Behavioral and social sciences theories and models: are they used in unintentional injury prevention research?

L. B. Trifiletti1,3, A. C. Gielen1, D. A. Sleet2 and K. Hopkins2

Abstract
Behavioral and social sciences theories and models have the potential to enhance efforts to reduce unintentional injuries. The authors reviewed the published literature on behavioral and social science theory applications to unintentional injury problems to enumerate and categorize the ways different theories and models are used in injury prevention research. The authors conducted a systematic review to evaluate the published literature from 1980 to 2001 on behavioral and social science theory applications to unintentional injury prevention and control. Electronic database searches in PubMed and PsycINFO identified articles that combined behavioral and social sciences theories and models and injury causes. The authors identified some articles that examined behavioral and social science theories and models and injury causes. The authors found that several important theories have never been applied to unintentional injury prevention. Among the articles identified, the PRECEDE PROCEED Model was cited most frequently, followed by the Theory of Reasoned Action/Theory of Planned Behavior and Health Belief Model. When behavioral and social sciences theories and models were applied to unintentional injury topics, they were most frequently used to guide program design, implementation or develop evaluation measures; few examples of theory testing were found. Results suggest that the use of behavioral and social sciences theories and models in unintentional injury prevention research is only marginally represented in the mainstream, peer-reviewed literature. Both the fields of injury prevention and behavioral and social sciences could benefit from greater collaborative research to enhance behavioral approaches to injury control.

Introduction
Health and safety behaviors contribute to many of today’s public health problems. Mokdad et al. (Mokdad et al., 2004) and McGinnis and Foege (McGinnis and Foege, 1993) demonstrated that health behaviors were responsible for 40–60% of the deaths in the US in 1990. This issue is particularly important for the problem of injury, which is the leading cause of death for persons aged 1–44 in the US (National Center for Health Statistics, Vital Statistics Systems, 2001). Using car safety seats (Centers for Disease Control and Prevention, 1991) and having working smoke alarms (National Safe Kids Campaign, 2004) are just two examples of the many health behaviors that have been shown to effectively reduce injuries.

Two Institute of Medicine committees have published literature reviews on social and behavioral risk factors and behavior change interventions for leading causes of morbidity and mortality.
(Institute of Medicine, 2000, 2001). Both committees found substantial support for the application of behavioral sciences theory to identify determinants of disease and develop effective interventions, although neither report addressed the use of theory for unintentional injury prevention.

While the breadth of research integrating behavioral and social sciences with injury prevention has grown in recent years, the use of specific behavioral and social sciences theories and models has varied widely, and as the primary basis for research or program design, behavioral and social sciences remain under-represented in the field of unintentional injury prevention. This may be due, in part, to the historical roots of injury prevention that rely heavily on environmental risk factors and passive interventions or those of health education that were grounded in chronic disease prevention (Gielen and Girasek, 2001; Gielen and Sleet, 2003). With a few exceptions, these fields remain somewhat segregated, and as students and new professionals in health education have limited exposure to the field of injury prevention and control, so do the up and coming injury researchers and practitioners have limited interactions with health education and the behavioral and social sciences.

Theories and models help specialists focus on what is changeable and the most suitable areas or targets for change.

A theory is a set of interrelated concepts, definitions, and propositions that present a systematic view of events or situations by specifying relations among variables, in order to explain and predict the events or situations. The notion of generality, or broad application, is important. Concepts thought of as the building blocks of theory or the primary elements. A construct is a term used for a key concept in a theory. Finally, a model is a generalized or hypothetical description used to analyze or explain something. (Glanz and Rimer, 1995)

Theories and models can be useful in planning, implementing and evaluating interventions. Theories and models help program planners and researchers go beyond basic unchangeable risk factors (e.g. gender, socioeconomic status) to answer why, what and how people can change their behavior.

Theories [and models] can be used to guide the search for reasons WHY people are or are not following public health and medical advice, or not caring for themselves in healthy ways. They can help pinpoint WHAT you need to know before developing or organizing an intervention program. They can provide insight into HOW you shape program strategies to reach people and organizations and make an impact on them. They also help you identify WHAT should be monitored, measured and or compared in the program evaluation. (Glanz and Rimer, 1995)

Advances in behavioral and social sciences and increased attention to behavior change research and theory and model development provide new opportunities for reducing injuries. Considering childhood injuries, Marsh (Marsh, 2000) stated that:

By using injury prevention methods and behavioral theory to better understand how and why children and their parents make health-related decisions, trauma care professionals will be better able to design injury prevention strategies.

These opportunities, however, have not been readily translated into injury prevention research or program development. In a recent systematic review focused on individual-level interventions to reduce childhood injuries, DiGuiseppi and Roberts (DiGuiseppi and Roberts, 2000) highlighted the need for more theory-based interventions. Several other recent works have likewise emphasized the need for greater integration of behavioral and social sciences theories with the development of injury interventions (Gielen, 1992; Sleet and Gielen, 1998; Gielen and Girasek, 2001; Thompson et al., 2002; Gielen and Sleet, 2003).

While many studies have been published focusing on a behavioral aspect or behavioral approach to injury prevention (Sleet and Hopkins, 2004), the extent to which researchers have used behavioral and social sciences theories or models as the basis...
for research or program activities is unclear. To enumerate and briefly categorize behavioral and social science theory applications to unintentional injury prevention, the authors reviewed the published US literature indexed in two electronic databases, PubMed and PsycINFO. The aims of this review were to: (1) identify and enumerate the articles that describe applications of behavioral and social sciences theories and models to unintentional injury prevention, (2) describe which behavioral and social sciences theories and models have been applied to which unintentional injury topics, and (3) develop and apply a categorization system to describe how these theories and models have been applied.

Methods

Search strategy and databases

The authors designed the search strategy to identify articles that combined injury causes and theories and models. A filter, or series of subject-related keywords (Medical Subject Headings), was used to extract potentially relevant articles from two electronic databases (PubMed and PsycINFO) for the years 1980–2001. The filter for defining ‘injury’ was comprised of the following words and phrases: wounds and injuries/prevention and control/psychology, accident prevention/education/methods, safety/education and unintentional. This filter was tested through a review of the query results. The selection of articles was limited to unintentional injury topics.

The theories and models included in this review were among those identified by Glanz et al. (Glanz et al., 2002) as the most widely used or ‘dominant’ theories and models in health education and health promotion today. These are the most commonly used in health education textbooks and by those working in the behavior change intervention field. These included: Health Belief Model, Theory of Reasoned Action or Theory of Planned Behavior, Stages of Change or Transtheoretical Model, Precaution Adoption Process Model, Protection Motivation Theory, Social Learning Theory, Social Cognitive Theory, Community Organization Theory, Organizational Change Theory, Diffusion of Innovation Theory, PRECEDE PROCEED Model and Social Marketing. In addition to these theories and models being the most extensively used in health education and health promotion, they focus on multiple levels of the ecological framework from the individual and interpersonal level to the organizational and community levels.

Searches that combined the injury filter with each theory and model were executed using PubMed and PsycINFO. These two databases were selected because they represent two of the most commonly used medical and psychological journal indexing. PubMed, a service of the National Library of Medicine, includes more than 14 million citations for biomedical articles. The subject scope of articles included in PubMed is biomedicine and health, broadly defined to encompass those areas of the life sciences, behavioral sciences, chemical sciences and bioengineering needed by health professionals and others engaged in basic research and clinical care, public health, health policy development or related educational activities. The majority of the publications covered are scholarly journals, a small number of newspapers, magazines and newsletters. PsycINFO contains more than 1 million citations, and summaries of journal articles, book chapters, books, dissertations and technical reports, all in the field of psychology. It also includes information about the psychological aspects of related disciplines such as medicine, psychiatry, nursing, sociology, education, pharmacology, physiology, linguistics, anthropology, business and law.

Despite the broad indexing provide by PubMed and PsycINFO, examination of the search results suggested that some potentially relevant articles were not being identified. Three additional search strategies were employed to address this concern. Authors reviewed a database of PRECEDE PROCEED Model articles (Institute of Health Promotion Research, 2003), conducted searches on specific author names based on findings from the original search and screened reference lists at the end of selected articles. The initial PubMed and PsycINFO searches, as well as the three additional search strategies, were conducted over a 6-month period from 2002 to 2003.
Selection of the articles for review

Article selection involved two steps: (1) a preliminary review of titles identified during the searches and (2) a review of article abstracts. To be included, an article had to apply one or more of the selected theories or models to an unintentional injury problem. Two authors (L. T. and A. G.) screened the title and abstract (when available) for each citation, and eliminated those inconsistent with the search strategy and criteria (outlined below). Articles on sunburn, intentional injury or violence and rehabilitation were excluded. The same two authors then independently reviewed the potentially relevant articles to determine the eligibility of each document, resolving any discrepancies through discussion before final selection was made. The authors reviewed the articles using the review form described below.

Article review form and process

The authors developed a standardized abstraction form to classify and describe key characteristics of each article, including: (1) study aims, (2) theories and models addressed in the article, and (3) the way behavioral and social science theory was used. To develop a consistent review and coding methodology, two authors (L. T. and A. G.) double-coded seven articles (10% of total reviewed) and resolved any discrepancies through discussion.

The authors developed a three-part categorization system using techniques similar to those used in thematic analysis to reflect the most commonly observed applications of theory across all articles. This categorization process showed that the goals and application of theory varied greatly in the articles reviewed. The application of theory included measuring theory or constructs as variables (e.g. measuring predisposing factors for bike helmet use), testing a theory (e.g. whether changes or variation in measured constructs predicts change or variation in the outcomes as predicted by the model), or simply mentioning that a theory was used to guide program design and/or implementation and/or select program measures. Our determination of the latter use was limited by the explanation that the authors of the study included in their description. There may be other ‘ways’ to use theory that were not categorized or included in this review.

If a theory was applied simply as a guide to program design or measure selection, rather than systematically tested, the findings cannot be as strongly attributed to the use of that theory. For example, if an article used the Health Belief Model to plan a bicycle helmet distribution program, the article was coded as ‘(1) Used to guide program design and/or implementation, and/or select program measures’. When an article measured a specific aspect of a theory, construct or model (e.g. predisposing and enabling factors of construction worker safety practices), authors coded it as ‘(2) Measurement of theory or constructs’. An article that specifically tested a theoretical construct or extension of the theory (e.g. whether the Theory of Reasoned Action was helpful in understanding variations in beliefs, attitudes, subjective norms, for home safety practices) was coded to show that it ‘(3) Tested theory’. These categories represent increasing levels of theory application. When articles’ use of theory or models did not conform to the aforementioned categorization or when the study authors did not adequately explain the role of theory or models it was labeled as ‘Other’.

Results

A total of 71 articles were reviewed using the article review form. Of these, 34 were discarded because the article did not specifically mention or address a theory, model or related construct, or because the article focused on an injury topic outside the defined inclusion criteria, e.g. violent injuries. The remaining 37 articles were used in the following summaries and descriptive analyses.

Few research studies analyzed featured behavioral and social sciences theories or models as the basis for the research or program design

Of the 453 articles identified in PubMed, only eight
(1.8%) addressed injury prevention. Similarly, of the 611 citations identified for Social Cognitive Theory in a PubMed search, only three (0.5%) addressed unintentional injury topics. In PubMed, a search for Diffusion of Innovations and Injury generated the most citations \((n = 12, 9.9\%)\), whereas in PsycINFO, a search on Social Cognitive Theory and Injury led to the greatest number of articles \((n = 32, 6.5\%)\). For several of the major behavioral and social sciences theories, there were no injury topic applications. From PubMed citations, the theories and models that had no injury applications included the Precaution Adoption Process Model and Organizational Change; in PsycINFO, these were the Precaution Adoption Process Model, Protection Motivation Theory, Community Organization, Organizational Change, PRECEDE PROCEED Model and Social Marketing.

**Theories most frequently used in unintentional injury**

Table I summarizes health behavioral and social sciences theories and models by injury topic. Theories or models that were not applied to unintentional injury topics were excluded and totals are not provided because some studies used more than one theory or model. For injury topics, use of the PRECEDE PROCEED Model was cited most frequently \((n = 16)\), followed by the Theory of Reasoned Action/Theory of Planned Behavior \((n = 14)\) and the Health Belief Model \((n = 14)\). Theories and models were used most often in motor vehicle injury prevention studies \((n = 12)\), followed by bicycle injuries and helmet use \((n = 10)\) and pedestrian injury prevention interventions \((n = 2)\). A total of five articles addressed multiple injury topics. When multiple injuries were addressed common themes were pediatric home injuries (burns, falls, poisoning, suffocation, laceration, drowning or firearms), motor vehicle injuries or parent safety practices. A total of seven articles studied injury topics categorized as ‘Other’, which included occupational injuries (lower back injuries in postal workers, construction worker safety and eye injury in soldiers), recreational injuries (e.g. inline skating) and alcohol-related injuries.

**How theories and models are used**

Table II summarizes the use of theory according to the aforementioned categorization system developed for this study. When articles were categorized by whether theory was ‘(1) Used to guide design, program or measures’, ‘(2) Measurement of theory or constructs’ and ‘(3) Tested theory’, it was found that theory was most often used to guide design, program or measures. It was possible for the same article to be categorized in multiple categories and under multiple theories. Using nine theories, there were 43 instances when the theory or model was used to guide the design, program or measures in the study. Of the nine that did this, the Health Belief Model, Theory of Reasoned Action/Theory of Planned Behavior, Social Learning Theory and PRECEDE PROCEED Model had the most citations. The remaining five theories and models, Precaution Adoption Process Model, Protection Motivation Theory, Community Organization, Diffusion of Innovation and Social Marketing, had either one or two articles that used them as a guide.

There were seven instances where the theories and models were used to develop or evaluate a measure of the theory or model and its constructs. Although there were fewer articles in this category, the Health Belief Model and the Theory of Reasoned Action/Theory of Planned Behavior were each used in three studies.

There were five articles that described studies designed to test the tenets or constructs of the Health Belief Model and Theory of Reasoned Action/Theory of Planned Behavior. There were six articles where theory or model use was categorized as ‘Other’.

**Discussion**

This review found an abundance of empirical public health research that used the selected behavioral and social sciences theories and models, and applied them to unintentional injury prevention. It is widely accepted that theory can be useful in understanding, explaining and changing people’s behavior related to a variety of health problems.
While injury prevention should be no exception, results from our review suggest that there are few scholarly applications of the most commonly used theories to this important public health problem. This reticence to include theory is particularly distressing given the enormity of the injury problem in the US. Some theories and models have been used in injury prevention research, but many others have yet to be applied. Our results identified enormous gaps in

<table>
<thead>
<tr>
<th>Theory or model</th>
<th>Bicycle injuries</th>
<th>Motor vehicle</th>
<th>Pedestrian</th>
<th>Multiple injuries</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Belief Model</td>
<td>Gielen et al., 1994;</td>
<td>Brink et al., 1989;</td>
<td></td>
<td>Russell, 1991; Glik et al., 1991, 1993; Wortel et al., 1995; Smith et al., 1999</td>
<td>Peterson et al., 1990;</td>
</tr>
<tr>
<td></td>
<td>Marsh et al., 2000</td>
<td>Chesham et al., 1993</td>
<td></td>
<td></td>
<td>Wortel et al., 1995;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Williams-Avery and MacKinnon, 1996;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wong and Seet et al., 1997;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sellestrom et al., 2000</td>
</tr>
<tr>
<td>Theory of Reasoned Action/Theory of</td>
<td>Gielen et al., 1994</td>
<td>Wittenbraker et al., 1983; Budd et al., 1984; Gielen and Radius, 1984; Gielen et al., 1984; Parker et al., 1992a,b; Chesham et al., 1993; Thuen et al., 1994</td>
<td>Glik et al., 1991; Russell et al., 1991; Gielen et al., 1995; Wortel et al., 1995</td>
<td>Wong and Seet, 1997; Sellestrom et al., 2000</td>
<td></td>
</tr>
<tr>
<td>Planned Behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precaution Adoption Process Model</td>
<td></td>
<td></td>
<td></td>
<td>Glik et al., 1991</td>
<td></td>
</tr>
<tr>
<td>Protection Motivation Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wortel et al., 1995</td>
</tr>
<tr>
<td>Social Learning Theory/Social</td>
<td>Gielen et al., 1994;</td>
<td>Gielen, 1992</td>
<td></td>
<td>Glik et al., 1991; Russell et al., 1991; Smith et al., 1999</td>
<td>Dedobbeleer and German, 1987;</td>
</tr>
<tr>
<td>Cognitive Theory</td>
<td>Marsh et al., 2000</td>
<td></td>
<td></td>
<td></td>
<td>Daltroy et al., 1993; Wong and Seet, 1997</td>
</tr>
<tr>
<td>Community Organization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Treno and Holder, 1997</td>
</tr>
<tr>
<td>Diffusion of Innovation</td>
<td>Farley et al., 1996, 1997</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRECEDE PROCEED</td>
<td>Gielen, 1992; Jones and Macrina, 1993; Farley et al., 1996, 1997; Becker et al., 1998; Hendrickson and Becker, 1998</td>
<td>Eriksen and Gielen, 1983; Gielen et al., 1984; Sleet, 1987; Brink et al., 1989; Simons-Morton et al., 1989</td>
<td>Stevenson et al., 1996; Howat et al., 1997</td>
<td>Dedobbeleer and German, 1987; Daltroy et al., 1993; Wong and Seet, 1997</td>
<td></td>
</tr>
<tr>
<td>Social Marketing</td>
<td>Morris et al., 1994</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
There were several limitations in this study. Our search strategy, while thorough, was not exhaustive or inclusive of all databases. We were limited to articles indexed in PubMed or PsycINFO with key words that matched our search criteria. This excluded some work not published in the peer-reviewed literature, such as dissertations and conference proceedings. Other methods of searching (by author and by review of reference lists in selected articles) yielded several articles and point to a problem with how articles are indexed in PubMed and PsycINFO.

---

Table II. Theory or model by three-part categorization of theory use

<table>
<thead>
<tr>
<th>Theory Used to guide design, program or measures</th>
<th>Measurement of theory or constructs</th>
<th>Tested theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Belief Model</td>
<td>Dedobbeleer and German, 1987; Glik et al., 1991, 1993; Gielen et al., 1992, 1994; Wortel et al., 1995; Peterson et al., 1990; Smith et al., 1999; Marsh et al., 2000; Sellstrom et al., 2000</td>
<td>Dedobbeleer and German, 1987; Russell, 1991; Sellstrom et al., 2000</td>
</tr>
<tr>
<td>Theory of Reasoned Action/ Theory of Planned Behavior</td>
<td>Gielen and Radius, 1984; Gielen et al., 1984, 1994; Glik et al., 1991; Wortel et al., 1995; Parker et al., 1992a; Sellstrom et al., 2000</td>
<td>Russell, 1991; Parker et al., 1992a; Thuen and Rise, 1994</td>
</tr>
<tr>
<td>Precaution Adoption Process Model</td>
<td>Glik et al., 1991</td>
<td></td>
</tr>
<tr>
<td>Protection Motivation Theory</td>
<td>Wortel et al., 1995</td>
<td></td>
</tr>
<tr>
<td>Social Learning Theory</td>
<td>Dedobbeleer and German, 1987; Brink et al., 1989; Glik et al., 1991; Daltroy et al., 1993; Gielen et al., 1994; Smith et al., 1999; Marsh et al., 2000</td>
<td>Russell, 1991</td>
</tr>
<tr>
<td>Community Organization</td>
<td>Treno et al., 1997</td>
<td></td>
</tr>
<tr>
<td>Diffusion of Innovation</td>
<td>Farley et al., 1996, 1997</td>
<td></td>
</tr>
<tr>
<td>PRECEDE PROCEED</td>
<td>Eriksen et al., 1983; Gielen et al., 1984; Dedobbeleer et al., 1987; Brink et al., 1989; Gielen et al., 1992; Daltroy et al., 1993; Jones et al., 1993; Farley et al., 1996 et al., 1997; Stevenson et al., 1996; Howat et al., 1997; Becker et al., 1998; Hendrickson et al., 1998</td>
<td></td>
</tr>
<tr>
<td>Social Marketing</td>
<td>Morris et al., 1994</td>
<td></td>
</tr>
</tbody>
</table>
This may explain why we found more frequent use of the PRECEDE PROCEED Model when compared with other theories and models. Researchers and practitioners whose work includes both theories and models AND injury prevention should pay careful attention to the selection of keywords that will be used in searches. Because we chose to focus our search on the most frequently used and cited behavioral and social sciences theories and models, some important behavioral and social sciences constructs were excluded from our search and review. For example, ‘stress’ and ‘coping’ could arguably fit within our definitions, and has been studied in relationship to sports participation and injuries (Smith et al., 1990, 1992; Petrie, 1992; Andersen and Williams, 1999; Ford et al., 2000). For the purposes of this paper, we restricted our focus to the most commonly used behavior change theories and models in health promotion and health education.

While there are identified gaps in the literature enumerated here, some progress has been made in merging injury and health education—that progress is illustrated in part by the inclusion of theories and models in major injury textbooks (Rivara et al., 2001; Christoffel et al., 2002; McClure et al., 2004), published reviews summarizing theory and injury (Gielen and Sleet, 2003), and the introduction of dissertation and fellowship awards for behavioral and social sciences and injury prevention research supported through, the Centers for Disease Control and Prevention, the Society for Public Health Education, and the International Union for Health Promotion and Education.

The broader question of whether the development and application of theory approaches to injury prevention behavior will improve prevention effectiveness is largely unanswered from this review because so few studies have been conducted to date. Those that have been grounded in theory have resulted in some positive outcomes which suggest that the use of theory or models in intervention development has benefits beyond a theoretical approach. The linkage between the fields of health promotion and injury prevention can and should proceed. Increased levels of government and private sector funding for injury prevention research that emphasizes the use of theory and models in planning and implementation would attract more researchers to the field. There is no shortage of injury problems for testing old theories or developing new ones. Behavioral change theories and models are constantly emerging (DiClemente et al., 2002), and many could have direct application to injury prevention. It will take creative researchers to find the nexus. For professionals who want to use behavioral sciences theories or models in injury prevention, this paper can provide a starting point to identify which theories and models already have been applied to specific injury topics, and in what ways they have been used.

Future directions and next steps for this research include updating and expanding the review to include other searchable databases. Extending this work to evaluate the robustness of the findings when theory is applied to a particular injury prevention topic would be a logical next step with the ultimate goal of knowing what theories and models work best for specific injury prevention topics.

References


mmwrhtml/00015058.htm.


Received on January 6, 2004; accepted on September 8, 2004