# Injury Epidemiology: Fourth Edition

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## Chapter 16. Summation of Major Principles

Injury is a public health problem that is neglected relative to its importance in lost life, disability pain, and suffering. Injury control has more immediate health and economic benefits than chronic disease control. The infectious disease model -- agent, carrier, host – can be applied to injuries. Interventions applied to agents, carriers, and hosts can reduce injuries, their severity, and consequences by modifying these factors at specific phases of the injury – before and during the acute phase and afterward.

Energy in its various forms -- mechanical, chemical, thermal, electrical, and radiation -- is the agent of injury. Research that focuses on modification of the agent or means of exposure to the agent will contribute most to injury control. To contribute knowledge that will hasten the most important injuries, research questions should focus on homogeneous subsets of severe injuries and changeable factors possibly related to their incidence and severity. Many available data sources emphasize non-changeable factors such as age and gender and include classifications that are not useful.

Data without valid indicators of severity may be misleading because the factors relevant to reducing severe injuries are often not involved as frequently in non-severe injuries. Case identification requires knowledge of severity and the flow of severe cases among treatment facilities.

Injury rates are calculated by dividing the number of injuries by the population at risk or measures of exposure such as the number of vehicles of specific characteristics or miles traveled for motor vehicle injuries. Rates are useful for inferring relative risk related to factors that can be changed to reduce risk. Rates are misleading when they are based on relatively rare exposures or do not reflect the future probability of injury inherent in the lifetime exposure to a product or activity. Comparison of rates associated with various products and activities is sometimes used to argue against practical and feasible injury control.

Surveillance (who, when, where, and how people are injured) has proved to be a powerful tool for targeting injury control measures of known effectiveness. Some extant surveillance systems have quirks in the data that can mislead the user. Missing data elements are a major problem in many. Certain data, such as police codes of injury severity and self-reported injuries and behaviors (e.g., seat belt and alcohol use) are invalid.

Specification of causal paths in complex causal sequences is often a goal of "basic" science but can be misleading in injury control. Usually, all of the potential risk factors can be ignored if a controllable necessary condition for harm is known. Since energy is the necessary and specific agent of injury, control of the energy or the way it is conveyed to the host will reduce injuries and, more important, severity. A complex causal model may be useful for understanding sometimes out-of-control systems that affect injury, such as alcohol use. Generally, however, the more removed the hypothesized "cause" is from the energy that injures, the less likely that its control would reduce injury.

Commonly used epidemiological study designs -- case-control, cohort -- can be used to investigate factors in injury incidence or severity. Controlled experiments are the most valid methods for evaluating injury control efforts but are not used in the study of injury causation for ethical reasons. Often they can be used to study interventions. Study designs that rule out false inferences and the use of statistical techniques that quantify parameters that can be changed for injury control must be learned and applied.

Injury control efforts are inordinately oriented to behavior change. Theories of behavior contain conflicting hypotheses regarding behavioral causation. Habit formation, frequency of intractable human error, and limits on individual abilities, particularly in emergencies, are often ignored. Injury rates at various stages in human development are a result of changing abilities, activities contributing to differential exposures to energy, and changing susceptibility to energy.

Behavior change efforts are most successful when they decrease exposure to energy and are harmful if exposures are increased by the intervention. Response to persuasion declines as the behavior necessary to reduce risk increases. Diffusion of effort toward many behaviors dilutes the effect. Personal counseling and community-based programs, particularly if incentives are included, are more effective than impersonal approaches such as advertising.

Compliance with laws or rules aimed at reducing injury is influenced by the degree of consensus regarding the justification for the law and the probability of detection of a violation. If violations are not publicly observable or the behavior can be changed easily when enforcers are approaching, the effect is diluted. The severity of punishment is less important than its prominence in political debates would indicate.

The clustering of violence, drunk driving, and other risky behavior in space and time, if revealed by surveillance, has been used to increase the efficiency and effects of law enforcement. The so-called “risk compensation” theory says that persons who use protection required by law offset the protection with more risky behavior. Evidence regarding offsetting behavior by those who do comply, however, does not support the theory.

Changes in agents, vehicles, and environments can be made voluntarily by designers, manufacturers, and marketers of products based on research on hazardous characteristics of products and the built environment. Regulations to impose standards for products and processes that injure have been associated with large reductions in death rates.

Environments may affect behavior in addition to exposing people to hazards. They can be modified to reduce violence as well as exposure to inanimate energy. The best studies of reduced risk from a product or environmental modification indicate no effect on offsetting behavior but compensation claims are influenced by the increased availability of money, above inflation, for such claims.

Well-placed and organized emergency medical systems with staff experienced in the treatment of trauma increase the probability of survival of the injured that withstand the initial energy insult. Questions remain regarding the efficacy of certain treatments at the scene of injury. The existence of trauma centers, where the probability of survival is increased, is threatened by evolving trends in the organization and financing of medical care systems. The resolution of these issues, as well as clinical trials of acute care and rehabilitation regimes, would benefit from examination by epidemiological methods.

The results of epidemiological studies specifying factors that can be changed to reduce injuries can be used to project the effects of policies regarding those changes. Many current injury-control efforts are administered by government agencies and private organizations that seem to have no system for establishing priorities and no systematic knowledge of policies and programs that are effective. Those who learn how, when, where, and who is injured are in a position to influence the setting of priorities. Those who also learn the approaches to injury control that are effective or ineffective are in a position to increase rationality in the policy-making and program-planning processes.

As I used to advise my students:
"DON'T START VAST PROJECTS WITH HALF-VAST IDEAS."