starting unless the driver blows into the interlock and has a blood alcohol concentration (BAC) below a pre-set low limit, usually .02 BAC.

Impaired driving is often linked to a bigger problem: alcohol misuse and abuse. Data collected by the interlock can provide substance abuse treatment providers with information regarding the person's consumption and behavior, which helps support better treatment outcomes. Costs associated with interlock devices are usually paid by the offenders and average \$3-4 per day in addition to the average initial installation charge of approximately \$70-90 and additional monthly fees to download and report the interlock data.<sup>40</sup> One challenge that state programs face is that some offenders cannot afford the fees associated with an interlock sanction.

## How can states increase ignition interlock use?

CDC and the National Highway Traffic Safety Administration collaborated on an evaluation conducted by the Preusser Research Group and managed by the Governors Highway Safety Association that aimed to provide information and best practices to states for ignition interlock programs. The evaluation looked at key features of interlock programs and use of interlocks in 28 states from 2006–2011.<sup>41</sup>

States may consider using the following eight program keys to strengthen state alcohol ignition interlock programs. Implementing just one of these program keys is likely to increase interlock use, and implementing multiple program keys is associated with even higher increases in interlock use.

### Eight Program Keys for Strong State Alcohol Ignition Interlock Programs

Program Key	Characteristics of a Strong Program Key	Example
Require or incentivize use.	Requirement or strong incentive to install interlocks.	A law covering all offenders with significant reduction of hard license suspension period if interlock is installed.
Levy strong penalties.	Strong, swift, and appropriate penalties.	Extension of interlock time, home monitoring, or jail time if refuse to install, fail breath test, or tamper or otherwise circumvent interlock.
Monitor interlocks to ensure proper use.	Careful monitoring to assure interlocks are installed and used as intended.	Random checks by DMV, probation, or treatment centers to ensure offender has installed and is using an interlock.
Implement uniformly across state.	Uniform and consistent implementation, statewide.	All agencies report data regularly in compatible format, using uniform definitions of violations in same time frame.
Coordinate across agencies.	Close coordination and communication across all agencies.	Regular communication with representatives from all interlock program involved agencies.
Educate stakeholders about the program.	Regular training or education for all interlock agency staff and management.	Regular trainings between interlock program managers, law enforcement, vendors, DMV, and court staff.
Provide adequate resources.	Adequate staff and funding resources.	Designated interlock program manager and staff, and financial assistance for offenders.
Use data for action.	Excellent data records (including level of offense, BAC level at time of arrest, number of prior arrests, installation and removal dates, and violations).	Combined annual data on offenders available from all agencies to monitor offenders, report violators, and evaluate program effectiveness.

## SECTION II. Prescription Drug Overdose

### BACKGROUND

The misuse and abuse of prescription drugs in the United States is widespread and the impact it has on states and communities is troubling. From 1999 to 2013, the amount of prescription opioids prescribed and sold in the United States nearly quadrupled, and overdose deaths quadrupled in lockstep.<sup>42</sup> In the United States, drug poisoning has now surpassed motor vehicle crashes as the leading cause of injury death. These deaths are attributable largely to an increase in overdoses involving prescribed controlled substances, especially opioid analgesics.<sup>43</sup>

Opioids have a role in treating some types of pain, but the misuse and abuse of these drugs is a serious public health concern. Although recent data suggests that nonmedical use of prescription opioids among adults ages 18-64 years has decreased, the prevalence of prescription opioid use disorders increased, as did the number of “highly frequent” users, or individuals with 200 days or more of nonmedical opioid use in the past year.<sup>44</sup>

Using multiple drugs, such as alcohol and sedatives, can increase overdose risk. Studies have shown a strong relationship between inappropriate opioid prescribing and negative health outcomes. Higher daily doses (as calculated by the morphine milligram equivalent dose per day, generally >100 morphine milligram equivalent per day) have been associated with misuse, emergency department visits, and overdoses.<sup>45,46</sup> Now, growing evidence suggests that people who misuse prescription opioids are shifting to heroin, which is cheaper and, in some communities, easier to obtain. Heroin deaths are increasing sharply, with the number of fatal overdoses tripling since 2010.<sup>47</sup>

Prescription drug abuse is costly for communities, leading to increased healthcare costs and greater risk of homelessness, incarceration, placement of children into foster homes, drug exposed pregnancies, and early death. Comprehensive strategies must take into account the complex interplay of factors and social determinants of health that are driving this epidemic. Some people who misuse prescription drugs believe that these substances are safer than illicit drugs because they are monitored and distributed through the healthcare system. This misperception may contribute to individuals, particularly youths, initiating first-time nonmedical use of prescription drugs.

In the same way that public health officials would approach other disease outbreaks, reversing the trend in prescription drug overdoses requires a comprehensive approach. To be most effective, this approach should be multidisciplinary, with strategies that include prevention and education, surveillance and monitoring with tools such as prescription drug monitoring programs (PDMPs), diversion control through law enforcement and licensure efforts, and a focus on treatment and recovery.



## KEY STRATEGIES

As states continue to explore policy options to address prescription drug abuse and misuse, it will be crucial to ensure a focus on prevention as well as treatment. It is important to think about (1) establishing systems to monitor the prevalence of prescription drug abuse and to use data to ensure coordinated policies and programs across key agencies, and (2) using data-driven approaches to eliminate or reduce the impact of prescription drug misuse and abuse.

### **At the policy or regulatory level, states can:**

- Enhance surveillance and monitoring through PDMPs to improve prescribing, inform clinical practice, and protect at-risk patients.
- Promote clinical practice tools that support clinicians in preventing unintended dangerous or inappropriate use of prescription drugs.
- Use oversight approaches to prevent multiple provider episodes (“doctor shopping”), pain clinic operation, and other prescriber practices outside of accepted medical standards.
- Improve access to overdose prevention tools such as naloxone, a medication designed to counter the effects of opioid overdose, as well as to drug abuse treatment and rehabilitation.

### **State health departments can continue to provide leadership and support efforts to prevent prescription drug overdose by:**

- Conducting surveillance and monitoring to identify individuals at highest risk of prescription misuse or overdose.
- Communicating with policy and decisionmakers regarding the overall burden of prescription drug overdoses within the state and policy strategies for preventing overdose and death.
- Raising awareness among the general public regarding the prescription drug overdose epidemic and steps that individuals can take to prevent addiction and overdose.
- Developing and disseminating clinical support tools to strengthen practices and prevent dangerous prescribing, while assuring access to legitimate pain management.
- Monitoring, evaluating, and sharing results of actions taken to reduce prescription drug overdoses.

## Prescription Drug Monitoring Programs

PDMPs can serve both public health and public safety objectives in a collaborative manner. Appropriately prescribing and dispensing controlled substances can reduce their diversion and abuse, and law enforcement efforts to limit drug diversion can protect public health. This is similar to the collaborative efforts between public health and law enforcement to reduce motor vehicle-related injuries and deaths.

### Primary areas in which PDMPs can be used to meet public health objectives include:

- **Education:** Providing information on prescribing trends and raising general awareness of the prescription drug abuse epidemic.
- **Epidemiological Surveillance:** Using PDMP data to understand prescribing trends and the prevalence of controlled substance use statewide and by county, region, or city.
- **Prevention:** Enabling healthcare providers to avoid prescribing duplicate therapies and creating deterrents to drug diversion.
- **Early Intervention:** Detecting patients at risk of drug abuse at initial stages of drug-seeking behavior.

Using state PDMPs is a valuable way to enhance patient care when prescribing and dispensing controlled substances. States have many different models of administrative oversight, specific drugs targeted for monitoring, methods of data collection, and levels of information sharing. Although PDMP best practices and recommendations have not been firmly established nationwide, many states are moving forward with a set of promising strategies and implementing core program elements, including:<sup>48</sup>

- **Universal Use:** Prescribers use PDMP each time they prescribe opioids and other controlled substances.
- **Real-Time:** PDMP reduces the prescription drug data transmission time between dispensers and PDMPs, with the goal of real-time access (i.e., under five minutes).
- **Actively Managed:** Agencies are using PDMP data for public health surveillance and to send proactive reports to authorized users to protect patients at the highest risk. The system is linked in a way that allows for comprehensive interstate data sharing.
- **Easy to Use Available Access:** PDMPs are easy to use and integrated into the clinical workflow, which eliminates practical, bureaucratic, and legal barriers to prescription drug information sharing.



## Prescribing Guidelines

Improving the way opioids are prescribed through clinical practice guidelines can promote safe, effective treatment while reducing opioid-related abuse and overdose. Prescribing practices that may be addressed through guidelines include: determining when to initiate or continue opioids for chronic pain outside of end-of-life care; adjusting opioid selection, dosage, duration, follow-up, and discontinuation; and assessing the risk and addressing the harms of opioid use.<sup>49</sup>

Prescribing guidelines can present different treatment approaches for acute and chronic pain; assess potential abuse risk before prescribing; help prescribers develop “contracts” that clarify pain



management expectations, goals, and responsibilities for patients and prescribers; and encourage use of the lowest effective dose of pain medication for the shortest possible duration.<sup>50</sup>

Pain prevention, assessment, and treatment is a challenge for both health providers and systems. Professional organizations, states, and federal agencies, including the American Academy of Pain Medicine, the Washington Agency Medical Directors Group, and the U.S. Department of Veteran Affairs, have all developed guidelines on opioid prescribing.<sup>51,52,53</sup> Addressing inappropriate prescribing through guidelines can potentially disrupt the cycle of opioid pain medication misuse and abuse that contribute to the overdose epidemic.

## Regulatory Action – Pain Clinics and Oversight

Many states have increased their enforcement efforts in order to curb prescription drug abuse. State medical boards are typically composed of physician and public members who are often appointed by the governor. Some boards are independent, exercising all licensing and disciplinary powers, while others are part of a larger state agency, such as the state health department, which may act as an advisory body. Regulatory actions can also help change behaviors among both providers and patients. Because states have the ability to regulate healthcare practices and monitor prescriptions, many of the critical policy levers exist at the state level.

A state's policy response should include coordination among many agencies and stakeholders with interests or responsibilities related to prescription opioid use, including health departments, insurance and workers' compensation bureaus, boards or agencies that regulate and license pharmacists and prescribing physicians, law enforcement, and other governmental entities that may play a role monitoring and enforcing policies.

To understand the legal authority needed to address inappropriate prescribing, doctor shopping, and "pill mills," states should review the existing statutes, rules, and relevant policies of non-government agencies, such as medical professional societies, that address opioid prescribing. A balanced approach is also important. States should be aware of unintended or potentially harmful consequences associated with establishing new standards of practice or changing the statutory and regulatory requirements for pain management clinics.

Many jurisdictions have developed interagency task forces to specifically address opioid abuse. One example of interagency collaboration is the Agency Medical Directors' Group (AMDG) in Washington state. AMDG was responsible for the development of the **Opioid Dosing Guideline for Chronic Non-Cancer Pain** (originally published in 2007) which was intended as an educational pilot to address how opioids were used to treat chronic pain. AMDG included medical directors of five Washington state agencies: Corrections, Health, Health Care Authority, Labor and Industries, and the state's Medicaid program. Boards and commissions that set practice standards reviewed the guideline, and the workgroup also received input from others in state government and the medical and scientific community.

Use of the AMDG Guideline, along with other robust statewide efforts, resulted in a 29 percent decrease in prescription opioid-related deaths between 2008 and 2013. Hospitalizations for prescription opioid overdose also decreased 29 percent between 2011 and 2013. The guidelines have since been evaluated and updated (in 2010 and 2015) to reflect current medical evidence and trends in opioid prescribing patterns.

## Texas' Closed Formulary

Formularies can influence prescribing practices by requiring physicians to obtain authorization to prescribe non-formulary drugs, like benzodiazepines and some opioids that are often used inappropriately, by certifying that the drugs are medically necessary to treat the injured patient. Some states have also implemented closed formularies for prescription drugs in an effort to control overutilization of expensive opioid medications. Closed formularies, such as those in Ohio, Texas, and Washington state, allow a limited list of covered medications for workers' compensation claims. In 2014, Oklahoma's Workers' Compensation Commission established a formulary under "emergency rules."

Texas adopted one of the nation's first workers' compensation pharmacy closed formularies in September 2011. It took time to get the program up and running: Texas started the process in 2005 by passing HB 7, which created the Division of Workers' Compensation (DWC) within the Texas Department of Insurance and authorized a closed formulary for prescription medications. After establishing the necessary regulatory infrastructure and developing treatment guidelines, the state is beginning to see results. In August 2014, DWC reported that under the closed formulary, the total number of claims receiving not-recommended "N" drugs (drugs that are not appropriate for first-line therapy) was reduced by 65 percent between 2010 and 2011.

The closed formulary has also significantly reduced prescription drug costs in the Texas workers' compensation system and impacted prescribing patterns for Texas physicians treating workers' compensation claims. The frequency of all opioid prescriptions was reduced by 11 percent and the frequency of "N" drug opioids was reduced by 64 percent between 2010 and 2011. Although more medications now require pre-authorization as a result of the closed formulary, DWC has worked on its administrative processes to improve communication and care coordination between insurance carriers and prescribing physicians, which has resulted in fewer consumer disputes since the formulary took effect.

Overall, total pharmacy costs for 2011 were reduced by approximately \$6 million when compared to 2010 claims. These cost reductions were even more significant for "N" drugs, which saw reductions of up to 82 percent.<sup>54</sup>

## Overdose Prevention

States are pursuing a number of strategies to reduce and prevent fatal opioid overdose. Naloxone, an opioid antagonist medication used to treat overdose, is an important part of a continuum of substance abuse services that includes prevention and intervention efforts, access to treatment, and recovery support services.

Improving access to emergency intervention—and, in particular, naloxone—has shown to be effective in reducing negative consequences associated with drug use. There have been efforts at both the federal and state levels to ensure naloxone availability, but access and cost barriers remain: the price of intranasal naloxone more than doubled in the second half of 2014. More than half of states have passed laws expanding naloxone access and offer some level of immunity from prosecution for seeking help for someone during an overdose occurrence. Because a large number of overdose deaths involve pharmaceuticals, it is critical that appropriate overdose response services are available in conjunction with protection from prosecution in emergency help-seeking situations.



In 2014, New York equipped 19,500 police officers with naloxone to combat overdoses across the state.<sup>55</sup> The U.S. Office of the Attorney General recommends that federal law enforcement agencies train personnel who may interact with opioid overdose victims and equip them with naloxone. Citing the Network for Public Health Law, state and local public health officials, regulatory boards, and other stakeholders are considering many legal and policy questions regarding overdose prevention, such as:<sup>56</sup>

- What are the emerging best practices regarding “Good Samaritan” drug overdose laws?
- Are there liability concerns related to police officers administering naloxone?
- Are nurse practitioners in my state permitted to write naloxone prescriptions?
- What are the rules governing pharmacist collaborative practice agreements for naloxone?

Early evidence indicates that efforts to prescribe and dispense naloxone have been successful. According to a report published by the Harm Reduction Coalition, by June 2014, at least 644 local, community-based opioid overdose prevention programs in the United States provided naloxone to laypeople, including drug users, their friends and family, and service providers who had the potential to witness an overdose. More than 26,463 drug overdose reversals using naloxone were reported between 1996 and June 2014.<sup>57</sup>

### Vermont’s Care Alliance for Opioid Addiction

Vermont has taken a multipronged approach to addressing opioid addiction that includes multiple community partners, regional prevention efforts, drug take-back programs, recovery services at 11 recovery centers across the state, and naloxone kit distribution to prevent overdose deaths. In 2013, the Vermont Legislature tasked the Vermont Department of Health with developing and administering a statewide pilot program for distributing the naloxone kits.

The [Care Alliance for Opioid Addiction](#) is at the heart of Vermont’s comprehensive treatment system, responsible for regional centers (hubs) that provide intensive addiction treatment to patients and consultation support to medical providers (spokes) treating patients in the general practice community.<sup>58</sup> Because patients treated in the hubs and their families may have contact with people at high risk of overdose, the hubs are uniquely positioned to enroll people in the program and provide training and intervention resources. By January 2015, the state health agency had distributed 2,385 overdose rescue kits to the pilot sites. More than 1,400 have been dispensed to patients and family members, and more than 100 kits have been used to save lives.<sup>59</sup>

# SECTION III. Preventing Child Abuse and Neglect

## BACKGROUND

Child maltreatment is a significant public health problem that requires a multifaceted approach across healthcare, education, child welfare, and juvenile justice. Child maltreatment and other adverse childhood experiences (ACEs) are non-specific risk factors for multiple diseases and conditions. Adversity in childhood also contributes to multigenerational illnesses and disparities. Because children who experience maltreatment

CDC has classified four common types of abuse:

- Physical abuse
- Sexual abuse
- Emotional abuse
- Neglect



are more likely to endure persistent and negative health outcomes later in life, it is critical to address the broader social and economic causes of child maltreatment through prevention-focused efforts. Effective prevention strategies can help stop child abuse and neglect before it happens.

Preventing child maltreatment requires a two-pronged approach: behavior change at the individual level, and at the same time, a focus on creating healthy relationships between families and neighbors, supporting community involvement, and promoting policies and societal norms to create safe, stable, and nurturing environments.

Brain development is shaped by different biological, psychological, social, and environmental factors, and traumatic experiences in early childhood are correlated with changes in brain physiology and functioning. When children feel safe and nurtured, their brains can focus on learning instead of focusing solely on survival-oriented tasks. Prolonged, chronic stress in early childhood can set children on a lower learning and achievement trajectory, adversely impacting an entire country's social and economic development in the long run.

States can take several steps now to ensure a foundation for healthy families in the next generation. When combined with policies that allow for equal access for all for families and communities, evidence-based programs and services can have a very broad impact.

## Findings from the Adverse Childhood Experiences Study

Research shows that the long-term effects of ACEs are reflected in adults' health status and behavior. The [Adverse Childhood Experiences study](#), conducted by CDC and Kaiser Permanente's Health Appraisal Clinic in San Diego, is a multi-year, large-scale research study exploring the associations between childhood adversity and later-life health and wellbeing. Between August 1995 and October 1997, more than 17,000 enrollees in Kaiser Permanente's HMO completed a survey with questions related to categories of adverse childhood experiences, including experiencing abuse (emotional, physical, and sexual) and neglect (emotional or physical), witnessing domestic violence, and growing up with substance abuse, mental illness, parental discord, or crime in the home.<sup>60</sup>

The study confirmed widespread prevalence of childhood trauma: almost two-thirds of study participants reported at least one adverse childhood experience, and many reported having three or more. The CDC-Kaiser study uses the ACE score, a total count of the number of ACEs reported by each respondent, to assess the total amount of stress during childhood. As the number of ACEs increases, so does a person's risk for many serious physical and behavioral health problems, including chronic disease, depression, alcoholism, drug abuse, smoking, severe obesity, risky sexual behavior, poor anger control, and attempted suicide.<sup>61</sup>

ACEs have an impact on individual health and well-being in adolescence and adulthood, including physical and mental health, substance abuse, healthcare utilization, psychotropic medication use, and autoimmune diseases. There have been numerous studies to suggest that people who are involved in service systems, such as child welfare, criminal justice, and Medicaid, show even higher rates of trauma and exposure to multiple traumatic experiences. The CDC-Kaiser study illustrates how the cumulative stress of ACEs can be a powerful determinate of the public's health and a major driver of physical and behavioral health costs.

Data from Alaska suggest that 40.6 percent of the state's adult Medicaid enrollment is linked back to ACEs, which means that in 2012, approximately \$350 million of adult Medicaid (age 20 or older) costs in Alaska could have been prevented if ACEs were eliminated.<sup>62</sup> In another example highlighting the staggering costs associated with ACEs, Maine spends more than \$3 billion dollars annually on ACEs-related outcomes, not counting lost work productivity. The state estimates that more than \$500 million of this estimate is attributed to people who have four or more ACEs.<sup>63</sup>

#### **States may consider the following opportunities and resources to prevent ACEs:**

**Collect state – and county-level data on ACEs prevalence.** More than 20 states currently collect information about ACEs by adding related questions to their Behavioral Risk Factor Surveillance Survey.

- Use data to examine the relationship between ACEs and other systems that impact the lives of children, including child welfare and juvenile justice.
- Designate funds to continue the collection, analysis, and dissemination of state ACEs data.
- Compile a statewide inventory of community ACEs prevention initiatives to use as a strategic tool to inform decision making and move from awareness to action.

#### **Increase awareness about ACEs and their impact on health and wellness.**

- Develop and share information about ACEs and their connections to specific health outcomes.
- Talk with other state agencies about the health, social, and economic benefits of reducing and preventing ACEs.
- Engage community members through ACEs and resilience trainings, public forums, community task forces, focus groups, and other facilitated conversations.

#### **Increase access to healthcare, including mental health services.**

- Study the regional distribution of mental health providers.
- Explore methods for improving reimbursement rates.
- Utilize telemedicine.
- Developing integrated models for behavioral healthcare (e.g., co-location of services).
- Work with primary care providers to screen for ACEs.

#### **Support efforts to prevent and treat ACEs.**

- Expand and evaluate programs that increase healthy family relationships, improve parenting behaviors, and decrease rates of child abuse and neglect.
- Increase the use of trauma-informed practices by social service agencies through training and technical assistance.

## KEY STRATEGIES

### Prevention Approaches

Assuring safe, stable, nurturing relationships and environments for children can have a positive impact on health and well-being and develop skills to help children reach their full potential. Entry points to influencing child development are situated in multiple sectors, including health and nutrition, education, and social services, and can be directed toward pregnant women, young children, and parents and caregivers.



Prevention programs that address the needs of children and their families include:

- Home visiting programs.
- Parental skill-building and social support programs.
- Intimate partner violence prevention.
- Teen pregnancy prevention programs and support programs for parenting teens.
- Mental health treatment programs.
- Substance abuse treatment programs for parents.

### Policy Approaches

Social and economic policies can affect poverty, unemployment, and housing. It is clear that investments in early childhood are needed for children to reach their full potential. For example, policies can help ensure more equitable opportunities for families, resulting in better outcomes for education, health, and economic productivity. More specifically, policies can help families access various services and community supports to make sure that they have the resources they need so that their children can be healthy and thrive.

“Family-friendly” workplaces, for example, can help support healthier communities. Family-friendly policies make it possible for employees to more easily balance family and work in order to fulfill both their family and work obligations.<sup>64</sup> Policies such as flexible parental leave allow parents to participate in their children’s lives, and having more time with their children helps parents and caregivers form positive bonds and relationships. These practices also produce societal benefits, because family-friendly policies lead to better outcomes for children and more stable families who have time to contribute to their communities.<sup>65</sup>

State health departments can help employers understand organizational family-friendly policy options and how to implement them. Health departments can also encourage more businesses to adopt these policies by working with employers who have implemented family-friendly programs and tapping them as spokespersons to talk to wider audiences about how these policies have benefited both them and their employees.

CDC’s [Essentials for Childhood](#) initiative proposes a menu of strategies that communities can consider to promote the types of relationships and environments that help children become healthy and productive citizens.<sup>66</sup>

Generally speaking, state health departments may find it useful to develop agency policies or regulatory recommendations that serve to:

- Require joint planning, implementation, and data sharing among child and family serving systems.
- Codify relationships between state agencies to ensure data exchange and resource commitment.



State policymakers are also seeing an increase in ACEs-related legislation. Several recent legislative activities are summarized below.

◆ [California ACR 155](#)

This legislation, passed in August 2014, encourages statewide polices to reduce children’s exposure to ACEs and stress. California is the second state to pass a resolution on ACEs. It is modeled after a Wisconsin resolution that encourages state policymakers to consider the impact of early childhood adversity on long-term health.

◆ [Wisconsin SJR 59](#)

This legislation, passed in January 2015, notes that “Policy decisions enacted by the Wisconsin state legislature will take into account the principles of early childhood brain development and will, whenever possible, consider the concepts of toxic stress, early adversity, and buffering relationships, and note the role of early intervention and investment in early childhood years as important strategies.”

◆ [Vermont H 596](#)

When an original version of this bill, H 762, was first introduced, there were seven provisions in the bill proposing that an ACEs questionnaire be used by Vermont Blueprint for Health providers (as part of Vermont’s statewide health services model) to expand ACEs screening and educate healthcare providers on ACEs and trauma-informed care. Although the bill initially failed on the last day of the legislative session in May 2014, the Vermont General Assembly then passed a broad healthcare reform bill (H 596) that contains several ACEs-focused measures, including a mandate for the Director of the Vermont Blueprint for Health to review the evidence base on the relationship between ACEs and population health and recommend whether ACEs-informed medical practice should be integrated into Blueprint practices and community health teams. This report was finalized in January 2015 and presented to the Vermont General Assembly.

◆ [Washington HB 1965](#)

Washington state passed this legislation in 2011 to identify and promote innovative strategies to prevent or reduce ACEs and form public-private partnerships to support these efforts. It established a statutory definition of ACEs and codified the state’s commitment to incorporating ACEs in state policy. In accordance with the law, the Washington State ACEs Public-Private Initiative was launched and is currently conducting a two-year retrospective evaluation of community-level work in five communities: North Central Washington (Wenatchee), Okanogan, Skagit, Walla Walla, and Whatcom.

**Essentials for Childhood offers several examples of the types of policies states may consider to support children and families. By targeting multiple settings where children grow up, these policy strategies can help ensure access to essential services that address family-specific needs.**

- Provide needed flexibility at work, such as paid time off (family and sick leave, including paid time off after the birth of a child).
- Align eligibility and recertification dates for benefits packages (e.g., income supports and housing assistance and nutrition programs).
- Expand accessibility to high-quality, affordable child care and early education.
- Establish affordable housing and housing protections for poor and low-income families.
- Provide protections against predatory lending practices.

## SECTION IV. Older Adult Falls

### BACKGROUND

Falls are not an inevitable part of aging, but they can have a significant impact on health-related quality of life and function among older adults. One out of every three adults aged 65 or older falls each year, making falls a leading cause of injury deaths, hospitalizations, and emergency department visits for this age group.<sup>67</sup> People who fall once are two to three times more likely to fall again. On average, the hospitalization cost for a fall injury is more than \$35,000.<sup>68</sup> Falls cost an estimated \$34 billion in healthcare spending annually and are considered a risk factor for needing long-term care services at home or entering a nursing facility.<sup>69</sup> With such costs projected to reach \$67.7 billion by 2020, public health officials, aging services, and housing authorities have a shared interest in reducing falls among older adults.

Many people who fall, even if they are not injured, develop a fear of falling. As a result, they may self-limit their activities and social engagements, which affects physical fitness and mobility and can contribute to depression, social isolation, and feelings of helplessness. Given the aging population, developing and implementing cost-effective programs to prevent falls is vitally important in order to limit the burden of fall-related injuries over the next several decades.

Research on preventing older adult falls and injuries has identified important and modifiable risk factors, including muscle weakness, gait and balance problems, psychoactive medication use, poor vision, and environmental hazards. There are several types of interventions that, if implemented on a large scale, can prevent a significant number of falls and fall-related injuries, including: group exercise programs (e.g., Tai Chi), home-based exercise programs (e.g., Otago), and home safety modifications (e.g., installing non-slip rubber mats or additional lighting), combined with behavioral changes recommended by an occupational therapist.

CDC's third edition of the [Compendium of Effective Fall Interventions](#) describes single interventions that address a specific fall risk factor (e.g., treating gait and balance issues with physical therapy). In total, the compendium discusses 29 single interventions (15 exercise interventions, four home modification interventions, and 10 clinical interventions) and 12 multifaceted interventions, which address multiple risk factors.

A cost-benefit analysis shows that community-based fall interventions generate a positive return on investment (ROI):<sup>70</sup>

- Otago Exercise Program costs \$339.15 per participant, has an average expected benefit of \$768.33, and an ROI of 127 percent for each dollar invested when the intervention is targeted to persons age 80 and older.
- Tai Chi: Moving for Better Balance costs \$104.02 per participant, has an average expected benefit of \$633.90, and an ROI of 509 percent for each dollar invested.
- The Stepping On program costs \$211.38 per participant, has an average expected benefit of \$345.75, and an ROI of 64 percent for each dollar invested.





## Fall Risk Assessments

Awareness of individual risk is also an important factor in falls prevention. In addition, healthcare providers play an important role in screening for and assessing their older adult patients' fall risk. The challenge for providers is to make older people aware of their potential risk of falling without causing distress or denial of a problem. Therefore, a self-assessment can be a good tool. Reviewing the patient's self-assessment provides useful information about what he or she believes to be the cause of any falls, and prompts a discussion about his or her priorities.<sup>71</sup>

There are also a number of suggested clinical interventions to reduce falls. For example, providers can review medications and stop, reduce, or alter drugs that increase a patient's fall risk. They can recommend daily vitamin D supplements and refer to community based fall prevention programs. A fall risk assessment is a covered benefit in Medicare's Annual Wellness Visit.

CDC has a multi-pronged approach to better engage and partner with the medical community in order to integrate falls screening, assessments, and interventions into the clinical setting.

CDC's **STEADI (Stopping Elderly Accidents, Deaths, & Injuries)** toolkit is a comprehensive resource based on the American and British Geriatrics Societies clinical practice guidelines for fall prevention. The STEADI toolkit helps primary care physicians and other healthcare providers incorporate fall screening, assessment, and management into their clinical practice. The toolkit includes basic information about falls, case studies, conversation starters, and standardized gait and balance assessment tests (with instructional videos). There is also a free continuing education course available to train providers on how to implement STEADI practice.

If they adopt STEADI, providers in New York state, Colorado, and Oregon are now eligible to earn part IV Maintenance of Certification credits through the American Board of Family Medicine and American Board of Internal Medicine. CDC estimates that if 5,000 healthcare providers adopt STEADI, over a five-year period it could lead to as many as:

- 6 million additional screened patients.
- 1 million prevented falls.
- \$3.5 billion in saved direct medical costs.

## Broome County, New York and United Health Services Health System – STEADI in Primary Care

The New York State Health Department worked with the United Health Services (UHS) Medical Group, located in Broome County, New York, to implement CDC's STEADI toolkit and optimize the UHS electronic health records (EHR) system to integrate fall risk screening as a standard component of the primary care visit. The Broome County Health Department conducted a community health assessment and found that the county's rates of deaths and emergency department visits due to older adult falls were higher compared with the state's overall rates. Based on this data and the aging demographics of the region, the state health department selected Broome County to receive funding for the STEADI pilot.

When the pilot began in 2012, the team first needed to figure out how to fit the STEADI algorithm into the workflow of the clinician and the office. There was no screening tool built into the EHR at the time, so IT administrators at UHS added fall risk screening questions and built them directly into the nurses' intake form. As a result, during the intake process, if a patient answers "yes" to any of the screening questions, an alert will now appear on the screen prompting the nurse to perform a timed "up and go" walking test. If the patient demonstrates an increased fall risk, the nurse records this information in the EHR system. The EHR then generates information that is sent to the physician, including educational materials and potential interventions to consider, such as community-based exercise and balance programs and vitamin D supplementation. Medication reconciliation also takes place during the nursing intake.

In the final step of the visit, the physician will perform a targeted assessment, develop a care plan, and make appropriate referrals. In Broome County, patients are given information about the "In Balance" program offered by the UHS Home Care home health agency, which assigns them a physical therapist and uses a customized approach to help them regain strength and balance. Patients may also be referred to Tai Chi, offered by the YMCA, or the Stepping On program run by Independence Awareness and the Broome County Health Department, in partnership with the Office for Aging.

EHR customization was considered an important attribute and key to the success of this program. It also allows UHS providers to track and monitor the "date of last fall risk assessment" to identify patients that have not been screened in the past year. Future plans include recruiting care coordinators to collect follow-up data and establish hand-offs between patients and local resources and services.

## KEY STRATEGIES

### Preventing Older Adult Falls: State Approaches

In order to have an effective and sustainable falls prevention statewide initiative, it is essential to have strong, committed partners at the leadership level between the department of health, the state agency on aging, and coalitions at the state and local levels. In July 2015, the National Council on Aging released the [2015 National Falls Prevention Action Plan](#), which builds on a version originally released in 2005. The updated plan includes 12 broad goals, 40 strategies, and more than 240 action steps focused on increasing physical mobility, improving medication management, enhancing home and environmental safety, increasing public awareness and education, and funding and expanding falls risk screening, assessment, and interventions to prevent falls.<sup>72</sup>



Led by the National Council on Aging, the Falls Free initiative is a national effort that is largely focused on connecting coalition members with other state and regional chapters and helping states promote effective strategies to address falls, including regulatory and policy changes. The Falls Free State Coalition Workgroup includes members from 42 states. This group created the State Policy Toolkit for Advancing Falls Prevention, which includes a dashboard of selected indicators.<sup>73</sup>

Included in the toolkit are recommendations for building relationships with policymakers to ensure that state health departments are seen as “go to” authorities on pending policy and regulatory changes to prevent falls and avoid potentially negative or unanticipated outcomes of policy decisions. Bringing greater awareness about the impact of older adult falls to the legislature is an important step in planning for legislative policy initiatives, as is data that reflects trends over time to inform policy decisions. Accurate and consistent data collection is essential to making the case for falls prevention and planning efforts to address areas of high injury rates and gaps in service.

### State Examples:

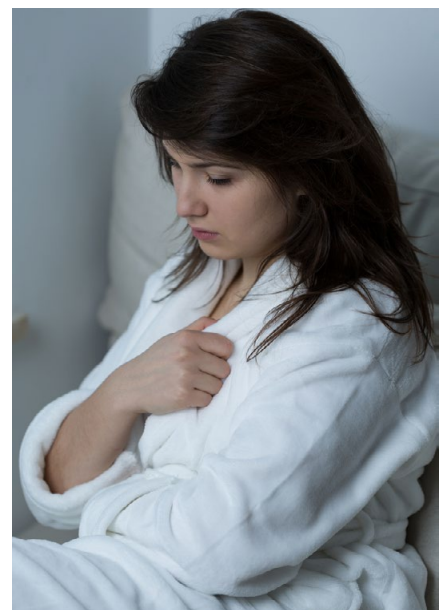
- Arizona launched the Arizona State Healthy Aging Strategic Plan, which includes strategies for falls prevention.
- The Georgia Falls Prevention Coalition worked with the Physical Therapy Association of Georgia and Mercer University to bring together physical therapist volunteers to conduct STEADI assessments.
- In Hawaii, Tai Chi for Health became a permanent part of Kaiser Permanente, Kauai Parks and Recreation, and Catholic Charities.
- The Southern Nevada Health District health educator gave a separate presentation in Spanish about senior falls prevention and the STEADI assessment for fall risk at a meeting of the Latin Chamber of Commerce.
- Ohio partnered with the Ohio Pharmacy Association to conduct fall risk screenings and collaborated with a large grocery store chain to conduct medication reviews for adults 65 years and older.
- Vermont worked with the Governor’s Commission on Successful Aging Health Care Reform subcommittee to submit key findings and make recommendations for the creation of a State Plan on Falls Prevention.


## SECTION V. Preventing Sexual Violence

### BACKGROUND

Sexual violence refers to any sexual activity where consent is not obtained or freely given. There are many types of sexual violence, including forced intercourse, sexual contact, and touching, as well as harassment, exploitation, and threats. Sexual violence perpetration is a product of multiple, interrelated factors that affect the individual, that person’s relationships, the community, and the broader cultural and social environment.<sup>74</sup>

Efforts to prevent sexual violence on college campuses have intensified in recent years. One in five women has been a victim of completed or attempted sexual assault while in college. Although it happens less often, men can also be victims of sexual violence. Sexual assaults on





college campuses are widely under-reported. Despite the prevalence of campus sexual assaults, approximately 40 percent of colleges and universities reported not investigating a single sexual assault in the previous five years.<sup>75</sup>

Campus sexual violence remains a legislative priority at the state and federal level. Over the last several decades, policymakers have put in place legislation that increases campus accountability for addressing sexual violence. The Campus Sexual Violence Elimination (SaVE) Act was enacted in March 2013 when the Violence Against Women Act was reauthorized, and included in the bill were amendments to the Clery Act. The SaVE Act expands the scope of the Clery Act, and as a result, most higher education institutions, including community colleges and vocational schools, are now held to more reporting, response, and prevention education requirements around rape, domestic violence, dating violence, sexual assault, and stalking.

The SaVE Act also establishes collaboration between HHS and the U.S. Departments of Justice and Education to collect and disseminate best practices for preventing and responding to domestic violence, dating violence, sexual assault, and stalking. Health departments can help inform prevention programs and policies in university systems as they work to address the issue and their new prevention and response efforts now mandated through the Campus SaVE Act.

Comprehensive approaches to violence need to address risk and protection at all levels, not just at the individual level. Individuals who experience one form of violence are more likely to experience other forms of violence, be at higher risk for behaving violently, and commit other forms of violence. Understanding how different forms of violence are linked to one another is paramount to developing effective policies, programs, and tools.

The work that health departments do to prevent sexual violence overlaps with the efforts of many other agencies and partners working to reduce other kinds of violence and improve community health. Protective factors, such as economic stability, healthy families, and access to education all help prevent child maltreatment, suicide, sexual violence, and community violence by providing an environment where violence is less likely to occur.

## Minnesota's Sexual Violence Prevention Plan

In 2013, the Minnesota Legislature directed the Minnesota Department of Health to prepare a report on its activities to prevent sexual violence, including coordination of existing state programs and services that address the root causes of sexual violence.<sup>76</sup> The Minnesota Department of Health Sexual Violence Prevention Program and members of the Sexual Violence Prevention Advisory team surveyed community partners and interviewed 26 state agency representatives from 11 different departments to gather information about current prevention activities, gaps in activities, and opportunities for improvement at the legislative and agency level. They found that opportunities to strengthen sexual violence prevention efforts exist at multiple levels, including:

### Legislative:

- Appoint representatives from the house, senate, and the judicial branches to serve on a sexual violence prevention advisory board.
- Support comprehensive health education programs and policies because they increase protective factors for sexual violence.
- Authorize agencies to conduct statewide crime victim surveys to collect accurate and timely data on victimization.
- Authorize agencies to conduct statewide student surveys to collect data on sexual violence and dating violence in youth.

### State Agency:

- Appoint agency staff to serve on sexual violence prevention advisory board.
- Implement and evaluate data and best practices for preventing sexual violence.
- Ensure that proposed policy and practice changes include the voices, opinions, and needs of populations who are disproportionately affected by sexual violence.
- Work with the state's education, child welfare, mental health, public health, healthcare, substance abuse, juvenile justice, corrections, and public safety systems to increase awareness of the impact of trauma, ACEs, and sexual violence.

### Community Organizations:

- Provide culturally responsive training on sexual violence prevention for all staff who serve children and youth, including school personnel, law enforcement, and other professionals.
- Increase prevention programming targeted at preschool aged children and other populations who are at higher risk of being victimized.
- Offer community programs on parenting, responsible fatherhood, conflict resolution, and home visiting.
- Increase collaboration between community organizations and effective sex offender treatment programs.

## KEY STRATEGIES

### Safe Dates and Shifting Boundaries: Primary Prevention Programs

In 2012, CDC conducted a systematic review of 140 studies examining the effectiveness of primary prevention strategies for sexual violence perpetration in order to summarize the best available research evidence for public health practitioners. Currently, there are only two primary prevention strategies that have demonstrated significant reductions in sexual violence behaviors in a rigorous outcome evaluation design: *Safe Dates* and *Shifting Boundaries*.



Intended for male and female eighth and ninth grade students, [Safe Dates](#) is a universal prevention program to prevent emotional, physical, and sexual abuse in adolescent dating relationships. According to one study, four years after receiving the program, students in the intervention group were significantly less likely to be victims or perpetrators of sexual violence involving a dating partner.

[Shifting Boundaries](#) is a 6-10 week school-based dating violence prevention strategy for middle school students that includes six classroom sessions and addresses policy and safety concerns in schools through the use of temporary restraining orders, a poster campaign to increase awareness of dating violence, and “hotspot” mapping to identify unsafe areas of the school for increased monitoring by faculty or school security personnel. While the classroom curriculum alone was not effective in reducing rates of sexual violence, the school-wide intervention was effective alone or in combination with the classroom instruction. At a six-month follow-up, the school-wide intervention showed reductions in sexual harassment, peer sexual violence and victimization, and dating violence.

Despite significant knowledge gaps, research shows that comprehensive, evidence-based sexual violence prevention plans that address risk and protective factors at the community or organization level have the greatest potential for population-level impact. The research is not definitive, but lessons learned from other prevention efforts, such as alcohol regulation and policy, may impart some potential opportunities for looking at community-level factors as they may contribute to sexual violence. Although alcohol-related policies do not address the root causes of sexual violence perpetration, research has shown that there is a strong relationship between excessive alcohol consumption and sexual violence.<sup>77,78,79</sup> As part of a more comprehensive strategy, policies affecting the cost (e.g., pricing strategies or increased taxes) and availability of alcohol (e.g., campus alcohol bans or outlet density) may represent way of modifying risk factors at the community-level to prevent sexual assault.

## Rape Prevention and Education Program

CDC currently provides funding to all 50 states, Washington, D.C., Puerto Rico, and four U.S. territories through the Rape Prevention and Education Program (RPE), which was established through passage of the Violence Against Women Act in 1994. States are permitted to use their RPE grant funds in a variety of ways to help prevent sexual violence, and program activities are guided by a set of prevention principles that include:<sup>80</sup>

- Preventing first-time perpetration and victimization.
- Reducing modifiable risk factors while enhancing protective factors associated with sexual violence perpetration and victimization.
- Using the best available evidence when planning, implementing, and evaluating prevention programs.
- Incorporating behavior and social change theories into prevention programs.
- Using population-based surveillance to inform program decisions and monitor trends.
- Evaluating prevention efforts and using the results to improve future program plans.

RPE's focus on primary prevention has enabled a focus on "upstream" thinking and stronger partnerships. The funds have bridged connections, for example, between rape crisis centers—which have a long history of advocacy and experience providing critical services to victims of sexual violence—and public health, which has advanced the science-based conceptual models essential to our understanding of how such violence can be prevented in the first place.

Additional research is needed to understand the impacts of prevention strategies on sexual violence behaviors. However, states can make progress by incorporating the following key concepts into the cycle of program planning and evaluation:

- Using data to better understand sexual violence.
- Developing comprehensive prevention plans that include policy, structural, and social norm components.
- Selecting prevention strategies based on best practices and available evidence.
- Evaluating strategies that are implemented.
- Sharing lessons learned.

State health agencies also have a responsibility to assess their state investments in violence prevention and convene partners for strategic planning. To support sexual violence prevention efforts more broadly, state health departments may also:

- Review and recommend health department positions on proposed legislation.
- Develop health department testimony on proposed legislation.
- Provide information on the effectiveness of existing state or local policies.
- Use surveillance data to inform policymakers.
- Identify model legislation, policies, or ordinances.



## Kentucky's RPE State Initiatives—From EMPOWER to Green Dot<sup>81</sup>

CDC launched the EMPOWER Program in 2005 as a capacity building demonstration project. The EMPOWER Program provided additional funding, technical assistance, and training to a subset of states receiving RPE funding. As part of the project, Kentucky organized the State Capacity Building Team (SCBT) steering committee, including members from the state sexual violence coalition and the Kentucky Cabinet for Health and Family Services. SCBT was responsible for assembling the state prevention team, whose task was to create a statewide sexual violence prevention plan.

Recognizing the importance of having local communities involved in the planning process, a committee of representatives from each of Kentucky's 13 regional rape crisis centers came together to work with the state prevention team. This partnership ultimately led to the decision to select one pilot program to implement in all of Kentucky's rape crisis centers in order to evaluate its effectiveness in preventing sexual violence.

In preparing to take on the project, a significant amount of time was spent developing a shared definition and understanding of primary prevention. Working with CDC and the other five states in the EMPOWER collaborative, Kentucky found that the best way to help people understand what primary prevention means was to think about it in terms of goals, activities, and strategies that aim to stop violence *before* it occurs. SCBT used a public health approach and the socioecological model as a way of ensuring community, regional, and state participation in the prevention planning and implementation process.

The program selected was called "Green Dot," a bystander primary prevention program first developed in 2006 and designed to reduce the risk of perpetration of all types of sexual and dating violence in high schools and colleges. It teaches students how to identify situations that could lead to an act of violence and shows them how to intervene safely and effectively. In the [Green Dot](#) approach, by promoting social norms that are not accepting of violence, students are shown how to intervene when faced with a situation that may result in an assault, particularly when alcohol or drugs are involved. Early success of Green Dot on the University of Kentucky college campus was a strong determinant in the state deciding to adapt and evaluate Green Dot in the high school setting.

In 2009, CDC awarded a five-year, \$2 million cooperative research agreement to the University of Kentucky and its partners, the Kentucky Association of Sexual Assault Programs, Inc. and the rape crisis centers that provide services across the state, to conduct a randomized control trial in 26 Kentucky high schools. Half of the schools were assigned to receive the Green Dot intervention to test how effectively the program increased active bystanding behaviors and decreased rates of violence victimization and perpetration over time.

In September 2014, preliminary findings found a greater than 50 percent reduction in the self-reported frequency of sexual violence perpetration by students at schools that received the Green Dot training. In schools that did not receive the training, there was a slight increase in self-reports.

While more rigorous evaluation on various prevention approaches is needed to determine what works to reduce sexual violence at the population level, Kentucky's approach offers the field valuable insight for building a program that addresses a broad range of risk and protective factors for sexual violence.

# SECTION VI. Youth Sports Concussions and Traumatic Brain Injury

## BACKGROUND

Traumatic brain injuries are sometimes described as a “silent epidemic.” In recent years, sports- and recreation-related traumatic brain injury (TBI) has been increasingly recognized as a significant collective public health concern affecting people of all ages in the United States. Based on data from the National Electronic Injury Surveillance System-All Injury Program, sports- and recreation-related traumatic brain injuries alone caused more than 3 million emergency department visits between 2001 and 2012, and approximately 70 percent of those were reported among persons ages 0 to 19 years. However, there are many more sports and recreation-related TBIs that are not treated in a hospital or emergency department.<sup>82</sup> While most people recover from TBI, others can experience lifelong disability or death.

Repeated TBIs can have prolonged and long-term effects. Children and adolescents who sustain a TBI can experience lasting physical impairments, lowered cognitive and academic skills, and changes in behavior, socialization, and adaptive functioning. Because of the considerable increase in the number of TBI-related emergency department visits over recent years, it is important to monitor these yearly trends to identify the groups at highest risk as well as describe the most common causes of TBI. States are identifying policy approaches that protect young athletes in an effort to make sports safer while making sure that everyone has an opportunity to benefit from sports and physical activity.

**As part of the Injury Center’s Core Violence and Injury Prevention Program, several states are focusing on TBI prevention:**

- **Massachusetts and Nebraska** are monitoring and supporting implementation of recently-passed sports concussion laws.
- **Oklahoma** is educating residents about sports-related TBI among individuals under 25.
- **Minnesota** is establishing a statewide surveillance system for tracking high school student-athletes who sustain concussions.
- **Ohio** is focusing on bicycle helmet use and sports related concussions in middle and high schools and recreational leagues.
- **Hawaii** is focused on improving helmet use when riding a motorcycle or motorized scooter.

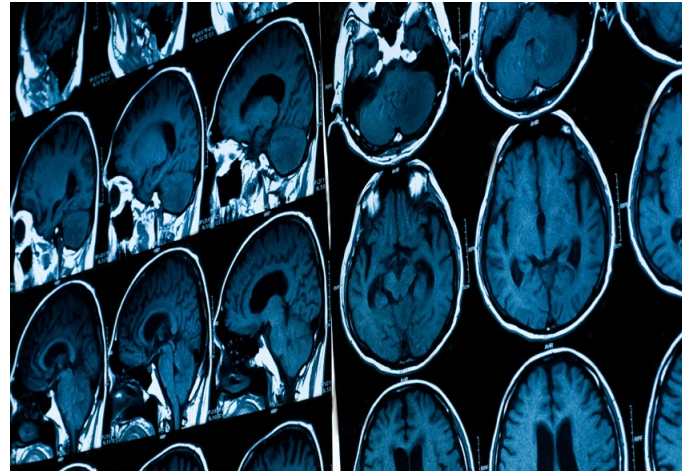


## TBI Surveillance and Data Needs

In November 2014, President Obama signed the Traumatic Brain Injury Reauthorization Act of 2014, which allowed for continued appropriations to HHS through fiscal year 2019 for TBI programs carried out by federal agencies. First enacted in 1996, this is the third reauthorization of the bill, which strengthens CDC’s ability to conduct TBI surveillance, prevention, and education. The law also supports NIH research activities and state grant programs and directs the HHS secretary to develop a plan to improve the coordination of federal activities, including a review of current interagency efforts.



At the federal level, a significant area of focus moving forward will be related to opportunities to build a national TBI surveillance system to better determine the incidence of sports- and recreation-related concussions, as recommended by the National Academy of Medicine (Institute of Medicine). Current data sources are insufficient and could be improved to inform decisionmaking on prevention initiatives, research needs, and education priorities. A more comprehensive national surveillance system that allows for an examination of trends would help guide states' prevention programs.



## KEY STRATEGIES

### Return to Play

Since 2009, there have been several federal legislative efforts related to youth sports concussions, including bills that support funding for states to collect data on the incidence and prevalence of youth sports concussions, adopt and implement return to play guidelines, and implement pre-season baseline and post-injury testing youth athletes.

Being cleared to participate in competitive or recreational activities by a qualified medical professional, especially for youth athletes, is important to avoid re-injury, prolonged recovery, or permanent neurological and psychological deficits. States can implement strategies to help improve early TBI detection, prevention, and treatment, and to help increase the adoption of “return to play” protocols. Policy approaches may be appropriate to ensure that people who have sustained concussions have recovered thoroughly before fully participating in sports or other activities.

Washington was the first state to pass a “modern day” youth sports TBI law in 2009, which focused on improving the recognition and understanding of concussion in sports, removing athletes suspected of sustaining a concussion, and requiring those athletes to receive clearance before returning to play. Texas had similar legislation in place in 2007, but it only applied if the athlete lost consciousness. In 2015, all 50 states and Washington D.C. had some form of youth sports-related TBI law that contained provisions about when an athlete may return to a sport or activity.<sup>83</sup> Fewer than 10 states, the [Network for Public Health Law](#) reports, have laws that address “return to learn,” or the concept of returning to the classroom or school environment following a concussion.

State laws should identify a specific entity, such as the board of education, that is responsible for implementing training and education provisions regarding TBI. In Massachusetts, Missouri, New York, and Pennsylvania, the legislative language directs health departments to develop concussion training programs. Be sure to verify with your state laws to determine who is responsible for developing and implementing these programs in your state.

In 2015, the Oregon School Activities Association became the first state high school activities association in the United States to require coaches to enroll in USA Football’s Heads Up Football program, and in 2008, it became the first state high school activities association to prohibit same day return to play for athletes with

a suspected concussion.<sup>84,85</sup> USA Football's Heads Up Football program includes training on concussion diagnosis and management, based on CDC's HEADS UP initiative.

### CDC HEADS UP Concussion Training

CDC's HEADS UP training offers information about concussion and other serious brain injury to coaches, parents, school and health professionals, and athletes. The HEADS UP campaign provides important information on preventing, recognizing, and responding to a concussion, and celebrated its 10th anniversary in 2013.

HEADS UP's accomplishments include:

- More than 215 million media impressions through print media and TV public service announcements.
- Close to 40 million social media impressions.
- More than 22,000 Facebook fans, and growing.
- More than 6 million distributed print materials.
- Completed online trainings for more than 3 million coaches.
- More than 50 HEADS UP products developed.
- More than 85 organizations signed on as participating organizations.

In fiscal year 2015, the HEADS UP campaign aimed to expand efforts to evaluate the public health impact of the campaign and build momentum for research and efforts focused on changing social norms around concussion.


Many laws that address youth sports concussions have similar provisions. States can consider this set of questions from the [Robert Wood Johnson Foundation Public Health Law Research](#) program to think about where some of these variations might exist in state laws:<sup>86</sup>

*Does your state's law...*

- Specifically address youth sports TBIs?
- Require a student athlete with a suspected TBI to be removed from play?
- Require parents to be notified of their child's suspected or diagnosed TBI?
- Specify requirements for when an athlete may return to play?
- Require additional mandatory TBI-specific training for coaches?
- Explicitly require distribution of some form of TBI or concussion information sheet?
- Require that a TBI information sheet be distributed at least annually to parents of athletes or student athletes?
- Explicitly address liability and, if so, does it identify who may or may not be liable for failure to comply with the law?



Additional research is emerging related to how youth sports concussion laws are being implemented, as well as factors that promote or impede implementation and ways to determine the level of compliance in each community or school district.



CDC evaluated the implementation of concussion legislation in Washington state and Massachusetts by interviewing stakeholders at both the state level (health departments and statewide interscholastic athletic associations) and at the school level (athletic directors and coaches). The case study identified challenges and successes that would help inform implementation in other states, including the following factors:<sup>87</sup>

- A need for involvement of a range of stakeholders in the planning process in order to identify barriers and improve outreach and education.
- The importance of developing a comprehensive and specific implementation plan to ensure that the original intent of the law is executed.
- Consideration of a broad approach to injury prevention, such as combining the return to play protocols for concussion with those for other sports-related injuries.
- A need to work with recreational leagues to whom the state law does not apply by sharing access to educational materials and resources.
- The importance of identifying requirements for continuing education on youth sports concussions.
- The value of educating teachers about concussion symptoms and emphasizing “return to learn” principles.

# References

- <sup>1</sup> CDC. "MMWR Estimated Lifetime Medical and Work-Loss Costs of Fatal Injuries – United States, 2013." Available at: [http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6438a4.htm?s\\_cid=mm6438a4\\_w](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6438a4.htm?s_cid=mm6438a4_w). Accessed 2-1-2016.
- <sup>2</sup> *Ibid.*
- <sup>3</sup> CDC. "Motor Vehicle Crash Injuries." Available at: <http://www.cdc.gov/vitalsigns/crash-injuries/index.html>. Accessed 2-1-2016.
- <sup>4</sup> Blincoe LJ, Miller TR, Zaloshnja E, et al. *The economic and societal impact of motor vehicle crashes, 2010*. Washington, DC: National Highway Traffic Safety Administration. 2015.
- <sup>5</sup> CDC. "Winnable Battles." Available at: <http://www.cdc.gov/winnablebattles/index.html>. Accessed 2-1-2016.
- <sup>6</sup> CDC. "Winnable Battles-related Healthy People 2020 Objectives." Available at: <http://www.cdc.gov/winnablebattles/targets/pdf/winnablebattles-related-healthypeople2020objectives.pdf>. Accessed 2-1-2016.
- <sup>7</sup> CDC. "The Community Guide." Available at: <http://www.thecommunityguide.org/>. Accessed 2-1-2016.
- <sup>8</sup> Chen, YY. *Seat belt use in 2013—Use rates in the states and territories*. Washington, DC: National Highway Traffic Safety Administration. 2014.
- <sup>9</sup> Lee LK, Monuteaux MC, Burghardt LC, et al. "Motor vehicle crash fatalities in states with primary versus secondary seat belt laws: A time-series analysis. *Ann Intern Med*. 2015. 163:184-190. Available at: <http://annals.org/article.aspx?articleid=2337274>. Accessed 2-1-2016.
- <sup>10</sup> Geeta B, Beck L, Bergen G., et al. "Predictors of rear seat belt use among U.S. adults, 2012." *J Safety Res*. 2015. 53:103-106. Available at: <http://www.sciencedirect.com/science/article/pii/S0022437515000237>. Accessed 2-1-2016.
- <sup>11</sup> CDC. "Adult Seat Belt Use in the US." Available at: <www.cdc.gov/vitalsigns/pdf/2011-01-vitalsigns.pdf>. Accessed 2-1-2016.
- <sup>12</sup> Governors Highway Safety Association. "Seat Belt Laws." October 2015. Available at: [http://www.ghsa.org/html/stateinfo/laws/seatbelt\\_laws.html](http://www.ghsa.org/html/stateinfo/laws/seatbelt_laws.html). Accessed 2-1-2016.
- <sup>13</sup> Debnam K, Beck K. "Driving while black: A comparison of the beliefs, concerns, and behaviors of black and white Maryland drivers." *Traffic Inj Prev*. 2011. 12(6):599-603. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/22133336>. Accessed 2-1-2016.
- <sup>14</sup> NHTSA. "Determining the Relationship of Primary Seat Belt Laws to Minority Ticketing." Available at: [http://www.nhtsa.gov/staticfiles/traffic\\_tech/tt406.pdf](http://www.nhtsa.gov/staticfiles/traffic_tech/tt406.pdf). Accessed 2-1-2016.
- <sup>15</sup> Russell N, Dreyfuss M, Cosgrove M, et al. *Legislative history of recent primary safety belt laws*. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration, 1999.
- <sup>16</sup> Dihn-Zarr TB, Sleet DA, Shults RA, et al. "Reviews of evidence regarding interventions to increase the use of safety belts." *Am J Prev Med*. 2001. 21(4S):48-65. Available at: <http://www.thecommunityguide.org/mvoi/mvoi-AJPM-evrev-seat-belts.pdf>. Accessed 2-1-2016.
- <sup>17</sup> Chen, YY. *Seat belt use in 2013—Use rates in the states and territories*. Washington, DC: National Highway Traffic Safety Administration. 2014.
- <sup>18</sup> Goodwin A, Kirley B, Sandt L, et al. *Countermeasures that work: A highway safety countermeasures guide for State Highway Safety Offices*. Washington, DC: National Highway Traffic Safety Administration. 2013.
- <sup>19</sup> Insurance Institute for Highway Safety. "Child Safety." Available at: <http://www.iihs.org/iihs/topics/t/child-safety/qanda>. Accessed 2-1-2016.
- <sup>20</sup> CDC. "Child Passenger Safety: Get the Facts." Available at: [http://www.cdc.gov/motorvehiclesafety/child\\_passenger\\_safety/cps-factsheet.html](http://www.cdc.gov/motorvehiclesafety/child_passenger_safety/cps-factsheet.html). Accessed 2-1-2016.
- <sup>21</sup> Durbin DR. "Technical report—Child passenger safety." *Pediatrics*, 127(4): e1050-e1066. Available at: <http://pediatrics.aappublications.org/content/early/2011/03/21/peds.2011-0215.full.pdf>. Accessed 2-1-2016.
- <sup>22</sup> American Academy of Pediatrics. "Policy Statement—Child Passenger Safety." Available at: <http://pediatrics.aappublications.org/content/early/2011/03/21/peds.2011-0213.full.pdf>. Accessed 2-1-2016.
- <sup>23</sup> CDC. "Child Passenger Safety." Available at: <http://www.cdc.gov/vitalsigns/childpassengersafety/>. Accessed 2-1-2016.
- <sup>24</sup> CDC. "Child Passenger Safety: Get the Facts." Available at: [http://www.cdc.gov/motorvehiclesafety/child\\_passenger\\_safety/cps-factsheet.html](http://www.cdc.gov/motorvehiclesafety/child_passenger_safety/cps-factsheet.html). Accessed 2-1-2016
- <sup>25</sup> Governors Highway Safety Association. "Child Passenger Safety Laws." Available at: [http://www.ghsa.org/html/stateinfo/laws/childsafety\\_laws.html](http://www.ghsa.org/html/stateinfo/laws/childsafety_laws.html). Accessed 2-1-2016.
- <sup>26</sup> California Department of Public Health. "Child Passenger Safety – Diversion Program." Available at: <http://www.childpassengersafetydiversionprogram.com/index.html>. Accessed 2-1-2016.
- <sup>27</sup> California Department of Public Health. "Car Seat Basics." Available at: <https://www.cdph.ca.gov/HealthInfo/injviosaf/Pages/CarSeatBasics.aspx>. Accessed 2-1-2016.
- <sup>28</sup> CDC. "Teen Drivers." Available at: [http://www.cdc.gov/motorvehiclesafety/teen\\_drivers/](http://www.cdc.gov/motorvehiclesafety/teen_drivers/). Accessed 2-1-2016.
- <sup>29</sup> Insurance Institute for Highway Safety. "Teenagers." Available at: <http://www.iihs.org/iihs/topics/t/teenagers/topicoverview>. Accessed 2-1-2016.
- <sup>30</sup> CDC. "Graduated Driver Licensing." Available at: <http://www.cdc.gov/ParentsAreTheKey/licensing/>. Accessed 2-1-2016.
- <sup>31</sup> CDC. 2013 Prevention Status Reports. "Motor vehicle injuries, graduated driver licensing system." Available at: <http://www.cdc.gov/psr/motorvehicle/index.html#graduated>. Accessed 2-1-2016.
- <sup>32</sup> Insurance Institute for Highway Safety. "GDL Crash Reduction Calculator." Available at: [http://www.iihs.org/iihs/topics/laws/gdl\\_calculator?topic-Name=teenagers](http://www.iihs.org/iihs/topics/laws/gdl_calculator?topic-Name=teenagers). Accessed 2-1-2016.



- <sup>33</sup> CDC. "Parents Are the Key to Safe Teen Drivers." Available at: <http://www.cdc.gov/parentsarethekey/index.html>. Accessed 2-1-2016.
- <sup>34</sup> Governors Highway Safety Association. "Graduated Driver Licensing Laws." Available at: [http://www.ghsa.org/html/stateinfo/laws/license\\_laws.html](http://www.ghsa.org/html/stateinfo/laws/license_laws.html). Accessed 2-1-2016.
- <sup>35</sup> Shell DF, Newman IM, Córdova-Cazar, AL, *et al.* "Driver education and teen crashes and traffic violations in the first two years of driving in a graduated licensing system." *Accid Anal Prev*. 2015. 82:45-52. Available at: <http://www.sciencedirect.com/science/article/pii/S0001457515001943>. Accessed 10-26-2015.
- <sup>36</sup> *Ibid.*
- <sup>37</sup> Safe States Alliance. "State Violence and Injury Prevention Program (Core VIPP). FY 2014 Background Document." Available at: [http://www.safestates-documents.com/files/InjuryViolencePreventionTopics/11\\_violenceinjuryprevention/StateViolenceandInjuryPreventionPrograms-COREVIPP-FY16BackgroundDocument.docx](http://www.safestates-documents.com/files/InjuryViolencePreventionTopics/11_violenceinjuryprevention/StateViolenceandInjuryPreventionPrograms-COREVIPP-FY16BackgroundDocument.docx). Accessed 2-1-2016.
- <sup>38</sup> NHTSA. "Alcohol-Impaired Driving." Available at: <http://www-nrd.nhtsa.dot.gov/Pubs/812102.pdf>. Accessed 2-1-2016.
- <sup>39</sup> CDC. "Increasing Alcohol Ignition Interlock Use: Successful Practices for States." Available at: [http://www.cdc.gov/motorvehiclesafety/impaired\\_driving/ignition\\_interlock\\_states.html](http://www.cdc.gov/motorvehiclesafety/impaired_driving/ignition_interlock_states.html). Accessed 2-1-2016.
- <sup>40</sup> Mayer, R. *Ignition interlocks – A toolkit for program administrators, policymakers, and stakeholders*. Washington, DC: National Highway Traffic Safety Administration. 2014.
- <sup>41</sup> CDC. "Increasing Alcohol Ignition Interlock Use: Successful Practices for States." Available at: [http://www.cdc.gov/motorvehiclesafety/impaired\\_driving/ignition\\_interlock\\_states.html](http://www.cdc.gov/motorvehiclesafety/impaired_driving/ignition_interlock_states.html). Accessed 2-1-2016.
- <sup>42</sup> CDC. "Prescription Drug Overdose. What States Need to Know About the Epidemic." Available at: <http://www.cdc.gov/drugoverdose/epidemic/states.html>. Accessed 2-1-2016.
- <sup>43</sup> CDC. "Controlled Substance Prescribing Patterns — Prescription Behavior Surveillance System, Eight States, 2013." Available at: [http://www.cdc.gov/mmwr/preview/mmwrhtml/ss6409a1.htm?s\\_cid=ss6409a1\\_e](http://www.cdc.gov/mmwr/preview/mmwrhtml/ss6409a1.htm?s_cid=ss6409a1_e). Accessed 2-1-2016.
- <sup>44</sup> Han B, Compton WM, Jones CM, *et al.* "Nonmedical prescription opioid use and use disorders among adults aged 18 through 64 years in the United States, 2003-2013." *JAMA*. 2015. 314(14):1468-1478. Available at: <http://jama.jamanetwork.com/article.aspx?articleid=2456166>. Accessed 2-1-2016.
- <sup>45</sup> Mack KA, Zhang K, Paulozzi L, *et al.* "Prescription practices involving opioid analgesics among Americans with Medicaid, 2010." *J Health Care Poor Underserved*. 2015. 26(1):182-198. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/25702736>. Accessed 2-1-2016.
- <sup>46</sup> Jones C. "Clinical guidelines for opioid analgesic prescribing." Presented at National Association of State Controlled Substances Authorities 2014 Educational Conference. October 24, 2014. Available at: <http://www.wardwebsites.net/conference2014/presentations/jones.pdf>. Accessed 2-1-2016.
- <sup>47</sup> Hedegaard H, Chen LH, Warner M. *Drug-poisoning deaths involving heroin: United States, 2000–2013*. Hyattsville, MD: National Center for Health Statistics. 2015. Available at: <http://www.cdc.gov/nchs/data/databriefs/db190.pdf>. Accessed 2-1-2016.
- <sup>48</sup> CDC. "What States Need to Know about PDMPs." <http://www.cdc.gov/drugoverdose/pdmp/states.html>. Accessed 2-1-2016.
- <sup>49</sup> CDC. "Draft CDC Guideline for Prescribing Opioids for Chronic Pain." Available at: <http://www.cdc.gov/drugoverdose/prescribing/guideline.html>. Accessed 2-1-2016.
- <sup>50</sup> Koh H. Community Approaches to the Opioid Crisis. *JAMA*. 2015. 314(14):1437-1438. Available at: <http://jama.jamanetwork.com/article.aspx?articleid=2456154>. Accessed 2-1-2016.
- <sup>51</sup> American Academy of Pain Medicine. "Clinical Guidelines." Available at: <http://www.painmed.org/library/clinical-guidelines/>. Accessed 2-1-2016.
- <sup>52</sup> Washington Agency Medical Directors' Group. "AMDG 2015 Interagency Guideline on Opioid Prescribing." Available at: <http://www.agencymeddirectors.wa.gov/Files/2015AMDGOpoidGuideline.pdf>. Accessed 2-1-2016.
- <sup>53</sup> U.S. Department of Veterans Affairs. VHA Pain Management. "VA/DoD Clinical Practice Guidelines: Management of Opioid Therapy for Chronic Pain." Available at: [http://www.va.gov/PAINMANAGEMENT/For\\_Providers.asp](http://www.va.gov/PAINMANAGEMENT/For_Providers.asp). Accessed 2-1-2016.
- <sup>54</sup> Texas Department of Insurance, Division of Workers' Compensation. "Biennial Report to the 84<sup>th</sup> Legislature." Available at: <http://www.tdi.texas.gov/reports/dwc/documents/2014dwcbiennialrpt.pdf>. Accessed 2-1-2016.
- <sup>55</sup> New York State Office of the Attorney General. "AG's COP program will provide over \$1,100,000 to equip and train more than 19,000 NYPD officers across New York City." Available at: <http://www.ag.ny.gov/press-release/ag-schneiderman-announces-funding-equip-nyc-police-officers-life-saving-heroin/>. Accessed 2-1-2016.
- <sup>56</sup> The Network for Public Health Law. "Drug Overdose Prevention and Harm Reduction." Available at: [https://www.networkforphl.org/topics\\_\\_resources/topics\\_resources/drug\\_overdose\\_prevention\\_and\\_harm\\_reduction/](https://www.networkforphl.org/topics__resources/topics_resources/drug_overdose_prevention_and_harm_reduction/). Accessed 2-1-2016.
- <sup>57</sup> CDC. "Opioid Overdose Prevention Programs Providing Naloxone to Laypersons — United States, 2014." Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6423a2.htm>. Accessed 2-1-2016.
- <sup>58</sup> Vermont Department of Health. "Care Alliance for Opioid Addiction." Available at: <http://healthvermont.gov/adap/treatment/documents/CareAllianceOpioidAddiction.pdf>. Accessed 2-1-2016.
- <sup>59</sup> Vermont Department of Health. "Appropriations Committee. FY2016 Budget." Available at: [http://www.leg.state.vt.us/jfo/appropriations/fy\\_2016/Department%20Budgets/FY2016%20Budget%20-%20Health%20-%20Narrative.pdf](http://www.leg.state.vt.us/jfo/appropriations/fy_2016/Department%20Budgets/FY2016%20Budget%20-%20Health%20-%20Narrative.pdf). Accessed 2-1-2016.
- <sup>60</sup> Felitti VJ, *et al.* "Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults." *Am J Prev Medicine*. 1998. 14(4):245-258. Available at: <http://www.ajpmonline.org/article/S0749-3797%2898%2900017-8/abstract>. Accessed 2-1-2016.
- <sup>61</sup> CDC, Division of Violence Prevention. "ACE Study Major Findings." Available at: <http://www.cdc.gov/violenceprevention/acestudy/findings.html>. Accessed 2-1-2016.
- <sup>62</sup> Alaska Department of Health and Social Services, Advisory Board on Alcoholism and Drug Abuse. "Adverse Childhood Experiences: Overcoming ACEs in Alaska." Available at: <http://dhss.alaska.gov/abada/ace-ak/Documents/ACEsReportAlaska.pdf>. Accessed 2-1-2016.

- <sup>63</sup> Maine Children's Growth Council. "Working with Adverse Childhood Experiences: Maine's History, Present and Future." Available at: [http://tcmhs.org/pdfs/ACES\\_Report\\_Final.pdf](http://tcmhs.org/pdfs/ACES_Report_Final.pdf). Accessed 2-1-2016.
- <sup>64</sup> Community Tool Box. "Promoting Family-Friendly Policies in Business and Governments." Available at: <http://ctb.ku.edu/en/table-of-contents/implementation/changing-policies/business-government-family-friendly/main>. Accessed 2-1-2016.
- <sup>65</sup> *Ibid.*
- <sup>66</sup> CDC. "Essentials for Childhood Framework: Steps to Create Safe, Stable, Nurturing Relationships and Environments for All Children." Available at: <http://www.cdc.gov/violenceprevention/childmaltreatment/essentials.html>. Accessed 2-1-2016.
- <sup>67</sup> CDC. "Important Facts About Falls." Available at: <http://www.cdc.gov/homeandrecreationalafety/falls/adultfalls.html>. Accessed 2-1-2016.
- <sup>68</sup> *Ibid.*
- <sup>69</sup> National Council on Aging. "Issue Brief: Funding for Elder Falls Prevention." Available at: <https://www.ncoa.org/resources/federal-budget-ncoa-fy16-falls-prevention-issue-brief/>. Accessed 2-1-2016.
- <sup>70</sup> Carande-Kulis V, Stevens JA, Florence CS, *et al.* "A cost-benefit analysis of three older adult fall prevention interventions." *J Safety Res.* 2015. 52:65–70. Available at: <http://www.sciencedirect.com/science/article/pii/S0022437514001170>.
- <sup>71</sup> CDC. "Stay Independent." Available at: [http://www.cdc.gov/steadi/pdf/stay\\_independent\\_brochure-a.pdf](http://www.cdc.gov/steadi/pdf/stay_independent_brochure-a.pdf). Accessed 2-1-2016.
- <sup>72</sup> National Council on Aging. "2015 Falls Free National Falls Prevention Action Plan." Available at: <https://www.ncoa.org/resources/2015-falls-free-national-falls-prevention-action-plan/>. Accessed 2-1-2016.
- <sup>73</sup> National Council on Aging. "State Policy Toolkit for Advancing Fall Prevention." Available at: <https://www.ncoa.org/resources/state-policy-toolkit-for-advancing-fall-prevention/>. Accessed 2-1-2016.
- <sup>74</sup> CDC. Sexual Violence. Available at: <http://www.cdc.gov/violenceprevention/sexualviolence/index.html>. Accessed 2-1-2016.
- <sup>75</sup> U.S. Senate Subcommittee on Financial and Contracting Oversight. "Sexual Violence on Campus: How too many institutions of higher education are failing to protect students." Available at: <http://www.mccaskill.senate.gov/SurveyReportwithAppendix.pdf>. Accessed 2-1-2016.
- <sup>76</sup> Minnesota Department of Health. "Sexual Violence Legislative Report." Available at: <http://www.health.state.mn.us/injury/pub/MDHSexualViolencePreventionLegislativeReport.pdf>. Accessed 2-1-2016.
- <sup>77</sup> Elder RW, Lawrence B, Ferguson A, *et al.* "The effectiveness of tax policy interventions for reducing excessive alcohol consumption and related harms." *Am J Prev Med.* 2010. 38(2):217–229. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/20117579>. Accessed 2-1-2016.
- <sup>78</sup> Campbell CA, Hahn RA, Elder R, *et al.* "The effectiveness of limiting alcohol outlet density as a means of reducing excessive alcohol consumption and alcohol-related harms." *Am J Prev Med.* 2009. 37(6):556–569. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/19944925>. Accessed 2-1-2016.
- <sup>79</sup> Babor T. *Alcohol: No Ordinary Commodity.* 2<sup>nd</sup> ed. Oxford: Oxford University Press. 2010.
- <sup>80</sup> CDC. Rape Prevention and Education (RPE) Program. Available at: <http://www.cdc.gov/violenceprevention/rpe/>. Accessed 2-1-2016.
- <sup>81</sup> Green Dot, et cetera, Inc. "Evaluation Assessment." Available at: [https://www.livethegreendot.com/gd\\_evalasses.html](https://www.livethegreendot.com/gd_evalasses.html). Accessed 2-1-2016.
- <sup>82</sup> Coronado VG. "Trends in sports- and recreation-related traumatic brain injuries treated in US emergency departments: The National Electronic Injury Surveillance System-All Injury Program." *J Head Trauma Rehabil.* 2015. 30(3):185-197. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/25955705>. Accessed 2-1-2016.
- <sup>83</sup> The Network for Public Health Law. "Issue Brief: Sports Related Traumatic Brain Injury and Return-to-Learn Provisions." Available at: [https://www.networkforphl.org/resources\\_collection/2015/05/07/581/issue\\_brief\\_sports\\_related\\_traumatic\\_brain\\_injury\\_and\\_return-to-learn\\_provisions](https://www.networkforphl.org/resources_collection/2015/05/07/581/issue_brief_sports_related_traumatic_brain_injury_and_return-to-learn_provisions). Accessed 2-1-2016.
- <sup>84</sup> Fuqua B. "Extra safety training now required for prep football staffs in Oregon." *Corvallis Gazette Times.* June 24, 2015. Available at: [http://www.gazettetimes.com/blogs/brad-fuqua/extra-safety-training-now-required-for-prep-football-staffs-in/article\\_0c514f34-dcaa-56bf-b3da-3a24a15e89bc.html](http://www.gazettetimes.com/blogs/brad-fuqua/extra-safety-training-now-required-for-prep-football-staffs-in/article_0c514f34-dcaa-56bf-b3da-3a24a15e89bc.html). Accessed 2-1-2016.
- <sup>85</sup> Walker S. "All Oregon high schools to enroll in Heads Up Football in 2016." *USA Football, Inc.* June 23, 2015. Available at: <http://usafootball.com/blogs/oregon-scholastic-activities-association/post/10425/all-oregon-high-schools-to-enroll-in-heads-up-football-in-2016>. Accessed 2-1-2016.
- <sup>86</sup> RWJF LawAtlas Public Health Law Research. "Youth Sports Traumatic Brain Injury Laws through May 2015." Available at: <http://lawatlas.org/query?-dataset=sc-reboot>. Accessed 2-1-2016.
- <sup>87</sup> CDC. "Implementing Return to Play: Learning from the Experiences of Early Implementers." Available at: [http://www.cdc.gov/headsup/pdfs/policy/rtp\\_implementation-a.pdf](http://www.cdc.gov/headsup/pdfs/policy/rtp_implementation-a.pdf). Accessed 2-1-2016.





Association of State and Territorial Health Officials  
2231 Crystal Drive, Suite 450  
Arlington, VA 22202

202-371-9090 tel | 202-371-9797 fax  
[www.astho.org](http://www.astho.org)



## Preventing Injury and Death Due To Motor Vehicle Crashes: Strategies for the States

### Executive Summary

Motor vehicle crashes take an enormous toll in the United States. More than 37,000 Americans were killed in motor vehicle crashes in 2008. This represents an average of 102 deaths every day – or one every 14 minutes. An additional 2.3 million Americans are injured in motor vehicle collisions every year.<sup>i</sup> The human and emotional toll due to these tragedies includes 230.6 billion dollars (as of 2001) in health care costs, lost wages, property damages, travel delays, and legal and administrative fees.

To address this issue, on May 11, 2010 the Association of State and Territorial Health Officials (ASTHO) and The Center for Disease Control and Prevention (CDC), National Center of Injury Prevention and Control (NCIPC), convened multiple stakeholders including health and transportation officials to discuss how they can join forces to decrease preventable injuries and deaths due to motor vehicle crashes. The meeting, *Addressing a Winnable Battle: Transportation and Public Health Officials Join Forces to Decrease Preventable Injuries and Deaths Due to Motor Vehicle Crashes*, reflected a commitment by ASTHO and NCIPC to urge states to act quickly and implement evidence-based interventions that prevent injuries and death due to motor vehicle crashes.<sup>ii</sup> This focused work has been characterized as a “winnable battle” by Dr. Thomas Frieden because interventions are available to the states that offer measurable impacts in reducing death over a relatively short period of time.<sup>iii</sup>

The overarching recommendation to state health officials emanating from *Addressing a Winnable Battle* was to move their state toward a comprehensive culture of safety which would include adopting multiple strategies across the existing spectrum of available interventions. A number of policy options were discussed on May 11, 2010 and are described below in a more comprehensive fashion. These evidence-based policies have shown either proven results; or, research and experience have shown that they are promising practices. It is recommended that state health officials consider, prioritize and adopt these policies in a way that makes sense for their home state. As of October 2010 over 32 health officials pledged to focus on injury prevention and to make reducing injury and death due to motor vehicle crashes a priority area.

### Evidence-Based State Policies for Traffic Safety

An evidence-based policy supports decision making by providing the best available peer-reviewed evidence. Information systems are used systematically, program-planning frameworks are applied that often have a foundation in behavioral science theory, the community is engaged in assessment and decision making, sound evaluation is conducted, and what is learned is disseminated to key stakeholders and decision makers. Evidence-based policies, including laws and other interventions that are known to prevent injuries caused by motor vehicle crashes, are available to the states. If effectively implemented within a state’s political, systemic, and enforcement environment, these policies save lives.

The last 20 years have taught us a great deal about what works in motor-vehicle safety. Information on evidence-based interventions, including policies and laws that prevent motor vehicle-related deaths and injuries, can be found in *The Guide to Community Preventive Services* published by the CDC.<sup>iv</sup> The Guide relies upon data from systematic reviews which are formal processes used to identify relevant studies, assess their quality, and summarize the evidence. Additional publications offering a similar body of information have been published by the National Traffic Highway Traffic Safety Administration (*Countermeasures That Work*), the National Council of State Legislators, The Governor's Highway Safety Association, The University of North Carolina Highway Safety Research Center and others.

Although the toll of motor vehicle crashes is substantial, it does not represent an insurmountable problem. We know how to prevent these tragedies through technological and behavioral intervention and, through policies supporting these interventions. The impact of policies can be significant. For example:

- 4,000 lives could be saved each year if everyone used seat belts.
- 8,000-9,000 lives could be saved each year through attainable reductions in impaired driving.
- 175 lives could be saved each year with enhanced graduated driver's license policies. These policies could also prevent 350,000 nonfatal injuries.

Participants at Addressing a Winnable Battle discussed policies that:

- Were established to address the readiness/fitness of drivers, such as graduated driver's licensing and medical advisory boards.
- Are responsive to distracted, aggressive, and impaired drivers.
- Are responsive to the environment in which motor vehicle crashes occur, including seat belt use and child passenger safety; the environment where tertiary care is provided, such as trauma care and emergency medical services; and the state regulatory and educational environment in which policies are developed and implemented.
- Encourage collaboration between state departments of transportation and public health, including active participation by state health departments in the development and implementation of the state strategic highway planning process and collaboration on health impact assessments (HIA).

## Policies/Laws Established to Address Inexperienced and Medically at Risk Drivers

### ***Graduated Drivers Licensing Laws (GDL)<sup>v</sup>***

As of 2010, twelve percent (7,460) of drivers involved in fatal crashes are between the ages of 15 and 20 years. The elevated crash risk for beginning drivers is universal, and graduated drivers licensing laws have consistently proven effective in reducing such risk. Peer-reviewed evaluations of GDL's effectiveness in New Zealand, Canada, and the United States show that crashes involving new drivers have been reduced by 9% to 43%.<sup>vi</sup> Graduated licensing laws usually include three distinct levels of licensing.

- A learner stage in which a young person must be accompanied by an adult while driving
- An intermediate stage in which the teen may drive without adult supervision providing he or she observes some restrictions. This might include a restriction on the times of day that a teen can

drive (e.g. no driving at night except to or from work) and a restriction on the number of teen passengers that can be in a car with an intermediate-licensed driver

- Full licensure without restrictions after two years.

The AAA Foundation for Traffic Safety published a *Nationwide Review of Graduated Drivers Licensing* in February 2007 that stated the, “most restrictive GDLs are associated with reductions of 38% and 40% in fatal crashes and injury crashes of 16-year-old drivers.”

Forty-nine states have implemented some form of a GDL law. However, the laws vary greatly. Some do not meet the standards set forth by the Insurance Institute for Highway Safety’s standards for a “good” GDL law. Three places that have effective GDL laws include California, the District of Columbia, and Washington. In each of these jurisdictions the law requires the following.

- A learner stage with a mandatory holding period of at least six months.
- A learner stage with a minimum amount of supervised driving required.
- An intermediate stage with a nighttime driving restriction and passenger restrictions.

### ***Medical Advisory Boards Regulating Adult Drivers Who are Medically At Risk Drivers<sup>vii</sup>***

Like young novice drivers, older adult and other medically at risk drivers are disproportionately involved in motor-vehicle collisions. The physical frailties of old age make it more likely that an elderly driver will be seriously injured when involved in a collision.

Functional screening measures can help identify older and other medically at risk drivers who may be at high-risk of being at-fault in crashes before those crashes take place. Some states have created a medical review process that supports the preservation of driving as a privilege while identifying individuals who should no longer be operating a car. Only two-thirds of the states have medical advisory boards to review the driving ability of medically at risk adult drivers. Even in these states, many of these medical advisory boards review relatively few cases each year. Establishing an effective and equitable process to understand who should be allowed to operate a motor vehicle and who should not be allowed to drive is essential. The AAA Foundation provides recommendations pertaining to the formation of medical advisory boards.

## **Policies Pertaining to Distracted, Aggressive, and Impaired Drivers**

### ***Cell Phone and Texting Laws<sup>viii ix x xi</sup>***

According to an examination of driver distraction data recorded in NHTSA databases, in 2008 an estimated 2,346,000 people were injured in motor vehicle crashes. The number of people injured with reported distraction was estimated at 22% or 515,000 persons. A number of states have passed laws to prevent motor vehicle crashes caused by the distraction of hand-held communication devices while driving.

- As of 2010, eight states and the District of Columbia, and the Virgin Islands prohibit drivers from using handheld cell phones or similar devices while driving. Except in Maryland, all of these laws allow primary enforcement—that is, a police officer may cite a driver for using a handheld device without any other traffic offense taking place.

- Thirty states and the District of Columbia, and Guam ban text messaging for all drivers. All but four of these laws allow primary enforcement laws.
- Thirty-one states and the District of Columbia ban all cell phone use – including the use of ‘hands-free’ phones - by novice drivers (defined either by age or time since receiving license).
- School bus drivers in eighteen states and the District of Columbia may not use a cell phone when passengers are present on the bus. Two states restrict school bus drivers from texting while driving.
- Many states include a category for cell phone/electronic equipment distraction on police accident report forms.

While progress has been made, there is much left to do. In some states cell phone use is an offense only if a driver is also committing some other moving violation (other than speeding) when using a phone. Eleven localities plus the District of Columbia have passed their own distracted driving bans which may preempt state laws. Some states prohibit localities from enacting such laws.

### ***Speed Management Laws<sup>xii xiii</sup>***

In 2008, speeding was a contributing factor in thirty-one percent of all fatal crashes. According to the National Highway Safety Association (NHTSA) the economic cost to society as of 2008 was \$40.4 billion. Countermeasures to reduce aggressive driving and speeding available to the states include speed limits, aggressive driving laws, automated enforcement, high-visibility enforcement, penalties, diversion, and public information supporting enforcement. Broad public acceptance and active enforcement is needed to achieve maximum results.

### ***Impaired Driving<sup>xiv</sup>***

Alcohol-related crashes in the United States cost the public an estimated \$114.3 billion in 2000, including \$51.1 billion in monetary costs and an estimated \$63.2 billion in quality of life losses. People other than the drinking drivers paid \$71.6 billion of the alcohol-related crash bill.

Enacting effective impaired driving laws could save 8,000-9,000 lives each year. These laws include:

- Blood alcohol content per se laws<sup>1</sup> of at least 0.08 percent (federal law)
- Administrative license revocation
- Child endangerment (if convicted of impaired driving in a motor vehicle in which children were passengers)
- Dram shop laws<sup>2</sup>
- Hospital blood alcohol reporting
- Ignition interlocks
- Mandatory assessments
- Mandatory education

<sup>1</sup> Per se laws declare it illegal to drive a vehicle above a certain alcohol level, as measured by a blood or breath test.

<sup>2</sup> Dram shop laws govern the liability of taverns, liquor stores and other commercial establishments that serve alcoholic beverages.

- Penalties for refusing to take a blood alcohol content test
- Sobriety check points
- Social host liability
- Vehicular homicide (if a driver is impaired and causes a collision resulting in a death)

Table 1 indicates the number of states that have passed each of these laws.

Thirteen states have made ignition interlocks mandatory or highly incentivized for all convicted drunk drivers, even first-time offenders. California’s new interlock law covers all offenders in four counties, but these counties represent a significant portion of the population in the state. Forty-two states, the District of Columbia, and Guam have increased penalties for high BAC.

Underage drinking laws such as .02 or less blood alcohol levels for drivers under twenty-one years of age supported by zero tolerance enforcement, youth programs, and school education programs are effective.

Table 1. Impaired Driving Laws	
Name of Law	No. of States
.08 Per Se Law	50
Administrative License Revocation	46
Child Endangerment	41
Dram Shop	41
Hospital BAC Reporting	6
Ignition Interlock	47
Mandatory Assessments	42
Mandatory Education	40
Mandatory BAC	37
Penalties for Test Refusal	36
Sobriety Check Points	40
Social Host Liability	34
Vehicular Homicide	45
Underage Drinking Laws (.02)	34

## Policies Responsive to the Environment

### ***Seat Belt Laws<sup>xv</sup>***

Seat belt laws are divided into two categories: primary and secondary. Primary seat belt laws allow law enforcement officers to ticket a driver for not wearing a seat belt, without any other traffic offense taking place. Secondary seat belt laws state that law enforcement officers may issue a ticket for not wearing a seat belt only when there is another citable traffic infraction.

Recent statistics are as follows.

- Thirty-one states, the District of Columbia, American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, and the Virgin Islands have primary seat belt laws.
- Eighteen states have secondary laws.
- New Hampshire has a primary child passenger safety law for children under the age of 18 years.

Passage of a primary seat belt law by every state, and consistent and efficient enforcement of these laws, would go a long way in reducing the toll of motor vehicle deaths and injuries.



## **Booster Seat Laws** <sup>xvi xvii xviii xix</sup>

In the United States during 2008, 968 children ages 14 years and younger died as occupants in motor vehicle crashes, and approximately 168,000 were injured. One CDC study found that, in one year, more than 618,000 children ages 0-12 rode in vehicles without the use of a child safety seat or booster seat or a seat belt at least some of the time. Child safety seats reduce the risk of death in passenger cars by 71% for infants, and by 54% for toddlers ages 1 to 4 years. There is strong evidence that child safety seat laws, safety seat distribution and education programs, community-wide education and enforcement campaigns, and incentive-plus-education programs are effective in increasing child safety seat use.


## **Policies for Trauma Facilities and Emergency Medical Services** <sup>xx xxi xxii xxiii</sup>

The reductions in motor vehicle injuries are largely due to vehicle design improvements and advances in emergency medical and trauma care. Because the number and distribution of trauma centers are very uneven across the nation, there is a large difference in access to trauma care from state to state. According to a study published in the *Journal of the American Medical Association* in 2005, approximately 46.7 million Americans have no access to a trauma center within an hour of their location. Most of these people live in rural areas. Sixty percent of all traffic fatalities occur on two lane rural roads. Many of these lives would be saved if trauma centers were available in underserved rural communities.

In general, emergency medical services (EMS) are woefully underfunded. A report of a survey published in January 2010 by the National Association of State Emergency Medical Services Officials clearly demonstrated that federal dollars for EMS were rapidly declining. The states that participated in this survey in both 2006 and 2009 experienced a 59 percent decline in the total amount of their EMS budget over this period. This loss is unprecedented and likely to impact the quality and quantity of emergency medical services available to the public. If treated at a level one trauma facility, a person's survival rate is increased by twenty-five percent. To locate trauma facilities nationwide the Centers for Disease Control and Prevention provides a mapping tool to the public.

The National EMS Information System (NEMSIS) was created to standardize the collection of pre-hospital data. The project is collecting state and local data that will be used to create a national database. There are currently twenty-three states submitting NEMSIS compliant data to the national database. All states have committed to eventually become NEMSIS compliant. The information created by this system will be invaluable in understanding how pre-hospital care can be improved to reduce the impact of injuries and save lives.

The type of emergency care provided to an injured person significantly impacts the patient's treatment outcome. When severely injured persons receive care at a Level 1 trauma center rather than a non-trauma center, they have a 25 percent reduction in mortality. However, it is not necessary to transport all or even many injured patients to such a high level of care; many patients with less severe injuries may be appropriately cared for at lower level trauma centers or community hospitals. Getting patients to the right place for their injuries not only ensures appropriate medical care is delivered to the patient in a timely fashion, but also maximizes the resources of the EMS and trauma system. The 2006 Guidelines for Field Triage of Injured Patients are designed to help local EMS providers get the right patient to the right place at the right time. Policies are needed that encourage local EMS providers to



use the 2006 Guidelines for Field Triage as the basis for their local transport and destination criteria for systems to implement the recommendations of the “Recommendations from the Expert Panel: Advanced Automatic Collision Notification and Triage of the Injured Patient.”

## Policies that Foster Collaboration between State Transportation and Health Departments and other Partners

Collaborations between state departments of transportation and health have proven to be a powerful force in addressing motor vehicle-related injuries. Expanding these coalitions to include other state stakeholders (sometimes in the form of a traffic safety commission) has also proved effective. In his remarks to *Addressing a Winnable Battle*, Larry Cohen, Executive Director of the Prevention Institute, listed a number of reasons why multidisciplinary collaborations are valuable. Multidisciplinary groups can:

- Identify common and divergent approaches to traffic safety.
- Take stock of individual and collective resources.
- Identify who (or what) is missing from the effort and engage additional partners.
- Forge comprehensive approaches and joint solutions to problems.
- Clarify how people from each discipline view and approach an issue.

Actively participating in the development and implementation of the state strategic highway safety planning process is one of the most effective activities these coalitions can initiate. Strategic highway safety planning is required for all states and territories by the federal government. This process helps create a shared vision, promotes a diverse network of partners, assists in identifying resources, supports allocation of funding to and alignment of traffic safety priorities, and promotes the achievement of state and national traffic safety goals. According to the American Association of State Highway and Transportation Officials (AASHTO) eighty percent of the states include a key state health partner in this process. AASHTO recommends that every state invite a representative from the state public health department to participate in the process. ASTHO and its members have a key role to play as a convener of multiple stakeholders.

Others who can play a valuable role in the state strategic highway planning process or other state-level coalitions include:

- State highway safety offices
- State motor vehicle administrations
- State police
- Federal Highway Administration regional offices
- National Highway Traffic Safety Administration regional offices
- Metropolitan planning organizations
- State office of emergency medical services

Collaboration between state transportation and health departments and other stakeholders in the use of health impact assessments can also play an important role in preventing motor-vehicle related injuries. This is a process that is used to assess the potential health impacts of a project, such as the building of a new highway connector, or a policy such as a gasoline tax. The steps in conducting a health impact assessment include the following.<sup>xxiv</sup>

- Identifying projects or policies for which an HIA would be useful
- Identifying which health impacts to assess
- Identifying which people may be affected and how they may be affected
- Suggesting changes to proposals for projects or policies to mitigate adverse health effects or promote positive health impacts
- Reporting the results to decision-makers and stakeholders
- Evaluating the effect of the HIA on the ultimate decision

### Supporting a Culture of Motor Vehicle Safety<sup>xxv</sup>

While policy is fundamental to decreasing deaths and injuries associated with motor vehicle crashes, it is only part of the answer. Policies are most effective when they take place within a culture that values motor vehicle safety. States can work to create such a culture. Washington, for example, has achieved a culture of safety by implementing a comprehensive policy approach. See Table 2 below for a summary of Washington’s plan.

**Table 2 - Washington State Comprehensive Plan to Create a Culture of Safety**

- Independent commission structure with broad representation from state and local agencies.
- Strength of partnerships among the state agencies and the governor.
- Data-driven, research-based planning and programming.
- Strong network of local community-based programs and resources which are assisted by the state agencies.
- Intensive legislative involvement and responsiveness to the WTSC and its member agencies.
- Champions in the legislature who delivered key safety initiatives.
- Strength of the House and Senate Transportation Committees in management of all transportation funding and support of public policy issues.
- A formal system of performance accountability to the governor, public, and legislature.
- An aggressive Target Zero goal prior to, and now within, the current strategic highway safety plan.

## Choosing a Winnable Strategy

As states choose and prioritize the policies they will pursue, they will require knowledge of the specific motor-vehicle-related data in their state as well as the political and cultural context in which policies can be successfully developed and implemented. State health agencies are uniquely positioned to support effective policy initiatives that will improve health outcomes. Dr. Frieden has encouraged policymakers to adhere to a conceptual framework called *The Health Impact Pyramid* which has five tiers including education approaches, clinical interventions, long lasting protective interventions, changing frameworks to make individuals default to healthy decisions and socio-economic factors. When an intervention touches all five tiers of the pyramid long-term success takes place.<sup>xxvi</sup>

At the May 11, 2010 meeting *Addressing a Winnable Battle* closed with a request from ASTHO's (2009-2010) President, Dr. Paul Halverson who asked state health officials to "study the data, assess their state, and consider at least one policy strategy that could lessen the burden of preventable injury in their home state." The outcome from the meeting resulted in a raised awareness of data driven evidence based policies; and, a diverse list of policy recommendations for the ASTHO membership discussed below.

If more states become specifically focused on implementing evidence-based interventions pertaining to injuries and deaths caused by motor vehicle-crashes, they should cease to be the leading cause of death for people ages 1-34 years. Policymaking pertaining to this topic area is a winnable battle and a valuable investment of time and resources for a worthy cause.

## Resources

AAA Foundation for Traffic Safety <http://www.aaafoundation.org/home/>  
Association of State Highway and Transportation Officials <http://www.transportation.org/>  
Governors Highway Safety Association <http://www.ghsa.org/>  
*Guide to Community Preventive Services* <http://www.thecommunityguide.org/>  
Health Impact Assessment, CDC <http://www.cdc.gov/healthyplaces/hia.htm>  
*A Highway Safety Countermeasure Guide for State Highway Safety Offices*  
National Association of State EMS Officials <http://www.nasemsd.org/>  
National Center for Injury Prevention and Control, CDC <http://www.cdc.gov/injury/index.html>  
National Conference of State Legislators <http://www.ncsl.org/>  
National Highway Traffic Safety Administration <http://www.nhtsa.gov/>  
UCLA Health Impact Assessment Clearinghouse Learning and Information Center  
<http://www.ph.ucla.edu/hs/hiaclhc/>.  
University of North Carolina Highway Safety Research Center <http://www.hsrb.unc.edu>  
<http://www.ghsa.org/html/publications/countermeasures/index.html>

<sup>i</sup> Traffic Safety Facts Data Washington, DC: NHTSA. (2007) Retrieved 08-26-10 <http://www.nhtsa.gov>.

<sup>ii</sup> Halverson, P. (2010) *Addressing a Winnable Battle: Transportation and Public Health Officials Join Forces*. Presented at the meeting of ASTHO, Arlington, VA.

<sup>iii</sup> Frieden, T. (2010). A Framework for Public Health Action: The Health Impact Pyramid. *AJPH*. 100, 4.

<sup>iv</sup> Zaza, S., Briss, P. & Harris, K. (Eds.) (2005). *Guide to Preventative Services, What Works to Promote Health?* Oxford Univ. Press. New York, N.Y.

<sup>v</sup> Graduated Driver Licensing (GDL) Laws. (2010). Governor's Highway Safety Association. Retrieved 08-26-10 from <http://www.ghsa.org>.

<sup>vi</sup> Injury Prevention and Control, Motor Vehicle Safety. (2010). CDC. Retrieved 08-26-10 from <http://www.cdc.gov>.

- 
- vii Soderstrom, C. (2010) *Medical Fitness to Drive Maryland MVA's Medical Advisory Board Issues*. Presented at the meeting of ASTHO, Arlington, VA.
- viii An Examination of Driver Distraction as Recorded in NHTSA Databases. (2009). Retrieved 09-07-10 from <http://www.nrd.nhtsa.dot.gov1pubs1811216.pdf>.
- ix AAA Public Affairs. (August 26, 2010). Retrieved 09-07-10 from <http://www.aaapublicaffairs.com>.
- x Distraction.gov, Official U.S. Government website for Distracted Driving, U.S. DOT. (n.d.) Retrieved 09-07-10 from <http://www.distraction.gov/statelaws>.
- xi Governors Highway Safety Association "The States Voice in Highway Safety". (2010). Retrieved 09-07-10 from <http://www.ghsa.org>.
- xii Traffic Safety Facts Data Washington, DC: NHTSA. (2008) Retrieved 09-07-10 from <http://www.nhtsa.gov>.
- xiii *Countermeasures That Work: A Highway Countermeasures Guide for State Highway Safety Offices* Fifth Edition. (2010). Retrieved 09-07-10 from [www.ghsa.org](http://www.ghsa.org).
- xiv Impaired Driving in the United States Cost Fact Sheet. (2002). NHTSA. Retrieved 08-26-10 from <http://www.nhtsa.dot.gov>.
- xv Traffic Safety Facts Research Note, Seat Belt Use in 2009 – Overall Results. (Sept 2009). Retrieved 09-07-10 from <http://www-nrd.nhtsa.dot.gov/Pubs/811100.pdf>.
- xvi DOT (US), NHTSA. *Traffic Safety Facts 2008: Children*. Washington (DC): NHTSA; 2009. [cited 2010 August 2].
- xvii Greenspan AI, Dellinger AM, Chen J. "Restraint use and seating position among children less than 13 years of age: Is it still a problem?" *J Safety Research* 2010. 41: 183-185.
- xviii DOT (US), NHTSA, *Traffic Safety Facts 2008: Children*. Washington (DC): 2009. [cited 2010 August 2].
- xix Zaza, S, Sleet DA, Thompson RS, Sosin DM, Bolen JC, Task Force on Community Preventive Services. "Reviews of evidence regarding interventions to increase the use of child safety seats." *Am. J Prev Med* 2001; 21 (4S), 31-47.
- xx Blatt, A.J., Branas, C.C., Flanigan, M.C., MacKenzie, E.J., ReVelle, C.S., Schwab, C.W., Teter, H.M., Williams, J.C. (2005). "Access to Trauma Centers in the United States". *JAMA*. 293:2626-2633.
- xxi Blessing, S. (2010). "Status of State Emergency Medical Services Office Funding and Utilization of Section 402 and 408 Highway Safety Funding (Mono). NASEMSO.
- xxii "A National Evaluation of the Effect of Trauma-Care on Mortality", *NEJM* 2006;354:366-78.
- xxiii [www.cdc.gov/injuryresponse/aacn.html](http://www.cdc.gov/injuryresponse/aacn.html)
- xxiv CDC Healthy Places. (n.d.) CDC. Retrieved 08-26-10 from <http://www.cdc.gov>.
- xxv Creating a Traffic Safety Culture – *A Case Study of Four Successful States, Case Study Three: Washington*, Mercer Consulting Group LLC East Lansing, MI, June 2007.
- xxvi Frieden, T. (2010). A Framework for Public Health Action: The Health Impact Pyramid. *AJPH*. 100, 4.

## Acknowledgements

ASTHO is grateful to the following persons who attended the May 11, 2010, meeting *Addressing a Winnable Battle: Transportation and Public Health Officials Join Forces to Decrease Preventable Injuries and Death Due to Motor Vehicle Crashes*. Their collective input, participation and recommendations are highly valued.

Kelli Braitman, Ph.D., Insurance Institute for Highway Safety  
Captain Stephanie Bryn, MPH, Health Resources & Services Administration (HRSA)  
Larry Cohen, MSW, Prevention Institute  
Joyce Dantzler, Department of Health Maryland  
T. Bella Dinh-Zarr, PhD, MPH, FIA Foundation  
Dolly Fernandes, DOH-EMS and Trauma Washington State  
Dia Gainor, MPA, Highway Incident & Transportation Systems  
Andrea Gielen, Sc. D., Johns Hopkins Bloomberg School of Public Health  
Melissa Gipson, National Center for Injury Prevention and Control (CDC)

---

Angela Glew, M.S., Michigan Department of Community Health  
Corinne M. Graffunder, DrPH, National Center for Injury Prevention and Control  
Michael Griffith, Office of Safety Integration, Federal Highway Administration  
Paul K. Halverson, DrPH, FACHE, Arkansas Department of Health  
David L. Harkey, UNC Highway Safety Research Center  
Barbara Harsha, M.A., Governors Highway Safety Association  
Arnetra Herbert, MS, BS, National Center for Injury Prevention & Control (CDC)  
Ralph Hingson, ScD, MPH, National Institute on Alcohol Abuse and Alcoholism  
Anthony Kane, PhD, American Association of State Highway & Transportation Officials  
Murray Katcher, MD, CMO, Wisconsin Department of Health and Family Services  
Virginia Lee, MPH, CHES, Prevention Institute  
Ann G. Mahony, MPH, Consultant  
Thomas Manuel, American Association of Motor Vehicle Administrators  
Jeffrey Michael, Ph.D., National Highway Traffic Safety Administration  
Joanne Michaels, National Traffic Law Center  
Jose T. Montero, MD, MPH, New Hampshire Department of Health & Human Services  
Robert Morrison, M.A., National Association of State Alcohol and Drug Abuse Directors  
Jake Nelson, National AAA  
Richard F. Pain, PhD, Transportation Research Board of the National Academies  
Carlene Pavlos, Division of Violence and Injury Prevention Washington State  
Melissa Savage, National Conference on State Legislatures  
Susan Scavo Gallagher, MPH, Tufts University  
Elin Schold-Davis, American Occupational Therapy Association  
Ellen R. Schmidt, MS, OT, Children's Safety Network  
Monique A. Sheppard, PhD, Center for Public Health Improvement and Innovation  
Carl A. Soderstrom, MD, Maryland Motor Vehicle Administration  
Sandy Spavone, National Organization for Youth Safety  
Ana Viamonte Ros, MD, MPH, Florida Department of Health  
Amber Williams, Safe States Alliance  
Stephen Wing, MSW, Substance Abuse and Mental Health Services Administration

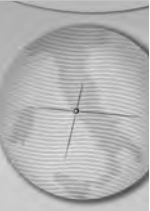
This document was made possible by funding from The Centers for Disease Control and Prevention (CDC) Opinions in this issue report do not necessarily represent the official policy of the CDC. This issue report was researched and prepared for the Association of State and Territorial Health Officials by Denise G. Osborn JD, MPH, Director of Injury Prevention and Behavioral Health. For additional information contact: [publications@astho.org](mailto:publications@astho.org)

The Association of State and Territorial Health Officials is the national non-profit organization representing the state and territorial public health agencies of the United States, the U.S. territories, and the District of Columbia. ASTHO's members, the chief health officials in these jurisdictions, are dedicated to formulating and influencing sound public health policy, and assuring excellence in state-based public health practice.



Association of State and Territorial Health Officials  
2231 Crystal Drive, Suite 450  
Arlington, VA 22202  
202-371-9090  
[www.ASTHO.org](http://www.ASTHO.org)





## Ecological approaches to the prevention of unintentional injuries

John P. Allegrante<sup>1</sup>, Dale W. Hanson<sup>2</sup>, David A. Sleet<sup>3</sup>, Ray Marks<sup>4</sup>

<sup>1</sup>Department of Health and Behavior Studies, Teachers College, and Department of Sociomedical Sciences, Mailman School of Public Health, Columbia University, New York, NY, USA; <sup>2</sup>School of Public Health Tropical Medicine and Rehabilitation Sciences, James Cook University, Queensland, Australia; <sup>3</sup>National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, GA, USA; <sup>4</sup>Department of Health and Physical Education, School of Health and Behavioral Sciences, York College, City University of New York, Jamaica, NY and Department of Health and Behavior Studies, Teachers College, Columbia University, New York, NY, USA

Correspondence to: John P. Allegrante, Box 114, 525 West 120th Street, New York, NY 10027. E-mail: jpa1@columbia.edu

### Abstract

**Background:** Injury as a cause of significant morbidity and mortality has remained fairly stable in countries with developed economies. Although injury prevention often is conceptualised as a biomedical construct, such a reductionist perspective overlooks the importance of the psychological, environmental, and sociocultural conditions as contributing factors to injury and its consequences. This paper describes the potential of the ecological model for understanding the antecedent causes of unintentional injuries and guiding injury prevention approaches. We review the origins and conceptualise the elements of the ecological model and conclude with some examples of applications of ecological approaches to the prevention of unintentional injury and promotion of community safety.

**Methods:** A review of the English-language literature on the conceptualization of ecological models in public health and injury prevention, including the application of the ecological model in the prevention of falls and road traffic injuries and in the community safety promotion movement.

**Results:** Three dimensions are important in social-ecological systems that comprise key determinants of injuries: 1) the individual and his or her behaviour, 2) the physical environment, and 3) the social environment. Social and environmental determinants have profound impact on population health and in the causation of injuries.

**Conclusions:** Social and environmental determinants of injury should be studied with the same energy, urgency, and intellectual rigor as physical determinants. Application of the ecological model in injury prevention shows the most promise in falls injury prevention, road traffic injury prevention, and community safety promotion.

*Key words: ecologic model, injury prevention, public health, safe communities, safety promotion*

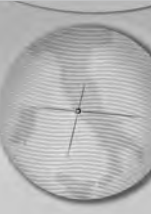
### Introduction

Health is not merely a product of individual biological, psychological, and behavioural factors; it is the sum of collective social conditions created when people interact with the environment. Preventing unintentional injury, like preventing diseases, requires attention to the entire social system [1].

Much of our thinking about health and disease causation has been dominated, since almost the beginning of the 20th century, by the prevailing medical model [2]. By extension, injury prevention has been conceptualised as a biomedical construct in which preventing injury is conceived as preventing the sudden release of

energy that produces tissue damage, or protecting the individual when energy is released (e.g., from seat belts). This reductionist perspective overlooks the importance of the psychological, environmental, and sociocultural conditions as contributing factors to an injury event and its consequences.

William Haddon, the father of modern injury prevention, prophetically introduced the concept of ecological injury prevention with publication of his seminal paper, "On the Escape of Tigers: An Ecological Note" [3]. In the context of the prevailing epidemiological model of causation in which the agent, host, and environment interact, he highlighted the opportunities for



harm reduction through redesign of the physical environment. Moreover, he argued that by preventing or dissipating the adverse release of energy, it was possible to minimise the chance of injury without necessarily preventing the “accident” [4]. By doing so, Haddon precipitated a major paradigm shift from accident prevention to injury prevention.

Now, three decades later, disease control has embraced an ecological perspective on the determinants of health that realises the importance of both the physical and social environments and the interaction of the individual with the environment [5]; however, injury prevention has lagged behind. While mounting evidence suggests that the social and economic environments exert profound and lasting effects on unintentional injury [6, 7], this knowledge has not yet been adopted in such a way to influence the prevention of unintentional injuries [8].

In this article, we describe the potential of the ecological model for understanding the antecedent causes of unintentional injuries and guiding injury interventions. We review the origins and conceptualise the elements of the ecological model, using the “injury iceberg” [8] as a useful metaphor, and conclude with some applications of the ecological model to the prevention of unintentional injury and community safety promotion.

### The ecological model

Concepts underlying the ecological model date back to the early 20th century when Park, Burgess, and McKenzie [9] are believed to have coined the term *human ecology*, extrapolating the theoretical paradigm of plant and animal ecology to the study of human communities. More recently, Last [10] defined *ecology* as “the study of relationships among living organisms and their environment” (p. 52), while *human ecology* refers to the “study of human groups as influenced by environmental factors, including social and behavioral factors” (p. 52).

Interventions that simultaneously influence multiple levels and multiple settings of an ecological system may be expected to lead to greater and longer-lasting changes in health outcomes [11]. McGinnis, Williams-Russo, and Knickman [12] have attempted to quantify how multiple determinants account for premature deaths. They estimated that genetic predisposition accounts for 30% of early deaths; social circumstances, 15%; environmental factors, 5%; behaviours, 40%; and shortfalls in medical care for 10% of all premature deaths. It follows, then, that the most effective

interventions to address multiple influences will occur at multiple levels [13].

According to Stokols [14, 15], health promotion programmes, and by extension injury prevention programmes, often take into account the individual’s interactions with the physical and social environments. Edward Rogers [16] was perhaps the first to advance the conceptual and potentially pragmatic value of ecological models in organised public health. This ecological perspective—especially as applied to changing health behaviour—was furthered by Moos [17], Green and McAlister [18], and McLeroy and colleagues [19].

Green and Kreuter [20] proposed a socioecological model of health promotion, compatible with injury prevention, in which health and safety can be interpreted in the context of the whole (ecological) system. The three dimensions to this system are: 1) the individual and his or her behaviour, 2) the physical environment, and 3) the social environment. Each dimension can be analysed at five levels:

1. *The intrapersonal level:* Characteristics of the individual, that is, his or her knowledge, skills, life experience, attitudes, and behaviours as they interface with the environment and society.
2. *The interpersonal level:* The immediate physical environment and social networks in which an individual lives, including family, friends, peers, and colleagues and coworkers.
3. *The organisational level:* Commercial organisations, social institutions, associations, clubs, and other structures that have rules and regulations enabling them to have direct influence over the physical and social environments maintained within their organisation.
4. *The community level:* The community can be defined within geographical or political boundaries and may share demographic, cultural, ethnic, religious, or social characteristics, with its members having a sense of identity and belonging, shared values, norms, communication and helping patterns.
5. *Societies:* These are larger systems, often defined along political boundaries, possessing the means to distribute resources and control the lives and development of their constituent communities.

To better understand the multiple levels of intervention required in an ecological approach to injury prevention, Hanson and colleagues [8] have proposed a visual metaphor, the *injury iceberg*, showing the relationship of the individual

to the physical and social environment, together with various levels of interaction (Figure 1).

The individual is, metaphorically speaking, the tip of the iceberg—just one part of a complex ecological system with many levels. While the individual may be the most visible component of this system, important determinants of their behaviour and environmental risk are “hidden below the waterline.” Attempts to modify the risk of injury at one level in isolation (for example, individual behaviour) will be resisted by the rest of the system, which will attempt to maintain its own internal stability (homeostasis). Syme and Balfour [21] have observed that “it is difficult to expect that people will change their behavior easily when many forces in the social, cultural, and physical environment conspire against such change . . . more attention will need to be given not only to the behavior and risk profiles of individuals, but also to the environmental context in which people live” (p. 796)—a strong argument for ecological approaches to change.

The socioecological paradigm emphasises the dynamic interplay among the three dimensions—the individual, the physical environment, and the social environment—which act at five levels: intrapersonal, interpersonal, organisational, community, and societal. These provide the ecological context in which the individual behaves within the environment [22]. Each level is built on the foundation of a “deeper” level. As these

deeper levels become larger and exercise more inertia, it becomes more difficult to change them. But once changed, these levels are more likely to sustain the desired outcome [23]. This ecological model provides a complex web of causation and creates a rich context for multiple avenues of intervention. It can be used to map the key links to an injury, identifying upstream latent failures, along with the more obvious downstream active failures. Identifying the most strategic links thus ensures effective action.

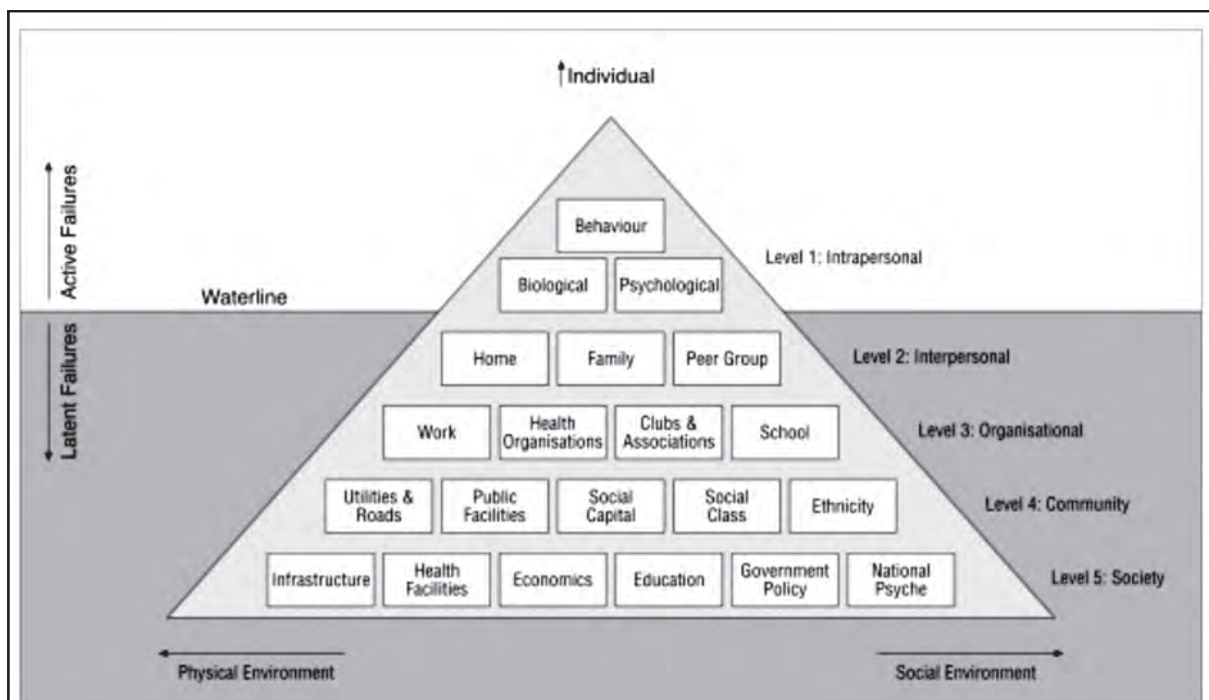
### Applications of the ecological model in injury prevention

While the use of behavioural and social science theories in the context of injury prevention has been limited to a selected few [24], there are numerous examples of using behavioural, social and ecological approaches designed to promote safety in physical activity [25], prevent obesity [26], and improve nutrition and food choice [27]. In injury prevention, the application of the ecological model in injury prevention has shown the most promise in falls injury prevention, road traffic injury prevention, and community safety promotion.

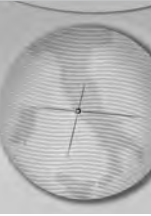
### Falls injury prevention

There is increasing support for the application of multi-faceted interventions to reduce falls among older adults [28]. Clemson et al. describe

Figure 1. The injury iceberg.



Source: Hanson et al. [8]. Figure reprinted with permission by the Health Promotion Journal of Australia.



a multi-faceted community-based programme to reduce the incidence of falls in an elderly population [29]. Applying the ecological framework, Clemson and colleagues studied the impact of improving individual falls self-efficacy and lower-limb balance and strength, while improving home and communal environmental and behavioural safety. In addition, attention to regular vision screening and medication reviews was encouraged. Compared to a control group, the intervention group experienced a 31% reduction in falls. A similar home-based intervention to prevent falls among community-dwelling frail older people, which included a home environmental assessment, facilitating any recommended changes, and training in the use of adaptive equipment, especially among previously frequent fallers, was effective in reducing falls rates among those with a history of recurrent falling [30].

A number of studies have demonstrated that multifaceted community-based approaches that utilise an ecological model of intervention are more effective than single-strategy intervention approaches [31,32]. Moreover, an ecological approach that focuses on the multiple causative factors for falls, and policies that foster screening and referral programmes are most likely to succeed. The ecological model also takes into consideration the need to train personnel to conduct risk assessments, and preventive interventions. Moreover, legislation to optimise safety in the home and its environment and adequate medical coverage and funding for counseling are all important elements in the ecological approach [28, 33].

### Motor vehicle injury prevention

Like falls, motor vehicle crashes and their associated injuries have multiple determinants; however, because of the weak behavioural technologies of the past, efforts to prevent injuries have largely focused on passive approaches. Nonetheless, with the decline in the potential for further engineering improvements, it has become clear that in addition to other considerations, behavioural and social change is essential to effective improvements in road safety [34].

The consensus among experts is that behaviour change is most likely to occur in the context of comprehensive, multisectoral, participative, and socially supportive interventions [35, 36]. Even the simplest behaviour is determined by a complex mix of biological, psychological, and sociocultural factors [37]. Road safety interventions can benefit from the incorporation of an ecological approach

that addresses these factors in intervention planning and implementation.

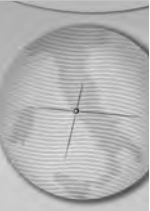
There is general agreement that single interventions do not have the same impact as multiple interventions in efforts to reduce or prevent injury [38]. Health promotion approaches to road traffic injury prevention have been advocated as one approach to ensure an ecological context is included [39, 40]. Indeed, a U.S. Centers for Disease Control and Prevention (CDC) report describing motor vehicle safety as one of the 20th century's 10 important public health achievements strongly suggests that success was achieved because of multiple interventions applied within an ecological context [41]. The changes held responsible for the improvements in motor safety included legislative policies, educational programmes, and changes in the physical and social environment [42, 43].

In the late 1980s, Sleet [44] and Simons-Morton et al. [45] proposed taking an ecological perspective and diagnostic framework to identify factors associated with drinking and driving, and applying a conceptual intervention model with multiple components. This has been subsequently supported by Sleet and colleagues [46] in describing effective interventions to prevent drinking and driving. These authors have suggested that while health education interventions may contribute to reducing alcohol-related traffic injury, ecological approaches are preferred and have been shown effective [35].

In ecological approaches, each intervention builds synergistically on the strengths of every other one. More specifically, given the complexity of factors that influence driving under the influence of alcohol, ecological approaches to reducing alcohol-impaired driving that use four components of the health promotion model, as proposed by Howat et al. [47], are likely to be especially effective. These include the use of: 1) economic interventions, 2) organisational interventions, 3) policy interventions, and 4) health education, including media, school and community education, and public awareness campaigns.

Similarly, Lonero and Clinton [36] identified four broad classes of tools with which to influence driver behaviour: legislation, enforcement, education, and reinforcement. In its report on preventing road traffic injuries [48], the World Health Organisation (WHO) focused attention on a systems approach to prevention, including the interaction among its elements—vehicles, roads, and road users and their physical, social, and economic environments.





### Community safety promotion

To focus solely on the biomedical concept of injury prevention is to misunderstand the fundamental nature of the human experience, and hence how the positive state of “safety” is achieved. Maurice et al. [49] define *safety* as “a state in which hazards and conditions leading to physical, psychological, or material harm are controlled in order to preserve the health and well-being of individuals and the community” (p. 237). The United Nations, in its 1994 report on human development, has asserted that safety and security is a fundamental human right and an essential condition for the sustainable development of societies [50]. Safety is as much concerned with the subjective dimension—the perception of safety—as it is with the objective dimension—the absence of injury. It is as much concerned with the community in which individuals reside as it is with the behaviour of the individuals who comprise the community. Thus, it is evident that safety is a psychological, sociological, and environmental phenomenon, as much as it is physiological. As such, safety is inherently an ecological concept [51].

Moller [52] states, that the community-based model for injury prevention includes the application of multiple countermeasures and multiple strategies in the context of community defined problems and community owned solutions. Effectively managing context by implementing the most appropriate mix of strategies to address the specific injury problems faced by the community is a critical factor determining the success. Most important, the community must be involved in the process of defining the problem, locating data, identifying practical solutions, and mobilising the resources necessary to implement and sustain the solution [8, 53, 54].

One approach is to maximise the capacity of a community to institutionalise and maintain change within its own “ecosystem” [8, 54]. Hanson [55] has identified four types of community resources that enable such capacity:

1. *Financial capital*: The economic resources available to a community. While clearly important, it is frequently overemphasised at the expense of other forms of capital.
2. *Physical capital*: The natural environment and man-made resources (for example, buildings and equipment) available to a community.
3. *Human capital*: The skill and knowledge of the individuals contained within a community.
4. *Social capital*: The features of social organisation such as networks, norms, and trust

that facilitate coordination and cooperation for mutual benefit [56].

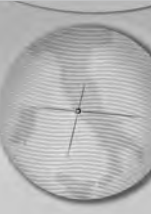
### WHO Safe Communities

Safe Communities is an approach to injury prevention and safety promotion that is supported by the WHO [57]. The safe community model seeks to understand injury and intervene at a community level. By involving people in finding their own solutions to community problems, the community aims to be a catalyst for environmental, structural, sociological, and political change. This empowers the community, and ultimately individuals within a community, to change their environment and their behaviours to reduce the risk of injury and increase the perception of safety. It uses an ecological paradigm to promote community safety promotion [8]. There are currently 177 WHO-designated Safe Communities [58]. Communities are assessed for WHO designation based on six indicators, designed to encourage best practice in safety promotion [53]:

1. An infrastructure based on partnerships and collaborations, governed by a cross-sectoral group that is responsible for safety promotion in their community;
2. Long-term, sustainable programmes covering both genders and all ages, environments, and situations;
3. Programmes that target high-risk groups and environments and programmes that promote safety for vulnerable groups;
4. Programmes that document the frequency and causes of injury;
5. Evaluation measures to assess their programmes, processes, and the effects of change; and
6. Ongoing participation in national and international Safe Communities Networks.

Spinks and colleagues [59] conducted a systematic review of the WHO Safe Communities approach on behalf of the Cochrane Collaboration. They identified 21 community-controlled evaluations using population-based injury morbidity and mortality data. These studies were conducted in two geographical regions: Europe (Austria, Sweden and Norway) and Australasia (Australia and New Zealand). Although the authors concluded that some communities were able to achieve a reduction in injury using the WHO model, important methodological limitations were present in all studies, illustrating the challenges of conducting ecological research on safety.

Programmes conducted in Scandinavia demonstrated stronger population outcomes than those conducted in Australasia. Falkoping, a



city in Sweden demonstrated a 23% decrease in all injury morbidity rates at the time the community coalition was active [60]. Motala, also a city in Sweden, demonstrated a 13% reduction in injury rates [61]. Harstad (a city in Norway) produced significant reductions in child burns and scalds, and traffic injury rates [62, 63]. In New Zealand, the Waitakere Safe Communities Project documented a significant reduction in child injury admission rates, but was unable to demonstrate a significant reduction in hospitalisation rates for all ages and all injuries [64]. In Australia, the Shire of Bulla (later to become the Hume Safe Communities) was unable to demonstrate a significant reduction in injury rates [65]. The Child Injury Prevention Project conducted in Mackay and Mt. Isa (Queensland) was able to demonstrate a decrease in Emergency Department (ED) presentations and hospital admissions in children aged four years and under while ED presentation and injury hospitalisations increased in control communities [66].

No studies were identified by WHO Safe Communities in low and middle income countries, so any generalisation of these results to the international community must be undertaken with caution. However, Spinks et al. [59] conclude it is time to conduct an appropriately funded and rigorously conducted global multi-community trial of the Safe Communities approach. These studies can provide further evidence of the value of taking an ecological approach within a community setting.

### Conclusions

This article has sought to highlight the limitations of approaching injury causation simply as a biomedical construct related to a sudden release of energy resulting in tissue damage to an individual. Such an approach underestimates both the influence and effects of environmental

and social contextual factors and narrows the prospects for developing effective prevention programs. Injury prevention and safety promotion should consider physical, psychological, and sociological dimensions and thus should be considered an ecological concept.

Hanson's [8] injury iceberg is a useful metaphor for understanding the concept of injury causation as an ecological system. In this system, the individual is just the tip of the iceberg, the most visible and identifiable component of a complex system in which the individual interacts with the physical and social environments. The most enduring means to reduce an individual's risk of injury in such a system is to systematically address the physical and social environmental factors hidden beneath the waterline, which ultimately shape individual and social behaviours that can give rise to injury.

While much has been achieved in the past 50 years, we face a new frontier of challenges in the prevention and control of injury in the 21st century. Social influences have a profound impact on population health and injury outcomes. Social and environmental determinants of injury should be studied with the same energy, urgency, and intellectual rigor as physical determinants.

### Acknowledgements

This paper was adapted with permission of the publisher from the chapter by Allegrante JP, Marks R, and Hanson DW, "Ecological Models for the Prevention and Control of Unintentional Injury" (Chapter 6, pages 105-126), in: Gielen AC, Sleet DA, DiClemente RJ, editors, *Injury and Violence Prevention: Behavioral Science Theories, Methods, and Applications* (San Francisco: Jossey-Bass, 2006). The views reflected are those of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention.

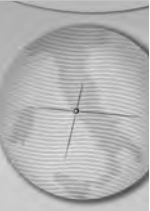
### References

- 1) Haignere CS. Closing the ecological gap: the public/private dilemma. *Health Educ Res* 1999;14:507-18.
- 2) Engel G. The need for a new medical model: a challenge for biomedicine. *Science* 1977;196:129-36.
- 3) Haddon W. On the escape of tigers, an ecological note. *Am J Public Health* 1970;60:2229-35.
- 4) Haddon W. Advances in the epidemiology of injuries as a basis for public policy. *Public Health Rep* 1980;95:411-21.
- 5) Commission on the Social Determinants of Health. Closing the gap in a generation: health equity through action on the social determinants of health. Final report of the Commission on the Social Determinants of Health. Geneva: World Health

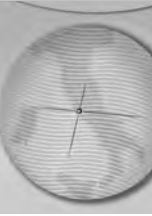
Organisation, 2008.

- 6) Laflamme L, Burrows S, Hasselberg M. Socioeconomic differences in injury risks: a review of findings and a discussion of potential countermeasures. Copenhagen: WHO Regional Office for Europe, 2009. Available from: <http://www.euro.who.int/Document/E91823.pdf> [Accessed February 4, 2010].
- 7) Petridou E, Tursz A. Socio-economic differentials in injury risk. *Inj Control Saf Promot* 2001;8:139-42.
- 8) Hanson D, Hanson J, Vardon P, et al. The injury iceberg: an ecological approach to planning sustainable community safety interventions. *Health Promot J Austr* 2005;16:5-15.
- 9) Park P, Burgess E, McKenzie R. *The city*. Chicago: University of Chicago Press, 1925.





- 10) Last J. A dictionary of epidemiology. 3rd edition. New York: Oxford University Press, 1995.
- 11) Cohen L, Swift S. The spectrum of prevention: developing a comprehensive approach to injury prevention. *Injury Prev* 1999;5:203-7.
- 12) McGinnis JM, Williams-Russo P, Knickman JR. The case for more active policy attention to health promotion. *Health Aff* 2002;21:78-93.
- 13) Smedley BD, Syme, SL. Promoting health: intervention strategies from social and behavioral research. Washington, DC: National Academy Press, 2000.
- 14) Stokols D. Establishing and maintaining healthy environments: towards a social ecology of health promotion. *Am Psychol* 1992;47:6-22.
- 15) Stokols D. Translating social ecological theory into guidelines for community health promotion. *Am J Health Promot* 1996;10:282-98.
- 16) Rogers ES. Human ecology and health: An introduction for administrators. New York: Macmillan, 1960.
- 17) Moos RH. Social-ecological perspectives on health. In: Stone GC, Cohen F, Adler NE, editors. *Health psychology: a handbook*. San Francisco: Jossey-Bass, 1980.
- 18) Green LW, McAlister AL. Macro intervention to support health behavior: some theoretical perspectives and practical reflections. *Health Educ Q* 1984;11:323-38.
- 19) McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ Q* 1988;15:351-77.
- 20) Green LW, Kreuter MW. *Health program planning: an educational and ecological approach*. 4th edition. New York: McGraw-Hill, 2005.
- 21) Syme SL, Balfour JL. Social determinants of disease. In: Wallace R, Doebbeling BD, Last JM, editors. *Maxcy-Rosenau-Last public health and preventive medicine*. 14th edition. Stamford, CT: Appleton and Lange, 1998:795-810.
- 22) Porter BE, Bliss JP, Sleet DA. Human factors in injury control. *Am J Lifestyle Med* 2010;4:90-7.
- 23) Swerissen H. Australian primary care policy in 2004: two tiers or one for Medicare? *Austr N Z Health Policy* 2004;1:2.
- 24) Trifiletti LB, Gielen AC, Sleet DA, Hopkins K. Behavioral and social sciences theories and models: are they used in unintentional injury prevention research? *Health Educ Res* 2005;20:298-307.
- 25) Sallis JF, Conway TL, Prochaska JJ, McKenzie TL, Marshall SJ, Brown M. The association of school environments with youth physical activity. *Am J Public Health* 2001;91:618-20.
- 26) Longjohn MM. Chicago project uses ecological approach to obesity prevention. *Pediatr Ann* 2004;33:62-3.
- 27) Booth SL, Sallis JF, Ritenbaugh C, et al. Environmental and societal factors affect food choice and physical activity: rationale, influences, and leverage points. *Nutr Rev* 2001;59, S21-S39.
- 28) Marks R, Allegrante JP. Falls prevention programs for older ambulatory community dwellers: from public health research to health promotion policy. *Soz Praventivmed* 2004; 49:171-8.
- 29) Clemson L, Cumming RG, Kendig H, Swann M, Heard R, Taylor K. The effectiveness of a community-based program for reducing the incidence of falls in the elderly: a randomised trial. *J Am Geriatric Soc* 2004;52:1487-94.
- 30) Nikolaus T, Bach M. Preventing falls in community-dwelling frail older people using a home intervention team (HIT): results from the randomised Falls-HIT trial. *J Am Geriatric Soc* 2003;51:300-5.
- 31) Dyer CAE, Taylor GJ, Reed M, Dyer CA, Robertson DR, Harrington R. Falls prevention in residential care homes: a randomised controlled trial. *Age Aging* 2004;33:596-602.
- 32) Richard L, Gauvin L, Gosselin C, Ducharme F, Sapinski JP, Trudel M. Integrating the ecological approach in health promotion for older adults: a survey of programs aimed at elder abuse prevention, falls prevention, and appropriate medication use. *Int J Public Health* 2008;53:46-56.
- 33) Allegrante JP, Marks R, Hanson DW. Ecological models for the prevention and control of unintentional injury. In: Gielen AC, Sleet DA, DiClemente RJ, editors. *Injury and violence prevention: behavioral science theories, methods, and applications*. San Francisco: Jossey-Bass, 2006:105-26.
- 34) Lonero LP, Clinton KM, Sleet DA. Behavior change interventions in road safety. In: Gielen AC, Sleet DA, DiClemente RJ, editors. *Injury and violence prevention: behavioral science theories, methods, and applications*. San Francisco: Jossey-Bass, 2006:213-33.
- 35) Shults RA, Elder RW, Nichols JL, Sleet DA, Compton R, Chattopadhyay SK. Task Force on Community Preventive Services. Effectiveness of multicomponent programs with community mobilisation for reducing alcohol-impaired driving. *Am J Prev Med* 2009;34:360-71.
- 36) Lonero LP, Clinton KM. Objectives for Behavioral Safety Programs. Available from: <http://www.drivers.com/article/302> [Accessed February 2, 2010].
- 37) Institute of Medicine. Committee on Health and Behavior. *Health and behavior: the interplay of biological, behavioral and societal influences*. Washington, DC: National Academy Press, 2001.
- 38) Sleet DA, Gielen AC, Diekman S, Ikeda R. Preventing unintentional injury: A review of behavior change theories for primary care. *Am J Lifestyle Med* 2010;4:25-31.
- 39) Sleet DA, editor. Occupant protection and health promotion. *Health Educ Q* 1984;11(2).
- 40) Sleet DA, Wagenaar AC, Waller PF, editors. *Drinking, driving, and health promotion*. *Health Educ Q* 1989; 16:329-33.
- 41) Centers for Disease Control and Prevention. Motor vehicle safety: a 20th century public health achievement. *MMWR* 1999;48:369-74.
- 42) Gielen AC, Sleet D. Application of behavior change theories and methods to injury prevention. *Epidemiol Rev* 2003;25:65-76.
- 43) Dellinger A, Sleet DA, Jones B. Drivers, wheels and roads: motor vehicle safety in the twentieth century. In: Ward J, Warren C, editors. *Silent victories: the history and practice of public health in twentieth-century America*. New York: McGraw-Hill, 2007.
- 44) Sleet DA. Public health approaches to alcohol-impaired driving. Final technical report. Washington, DC: US Department of Transportation, National Highway Traffic Safety Administration, 1988 May.
- 45) Simons-Morton BG, Brink SG, Simons-Morton DG, et al. An ecological approach to the prevention of injuries due to drinking and driving. *Health Educ Q* 1989;16:397-411.
- 46) Sleet DA, Howat P, Elder R, Maycock B, Baldwin G, Shults R. Interventions to reduce impaired driving and traffic injury. In: Verster JC, Pandi-Perumal SR, Ramaekers JG, De Gier JJ, editors. *Drugs, driving and traffic safety*. Switzerland: Birkhauser Verlag, 2009.
- 47) Howat P, Sleet D, Elder R, Mayock B. Preventing alcohol-related traffic injury: a health promotion approach. *Traffic Inj Prev* 2004;5:208-19.
- 48) Peden M, Scurfield R, Sleet D, et al., editors. *World report on road traffic injury prevention*. Geneva, Switzerland: World Health Organisation, 2004.
- 49) Maurice P, Lavoie M, Laflamme L, Svanstrom L, Romer C, Anderson R. Safety and safety promotion: definitions for operational developments. *Inj Prev Contr* 2001;8:237-40.
- 50) United Nations Development Program. *Human Development Report 1994: New Dimensions of Human Security*. Available from: <http://hdr.undp.org/en/reports/global/hdr1994/> [Accessed February 3, 2010].
- 51) Labonte R. *Econology: integrating health and sustainable development*. Part One: theory and background. *Health Promot Int* 1991;6:49-65.
- 52) Moller J. Reconsidering community based interventions. *Inj Prev* 2004;10:2-3.



- 53) Coggan C, Bennett S. Community-based injury prevention programs. In: McClure R, Stevenson M, McEvoy S, editors. *The scientific basis of injury prevention and control*. Melbourne, Australia: IP Communications, 2004:347-58.
- 54) Hanson D, Hanson J, Vardon P, McFarlane K, Speare R, Durheim D. Documenting the development of social capital in a community safety promotion network: it's not what you know but who you know. *Health Promot J Austr* 2008;19:144-51.
- 55) Hanson D. *Community safety promotion networks from metaphor to methodology [dissertation]*. Queensland (Australia): James Cook University, School of Public Health Tropical Medicine and Rehabilitation Science, 2007.
- 56) Putnam R. Bowling alone: America's declining social capital. *J Democracy* 1995; 6:65-78.
- 57) Svanstrom L. *Evidenced-based injury prevention and safety promotion—a review of concepts and studies*. Stockholm, Sweden: Karolinska Institute, Department of Public Health Sciences, 1999.
- 58) WHO Collaborating Center on Community Safety Promotion. *Safe Communities Network Members*. Available from: [http://www.phs.ki.se/csp/who\\_safe\\_communities\\_network\\_en.htm](http://www.phs.ki.se/csp/who_safe_communities_network_en.htm) [Accessed February 4, 2010].
- 59) Spinks A, Turner C, Nixon J, McClure R. The "WHO Safe Communities" model for the prevention of injury in whole populations. *Cochrane Database Syst Rev*, 2009;8(3):CD004445.
- 60) Schlep L. Community intervention and changes in accident pattern in a rural Swedish municipality. *Health Promot* 1987;2:109-25.
- 61) Timpka T, Lindqvist K, Schelp L, Ahlgren M. Community-based injury prevention: effects on health care utilisation. *Int J Epidemiol* 1999;28:502-8.
- 62) Ytterstad B, Smith GS, Coggan CA. Harstad injury prevention study: prevention of burns in young children by community based intervention. *Inj Prev* 1998;4:176-80.
- 63) Ytterstad B. The Harstad Injury Prevention Study: a decade of community-based traffic injury prevention with emphasis on children. *Postal dissemination of local injury data can be effective*. *Int J Circumpolar Health* 2003;62(1):61-74.
- 64) Coggan C, Patterson P, Brewin M, Hooper R, Robinson E. Evaluation of the Waitakere Community Injury Prevention Project. *Inj Prev* 2000; 6:130-4.
- 65) Ozanne-Smith J, Day L, Stathakis V, Sherrard J. Controlled evaluation of a community based injury prevention program in Australia. *Inj Prev* 2002;8:18-22.
- 66) Davis E, Roselli T, McClure R. *The Child Injury Prevention Project: A Joint Department of Emergency Services and Queensland Health Initiative: Final Evaluation Report*. Available from: [http://www.health.qld.gov.au/chipp/documents/chipp\\_eval\\_report.pdf](http://www.health.qld.gov.au/chipp/documents/chipp_eval_report.pdf) [Accessed February 2, 2010].

# Preventing Unintentional Injuries in the Home Using the Health Impact Pyramid

Health Education & Behavior  
2015, Vol. 42(1S) 115S–122S  
© 2015 Society for Public  
Health Education  
Reprints and permissions:  
sagepub.com/journalsPermissions.nav  
DOI: 10.1177/1090198114568306  
heb.sagepub.com



Karin A. Mack, PhD<sup>1</sup>, Karen D. Liller, PhD<sup>2</sup>,  
Grant Baldwin, PhD, MPH<sup>1</sup>, and David Sleet, PhD<sup>1</sup>

## Abstract

Injuries continue to be the leading cause of death for the first four decades of life. These injuries result from a confluence of behavioral, physical, structural, environmental, and social factors. Taken together, these illustrate the importance of taking a broad and multileveled approach to injury prevention. Using examples from fall, fire, scald, and poisoning-related injuries, this article illustrates the utility of an approach that incorporates a social–environmental perspective in identifying and selecting interventions to improve the health and safety of individuals. Injury prevention efforts to prevent home injuries benefit from multilevel modifications of behavior, public policy, laws and enforcement, the environment, consumer products and engineering standards, as demonstrated with Frieden’s Health Impact Pyramid. A greater understanding, however, is needed to explain the associations between tiers. While interventions that include modifications of the social environment are being field-tested, much more work needs to be done in measuring social–environmental change and in evaluating these programs to disentangle what works best.

## Keywords

falls, fire, Health Impact Pyramid, injury prevention, poisonings

## The Burden of Injuries

Injuries continue to be the leading cause of death for the first four decades of life. Following motor vehicles, the home is the second most common location for fatal injuries in the United States (Runyan, Casteel, et al., 2005). The burden and costs of injuries at home are substantial. There are approximately 30,000 unintentional injury–related deaths at home each year (Mack, Rudd, Mickalide, & Ballesteros, 2013), and there are an average of 21 million medical visits made each year because of home injuries (Runyan, Perkis, et al., 2005). Leading causes of unintentional home injury deaths include falls, poisonings, and fire/burns. Together, these comprise 86% of all unintentional home injury deaths (Mack, Rudd, et al., 2013).

Home injuries result from a confluence of behavioral, physical, structural, environmental, and social factors, illustrating the importance of taking a broad multilevel approach to injury prevention that recognizes reciprocity between the person and the environment, as well as interdependence between points of intervention (Green & Kreuter, 2010). The objective of this manuscript is to illustrate the efficacy of this approach by focusing on several major causes of injuries in the home environment.

## Conceptual Framework

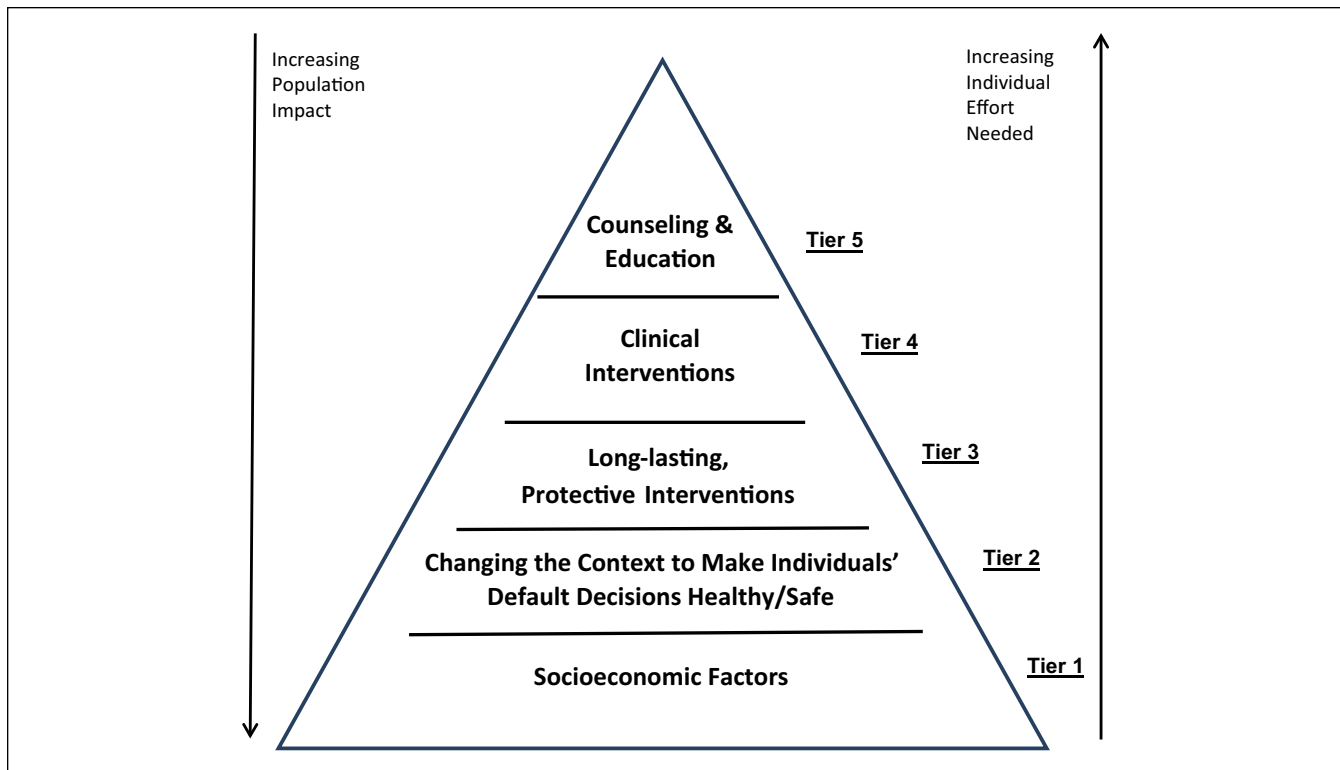
Recently, Frieden (2010) introduced a useful way to conceptualize and understand the potential public health impact of interventions. Briefly, he proposed a five-tiered Health Impact Pyramid (HIP), with interventions having the greatest population impact along the bottom tier and those with more limited broad public health impact at the top (Figure 1). Public health action and interventions represented by the bottom tier of the HIP require less individual effort. Programs at the higher tiers achieve limited public health impact largely because of their dependence on long-term individual behavior change and challenges of scalability. In other words, it is a challenge to introduce and scale up a program to larger and larger segments of the population that may require a tailored and culturally adapted modification to the intervention. And there may be substantial costs for that

<sup>1</sup>Centers for Disease Control and Prevention, Atlanta, GA, USA

<sup>2</sup>University of South Florida, Tampa, FL, USA

### Corresponding Author:

Karin Mack, Centers for Disease Control and Prevention, 4770 Buford Highway NE, F62, Atlanta, GA 30341, USA.  
Email: kmack@cdc.gov



**Figure 1.** Health Impact Pyramid.  
Note. Adapted from Frieden (2010).

method. Frieden notes that making the “default” choice healthy and safe is essential while understanding that there is a natural tension between protection and personal freedom. The core tenets of the HIP apply to all public health problems—including injury prevention in the home.

In Frieden’s HIP, efforts to address socioeconomic factors are at the base. The exact mechanism by which socioeconomic factors exert an effect on health are not always apparent, but poverty, low educational attainment, and relative deprivation can increase the exposure to environmental hazards. By the same token, socioeconomic factors also influence exposure to specific injury hazards, in the form of unsafe housing, neighborhood crime, inadequate access to preventive health care, increased crowding, and unaffordable safety devices.

The next tier up from the base includes public health interventions that change the environmental context for health and safety. These are generally policies to ensure safe products and environments, ensuring that the healthiest choice is the easiest choice to make. Interventions at this tier are hard to defeat. The third tier involves one-time protective interventions that can have long-term benefits. The fourth tier of the HIP involves direct clinical care that identifies potential risk and can modify care to reduce the risk of injury. At the top of the HIP are counseling and education practices.

Ideally, public health action for injury prevention engages all five tiers of the HIP to maximize synergy and the likelihood of long-term success. Some urge caution as not to lose sight of the interdependence of the levels (Green & Kreuter, 2010). Others argue that it is optimal to engage the levels simultaneously (Northridge & Freeman, 2011).

## Intervention Strategies

There are some compelling examples illustrating the potential of addressing multiple tiers of the HIP for injury prevention. In this section, we review knowledge about selected programs and policies as a means of preventing home injuries. We focus on falls, fires and burns, scalds, and poisonings as these are some of the leading causes of injury-related morbidity and mortality in the home.

### Fall Injury Prevention

Falls are a leading cause of home injuries (Mack, Rudd, et al., 2013; Runyan, Perkis, et al., 2005). Among children, young age ( $\leq 0-6$  years), male gender, and low socioeconomic status have been shown to be risk factors for fall injuries among children (Mao, McKenzie, Xiang, & Smith, 2009). Important fall-related hazards for children in the home include baby walkers, stairs, windows above ground

level, bathrooms, and certain furniture (Mack, Gilchrist, & Ballesteros, 2008; McDonald, Girasek, & Gielen, 2012). Beds have been identified as the leading product involved in injuries in infants, and as the leading product in the percentage of nonfatal home injury costs for children under 5 years of age (Mack, Gilchrist, & Ballesteros, 2007; Zaloshnja, Miller, Lawrence, & Romano, 2005). Outside play equipment, including play sets and trampolines, can also be dangerous for children. Residential hazards associated with falls among children include a lack of safety devices such as properly installed and used safety gates or window guards and structural defects (e.g., uneven floors; insufficient surfacing under play equipment).

Although few child fall prevention interventions have been rigorously evaluated, individual studies have suggested positive results. Voluntary regulations to extend the width of walkers (so as to not fit through doorways) and to modify the base to prevent tip-overs (Tier 2 “hard to defeat” interventions) were effective (Rodgers & Leland, 2008). Installing stair-gates has also been shown to be an effective home-based intervention (Kendrick et al., 2008). Other interventions that may help to prevent childhood fall injuries include window guards and window locks for windows above ground level (Tier 3) and balcony railings less than 4 inches apart (Tier 2). The evidence that window guards reduce childhood morbidity and mortality from falls comes primarily from dramatic results following a community-wide program to provide window guards in high-risk apartments, where falls declined 50% in the 2 years after the program’s inception (Barlow, Niemirska, Gandhi, & Leblanc, 1983; Spiegel & Lindaman, 1977). Building codes that require safe stair and balcony design and other home modifications are likely to be effective for fall prevention since they remove the need for home dwellers to modify their home for safety or to continually act to be safe—they make the default decision safety (Tier 2 of the HIP).

Among older adults, the leading cause of home unintentional injury death is falls. Individual behaviors and physical ability levels are important factors contributing to falls in older adults (Lord, Menz, & Sherrington, 2006; Stevens, Noonan, & Rubenstein, 2009), but falls in the home can also be prevented by recognizing and modifying home hazards and using key safety features. Structural residential hazards associated with falls among older adults include lack of handrails on stairs, lack of grab bars and nonslip surfaces in the bathroom, tripping or slipping hazards (e.g., throw rugs, waxed flooring), outdoor steps, inadequate lighting, and the presence of electrical or telephone cords in the walkway (Carter, Campbell, Sanson-Fisher, Redman, & Gillespie, 1997; Rosen, Mack, & Noonan, 2013). Homes can be designed and constructed to protect elderly occupants from fall-related injuries. The evidence that structural modifications, such as installation of handrails, grab bars, and improved lighting are promising interventions for reducing risk of falls among older adults comes from two systematic

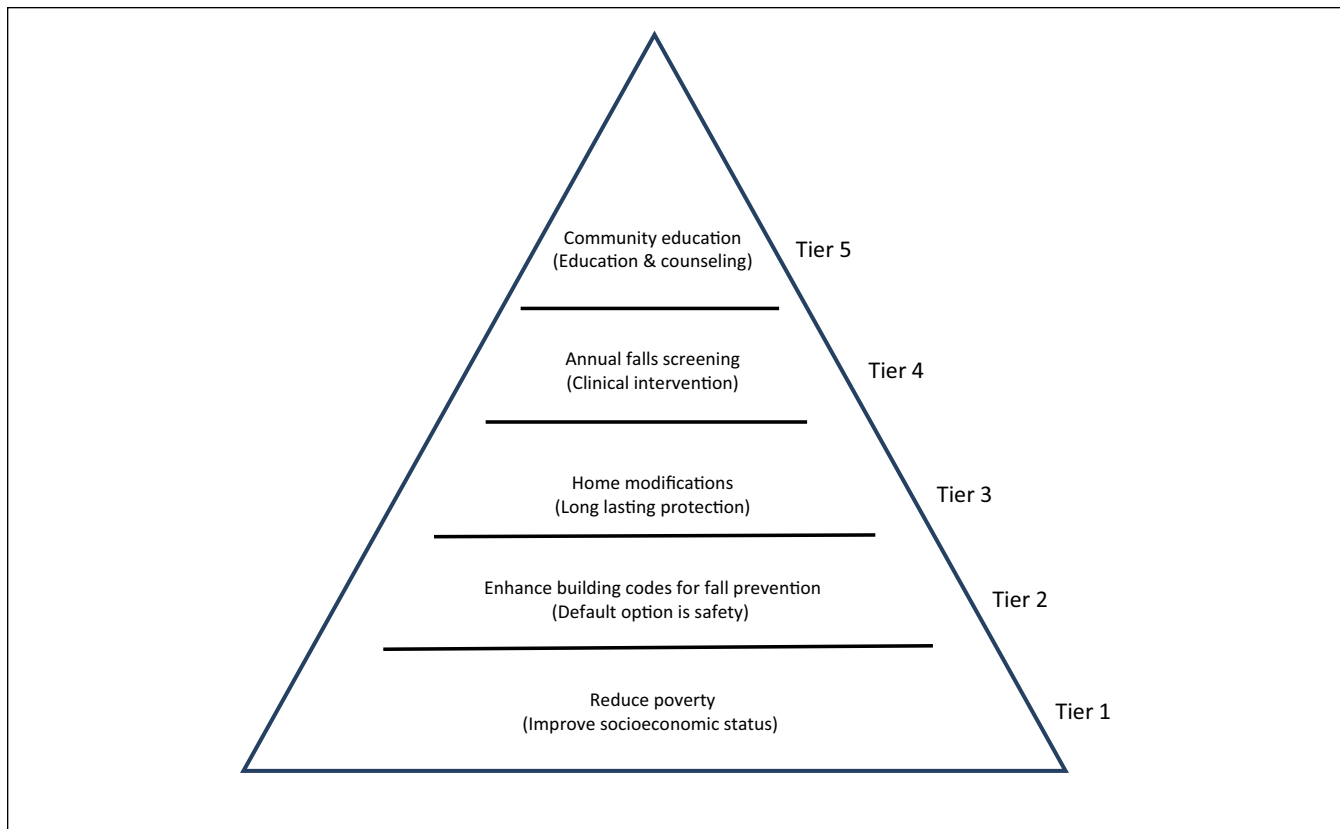
reviews (Gillespie et al., 2012; Turner et al., 2011). Fall prevention strategies that have been most effective have engaged multifaceted community-based approaches that consider the multiple causative factors in falls (individual and physical features—Tiers 2-5 of the HIP; Stevens, 2010).

Older adult fall prevention activities could feasibly cover all tiers of the HIP and are illustrated in Figure 2. For example, at the base (Tier 1) reducing poverty can contribute to better living standards (including living in safer housing that incorporates up-to-date safety specifications). Enhancing building codes for safer stair design, including requiring hand rails on both sides of the stairs, is an example of Tier 2 level change that is somewhat difficult to defeat (hand rails would be difficult to remove). Some fall prevention programs work with older persons to remove home fall hazards, such as throw rugs. The removal of the rug is an example of a home modification that could have long-lasting protective impact (Tier 3), although an individual or new tenant could purchase a new throw rug. Effective screening, polypharmacy review, and the use of electronic medical records are examples of a Tier 4 strategy for older adult fall prevention (clinical intervention). These interventions, however, are limited by access to screenings, adherence to medical advice, and widespread implementation. While individually effective, the population-level impact of screening, polypharmacy review, and electronic health record use would be limited. Finally, community programs that provide educational sessions to older persons (Tier 5, counseling and education) may spur the individual to take action, but consistent and repeated messaging would be needed to have large population impact. Current fall prevention programs often engage multiple levels of the HIP at the same time (e.g., Stepping On fall prevention program ([http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium/3.1\\_steppingon.html](http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium/3.1_steppingon.html))). Stepping On is a community-based program that combines education with action such as enhancing balance and strength, providing medication review, conducting vision screening, and assessing and remediating home hazards.

### *Fire and Burn Injury Prevention*

A primary risk factor for death and injury in residential fires is an absent or nonworking smoke alarm (Ballesteros & Kresnow, 2007; Istre, McCoy, Osborn, Barnard, & Bolton, 2001). Those at high risk of death due to fire or heightened difficulty in benefiting from smoke alarms include children 4 years and younger, older adults, those living in poverty, people with hearing, vision, or other physical or mental limitations or disabilities, and smokers (Istre et al., 2001). Households with income below the poverty level, with lower levels of education attainment, and those with older or no children were less likely to have a smoke alarm (Warda, Tenenbein, & Moffatt, 1999a). Additional groups at high risk for dying in a house fire include African Americans and people who live in





**Figure 2.** Health Impact Pyramid for older adult fall prevention.  
 Note. Adapted from Frieden (2010).

substandard homes where emergency egress is often compromised (U.S. Fire Administration, 2006). Studies show that even though 90% of homes in the United States have smoke alarms, about one quarter are not functional (Ballesteros & Kresnow, 2007; Hannon & Shai, 2003).

Homes that are built according to strict building codes that address fire-safe material and construction, electrical specifications, and residential sprinklers protect residents regardless of basic socioeconomic factors (Insurance Institute for Business & Home Safety, 2011). Requiring all structures to conform to a minimum fire-safety code makes safety the default choice—Tier 2 of the HIP. That is not to say that codes eliminate socioeconomic differences in housing relative to fire risk, but rather, they can act to mitigate levels of risk (Gielen et al., 2012; U.S. Surgeon General, 2009). To be effective, building codes need to be enforced and updated, and older housing stock would need to be brought up to current code standards. Broad programs to make safe homes available to low-income families (bottom tier of HIP) have been successful in reducing injuries (Phelan et al., 2011).

Smoke alarms are a strong tool in the arsenal of fire safety (Ahrens, 2014). Codes or regulations that require smoke alarms (see <http://www.ncsl.org/research/environment-and-natural-resources/smoke-and-carbon-monoxide-alarms-codes.aspx>) can affect population health for a small

investment. This benefit can occur outside of state and local regulations, for example, smoke alarms are required in all units owned by the U.S. Department of Housing and Urban Development (HUD) and all HUD-associated rental units. Smoke alarms fall into Tier 3 of the HIP because these protective interventions typically require some level of interaction with the resident. This may include installation and periodically testing the alarm to make sure it is operational and responding when the alarm sounds. And, unfortunately traditional smoke alarms did not require great effort to avoid the benefit. It was common to remove the battery to avoid nuisance alarms. Newer alarms are manufactured with long-lasting batteries sealed inside and the entire unit is replaced when the battery runs out, making it harder to defeat the protection. Alternatively, smoke alarms can be hardwired into the home's electrical system, making it even more effective as a long-lasting protection.

Residential sprinklers are also a promising strategy to prevent deaths and injuries due to fires (Hall, Ahrens, & Evarts, 2012; U.S. Fire Administration, 2008) and are gaining greater acceptance as a feature of new home construction, although families may be reluctant to retrofit their homes because of perceptions of high cost (National Fire Protection Association, 2009). Furthermore, these systems are also relatively difficult to defeat and fit then within Tier 2 (for state



requirements see <http://www.firesprinklerinitiative.org/legislation/sprinkler-requirements-by-state.aspx>).

It is critical, however, to pair improved access to fire safety products such as smoke alarms with fire safety education (HIP Tier 5) as education plays several key roles (Gielen, Sleet, & DiClemente, 2006). First, residents must know when they need a smoke alarm, where to purchase it, how to install it, and what to do when an alarm sounds. Only 23% of homes in the United States have a fire escape plan and practice it, yet all residents need to be prepared to exit a home when a smoke alarm sounds (Ballesteros & Kresnow, 2007). The fire escape plan should include at least two different ways of escape for each household resident and egress routes should not be blocked. A safe place should be designated outside of the home to meet after escaping the fire. Second, education is helpful in increasing the number of families with a functional smoke alarm (Kendrick et al., 2009). Both styles of smoke alarms (battery or hardwired) need to be checked regularly, and public service announcement reminders are often timed to coincide with when clocks are reset to daylight or standard times.

Public health interventions currently employed to reduce fire-related injuries and deaths fall largely within Tiers 5, 3, and 2 of the HIP. Pairing Tier 5 with interventions in Tiers 3 and/or 2 is an example of the interdependence between tiers so often necessary to achieve maximum impact (Warda, Tenenbein, & Moffatt, 1999b).

### *Scald Injury Prevention*

Scalds and thermal and electrical burns are another outcome of home injuries. Between 1997 and 2002, 78,000 infants and toddlers were treated annually in ambulatory care settings for injuries due to contact with a hot object or substance (Hammig & Ogletree, 2006). Exposure in an adult for 2 seconds to water at a temperature of 150°F can result in a third-degree burn, and for children it can happen even more quickly (Diller, 2006).

Scald injuries can be prevented. Five years after a 1983 Washington State law required new water heaters to be preset at 120°F at the factory, 77% of homes tested had safe tap water temperatures accompanied by a reduction in the frequency, morbidity, and mortality of tap water burn injuries in children (Erdmann, Feldman, Rivara, Heimbach, & Wall, 1991). This is a clear example of a change in Tier 2 of the HIP, making the default action safer leading to improved outcomes. Individuals do not, however, have to expend significant effort to change the default. Therefore, home safety education (Tier 5) should also be employed to increase the proportion of families that have a safe hot tap water temperature (Babul, Olsen, Janssen, McIntee, & Raina, 2007; Kendrick et al., 2009). Some successful strategies to teach to decrease scalds include setting the temperature in water heaters to 120°F or lower; installing hot water temperature limiters at the faucet; using roll up cords for electric coffee pots;

and using pots, pans, and kettles designed to be less likely to tip and spill hot liquids (Staunton, Frumkin, & Dannenberg, 2007). These strategies incorporate a mix of Tier 3 strategies (long-lasting protective interventions) and Tier 2 (changing the context to make safety hard to defeat) of Frieden's HIP. However, Tier 5 strategies (education and counseling) can be important adjuncts to improve consumer (proper) use and to encourage policy makers and manufacturers' behavior.

### *Poisoning Prevention*

The majority of poisoning deaths in the United States are unintentional and rates have been rising steadily since 1992. The American Association of Poison Control Centers reports that there were more than 2.2 million poisoning exposures in 2012 (Mowry, Spyker, Cantilena, Bailey, & Ford, 2013). Males have higher rates of poisoning death than females across all age groups, although the rate for females has been rising rapidly (Mack, Jones, & Paulozzi, 2013). Much of the change in poisoning-related deaths among adults, however, comes as a result of changes in prescription drug use and prescribing. And although many poisoning exposures occur in the home regardless of age, we focus this section on poisonings among children as the decline in their poisonings demonstrates how the HIP works to achieve success.

According to the 30th annual report of the American Association of Poison Control Centers National Poison Data System (NPDS; Mowry et al., 2013), most common exposures for children under age 5 years were ingestion of household products, such as cosmetics and personal care products, analgesics, household cleaning substances, foreign bodies/toys/miscellaneous, and topical preparations. Data from the Centers for Disease Control and Prevention (2012) show that there were only 42 fatal unintentional poisonings reported for children aged 0 to 4 years in 2012.

Studies show clear declines in poisonings after the passing of the Poison Prevention Packaging Act (PPPA) in 1970 (Clarke & Walton, 1979; Walton, 1982), which required a number of household substances to be packaged in child-resistant packaging. One study, however, revealed that a substantial number of the post-PPPA poisonings (as high as 40%) were due to either improperly secured safety caps or products that were not required to be packaged in a child-resistant container (Rodgers, 1996). While the safety caps allowed for the default of safety, safe behaviors are still needed to keep the caps on the bottles and not transfer the contents of the bottles to other containers (Tier 3 HIP).

Besides safety caps, other packaging of medication has shown to be important. This includes the use of unit-dose packaging where one pill or unit of medication resides in a see-through plastic blister (McDonald et al., 2012). To access the product, one has to force through the paper or foil backing. Poisonings can be averted by increasing the strength of the backing so that a child could not push through (Tier 2 HIP) but also by the sheer fact there is only one pill or unit of

medication available, making it unable to defeat (McDonald et al., 2012). Using annual reports from the American Association of Poison Control Centers, Tenenbein (2005) showed that there was a decrease in the incidence of nonintentional ingestion of iron by young children and a decrease in the mortality of poisoning by iron after unit-dose packaging was first introduced. This research helped validate unit-dose packaging as an effective strategy for the prevention of iron poisoning and iron poisoning deaths in young children.

In addition to lower levels of Frieden's HIP playing important roles in poisoning prevention for children, higher levels have contributions as well. Tier 3 of the HIP includes parents and other caregivers storing medications and other poisonous substances away from children, preferably locked in inaccessible cabinets or drawers. Doing this however, does not negate the importance of parental supervision. Schillie, Shehab, Thomas, and Budnitz (2009) used the National Electronic Injury Surveillance System (NEISS) to estimate the number of medication overdoses of children leading to emergency department visits. The results showed that four-fifths (or 82.2%) of the overdoses of children  $\leq 18$  years of age were from unsupervised ingestions and nearly all (97%) of the medication overdose cases of children aged 1 to 5 years were due to unsupervised ingestions. The authors contend that since young children have such curiosity and engage in hand-to-mouth behavior, engineering strategies such as unit-dose packaging and use of adaptors on bottles of liquid medication that serve as a needleless syringe and provide less content, are important. Tier 4 is demonstrated by the availability of clinical support from Poison Control Centers (universal phone number 1-800-222-1222), pediatricians, and other health care professionals; however, clinical intervention is prompted by telephone-related counseling and education (Tier 5), demonstrating the interdependency needed for impact. Educating children and parents about poisoning and poison prevention through community programs and interventions also demonstrates Tier 5 of the HIP, but may be limited by efficacy, reach, and scalability. Although implementing higher tiers of the HIP alone may not lead to clear declines in poisonings, their use in combination with lower levels will strengthen the overall impact. For example, while child-resistant caps on medicine may be a Tier 3 strategy (long-lasting protective intervention), supervisors of children will still need to be vigilant to insure that lids on medicines are replaced after opening. Again, this illustrates the importance of Tier 5 strategies to educate and counsel parents and providers.

## Conclusions

Injuries are not accidents: they are predictable and like many diseases, preventable. Injuries are related to many factors that span individual, interpersonal, organizational, community, and societal determinants. Effectively managing context by implementing the most appropriate mix of strategies is a critical factor for success (Hanson, Finch, Allegrante, & Sleet, 2012). While the HIP can illustrate the relative influence of five categories of interventions, their interdependence and synergistic

effect cannot be overlooked (Green & Kreuter, 2010). Injury prevention, like other health problems, is most effectively addressed using a multilevel perspective (McLeroy, Bibeau, Steckler, & Glanz, 1988).

The costs and consequences of home injuries are significant, both on families and society. Injury prevention efforts to prevent home injuries will benefit from changes in behavior, public policy, laws and enforcement, environmental change, as well as improvements in consumer products and engineering standards. While injury statistics guide our practice and research to prevent home injuries, a more powerful force are the people behind the statistics whose lives can be spared and whose disabilities can be prevented. Reducing poverty, changing the social and environmental context (making the safe choices easy choices or the default ones), implementing one-time interventions that last, delivering clinical interventions, and providing essential counseling and education to facilitate individual behavior change are keys to effective home injury prevention.

While interventions that include modifications of these factors are being field-tested, much more work needs to be done in measuring change and in evaluating programs that target the lower HIP tiers. In this context, understanding the important role for theories and theory-led interventions will be critical (Hayden, 2014), in addition to the prudent use of education and behavior change strategies that can support or promote structural and environmental change (Gielen, Sleet, & Parker, 2014). We can study the influence of such issues as cultural norms, socialization, social capital, concentration of poverty, and economic inequalities, on injury and its prevention, independent of the individual risk and protective factors involved; however, as Lieberman, Golden, and Earp (2013) point out, we must also be cognizant of the potential that structural and environmental change in the lower tiers of HIP may ignore or de-empower individuals and communities because "... efforts to tweak physical, social, economic, or political conditions in order to produce behavior change, without the active engagement of the individual affected, reflect a decision to prioritize certain choices over others" (Lieberman et al., 2013, p. 522).

We do not always need to wait for a complete understanding of what causes a condition to advance prevention. There are often natural experiments that arise out of a community's desire to address social issues for reasons other than injury prevention that provide the opportunity to understand a multitude of inter-related factors and their relation to injury. For example, can poverty reduction or job-training programs also prevent child injury? Do efforts to provide social support to parents reduce unintentional childhood injury and maltreatment? How can efforts in the top tiers of HIP support or enhance efforts in the lower tiers? Studying the effect of programs and policies such as these can also inform our understanding of the pathways connecting the social environment and injury. Modifications that change the socio environmental conditions and those that make healthy and safe choices the default option (notably the lower two tiers of the HIP) hold the most promise to stimulate large populations changes in injuries. But as Green and Kreuter

(2010) point out in their response to Frieden's HIP, selecting among the various tiers of the pyramid ". . . might create an 'either/or' rather than an 'and' mentality about intervention strategies, losing sight of their interdependence" (p. 1824). Research and programmatic development across levels in the HIP, and investigating the interdependence between the levels, can lead to new discoveries, paradigms, and theories that will hold great potential for advancing the goal to reduce morbidity and mortality from home injuries even further.

### Authors' Note

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

### Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

### Supplement Issue Note

This article is part of a *Health Education & Behavior* supplement, "The Evidence for Policy and Environmental Approaches to Promoting Health," which was supported by a grant to the Society for Public Health Education (SOPHE) from the Robert Wood Johnson Foundation. The entire supplemental issue is open access at [http://heb.sagepub.com/content/42/1\\_suppl.toc](http://heb.sagepub.com/content/42/1_suppl.toc).

### References

- Ahrens, M. (2014). *Smoke alarms in U.S. Home fires*. Retrieved from <http://www.nfpa.org/~media/Files/Research/NFPA%20reports/Fire%20Protection%20Systems/ossmokealarms.pdf>
- Babul, S., Olsen, L., Janssen, P., McIntee, P., & Raina, P. (2007). A randomized trial to assess the effectiveness of an infant home safety programme. *International Journal of Injury Control and Safety Promotion, 14*, 109-117. doi:10.1080/17457300701272474
- Ballesteros, M. F., & Kresnow, M. J. (2007). Prevalence of residential smoke alarms and fire escape plans in the U.S.: Results from the Second Injury Control and Risk Survey (ICARIS-2). *Public Health Reports, 122*, 224-231.
- Barlow, B., Niemirska, M., Gandhi, R. P., & Leblanc, W. (1983). Ten years of experience with falls from a height in children. *Journal of Pediatric Surgery, 18*, 509-511.
- Carter, S. E., Campbell, E. M., Sanson-Fisher, R. W., Redman, S., & Gillespie, W. J. (1997). Environmental hazards in the homes of older people. *Age & Ageing, 26*, 195-202. doi:10.1093/ageing/26.3.195
- Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. (2012). *Injury prevention and control: Data & Statistics* (Web-based Injury Statistics Query and Reporting System [WISQARS]). Retrieved from <http://www.cdc.gov/injury/wisqars>
- Clarke, A., & Walton, W. W. (1979). Effect of safety packaging on aspirin ingestion by children. *Pediatrics, 63*, 687-693.
- Diller, K. R. (2006). Adapting adult scald safety standards to children. *Journal of Burn Care & Research, 27*, 314-322. doi:10.1097/01.Bcr.0000216473.50837.12
- Erdmann, T. C., Feldman, K. W., Rivara, F. P., Heimbach, D. M., & Wall, H. A. (1991). Tap water burn prevention: The effect of legislation. *Pediatrics, 88*, 572-577.
- Frieden, T. R. (2010). A framework for public health action: The health impact pyramid. *American Journal of Public Health, 100*, 590-595. doi:10.2105/AJPH.2009.185652
- Gielen, A., Shields, W., McDonald, E., Frattaroli, S., Bishai, D., & Ma, X. (2012). Home safety and low-income urban housing quality. *Pediatrics, 130*, 1053-1059. doi:10.1542/peds.2012-1531
- Gielen, A., Sleet, D. A., & Parker, E. (2014). Unintentional injury and behavior change. In S. Kahan, C. A. Gielen, P. J. Fagan, & L. W. Green (Eds.), *Health behavior change in populations* (pp. 294-315). Baltimore, MD: Johns Hopkins University Press.
- Gielen, A., Sleet, D., & DiClemente, R. (2006). *Injury and violence prevention: Behavioral science theories, methods, and applications* (1st ed.). San Francisco, CA: Jossey-Bass.
- Gillespie, L. D., Robertson, M. C., Gillespie, W. J., Sherrington, C., Gates, S., Clemson, L. M., & Lamb, S. E. (2012). Interventions for preventing falls in older people living in the community. *Cochrane Database of Systematic Reviews, 9*, CD007146. doi:10.1002/14651858.Cd007146.Pub3
- Green, L. W., & Kreuter, M. W. (2010). Evidence hierarchies versus synergistic interventions. *American Journal of Public Health, 100*, 1824-1825. doi:10.2105/AJPH.2010.197798
- Hall, J. R. Jr., Ahrens, M., & Evarts, B. (2012). *Sprinkler impact on fire injury* (Fire Protection Research Foundation Rep.). Quincy, MA: National Fire Protection Association. Retrieved from <http://www.nfpa.org/research/fire-protection-research-foundation/reports-and-proceedings/suppression/home-fire-sprinklers/sprinkler-impact-on-fire-injury>
- Hammig, B. J., & Ogletree, R. J. (2006). Burn injuries among infants and toddlers in the United States, 1997-2002. *American Journal of Health Behavior, 30*, 259-267.
- Hannon, L., & Shai, D. (2003). The truly disadvantaged and the structural covariates of fire death rates. *Social Science Journal, 40*, 129-136. doi:10.1016/S0362-3319(02)00263-X
- Hanson, D. W., Finch, C. F., Allegrante, J. P., & Sleet, D. (2012). Closing the gap between injury prevention research and community safety promotion practice: Revisiting the public health model. *Public Health Reports, 127*, 147-155.
- Hayden, J. (2014). *Introduction to health behavior theory* (2nd ed.). Burlington, MA: Jones & Bartlett Learning.
- Insurance Institute for Business & Home Safety. (2011). *Rating the states Atlantic and Gulf Coast states. An assessment of residential building code and enforcement systems for life safety and property protection in hurricane-prone regions*. Retrieved from <http://www.disastersafety.org/wp-content/uploads/ibhs-rating-the-states.pdf>
- Istre, G. R., McCoy, M. A., Osborn, L., Barnard, J. J., & Bolton, A. (2001). Deaths and injuries from house fires. *New England Journal of Medicine, 344*, 1911-1916. doi:10.1056/NEJM200106213442506
- Kendrick, D., Smith, S., Sutton, A. J., Mulvaney, C., Watson, M., Coupland, C., & Mason-Jones, A. (2009). The effect of education and home safety equipment on childhood thermal injury prevention: Meta-analysis and meta-regression. *Injury Prevention, 15*, 197-204. doi:10.1136/ip.2008.020677
- Kendrick, D., Watson, M. C., Mulvaney, C. A., Smith, S. J., Sutton, A. J., Coupland, C. A., & Mason-Jones, A. J. (2008).



- Preventing childhood falls at home: meta-analysis and meta-regression. *American Journal of Preventive Medicine*, 35, 370-379. doi:10.1016/j.amepre.2008.06.038
- Lieberman, L., Golden, S. D., & Earp, J. A. (2013). Structural approaches to health promotion: What do we need to know about policy and environmental change? *Health Education & Behavior*, 40, 520-525. doi:10.1177/1090198113503342
- Lord, S. R., Menz, H. B., & Sherrington, C. (2006). Home environment risk factors for falls in older people and the efficacy of home modifications. *Age and Ageing*, 35(Suppl. 2), ii55-ii59. doi:10.1093/ageing/af088
- Mack, K. A., Gilchrist, J., & Ballesteros, M. F. (2007). Bunk bed-related injuries sustained by young children treated in emergency departments in the United States, 2001-2004, National Electronic Injury Surveillance System: All injury program. *Injury Prevention*, 13, 137-140. doi:10.1136/ip.2006.013193
- Mack, K. A., Gilchrist, J., & Ballesteros, M. F. (2008). Injuries among infants treated in emergency departments in the United States, 2001-2004. *Pediatrics*, 121, 930-937. doi:10.1542/peds.2007-1731
- Mack, K. A., Jones, C., & Paulozzi, L. J. (2013). Vital signs: Overdoses of prescription opioid pain relievers and other drugs among women—United States, 1999-2010. *MMWR Morbidity and Mortality Weekly Report*, 62(26), 537-542.
- Mack, K. A., Rudd, R. A., Mickalide, A. D., & Ballesteros, M. F. (2013). Fatal unintentional injuries in the home in the U.S., 2000-2008. *American Journal of Preventive Medicine*, 44, 239-246. doi:10.1016/j.amepre.2012.10.022
- Mao, S. J., McKenzie, L. B., Xiang, H., & Smith, G. A. (2009). Injuries associated with bathtubs and showers among children in the United States. *Pediatrics*, 124, 541-547. doi:10.1542/peds.2008-2489
- McDonald, E., Girasek, D., & Gielen, A. (2012). Home injuries. In K. Liller (Ed.), *Injury prevention for children and adolescents: Research, practice, and advocacy*. Washington, DC: American Public Health Association.
- McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly*, 15, 351-377.
- Mowry, J. B., Spyker, D. A., Cantilena, L. R. Jr., Bailey, J. E., & Ford, M. (2013). 2012 Annual report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 30th annual report. *Clinical Toxicology*, 51, 949-1229. doi:10.3109/15563650.2013.863906
- National Fire Protection Association. (2009). *Comparative analysis of housing cost and supply impacts of sprinkler ordinances at the community level*. Quincy, MA: Author. Retrieved from [http://www.firesprinklerinitiative.org/~media/Fire%20Sprinkler%20Initiative/Files/Reports/FSI\\_Comparison\\_Analysis\\_Final\\_Report.pdf](http://www.firesprinklerinitiative.org/~media/Fire%20Sprinkler%20Initiative/Files/Reports/FSI_Comparison_Analysis_Final_Report.pdf)
- Northridge, M. E., & Freeman, L. (2011). Urban planning and health equity. *Journal of Urban Health*, 88, 582-597. doi:10.1007/s11524-011-9558-5
- Phelan, K. J., Khoury, J., Xu, Y., Liddy, S., Hornung, R., & Lanphear, B. P. (2011). A randomized controlled trial of home injury hazard reduction: The HOME injury study. *Archives of Pediatrics & Adolescent Medicine*, 165, 339-345. doi:10.1001/archpediatrics.2011.29
- Rodgers, G. B. (1996). The safety effects of child-resistant packaging for oral prescription drugs. Two decades of experience. *JAMA Journal of the American Medical Association*, 275, 1661-1665.
- Rodgers, G. B., & Leland, E. W. (2008). A retrospective benefit-cost analysis of the 1997 stair-fall requirements for baby walkers. *Accident Analysis & Prevention*, 40, 61-68. doi:10.1016/j.aap.2007.04.003
- Rosen, T., Mack, K. A., & Noonan, R. K. (2013). Slipping and tripping: fall injuries in adults associated with rugs and carpets. *Journal of Injury & Violence Research*, 5, 61-69. doi:10.5249/jivr.v5i1.177
- Runyan, C. W., Casteel, C., Perkis, D., Black, C., Marshall, S. W., Johnson, R. M., . . . Viswanathan, S. (2005). Unintentional injuries in the home in the United States Part I: Mortality. *American Journal of Preventive Medicine*, 28, 73-79. doi:10.1016/j.amepre.2004.09.010
- Runyan, C. W., Perkis, D., Marshall, S. W., Johnson, R. M., Coyne-Beasley, T., Waller, A. E., . . . Baccaglioni, L. (2005). Unintentional injuries in the home in the United States Part II: Morbidity. *American Journal of Preventive Medicine*, 28, 80-87. doi:10.1016/j.amepre.2004.09.017
- Schillie, S. F., Shehab, N., Thomas, K. E., & Budnitz, D. S. (2009). Medication overdoses leading to emergency department visits among children. *American Journal of Preventive Medicine*, 37, 181-187. doi:10.1016/j.amepre.2009.05.018
- Spiegel, C. N., & Lindaman, F. C. (1977). Children can't fly: A program to prevent childhood morbidity and mortality from window falls. *American Journal of Public Health*, 67, 1143-1147.
- Staunton, C., Frumkin, H., & Dannenberg, A. (2007). Changing the built environment to prevent injury. In L. S. Doll, S. E. Bonzo, J. A. Mercy & D. A. Sleet (Eds.), *Handbook of injury and violence prevention* (pp. 257-276). New York, NY: Springer.
- Stevens, J. (2010). *A CDC compendium of effective fall interventions: What works for community-dwelling older adults*. Atlanta, GA: Centers for Disease Control and Prevention. Retrieved from <http://www.cdc.gov/HomeandRecreationalSafety/Falls/compendium.html>
- Stevens, J., Noonan, R., & Rubenstein, L. (2009). Older adult fall prevention: Perceptions, beliefs, and behaviors. *American Journal of Lifestyle Medicine*, 4, 16-20. doi:10.1177/1559827609348350
- Tenenbein, M. (2005). Unit-dose packaging of iron supplements and reduction of iron poisoning in young children. *Archives of Pediatrics & Adolescent Medicine*, 159, 557-560.
- Turner, S., Arthur, G., Lyons, R. A., Weightman, A. L., Mann, M. K., Jones, S. J., . . . Lannon, S. (2011). Modification of the home environment for the reduction of injuries. *Cochrane Database of Systematic Reviews*, 2, CD003600. doi:10.1002/14651858.Cd003600.Pub3
- U.S. Fire Administration. (2006). *Fire and the older adult*. (FA-300). Washington, DC: Government Printing Office.
- U.S. Fire Administration. (2008). *Home fire protection residential fire sprinkler systems save lives* (FA-43/February). Retrieved from [http://www.usfa.fema.gov/downloads/pdf/publications/fa\\_43.pdf](http://www.usfa.fema.gov/downloads/pdf/publications/fa_43.pdf)
- U.S. Surgeon General. (2009). *The Surgeon General's call to action to promote healthy homes*. Rockville, MD: Office of the Surgeon General (U.S.).
- Walton, W. W. (1982). An evaluation of the Poison Prevention Packaging Act. *Pediatrics*, 69, 363-370.
- Warda, L., Tenenbein, M., & Moffatt, M. E. (1999a). House fire injury prevention update. Part I. A review of risk factors for fatal and non-fatal house fire injury. *Injury Prevention*, 5, 145-150.
- Warda, L., Tenenbein, M., & Moffatt, M. E. (1999b). House fire injury prevention update. Part II. A review of the effectiveness of preventive interventions. *Injury Prevention*, 5, 217-225.
- Zaloshnja, E., Miller, T. R., Lawrence, B. A., & Romano, E. (2005). The costs of unintentional home injuries. *American Journal of Preventive Medicine*, 28, 88-94. doi:10.1016/j.amepre.2004.09.016

7. Kaelber DC, Jha AK, Johnston D, et al. A research agenda for personal health records (PHRs). *J Am Med Inform Assoc.* 2008;15(6):729–736.
8. Chan KS, Weiner JP. Electronic health record-based quality indicators for ambulatory care: findings from a review of the literature. Available at: [http://healthit.ahrq.gov/portal/server.pt/gateway/PTARGS\\_0\\_3882\\_217665\\_0\\_0\\_18/e-indicator-lit-review.pdf](http://healthit.ahrq.gov/portal/server.pt/gateway/PTARGS_0_3882_217665_0_0_18/e-indicator-lit-review.pdf). Accessed January 5, 2010.
9. Hillis SD, Owens LM, Marchbanks PA, et al. Recurrent chlamydial infections increase the risks of hospitalization for ectopic pregnancy and pelvic inflammatory disease. *Am J Obstet Gynecol.* 1997;176(1):103–107.
10. Brunham RC, Maclean IW, Binns B, et al. *Chlamydia trachomatis*: its role in tubal infertility. *J Infect Dis.* 1985;152(6):1275–1282.
11. Varon J, Marik PE. Clinical information systems and the electronic medical record in the intensive care unit. *Curr Opin Crit Care.* 2002;8(6):616–624.
12. Shapiro JS, Kannry J, Lipton M, et al. Approaches to patient health information exchange and their impact on emergency medicine. *Ann Emerg Med.* 2006;48(4):426–432.
13. Menke JA, Broner CW, Campbell DY, et al. Computerized clinical documentation system in the pediatric intensive care unit. *BMC Med Inform Decis Mak.* 2001;1:3. Available at: <http://www.biomedcentral.com/1472-6947/1/3>. Accessed January 5, 2010.
14. Evans KD, Benham SW, Garrard CS. A comparison of handwritten and computer-assisted prescriptions in an intensive care unit. *Crit Care.* 1998;2(2):73–78.
15. Centers for Disease Control and Prevention. Sexually transmitted diseases treatment guidelines, 2006. *MMWR Recomm Rep.* 2006;55(RR-11):1–94.
16. Centers for Disease Control and Prevention. Update to CDC's sexually transmitted diseases treatment guidelines, 2006: fluoroquinolones no longer recommended for treatment of gonococcal infections. *MMWR Morb Mortal Wkly Rep.* 2007;56(14):332–336.
17. Kuperman GJ, Bobb A, Payne TH, et al. Medication-related clinical decision support in computerized provider order entry systems: a review. *J Am Med Inform Assoc.* 2007;14(1):29–40.
18. Hunt DL, Haynes RB, Hanna SE, et al. Effects of computer-based clinical decision support systems on physician performance and patient outcomes: a systematic review. *JAMA.* 1998;280(15):1339–1346.
19. Pathela P, Harvey K, Blank S, et al. The utility of male urethral gram stain for informing treatment decisions on the day of clinic visit. Paper presented at: 17th Meeting of the International Society for Sexually Transmitted Disease Research/10th International Union against Sexually Transmitted Infections World Congress; July 29–August 1, 2007; Seattle, WA.
20. Handel S, Schillinger JA, Borrelli J, et al. STD testing at emergency contraception visits to local STD clinics. Paper presented at: 2008 National STD Prevention Conference; March 10–13, 2008; Chicago, IL.
21. Borrelli J, Paneth-Pollak R, Wright S, et al. The impact of introducing “express visits” for asymptomatic persons seeking STD services in a busy urban STD clinic system, 2005–2006. Paper presented at: 2008 National STD Prevention Conference; March 10–13, 2008; Chicago, IL.

## A Framework for Public Health Action: The Health Impact Pyramid

A 5-tier pyramid best describes the impact of different types of public health interventions and provides a framework to improve health. At the base of this pyramid, indicating interventions with the greatest potential impact, are efforts to address socioeconomic determinants of health. In ascending order are interventions that change the context to make individuals' default decisions healthy, clinical interventions that require limited contact but confer long-term protection, ongoing direct clinical care, and health education and counseling.

Interventions focusing on lower levels of the pyramid tend to be more effective because they reach broader segments of society and require less individual effort. Implementing interventions at each of the levels can achieve the maximum possible sustained public health benefit. (*Am J Public Health.* 2010;100:590–595. doi:10.2105/AJPH.2009.185652)

Thomas R. Frieden, MD, MPH

### LIFE EXPECTANCY IN DEVELOPED COUNTRIES HAS INCREASED

from less than 50 years in 1900 to nearly 80 years today.<sup>1</sup> The greatest improvement occurred in the first half of the 20th century, when life expectancy in the United States and many parts of Europe increased by an average of 20 years,<sup>2</sup> largely because of universal availability of clean water and rapid declines in infectious disease,<sup>3</sup> as well as broad economic growth, rising living standards, and improved nutritional status.<sup>4</sup> Smaller gains in the latter half of the 20th century resulted primarily from advances in treatment of cardiovascular disease and control of its risk factors (i.e., smoking, high blood pressure, and high cholesterol).<sup>5</sup>

The traditional depiction of the potential impact of health care interventions is a four-tier pyramid, with the bottom level representing population-wide interventions that have the greatest impact

and ascending levels with decreasing impact that represent primary, secondary, and tertiary care.<sup>6</sup> Other frameworks more specific to public health have been proposed. Grizzell's 6-tier intervention pyramid emphasizes policy change, environmental enhancement, and community and neighborhood collaboration.<sup>7</sup> Hamilton and Bhatti's 3-dimensional population health and health promotion cube incorporates 9 health determinants (e.g., healthy child development, biology and genetics, physical environments, working conditions, and social support networks) and evidence-based actions to address them (e.g., reorienting health services, creating supportive environments, enacting healthy public policy, and strengthening community action).<sup>8</sup> The maternal and child health pyramid of health services, developed by the US Health Resources and Services Administration, consists of 4 levels

of services used by states to allocate resources for mothers and children.<sup>6</sup> Infrastructure building (e.g., monitoring, training, systems of care, and information systems) is at the bottom of the pyramid, followed by population-based services (e.g., newborn screening, immunization, and lead screening) and enabling services (e.g., transportation, translation, case management, and coordination with Medicaid), with direct health care services at the top.

All of these models, however, focus most of their attention on various aspects of clinical health services and their delivery and, to a lesser extent, health system infrastructure. Although these are of critical importance, public health involves far more than health care. The fundamental composition, organization, and operation of society form the underpinnings of the determinants of health, yet they are often overlooked in the development frameworks to

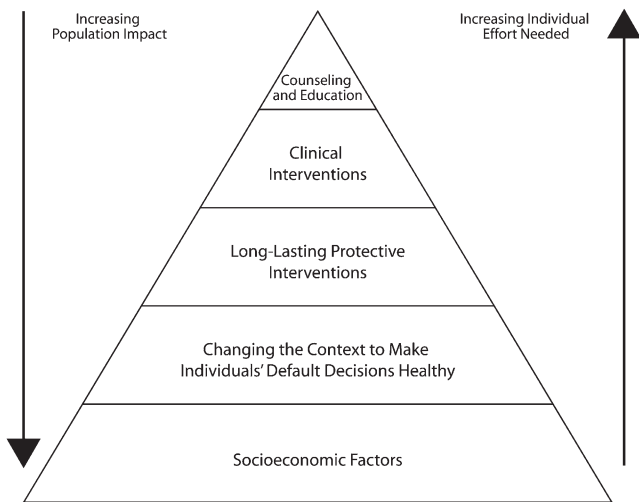


FIGURE 1—The health impact pyramid.

(e.g., poverty reduction, improved education), often referred to as social determinants of health, that help form the basic foundation of a society.<sup>11,12</sup> Socioeconomic status is a strong determinant of health, both within and across countries.<sup>13</sup> Although the exact mechanisms by which socioeconomic status exerts its effects are not always apparent, poverty, low educational attainment, relative deprivation, and lack of access to sanitation increase exposure to environmental hazards.<sup>14</sup> Educational status is also tightly correlated with cardiovascular risk factors, including smoking.<sup>15,16</sup>

Although poverty increases ill health within a society, economic development can also increase illness and death from noncommunicable disease. As living standards and life expectancy improve, risk for cardiovascular disease and some cancers increases.<sup>17</sup> Much of this increase results from modifiable risk factors related to overconsumption of tobacco, unhealthy food, and alcohol, with a concurrent decrease in physical activity. Greater wealth can also lead to more roads and an increase in motor vehicle use, which can result in increased outdoor air pollution and more injury and death from traffic crashes.

A third of the world's urban population lives in slums.<sup>18</sup> Substantial health improvements in high-poverty areas will require improved economic opportunities and infrastructure, including reliable electric power, sanitation, transport, and other basic services.<sup>19</sup> Clean water and improved sanitation introduced in the United States in the late 19th and early 20th centuries may have been primarily responsible for reducing mortality rates by about half and child mortality rates by nearly two thirds in major cities.<sup>20</sup>

Still, more than 900 million people worldwide have no access to clean drinking water and about 2.5 billion have no access to adequate sanitation.<sup>21</sup> As the World Health Organization's Commission on Social Determinants of Health reported, "Social injustice is killing people on a grand scale."<sup>11(p26)</sup>

### Changing the Context to Encourage Healthy Decisions

The second tier of the pyramid represents interventions that change the environmental context to make healthy options the default choice, regardless of education, income, service provision, or other societal factors. The defining characteristic of this tier of intervention is that individuals would have to expend significant effort not to benefit from them. For example, fluoridated water—which is difficult to avoid when it is the public supply—not only improves individual health by reducing tooth decay,<sup>22</sup> but also provides economic benefits by reducing health spending and productivity losses. In countries without either adequate natural or added fluoridation, health authorities are limited to counseling interventions, such as encouraging toothbrushing.

Other contextual changes that create healthier defaults include clean water, air, and food; improvements in road and vehicle design; elimination of lead and asbestos exposures; and iodization of salt.<sup>22</sup> The potential societal impact of decreasing cardiovascular risk factors by changing from saturated to unsaturated cooking oils was demonstrated in Mauritius<sup>23</sup>; eliminating artificial *trans* fat in food is another way to prevent cardiovascular disease.<sup>24</sup> Strategies to create healthier environmental contexts also include

describe health system structures. As a result, existing frameworks accurately describe neither the constituent elements nor the role of public health.

### A FIVE-TIER PYRAMID

An alternative conceptual framework for public health action is a 5-tier health impact pyramid (Figure 1). In this pyramid, efforts to address socioeconomic determinants are at the base, followed by public health interventions that change the context for health (e.g., clean water, safe roads), protective interventions with long-term benefits (e.g., immunizations), direct clinical care, and, at the top, counseling and education. In general, public action and interventions represented by the base of the pyramid require less individual effort and have the greatest population impact. However, because these actions may address social and economic structures of society, they can be more controversial, particularly if the public

does not see such interventions as falling within the government's appropriate sphere of action.

Interventions at the top tiers are designed to help individuals rather than entire populations, but they could theoretically have a large population impact if universally and effectively applied. In practice, however, even the best programs at the pyramid's higher levels achieve limited public health impact, largely because of their dependence on long-term individual behavior change.<sup>9</sup> As Rose writes,

Personal life-style is socially conditioned. . . . Individuals are unlikely to eat very differently from the rest of their families and social circle. . . . It makes little sense to expect individuals to behave differently than their peers; it is more appropriate to seek a general change in behavioural norms and in the circumstances which facilitate their adoption.<sup>10(p135)</sup>

### Socioeconomic Factors

The bottom tier of the health impact pyramid represents changes in socioeconomic factors



designing communities to promote increased physical activity; enacting policies that encourage public transit, bicycling, and walking instead of driving; designing buildings to promote stair use; passing smoke-free laws; and taxing tobacco, alcohol, and unhealthy foods such as soda and other sugar-sweetened beverages.

Cardiovascular disease risk factors (e.g., hypertension) are currently addressed at the individual level through screening and medication. But even assuming perfect treatment, this approach fails to prevent almost half of the disease burden caused by elevated blood pressure; cardiovascular risk increases with systolic blood pressure above 115 mm Hg, a level at which medical treatment is not recommended currently.<sup>25,26</sup> Changing the environmental context so that individuals can easily take heart-healthy actions in the normal course of their lives can have a greater population impact than clinical interventions that treat individuals.

For example, modern diets contain many times the minimum daily requirement of sodium—mostly from packaged foods and restaurant meals—making it difficult for individuals to control their intake.<sup>27</sup> Reducing dietary sodium can reduce hypertension at the population level.<sup>28,29</sup> A healthier food environment can be created by decreasing salt in packaged foods. This is happening in the United Kingdom, which introduced four-year sodium reduction targets,<sup>30</sup> and in Finland, where dietary sodium intake decreased approximately 25% in the past 30 years.<sup>31</sup>

### Long-Lasting Protective Interventions

The third level of the pyramid represents 1-time or infrequent

protective interventions that do not require ongoing clinical care; these generally have less impact than interventions represented by the bottom 2 tiers because they necessitate reaching people as individuals rather than collectively. Historic examples include immunization, which prevents 2.5 million deaths per year among children globally.<sup>32</sup> Another example is colonoscopy, which can significantly reduce colon cancer and is only needed every 5 to 10 years for most people. Smoking cessation programs increase quit rates; life expectancy among men who quit at age 35 is almost 7 years longer than for those who continue to smoke.<sup>33</sup>

Male circumcision, a minor outpatient surgical procedure, can decrease female-to-male HIV transmission by as much as 60%.<sup>34</sup> Scale-up could potentially prevent millions of HIV infections in sub-Saharan Africa.<sup>35,36</sup> A single dose of azithromycin or ivermectin can reduce the prevalence of onchocerciasis, a major cause of blindness.<sup>37</sup>

### Clinical Interventions

The fourth level of the pyramid represents ongoing clinical interventions, of which interventions to prevent cardiovascular disease have the greatest potential health impact. Although evidence-based clinical care can reduce disability and prolong life, the aggregate impact of these interventions is limited by lack of access, erratic and unpredictable adherence, and imperfect effectiveness. Access can be limited even in systems that guarantee health coverage for all<sup>38</sup> and is a much greater problem in the United States and other countries without universal health care coverage.<sup>39,40</sup> Nonadherence is especially problematic for chronic conditions that are

usually asymptomatic, such as hypertension, hyperlipidemia, and diabetes. At least a third of patients do not take medications as advised, and nonadherence cannot be predicted from socioeconomic or demographic characteristics.<sup>41,42</sup>

Rigorous accountability, incentives for meaningful outcomes (e.g., blood pressure and cholesterol control), and systems to enable improved performance are all essential to improve health care system performance. Electronic health records have the potential—if and only if they are implemented with prevention and accountability as guiding principles—to facilitate greatly improved preventive and chronic care.<sup>43</sup> This goal is more likely to be attained if electronic record keeping is implemented along with changes in both financial incentives and physician practices to proactively support preventive care and control of chronic diseases.<sup>44</sup>

### Counseling and Educational Interventions

The pyramid's fifth tier represents health education (education provided during clinical encounters as well as education in other settings), which is perceived by some as the essence of public health action but is generally the least effective type of intervention.<sup>9</sup> The need to urge behavioral change is symptomatic of failure to establish contexts in which healthy choices are default actions. For example, counterbalances to our obesogenic environment include exhortations to increase physical activity and improve diet, which have little or no effect. More than one third of US adults, or 72 million people, were obese in 2006, a dramatic increase over

1980.<sup>45</sup> Two thirds of these individuals were counseled by a health care provider to lose weight,<sup>46</sup> yet daily calorie and fat intake continues to rise.

Counseling, either within or outside the clinical context, is generally less effective than other interventions; successfully inducing individual behavioral change is the exception rather than the rule. For example, although clear, strong, and personalized smoking cessation advice, even in the absence of pharmacological treatment, doubles quit rates among smokers who want to stop and should be the norm in medical care, it still fails to help 90% of those who are motivated to quit.<sup>47,48</sup>

Nevertheless, educational interventions are often the only ones available, and when applied consistently and repeatedly may have considerable impact. An example of a successful evidence-based educational intervention is trained peer counselors advising men who have sex with men about reducing HIV risk.<sup>49</sup>

### PROGRAM IMPLEMENTATION

Comprehensive tobacco control programs, which contain elements that work at all levels of the pyramid, illustrate the potential application of this paradigm and the synergies among different levels of intervention. People with low incomes and low educational attainment have higher rates of smoking than do people with higher incomes and education.<sup>50</sup> Interventions that address social determinants of health, such as increasing a population's educational and economic status, should therefore reduce smoking rates. However, because these changes often require fundamental social

**TABLE 1—Structural Approaches to Health Promotion for Communicable Disease, Noncommunicable Disease, and Injury Prevention**

Approaches to Prevention	Communicable Disease	Noncommunicable Disease	Injuries
Counseling and educational interventions	Behavioral counseling to reduce sexually transmitted infections	Dietary counseling Counseling to increase levels of physical activity Public education about avoiding lifestyle-mediated disease	Counseling and public education to avoid drinking and driving and encourage compliance with traffic laws School-based programs to prevent or reduce violent behavior
Clinical interventions	HIV treatment to decrease viral load and reduce transmission Treatment of tuberculosis, resulting in decreased spread of infection	Treatment of hypertension and hyperlipidemia Aspirin therapy for people with coronary heart disease	Methadone and buprenorphine treatment to decrease opiate overdose Screening and treatment of women older than 65 years for osteoporosis to reduce fractures
Long-lasting protective interventions	Immunizations Male circumcision in countries with high HIV prevalence and significant female-to-male transmission Mass antibiotics to prevent or treat tropical diseases (e.g., onchocerciasis)	Colonoscopy Treatment of tobacco addiction Surgical sterilization, intrauterine device insertion, or other long-acting contraception to reduce maternal mortality Dental sealants	Brief behavioral counseling to reduce alcohol consumption Home modification, such as installation of grab bars and handrails, to prevent falls among the elderly
Changing the context	Clean water Reduced indoor smoke pollution from biomass cooking Ubiquitous condom availability	<i>Trans</i> fat elimination in processed food to reduce cardiovascular disease Sodium reduction in packaged foods and food served in restaurants to reduce cardiovascular disease Fluoridation of water to prevent dental cavities Elimination of lead paint and asbestos exposures Increased unit price for tobacco, alcohol, and sugar-sweetened beverages Smoke-free workplaces Community and transit design to promote greater physical activity	Road and vehicle design requirements to reduce crashes and protect pedestrians and bicyclists Laws prohibiting the sale of alcohol to minors and increased alcohol price Laws prohibiting driving at even low blood alcohol levels Effectively implementing laws to mandate helmet use by motorcyclists and motorcycle passengers Occupational safety requirements
Socioeconomic factors	Reduced poverty to improve immunity, decreased crowding and environmental exposure to communicable microbes, and improved nutrition, sanitation, and housing	Reduced poverty, increased education levels, and more nutritional options to reduce cardiovascular disease, some cancers, and diabetes	Reduced poverty levels to reduce drug use and violence, improved housing options, and lowered vulnerability to extreme weather conditions

change, they are generally not within the traditional purview of tobacco control or public health programs.

Context-changing interventions, such as increasing tobacco taxes, establishing smoke-free workplaces, and changing the social norms regarding smoking through hard-hitting antitobacco campaigns and elimination of advertising and promotional cues to smoke, are highly effective in reducing tobacco use.<sup>51</sup> Hard-hitting

ad campaigns, particularly as part of a comprehensive tobacco control program, not only reduce tobacco use by changing the social context of smoking<sup>52</sup> but also provide in effect a social immunization against smoking that persists over time. Clinical care that includes cessation medications can triple quit rates in individual smokers, but even the best systems treat only a small proportion of smokers, and only one third of those who are

motivated to quit and are treated will succeed.<sup>48</sup> Education about the harms of smoking provides people with information to help them change their behavior. Other examples of this 5-tiered framework applied to communicable disease, chronic disease, and injury prevention are given in Table 1. Inevitably, some programs blur the distinctions between tiers. For example, mass media campaigns for tobacco control could be viewed as an educational

intervention (tier 5), but if done effectively, such actions can change the context by altering the social norms related to tobacco use (tier 2).

### PRACTICAL APPLICATION OF THE HEALTH IMPACT PYRAMID

The health impact pyramid, a framework for public health action, postulates that addressing socioeconomic factors (tier 1, or

the base of the pyramid) has the greatest potential to improve health. Interventions that change the context for individual behavior (tier 2) are generally the most effective public health actions; 1-time clinical interventions (tier 3), such as immunizations, can be more effectively applied than those requiring ongoing care; and clinical interventions (tier 4) are generally, although not inevitably, more effective than counseling and education (tier 5).

Although the effectiveness of interventions tends to decrease at higher levels of the pyramid, those at the top often require the least political commitment. Achieving social and economic change might require fundamental societal transformation. Contextual change is often controversial, as evidenced by disputes over smoke-free laws, restrictions on artificial trans fat, and water fluoridation.<sup>53,54</sup> One-time interventions tend to be less controversial, although immunization programs that attempt to reach all members of a society often meet resistance arising from suspicion and disbelief.<sup>55</sup>

Although the structure and financing of health care systems can be controversial, clinical care itself rarely is. While exceptions exist, health education usually requires minimal political backing. Hence the greater popularity of school-based antismoking programs (despite consistent evidence they provide little to no benefit<sup>56</sup>) than of proven tobacco control interventions such as taxation, smoke-free environments, and comprehensive marketing bans. Similarly, exhorting people to exercise more and eat less is politically popular, but taxation of soda and other sugar-sweetened beverages,<sup>57</sup> bans on marketing junk food to

children, and community redesign to encourage walking and bicycling, although far more effective, are also politically more difficult.

Interventions that address social determinants of health have the greatest potential public health benefit. Action on these issues needs the support of government and civil society if it is to be successful.<sup>58</sup> The biggest obstacle to making fundamental societal changes is often not shortage of funds but lack of political will; the health sector is well positioned to build the support and develop the partnerships required for change.<sup>59</sup>

To say that social and contextual changes are more effective at improving public health is not to imply that other interventions should be ignored. For different public health problems, different interventions may be the most effective or feasible in any given context. Education to encourage condom use, although of only limited effectiveness, can reduce HIV transmission and save lives. Changing the context to make condoms ubiquitously available and acceptable makes education about their use more effective. Comprehensive public health programs should generally attempt to implement measures at each level of intervention to maximize synergy and the likelihood of long-term success. ■

#### About the Author

Thomas R. Frieden is with the Centers for Disease Control and Prevention, Atlanta, GA

Correspondence should be sent to Thomas R. Frieden, MD, MPH, Director, Centers for Disease Control and Prevention, 1600 Clifton Rd, NE, MS D-14, Atlanta, GA 30333 (e-mail: [txf2@cdc.gov](mailto:txf2@cdc.gov)). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints/Eprints" link.

This article was accepted December 8, 2009.

#### Acknowledgments

The author thanks Kelly Henning for valuable insight and input and Drew Blakeman, Cheryl de Jong Lambert, Leslie Laurence, and Karen Resha for assistance with article preparation and research.

#### References

- World Economic and Social Survey 2007. New York, NY: United Nations; 2007. Available at: <http://www.un.org/esa/policy/wess/wess2007files/wess2007.pdf>. Accessed December 12, 2008.
- Kinsella K, Gist Y. Gender and aging: mortality and health. Suitland, MD: Bureau of the Census, Economics and Statistics Administration; 1998. Available at: <http://www.census.gov/ipc/prod/ib98-2.pdf>. Accessed December 12, 2008.
- Panel on Population Projections, Committee on Population, National Research Council. *Beyond Six Billion: Forecasting the World's Population*. Bongaarts J, Bulatao RA, eds. Washington, DC: National Academy Press; 2000.
- McKeown T. *The Modern Rise of Population*. New York, NY: Academic Press; 1976.
- Ford ES, Ajani UA, Croft JB, et al. Explaining the decrease in U.S. deaths from coronary disease, 1980-2000. *N Engl J Med*. 2007;356(23):2388-2398.
- For a Healthy Nation: Return on Investments in Public Health*. Hyattsville, MD: US Public Health Service; 1994.
- Grizzell J. High reach/low cost health agenda programming. Pomona, CA: California State Polytechnic University, Pomona; 2007. Available at: [http://www.csupomona.edu/~jvgrizzell/healthagenda/intervention\\_pyramid.htm](http://www.csupomona.edu/~jvgrizzell/healthagenda/intervention_pyramid.htm). Accessed May 15, 2009.
- Hamilton N, Bhatti T. *Population Health Promotion: An Integrated Model of Population Health and Health Promotion*. Ottawa: Health Canada, Health Promotion Development Division; 1996.
- Whitlock EP, Orleans CT, Pender N, Allan J. Evaluating primary care behavioral counseling interventions. *Am J Prev Med*. 2002;22(4):267-284.
- Rose G, Khaw K-T, Marmot M. *Rose's Strategy of Preventive Medicine*. New York, NY: Oxford University Press; 2008.
- Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health. Geneva, Switzerland: World Health Organization; 2008. Available at: [http://whqlibdoc.who.int/publications/2008/9789241563703\\_eng.pdf](http://whqlibdoc.who.int/publications/2008/9789241563703_eng.pdf). Accessed October 18, 2009.
- Marmot M. Social determinants of health inequalities. *Lancet*. 2005;365(9464):1099-1104.
- Mackenbach JP, Stirbu I, Roskam AJ, et al. Socioeconomic inequalities in health in 22 European countries. *N Engl J Med*. 2008;358(23):2468-2481.
- Wood D. Effect of child and family poverty on child health in the United States. *Pediatrics*. 2003;112(3 part 2):707-711.
- Winkleby MA, Jatulis DE, Frank E, Fortmann SP. Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. *Am J Public Health*. 1992;82(6):816-820.
- Centers for Disease Control and Prevention. Cigarette smoking among adults—United States, 2002. *MMWR Morb Mortal Wkly Rep*. 2004;53(20):427-431.
- Frieden TR, Henning KJ. Public health requirements for rapid progress in global health. *Glob Public Health*. 2009;4(4):323-337.
- Sclar ED, Garau P, Carolini G. The 21st century health challenge of slums and cities. *Lancet*. 2005;365(9462):901-903.
- Unger A, Riley LW. Slum health: from understanding to action. *PLoS Med*. 2007;4(10):1561-1566.
- Cutler D, Miller G. The role of public health improvements in health advances: the twentieth-century United States. *Demography*. 2005;42(1):1-22.
- UN-Water. Global annual assessment of sanitation and drinking water: 2008 pilot report—testing a new reporting approach. Geneva, Switzerland: World Health Organization; 2008. Available at: [http://www.unwater.org/downloads/GLAAS\\_2008\\_Pilot\\_Report.pdf](http://www.unwater.org/downloads/GLAAS_2008_Pilot_Report.pdf). Accessed December 3, 2009.
- Centers for Disease Control and Prevention. Ten great public health achievements—United States, 1900-1999. *MMWR Morb Mortal Wkly Rep*. 1999;48(12):241-243.
- Uusitalo U, Feskens EJ, Tuomilehto J, et al. Fall in total cholesterol concentration over five years in association with changes in fatty acid composition of cooking oil in Mauritius: cross sectional survey. *BMJ*. 1996;313(7064):1044-1046.
- Angell SY, Silver LD, Goldstein GP, et al. Cholesterol control beyond the clinic: New York City's trans fat restriction. *Ann Intern Med*. 2009;151(2):129-134.
- Lewington S, Clarke R, Qizilbash N, Peto R, Collins R, Prospective Studies Collaboration. Age-specific relevance of

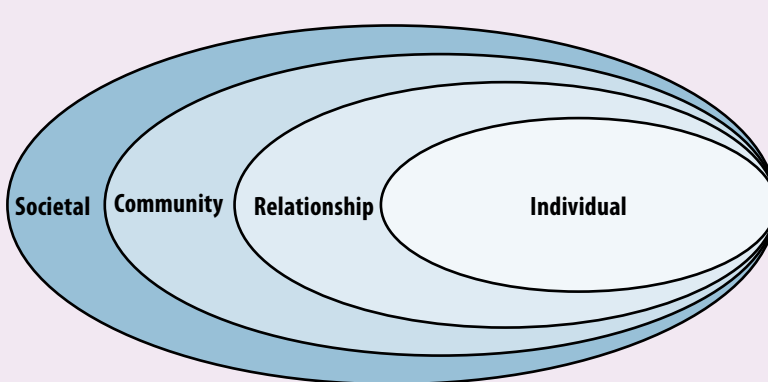
- usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet*. 2002;360(9349):1903–1913.
26. Law M, Wald N, Morris J. Lowering blood pressure to prevent myocardial infarction and stroke: a new preventive strategy. *Health Technol Assess*. 2003; 7(31):1–94.
27. Mattes RD, Donnelly D. Relative contributions of dietary sodium sources. *J Am Coll Nutr*. 1991;10(4):383–393.
28. Sacks FM, Svetkey LP, Vollmer WM, et al. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH–Sodium Collaborative Research Group. *N Engl J Med*. 2001; 344(1):3–10.
29. Danaei G, Ding EL, Mozaffarian D, et al. The preventable causes of death in the United States. *PLoS Med*. 2009;6(4): e1000058.
30. He FJ, MacGregor GA. A comprehensive review on salt and health and current experience of worldwide salt reduction programmes. *J Hum Hypertens*. 2009;23(6):363–384.
31. Laatikainen T, Pietinen P, Valsta L, Sundvall J, Reinivuo H, Tuomilehto J. Sodium in the Finnish diet: 20-year trends in urinary sodium excretion among the adult population. *Eur J Clin Nutr*. 2006;60(8):965–970.
32. WHO, UNICEF, World Bank. State of the World's Vaccines and Immunization. 3rd ed. Geneva, Switzerland: World Health Organization; 2009. Available at: [http://whqlibdoc.who.int/publications/2009/9789241563864\\_eng.pdf](http://whqlibdoc.who.int/publications/2009/9789241563864_eng.pdf). Accessed January 14, 2010.
33. Taylor DH Jr, Hasselblad V, Henley SJ, Thun MJ, Sloan FA. Benefits of smoking cessation for longevity. *Am J Public Health*. 2002;92(6):990–996.
34. Auvert B, Taljaard D, Lagarde E, Sobngwi-Tambekou J, Sitta R, Puren A. Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: the ANRS 1265 Trial. *PLoS Med*. 2005;2(11):e298.
35. Nagelkerke NJ, Moses S, de Vlas SJ, Bailey RC. Modelling the public health impact of male circumcision for HIV prevention in high prevalence areas in Africa. *BMC Infect Dis*. 2007;7:16.
36. WHO/UNAIDS. New data on male circumcision and HIV prevention: policy and programme implications. Geneva, Switzerland: World Health Organization; 2007. Available at: [http://libdoc.who.int/publications/2007/9789241595988\\_eng.pdf](http://libdoc.who.int/publications/2007/9789241595988_eng.pdf). Accessed October 18, 2009.
37. Melese M, Chidambaram J, Alemayehu W, et al. Feasibility of eliminating ocular Chlamydia trachomatis with repeat mass antibiotic treatments. *JAMA*. 2004;292(6):721–725.
38. Shah SM, Cook DG. Socio-economic determinants of casualty and NHS direct use. *J Public Health (Oxf)*. 2008;30(1): 75–81.
39. Lasser KE, Himmelstein DU, Woolhandler S. Access to care, health status, and health disparities in the United States and Canada: results of a cross-national population-based survey. *Am J Public Health*. 2006;96(7):1300–1307.
40. Schoen C, Doty MM. Inequities in access to medical care in five countries: findings from the 2001 Commonwealth Fund International Health Policy Survey. *Health Policy*. 2004;67(3):309–322.
41. Sbarbaro JA. Compliance: inducements and enforcements. *Chest*. 1979; 76(6 Suppl):750–756.
42. Haynes RB, McKibbin KA, Kanani R. Systematic review of randomized trials of interventions to assist patients to follow prescriptions for medications. *Lancet*. 1996;348(9024):383–386.
43. Mostashari F, Tripathi M, Kendall M. A tale of two large community electronic health record extension projects. *Health Aff (Millwood)*. 2009;28(2):345–356.
44. Frieden TR, Mostashari F. Health care as if health mattered. *JAMA*. 2008; 299(8):950–952.
45. Prevalence of overweight and obesity among adults: United States, 2003–2004. Atlanta, GA: Centers for Disease Control and Prevention; 2008. Available at: [http://www.cdc.gov/nchs/products/pubs/pubd/hestats/overweight/overwght\\_adult\\_03.htm](http://www.cdc.gov/nchs/products/pubs/pubd/hestats/overweight/overwght_adult_03.htm). Accessed July 23, 2009.
46. Ogden CL, Carroll MD, McDowell MA, Flegal KM. Obesity among adults in the United States—no change since 2003–2004. Hyattsville, MD: National Center for Health Statistics; 2007. NCHS data brief 1. Available at: <http://www.cdc.gov/nchs/data/databriefs/db01.pdf>. Accessed October 18, 2009.
47. Thorndike AN, Regan S, Rigotti NA. The treatment of smoking by US physicians during ambulatory visits: 1994–2003. *Am J Public Health*. 2007;97(10): 1878–1883.
48. Fiore MC, Jaen CR, Baker TB, et al. *Treating Tobacco Use and Dependence: 2008 Update. Clinical Practice Guideline*. Rockville, MD: US Public Health Service; 2008.
49. US Preventive Services Task Force. Behavioral counseling to prevent sexually transmitted infections recommendation statement. Rockville, MD: Agency for Healthcare Research and Quality; 2008. Available at: <http://www.ahrq.gov/clinic/uspstf08/sti/stirs.htm#clinical>. Accessed November 13, 2008.
50. Centers for Disease Control and Prevention. Cigarette smoking among adults and trends in smoking cessation—United States, 2008. *MMWR Morb Mortal Wkly Rep*. 2009;58(44):1227–1232.
51. *The Role of the Media in Promoting and Reducing Tobacco Use*. Bethesda, MD: National Cancer Institute; 2008. Tobacco control monograph 19. NIH Publication 07-6242.
52. Office on Smoking and Health. *Best Practices for Comprehensive Tobacco Control Programs—2007*. Atlanta, GA: National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention; 2007.
53. Cross DW, Carton RJ. Fluoridation: a violation of medical ethics and human rights. *Int J Occup Environ Health*. 2003; 9(1):24–29.
54. Frieden TR, Bassett MT, Thorpe LE, Farley TA. Public health in New York City, 2002–2007: confronting epidemics of the modern era. *Int J Epidemiol*. 2008; 37(5):966–977.
55. Garrett L. Preferring anarchy and class disparity. In: *Betrayal of Trust: The Collapse of Global Public Health*. New York, NY: Hyperion; 2000:268–485.
56. Thomas R, Perera R. School-based programmes for preventing smoking. *Cochrane Database Syst Rev*. 2006;3: CD001293.
57. Brownell KD, Frieden TR. Ounces of prevention: the public policy case for taxes on sugared beverages. *N Engl J Med*. 2009;360(18):1805–1808.
58. Marmot M, Friel S, Bell R, Houweling TA, Taylor S, Commission on Social Determinants of Health. Closing the gap in a generation: health equity through action on the social determinants of health. *Lancet*. 2008;372(9650):1661–1669.
59. Friel S, Bell R, Houweling T, Marmot M. Calling all Don Quixotes and Sancho Panzas: achieving the dream of global health equity through practical action on the social determinants of health. *Glob Health Promot*. 2009(Suppl 1): 9–13.

Copyright of American Journal of Public Health is the property of American Public Health Association and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.



# The Social-Ecological Model: A Framework for Violence Prevention

The ultimate goal of the work of violence prevention is to stop violence before it begins. CDC uses a four-level social-ecological model (SEM) to better understand and prevent violence.<sup>1</sup> Violence is complicated and results from a combination of multiple influences on behavior. It is about how individuals relate to those around them and to their broader environment. The SEM allows us to address the factors that put people at risk for or protect them from experiencing or perpetrating violence (risk and protective factors) and the prevention strategies that can be used at each level to address these factors.



### A CLOSER LOOK AT EACH LEVEL OF THE SEM

**Individual**  
Identifies biological and personal history factors; such as age, education, income, substance use, or history of abuse, that increase the likelihood of becoming a victim or perpetrator of violence.

**Relationship**  
Examines close relationships that may increase the risk of experiencing violence as a victim or perpetrator. A person's closest social circle-peers, partners and family members-influences their behavior and contributes to their range of experience.

**Community**  
Explores the settings, such as schools, workplaces, and neighborhoods, in which social relationships occur and seeks to identify the characteristics of these settings that are associated with becoming victims or perpetrators of violence.

**Societal**  
Looks at the broad societal factors, such as health, economic, educational and social policies, that help create a climate in which violence is encouraged or inhibited and help to maintain economic or social inequalities between groups in society.

## How does the SEM inform prevention practice?

Each level in the social ecological model can be thought of as a level of influence and also as a key point for prevention. It offers a framework for program planners to determine how to focus prevention activities. In order to prevent violence, it is important to implement programs and policies that can reduce risk factors and increase protective factors at each of the different levels in the model.

## Are your prevention activities addressing multiple levels of the SEM?

Using the matrix on the back as a guide, map your prevention program activities onto the SEM. Use this framework to answer the following questions: Where do you want to make the most impact? Where are the gaps? What activities can fill those gaps?

SEM Map of Program Activities			
What is the issue you are working to prevent?			
Level of SEM	Activity or strategy currently being implemented?	What risk factors does this strategy reduce?	What protective factors does this strategy increase?
Example Issue: Youth Violence	A series of after-school youth programs are established in local middle schools through collaborations with local youth serving organizations.	Limited or no monitoring and supervision, as well as a lack of social connectedness are risk factors for youth violence.	The availability of after school programs in the community offer a layer of supervision and monitoring, increase recreational opportunities for youth and increase their level of social connectedness.
Example SEM Level: Community			
Individual			
Relationship			
Community			
Societal			



Level of SEM	Examples of Factors that Potentially Increase Risk (Risk Factors)	Examples of Strategies By Level of Influence <sup>2</sup>
<b>Individual</b> <ul style="list-style-type: none"> <li>Personal characteristics</li> <li>Biological factors</li> <li>Behavior</li> <li>Personal experience</li> </ul>	<ul style="list-style-type: none"> <li>Age / gender</li> <li>Lower levels of education</li> </ul> Belief supporting use of violence <ul style="list-style-type: none"> <li>Anger or hostility toward others</li> <li>Having few friends or being isolated from others</li> <li>Being unemployed</li> <li>Substance use</li> <li>History of engaging in violence</li> </ul>	<ul style="list-style-type: none"> <li>School-based programs that help students develop social, emotional and behavioral skills to build positive relationships</li> <li>In-home programs that teach parents skills for age-appropriate infant and toddler care</li> <li>An after-school program that provides tutoring to increase academic performance</li> <li>Group sessions that increase knowledge and understanding of healthy dating relationships</li> <li>Classroom based health curriculums that teach ways to cope with loss and disappointment, and learn warning signs for depression</li> </ul>
<b>Relationship</b> <ul style="list-style-type: none"> <li>Interaction between two or more people</li> </ul>	<ul style="list-style-type: none"> <li>Fights, tension, or struggles among family members</li> <li>Marital instability, divorces or separations</li> <li>Poor communication between parents</li> <li>Poor supervision or monitoring of children</li> <li>Association with aggressive or delinquent peers</li> <li>Emotionally unsupportive family</li> </ul>	<ul style="list-style-type: none"> <li>Education and family support to promote positive child development offered within child-parent centers</li> <li>A mentoring program that pairs youth with caring adults</li> <li>A peer program that teaches youth how they can promote positive norms for dating in their circle of friends</li> <li>Relationship workshops where couples work with other couples on respectful communication strategies</li> <li>An art program that increases emotional support to children by pairing elders from a senior center with children from a preschool program</li> </ul>
<b>Community</b> <ul style="list-style-type: none"> <li>Settings or institutions in which social relationships take place</li> </ul>	<ul style="list-style-type: none"> <li>Level of residents' social connectedness</li> <li>Income level of neighborhood</li> <li>Rate of residents moving in and out of a neighborhood</li> <li>Lack of neighborhood organization</li> <li>Limited economic opportunities</li> <li>Lack of recreational opportunities</li> <li>Poor physical layout of a neighborhood</li> </ul>	<ul style="list-style-type: none"> <li>Residents organize and make physical improvements to their neighborhoods</li> <li>A city develops safe recreational areas for residents</li> <li>Community associations work with the mayor's office to develop a series of after-school programs for youth</li> <li>A school district creates, implements, monitors, and evaluates a policy to prevent bullying behavior</li> <li>A city establishes a business improvement district to increase community employment opportunities and make other improvements in the community</li> <li>A citywide policy that changes the planning procedures for the layout of new communities</li> </ul>
<b>Societal</b> <ul style="list-style-type: none"> <li>Societal factors that either create a level of acceptance or intolerance for violence. Also included are factors that can create and sustain gaps between different segments of society.</li> </ul>	<ul style="list-style-type: none"> <li>Social norm that it is acceptable to use violence to resolve conflict and that consequences are minimal</li> <li>Cultural norms</li> <li>Health policies</li> <li>Economic policies</li> <li>Educational policies</li> </ul>	<ul style="list-style-type: none"> <li>Legislation to encourage employers to offer family-leave options and flexible schedules to both men and women</li> <li>A national media campaign including TV, radio, newspaper, and Internet methods of communication to create awareness and change the way people think about violence</li> <li>A state sponsors a media campaign designed to reduce the stigma associated with self-directed violence being considered only a mental health problem</li> <li>Statewide legislation that provides tax incentives to businesses that partner with school districts to provide learning-based technology and other academic resources in disadvantaged communities</li> </ul>

1. Dahlberg LL, Krug EG. Violence-a global public health problem. In: Krug E, Dahlberg LL, Mercy JA, Zwi AB, Lozano R, eds. World Report on Violence and Health. Geneva, Switzerland: World Health Organization; 2002:1-56.

2. The examples given for each level of the social-ecological model are meant to illustrate the concept of an individual-level strategy, relationship-level strategy, etc. and are not necessarily evidence-based. Information about evidence-based strategies at each level can be found at registries for evidence-based practice such as *The Community Guide to Prevention Services* - <http://www.thecommunityguide.org/about/methods.html> or *Blueprints for Violence Prevention* - <http://www.colorado.edu/cspv/blueprints/>.

# Injury prevention as social change

R J McClure,<sup>1</sup> K Mack,<sup>1</sup> N Wilkins,<sup>1</sup> T M Davey<sup>2</sup>

## INTRODUCTION

We will not solve the public health problem of injury simply by educating individuals about the nature of injury risk, improving their risk assessment and providing these individuals with information to enable them to reduce the level of risk to which they are exposed. Substantial improvement in the societal injury burden will occur only when changes are made at the societal level that focus on reducing the population-level indicators of injury.<sup>1 2</sup> The shift from an individual to a population perspective has substantial implications for the way we perceive, direct, undertake, and evaluate injury prevention research and practice. The analogy of 'the population as patient' provides a clear illustration of the foundational truths that underpin the preferred public health approach to the prevention of injury.

Society is the system within which populations exist. Sustained change made at the societal level to reduce population-level indicators of injury morbidity and mortality involves systemic change. In this paper, we consider a shift from the contemporary *systematic* approach to unintentional injury and violence prevention,<sup>3</sup> to a *systemic* approach<sup>4</sup> more consistent with the principles of ecological public health.<sup>5</sup> We consider the extent to which the logic of the systematic model, and the related misconceptions about the role of uncertainty in science, limit local, national and global efforts to minimise injury-related harm. We explore the implications of a systemic perspective for the field of injury prevention and conclude by delineating a new programme of work that could be of considerable benefit to the injury-related health of populations.

## Individual risk versus population frequency

Should there be a perceived benefit of engaging in a risky driving behaviour, a

person on a given day could double her or his risk of death without noticing the change in their likelihood of dying on the road. If, on that day, the person sustains no adverse consequence from his or her risky driving behaviour, the person's tendency to take that risk again would be reinforced. However, in a city, state or nation with a population of 10 million people, and 11.8 RTC deaths per 100 000 person years that increase in population fatal crash risk by 0.000118 would result in three extra deaths in that population per day, and 1179 deaths extra for the year. Furthermore, a person who moves from Sweden, where there is an estimated national RTC fatality rate of 2.8 per 100 000 per year,<sup>6</sup> to South Africa where there is an estimated rate of 25.1 deaths per 100 000 per year,<sup>6</sup> dramatically increases their personal risk of injury, even if they do not consciously change their driving behaviour—simply because they are changing the context within which their driving occurs.

If we understand causation of injury at the individual level, and the problem in the population as an aggregation of individual risk, we are dealing with abstract risks and probabilities and the transient nature of individual-level risk factors. If we understand prevention of injury in terms of individual risk assessment and acceptance, then prevention requires intervention at the level of every risk calculation people make. This approach has serious limitations in that, first, it assumes people actually do continually make those rational risk calculations throughout their day, and second, it ignores the fact, illustrated by the above example, that at the individual level, the rational answer frequently falls in favour of increasing the small individual risk in order to achieve certainty of gaining the benefit of the moment.

On the other hand, if we talk in terms of frequencies of deaths in a population, the problem of injury can be more clearly understood, more rationally debated and more easily addressed. The relationships between probabilities, objective and subjective risk assessment, and potential effects of individualised behaviour change, can be hard to cognitively operationalise. However, when expressed as bald population frequencies, these numbers represent the facts to which

potential solutions can be pegged, decisions made and societies held accountable.

Perhaps the most compelling benefit of the 'population as patient' approach is that it provides a clear scope for injury prevention and a means by which prevention goals can be achieved. While we may not know enough to cure a disease, we do know enough to at least shift the health of the least healthy populations to match that of the healthiest.<sup>7</sup> All countries of the world have access to the same evidence base to support technical and behavioural solutions for RTC injury, yet the RTC death rate in some populations is 10 times the rate in others.<sup>6 7</sup> When setting out to halve the global road toll,<sup>8</sup> the first step is to recognise that the occurrence of disease and injury reflects the circumstances of society as a whole.<sup>7 8</sup> There is tremendous opportunity for reduction in RTC injury that can be achieved by bringing the road transportation system of the highest risk populations into line with transport systems already existent in populations of lowest risk. Public health approaches to unintentional injury and violence prevention should not be merely educating individuals about their own individual risk, but instead should focus on putting in place changes to the system that are required if lives are to be saved.

The argument that is usually made against collective responsibility is the rights based argument, which asserts individuals have a right to decide whether or not they want to wear a seat belt, or speed, or use a cellphone while driving. An individual may say 'I have a right to drive as I wish and choose the level of risk I am prepared to take, and I need laws that allow me the freedom to do so,' but a transportation system designed to protect that right would be inherently more dangerous, not just for that individual but for all users. The reason for this is that people actually do not make rational risk calculations on a continuing basis throughout their daily lives because of the impossibly large cognitive load that would entail.<sup>9</sup> Instead they use mental short-cuts (heuristics) to aid their decision making.<sup>9</sup> Transportation safety laws and regulations are designed to encourage appropriate road user decisions by entrenching a set of universal heuristics. The road user can replace a large part of the cost-benefit calculations involved in driving with one heuristic, that is, 'following the road rules,' that simplifies the driving experience for all and reduces the ambient levels of risk inherent in the system. A transportation system regulated such that it allows an individual to decide on a

<sup>1</sup>National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia, USA; <sup>2</sup>School of Public Health, University of Queensland, Brisbane, Queensland, Australia

**Correspondence to** Dr Roderick John McClure, Division of Analysis, Research and Practice Integration (DARPI), National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, 4770 Buford Highway NE, MS F-62, Atlanta, GA 30341, USA; [rmcclure@cdc.gov](mailto:rmcclure@cdc.gov)

situation-by-situation basis whether they want or do not want to increase their personal risk, is a transportation system in which the risk to all users is increased and innocent lives will be lost.

### The systematic versus systemic model of injury causation and prevention

The public health approach to injury prevention is usually described in terms of a linear systematic process. It begins with an elucidation of the nature and extent of the injury problem. Proximal risk and protective factors are then identified. Countermeasures, and strategies for implementing the countermeasures, are generated to address the modifiable risk factors. The efficacy of the countermeasures and strategies are quantified, and interventions developed to create programmes for implementation to target groups in controlled settings. If found to be effective in these circumscribed settings, the programmes are deemed to be evidenced-based programmes ready for 'scaling up' to the population level.

Implicit in the systematic model of injury prevention is the notion that proximal risk factors can be isolated from their contexts; interventions to address these risk factors can be developed and tested; and that knowledge of the interventions leads to reduced injury-related morbidity and mortality. The prevention process based upon the systematic approach favours the selection of a specific target injury type in an area where the mechanisms for the injury can be clearly delineated, and where knowledge about countermeasures for these mechanisms can be succinctly summarised and appropriately disseminated.

At the heart of the systematic model of injury prevention are Newtonian principles of energy exchange.<sup>3</sup> Like Newtonian physics, the systematic model of injury causation and approach to prevention of injury is valid only within the limited boundaries defined for the model. It assumes a person's individual risk is the sum or product of factors in a linear causal pathway where people act independently of other individuals in society. In replacing the bounded truths of Newton with a more general theory of relativity, Einstein's work highlights the importance of appropriately matching the frames of reference of an explanatory model with the purpose for which the model is used. People do not believe, behave or act as independent entities, but as members of societies, and in societies it is frequently the interaction between the components that determines the nature,

extent and direction of progress. Organic relationships are more frequently exponential than linear and feedback loops and homeostatic mechanisms keep things in balance until tipping points occur.<sup>10 11</sup> Social change is achieved by restricting growth in one direction and encouraging growth in another, not by replacing one existent reality with its counterfactual. The assumptions on which the systematic model of injury prevention is based are not consistent with the environments in which these models are expected to perform.

A model of injury prevention at the population level would need to account for the problem of injury within, not outside of, the societal context in which it occurs.<sup>12</sup> Societies are constantly changing, with tightly coupled components, non-linear relationships, and history dependent status. They are self-organising, adaptive and evolving, operationalised through trade-offs, counterintuitive and policy resistant. In possessing these attributes, societies define themselves to be complex systems.<sup>11</sup>

A systemic intervention capable of achieving sustained population-level change is designed and built from the ground up within the institutions and infrastructures that define society's form and function. While many interventions contain components that are built in a 'laboratory,' a societal intervention is always of orders of magnitude larger than any of its component parts, and always dependent on the societal governance, resourcing, engagement and context in order to operationalise any of its research-tested elements.

In their state-of-the-art account, *Eliminating serious injury and death from road transport*,<sup>14</sup> Johnson and colleagues provide a clear illustration of the systemic nature of effective injury efforts and the ineffectiveness of an approach focusing just on component causes. Highlighting the results of a European study<sup>15</sup> that explained the success of Sweden, the UK and the Netherlands in their efforts to reduce motor vehicle death rates, Johnson and colleagues argue that effective prevention is more about how societies go about addressing the motor vehicle injury problem rather than about the package of risk factor countermeasures they choose.<sup>13</sup> The efficacy of seat belts, speed limits or roadside crash barriers, can be quantified in research settings, but these countermeasures can never comprise a motor vehicle safety solution on their own. These components can only influence population-level RTC mortality and

morbidity if incorporated into a larger intervention that includes a strong public demand for change, committed societal leadership, a climate of safety, an appropriate infrastructure, cooperation and coordination between all stakeholders, and a long-term perspective from all.<sup>12</sup> These additional elements are social institutions that exist in the world, not in controlled research settings.

Thus, as illustrated by the above example, effective injury prevention solutions are built from the ground up in the public domain, not in a research environment and multiplied to scale. Injury prevention is achieved by making those changes in society's form and function that lead to downstream reductions in the population prevalence of the proximal risk factors for injury.

Without cultural change we will remain locked into a process of making only incremental improvements. To achieve cultural change we need to understand how to influence social change at a macro level.<sup>13</sup>

### The principle of the drunkard's search

Much of the current support for the systematic model comes from a misplaced understanding of the nature and role of uncertainty in science.<sup>15-17</sup> The mantra of modern medicine (and associated public health, policy and resource allocation activities) is the importance of implementing only evidence-based interventions. Evidence-based interventions are those that have been demonstrated to have an effect in research studies designed and conducted in such a way that the effect estimates are precise, and chance and bias do not threaten the validity of the study findings. We completely agree with the goal of implementing evidence-based interventions. However, it might be time to consider whether the search for an evidence base has become simply a search for certainty.

Studies that are currently defined as providing the highest level evidence are actually not studies that provide the highest level of evidence, but studies that provide the highest level of certainty.<sup>18</sup> The actual evidence obtained might be exceedingly trivial, and yet still of high 'quality' according to the existing evidence base taxonomy. The evidence on which population-level injury prevention depends, is evidence that exists in the real world at the population level. Given the limitations of what can actually be examined in highly controlled experiments in research settings, this search for certainty

has resulted in more and more research about topics more and more removed from what we need to drive injury prevention. If only those intervention components that can be isolated for testing through randomised controlled trials under circumscribed conditions, with the individual as the unit of analysis, can be considered 'quality,' then while we may be certain about the study results, the results tell us little about the effectiveness of the overall population-based intervention.<sup>19-23</sup>

The evidence base to support injury prevention at the population level needs to cover community engagement, local contexts, measurement of unintended consequences, feedback loops, the relationship between intervention components, and the connections between area-level and individual-level causes and effects. There is no question that population-level interventions need to be based on the highest-level science. The challenge is to develop science in this societal space, rather than depend on the science currently developed for use in the controlled environment of 'laboratory' experiments.<sup>24 25</sup>

It is a fact that we live with uncertainty, in science and in life; 'As far as the laws of mathematics refer to reality, they are not certain, as far as they are certain, they do not refer to reality'.<sup>26</sup> The issue for scientists, and decision makers, is how to accommodate uncertainty into one's interpretations of the observed world and our consequent decisions. We do not eradicate uncertainty about an intervention's effect by isolating only those components that can be controlled, and then testing the efficacy of those components. Finding certainty in the laboratory simply ignores the consequent uncertainty of how the product functions in the world outside the laboratory where the intervention belongs. Attempting to eradicate uncertainty by conducting randomised controlled trials on components of an intervention simply moves that uncertainty into the phase of implementation effectiveness, and our overall level of uncertainty in the value of our intervention remains unchanged.

Again, the 'population as patient' analogy is instructive. Clinical medicine understands the human organism to be a complex system-of-systems generally held in homeostatic equilibrium by the properties of each of the systems and the relationship between them. Thus 'in vitro' research undertaken in test tubes is not considered to be best evidence as the results 'in vitro' often differ from the 'in vivo' evidence obtained from holistic

observations of the fully working human body. By analogy it is in the fully working society that the effectiveness of injury interventions need to be judged, as the results there are not logically predicted from observations made on isolated randomised controlled trials of component parts.

### So what does all this mean for the field of injury prevention?

Replacing the systematic approach with a systemic one has three implications for the field of injury prevention. The first for injury research, the second for injury prevention practice, and the third for the role of injury prevention within the institutions that make up our society.

In the past, injury prevention researchers have prized the pursuit of knowledge in abstract research settings and following the manner described by Karl Popper, asked 'why not'.<sup>27</sup> The task now is to look at what is the real world and ask why. The frequencies of injuries in a population is facts, not inferences or estimates. They exist. Differences in rates between populations are real differences, and in a deterministic world there are by definition, real causes for the differences between rates. The causes lie in differences in the societal institutions, practices and infrastructures between the populations, not in the differences between people. At the population level, human nature is the same all over the world. Where differences lie, are between the systems within which people live; and it is in the differences between these systems that the answer to the causal questions can be found. Once causes are identified, population-solutions to the public health problem that is injury become clearly evident.

Systems research studies is just as much a scientific concern as are randomised controlled trials. Rigour in the philosophy and practice of science is no less important in either stream. However, in all science we need to keep remembering that the properly formulated research question comes first, then the appropriate scientific method to address the question is chosen second. We should not first choose to use a hammer then find the only thing we can then do to build the house of evidence is knock in the nails. Elucidating the components of the systems responsible for the different injury rates between populations is a scientific exercise.<sup>24 25</sup> There is still little research in the area of population-level change. If we have the methods to do that now, we should use them. If the scientific methods to do so are not yet

available at a sufficient level or rigour, then we need to develop the methods, not change the question. In these last two sentences lies the research challenge of the systemic approach to prevention.

Injury prevention is currently based on the energy transfer definition of injury.<sup>3</sup> Derived from the infectious disease model and operationalised at the individual level, it overtly avoids notions of accountability and outcome. In accordance with this definition, funders support injury prevention activity in areas where the mechanisms for a type of injury can be clearly delineated, and where knowledge about countermeasures for these mechanisms can be succinctly summarised and appropriately disseminated. A population approach to prevention, on the other hand, suggests a definition of injury prevention that is systems-focused, outcomes-driven, grounded in accountability and ubiquitously applicable; that is,

..the optimal governance and functioning of individuals within their social and physical environments in circumstances where human well-being is an essential performance requirement expected of all institutions, organisations and citizens.<sup>4</sup>

In contradistinction to the systematic approach, prevention practice at the systemic level requires a collective vision for an agreed common good; a long-term, strategic plan for achieving that agreed outcome; commitment from all involved to work on what needs to be done to achieve that goal; implementation of what is known; and development of new knowledge on the basis of changes observed. In this sentence is the challenge of the systemic approach for practitioners.

So what would injury prevention look like if the field responded as suggested and shifted more towards systemic solutions measured in terms of population-level reductions in injury morbidity and mortality? The result would be alarming and deeply rewarding, and would take considerable courage.

Injury prevention as a field would partially devolve throughout the more general universal approach to improving societies' form and function. In doing so it would become more centrally located within existing social and medical establishments; and in being more centrally located it would lose some of its injury-specific identity and assume more the mantle of societal improvement. Yes, this would change the way we see ourselves, and the way we do business; but it would change for the better. Injury prevention



specialists would be just as needed as we now are, but we would become part of a bigger framework that comprised a more compelling solution.

**Contributors** All authors were equally involved in all aspects of the conceptualisation and writing of this manuscript.

**Disclaimer** The findings and conclusions in this manuscript are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

**Competing interests** None declared.

**Provenance and peer review** Not commissioned; externally peer reviewed.



CrossMark

**To cite** McClure RJ, Mack K, Wilkins N, et al. *Inj Prev* 2016;**22**:226–229.

Received 2 September 2015

Revised 4 November 2015

Accepted 10 November 2015

Published Online First 9 December 2015

*Inj Prev* 2016;**22**:226–229.

doi:10.1136/injuryprev-2015-041838

## REFERENCES

- Mack KA, Liller KD, Baldwin G, et al. Preventing unintentional injuries in the home using the Health Impact Pyramid. *Health Educ Behav* 2015;**42** (1 Suppl):115S–22S. [http://www.swov.nl/rappor...wer\\_plus6\\_Final\\_Report.pdf](http://www.swov.nl/rappor...wer_plus6_Final_Report.pdf)
- Mercy J, Mack K, Steenkamp M. Changing the social environment to prevent injury. In: Doll L, Bonzo S, Mercy J, et al, eds. *Handbook of injury and violence prevention*. New York, NY: Springer, 2007:277–94.
- Haddon W. On the escape of tigers: an ecological note. *Am J Public Health Nations Health* 1970;**60**:2229–34.
- McClure RJ. On living with Tigers: an ecological post script. *J Health Saf Res Pract* 2012;**4**:1–7.
- Rayner G, Lang T. *Ecological public health reshaping the conditions for good health*. London, UK: Routledge, 2012.
- Global status report on road safety 2015. Geneva: World Health Organization, 2015.
- Rose G. *The strategy of preventive medicine*. Oxford, UK: Oxford University Press, 2012.
- United Nations Department of Economic and Social Affairs. *Partnerships for sustainable development goals*. Geneva: United Nations, 2015 <https://sustainabledevelopment.un.org/content/documents/211617%20Goals%2017%20Partnerships.pdf> (accessed 30 Oct 2015).
- McLucas AC. *Decision making: risk management, systems thinking, and situation awareness*. Canberra, ACT: Argos Press, 2003.
- Gladwell M. *The tipping point: how little things can make a big difference*. New York, NY: Little, Brown and Company, 2000.
- Sterman JD. Learning from evidence in a complex world. *Am J Public Health* 2006;**96**:505–14.
- Moller J. Reconsidering community based interventions. *Inj Prev* 2004;**10**:2–3.
- Johnson IR, Muir C, Howard EW. *Eliminating serious injury and death from road transport: a crisis of complacency*. Boca Raton, FL: CRC press, 2014.
- Wegman F, Eksler V, Hayes S, et al, eds. *SUNflower +6. A comparative study of the development of road safety in the SUNflower+6 countries: final report*, Leidschendam, NL: SWOV, 2005.
- Kaplan A. *The conduct of inquiry: methodology for behavioral science*. New Brunswick, NJ: Transaction Publishers, 1998;11.
- Pruyt E, Willem L, Auping WL, et al. Ebola in West Africa: model-based exploration of social psychological effects and interventions. *Syst Res Behav Sci* 2015;**32**:2–14.
- Pruyt E. State of Art versus State of Science of Integrated Risk-Capability Analysis under Deep Uncertainty Third International Engineering Systems Symposium CESUN 2012. *Delft University of Technology*, 18–20 June 2012.
- Guyatt GH, Sackett DL, Sinclair JC, et al. Users' guides to the medical literature. IX. A method for grading health care recommendations. Evidence-Based Medicine Working Group. *JAMA* 1995;**274**:1800–4.
- World Health Organisation. *Health promotion evaluations: recommendations to policy-makers. A report of the WHO European Working Group on Health Promotion Evaluation*. Copenhagen, DK: WHO, 1998.
- Rychetnik L, Frommer M, Hawe P, et al. Criteria for evaluating evidence on public health interventions. *J Epidemiol Community Health* 2002;**56**:119–27.
- Sanson-Fisher RW, Bonevski B, Green LW, et al. Limitations of the randomized controlled trial in evaluating population-based health interventions. *Am J Prev Med* 2007;**33**:155–61.
- Gilligan C, Sanson-Fisher R, Shakeshaft A. Appropriate research designs for evaluating community-level alcohol interventions: what next? *Alcohol Alcohol* 2010;**45**:481–7.
- Rivara F. Evaluating the effect of an injury prevention intervention in a population. *Am J Prev Med* 2008;**34**:S148–52.
- Biglan A, Ary D, Wagenaar AC. The value of interrupted time-series experiments for community intervention research. *Prev Sci* 2000;**1**:321–49.
- Hawkins NG, Sanson-Fisher RW, Shakeshaft A, et al. The multiple baseline design for evaluating population-based research. *Am J Prev Med* 2007;**33**:162–8.
- Einstein A. *Geometry and experience*. Berlin, DE: Springer, 1921.
- Popper K. *Logik der Forschung*. Vienna, AT: Springer, 1935.

### Montreal's take on helmet laws

A study found that of 120 Montrealers with head trauma from bicycle injuries, 75% were not wearing helmets. Interestingly, on ski hills where there is no law, most wear a helmet, but many cyclists still do not. The province is considering making helmets mandatory but the City of Montreal and a bike group, Vélo Québec, are opposed. Comment: their argument is that it would discourage people from cycling. This remains unproven.

### Drinking age 'unfair'?

New Jersey and California are considering lowering the drinking age to 18. The 'reasoning' is that it is not fair that an 18-year-old can serve in the military but not buy alcohol. Comment: this logic should also prompt other measures for which the risk has been proven to increase inversely with age.

### Domestic violence prevention advocate dies in apparent murder suicide

In an ironic twist, a long-time advocate against domestic violence and her husband died from an apparent murder-suicide. However, it has been pointed out that 'Murder-suicide in intimate partner relationships is domestic violence'.



## Injury prevention as social change

R J McClure, K Mack, N Wilkins and T M Davey

*Inj Prev* 2016 22: 226-229 originally published online December 9, 2015  
doi: 10.1136/injuryprev-2015-041838

---

Updated information and services can be found at:  
<http://injuryprevention.bmj.com/content/22/3/226>

---

*These include:*

### References

This article cites 13 articles, 4 of which you can access for free at:  
<http://injuryprevention.bmj.com/content/22/3/226#BIBL>

### Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

---

### Notes

---

To request permissions go to:  
<http://group.bmj.com/group/rights-licensing/permissions>

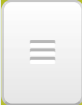
To order reprints go to:  
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:  
<http://group.bmj.com/subscribe/>





SEARCH



Home » [Disparities in Child Passenger Safety](#)

# Disparities in Child Passenger Safety

This CSN infographic focuses on the disparities in child passenger deaths and offers prevention strategies.

[Download a print version of the infographic](#)

## INFOGRAPHIC LISTINGS

[The Facts On Childhood Drowning](#)

[Falls in Children and Youth: Hospitalizations](#)

[How Common Are Bullying and Fighting among High Schoolers?](#)

[E-Cigarette Poisoning](#)

[Halloween Safety](#)

[Boating Safety](#)

[Child Access to Firearms in the United States](#)

[Playground-Related Injuries Treated in the Emergency Department](#)

[Magnitude of Firearm-Related Fatalities in](#)

**DISPARITIES IN CHILD PASSENGER SAFETY**

**MOTOR VEHICLE CRASHES** are a leading cause of death for children\*

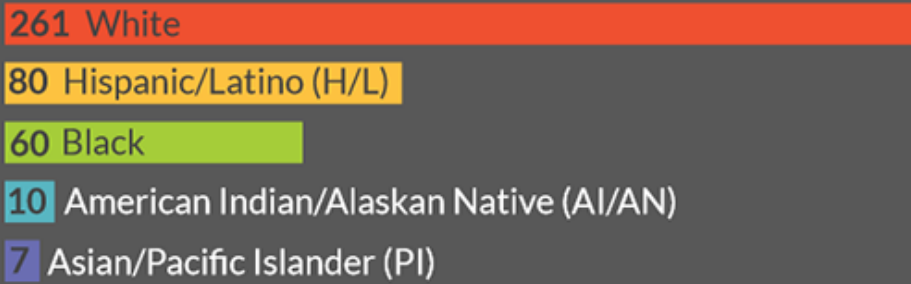
2010-2014  
**343**  
child passengers die per year  
(average 2010 through 2014)

When broken out by age groups, that comes to

<b>115</b> children <1-4 years	<b>100</b> children 5-9 years	<b>128</b> children 10-14 years
-----------------------------------	----------------------------------	------------------------------------

[MORE INFOGRAPHICS](#)

When broken out by race/ethnicity<sup>†</sup>, that comes to



child passenger deaths per year

Numbers do not add up to 343 due to rounding

But these numbers don't tell the **WHOLE STORY...**

**AI/AN child passengers** die at a *higher rate* than any other racial/ethnic group

This means that for every 1,000,000



die as passengers

**AI/AN** child passengers are:

- 2.6 times more likely to die than **Black** child passengers
- 3.0 times more likely to die than **White** child passengers
- 3.1 times more likely to die than **H/L** child passengers
- 7.8 times more likely to die than **Asian/PI** child passengers



Children in **RURAL** areas are **2 to 5 times more likely** to be seriously/fatally injured in a crash than in **URBAN** areas



**THE GOOD NEWS**

# is that these deaths are **PREVENTABLE**

Child passenger deaths have decreased by **67%** from 2005 through 2014



Child safety seats can reduce fatalities by



# 4/5



parents report that their child uses age-appropriate restraints on *every trip*



Parents who received information about child safety seats from their child's *doctor's office* were nearly **2X** **TWICE** as likely to use the correct restraints

**Child restraint system (CRS) checks** by certified child passenger safety technicians during **WELL-CHILD VISITS**

**increase correct safety seat use** in urban, low-income communities



While the gap is closing,  
**DISPARITIES**

# DISPARITIES STILL EXIST

## What can we do to fix it?



Provide *culturally competent outreach* to **vulnerable and underserved** populations

Tailor programs and campaigns to reach parents of *different cultural and socioeconomic backgrounds*



Distribute education materials in **MULTIPLE LANGUAGES**



Have *health care providers* talk to parents about age-appropriate child restraint systems



Provide CRS **CHECKS** at health centers in vulnerable communities



Distribute *free or low-cost child safety seats and booster seats* to parents in vulnerable and underserved populations



May 2016  
\* Children are defined as <15, toddlers are defined as 1 through 4, and infants are defined as <1 year  
† White, Black, AI/AN, and Asian/PI are non-Hispanic  
For detailed sources and more information, visit: [ChildrensSafetyNetwork.org/infographics/cps-disparities](http://ChildrensSafetyNetwork.org/infographics/cps-disparities)

## Disparities in Child Passenger Safety

Motor vehicle crashes are a leading cause of death among children[\*]

From 2010 through 2014, an average of 343 child passengers died per year

When broken out by age, that comes to:

- 115 children <1 through 4 years old
- 100 children 5 through 9 years old
- 128 children 10 through 14 years old

When broken out by race/ethnicity<sup>[†]</sup>, that comes to:

- 261 White
- 80 Hispanic/Latino (H/L)
- 60 Black
- 10 American Indian/Alaskan Native (AI/AN)
- 7 Asian/Pacific Islander (PI)

child passenger deaths per year

## **But these numbers don't tell the whole story...**

AI/AN child passengers die at a higher rate than any other racial/ethnic group

This means that for every 1,000,000

- White children, 5.6
- H/L children, 5.4
- Black children, 6.5
- AI/AN children, 16.7
- Asian/PI children, 2.1

die as passengers



AI/AN child passengers are:

- 2.6 times more likely to die than Black child passengers
- 3.0 times more likely to die than White child passengers
- 3.1 times more likely to die than H/L child passengers
- 7.8 times more likely to die than Asian/PI child passengers (WISQARS)

Children in rural areas are 2 to 5 times more likely to be seriously or fatally injured in a crash than in urban areas (Huseth, 2013)

## **The good news is that these deaths are preventable**

Child passenger deaths have decreased by 67% from 2005 through 2014 (WISQARS)

<b>Year</b>	<b>Deaths</b>
2005	842
2006	763
2007	694
2008	470
2009	495
2010	376
2011	396

2012	356
2013	309
2014	277

Child safety seats can reduce fatalities by 71% for infants and 54% for toddlers (NHTSA, 2013)

4 out of 5 parents report that their child used the age-appropriate restraint on every trip (Macy, 2014)

Parents who received information about child safety seats from their child's doctor's office were nearly twice as likely to use the correct restraints (Macy, 2014)

Child restraint system (CRS) checks by certified child passenger safety technicians during well-child visits increase correct safety seat use in urban, low-income communities (Quinlan, 2007)

## **While the gap is closing, disparities still exist**

What can we do to fix it?

Provide culturally competent outreach to vulnerable and underserved populations

Tailor programs and campaigns to reach parents of different cultural and socioeconomic backgrounds

Distribute education materials in multiple languages

Have health care providers talk to parents about age-appropriate child restraint systems

Provide CRS checks at health centers in vulnerable communities

Distribute free or low-cost child safety seats and booster seats to parents/caregivers in vulnerable and underserved populations

## Sources

WISQARS. Fatal Injury Data. WISQARS (p. Accessed March 15, 2016 by R. Willmer). Atlanta, GA. Retrieved from <http://www.cdc.gov/injury/wisqars/fatal.html>

National Highway Traffic Safety Administration (NHTSA). (2013). *2011 Children Traffic Safety Fact Sheet*. Retrieved from <http://www-nrd.nhtsa.dot.gov/Pubs/811767.pdf>

Huseth, Andrea. (2013). *Misinformation Contributing to Safety Issues in Vehicle Restraints for Children: A Rural/Urban Comparison*, MPC-13-264. North Dakota State University - Upper Great Plains Transportation Institute, Fargo: Mountain-Plains Consortium. Retrieved from: <http://www.mountain-plains.org/pubs/pdf/MPC13-264.pdf>

Macy, M. L., Cunningham, R. M., Resnicow, K., & Freed, G. L. (2014). Disparities in age-appropriate child passenger restraint use among children aged 1 to 12 years. *Pediatrics*, *133*(2), 262–71.  
<http://doi.org/10.1542/peds.2013-1908>

Quinlan, K. P., Holden, J., & Kresnow, M.J. (2007). Providing car seat checks with well-child visits at an urban health center: a pilot study. *Injury Prevention: Journal of the International Society for Child and*

*Adolescent Injury Prevention*, 13, 352–354.


<http://doi.org/10.1136/ip.2006.015099>

To view this infographic on the web, visit:

<http://www.ChildrensSafetyNetwork.org/infographics/cps-disparities>

[\*] Children are defined as <15, toddlers are defined as 1 through 4, and infants are defined as <1 year

[†] White, Black, AI/AN, and Asian/PI are non-Hispanic

Attachment	Size
 <a href="#">Download a print version of the infographic</a>	478.76 KB

**Topics:**

[Injury Disparities](#)

[Child Passenger Safety](#)

**Resource Type:** CSN Infographic



Children's Safety Network

[Technical Assistance](#)   [State Information](#)   [Injury Topics](#)   [Resources](#)

[CSN on Social Media](#)   [Child Safety CoIIN](#)   [NCCSI](#)

This project is supported by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) under the Child and Adolescent Injury and Violence Prevention Resource Centers Cooperative Agreement (U49MC28422) for \$1,199,683. This information or content and conclusions are those of the author and should not be construed as the official position or policy of, nor should any endorsements be inferred by HRSA, HHS or the U.S. Government.



© 1994 - 2016 Education Development Center, Inc. All Rights Reserved.

The people depicted in the photographs that appear on this website are models and are used for illustrative purposes only.

For the best experience, we recommend using the most up-to-date versions of Chrome, Firefox, Internet Explorer or Safari.

[ABOUT CSN](#)

[PRIVACY POLICY](#)

[LEGAL](#)

[ADMIN LOGIN](#)



# THE FACTS ON CHILDHOOD DROWNING

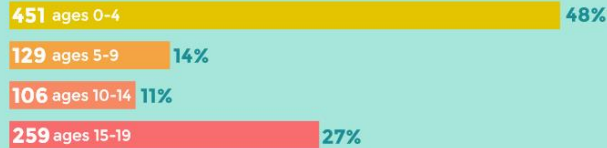
## NUMBERS

Every year<sup>1</sup> in the US,  
**3,572** people die from  
**DROWNING**  
**945** of them are  
**CHILDREN**<sup>2</sup>

Children account for  
**1 in 4**   
**DROWNING DEATHS**

## WHO?

Nearly half are **infants and toddlers**

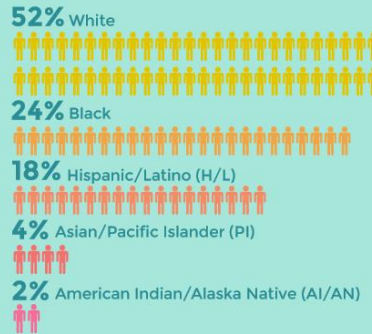


Boys account for  
**3 in 4**  
 child drowning deaths



While White<sup>3</sup> children account for more than half of these fatalities, Black and AI/AN children drown at **higher rates**

This means they are **significantly more likely to drown**



For every 1,000,000...



## WHERE

Infants under the age of 1 are most likely to drown in a **BATHTUB**



Most children ages 1 through 4 drown in **HOME SWIMMING POOLS**



The likelihood of drowning in natural water settings (lakes, oceans, and rivers) **INCREASES WITH AGE**



## NEAR DROWNING

For every child that drowns, **5 more** are treated in the emergency department for near drowning



In the most severe cases, near drowning may lead to:

- Brain damage
- Memory problems
- Learning disabilities
- Permanent loss of basic functioning (vegetative state)



**2.4%** of children hospitalized for near drowning are transferred to rehabilitation hospitals

## PREVENTION

Drowning can happen **QUICKLY** and **QUIETLY**

**FORMAL SWIMMING LESSONS** reduce the risk of drowning in 1- to 4- year-old children by **88%**

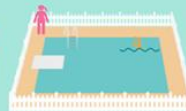


**FOUR-SIDED ISOLATION FENCES** that keep the pool separate from the house and yard reduce a child's risk of drowning by **83%** compared to three-sided fencing that encloses the house and pool together



Children should wear **LIFE JACKETS** on boats

Children should **ALWAYS** be actively supervised in and around water by a designated adult water watcher



## MORE INFO



<sup>1</sup> Average from 2010 through 2014

<sup>2</sup> For the purpose of this infographic, children are defined as <20, toddlers are defined as 1 through 4, and infants are defined as <1

<sup>3</sup> White, Black, Asian/PI, and AI/AN are non-Hispanic

July 2016

For detailed sources and more information, visit: [ChildrensSafetyNetwork.org/infographics/drowning](http://ChildrensSafetyNetwork.org/infographics/drowning)

# The Facts On Childhood Drowning

## Numbers

Every year<sup>1</sup> in the US, 3572 people die from drowning  
945 of them are children<sup>2</sup>

Children account for 1 out of 4 drowning deaths

## Who?

Nearly half are infants and toddlers

Age	Average Deaths per Year (2010 through 2014)
0 through 4	451 (48%)
5 through 9	129 (14%)
10 through 14	106 (11%)
15 through 19	259 (27%)

Boys account for 3 out of 4 child drowning deaths

Race/Ethnicity <sup>3</sup>	Deaths (Percent)
White	52%
Black	24%
Hispanic/Latino	18%
Asian/Pacific Islander (PI)	4%
American Indian/Alaska Native (AI/AN)	2%

While White children account for more than half of these fatalities, AI/AN and Black children are significantly more likely to drown

For every 1,000,000

- White children, 10.9
- Black children, 18.3
- Hispanic/Latino children, 8.3
- Asian/PI children, 8.1
- AI/AN children, 19.7

will drown

## Where

Infants under the age of 1 are most likely to drown in a bathtub

Most children ages 1 through 4 drown in swimming pools at home

The likelihood of drowning in natural water settings (lakes, oceans, and rivers) increases with age (CDC)

## Near drowning

For every child that drowns, 5 more are treated in the emergency department for near drowning

In the most severe cases, near drowning may lead to brain damage, memory problems, learning disabilities, and permanent loss of basic functioning (vegetative state) (CDC)

2.4% of children hospitalized for near drowning are transferred to rehabilitation hospitals (NIS)

## Prevention

Drowning can happen quickly and quietly

Formal swimming lessons reduce the risk of drowning in 1- to 4-year-old children by 88% (Brenner, 2009)

Four-sided isolation fences that keep the pool separate from the house and yard reduce a child's risk of drowning by 83% compared to three-sided fencing that enclose the house and pool together (CDC)

Children should wear life jackets on boats

Children should always be actively supervised in and around water by a designated adult Water Watcher

Brenner RA, Taneja G, Haynie DL, et al. Association Between Swimming Lessons and Drowning in Childhood: A Case-Control Study. *JAMA Pediatrics*.2009;163(3):203-210. doi:10.1001/archpediatrics.2008.563.

<http://archpedi.jamanetwork.com/article.aspx?articleid=381058>

2012 Healthcare Utilization Project, Nationwide Inpatient Sample (NIS) (Accessed June 7, 2016 by R. Spicer).

WISQARS. Fatal Injury Data. WISQARS (Accessed May 4, 2016 by R. Willmer). Atlanta, GA. Retrieved from <http://www.cdc.gov/injury/wisqars/fatal.html>. All numbers are based on averages from 2010-2014.

Unintentional Drowning: Get the Facts. CDC. <http://www.cdc.gov/homeandrecreationalafety/water-safety/waterinjuries-factsheet.html>

To see this on our website, visit: <http://childrenssafetynetwork.org/infographics/drowning>

### Additional resources:

[Water Watcher Card | Safe Kids Worldwide](#)

[Keeping Kids Safe in and Around Water: Exploring Misconceptions That Lead to Drowning | Safe Kids Worldwide](#)

[Dangerous Waters: Profiles of Fatal Childhood Drownings in the U.S. 2005–2014 | Safe Kids Worldwide](#)

---

<sup>1</sup> Average from 2010 through 2014

<sup>2</sup> For the purpose of this infographic, children are defined as under 20, toddlers are defined as 1 through 4, and infants are defined as <1

<sup>3</sup> White, Black, Asian/PI, and AI/AN are non-Hispanic