

Introduction

Injury prevention strategies must be specific to target populations because of the diversity between and among populations. Different age and gender structures, ethnicity and attitudes, resources, social structure and environments lead to different types and severity of injuries and different injury rates.

To ensure access to adequate resources required for studying these differences, a multidisciplinary framework to guide the conduct of research is needed. The proposed Injury Prevention and Evaluation Cycle (IPEC), an elaboration of a framework suggested by Tugwell, Bennet, Sackett & Haynes (1985), provides this framework.

Injury research draws on the theories and methods developed in such disciplines as epidemiology, public health surveillance, intervention studies, education, program planning and implementation and economics. Although the steps of IPEC are defined, the theories behind each of these steps need to be identified, developed and applied to further the field of injury research. The purpose of this work is not to advocate the use of specific theories but to use these theories as examples to illustrate the steps of IPEC.

Step 7 Closing the Loop

IPEC is an iterative process, in that the burden of injury may be reduced in small increments, and that surveillance must be maintained in order to sustain continued reduction. Re-assessing the burden of injury determines if any changes have occurred, reductions in injury have been achieved, and re-commences the cycle.

Step 6 How do you monitor changes to injury?

Measurable goals are required for the short- and long-term progress of a prevention program to be monitored. A system can be tailored to each prevention program based on selected markers representative of the issue.

Elements to be measured include establishment of the structure of the program, completion of the process stages, and changes in injury outcome. Ideally, a global surveillance system could be developed to monitor the entire population for all types of injury, based on the collection of a minimum injury data set.

Monitoring programs leads to the end of IPEC and the reassessment of the burden of injury, a re-evaluation of the priorities for injury prevention.

Step 5 How are injury prevention programs planned and implemented?

Based on the program effectiveness and efficiency, program planning and implementation considers the feasibility of the community prevention with regards to potential limitations or problems. Social marketing theory encompasses the strategies to increase awareness among the general population and professionals, ensuring the social and political support required for a successful prevention program. Models encompass exchanging resources for safety, meeting the needs of the community and market research.

The Injury Belief Model addresses public attitudes towards injury risk. The beliefs, attitudes and emotions of the target audience must be understood if injury prevention strategies aim to change the skills and knowledge of the population.

Implicit in planning and implementing a prevention program is the ability to monitor its success. Goals and objectives must be well defined and a system must be in place to follow selected markers.

Step 1 Are injuries a problem?

The Burden of Injury is the cumulative effect injury has on a defined population during a specified period of time, quantified by mortality and morbidity, personal and societal costs, and disability. These measurements are achieved using descriptive epidemiology and economic analyses.

Once the burden has been assessed, epidemiological studies can be undertaken to identify priorities for action by identifying risks.

Step 2 What are the risk factors and conditions of injury?

The causes of injury need to be understood to reduce the frequency or severity of injuries. Throughout the history of epidemiology, theory has progressed from single cause approaches to multifactorial etiology, illustrated by the Web of Causation proposed by MacMahon et al. (1960). This is a more complex form of the chain of causation, where several chains are intertwined with risk factors and outcomes overlapping, creating both direct and indirect associations. This emphasizes the opportunity for prevention when only some of the causes are understood.

Examples:

Individual Level Risk Factors

Haddon's Matrix, used to elucidate risk factors at the individual level, examines the risk factors of injury according to three event phases. This is an elaboration of the classical epidemiological triad, interactions between host, agent and environment. For example:

	Pre-Event	Event	Post-Event
Environment	Winter	Icy road	Distance to emergency services
Agent/Vehicle	Speeding	Skidding into a tree	Mangled car
Host	No seat belt	Hits head	Coma

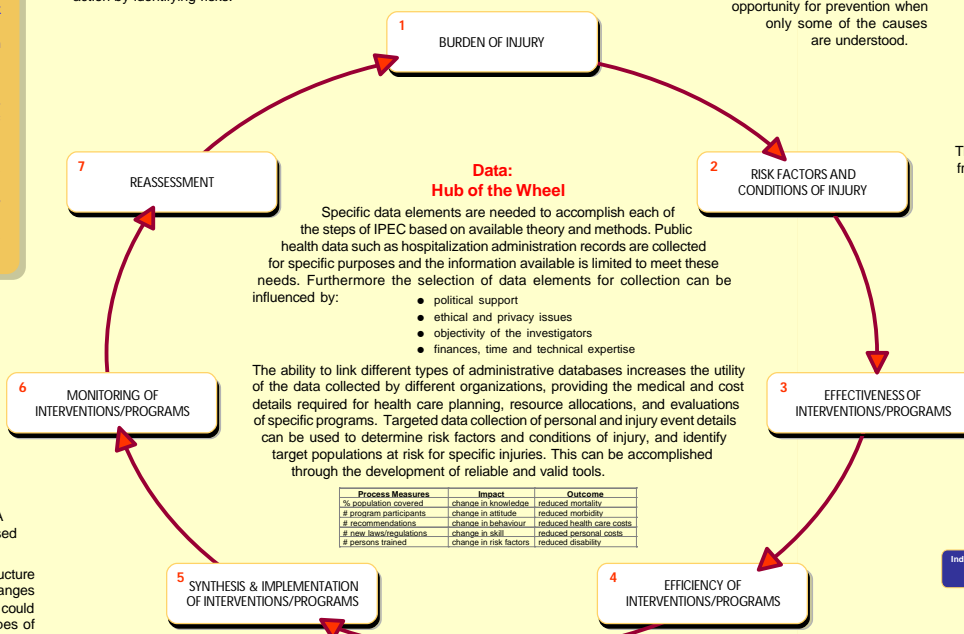
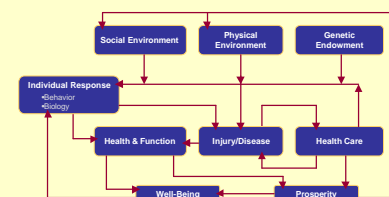
Population Level Risk Factors

The Evans-Stoddart Model approaches risk factors and conditions from the population level, encompassing the interrelations of eight domains and the health of the population.

This population health approach is very comprehensive and potentially more useful in understanding the complex interrelations of various health determinants and their influence on the patterns of injury variations across populations. This reflects the expansion of emphasis from a biomedical focus to include a socio-ecological model of health.

Once multiple risk factors and conditions have been quantified and identified, they can be matched to the measurable objectives of prevention programs. These programs can then be evaluated, improved and expanded, or estimates can be used in the development of new initiatives.

Evans-Stoddart Model



Step 4 Are the injury prevention programs efficient?

Efficiency is the ability of a program to produce the greatest results for the least amount of resources spent. Given the limited public health resources currently available, it is imperative to demonstrate program efficiency.

Methods for evaluating program efficiency include cost-benefit, cost-effectiveness, cost-utility, and cost-outcome, among others. These methods require:

- Selecting the perspective for the evaluation, e.g. society, government
- Adjusting for value over time
- Estimating costs of intervention and effect on outcomes
- Calculating benefits and the cost outcome ratio
- Describing unquantified costs and benefits

Further to estimating the traditional social cost of a prevention program, social value can be estimated. The Willingness to Pay theory accomplishes this using the revealed preference or contingent valuation methods. The first is based on real examples of trading costs for safety, while the second elicits opinions by questionnaire.

These evaluations are used to justify the resources needed to run the prevention program. Planning and implementation strategies can be explored to improve or expand programs, or to initiate new programs.

Conclusion

The purpose of IPEC is to describe the process of identifying and reducing injuries and to evaluate the data required to accomplish each of the seven steps. Data are essential to IPEC, and are limited by their sources, standards and detail. By bringing these theories and models together into one framework, injury research is guided through an iterative process with the ability to reduce injuries and measure success.

Step 3 Are the injury prevention programs effective?

Effectiveness measures the ability of an injury prevention program to reduce the burden of injury in the community setting. The Preceed-Proceed Model outlines the phases of prevention, including process and outcome evaluations.

Program Development Evaluation and Process Assessment both focus on the structure of the program, ensuring that:

- Each step is completed
- Appropriate target audience is being reached
- Information or equipment is being delivered

Prevention-effectiveness and Outcome Assessment measure changes in knowledge, attitude, behaviour, or injury rates that occur as a result of the program. Study designs used to accomplish this include experimental, quasi-experimental and non-experimental.

Once it has been established that the program can reduce the burden of injury, the efficiency of the study must be assessed.