A Meta-analysis of Health Behavior Theories Used in Bicycle Helmet Promotion Programs

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Abstract

Many pedal cyclists are killed or injured each year as a result of unintentional injuries sustained in bicycle accidents. Usually, the deaths and the more serious injuries are due to head trauma. In the United States alone, one child dies every day and as many as 50 more receive permanent brain injuries. Because bicycle helmets have been found to be extremely effective in reducing head injuries to cyclists, many programs have been developed and much legislation has been enacted to increase their use. This study endeavors to determine if established educational theories are being used in the program development, which theories are being used, and which may be the most effective in influencing helmet use.

Studies of helmet promotion programs were gathered from around the world using the World Wide Web and personal communication with authors and implementors which resulted in 31 programs for analysis of theory content. Unarticulated theories were made explicit. Legislation, educational programs, and combination programs of legislation and education were separated and then grouped by study design for analysis. Outcome measures and evaluation methods were also recorded.

This study found that there were five major implicit, or unarticulated, theories being used in the educational programs reviewed. Further, outcome measures were not standardized, which made answering the question of which theories most influence cyclists to wear helmets even more difficult to answer.

It was found that theories were being used in helmet promotion program development. The information learned in this study may encourage program developers to use a more systematic approach to program development in the future, using explicit theories and a standardized method of outcome evaluation. It was also discovered that peer pressure, a major barrier to helmet use, was not being effectively addressed in the

programs and may need to be made a focus of future bicycle helmet promotion programs.

INTRODUCTION

Many people, especially children, are injured or killed each year in unintentional injuries related to bicycle use. The injuries sustained that are the most likely to result in death are head injuries. In the United States alone, one child dies every day and fifty more suffer permanent brain injuries from bicycle accidents (Ryan, 1998). Overall in the United States, there are as many as 757,000 injuries (Henderson, 1995) and up to 2,500 deaths each year (Prudential, 1997). In addition to the cost in lives, the monetary cost to society is staggering. The cost of brain injuries to society may be near $48.3 billion each year (Prudential, 1997).

Because head injury is the cause of death in as many as 90% of cyclists, and also the cause of many debilitating injuries (Prudential, 1997), it is important to reduce the risk and occurrence of these injuries. Bicycle helmets have been found to be extremely effective in reducing head injuries and deaths. Studies have shown that the reduction of these head injuries and deaths could be anywhere from 80 to 95% depending on the evaluation criteria used (Prudential, 1997).

Because the use of bicycle helmets is very low, usually 4 to 5% in most areas, increasing their use could greatly reduce the number of injuries and deaths (Henderson, 1995). To this end, many programs have been developed to encourage the use of bicycle helmets. Many of these programs have not relied, however, on sound educational and behavioral theories in an explicit manner. An informal review of several bicycle helmet promotion programs by this author, (Johnson, et.al., 1991; Smith, 1999; Vegega & Levy, 1999; Stutts & Hunter, 1990; United States, 1999), suggested that theories are not being purposely used as a foundation or focus for programs. This lack of a theoretical base may result in programs that are not working as well as they could, and also making the task of evaluation extremely difficult if not impossible.

Use of sound behavioral theories will help to develop more efficient and effective helmet promotion programs. This study will seek to systematically review the development of the programs and if theories are being used, which theories are being used (explicitly or implicitly), and which of these theories or combinations of theories best influences helmet use. It is anticipated that the use of behavioral theories for programs results in a more effective promotion program for helmet use, and that legislation increases helmet use more than educational programs alone.

In order to extract the most commonly used theories hidden in the programs and identify those programs that have been most successful, a careful analysis and comparison of programs has been carried out. This comparison, also called a meta-analysis, "can help to identify gaps in the knowledge found in the published literature and thus can help provide guidance for future research" (Selden, 1992). A meta-analysis has also been termed "a systematic research synthesis" (Rossi et al., 1999). A meta-analysis, according to Lyons (1998) is "a set of statistical procedures designed to accumulate experimental and correlational results across independent studies that address a related set of research questions." Features of a meta-analysis include location and reviews of multiple studies and their summarization, followed by processing the data. The data is then combined in order to determine the magnitude of the information. A meta-analysis is conducted to learn about effects of interventions or conditions and the robustness of the effects (Durlak & Lipsey, 1991). The use of a meta-analysis allows for an examination of the heterogeneity between studies collected over a broad range within the topic of interest (Matthais, 1997). As opposed to a quantitative meta-analysis, this study will consist of a qualitative meta-analysis of the studies, meaning that rather than computing a summative estimate of bike helmet effectiveness, this study will systematically compare the theories used for bicycle helmet programs. This is important so that programs can be made more successful by allowing for a "better fit" between the activities of the program and the people and problems that are being addressed. This will allow for changes to improve the program and continued inclusion of those aspects that are working and exclusion of those aspects that are not. The next sections will review the extant literature on bicycle helmet safety.

Number of Bicyclists and Injuries

Many people around the world are injured in bicycle accidents, with serious injuries most commonly occurring to the head. Henderson (1995) reports that in New South Wales, Australia, in 1993, eight cyclists died and 282 were seriously injured while another 1156 more were less seriously injured. Each year in the United States, bicycle related accidents account for between 580,000 and 757,000 injuries and 900 to 2,500 deaths. Between 75 - 87% of these injuries are associated with collisions with cars or trucks (AAOS, 1992).

In 1993, the injury rate for children in the United States between the ages of five and 14 was 17 per 1,000 riders. For those over 15, the rate was much lower, putting the risk of riders 15 and under at five times that for older riders. Fifty percent of the time, young children received head or face injuries (Henderson, 1995). In a study by Sacks and colleagues (1991), head injury was found to be the most common cause of serious injury, death, and disability for children who were involved in bicycle accidents. Head injury has been estimated to be the cause of death in 62% to 90% of all fatalities (Henderson, 1995; Prudential, 1997). Of those with head injuries who are admitted to a hospital, it has been found that they were 20 times more likely to die than those without head injuries (Henderson, 1995).

Costs in Lives and Dollars

The cost of the injuries is staggering. A study in New South Whales, Australia, by the Staysafe Committee on Road Safety estimated that 6% of the costs of road collisions were from bicycle accident injuries, approximately $100 million annually (Henderson, 1995). The Brain Injury Association in the U.S., estimated the cost of brain injuries to be $48.3 billion each year. Hospitalization accounts for $31.7 billion of that amount (Prudential, 1997). The Consumer Product Safety Commission has reported amounts to be approximately $8 billion per year spent on injuries related to bicycle accidents. Also, rehabilitation services can cost up to and over $110,000 per person and one brain injured patient could cost up to $4.5 million over his or her lifetime (Smith, 1996). Broken down, this equals $120 per year for each cyclist in the U.S. Studies show that there is a 2 to 1 savings ratio between money spent on direct and societal costs compared to the cost of helmets (Henderson, 1995).

The Effectiveness of Bicycle Helmets

Helmets have been shown to be extremely effective in reducing the risk of brain injuries from bicycle accidents. Studies report the reduction to be over 80% and some report the reduction to be 88% to 95% (Prudential, 1997; AAOS, 1985). Henderson (1995) reported that head injury risk is reduced 63% and loss of consciousness is reduced 86% with helmet use. Further, it showed that the risk of head injury leading to death of an unhelmeted cyclist was ten times greater than a helmeted rider (Henderson, 1995).

Studies have shown that when helmet use goes up, head injuries and fatalities go down. In Melbourne, Australia, the number of cyclists with head injuries fell between 1981 when the helmet law was introduced, through 1990 when the number of injuries was studied. This same study reported that one year after the law was enacted, the number of head injuries decreased by 41% as compared to the previous year (Henderson, 1995). In 1989, the number of people hospitalized in New York fell after the introduction of helmet laws (Prudential, 1997). In Seattle, Washington, the Harborview program, begun in 1988, revealed that helmet use rose from 2% before the promotion program, to 70% 10 years after the program was started. This resulted in the incidence brain injuries dropping to an all time low (Ryan, 1998).

Helmet Use

The extent of reported helmet use varies in different places. One consistent finding is that children wear helmets less often than adults. It has been reported that only between 2% and 15% of the general population of the U.S. wear helmets (Prudential, 1997; Smith 1996). The Consumer Product Safety Commission (CPSC) found that of those who own helmets, only 43% wear them most of the time and 44% never wear them. It has also been reported that children between 12 and 14 years of age are the least likely to wear helmets (Prudential, 1997).

Reasons for Non-use of Helmets

Many reasons have been found for the non-use of helmets. Lack of knowledge for adults is one of the largest factors for non-use of helmets. The most common reason for children not owning helmets was that the parents "never thought about purchasing them" (Prudential, 1997; Miller,P., Binns, J. & Christoffel, K., 1996). Miller, and colleagues (1996) reported that the parents felt the child would not wear a helmet anyway (26%) and 16% felt they were too expensive. For children, it is the idea that it isn't "cool" to wear a helmet since their friends don't wear them or hardly anyone else does (Finch, 1996). The CPSC and the American Automobile Association found that fit and comfort were major reasons children didn't wear helmets and 52% of these children also said it was because of the way they look (Prudential, 1997). Some children say they are uncomfortable and even that they are such good bicyclists that they won't have any accidents (Prudential, 1997). Many also believe that the helmets won't protect them in a serious collision (Henderson, 1995). Furthermore, in situations where parents don't use helmets, it was found that the children probably would not either (Dannenberg, 1993). The study by Miller and colleagues (1996) reported that if the parents had a strict rule about using helmets, then the children were 88% more likely to use one than if there was no rule (1996). Thus, a variety of factors, including parental role modeling, influenced children's use of helmets.

Efforts to Increase Helmet Use

Many bicycle helmet promotion programs have been developed throughout the world. The programs discussed in this paper are similar in many ways but also use different theories and methods of evaluation. Most programs have involved education components alone, some have been based only on legislation, and others have combined education and legislation. The combination approach has been used much less often than the first two.

Most of the legislative efforts to increase helmet use has been the passage of a single law with small penalties for non use. A study by Pruder and colleagues (1999) of programs in three New York City suburbs used legislation alone with a $50 penalty. Observation of helmet use before and after each law was enacted revealed an increase in helmet use in all three areas. The law that included a wider age range showed the greatest increase in helmet use. This study showed that legislation was successful in increasing use, but also suggested that if no age limits were incorporated in the law as well as promotion and education, it would enhance helmet use even more.

Another study of legislation in New Jersey in 1997 reported that after a helmet use law was enacted for children under age 14, bicycle related fatalities fell by 60%. For those cyclists over age 14 who were not affected by the law, the number of fatalities fell only 5% (BHSI, 1999).

In 1999, the United States Military incorporated regulations on bicycle helmets on all military installations. The Department of Defense requirements, most probably, resulted in 100% compliance although there was no evaluation of injury outcomes (DoDI, 1999).

In addition to legislation, many educational programs have been implemented. One example was a helmet campaign in Madison, Wisconsin, reported in 1999, that targeted the entire cycling population of the city (about 150,000 people). The objectives of this program were to reach the cyclists and increase helmet use among them. Extensive media coverage was used including television, radio, newspapers, posters, and brochures. Many of these messages were combined with helmet discounts. Prior to the campaign, a survey estimated helmet use at 10%. The post campaign survey reported helmet use at 19% (BHSI, 1999).

A more focused program was designed and implemented in Pitt County, North Carolina in 1990. This program targeted children from four to 14 years old. A media campaign was used to promote awareness of parents, an educational component was introduced in the public schools, and a discount coupon was available for helmet purchase. The post program survey showed an increase of helmet ownership from 6% to 16% and over one-third of the families had heard of the project (BHSI, 1999).

Another educational program took place in Goderich, Canada, in 1991. This program combined an educational component and a discount helmet offer. Bicycle rodeos were held in the later part of the program. Ironically, a child who was not wearing a helmet was fatally injured during the program, creating substantial awareness of bicycle helmets. The program was evaluated by surveying the students for helmet purchase, which showed that 250 helmets were purchased and helmet use for five to 14 year olds increased 17 fold. Unfortunately, it was estimated that 82% of cyclists still did not wear helmets (Rourke, 1994). There are very few combination legislation and education programs that contain the educational activities used in that portion of the program. In fact, only one with the educational activities described was located for this review. This program did report an increase helmet use rates of 70% to 90% and a decrease in head injuries, but it is unknown how this was determined (Vulcan, A.P., Cameron, M.H., & Watson, W.L., 1992).

Behavioral Theories

To create successful health promotion programs, it is important to base the intervention on sound behavioral theories. "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" (Glanz, 1995). Being able to understand and use behavioral change theories makes desirable changes a more likely result for the health educator. As stated by Glanz and Rimer (1995), "programs that are the most likely to succeed are based on a clear understanding of the targeted health behaviors and their environmental context." Behavior change occurs in as many ways as there are people and problems. It follows then, that strategies to change behavior must be just as diverse (Dennison, 1996). Not only can theory help in planning, executing, and evaluating a program, it is helpful in understanding the reasons for specific health behaviors. By understanding why people choose certain actions, the intervention to change these actions can be explained and targeted in a specific and directed manner. Theories are malleable, that is, they can be shaped to the situation being addressed. One particular theory will not be appropriate for all situations. Theories also overlap making separation of strategies difficult in some situations, but allows for a program that is cohesive and seamless. Most often, when a particular issue is being addressed, the program to address that issue requires more than one theory to result in an effective and sound program. The theoretical constructs (also referred to as concepts above) identified in the reviewed programs are commonly found in many well accepted behavioral change models or theories. The identification of these constructs will be helpful in creating a systematic way to examine relationships between the constructs and their propositions so that the most effective programs can be created.

In the realm of bicycle helmet promotion, theory can help describe the factors that influence the cyclist to wear or not to wear helmets. When this is understood, behavioral change theories can be chosen to match these factors to improve the rate of helmet use. For example, one explanation for not wearing helmets may be that they are perceived as not accessible. If the reason for inaccessibility is found to be cost, then reducing cost may increase purchases and use of helmets. By the use of theory, the educator can skillfully create interventions that address specific situations and specific circumstances. In this example, the theoretical proposition is that barriers (inaccessibility) prevent use and that reducing the barriers increase use.

Theoretical constructs have been combined to form many models of health behavior change such as the Health Belief Model, Theory of Reasoned Action etc. These models are extremely helpful in developing, implementing, and evaluating programs, but they are not the only combinations that can be utilized. In fact, many programs use combinations of models or theories borrowed from many different models. This is prudent since all situations and individuals do not respond to particular interventions in the same manner, nor do they have the same issues to overcome.

The theories used in the bicycle helmet promotion programs discussed in this paper are many and are most often implicit. That is, theoretical propositions might have been used to construct the intervention but were not explicitly mentioned in the literature. This paper has endeavored to extract the implicit theories used in the programs, thereby making them explicit, in order to suggest avenues for the development of successful programs and to allow for theoretically informed evaluation of the programs.

The following analysis of bicycle helmet promotion programs seeks to answer the questions: *are theories being used to develop bicycle helmet promotion programs, what theories are being used, and which combinations of theories best influence the development of bicycle helmet programs?* The answers to these questions may demonstrate that the use of explicit or articulated theories does indeed result in better, more effective programs. It may also be found that legislation, which is a part of the Ecological Model, may increase helmet use even more than educational promotion programs.

Methods

Many helmet promotion programs reviewed in this paper were found using computer searches. Other programs and information were obtained from informal interviews with individuals involved in health education in hospitals, county health departments, state and federal government agencies, and insurance companies.

Program Search

The computer searches were initiated in January, 2000 and the dates of the query were not specified. The search began by using the internet databases Google, Lycos, Info Trac and Medline, producing 4478 results. The first attempt in locating bicycle helmet promotion programs was done using the Google search engine using the keywords *bicycle helmets*, which uncovered 3,639 results. Because there were so many articles and web pages regarding bicycle helmets, the keywords were changed to *bicycle helmet safety*, which still resulted in information that was not related to helmet programs themselves. The information covered topics such as helmet manufacture, bicycle clubs, helmet injury statistics, bicycle gear, and riding maps. Finally, the keywords *Bicycle helmet programs* were used and resulted in a more focused collection of 105 articles which were determined to describe actual helmet programs. To be sure of obtaining all relevant information, the keywords *bicycle helmet promotion* were also used, which resulted in essentially the same information as bicycle helmet programs.

In order to be systematic in the computer search, the same tactic was used for the other search engines. The Lycos search using the keywords *bicycle helmets* found 802 results, many of which were not helmet programs. The keywords were then changed to *bicycle helmet safety* and then *bicycle helmet programs* which identified four actual helmet promotion programs. Much of the information brought up by this search was duplicative of information from the Google search. This same approach was used with the Info Trac search engine from which only one bicycle helmet promotion program description resulted.

Medline was accessed and the same protocol was followed. *Bicycle Helmets* as the keywords resulted in 36 articles, which was narrowed by using the keywords *bicycle helmet safety* and then *bicycle helmet programs*. Much of the information in each of these data bases was duplicate information since many of the same web pages on bicycle helmets were listed in each. These processes resulted in 128 bicycle helmet programs to review for this paper. This process is illustrated in Table 1.

Actual Bicycle helmet programs were also obtained from individuals who were contacted personally by telephone, regular mail, e-mail, and fax. These individuals were located by contacting county health departments who gave referrals to those involved in helmet programs. These referrals then led to a total of 15 contact people, eight of whom agreed to speak with the investigator. Five of the contacts were able to provide information on helmet programs which were included in this study. These five programs were developed by local, state, and federal agencies, and have been used by state and local health departments, hospitals, public schools, and insurance companies.

Figure 1 summarizes the review process. Of the 4,486 initially reviewed programs, 4,358 were not bike helmet programs or did not give sufficient information (for example, strategies used or evaluation outcomes). The remaining 128 articles were analyzed for evaluation methods and outcomes. These included actual observation of use, surveys or reports of use, attendance of programs, helmet discounts used, helmets given away, helmets sold, helmets owned, and requests for more helmet programs. Some programs were evaluated by changes in death or injury rates. After this review, 96 were disqualified for lack of an evaluation and 31 were retained for study. A review of programs revealed that none of the 31 selected contained explicit behavioral theories. Of these 31 studies, 19 were educational programs, 11 were legislative programs, and one was a combination of both. The initial search did not specify a time period, but the final 31 studies dated from 1988 to 2000. All of the 19 educational studies are reviewed in the annotated bibliography in Appendix A.

Table 1. Results of search using Bicycle Helmet Safety and Bicycle Helmet Programs as the key phrases, and programs from individuals.

DATA BASE	# ARTICLES FOUND	# ARTICLES REVIEWED
GOOGLE	3,639	105
LYCOS	802	4
INFO TRAC	1	1
MEDLINE	36	13
PROGRAMS OBTAINED FROM INDIVIDUALS	8	5
TOTAL	4,486	128

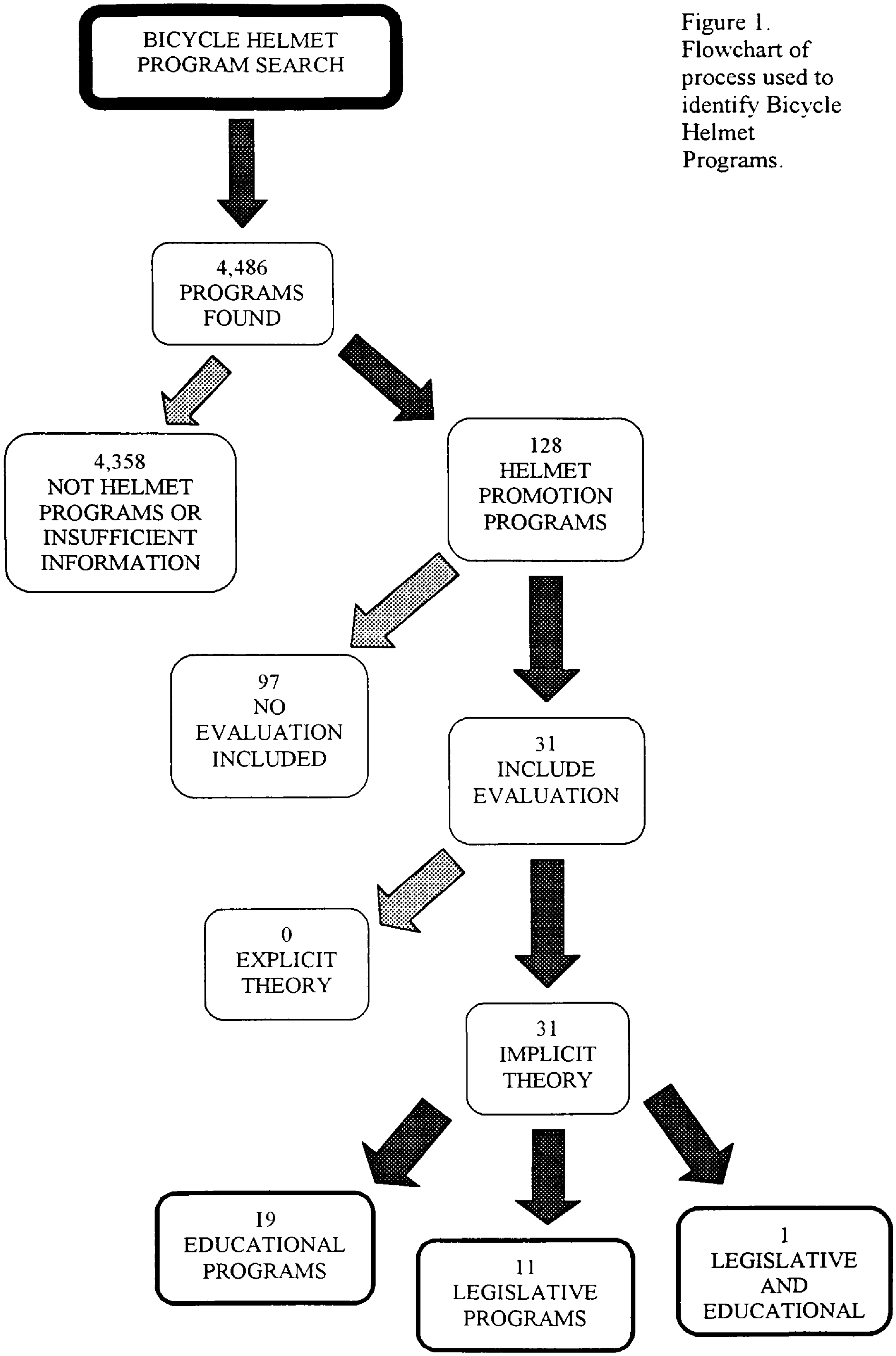

Figure 1. Flowchart of process used to identify Bicycle Helmet Programs.

Theory Analysis

Following this process, the helmet promotion programs were analyzed for theory content. Common and often used behavioral change theories were identified in the text and this information was then analyzed to determine the most often used theories. A theoretical proposition such as: if a person at risk is shown how to perform a particular behavior to reduce that risk, then he or she will perform that behavior, was identified from the programs' components following the methodology of Laub, Somera, Gowen, and Diaz (1999) in making implicit theories explicit. By determining the activities and fitting them to a theoretical proposition, it was possible to develop a list of constructs derived from the propositions used in each program. As stated by Rossi et al., (1999) this type of analysis will help to "examine the relationships between observed program effects and the characteristics of the programs and methods involved in the evaluations." The activities of each program were extracted and fit with the constructs and propositions as presented in Table 2. For example, if the program used demonstrations of helmet effectiveness, this information was provided to the student and was classified within the information construct.

The activities used in the programs were matched with well known health educational theory components. The constructs identified and their theoretical propositions were referred to as: information, awareness, skill building, access, and benefits. **Information** as a construct is explained as providing information and knowledge about a behavior so that the person can act upon that knowledge. The activities linked to this construct were lectures, quizzes, brochures, and demonstrations (e.g. a jello brain mold in a jar or an egg in a specially made helmet being dropped to the floor to illustrate results of helmet use or nonuse). The construct of **awareness** is based on the

Table 2. Column 1 presents the theoretical constructs found in the helmet programs reviewed. Column 2 Describes the theoretical proposition on which the construct was based. Columns 3 & 4 outline the activities based on the proposition and their application to bicycle safety.

THEORETICAL CONSTRUCT	THEORETICAL PROPOSITION	ACTIVITIES BEHIND PROPOSITION	APPLICATION OF THEORETICAL PROPOSITION TO BICYCLE SAFETY
INFORMATION - Providing information and knowledge on health risks and behavior	If information about risks of a behavior are known, then the risky behavior will decrease	Lectures, quizzes, fact sheets, demonstrations of results of helmet nonuse (jello molds etc.)	Cyclists have knowledge they need to reduce the risky behavior of not wearing helmets
AWARENESS- Promotion of health risk through various means	If there is awareness of a risk, then the behavior to reduce that risk will occur	Mass media, newspapers, posters television, & radio public service announcements & brochures	Cyclists are aware that there is a risk and can now act upon the awareness
SKILL BUILDING - Teaching skills necessary to accomplish the health behavior	If the skills to reduce the risk are performed, then the behavior will change	Bicycle obstacle courses, rodeos, helmet fitting, & riding skills	Cyclists are able to ride safer and use bicycle helmets correctly
ACCESS - Making resources available to allow achievement of the desired behavior	If there is improved access to resources to change behavior, then the behavior will change	Helmets made easily available geographically, many reduced prices and discount coupons	Cyclists know where helmets are and can more easily afford them
BENEFITS - Receipt of awards and rewards.	If there are rewards for changing the behavior, then the behavior will change	Rewards in the form of pizzas, milk shakes, & certificates	Cyclists have tangible incentives and are now more likely to wear helmets

premise that one cannot perform a particular behavior unless he is aware of risk. Information is the knowledge necessary to change a risky behavior, while awareness is knowing there is a risk. Activities to improve awareness were mass media reports, posters and other "reminders." **Skill building** involved the idea that teaching someone how to perform a behavior will encourage them to do it regularly. Skill building consisted of bicycle rodeos or obstacle courses, helmet fitting, and riding skills. **Access**, in this study focused on geographical and economical availability of helmets. If the helmets were easily obtainable and low cost, they would more likely be purchased and ultimately used. Many programs also gave away free helmets as the activity behind the construct. **Benefits** as a construct were things such as rewards given for using helmets (e.g. this construct suggests that providing benefits and reinforcers lead to behavior change). Especially for children, prizes for complying with a behavior make the behavior change more likely.

The programs were then organized by type (e.g. educational, legislative, or both) and then arranged by study design (i.e. experimental, longitudinal, or cross-sectional) and by listing them from most reliable design to least reliable design. This allowed for an examination of the potential influence of study design on the theories chosen. The population type and numbers targeted were also analyzed. The implicit constructs, as described above, were arranged according to program and finally, the evaluation method and outcome were listed along with the judgment of success by the author or implementor.

RESULTS

Of the initial list of 4,483 programs, 31 were reviewed that met the criteria of providing the educational activities used and an outcome evaluation. Studies that reported an outcome measure, but did not specify the tool used for the measurement (e.g.

observation of use, survey) were also included. Of these, there were 19 educational programs, 11 bicycle helmet laws, and one program that combined education and legislation. The general ages of the target populations were kindergarten through eighth grade, although some programs included preschool children and others were directed at cyclists of any age. Within the group of educational programs, three used an experimental design, eight a longitudinal design, and 16 a cross-sectional design. The 11 bicycle helmet legislative actions all used a longitudinal design. The combination legislation and education program was also studied longitudinally. The programs were conducted between the years of 1988 - 2000. The majority of programs began in the 1990's, presumably because of the increased awareness of bicycle helmets in more recent years.

The experimental design may have been the strongest design study since "one can be more certain than with any other design about attributing the cause to the independent variables" (Vogt, 1999). It was interesting that these programs did not explicitly use behavioral theories, even though they used the more sophisticated experimental program study design. The constructs were there implicitly, but only listed as activities that were used in the program, not as propositions about how or why the outcome could be affected. The programs using a longitudinal design for evaluation, are important because they demonstrate the difference in helmet use over a period of time, but they do not account for other influences between pre and post intervention. The programs using a cross-sectional study design may be the weakest since they only examine the program at one point in time. There was no baseline established to ascertain if helmet use increased. The programs with these designs also used implicit theories, only listing activities used.

Outcome Evaluation

In addition to the variation in study designs, the results were examined according to: observational use (actual counting of people wearing helmets), number of helmets sold or given away, surveys of ownership or use, educational material distributed, requests for more programs, attendance of children, measurements of number of head injuries, and measurements of death rates. There were three programs that did not report the method of evaluation used, but were included because they contained an outcome measure indicating that an evaluation was done. Observational use measurements would seem to be the best way to determine actual helmet use, since the cyclists are directly observed by trained personnel in different areas and at different times and actual counts are taken of those wearing helmets. All the other types of evaluation don't measure how many helmets are being used and may not be indicative of the performance of the program in increasing that use.

Educational Programs

The 19 educational helmet promotion programs are detailed in Table 3. The first three programs reviewed were experimental in design, using randomly assigned target populations who were either provided with an intervention or used as a control. Even though this design was used, the theories were not made explicit by the author of the program, which is surprising since experimental designs are considered the best way to conduct a valid and reliable study and presumably these studies involved persons who should have had some theoretical perspective (Vogt, 1999). As Rossi and colleagues (1999) point out, the importance of theory has long been recognized by evaluators as a basis for "prioritizing evaluation questions, designing evaluation research, and interpreting evaluation findings." The cost and time involved may have resulted in the limited use of this study design. All of these programs, though, did use observational use as the evaluation tool which may result in the most accurate results.

In these three programs, the ages targeted were young children, beginning at five years old. One study included only up to second grade which is usually seven or eight years of age. The others included up to eighth grade, usually about fourteen years old. The target populations ranged from 550 to 10,000.

One of these experimental programs used all five of the implicit constructs. All three of the studies used *information* , such as lectures and demonstrations; *awareness*, such as posters and public service announcements; and *access* which was usually in the form of helmet discounts. Two of these studies used *skill building* as a component, which included bicycle riding safety and helmet fitting.

Eleven other studies used a longitudinal study design. They also involved a wide range of cyclists, ages, and target populations - from preschool to cyclists of any age. One study targeted 300, while the program reviewed by Stutts (1990) targeted up to 150,000 people. Several of the programs did not report the size of the target population, only that it was city-wide or county-wide.

These longitudinally-studied programs had from two to four implicit constructs. *Information* was used in six of the studies, as was *awareness*, with the activities the same or very similar to those used in the experimental studies. The construct of *skill building* was used in five of the studies and again included bike riding safety and helmet fitting. Some of the programs also taught bicycle maintenance and repair. *Access*, the increased availability and decreased cost of helmets, was the most common construct used and was included in seven of the programs. Four of the programs also used *benefits* in the form of

Four of the programs also used *benefits* in the form of rewards as an incentive to helmet use.

Because of the different methods of outcome evaluation used in the longitudinal studies, their outcomes are difficult to compare. Observational use, surveys of use, surveys of ownership, word of mouth, informal use observations by community members, and helmets sold were the types of reported outcomes. For example, the Logan program study (1998) reported increased observed use and then falling use, but did not disclose how the numbers were ascertained. The Madison, Wisconsin program (1999) reported a 15% to 19% increase in use measured by the observational method. This program used *awareness* and *access*, only telling people about the existence of helmets and how to get them at a decreased cost. Other programs used surveys of ownership and surveys of use and these may not have always been reliable and therefore not necessarily comparable to other studies whose outcomes were evaluated differently.

There were eight cross-sectional studies of helmet programs. These studies covered a wide range of ages and populations sizes. Most programs targeted youth in K-8. Only one, the Cool Cat Program, focused on preschool children. Most of the interventions targeted a whole city or county.

Theories used in these programs were also analyzed. The construct of *information* was important in these programs and used in all but one. Of the eight programs, six used *awareness*, these two constructs were used together in half of the cross-sectional programs. *Skill building* was a part of six programs, but was not used in two of the largest programs. *Access* was used in all but one program which consisted of offering discounts and convenient geographical availability of helmets. *Benefits* or rewards were used in five of these programs which consisted of certificates for wearing helmets and coupons for food or other activities.

These programs were evaluated by attendance, helmet giveaways, helmets sold, brochure and color book distribution, and requests for more programs, especially rodeos. These measures were only proxies of helmet use, and cannot be compared to those using actual observation as the evaluation tool. Interestingly, studies employing the weakest design (cross-sectional) also used the weakest measure of bicycle helmet use. This may be because the program author was not familiar with program design and evaluation.

Legislative Programs

The programs using only legislation did not rely on the behavior theories identified in the educational programs. These are summarized in Table 4. The implicit theory in use here is that legislation and its enforcement provide for behavior change. The action, wearing a helmet, can be affected not only by the individual's own feelings, but these feelings are influenced by the rest of the interactions he or she encounters in daily life. For example, one's family may have certain attitudes about a behavior which will influence the behavior of the individual. As involvement with others beyond the family expands, peers and social activities also influence behavior. When institutions such as churches, schools, and community organizations promote or inhibit a behavior, they may very well play a role in the individual's behavior (Selden,1980). The individual may in turn, influence these groups or institutions as well. The ecological model, in which the legislative action is a part, is a popular theoretical framework wherein public policy affects behavior change (Sallis & Owen, 1997).

The legislation reviewed targeted large populations of entire cities, counties, or states. The most common laws affected those cyclists under 16 years of age, though five of the laws affected cyclists of all ages. The study design for all the helmet legislation was longitudinal, although again, the evaluation methods were not all the same. Observed use, the best evaluation outcome measure, was used in only two out of the 11 evaluations. Both of these studies had significant increases in helmet use. Surveys and self reports of use (the difference of these terms was not explained in the literature) were the outcome evaluation methods used in four programs. Two of the programs did not report the method used for evaluation, but both reported significant increases in use.

A study by Sacks and colleagues (1997) of a law for those under 16 years old in a state-wide program, used four types of data: observational use, school employee reports of use, student surveys, and adult (parental) surveys of use. All reported an increase of use with the school reporting the highest increase. It is not known if the school had stricter enforcement such as a policy that all riders must wear a helmet to and from school.

Other methods of evaluation were used with other legislation. Head injury rate was measured before and after the legislation in Victoria Australia. Emergency room records showed a 41% decrease in head injuries after enactment of the law. In New Jersey, death records measuring head injury deaths from bicycle accidents showed a 60% drop in deaths from this cause after legislation was adopted.

The Department of Defense (DoD) also enacted a bicycle helmet regulation. This regulation affected all military personnel who ride bicycles on military installations regardless of age or rank. This is a large population and it is expected that because of military enforcement, there is total compliance. It is interesting that children are usually the main concern in bicycle safety and helmet use, but the government feels strongly enough about the effectiveness of bicycle helmets to make them mandatory for adults.

Educational and Legislative Programs

Only one study combining an educational program with legislation was found with enough information to include in this study. This program is detailed in Table 5. All constructs except *skill building* were used along with a mandatory helmet law affecting all cyclists in a state-wide effort. This study reported a 90% increase in use and a decrease in head injuries. Data analysis leading to these results were not reported in the study, nor was there a beginning use rate reported to determine the actual increase. If this program actually has resulted in a 90% helmet use increase, it would definitely be determined to be the most successful program reviewed in this paper.

Table 6 illustrates the number of implicit constructs that were used in each reviewed educational program. Ten of the programs used four constructs, making this number of constructs the most common. Three programs used three constructs each and another four programs used five constructs. Two of the programs only used two constructs. This information illustrates that the most common number of constructs was four and the least common was two. Table 7 reveals that the constructs were used 72 times throughout all 19 of the educational programs. The most commonly used construct was *access* and the least commonly used was *benefits*. The number of times *information, awareness, skill building,* and *access* were used were quite similar. The average number of constructs used per program was 3.8.

TABLE 3. EDUCATIONAL PROGRAMS DETAILED

AUTHOR, PROGRAM, OR IMPLEMENTOR & YEAR	POP. TYPE/AGE	n TARGET	CONSTRUCTS USED PER PROGRAM	STUDY DESIGN	OUTCOME & EVALUATION METHOD	SUCCESS BY AUTHOR
LILLER, et.al. 1995	K - 2	3,500	1. INFORMATION 2. AWARENESS 3. SKILL BUILD 4. ACCESS	EXPERIMENTAL	OBSERVATIONAL USE INTERVENTION GROUP INCREASED USE 32% CONTROL GROUP INCREASED 10%	YES
MORRIS & TRIMBLE 1991	K - 8	1,500 to 2,000	1. INFORMATION 2. AWARENESS 4. ACCESS	EXPERIMENTAL	OBSERVATIONAL USE FOR ALL INTERVENTION OF EDUCATION ONLY INCREASED FROM 0 OF 25 CYCLISTS TO 0 OF 73, EDU. + SUBSIDY: O OF 22 TO 6 OF 27, CONTROL GROUP: O OF 22 TO O OF 23 CYCLISTS	SLIGHT INCREASE ONLY WITH SUBSIDY
PARKIN et.al. 1993	5 - 14 YRS	10,000	1. INFORMATION 2. AWARENESS 3. SKILL BUILD 4. ACCESS 5. BENEFITS	EXPERIMENTAL	OBSERVATIONAL USE HIGH INCOME INTERVENTION GROUP INCREASED FROM 4% TO 48% CONTROL GROUP INCREASED 5% TO 34% LOW INCOME INTERVENTION GROUP INCREASED FROM 4% TO 8%, CONTROL GROUP INCREASED FROM 3% TO 14%	MUCH GREATER SUCCESS WITH HIGH INCOME
CALIFORNIA SCIENCE CENTER, COMMITMENT TO TRAFFIC SAFETY 1999	ALL CYCLISTS	10,000	1. INFORMATION 3. SKILL BUILD 4. ACCESS 5. BENEFITS	LONGITUDINAL	OBSERVATIONAL USE INCREASED FROM 5% TO 25%	YES
LOGAN 1995	K - 8	403	2. AWARENESS 3. SKILL BUILD 4. ACCESS 5. BENEFITS	LONGITUDINAL	OBSERVATIONAL USE INCREASED FROM 3% TO 38% THEN FELL TO LESS THAN 5% REASON UNKNOWN	NO
MARTINEZ, et.al. 1999	ALL - UP TO COLLEGE AGE	CITY WIDE	1. INFORMATION 2. AWARENESS 3. SKILL BUILD 4. ACCESS	LONGITUDINAL	OBSERVATIONAL USE INCREASED, NO NUMBERS OF USE REPORTED 2,500 HELMETS SOLD	YES
MADISON WISCONSIN 1999	ALL CYCLISTS	150K	2. AWARENESS 4. ACCESS	LONGITUDINAL	OBSERVATIONAL USE INCREASED 15 - 19%	YES

TABLE 3. EDUCATIONAL PROGRAMS DETAILED CON'T

AUTHOR, PROGRAM, OR IMPLEMENTORS & YEAR	POP. TYPE/AGE	n TARGET	CONSTRUCTS USED PER PROGRAM	STUDY DESIGN	OUTCOME & EVALUATION METHOD	SUCCESS BY AUTHOR
NEW HAMPSHIRE 2000	K - 8	CITY WIDE	1. INFORMATION 2. AWARENESS 3 SKILL BUILD 5. BENEFITS	LONGITUDINAL	INCREASE IN USE BUT THERE WAS NO FORMAL OBSERVATION OF ACTUAL USE	NO
PITT COUNTY 1990	K - 8	COUNTY	1. INFORMATION 2. AWARENESS 4. ACCESS	LONGITUDINAL	SURVEY FOUND INCREASED USE FROM 6% TO 16%	YES
ROUZIER, et.al. 1995	COMM	76K	1. INFORMATION 2. AWARENESS 4. ACCESS 5. BENEFITS	LONGITUDINAL	OBSERVATIONAL USE INCREASED 9.9% TO 37.1%	YES
STUTTS & HUNTER 1990	4TH & 5TH	300	1. INFORMATION 3. SKILL BUILD 4. ACCESS	LONGITUDINAL	OWNERSHIP 12.7% TO 9.4% PARENTAL SURVEY	NO
BERRIEN COUNTY PROGRAM 1999 ALBERS	K - 8	COUNTY	1. INFORMATION 3. SKILL BUILD 4. ACCESS	CROSS-SECTIONAL	47 HELMETS GIVEN AWAY	YES
CONNECTICUT HEADS UP FOR SAFETY 1999	ALL CHILDREN	CITY WIDE	1. INFORMATION 2. AWARENESS 4. ACCESS 5. BENEFITS	CROSS-SECTIONAL	RESPONSE IMPRESSIVE NO FORMAL OBSERVATION OF ANY KIND DONE	NO - NOT ENOUGH INFO
COOL CAT BIKE HELMET PROGRAM 1996 CARPENTER	PRE-SCHOOL	4,000	1. INFORMATION 2. AWARENESS 3. SKILL BUILD 4. ACCESS 5. BENEFITS	CROSS-SECTIONAL	4,000 COLOR BOOKS GIVEN 1,000 HELMETS DISTRIBUTED 10.000 BROCHURES TO PARENTS	YES
KALAMAZOO SAFE KIDS CELERY FLATS 1999	K - 8	CITY	1. INFORMATION 2. AWARENESS 3. SKILL BUILD 4. ACCESS 5. BENEFITS	CROSS-SECTIONAL	EVALUATED BY ATTENDANCE TOTAL OF 200 ATTENDED	YES

TABLE 3. EDUCATIONAL PROGRAMS DETAILED CON'T

AUTHOR, PROGRAM OR IMPLEMENTOR & YEAR	POP. TYPE/AGE	n TARGET	CONSTRUCTS USED PER PROGRAM	STUDY DESIGN	OUTCOME & EVALUATION METHOD	SUCCESS BY AUTHOR
KALAMAZOO SAFE KIDS 1999	K - 8	5 COUNTY	1. INFORMATION 2. AWARENESS 3. SKILL BUILD 4. ACCESS 5. BENEFITS	CROSS-SECTIONAL	500 ATTENDED 30 HELMETS GIVEN AWAY	YES
MISSOULA MONTANA 1982 WILLIAMS	K - 8	8,000	2. AWARENESS 4. ACCESS	CROSS-SECTIONAL	249 HELMETS SOLD	YES
ST. IGNACE, MI 1999 DELMORRIETTA	K - 8	COUNTY	1. INFORMATION 3. SKILL BUILD 4. ACCESS 5. BENEFITS	CROSS-SECTIONAL	240 HELMETS DISTRIBUTED	YES
SEATTLE, WASHINGTON 1988	K - 8	CITY WIDE	1. INFORMATION 2. AWARENESS 3. SKILL BUILD 4. ACCESS	CROSS-SECTIONAL	HELMET SALES INCREASED FROM 1,500 TO 20K 41 SCHOOLS INVOLVED 28 REQUESTS WERE MADE FOR RODEOS	YES

TABLE 4. LEGISLATIVE PROGRAMS DETAILED

AUTHOR, PROGRAM, OR IMPLEMENTOR & YEAR	POP. TYPE/AGE	n TARGET	CONSTRUCTS USED PER PROGRAM	STUDY DESIGN	OUTCOME & EVALUATION METHOD	SUCCESS BY AUTHOR
CONNECTICUT 1994	UNDER 15 YRS	STATE WIDE	LEGISLATION	LONGITUDINAL	SURVEY OF USE REPORTED INCREASED FROM 30-40% TO 60-70%	YES
DEPARTMENT OF DEFENSE 1999	ALL MILITARY	ALL MILITARY	LEGISLATION	LONGITUDINAL	EXPECTED TOTAL COMPLIANCE NO EVALUATION DONE	YES
GEORGIA 1993	UNDER 16 YEARS	STATE	LEGISLATION	LONGITUDINAL	SELF REPORTED USE INCREASED 33% TO 50%	YES
VICTORIA, AUSTRALIA 1995 HENDERSON	ALL CYCLISTS	STATE	LEGISLATION	LONGITUDINAL	SURVEY OF USE REPORTED INCREASE FROM 5% TO 75% HEAD INJURY DECREASED 41% ACCORDING TO MEDICAL RECORDS	YES
NEW JERSEY 1992	ALL CYCLISTS	STATE	LEGISLATION	LONGITUDINAL	DEATH RATE DROPPED 60% ACCORDING TO DEATH RECORDS	YES
NEW YORK 1995	UNDER 14 YEARS	3 CITIES	LEGISLATION	LONGITUDINAL	SURVEY OF USE AVERAGE INCREASE 14% TO 27%	YES
OREGON 1994	UNDER 16 YEARS	STATE	LEGISLATION	LONGITUDINAL	PARENTAL REPORTS STATED USE INCREASED 38% TO 70%	YES
PRUDENTIAL 1997	ALL CYCLISTS	COUNTY	LEGISLATION	LONGITUDINAL	USE INCREASED FROM 4% TO 47% UNKNOWN EVALUATION METHOD	YES
PRUDER, et.al. 1999	ALL CYCLISTS	2000	LEGISLATION	LONGITUDINAL	OBSERVED USE INCREASED 35%	YES

TABLE 4. LEGISLATIVE PROGRAMS DETAILED CON'T

AUTHOR, PROGRAM, OR IMPLEMENTORS & YEAR	POP. TYPE/AGE	n TARGET	CONSTRUCTS USED PER PROGRAM	STUDY DESIGN	OUTCOME & EVALUATION METHOD	SUCCESS BY AUTHOR
RHODE ISLAND 1996	UNDER 16 YEARS	5 CITIES	LEGISLATION	LONGITUDINAL	AVERAGE INCREASE IN USE FROM 4.1% TO 34.8% UNKNOWN EVALUATION METHOD	YES
SACKS, et.al. 1997	UNDER 16 YRS.	STATE WIDE	LEGISLATION	LONGITUDINAL	OBSERVED USE INCREASED 25% TO 49.3% SCHOOL REPORT USE INCREASED 20% TO 56% STUDENT SELF REPORT 15% TO 39% ADULT SURVEY OF USE 37% TO 66%	YES

TABLE 5. LEGISLATION AND EDUCATIONAL PROGRAMS COMBINED DETAILED

AUTHOR OR PROGRAM YEAR	POP TYPE/AGE	n TARGET	CONSTRUCTS USED PER PROGRAM	STUDY DESIGN	OUTCOME & EVALUATION METHOD	SUCCESS BY AUTHOR
VICTORIA, AUSTRALIA VULCAN, et.al. 1992	ALL CYCLISTS	STATE WIDE	1. INFORMATION 2. AWARENESS 4. ACCESS 5. BENEFITS IN CONJUNCTION WITH LEGISLATION	LONGITUDINAL	USE RATES INCREASED UP TO 90% HEAD INJURIES DECREASED EVALUATION METHODS UNKNOWN	YES

TABLE 6. NUMBER OF IMPLICIT CONSTRUCTS USED IN EACH OF THE 19 EDUCATIONAL PROGRAMS REVIEWED .

2 CONSTRUCTS WERE USED IN 2 PROGRAMS
3 CONSTRUCTS WERE USED IN 3 PROGRAMS
4 CONSTRUCTS WERE USED IN 10 PROGRAMS
5 CONSTRUCTS WERE USED IN 4 PROGRAMS

TABLE 7. NUMBER OF TIMES EACH IMPLICIT CONSTRUCT WAS USED IN ALL REVIEWED PROGRAMS.

	THEORETICAL CONSTRUCT	NUMBER OF STUDIES USING CONSTRUCT
1	INFORMATION	16
2	AWARENESS	15
3	SKILL BUILDING	13
4	ACCESS	18
5	BENEFITS	10

TOTAL NUMBER OF CONSTRUCTS USED = 72

AVERAGE NUMBER OF CONSTRUCTS USED PER PROGRAM = 3.8

total of 19 educational programs reviewed

legislation is not represented in theory usage

DISCUSSION

Theories were used to develop the educational bicycle helmet promotion programs, but they were not used explicitly. The implicit theories made explicit in this paper can be related to many established health education theories or models (e.g. Health Belief Model, Ecological Model).

This paper defines the construct of *information* as the dissemination of knowledge of helmet use, risks of non-use, and helmet efficiency. Most health education theories suggest that information is necessary, but not sufficient for preventive behaviors. For example, according to the Transtheoretical Model, persons who have little or no information about a health issue are called precontemplators (Glanz & Rimer, 1995).

The *awareness* construct, described herein as the promotion of knowledge of a health behavior through the media, is also used in many health education models and can be considered an extension of the information construct. Making people aware of a situation is addressed in many ways. An especially common awareness tool is seen in the wearing of ribbons whose color indicates its significance. Among other models, this construct can be recognized in the ecological model because of significance of involving all areas of the persons' life (e.g. television, radio, and peers).

Access or geographical and economic availability is a construct often found in the reviewed programs. This is a construct often used in efforts to change health behavior. In the Health Belief Model, perceived barriers is the construct that is most closely related to this theory. Also, the Ecological Model is related in that it addresses the need to make the behavior achievable to the population by removing ecological barriers such as lack of availability, difficulty in availability, peer pressure, institutional pressure, or economical unavailability (Sallis & Owen, 1997; Glanz, et.al. 1990).

Skill building is included, in some form, in many established models of educational behavior change. This paper describes this construct as the ability to wear helmets correctly and ride safely etc. The behavioral capability construct and self-efficacy of the Social Learning Theory are examples of the use of this construct. Many behavior changes require a skill to make the change so many health education models contain a *skill building* component (Glanz, et.al., 1990).

The final construct extracted from the programs reviewed was the theoretical construct of *benefits*, here described as awards or rewards for the performance of the desired behavior. Such models as the Social Learning Theory have contained this construct described as reinforcement (Glanz & Rimer, 1995).

The programs reviewed were largely atheoretical and because of the heterogeneity in the collection of data (e.g. observations vs. surveys) and the study designs (cross-sectional vs. experimental), conclusions cannot be made about which constructs best promote bicycle helmet use. If the constructs and combinations of constructs used could be correlated with a consistent evaluation method and study design then the most successful program could possibly be identified. Because evaluation was not standardized, comparison of success could not be measured across all programs. Of the four programs utilizing all five implicit constructs, only one (Parkin, et.al., 1993), used the best measure of helmet use, observational use, and showed a significant 24.6% increase in helmet use. Theories were being used (implicitly) to develop the programs and which constructs were used in the theoretical frameworks has also been discovered. The combination of constructs used has been illustrated, although the combinations that produce the most increase in helmet use cannot be determined due to the lack of standardized evaluation methods.

One problem with many of the studies is the use of selected outcome measures.

For example, helmets given away is likely to be a poor measure of helmet use. The best measure of helmet use, observation by trained personnel, was not used by the programs with the strongest study design (experimental). The weakest designs (cross-sectional) used the least powerful outcome data (e.g. helmets given away). Studies using attendance or giveaways for evaluating are not measuring how many helmets are being worn, but only how many people know about helmets and may now own them. This type of evaluation does nothing to further the knowledge about helmet use. Some studies that report a favorable response to the program are anecdotal evidence of more helmets being seen and are not reliable evidence of increased use.

The desired result of helmet use is a decrease in head injuries and death for cyclists. This can be measured by emergency room records and death reports, but this still doesn't show that educational helmet programs are making the difference. It could be that cycling areas are being made safer, cyclists are being taught safer riding techniques, and helmets are being used and together these result in the decrease in injuries and deaths. Determining if rate of helmet use alone results in this desired outcome would require a much broader and intensive study. In short, future studies should employ an experimental or longitudinal design and have trained observers record actual helmet use. This would result in the most reliable and accurate study designs and outcome measurements of helmet use.

A striking finding in the reviewed studies is that many of the barriers to helmet use by children were not addressed by the programs. Even though children don't wear helmets because they are uncomfortable, only one legislative action addressed this problem (Vulcan, et.al., 1992). But, the biggest barrier to helmet use by children is that it isn't "cool" and no one else wears them. The implicit theories may work toward getting more children to wear helmets, but there was no information found revealing any efforts to improve the image of using a helmet. Helmet manufacturers have made more colorful and attractive helmets, but the programs reviewed in this study do not stress the important role of peer pressure. It has also been found that when helmets are worn by peers, parents, or other adults riding with children, children are much more likely to wear them (Prudential, 1997).

The idea of requiring helmet use for varying age groups seems nonsensical. An adult may consider himself or herself a more capable rider than someone under sixteen, but that does not mean that other riders, motorists, or types of riding areas and the terrain are less likely to cause injury. In fact, it has been shown that areas with no age restrictions on legislation for mandatory helmet use have a significantly lower head injury rate (Henderson, 1995). Also, children are more likely to use helmets when adults do, making child-only programs less effective then age-inclusive ones.

Of all the helmet legislation enacted, the results were considered successful. Legislation affects large populations, but many times, surveys or parental reports were used to measure whether there was an increase in helmet use. Again, in contrast to observational use as the evaluation method, this leaves much to be desired for real comparisons of effectiveness.

As with other health related behavior studies - as seat belts, infant car seats, and even using sun screen - educating children and parents (or other adults) has been shown to increase the use of these safety devices (Jades & Pettengell, 1982; Stein, 1997). Parental use of seat belts, for example, is a determinate of use by children. The chances of a child using a seat belt drops to 20% if the driver is not buckled up (Consumer News, 1998). Legislation has had a tremendous effect on the number of people using seat belts themselves and by their children which has resulted in fewer and less serious motor vehicle injuries. This has now been taken further with infant car seats and stricter seat belt laws. This has been seen with bicycle helmets as well: the stricter the law, the more helmets worn (Guide to Preventive Services, 1999; Eriksen & Gielen, 1983; Graitcer, 1998).

The discovery that the programs do not explicitly state the theories used in their development begs the question of why? D'Onofrio (1992) suggests that many health educators are not knowledgeable about the theories or are afraid to attempt their use. Many health educators have not been schooled in theory use and the use of theories may be overwhelming. They may also feel that theory is only for research and does not fit into the real world (D'Onofrio, 1992). This idea should be abolished. As seen in the many programs reviewed, the planners did use theory, they were just not aware of it. As D'Onofrio (1992) so eloquently stated:

> Efforts to make the "common sense' theories of practitioners explicit also can arouse interest in examining formal theories that address similar concepts and relationships. When a series of formal theories are studied, each can be introduced by referring again to the questions that practitioners have raised and related propositions that they have developed. Then, as health educators discover that academicians have worked on theories that parallel and extend their own "theories-in-use," both types of theory are validated. Practitioners who find that formal theory supports one of their own propositions are elated with this legitimization of their ideas. As they speculate on possibilities for referring to published volumes and internationally known authors in order to justify their own judgments in various practice situations, they experience a new sense of power and theory no longer appears irrelevant.

Even for this study's author, these words ring true. Especially when the practice of health education has not been a professional endeavor as of this time, this view of theory helps to explain and demystify lingering doubts of its use.

The main limitation to this study was the methodology of making explicit the implicit theories. Because the studies did not themselves articulate a theory, the helps to explain and demystify lingering doubts of its use.

The main limitation to this study was the methodology of making explicit the implicit theories. Because the studies did not themselves articulate a theory, the identification of theory rested with the author. Future studies can ameliorate this limitation by employing multiple trained reviewers of helmet promotion programs (rather than just one) to identify the constructs within the programs. Given more resources, this study can be extended by formally interviewing the planners of the programs to see if they can articulate the theories behind their interventions which would help in the understanding of program design by the planners themselves.

CONCLUSION

The findings of this study may provide information to health educators interested in developing programs to increase helmet use or other health promotion programs. It is hoped that the information discovered in this paper will encourage developers of health promotion programs to include the conscious use of explicit theories and a standardized method of evaluation of outcome. It would also be important to expand and standardize the scope of legislation to include all age groups and to also standardize its evaluation method. A challenge to helmet use is peer pressure. Exploration into promoting the use of helmets as a smart and "cool" thing could overcome an extremely important barrier to children's use of helmets. These suggestions may not only positively influence the effectiveness of the programs, but they could reduce the resources needed for development, implementation, and evaluation by providing a model for program planners to utilize that has previously been proven effective.

BIBLIOGRAPHY

Albers, Terry. (November 16, 1999). Personal communication. Berrien County Helmet Program.

American Academy of Orthopaedic Surgeons Position Statement. (1985, Dec. / revised 1992, Dec.). Document # 110.

Bensman, T. (1996, Dec. 4). Capella residents put brakes on new bicycle helmet law. The Dallas Morning News. [Online]. Available from: http://wow.applink.net

Bicycle Helmet Safety Institute. (1999, March 28 - last update). Must I buy a bicycle helmet for my child? BHSI home page. [Online]. Available from: http://wow.bhsi.org

BHSI (1999, April 28 - last update). Mandatory helmet laws: a summary. BHSI homepage. [Online]. Available from: http://www.bhsi.org

California Science Center Commitment to Traffic Safety Program. (1999). [Online]. Available from: http://www.nhtsa.gov/people/outreach/safedige/summer 1999/su9940.htm

Carpenter, Deb. (November 16, 1999). Personal communication. Regional Coordinator, Safe Kids of Kalamazoo.

Connecticut Bicycle Helmet Program. (March 16, 2000). The newsletter of the Who Helmet Initiative. [Online]. Available from: http://www.sph.emory.edu/helmets

Consumers News. (1998). Child Restraint. [Online]. Available from: http://www.wtnh.com/news

Cool Cats Bicycle Helmet Promotion Program. (7-20-99). [Online]. Available from: http://www.nhtsa.dot.gov

Dannenberg, A.L., Cote, T.R., Kresnow, M.J., Sacks, J.J., Lipsitz, C.M., Schmidt, E.R. (1993). Bicycle Helmet Use by Adults: The impact of companionship. Public Health Report, 108(2), 212-7.

Delmorrietta, Michelle. (November 16, 1999). Personal communication. Schoolcraft County Health Department, St. Ignace, Michigan

Denison, J. (1996, October 8, - last updated). Behavior Change - A Summary of Four Major Theories. [Online]. Available from: http://www.fhi.orghtml#224342

Department of Defense. (1999, March 28 - last updated). Traffic Safety Program. U.S. Military regs on bicycle helmets. DoDI 6055.4

Di Guiseppi, C.G., Rivara, F.P. & Koepsell, T.D. (1990, Jan.). Am J Dis Child. Thrive on Health, Thrive on Line Homepage. [Online]. Available from: http://www.thriveonline.com

D'Onofrio, C.N., (1992). Theory and the empowerment of health education practitioners. Health Education Quarterly, 19(3), 385-403.

Dorsch, M.M., Woodward, A.J., & Somers, R.L. (1984). Effect of helmet use in reducing head injury in bicycle accidents in proceedings, 28th annual conference. American Association for Automotive Medicine. (reprinted in Accident Analysis and Prevention, 19, 183.

Eichelberger, N.R., Gotschall, C.S., Freely, H.B., Harstadm, P., & Bowman, L.M. (1993). Parental attitudes and knowledge of child safety. American Journal of Disabled Children,144(6), 714-720.

Eriksen, M.P. & Gielen, A.C. (1983). The application of health education principles to automobile child restraint programs. Health Education Quarterly,10(1), 30-35.

Finch, C.F., (1996). Teenagers' attitudes towards bicycle helmets three years after the introduction of mandatory wearing. Injury Prevention, 2(2), 126-30.

Georgia Helmet Program. (March 16, 2000). [Online]. Available from: http://www.sph.emory.edu/helmets

Glanz, K. & Rimer B. (1995). Theory At a Glance. A Guide for Health Promotion Practice. U.S. Department of Health and Human Services. Public Health Service. National Institutes of Health.

Glanz, K, Lewis, F., & Rimer, B. Edu. (1990). Health Behavior and Health Education: Theory, Research and Practice. Jossey-Bass, Inc. Pub. San Francisco, CA.

Graitcer, P.L. (1998). Helmets work best. Headlines, The Newsletter of the WHO Helmet Initiative,7(1) [Online]. Available from: http://www.sph.emory.edu/helmets

Guide to Clinical Preventive Services. (1999). Counseling to Prevent Motor Vehicle Injuries. [Online]. Available from: http://cpmcnet.columbia.edu

Green, J., Mullen, P., & Green. (1992). A meta-analysis of studies of the Health Belief Model with adults. Health Education Research, Theory and Practice,7(4), 107-116.

Harrison, J., Mullen, P., & Green, L. (1992). A Meta-analysis of Studies of the Health Belief Model with Adults. Health Education Research, Theory and Practice, 7(4), 107-116.

Henderson, M. (1995). The effectiveness of bicycle helmets: a review. Motor Accidents Authority of New South Wales, Australia.

Hendrickson, S.L., Becker, H., Compton, L. (1997). Collaborative assessment: Exploring parental injury prevention strategies through bicycle helmet use. Journal of Public Health Management Practice, 3 (6), 60-70.

Jades, D.C. & Pettengell, R. (1982). Parent education: its effect on the way children are transported in cars. New Zealand Medical Journal, 95(707), 314-6.

Johnson, C., Graves, C., & Hogan, M. (1991). Promoting bicycle helmets; A new focus for injury prevention. Indiana Medicine, 84(4), 264-6.

Jones, C.S., King, W., Proteet-Johnson, D., & Wang, M.Q. (1993). Prevention of bicycle injuries in childhood: Role of the caregiver. Southern Medical Journal, 86(8), 859-865.

Laub, C., Somera, D., Gowen, L., & Diaz, R. (1999). Constructing a Community - Driven, Theory - Based HIV Prevention Intervention for Youth. Health Education & Behavior, 2, 185-199.

Liller, K.D.,Kent, E.B., Knowle, A., & McDermott, R.J. (1995). Promoting use of bicycle helmets among children: a school and community based effort. Journal of Health Education, 26(3), 173-177.

Liller, K.D., Smorynski, A., McDermott, R.J., Crane, N.B., & Weibley, R.E. (1995). The More Health Bicycle Safety Project. Journal of School Health, 65(3), 87-90.

Logan, p., Leadbetter, S., Gibson, R.E., Schieber, R., Branche, C., Bender, P., Zane, D., & Humphreys, J. (1998). Evaluation of a bicycle helmet giveaway program - Texas, 1995. Pediatrics,1, 578-82.

Macknin, M.L., Medendorp, S.V. (1994). Association between bicycle helmet legislation, bicycle safety education, and use of bicycle helmets in children. Archives of Pediatric Adolescent Medicine, 148(3), 255-9.

Madison Wisconsin Helmet Program. (October 11, 1999). [Online]. Available from: http://www.bhsi.org/webdocs/MANUAL/manual.htm

Martinez, R., Alotnick, A. (1999). A university hospital ed based bicycle helmet promotion program: B-Hip: The Stanford Hospital Bicycle Helmet Intervention Program. [Online]. Available from: http://www.bhsi.org/webdocs/MANUAL/manual.htm

Matthias, E., Smith, G., & Phillips, A. (1997 December). Meta-analysis - Principles and Procedures. BMJ Education and Debate. [Online]. Available from: http://www.bmj.com/archive/7121/7121.ed.htm

Miller, P.A., Binns, H.J., & Christoffel, K.K. (1996). Children's bicycle helmet attitudes and use. Association with parental rules. The Pediatric Practice Research Group. Archives of Pediatric Adolescent Medicine, 150(12), 1259-64.

Morris, B., Trimble, N., (1991). Promotion of bicycle helmet use among schoolchildren: a randomized clinical trial. Canadian Journal of Public Health, 82, 92-4.

New Hampshire Bicycle Safety. (March 16, 2000). [Online]. Available from: http://www.bts.gov/ntl/docs

Nash. (2000). Lecture: Theories for CBSW. [Online]. Available from: http://www.ssw.pdx.edu/nash/pg535-4.htm

New Jersey Helmet Law. (March 16, 2000). The Newsletter of the WHO Helmet initiative. [Online]. Available from: http://www.sph.emory.edu/helmets

New York Helmet Law. (March 16, 2000). The Newsletter of the WHO Helmet Initiative. [Online]. Available from: http://www.sph.emory.edu/helmets

Oregon Helmet Law. (March 16, 2000). The Newsletter of the WHO Helmet Initiative. [Online]. Available from: http://www.sph.emory.edu/helmets

Otis, J., Lesage, D., Godin, G., Brown, B., Farley, C., & Lambert, J. (1992). Predicting and reinforcing children's intentions to wear protective helmets while bicycling. Public Health Report, 107(3), 283-9.

Parkin, P.,C., Spence, L.J., Hu, H., Krantz, K.E., Shortt, L.G., & Wesson, D.E. (1993). Evaluation of a promotional strategy to increase bicycle helmet use by children. Pediatrics,91(4), 772-777.

Pitt County Helmet Program. (October 11, 1999). [Online]. Available from: http://www.bhsi.org/webdocs/MANUAL/ manual.htm

Pruder, D., Vistinatainer, P., Spitzer, D., & Devarra, D. (1999). A comparison of the effect of different bicycle helmet laws in three New York City suburbs. American Journal of Public Health, 89, 1736-8.

Prudential Health Care. (1997, March 28). Helmet safety for bicyclists and in-line skaters. White paper prepared for National Helmet Safety Campaign. Sponsored by the Brain Injury Association and Prudential Health Care.

Rhode Island Bicycle Law. (March 16, 2000). The Newsletter of the WHO Helmet Initiative. [Online]. Available from: http://www.sph.emory.edu/helmets

Rossi, P., Freeman, H., & Lipsey,M. (1999). Evaluation, A Systematic Approach. California: Sage.

Rouzier, P., Alto, W. (1995). Evolution of a successful community bicycle helmet campaign. Journal of the American Board of Family Practice, 8, 283-7.

Ryan, Michael. (1998, May 24) An easy way to save a child's life. Parade, 4-5.

Sacks, J.J., Holmgreen, P., Smith, S.M., & Sosim, D.M. (1991). Bicycle associated head injuries and deaths in the United States from 1984 through 1988: how many are preventable? Journal of the American Medical Association, 266, 3016-3018.

Sacks, J.J., Curtis, L., Cieslak, P.R., & Hedberg, K. (1997). Evaluation of a statewide bicycle helmet law via multiple measures of helmet use. Archives of Pediatric Adolescent Medicine.151(1), 59-65.

Sallis, J.F., & Owen, N. (1997) Ecological Models. Health Behavior and Health Education: Theory,Research, and Practice. Ed. Glanz, Lewis, Rimer. Jossey-Bass, San Francisco.

Schieber, R. A., Kresnow, M.J., Sacks, J.J., Pledger, E.E., O'neil, J.R., & Toomey, K.E. (1996). Effects of a state law on reported bicycle helmet ownership and use. Archives of Pediatrics and Adolescent Medi cine. 150(7), 707-12.

Seattle, Washington Bicycle Helmet Program. (October 11, 1999). [Online]. Available from: http:// www. bhsi.org/webdocs/MANUAL/manual.htm

Selden, C. (1980 January - 1992 December). Meta-analysis. Current Bibliographies in Medicine [Online]. Available from: http://www.nlm.nih.gov/pubs/cbm/metaanal.html

Smith, D. (1996, Oct. 14). Bicycle helmet law is heads-up policy. San Antonio Business Journal.

Stanford University Hospital. (undated). A university hospital ed-based bicycle helmet promotion: B-HIP: The Stanford Bicycle Helmet Intervention Program. Document.

Stein, D. (1997). Parents on right sun safety track: but still room for improvement. The American Academy of Dermatology PR Newswire. [Online]. Available from: http://www.kidsource.com

Stutts, J. & Hunter, W. (1990, Dec.). Evaluation of a Bike Safety Curriculum for Elementary School Age children. UNC Highway Safety Research Center & North Carolina Governor's Highway Safety Program.

Theory At a Glance. The Health belief Model (Detailed) [Online]. Available from: #http://www.comm;init.com_point/change_theories/sld024.htm

Traffic Safety Digest. (March 16, 2000). California Science Center Commitment to Traffic Safety Program. [Online]. Available from: http://www.nhtsa.dot.gov

United States. (1993, March 26). Bicycle helmet promotion programs - Canada, Australia and the U.S., Morbidity and Mortality Weekly Report. 43,(11).

United States. (1998). National Safe Kids Campaign. Washington, D.C. National Highway Traffic Safety Administration.

Vegega, M. & Levy, M. (1999, Jan. 20). NHTSA's Bike Safety Program. Bicycle Safety Initiatives. Summary for National Bicycle Safety Network.

Vogt, W.P. (1999) Dictionary of Statistics & Methodology. A Nontechnical Guide for the Social Sciences. (2nd. ed.) New York: Sage.

Vulcan, A.P., Cameron, M.H., & Watson, W.L. (1992). Mandatory bicycle helmet used: experience in Victoria, Australia. World Journal of Surgery, 16(3), 389-97.

Williams, J. (October 11, 1999). Missoula Montana Helmet Program. [Online]. Available from: http://www.bhsi.org/webdocs/MANUAL/manual.htm

APPENDIX A:

Annotated Bibliography of Bicycle Helmet Programs used in Analysis

ANNOTATED BIBLIOGRAPHY

Albers, Terri. (November 16, 1999). Personal communication. Berrien County Helmet Program.

County program which used police to provide bicycle inspections, teach hand signals and helmet fitting. An obstacle course was offered and was very well received. Parents evaluated the program activities, but there was no evaluation of helmet use. Forty-seven helmets were given away, but attendance was not taken so the proportion of attendees taking helmets could not be ascertained. The number of helmets given away does not equate to the number of helmets used by the children so success is only in getting more helmets into circulation.

Carpenter, Deb. (November 16, 1999). Personal communication. Regional Coordinator, Safe Kids of Kalamazoo and Celery Flats.

Both the Kalamazoo Safe Kids and Celery Flats programs were conducted similarly. They were comprehensive programs in terms of theories used. Both were evaluated by attendance of children. The Kalamazoo Safekids also reported that 30 helmets were given away. The police were present and conducted safety instruction and helmet fitting. Even though attendance doesn't always result in use of helmets, the kids are at least aware of the idea of wearing them.

Connecticut Bicycle Helmet Program. (March 16, 2000). The newsletter of the WHO Helmet Initiative. [Online]. Available from: http://www.sph.emory.edu/helmets

Program begun by a local law firm in Hartford, Connecticut. Police involvement. Children riding without helmets were escorted home and parents were informed of helmet safety. If qualified, free helmets were given to child. If children are "caught" wearing a helmet, they are given a coupon for ice cream or other food item. There was no real measure of results except for a very positive response from the community. The enforcement by the police may help to keep the usage up.

Cool Cats Bicycle Helmet Promotion Program. (7-20-99). [Online]. Available from: http://www.nhtsa.dot.gov

This program was developed by the Michigan Department of Health. Parental information on bicycle helmets and riding safety was included. Program was presented to 4,000 children and 1,000 helmets were given away. These giveaways, as attendance, are not a guarantee of helmet use.

Delmorrietta, Michelle. (November 16, 1999). Personal communication. Schoolcraft County Health Department, St. Ignace, Michigan.

Health Department partnered with city police who taught bicycle safety, hand signals, helmet fit, performed bicycle safety checks, coordinated an obstacle course, and showed videos on bike and helmet safety. Gave away 240 helmets. Successful in getting helmets to kids and police spoke to parents.

Liller, K.D.,Kent, E.B., Knowle, A., & McDermott, R.J. (1995). Promoting use of bicycle helmets among children: a school and community based effort. Journal of Health Education, 26(3), 173-177.

Experimental study done in Hillsborough County, Florida. First intervention group received education only, second group received education and helmet subsidy, and the control group received neither education or subsidy. Twenty-three thousand pieces of educational materials were distributed and 244 helmets were sold. Observation used for the evaluation method was a reliable method and showed an increase in helmet use in the intervention group of 32%.

Logan, P., Leadbetter, S., Gibson, R.E., Schieber, R., Branche, C., Bender, P., Zane, D., & Humphreys, J. (1998). Evaluation of a bicycle helmet giveaway program - Texas, 1995. Pediatrics,1, 578-82.

The main focus of this program was a helmet giveaway, but rodeos and education were also used.Observation of helmet use was done at two times. Use initially increased and then fell. There were discussions with parents. This drop in use may indicate a need for maintenance or continued reinforcement of helmet use.

Madison Wisconsin Helmet Program. (October 11, 1999). [Online]. Available from: http://www.bhsi.org/webdocs/MANUAL/manual.htm

Extensive mass media use, coalition of health care organizations, bicycle clubs, city and state agencies were important components of this program. Wisconsin Department of Transportation produced two PSAs. Evaluated by observed use of helmets which is a more reliable gauge of helmet use than attendance or giveaways.

Martinez, R., Alotnick, A. (1999). A university hospital ed-based bicycle helmet promotion program: B-Hip: The Stanford Hospital Bicycle Helmet Intervention Program. [Online]. Available from: http://www.bhsi.org/webdocs/MANUAL/manual.htm

This program involved the NHTSA, Stanford University, and Kaiser Permanente Emergency Medicine Residency Program. Focus of campaign was on changing the roles of healthcare providers to be leaders in the community, including bedside counseling and special projects. Many others were involved in the campaign such as: bike shops; campus safety; public relations; athletic departments: and transportation offices. Education of all in the community by experts was a main tenet of the campaign.

Missoula Montana Helmet Program. October 11, 1999). [Online]. Available from: http://www.bhsi.org/webdocs/MANUAL/manual.htm

Program reached 8,000 children. Bicycle shops participated with information and coupons which provided information for comparison helmet shopping. Two hundred and forty-nine helmets were sold. No observation was done to show actual use.

Morris, B., Trimble, N., (1991). Promotion of bicycle helmet use among schoolchildren: a randomized clinical trial. Canadian Journal of Public Health, 82, 92-4.

New Hampshire Bicycle Safety. (March 16, 2000). [Online]. Available from: http://www.bts.gov/ntl/docs

Very detailed program including clearly spelled out components. Experimental design was used with the intervention group receiving classroom teaching, a poster contest, brochures sent home to parents, and another bicycle safety pamphlet sent home one week later. The second intervention group got the same intervention as the first, but the later pamphlet contained a coupon for a discount on helmets. The control group received nothing. Of the 550 students offered the subsidy, 72 bought helmets. This study did use observation as an evaluation tool but did not have large enough groups of children riding their bicycles to school to observe to allow this program to be reliably evaluated.

New Hampshire Bicycle Safety. (March 16, 2000). [Online]. Available from: http://www.bts.gov/ntl/docs

City wide program. Evaluation was not a formal, consisting only of casual observation of use by community members and reported to program planners. Because of weak methodology, evaluations were suspect.

Parkin, P.,C., Spence, L.J., Hu, H., Krantz, K.E., Shortt, L.G., & Wesson, D.E. (1993). Evaluation of a promotional strategy to increase bicycle helmet use by children. <u>Pediatrics,91</u>(4), 772-777.

Experimental design with high and low income groups. The high income intervention group received lectures at assemblies including a Canadian Olympic cyclist, posters, helmet fitting and sales available at the school, and helmet discounts. The low income intervention schools received the same things, but a rebate coupon with proof of purchase of a helmet also. The high income control group use increased from 5% to 34% while the high income intervention group increased from 4% to 48%. The low income intervention group increased from 4%

to 8% while the control group increased from 3% to 14%. The strong experimental design and observation of outcome make this a strong study. One question this study asks is why did the low income control group increase use more than the low income intervention group?

Pitt County Helmet Program. (October 11, 1999). [Online]. Available from: http://www.bhsi.org/webdocs/MANUAL/ manual.htm

Several agencies worked together in this farm community. A grant was received from the CDC. This program involved education of pediatricians and family practitioners to counsel parents. Targeted media, schools, health professionals and community in general. The survey used to gauge helmet use before and after intervention may not really reveal the actual use of helmets.

Rouzier, P., Alto, W. (1995). Evolution of a successful community bicycle helmet campaign. Journal of the American Board of Family Practice, 8, 283-7.

This educational program in Grand Junction, Colorado used a helmet discount program developed through community donations and used observation of use to evaluate effectiveness. The study concluded that the increased use of helmets was mostly attributable to the helmet discounts.

Stutts, J. & Hunter, W. (1990, Dec.). Evaluation of a Bike Safety Curriculum for Elementary School Age children. UNC Highway Safety Research Center & North Carolina Governor's Highway Safety Program.

This program detailed curriculum and directions, explained limitations of program including small numbers of participants. Rate of injury was a measure of success, but did not necessarily result from helmet use. This may have been from children learning safer riding habits. Actual survey of ownership decreased after program.

Traffic Safety Digest. (March 16, 2000). California Science Center Commitment to Traffic Safety Program. [Online]. Available from: http://www.nhtsa.dot.gov

Learning center for safety and traffic safety exhibits is a very interesting concept. It may, though, result in not as many kids attending because they must go there rather than the program coming to their school or community. Observational helmet use increased in the park itself, but that didn't necessarily translate into everyday use.

Vulcan, A.P., Cameron, M.H., & Watson, W.L. (1992). Mandatory bicycle helmet used: experience in Victoria, Australia. World Journal of Surgery, 16(3), 389-97.

This article described a legislative and educational program in which all cyclists in Victoria, Australia, were affected by a law requiring helmets. The community, including schools, mass media, professional organizations, bulk purchasing and state government rebates were assets of this program. An interesting idea with this program was that the Australian standard for bike safety was changed to meet the consumer demands of lighter helmets with more ventilation