

POTENTIAL MECHANISMS UNDERLYING THE DECISION TO USE A SEAT BELT: A LITERATURE REVIEW

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A Literature Review**

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16. Abstract <p>The purpose of this literature review was to serve as the background knowledgebase for a 5-year cooperative agreement between NHTSA and the University of Michigan. This discretionary cooperative agreement is intended to study promising lines of research that elucidate the mechanisms that underlie risk perception and can be applied to converting part-time belt users to full-time users. The overall goal of this cooperative agreement is to develop testable strategies, based on basic and applied research, for influencing risk perception to move motor vehicle occupants from part-time to full-time use of seat belts. Specific topics covered in this literature review are: individual belt user characteristics; social influences on belt use; applications from research on other risky behaviors; policy/enforcement/incentive; communication and education; and technology. Conclusions are drawn within each section and for the review overall.</p>			
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INTRODUCTION

Traffic crashes are the leading cause of death in the United States (US) for individuals age 4-34 (Subramanian, 2006). In fact, in 2009 the US lost 33,808 individuals to traffic crashes (National Highway Traffic Safety Administration, NHTSA, 2010a). Increasing seat belt use is the simplest and most effective way to decrease traffic fatalities and injuries (Automotive Coalition for Traffic Safety, 2001). When lap and shoulder belts are used in conjunction, they reduce the risk of fatal injury to front-seat passenger car occupants by 45 percent and reduce the risk of moderate-to-critical injuries by 50 percent. For occupants of light trucks, seat belts lower the risk of fatal injury by 60 percent and moderate-to-critical injury by 65 percent. From 1975 to 2009, NHTSA (2010b) estimates that seat belts saved 267,890 lives.

Seat belt use in the US and territories reached an all-time high of 83 percent in 2008 (NHTSA, 2009). Despite this achievement, use of seat belts in the US still lags behind many other developed countries. For example, Australia has an estimated use rate of 96 percent (Australian Automobile Association, 2004); the United Kingdom reports 93 percent use country-wide (UK Department of Transport, 2006); belt use in Japan is 88 percent (International Association of Traffic and Safety Sciences, 2005); and Canada reports 87 percent use (Transport Canada, 2005). Even within the US, statewide belt use rates vary from 67 to 97 percent (NHTSA, 2009). Clearly, there is still progress to be made in getting US motor vehicle occupants to use seat belts on every motor vehicle trip.

The Potential Relationship between Risk and Belt Use

The mission of NHTSA is to save lives, prevent injuries, and reduce vehicle-related crashes. Consistent with this mission, NHTSA has had a long-standing interest in promoting seat belt use in the US. Evidence strongly suggests that use of a seat belt is influenced by a person's perception of risk.¹ Direct observation studies have shown that belt use is higher on freeways than on local roads (e.g., Eby, Vivoda, & Fordyce 2002); higher in urban than rural areas (e.g., Glassbrenner, 2004a); positively influenced by changing a state's belt enforcement from secondary to primary (e.g., Eby, Vivoda, & Fordyce 2002); and increased by highly-visible enforcement campaigns (e.g., Solomon, Chaudhary, & Cosgrove, 2003). This range of results could be interpreted as resulting from variations in a person's perception of risk in these different situations. Furthermore, the 2007 Motor Vehicle Occupant Safety Survey (MVOSS) found that 95 percent of respondents reported using a belt to avoid serious injury, while 75 percent also reported using a belt to avoid receiving a belt citation (Boyle & Lampkin, 2008). The same survey found that the most frequently reported reason for nonuse was that the respondent was only traveling a short distance. A nationwide telephone survey of part-time belt users found similar results (Eby, Molnar, Kostyniuk, Shope, & Miller, 2004), supporting the idea that belt use is influenced by a person's perception of risk.

Many of NHTSA's efforts to promote seat belt use, consequently, have centered on programs that attempt to influence how risk is perceived. This approach is shown conceptually in Figure 1.

¹ This report makes a distinction between "risk assessment" and "risk perception." To many researchers studying risk, they mean the same thing. On the other hand, it is sometimes reasonable to use "risk assessment" to refer to the measurement of physical quantities that are sometimes taken as indicators of "objective" risk (e.g., death rates from a particular hazard), whereas "risk perception" is used to refer to purely subjective appraisals of various forms. Since this report is pitched toward understanding mechanisms underlying subjective risk, we use the term "risk perception."

The framework depicted in the figure shows how the use of seat belts is influenced by seat belt promotion programs (countermeasures). The figure has three components, the first of which is “behavior change,” meaning NHTSA wants people to increase their use of seat belts. For belt use behavior to change, NHTSA needs to change the level of risk people perceive for lack of seat belt use. Perceived risk rather than actual risk is what influences behavior. Because seat belt use is both a public health issue (seat belts reduce injury severity) and a legal issue (seat belt use is required by law in all but one state), these two risk domains are relevant in influencing safety-belt-use behavior.

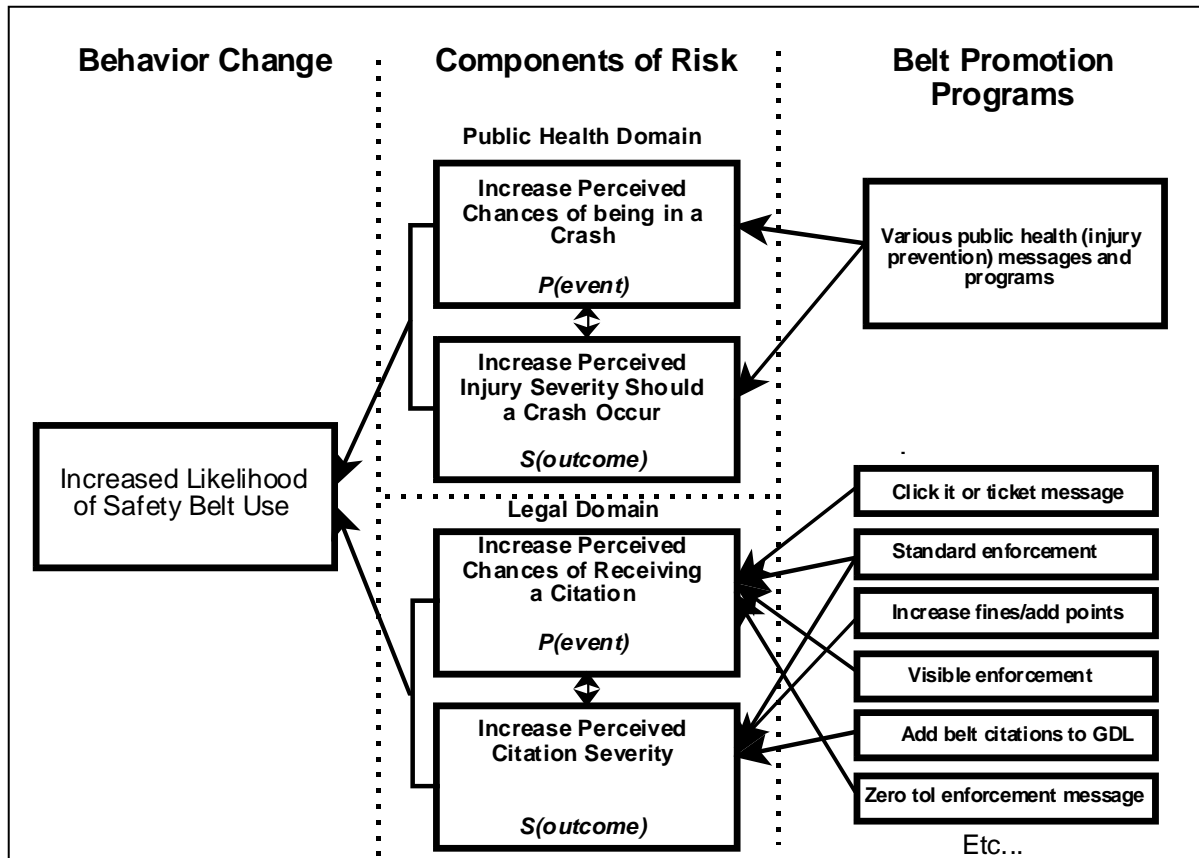


Figure 1: Conceptual framework for how seat belt promotion programs can influence perceived risk and use of seat belts.

Within each domain, there are two interrelated components: the probability of the negative event occurring and the perceived severity of the negative outcome. In the public health domain, the negative event is a crash, and the severity of the outcome is the extent of injury. In the legal domain, the negative event is getting pulled over and receiving a seat belt citation and the severity of the outcome is the cost associated with the citation (e.g., fines, increased insurance premiums, embarrassment). Within each domain, the two components interact. For example, in the legal domain, if the perceived severity of the outcome is quite small (low fines), then a high perceived chance of receiving a citation will not change behavior. Conversely, in the public health domain, if a person thinks the event will never happen (i.e., the person believes that he or she will never crash), then a high perceived severity of the outcome will not influence behavior.

Perceived risk is a focus of many seat belt promotion programs. Effective countermeasures work by changing the perceived risk in at least one of the four middle boxes in Figure 1. The

numerous programs and messages about the safety benefits of using seat belts attempt to change behavior by changing perceived risk in the public health domain. A major thrust for NHTSA has been to influence seat belt use by changing perceived risk in the legal domain. These programs attempt to increase the perceived likelihood of receiving a citation and/or increase the perceived severity of receiving a citation. Several countermeasures designed to change perceived risk in the legal domain are identified in Figure 1. The “Click It or Ticket” high visibility enforcement program is very clearly designed to increase the perceived risk of receiving a citation. The presence of standard (primary) enforcement leads to higher belt use than secondary enforcement because this enforcement provision can both increase the perceived chances of receiving a citation and also increase the perceived severity of receiving a citation, given that the fine amount is often more highly publicized. Similar arguments are made for the other examples given. It is important to keep in mind that these programs also work in conjunction with each other to change perception of risk to ultimately change behaviors. If a message about increased enforcement is not followed up by people actually seeing increased enforcement, then the message may not have the desired effects.

Modeling Risky Driving Behavior

NHTSA has also had a long-standing interest in modeling risky-driving behavior and understanding the mechanisms underlying risk perception, particularly in young drivers (e.g., NHTSA, 1995a, 1995b; Eby & Molnar, 1998). Some of this previous work conceptualized risky-driving behavior as the outcome of a decision for which risk, along with other factors, has been weighted in the decision making process. One such model is shown in Figure 2.

The Eby and Molnar (1998) model conceptualized risky- and safe-driving behaviors as the outcome of a decision-making process in which risky driving might be chosen over behaviors that were less risky because the risky driving afforded the driver greater perceived benefit. The model is divided into two parts, subjective and objective. The subjective component, shown enclosed by the dashed line, represents the cognitive factors involved in the decision-making process, including the driver’s memories, attentional capacities, perceptions of risk, attitudes, motivations, moral influences, and learning, reasoning, and problem solving abilities. The objective component, shown enclosed by a dotted line, constitutes the driving behaviors; that is, those actions that can be observed on the road. For this model, all driving behaviors are defined as either safe or risky. Risky-driving behaviors are defined as those actions that increase the objective likelihood of a crash or the severity of injury should a crash occur (e.g., Olk & Waller, 1998; Simpson, 1996; Williams, 1997). As such, a driver might not consider his or her action to be a risky one even though it increases his or her chances of being in a crash or severely injured in a crash.

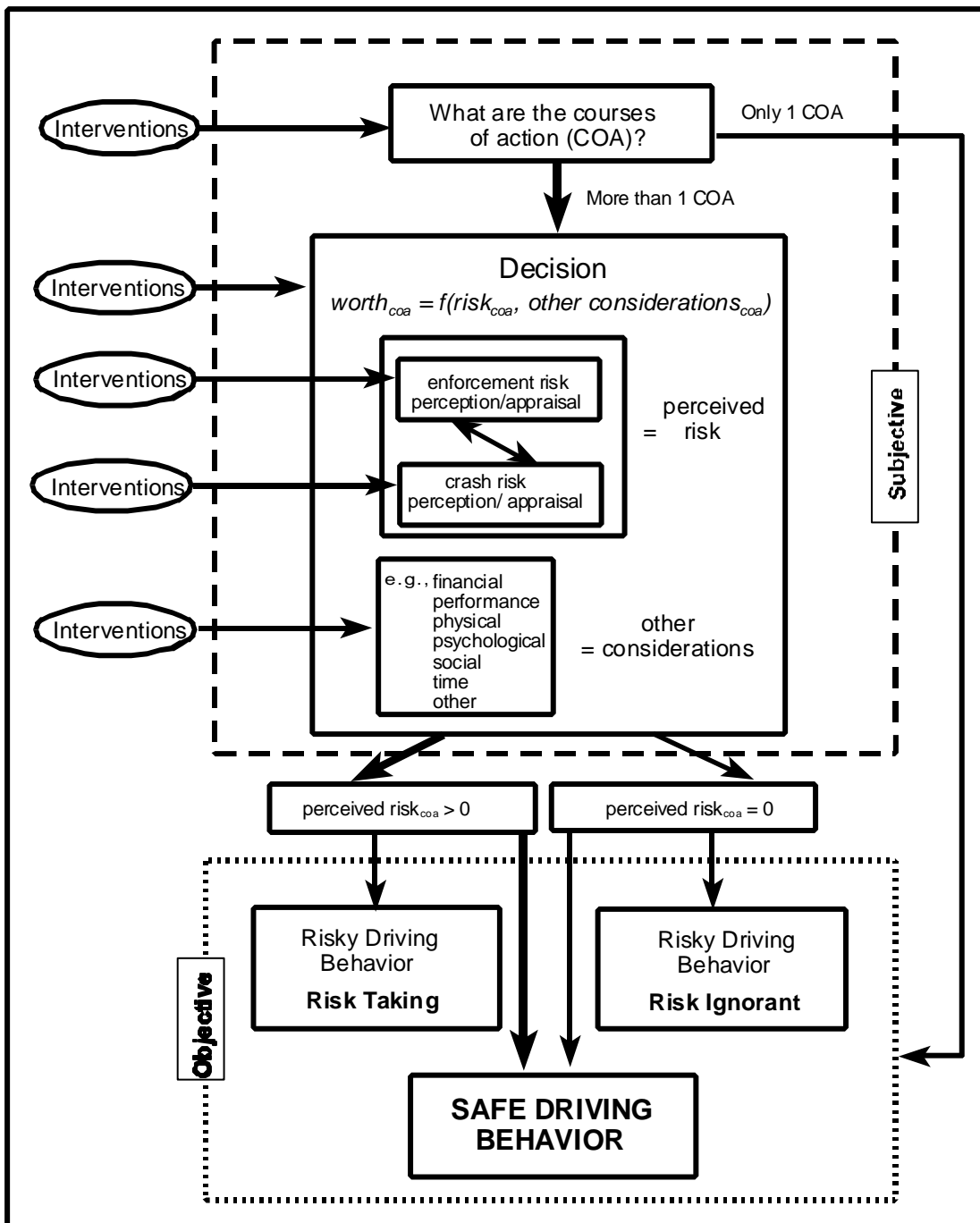


Figure 2: A decision-making model of risky-driving behavior, showing where traffic safety messages and programs (interventions) might be applied to increase the likelihood of safe driving (from Eby & Molnar, 1998).

According to the model, when a driver approaches a situation in which an action is required, for example approaching a signalized intersection where the light has changed from green to yellow, he or she analyzes the possible courses of action (COAs). If the driver only knows about or is only able to produce a single possible action, then he or she performs that action (represented in Figure 2 by the arrow exiting the courses-of-action box [only 1 COA] and terminating at the objective-driving-behavior part of the model [dotted line]). If there is more than one perceived

course of action, then the model proposes that the driver uses a decision process to choose a single course of action from the set of possible actions. As suggested by Yates and Stone (1992), the model proposes that the driver evaluates each course of action by determining a subjective worth for each action. An increase in the subjective worth for a course of action means an increase in the likelihood that that course of action is chosen. The choice of course of action is based on a decision rule that takes into account the subjective worth for each possible course of action. The perception of risk in both the public health and legal domains is a prominent feature of this model.

When first developed, this model was sufficient to provide a framework for Eby and Molnar's (1998) review of the cognitive development literature. However, recent work by Paul Slovic and his colleagues (Slovic, Finucane, Peters, & MacGregor, 2002) has highlighted the influence of emotions on decision making involving risk. The theoretical framework proposed by Slovic is that a person's affect (the positive or negative feelings about a stimulus) are relied upon during decision making (called the affect heuristic). Since affective responses occur automatically, risky decision-making may occur rapidly and be based solely on a person's affective response regarding seat belt use. This theoretical concept has been convincingly applied to decision making in a variety of fields such as behavioral economics (Slovic et al., 2002) and smoking (Slovic, 2001), but has not been applied to decision making regarding the use of seat belts. The affect heuristic may be a promising line of future research to better understand the relationship between risk and seat belt use.

Further, many mechanisms underlying risk perception are not well understood in relation to seat belt use. For example, Eby and Molnar (1998) suggested that belt use may be low for some people because they fail to understand the effects of cumulative risk; that is, the more frequently one engages in a risky behavior, the more likely it becomes that there will be a negative outcome at some point while engaging in that behavior. In other words, people may assess risk on a trip-by-trip basis for which the risk of a crash is low, rather than over a lifetime of trips for which crash risk is high. People's belief in fatalism also appears to play a role in belt use decisions. For example, the MVOSS (Boyle & Lampkin, 2008) found that one-quarter of drivers surveyed believed in fatalism. However, drivers who rarely or never used seat belts were considerably more likely to express this belief with 60 percent reporting agreement with the statement, "If it is your time to die, you'll die, so it doesn't matter whether you wear your seat belt."

The Project

This document serves as the background knowledgebase for a 5-year cooperative agreement between NHTSA and the University of Michigan (U-M). This discretionary Cooperative Agreement is intended to study promising lines of research that will elucidate the mechanisms that underlie risk perception and can be applied to converting part-time belt users to full-time users. The overall goal of this Cooperative Agreement is to develop testable strategies, based on basic and applied research, for influencing risk perception to move motor vehicle occupants from part-time to full-time use of seat belts. Specific objectives include:

- To better understand the mechanisms underlying risk perception by conducting a systematic review and synthesis of the literature.

- To better understand the actual roles that risk perceptions and other factors play in people's decision behavior by conducting a comprehensive literature review and multiple studies.
- To identify and explore approaches to influencing risk perception and other factors applicable to part-time belt users by conducting multiple studies.
- To explore how approaches can best be implemented to increase belt use among part-time users by conducting multiple studies.
- To facilitate the translation of these research findings into practical program applications by developing appropriate products for traffic safety professionals.

The topics for this literature review were developed in conjunction with project personnel from the University of Michigan Transportation Research Institute (UMTRI), NHTSA personnel, and a Faculty Oversight Committee (FOC) consisting of the following U-M faculty: Dr. J. Frank Yates (Psychology Department; Business School); Dr. Stephen Pollock (Industrial and Operations Engineering); Dr. Alfred Franzblau (Environmental Health Sciences; Emergency Medicine); Dr. Lee A. Green (Family Medicine); and Dr. Paul A. Green (UMTRI). A general outline was developed by UMTRI project personnel and forwarded to the FOC for feedback. The FOC and UMTRI project personnel met to discuss topics and finalize the outline. Students were hired to gather relevant articles and to write topic summaries. The students worked closely with UMTRI project personnel and the FOC during the literature review process. About one-half of the way through the time devoted to the literature review, the students presented their progress to the FOC and received feedback on their work. Draft topic summaries were reviewed by the FOC and UMTRI personnel and feedback was provided to the students. Final topic summaries were edited and combined into a single document by the last two authors. The final conclusions were generated by UMTRI project personnel and the FOC.

INDIVIDUAL BELT USER CHARACTERISTICS

Studying individual characteristics of seat belt users and nonusers can help inform appropriate methods for increasing seat belt use among nonusers. In this section, several individual characteristics related to the tendency to use belts are reviewed. These wide ranging characteristics are organized into the following domains: demographic/environment, personality, decisional, emotional, and behavioral.

Demographic Characteristics

It is clear that belt use varies by demographic characteristics of vehicle occupants. This section explores the potential causes of the differences. The specific demographic differences addressed here include sex—males are less likely to use seat belts than females (Preusser, Lund, & Williams, 1991; Pickrell & Ye, 2009a; Vivoda et al., 2004); age—young people (teens and early 20s) are less likely to use belts than older people (Pickrell & Ye, 2009a; Lee & Schofer, 2003; Vivoda, Eby, & Kostyniuk, 2004; Lerner et al., 2001); race—African Americans are less likely to use belts than Whites (Pickrell & Ye, 2009a); socioeconomic status (SES)—belt use is lower among those of lower education and income (Boyle & Lampkin, 2008; Preusser et al., 1991; Colgan et al., 2004; Phaner & Hane 1973a,b; Lerner et al., 2001; Romano, Tippetts, Blackman, & Voas, 2005; Shin, Hong, & Waldron, 1999; Shinar, 1993; Shinar, Schechtman, & Compton, 2001); and marital status—married individuals are more likely to use belts than unmarried individuals (Kweon & Kockelman, 2006).

Sex

Begg and Langley (2000) found that males and females give different reasons for not using seat belts. While both sexes cited forgetfulness as the primary reason, a higher percentage of males than females reported that they do not like them or find them uncomfortable. This difference held for driving or riding as a front seat passenger, but not rear seat passenger; for the latter both males and females equally cited discomfort and forgetfulness as reasons for nonuse of a belt. Similarly, interactions between sex and socioeconomic status (SES) have been found such that females' belt use rates change by socioeconomic status, but males' do not (Shinar et al., 2001). Contrasting results come from the 2007 MVOSS (Boyle & Lampkin, 2008). Equivalent proportions of males and females reported not wearing their belts because the seat belt is uncomfortable, and females were more likely than males to report disliking or finding seat belts annoying.

The idea of and research behind sex differences is indeed a controversial one. Even among psychologists, the presence and degree of sex differences is not always agreed upon (for a summary of the debate, see Lippa 2006). Yet, sex differences in seat belt use are clear. The challenge becomes understanding what causes this sex difference, and how best to reduce it by encouraging more males to use seat belts. The sex differences of interest to seat belt use are likely to be in the attitudinal, cognitive, social, and biological domains (Halpern, 2000; Maccoby, 2002).

Debate continues on whether there is something essentially “male” about not using a seat belt. The lower rate could simply be due to some males' larger physical stature, which makes wearing a belt uncomfortable, but may also be due to more complex psychological and social concepts of attitude tendencies, gender identity (e.g., what it means to be a man), and sex-related peer

relationships. Maccoby (2002) states that males often partake in risky behavior together, suggesting a sex-linked social component to risky behavior. She also discusses the formation of male and female subcultures, and calls for the integration of individual difference research on sex and group process research.

Age

Age differences in belt use have been found between younger people (teens and early 20s) and older people. This difference is generally found in studies that define younger age as 16 or 18 years of age to 24 or 25 years of age (Glassbrenner, 2005a; Shinar et al., 2001). Zanjani, Schaie, and Willis (2006) grouped participants into age groups defined as 19-42 years, 43-62 years, 63-72 years, and 73 years and older, and did not find any change in belt use with age. Several studies focus only on certain age groups, such as adolescents (Begg & Langley, 2000; Brener & Collins, 1998; Chliaoutakis, Gnardellis, Drakou, Darviri, & Sboukis, 2000; Harré, Brandt, & Dawe, 2000; Leverence et al., 2005; McCartt & Northrup, 2004; Thuen & Rise, 1994; van Beurden, Zask, Brooks, & Dight, 2005; Williams, Preusser, & Lund, 1984; Williams, Wells, & Lund, 1983; Wurst, 2002) or older adults (Cox, Cox, & Cox, 2005). While these studies do not allow for direct comparison of age differences, they offer insight into potential causes of belt use among different age groups. For example, Reyna and Farley (2006) review several risk behaviors, including seat belt use, and suggest causes and interventions based on cognitive qualities of adolescents compared to adults. Less work has been done on this issue with older adults.

A number of other non-driving factors are unique to the ages 16 to 24 years. Social relationships with peers change, including increasing freedom in choice of peers and the role of peers and parents in one's life (Arnett & Tanner, 2005; Bricker, Peterson, Sarason, Andersen, & Rajan, 2007; Neyer & Lehnart, 2007). Similarly, neurological changes in adolescence may make some individuals more prone to risky behavior (Galvan, Hare, Voss, Glover, & Casey, 2007).

With respect to age, the groups in which low belt use is found (teens and early 20s) can be thought of collectively as "new drivers." Several things are different between "new drivers" and more experienced drivers, some of which have to do with driving specifically, and some of which are independent of driving. Furthermore, the simple fact that one is driving means that he or she has more freedom of movement and freedom to associate with peers outside of parental or adult supervision. Certainly this change only increases with the transition to college. Similarly, hormonal and neurological changes occur during this age period (Galvan et al., 2007), and recent research has shown that adolescent brains may process information (perhaps including risk) differently from more mature brains (Reyna & Farley, 2006).

Even though young drivers are more likely to be involved in a crash in their first few months of independent driving, their lifetime probability of having been in at least one crash will increase with age and opportunity (i.e., time on the road). For those who have not been in a crash (even a low speed impact), the benefit of wearing a seat belt, and an understanding of the force of a crash, may not be salient. It may be hard for them to see the reason for wearing a seat belt if they do not realize how much they will need it if they are in a crash. However, this hypothesis may be countered by evidence (Fhaner & Hane, 1973a; Weinstein, 1989) suggesting that individuals who had been in a crash were no more likely to wear a seat belt than those who had not, as well as other research on the role of past experience in predicting health behavior.

Another age-related issue that should be addressed in future research is the extent to which intergenerational transmission of attitudes and behavior affects seat belt use, particularly compared to social/contextual factors. Work on subjective norms (or an individual's perception of how others view his or her behavior) suggest that they are implicated in the process of behavior change (e.g., Shin et al., 1999); subjective norms are discussed in more detail in the chapter on behavior change theories. While Shin et al. (1999) present interesting findings on the relationship of SES to seat belt use, they do not uncover why the parents of the children studied (who are also of lower SES) are not using or encouraging use of seat belts by their children. A detailed analysis of intergenerational transmission of attitudes and behaviors is beyond the scope of this review, but it may be worth studying in future empirical work on belt use.

Race

That there are differences between racial groups in seat belt use is well established, using different data collection methodologies and samples (Ellis et al., 2000; Glassbrenner, 2004, 2005b; Nelson, Bolen, & Kresnow, 1998; Parada, Cohn, Gonzalez, Byrd, & Cortes, 2001; Vivoda, Eby, & Kostyniuk, 2004). Some of these studies focus specifically on immigrant or first generation populations (Allen, Elliott, Morales, & Diamant, 2007; Romano et al., 2005). It is clear from the findings in the Introduction that there are racial differences in belt use, with the general trend being that seat belt rates are lower among Blacks than Whites or other races, particularly Blacks between the ages of 16 and 24 (Glassbrenner, 2004; Glassbrenner, 2005a; Vivoda et al., 2004). However, the differences between Whites and other races vary among studies, from no difference (Glassbrenner, 2005a) to studies showing that Asians (Nelson et al., 1998) and Hispanics (Allen et al., 2007; Nelson et al., 1998) use seat belts more regularly than Whites, particularly first-generation Asians and Hispanics. Some evidence exists that minorities may be more influenced by seat belt laws than non minorities (Nichols, 2005). Other researchers have found this interaction of race with primary seat belt enforcement (Preusser, Solomon, & Cosgrove, 2005; Wells, Farmer, & Williams, 2002).

Vivoda et al. (2004) present observational evidence showing that Black motorists (compared with White or other races) are less likely to wear seat belts. The authors also present, through logistic regression models, results showing that the interaction between age and race is significant when age is between 16 and 29 years of age. Use of belts by White drivers age 16-22 was 2.5 times belt use by Black drivers of the same age. For drivers age 23-29, the racial difference was 1.7 times. Note that there was no difference between respondents of the two upper age categories (30-64 and 65+). The interaction of race (Black) and age (younger) suggests that young Black males are particularly infrequent users of seat belts, and constitute a unique group toward whom tailored interventions could be targeted. Some work has been done on development of seat belt use programs tailored by race or ethnicity (Cohn, Hernandez, Byrd, & Cortes, 2002; Ellis et al., 2000).

Socioeconomic Status (SES)

Income, education, and employment can be considered independently or as a combined characteristic of SES. The conceptual relationship, as well as typically high correlation of these three demographic characteristics, lead some researchers to consider them as a whole or combinations of one or more (Romano et al., 2005), while others pick one and refer to it as SES or pick surrogate variable to represent SES, such as the value of the car driven (Colgan et al., 2004), zip-code of residence (Lerner et al., 2001), or housing values in a neighborhood (Shinar,

1993). Across various conceptions of SES and its component variables, it appears that individuals with higher SES are more likely to wear seat belts than individuals with low SES (Colgan et al., 2004; Fhaner & Hane 1973b; Lerner et al., 2001; Romano et al., 2005; Shinar, 1993; Shinar et al., 2001). Shinar et al. (2001) found that this relationship did not hold for males, suggesting that the impact of being male is more powerful than the impact of SES in terms of seat belt use.

In an attempt to explain SES differences in belt use, Shin et al. (1999) approached the topic by studying high school students in inner city, middle-class, and private schools. They found support for social modeling explanations for lower seat belt use by lower SES individuals, with students from inner-city schools less likely than students from the other schools to report that parents model seat belt use less or verbally encourage them to use seat belts.

Marital Status

The finding that married individuals are more likely to wear seat belts than non married individuals is an interesting one (Kweon & Kockelman, 2006), although it has been noted that for younger drivers, marriage alone does not predict higher belt use (Wagenaar, et al., 1987). No clear causal mechanisms have been studied on this topic. Although the relationship between marriage and belt use is not clear, some speculation is worthwhile. Assuming marriage itself is the primary cause of this difference, it could be due to increase responsibility (i.e., having someone else who is counting on you) or to “peer pressure” between spouses. Perhaps a belt use standard is transferred from one partner to another.

In using these demographic variables as predictors of belt use in theoretical and statistical models, it is important to be clear about what they represent. Age for example (or number of years of being alive) is not, in itself, a causal force in seat belt use (or anything other than biological maturation). However, age represents a number of different constructs which might be causally related to seat belt use. For example, career and community stability often increase with age, as well as individual and family responsibility. Some younger individuals may not be concerned about wearing belts because “they have nothing to lose” or “they have no one to be responsible to other than themselves.” Neurological and peer-group changes also occur between adolescence and adulthood (Arnett & Tanner, 2005; Galvan et al., 2007). Similarly, income and education can represent a number of different things beyond financial resources and knowledge, as can be seen in the review of socioeconomic status and seat belt use. Race, too, may represent a number of cultural variables, as well as multivariate relationships to other demographic variables (education, income, locale of residence, and so on).

When thinking about using demographic information to increase seat belt use, some speculations about causal mechanisms is helpful. The univariate descriptive rates and multivariate predictive models reviewed here provide some insight into who is not using belts. We can take the lower-use groups as “target groups” for interventions (Cohn et al., 2002; Ellis et al., 2000). Being able to target and tailor a belt-use program, even if only on something as gross as sex or race, may increase the power of the intervention to change the behavior of members of the target group.

Finally, individual differences in demography in the use of seat belts can be understood through the specific individual differences discussed in the later parts of this section (for example, risk taking, affect, habit, and the like), so demographic results are cited, where available, within the discussions of each of these individual characteristics. At the same time, we know that

demographic and other personal characteristics are often related (Artazcoz, Benach, Borrell, & Cortès, 2004) and likely interact with one another in influencing seat belt use.

Environmental Characteristics

Roadway Type

Environmental characteristics have been linked to seat belt use. For example, Fhaner and Hane (1973a) present an early and regularly cited review of environmental influences on seat belt use. Some differences in seat belt use have been found in studies that make observations on “rural” and “urban” roads. Use rates are lower in rural areas than more urban ones (Glassbrenner, 2004), but it is unclear exactly what causes this. Similarly, drivers on highways use belts more than drivers on city streets (Wagenaar et al., 1987). This finding may overlap with the urban/rural difference reported above, but the comparison here is road or traffic type, and not “urbanicity” per se. Whether the lower of belts while traveling use on city streets is a function of drivers who are also city dwellers, or something about the act of driving in a city compared to on a highway (e.g., perhaps perceived reduced risk due the slower speed) would have to be investigated through more complex multivariate models. This second hypothesis is supported by independent evidence reported by Fhaner and Hane (1973a) from studies in which “speed of travel,” not just road type, were measured. Higher speeds correlate with higher belt use.

Vehicle Type

Unbelted drivers are more likely to be driving older rather than newer vehicles (Preusser et al., 1991). Belt use is highest among drivers of vans/minivans, sport utility vehicles, and passenger cars, with belt use in pickup trucks significantly lower than other vehicle types (Glassbrenner & Ye, 2006; Boyle & Vanderwolf, 2004). Drivers of light commercial vehicles use seat belts less frequently than drivers of passenger vehicles (Eby, Fordyce, & Vivoda, 2002), even when age, sex, and vehicle type are accounted for.

Presence of Other Passengers

Another environmental characteristic of belt use has more to do with who is in the vehicle, than what is outside the vehicle. When all passengers are under the age of 8, seat belt use is highest for drivers (Glassbrenner, 2005a). In the same report, it was found that drivers age 16-24 use seat belts more when there is at least one passenger not age 16-24 in the car. Additionally, Glassbrenner (2005a) found that seat belt use is lower for rear-seat passengers than front-seat passengers (a 14 percentage point difference). It may be that belts are not available in the back seats of some vehicles or are more difficult to put on. However, when age is taken into account, it becomes clear that the lower rate of use is due more to child rear-seat passengers than adult rear-seat passengers. Lack of parental monitoring and children thinking they can disobey (assuming they have been told to put on a belt) may account for this difference.

Other Factors

Lower belt use also appears to be related to other trip qualities. Drivers are less likely to wear a seat belt on a short trip compared to a long trip (Fhaner & Hane, 1973a; Howell, Nocks, & Owen, 1990). With respect to nighttime versus daytime rates, Fhaner and Hane (1973a) found

contradictory evidence related to differences in methodology. Self-report studies show more use in the dark (Fockler & Cooper, 1990), but observational studies show the reverse relationship, with less use at night (Chaudhary & Preusser, 2006; Vivoda et al., 2007).

Personality Characteristics

The conceptualization of personality is not clear-cut. Underlying any discussion of personality is a question about whether the personality characteristics under study are trait-based or state-based, where “personality traits” are seen as constant within an individual across contexts and across time and “personality states” are seen to be malleable and interact with given social and psychological contexts at a given time. A basic application of trait theory might say, “This person is extraverted, and we expect he will be extraverted in all social contexts” while a state theory might say “This person has a tendency toward extraversion, but is most extraverted with people of the opposite sex, and is fairly shy with same-sex individuals.” If, however, we consider that driving (and thus seat belt use) represents a certain kind of context, we may want to think about how state or trait definitions of personality might have implications for the role of personality in seat belt use. Additionally, a distinction should be made between personality and temperament. While personality is often thought of as something that can be influenced by the environment, temperament is “what a child comes to the world with,” and has a more biological connotation. For a review of the temperament literature and its relationship to personality, see Gillespie (2003) and Rothbart and Bates (1998), and for applications of temperament to health and risky behavior, see Bijttebier, Vertommen, and Florentie (2003), Caspi et al. (1997), and Moore et al. (2005). Personality can be shaped by environment and developed over time, but temperament may be a more basic, stable human characteristic. The reason this is important is that it leads to two different sets of measures. There has been research on personality and seat belt use, but less on temperament and seat belt use.

The concept of temperament may fill gaps in seat belt use prediction where personality cannot predict. Caspi et al. (1997) show a link between temperament in childhood, later personality, and health-risk behaviors including risky driving and seat belt use. Low scores on Traditionalism, Harm Avoidance, Control, and Social Closeness Scales, and high scores on Alienation and Aggression scales at age 18 lead to more risky driving behavior at age 21, as well as alcohol use and participation in violent crime.

Personality Constructs

A well-supported theory often cited in the psychology literature is known as the “Big Five” personality constructs. These five constructs are openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (Dahlen & White, 2006). A fair amount of research on the Big Five has investigated driving behavior. Dahlen and White (2006) suggest that extraversion (with more crashes, fatalities, traffic violations, and driving under the influence), neuroticism (with more crashes, fatalities, aggressive driving, and dislike of driving), and conscientiousness (with fewer at-fault crashes, fewer total crashes, and fewer moving violations), have been the best predictors of driving outcomes. Mixed findings result from exploration of openness to experience and agreeableness. Dahlen and White (2006) looked at risky and aggressive driving behavior using the Big Five personality construct framework. They included seat belt use in their study, but do not report on it independently of other risky driving behavior. In their study, driving anger, sensation seeking, emotional stability, agreeableness, and openness

to experience were related to unsafe driving. The authors recommended that researchers examine multiple predictors, including personality traits and demographic information, in future research. In a meta-analysis of personality and health behaviors, Bogg and Roberts (2004) found that conscientiousness is negatively related to risky health behavior and positively related to beneficial health behaviors. Unfortunately, these authors only included one study on seat belt use (Donovan, Jessor, & Costa, 1991) and, thus, did not report specifically on findings about seat belt use in the meta-analysis. Also, the meta-analysis only included research on the conscientiousness dimension of personality. However, the evidence from Donovan et al. (1991) is strong that conventionality is associated with several health behaviors including seat belt use. Conventionality is a better predictor of seat belt use for males than females, but this sex difference is smaller in senior high than in junior high.

Sensation Seeking

The personality characteristic of “sensation seeking” has direct applicability to seat belt use and driving, which are easily translated into sensational or thrilling events (i.e. driving fast, or driving unbelted). The most contemporary work on this topic likely comes from Zuckerman (2007). Much of this work relies on a Sensation Seeking Scale developed by the author. There are clear demographic differences in sensation seeking. According to Zuckerman, sex and age are the two most significant factors influencing sensation seeking. Across cultures, males score higher than females on all but one of the subscales of Zuckerman’s sensation seeking scale. More specific to risk taking, Bromiley and Curley (1992) cite previous research that shows that males take more risks in situations involving death, income, or a football game, but females take more risks in situations involving careers or marriage, suggesting that the types of risks each sex is willing to take may be different. Sensation seeking scores increase with age in childhood, peak in late adolescence, and decline with age (Zuckerman, 2007). Risky driving is particularly prevalent among adolescence as reported by several sources summarized in Zuckerman. Zuckerman also cites moderate relationships between race and sensation seeking, with Blacks scoring lower than other races on all but one subscale of the sensation seeking scale. Zuckerman found that SES differences in sensation seeking are only found in females and on one subscale.

Locus of Control

The concept of “locus of control” refers to whether individuals believe that their actions are within their own control (internal locus of control) or in the control of others or external forces (external locus of control). This concept is often applied to health research and termed “health locus of control” (Schifter & Ajzen, 1985). Research on seat belt use has employed this personality construct to understand psychological personality characteristics that lead to higher belt use. Desmond, Price, and O’Connell (1985) found no relationship between locus of control and belt use in a study of high school students, but this was attributed to the low prevalence of internally-oriented participants in their sample. Other studies on seat belt use and locus of control have also found no link between the two variables (Ricchio-Howe, 1991). This finding is not ubiquitous, however. In a review of literature on locus of control, Wallston and Wallston (1978) found one study that links internal locus of control to higher belt use (Williams, 1972). Other research on health behavior change more generally has found locus of control to predict change and positive coping intentions, with internally-oriented people more likely to change than externally-oriented people (Kaplan & Cowles, 1978; Lewis, Morisky, & Flynn, 1978; McMath & Prentice-Dunn, 2005; Saltzer, 1978). Results on demographic differences in locus of control are mixed. Some studies show no difference (Zdanowicz, Janne, & Reynaert, 2003). Others show

some evidence for age differences in adolescence in locus of control, with internal locus of control increasing for each year during the high school years (Chubb, Fertman, & Ross, 1997).

Self-Efficacy

Self-efficacy is a personality construct closely related to internal locus of control (Schwarzer, 1992). The concept of self-efficacy comes out of social cognitive theory and plays a large role in the behavior change theories discussed later in this report. Individuals with high self-efficacy feel that they are capable of accomplishing things to which they put their mind (i.e., that they themselves are effective in making change). Self efficacy has been found to be related to several positive health behaviors (Sirois, 2004).

More work looking specifically at seat belt use and personality traits would be beneficial to efforts to understand and increase seat belt use. Given the current state of the field and the recognized overlap of the two constructs, it is suggested that temperament be considered (if possible) in any study of personality. This will expand the potential number of causal factors that can be linked to seat belt use. Temperament and personality have both been successful predictors of healthy and risky behavior (Caspi et al., 1997).

From the review above, a fairly clear picture of the role of personality in health behavior can be seen. Individuals with high locus of control, low sensation seeking, high conscientiousness, and high self-efficacy are generally found across studies to be more likely to engage in healthy behaviors than individuals with low locus of control, high sensation seeking, low conscientiousness, and low self-efficacy. However, relatively few studies have focused on self-efficacy and seat belt use compared to studies of personality and other health behaviors. In terms of interventions to increase seat belt use, there is some evidence of a need to match belt use interventions or education campaigns to personality-types and temperament types (Greene & Brinn, 2003).

Decision Characteristics

Risk Perception

Risk perception can be thought of as the perceived likelihood of an event and the potential loss associated with a negative outcome resulting from the event (Yates, 1992). In research on driving and seat belt use, this can be specified in terms of risks for different outcomes. All drivers associate some level of crash risk with driving. Similarly, they probably have subjective judgments about the outcome of a crash on some rough injury scale such as no bodily injury, minor injury, major injury, debilitating injury, and death. Perception of risk is included in several health behavior change theories such as the Theory of Reasoned Action and the Health Belief Model, both of which are discussed in depth in the behavior change theories section.

Chaudhary, Solomon, and Cosgrove (2004) found a positive correlation between perceived risk of getting a ticket for not wearing a belt and self-reported belt use. Looking at young drivers, Calisir and Lehto (2002) found that perceived risk of a crash was related to road type, perceived consequences of a crash, perceived usefulness of seat belts, likelihood of being responsible for crash, likelihood of having time to warn the other driver, dangerous driving behavior, and sex.

However, risk perception was not found to be a good predictor of belt use, similar to findings from Stasson and Fishbein (1990). Sex, grade point average, and age were the best predictors of actual belt use. Trafimow and Fishbein (1994) found an interaction between risk perception and attitudes toward seat belt use in the intention to wear seat belts. When risk of the driving situation was perceived as low, attitudes were a strong predictor of intentions to wear seat belts, but this was not the case when risk was perceived as high (suggesting the risk alone is enough to encourage belt use when it is high).

Risk perception is not necessarily accurate. From van der Pligt's (1998) literature review, one can conclude that small probabilities (risks) tend to be overestimated and large probabilities tend to be underestimated. Additionally, cognitively available or easily imagined risks (i.e., the first to come to mind, the ones seen most recently) are often overestimated. Tversky and Kahneman's (1974) availability heuristic may explain this. This cognitive heuristic says that events or images that are easily brought to mind are assumed to be more frequent in occurrence. Furthermore, van der Pligt's review suggests that bias in risk assessment is primarily in the magnitude of the risk, but not the strength of the risk relative to other risks. In other words, individuals might underestimate the risk of getting in a car crash, but still accurately rank a car crash as less frequent than being hit by lightning. In addition to difficulty in accurately assessing objective risk, individuals have a hard time applying known risks to themselves (Lee, 1989; McKenna, Warburton, & Winwood, 1993; Weinstein, 1999; Weinstein, Slovic, & Gibson, 2004).

In addition to understanding risk perception, seat belt use research and intervention benefits from understanding risk tolerance, or how much risk individuals prefer to have or can deal with in their lives. Risk homeostasis theory has been a popular theory in this area (Wilde, 1994, 2005). This theory suggests that individuals have an optimal level of risk (a risk preference), and that they participate in riskier or safer behaviors so that a balance or homeostasis of risk is maintained. By definition, risk homeostasis includes costs of events, or what is at risk of being lost. With risky driving, physical health and criminal charges are risked. In gambling, financial resources are risked. Another perspective on risk perception is "zero-risk theory (Näätänen & Summala, 1976). As the name suggests, this theory says that people seek situations in which no risk is experienced. According to Wagenaar (1992), both of the theories agree that safety efforts should focus on influencing habits and not on influencing risk perception, because both the zero-risk optimality and the homeostasis equation are thought to operate subconsciously.

There has been interesting work in risk perception specifically as it relates to driving and seat belt wearing. Pitz (1992) studied perceived risk in driving situations involving the driver's control of the vehicle. In these circumstances, "risk during" driving was perceived as low and there was little risk feedback (i.e., seeing a crash). The authors compare this to flying, which somehow feels riskier to many, likely due in part to the lack of control (see Fischhoff, 1995; Fischhoff, Lichtenstein, Slovic, Derby, and Kenney, 1981; Slovic, 2000; and Svenson, Fischhoff, and MacGregor, 1985 for more on risk perception and tolerance, and Evans, 1991 for a criticism of some risk-perception theory, particularly the idea of risk homeostasis).

Decision Modes

Decision making and decision modes relate to seat belt use to the degree that wearing a seat belt is a decision. There are many ways to make a decision, logically weighing pros and cons, attaching value to them, recalling previous experience, or relying on intuition "gut feelings." Most research on decision making is in the tradition of analytic reasoning. Under the general term of decision making, there are several components, including choices, acceptances and

rejections, evaluations, and constructions (Yates & Tschirhart, 2006). Furthermore, decision processes can be summarized as resolutions of 10 cardinal issues (Yates, 2003; Yates & Tschirhart, 2006): need; mode; investment; options; possibilities; judgment; value; tradeoffs; acceptability; and implementation. Not every issue is resolved completely for all decisions. Decision modes include both who will decide and how the decision will be made. With regard to seat belt use, the role of “who” can be filled by the individual (as is generally the case in most decision-making research), a parent (deciding for a child), a driver (deciding for all passengers in the vehicle), or, at a more removed level, the state (deciding for all citizens). With respect to how a decision is carried out, options include analytically, rule-based, automatically, and intuitively. Automatic decision making (including habit) will be discussed later in this section. For more reading on intuitive decision-making, see Klein (1999).

A study by Sutton and Hallett (1989) reported on an experiment directly testing the effectiveness of a seat belt use message that included a fear appeal. The experimental group viewed a videotape on seat belts, while the control group viewed a neutral tape. Seat belt use intentions, beliefs, and fears were measured immediately after the manipulation, 3 months later, and 1 year later. An effect of the manipulation was seen immediately, but not at the later time periods. This study suggests that evaluations of interventions should always be longitudinal. The authors claim that a path analysis partially supported their decision model. The decision model employed in this study seemed to be a basic variant of an expected utility theory, in which it would be expected that the seat belt video would influence the subjective probabilities of injury if one was in a crash. Additionally, the use of a fear appeal suggests that the study is influenced by Protection Motivation Theory, discussed in the behavior change theories section, but the authors do not address that specifically.

On the issue of decision modes more specifically, there is much debate about whether individuals are rational or irrational deciders, or something in between (see Stanovich & West, 1998, 1999a, 1999b, 2001). More details on the errors people make in judgment and decisions will be addressed later in the section on lay rationality and misassumptions.

The distinction between different types of decision modes could be more readily applied to seat belt use. The multiple modes proposed by Yates and Tschirhar (2006) and Yates (2003) are worthwhile departures from analytic decision making theories in which individuals are assumed to carefully consider and weigh many costs and benefits. The decision to wear a seat belt on every trip seems to fall under an automatic, or intuitive decision mode, more than an analytic one. Similarly, the issue of who makes a decision (as part of the decision mode) has rarely if ever been studied explicitly in seat belt research.

It seems clear from other research reviewed earlier that people cite several different reasons for not using seat belts, including forgetfulness and discomfort. It should also be considered that the decision processes or modes leading to seat belt use or nonuse may not always be obvious to individuals, and so controlled studies could be done to isolate which type of decision mode individuals are using when deciding to use a seat belt, either in terms of a global behavioral intention, or in a specific behavioral occurrence.

It should be clear from the discussion of risk-perception and the discussion of decision modes here that decision processes are worth considering in a discussion of seat belt use. If we know why individuals decide not to wear a belt, we can develop approaches for specifically affecting those decisions. However, a major critique of decision research, specifically in the realm of seat belt use, revolves around the debate of habituation behavior versus behavior that individuals

consciously decide to do. One can make a conscious decision (i.e., a behavioral intention) to wear a seat belt all the time, but situational variables may influence the degree to which they actually conform to their intention.

Models of Lay Rationality (Assumptions/Misassumptions)

It has been known for some time that individuals make regular errors in judging the probability of occurrence of events or the relationship between certain events or characteristics (Tversky & Kahneman, 1971, 1974), and this line of research still influences contemporary reasoning and decision research and theory (Fischhoff, 2007; Tversky & Kahneman, 2004; Yates, 2006). The theory that developed out of this early work revolves around biases in cognition and reasoning that result from the use of heuristics in everyday decision making. The purpose of these heuristics is to make every-day decision making and problem solving less burdensome. Most decisions we have to make do not require formal mathematical calculations, and our outcomes are generally acceptable. However, this regular use of heuristics leads us to make logical errors, which can show up in understandings of risk, consequences, and the efficacy of health behavior.

A list of heuristics that are often used by individuals in their reasoning and decision making, and often lead to error, came out of this early work (Tversky & Kahneman, 1974). This list includes the representativeness heuristic, the availability heuristic, and the adjustment and anchoring heuristic. The representative heuristic involves determining the likelihood of an outcome based on the degree to which that outcome seems representative of a particular underlying causal relationship, even if it violates formal probability calculations (Yates, 2006). A concrete example of the representativeness heuristic can be seen in the conjunction fallacy, which involves thinking that two events or characteristics are more likely to occur together than either of the component events or characteristics independently because the image produced by their co-occurrence is representative of some underlying expected relationship. For example, when given a description of a woman who is said to be a college student, studying philosophy and involved in anti-nuclear protests, and then asked whether it is more likely that this woman is a bank teller, or a bank teller and active in the feminist movement, people will generally pick the latter, even though the probability of the two events occurring together is by definition smaller than either one of them occurring. Similarly, individuals will often ignore base rate information of number of people in the population who are farmers and librarians when judging whether a particular person is a farmer or a librarian based on a detailed description of personality traits and interests, opting for the profession that seems to match, stereotypically, the traits presented (Tversky & Kahneman, 1974). The availability heuristic involves predicting the likelihood of occurrence of some event based on the ease of availability in memory of that event. Events that are more easily recalled are assumed to occur more frequently. The anchoring and adjustment heuristic suggests a two-step process in which people first make (anchor) an initial judgment, and then adjust it based on additional information or reasoning. However, the adjustments are not necessarily any more accurate than the anchor. Advances in the theory of heuristics and biases over the past 3 decades can be found in Kahneman, Slovic, and Tversky (1982) and Tversky and Kahneman (2004).

Since the development of the original theory on heuristics and biases, debates have arisen in the research community regarding the rationality of decision-making and how it should be studied (Stanovich & West, 1998, 1999a, 1999b, 2001). Some of this research suggests that the errors humans make in reasoning and judgment are not due to performance errors, but to computational limitations (Stanovich & West, 2001). It may be these computational limitations that lead to the use of heuristics, and thus inaccurate judgments.

It may be tempting to attribute these errors due to the use of heuristics to lack of education or intelligence. However, these results have been replicated in even highly educated individuals (Tversky & Kahneman, 1971) suggesting that they are core human cognitive phenomena, and not simply a function of education or intellect.

Applications of findings on heuristics and biases should be readily applicable to the development of seat belt use messages. Additionally, relatively recent work on individual differences in decision making has found that culture may play a role in how individuals make judgments and their confidence in those judgments (Yates, Lee, Shinotsuka, Patalano, & Sieck, 1998). Cultural information, in addition to demographic information, can be used in tailoring seat belt use interventions. It would be helpful to verify the findings reviewed in this section with respect to seat belt use, crash likelihood, probability of death or injury with and without a seat belt and related concepts, as most of the research cited here is based on scenarios that are not seat belt related.

Fuzzy Trace Theory

Fuzzy trace theory is a general advance in cognitive psychology that covers memory, perception, judgment, decision making, and cognitive development. For purposes of understanding seat belt use, focus will be on decision and judgment aspects of fuzzy trace theory. According to Reyna and Brainerd (1995), fuzzy trace theory was developed to deal with findings that countered previous theories in cognitive science, which asserted that memory and reasoning were related. Reyna (2004) and Reyna and Brainerd (1995) assert that during an event, two representations are formed, one verbatim and one gist, but that these representations are formed, stored, and retrieved independently (thus making fuzzy trace theory a “dual processing” theory of memory and judgment). Reyna (2004) suggests that fuzzy trace theory can be used to interpret old results, for example, the finding that people often overestimate small risks. She suggests that previous research has many examples of how the gist representation, “which reflects the person’s education, emotion, culture, and world view, rather than verbatim information, governs the perception of risk,” (Reyna, 2004, p. 62). She outlines three questions that contemporary risk and decision researchers are asking:

- 1) How are classes of events that are involved in reasoning about risk represented in memory?
- 2) How do people retrieve “reasoning principles” as they engage in the process of reasoning?
- 3) Is reasoning subject to processing interference, especially from thinking about overlapping classes of events?

Applying fuzzy trace theory to adolescents may give insights into potential demographic differences in risk perception (Reyna & Farley, 2006). There is clearly much work to do in the development and application of fuzzy trace theory. One of those areas could be the perception of risk related to seat belt use, possibly using Reyna’s (2004) three research questions. A more concrete application to seat belt use may be a fuzzy trace theory approach to the design of seat belt use messages. If it is true that both verbatim and gist representations are formed in memory, this information could be used to design messages that have a strong general point that can be remembered as a gist as well as a specific informational message (e.g., a statistic) that is better remembered verbatim. It seems as though maximizing a message’s impact, under fuzzy trace theory, would involve being sure that the message is not lost if one of the cognitive processes

(gist or verbatim) is more efficient than the other. In other words, messages should be strong in both “gist meaning” (i.e., feeling, tone, “the big picture”) and “verbatim meaning” (i.e., specific details of action, statistics, and so forth). Recalling Reyna’s (2004) finding that gist representations are a larger contributor to risk perception than verbatim representations, at a minimum seat belt use appeals should focus on messages with strong gist impact (e.g., images, emotionally charged points, general statistical comparisons, and so on) as opposed to messages that would require strong verbatim representation, such as specific statistics.

Emotional Characteristics

Affect

There have been some modifications to rational choice models that have incorporated affect and emotion to predict behavior (Schwarz, 2000). It has been suggested that decisions may be driven by emotional or affective states and not entirely by rational decision processes. Armitage, Conner, and Norman (1999) found that when negative mood was experimentally induced in participants, attitudes but not subjective norms predicted intentions to use a condom and to make healthy food choices. Isen and Labroo (2002) have shown that positive affect is beneficial for many types of cognitive tasks, including problem solving, memory, coping, and safety behavior. They suggest that the decision making process is more thorough and clearer when affect is positive, and when a task is interesting, personally meaningful, or important. Their review includes evidence that positive affect increases safety behavior by reducing risky behavior. They note that these findings are contradictory to previous literature, which has suggested that positive affect may lead to less safe behavior as one “throws caution to the wind.” According to their review, positive affect leads to variety-seeking, but only within safe-alternatives.

Darley and Lim (1993) found that the relationship between emotion and behavioral intentions regarding drunk driving is moderated by both personal relevance of the decision (personal importance of the issue) and self-monitoring (the degree to which a person is sensitive to context and the responses of others and modifies his or her behavior accordingly). That is, the relationship between emotion and intention was stronger for participants for whom the topic had high personal relevance and participants who were high self-monitors. Ajzen and Timko (1986) found similar results with respect to self-monitoring. Slovic and Peters (2006) provide a framework for linking the heuristics of Tversky and Kahneman with affective components of cognition. In other words, they link the “thinking” of decision-making with the “feeling” of decision making.

As in much decision theory, affect has been notably absent from the research on seat belt use and related risk perception research. However, some potential applications to seat belt use come out of studies that look at affect and public service campaigns (Darley & Lim, 1993). The Darley and Lim study (1993) suggests that there are person-specific variables (personal relevance and self monitoring) that can be capitalized on to influence seat belt use. While self-monitoring may be difficult to change, simply knowing that low self-monitors will not respond as strongly to typical public service messages may be helpful in developing new messages or approaches. Similarly, while personal relevance cannot be changed directly, messages can be developed that maximize the salience of any potential personal relevance (e.g., referring to children or significant others, or to people the message recipient has known who have been injured).

Fatalism/Destiny

Fatalism is the idea that an individual's destiny is out of his or her control. Fatalism may be related to low belt use in that if someone believes that his or her death or injury is predetermined (or at least controlled by an outside force, or "higher power"), then his or her behaviors will not affect the occurrence of injury or death.

Colon (1992) found that beliefs in destiny accounted for race differences in seat belt use. Race was categorized as White/Non-White. Belief in destiny as it pertains to belt use was assessed from responses to a seven-point Likert scale item, "There is no point in using a seat belt since you can't change your destiny." Whites had higher belt use and lower belief in destiny. Peltzer (2003) measured fatalism and seat belt use in White and Black South African Drivers. The single-item fatalism scale dealt specifically with fatalism relative to seat belt use. On a four-point scale, with response choices from strongly agree to strongly disagree, respondents were asked to respond to the statement, "I can't change my destiny, so there's no point in wearing a seat belt." Most drivers did not have a fatalistic orientation (84 percent of Black; 79 percent of White), but a non-fatalistic viewpoint was associated with increased seat belt use. No race differences in belt use were found. Byrd, Cohn, Gonzalez, Parada, and Cortes (1999) found similar results in terms of fatalistic orientation, but found it was not related to seat belt use. In a study of high school students from inner-city and middle-class schools, Shin et al. (1999) found support for the fatalism hypothesis, with students from the inner-city school being more likely to endorse the opinion, "there is no point in wearing seat belts since you have no control over your fate or destiny" (p. 485). In general, demographic differences in fatalism suggest that Whites (Colon, 1992; Peltzer, 2003) and higher socioeconomic status individuals (Shin et al., 1999) have less belief in fatalism.

There are mixed findings regarding the relationship of fatalism/destiny to seat belt use, but the results generally indicate that fatalism and destiny are related to race and socioeconomic status. For individuals with high fatalism scores, seat belt interventions may be developed so that they try to change this perspective. Some acknowledgement of nonusers' current beliefs (i.e., high fatalism) can be acknowledged with messages such as, "There are a lot of things you can't change in life, but here's one you can. Always wear your seat belt." A deeper understanding of the fatalism construct would be helpful to developing interventions to counteract it. Shin et al. (1999) provide findings suggesting that an internal sense of fatalism may not be completely a psychological construct, but may be reinforced by authority figures in adolescents' lives through modeling of fatalism-based behavior (i.e., parents not wearing seat belts and not asking their children about their seat belt habits). While fatalism seems to encompass a complex, multi-faceted belief system, most of the studies reviewed here have used very simple measures of it, or measures which ask about fatalism solely in the context of wearing seat belts. There is an opportunity to measure fatalism/destiny more broadly to better understand all of the psychological and social components of this belief system and develop interventions to change it.

Behavioral Characteristics

Implementation Plans/Intentions

Intentions or plans to participate in certain behavior are essential components of several psychological theories, including those discussed in the behavior change theories section of this review. Implementation plans and intentions are generally found in the psychological literature under the term “behavioral intentions.” The concept that people have a plan to partake of or abstain from certain behaviors is a cornerstone of the Theory of Reasoned Action and Theory of Planned Behavior, as well as other health behavior theories (Ajzen & Fishbein, 1980; Fishbein, 1979; Fishbein & Ajzen, 1975; Wittenbraker, Gibbs, & Kahle, 1983). Researchers would ideally like to be able to observe and record actual behavior. Intervention planners want to change real behavior. However, observation of actual behavior is not always possible, and thus the concept of behavioral intentions is helpful in research and program planning and evaluation. There is some evidence that behavioral intentions predict actual behavior fairly well (Jonah & Dawson, 1982; Norwich & Duncan, 1990).

A contemporary line of research on intentions has used an explanatory construct called consideration of future consequences (CFC), which refers to a person’s tendency to think about consequences of actions. CFC has been found to relate to behavioral intentions (Orbell & Hagger, 2006; Orbell, Perugini, & Rakow, 2004). This research finds that CFC interacts with the timeframe and whether consequences are positive or negative, so that low-CFC individuals are more persuaded to action when positive consequences are short-term and negative consequences are long-term. High-CFC individuals are motivated to act under opposite consequence and timeframe structures (i.e., when positive consequences are long-term and negative consequences are short-term).

The research on behavioral intentions is often tied to attitudes, with the theoretical prediction that attitudes toward behaviors predict behavioral intentions (Ajzen & Fishbein, 1980; Fishbein, 1979; Fishbein & Ajzen, 1975). For this reason, some research on attitudes toward seat belt use will be summarized here. Several authors have found that positive attitudes toward seat belt use or seat belt legislation lead to behavioral intentions to use seat belts (Fockler & Cooper, 1990; Jonah & Dawson, 1982; Stasson & Fishbein, 1990; Wittenbraker, Gibbs, & Kahle, 1983). Knapper et al. (1976) obtained positive seat belt attitudes from most of their respondents, regardless of actual seat belt use. However, it is unclear whether the attitudes in question were about seat belts generally or about the behavior of seat belt use. Fishbein and Ajzen (1975) have argued and shown empirically that it is better to ask about attitudes toward a behavior, if behavior is to be predicted, than to ask about attitudes toward an object in general.

The findings on behavior intentions suggest that they can be influenced by changing attitudes. That attitude-intention link tends to hold for seat belt use, and thus an approach to increasing seat belt use intentions might be through increasing positive attitudes toward seat belt use. Keeping in mind the caution of Fishbein and Ajzen (1975), it may be more effective to focus on changing attitudes toward wearing a seat belt, rather than just attitudes toward seat belts in general. Individuals may think that seat belts are a good idea “in general” but have negative attitudes toward wearing a belt themselves. Improving attitudes toward seat belt use, making it a smart and trendy thing to do (i.e., making it “uncool” to be unbelted), could lead to increased behavioral intentions to wear a seat belt and thus more actual seat belt use.

Health Behavior

Seat belt use can be considered one of many health behaviors that individuals adopt or avoid. Health behaviors (and their absence) are often found to cluster (Caspi et al., 1997). A discussion of general health behavior and its relation to seat belt use can proceed along two lines. One line considers general health practices, such as annual physician visits, health screening, dental hygiene and the like. A second line considers health behavior (or unhealthy behavior) that is more temporally bound, such as drinking and drug use.

Several studies have found relationships between alcohol consumption on a given occasion and seat belt use by college students (Everett, Lowry, Cohen, & Dellinger, 1999) and in general adult populations (Foss, Beirness, & Sprattler, 1994). A report by NHTSA, using crash data, found a similar relationship between alcohol consumption and belt use (NHTSA, 2005). Foss et al. (1994) found that males who had been drinking were less likely to be wearing seat belts than females who had been drinking. However, Everett et al. (1999) found that drinking and seat belt use were not related among college graduates. In a study of the relationship between multiple health behaviors and health behavior attitude, Eiser, Sutton, and Wober (1979) found a link between smoking and lower seat belt use, and this was tied to a general attitude about the rights of individuals to risk their own health.

Emotional health can be considered part of health and health behavior. In a study of urban youth, Schichor, Beck, Bernstein, and Crabtree (1990) found that youth who never or rarely wear a seat belt were more likely to experience depressed mood, have low social support at home, have a negative life outlook, have trouble at school and with the law, and be on probation. No relationship was found between seat belt use and other physical health behaviors, such as smoking, drug use, alcohol use or unprotected sexual activity. Shinar, Schechtman, and Compton (1999) found a small relationship between individual safe driving behaviors and other individual health maintenance behaviors. They found little relation between two measures of drinking habits and driving behavior and seat belt use, but seat belt use was negatively related to overall amount of drinking. The small, but significant correlations found suggest that health behaviors and seat belt use are related, but only for certain behaviors.

Several studies have found a link between obesity and seat belt use, with overweight and obese people being less likely to wear seat belts than healthy weight individuals (Hunt, Lowenstein, Badgett, & Steiner, 1995; Lichtenstein et al., 1989; Zhu et al., 2006). While this may be due to uncomfortable fit, Hunt, Lowenstein, Badgett, and Steiner (1995) put this finding into a broader picture of health, reporting that non belt-users were more likely to be obese, to be problem drinkers, and to have sedentary lifestyles. Confirming the comfort hypothesis, they found that “discomfort” was the most common reason cited for nonuse, specifically among obese individuals.

Knowing a person’s health behaviors and health characteristics has unique implications for understanding seat belt use, and offers unique potential for tailored intervention. For example, the finding that obese individuals are less frequent belt users and are also likely to cite “comfort” as a reason for not wearing seat belts, suggests that a design solution may increase belt use (such as more pliable belts, belt padding, or belts that rest across different parts of the body). The relationship between alcohol use and belt use is a concern, because it leads to the realization that individuals are driving while intoxicated *and* unbelted. The co-occurrence of these two behaviors suggests that belt use could be influenced in contexts that are familiar to, or ways that are appealing to drinkers. In a method similar to designated driver campaigns, which are sometimes

visible in bars and may involve participation by bar staff, a seat belt-use campaign could be implemented in a context that is linked with low belt use (e.g., coasters that say “Sober doesn’t mean you’re safe. Buckle up”). The results by Shinar et al. (1999) showing weak correlations between other health maintenance behavior and seat belt use lead to the conclusion that using a seat belt is simply part of a “healthy person profile” and that there are intervening factors other than health concerns that influence belt use.

Conclusions

Summarizing across the aspects of human psychology and sociology discussed above and applying the synopsis to the challenge of increasing seat belt use is a large task. The challenge comes, in part, from the fact that these individual-level characteristics have not been applied to seat belt use equally. Factors such as risk perception and personality (specifically sensation seeking) have a strong history in seat belt use research. Other areas, such as lay rationality and fuzzy trace theory, have yet to be applied systematically to seat belt use. In addition, many of these individual-level concepts (such as risk perception, lay rationality, and fuzzy trace theory) are inter-related and come together in complex ways to influence seat belt use.

One framework for understanding belt use could involve demarcating the research discussed above by psychological (internal) or social (external) causes of belt use. Most social scientists would probably argue that belt use, as well as other health behavior, is a combination of psychological and social influences. However, this basic distinction can still help develop a framework under which the relative strength of each set of forces can be evaluated.

The studies reviewed in this section, while providing much information on seat belt use rates, have several limitations. First, many are descriptive and lack critical variables for understanding the full picture of seat belt use. Second, even studies that present complex statistical predictions of seat belt use (Vivoda et al., 2004) often do not establish the causal relationship between demographic characteristics and seat belt use. In other words they answer the question “Who does not use seat belts?” but not the question “Why do they not use seat belts?” For example, is the lower rate of seat belt use by males due simply to comfort, as suggested by Begg and Langley (2000), or is it something more complex, including sex role stereotypes, role modeling, or sensation seeking? Third, a methodological critique of the seat belt literature involves the definition of belt use. Some studies use self-report while others use observation. Some self-report studies measure individual belt use “on average” while others define a specific time frame, such as “the last five trips.” Finally, most of the studies reviewed here have been quantitative in nature, and this may be why clearer findings about reasons for belt use are not available. While the establishment of seat belt use rates and demographic differences is primarily a quantitative task, qualitative methods used in conjunction with quantitative methods may provide a deeper understanding of why people use and do not use belts, and thus why there are demographic differences.

A final suggestion for grouping these findings is a developmental one. Although developmentally relevant (e.g., age-specific) information is not available for each subsection discussed here, there are logical reasons for grouping these individual-level findings by age. First, there are several pieces of research reviewed here that study seat belt use and other health behavior by specific age groups, often high-school or college students. Second, several of the individual characteristics reviewed here vary by age (e.g., cognitive ability, judgment, sensation

seeking, and emotions). Third, seat belt use rates show clear age-related patterns. Matching the summary of individual differences to the age pattern seen in seat belt use could be helpful. Finally, options for intervention will be different for individuals of different ages, in addition to any tailoring that is done based on other individual characteristics. Organizing findings developmentally reduces the possibility of over-extrapolating findings from one age group to another.

Painting the individual “profile” of nonuse involves understanding personality, sex, age, race, socioeconomic status, decision processes, and affect. Belt nonusers are more likely male, younger, poorer, driving on city streets and in rural areas, sensation seekers, and fatalists, and exhibit negative mood, external locus of control, high neuroticism, high conscientiousness, and likely a lack of belt use habits. Developing interventions that meet all of these individual characteristics may be impossible, but seeing the whole picture helps determine what to focus on, and how best to do it.

SOCIAL INFLUENCES ON BELT USE

Social influence is the process by which one generates and manages change in the social world (Cialdini & Trost, 1998). It refers to the different ways that people can impact one another, including changes in attitudes, beliefs, feelings, and behavior (Gilovich, Keltner, & Nisbett, 2006). Extensive research exists that explains how, when, and why social influence works, often in terms of its underlying components and mechanisms (e.g., conformity and social norms; see Cialdini & Trost, 1998). While little has been done to apply social influence theories to explaining seat belt use and nonuse in particular, there is much research showing the effects of social influence on related behaviors (e.g., drinking, drinking and driving, speeding, smoking; see Clark & Lohéac, 2007; Neighbors et al., 2007; Perkins, 1997; Perkins & Wechsler, 1996; Ritzel, 2002; Scher et al., 2001). This section discusses the effect of social influences on belt use and is divided into six parts: norms, national culture and traffic safety culture, peer influences, parental influences, diffusion of innovation, and attribution theory.

Norms

Social norms are a major component of the social scientific knowledge of interpersonal processes and social influence (Cialdini & Trost, 1998). They are best defined as people's beliefs about the attitudes and behaviors that are normal, acceptable, and sometimes expected in a given social context, and that can guide and/or constrain social behavior without the force of laws (Ritzel, 2002). Norms can vary by the extent to which they are injunctive (i.e., prescribing a valued behavior) or descriptive (i.e., showing how others would act in a similar situation). The implications of norms as a means of social influence stem from people's need and motivation to conform, whether it be through: 1) informational social influence, whereby one takes the comments or actions of other people as a source of information as to what is correct, proper, or efficacious; or 2) normative social influence, whereby the influence comes from the desire to avoid disapproval, harsh judgments, or social sanctions (Cialdini & Trost, 1998; Gilovich et al., 2006). Social norms can help shape the desire to act effectively, to build and maintain relationships with others, and to maintain self-image.

While much is known about how social norms work and influence behavior, less is known about how they develop. The two main perspectives on the development of social norms argue that norms are (1) arbitrary rules for behavior that are adopted because they are valued or reinforced by the culture, or (2) that they are functional and aid in accomplishing the goals of the group (Cialdini & Trost, 1998). Finally, the influence of social norms can be adaptive, as when people conform to norms that are consistent with healthy behaviors, or maladaptive, either when people conform to unhealthy norms or more often when they hold incorrect perceptions of what the true norms are and therefore behave in accordance with false standards. The latter, social influence through incorrect perceptions of social norms, can occur when individuals overestimate the permissiveness of peer attitudes or behavior toward a risky behavior or underestimate the extent to which peers engage in safe behavior, and therefore gravitate in the direction of the risky behavior (Ritzel, 2002).

Social norms can influence seat belt use in many ways. Studies have shown that use of seat belts is better predicted by social norms and perceived social pressure than by other factors such as the perceived risk associated with nonuse (e.g., Cunill, Gras, Planes, Oliveras, & Sullman, 2004; Snyder, Spreitzer, Bowers, & Purdy, 1990; Stasson & Fishbein, 1990). Moreover, the most

extensive research on the influence of social norms focuses on the extent to which false, perceived norms can increase one's likelihood to engage in unsafe behavior (Ritzel, 2002). Specifically, this occurs most commonly among young persons who often hold incorrect perceptions of what the true norms regarding problem behaviors are for people in situations similar to their own. Most studies have documented this with drinking, whereby students often overestimate the prevalence of alcohol consumption by their peers, and therefore find it acceptable that they drink as well (e.g., Clark & Lohéac, 2007; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Perkins, 1997; Perkins & Wechsler, 1996; Ritzel, 2002; Ritzel et al., 2001; Scher, Bartholow, & Nanda, 2001). Similar patterns may occur with seat belt use, whereby people (particularly teens) may be discouraged from wearing seat belts because they underestimate the degree to which their peers actually wear them (e.g., Lorenz, 2007). For example, one study found that while 70 percent of the students reported 90-100 percent seat belt use, they reported that only 48 percent of their peers used seat belts 90-100 percent of the time (Lorenz, 2007).

To the degree that norms—actual or perceived—are powerful in influencing people's risky behavior (e.g., drinking and driving), more research would be useful in understanding ways in which social norms can influence and increase seat belt use. Extensive research has been done to understand how interventions to reduce drinking and drug use on campuses can be significantly improved by focusing on correcting perceived norms, rather than the traditional prevention programs which actually acknowledge prevalence of problem behaviors (Neighbors et al., 2007). Thus, given the importance of social norms in influencing behavior, and the documented problem of nonuse of seat belts among young drivers, it follows that correcting the perceived norms for seat belt use (e.g., by raising awareness that belt use by peers is more prevalent than thought) may be more effective than traditional interventions that focus on promoting safety behavior more explicitly (e.g., by raising awareness of the benefits of seat belts or the risks of not using them). Evidence for the utility of such interventions includes findings that show seat belt use to be more positively related to subjective norms and the judged convenience and popularity of seat belts than to their perceived contributions to safety (Cunill et al., 2004; Stasson & Fishbein, 1990; Svenson et al., 1985). These results suggest that providing more information about the effectiveness of seat belts may not be as efficient in increasing seat belt use as emphasizing other factors, such as comfort and social norms, which cannot be outweighed by people's tendency to underestimate the probability of being in an automobile crash.

National Culture and Traffic Safety Culture

A general definition of culture is that it consists of the beliefs, values, norms, and things people use to guide their social interactions in everyday life (Moeckli & Lee, 2007). Applying this definition to traffic safety shows how general culture can shape traffic safety culture, which dictates, for example, what people believe is acceptable driving behavior. American culture tends to also value freedom, privacy, and libertarianism to a greater degree than do other cultures (Markus & Kitayama, 1991; Nisbett, Peng, Choi, & Norenzayan, 2001). One illustration of the resulting cultural characteristics in traffic safety, for example, is that Americans highly value mobility, to the extent that many are willing to tradeoff safety in order to maintain the high level of mobility that is often taken for granted (Howard & Sweatmen, 2007; Sleet, Dinh-Zarr, & Dellinger, 2007). This priority of mobility seems to be a uniquely American value, as it is often contradicted in countries that put the priority on safety, as is the case in Sweden and Australia, which operate on a very low tolerance for traffic-related injury (Williams & Haworth, 2007). Further, unlike other countries (e.g., Sweden), Americans generally show less tolerance for

paternalism. The primary responsibility for traffic safety in the US rests on the driver, whereas Sweden's traffic safety culture is based on the premise that it is unethical for the government to fail to take whatever measures necessary to reduce traffic safety risks (Bahar & Morris, 2007). The argument often made by Americans who do not use belts is that seat belt laws infringe upon individual freedom and that it is the person's own right to choose whether or not to buckle up (Horn, 1989; Wilson, 1984). This could explain why mandatory seat belt laws faced more obstacles in the US than in most European countries, and also explains America's generally lower belt use rates (Geller, 1985; Leichter, 1986b). The cultural component of traffic safety is also illustrated by the debate on motorcycle helmet legislation. In spite of the overwhelming evidence that motorcycle helmet laws reduce fatalities and serious injuries, only 20 states currently require all riders to wear helmets, primarily because advocacy groups have been successful in repealing state helmet laws (Jones & Bayer, 2007). Again, this shows that some people are willing to tolerate some potentially avoidable risk because, presumably, they value libertarianism. That said, the trade-offs between these two seemingly conflicting value systems are always under debate, and compromises are always sought (Leichter, 1986a; Littlechild & Wiseman, 1986; Thaler & Sunstein, 2003). Moreover, those Americans who reject state enforcement of belt use laws seem to share the general yet incorrect belief that no one except themselves would suffer if they were unbuckled in an automobile crash. It is still important to point out that most Americans have favorable opinions toward seat belts and even seat belt laws, showing that the cultural argument is real but limited.

The fact that such attitudes in American traffic safety culture are built upon the incorrect assumption that seat belt use is a personal decision that affects no one but the user gives much promise to the prospect of reorganizing the idea of seat belt use from a personal decision to a more public one, perhaps not unlike the way the issue of smoking has been reinterpreted (Sleet et al., 2007). For example, the same principle that allows American citizens to embrace or at least not be as resistant to smoking laws (e.g. making it known that smoking hurts nonsmokers as well) may also translate to seat belt nonuse. Many issues can serve to support the argument for mandatory seat belt laws (e.g., seat belt laws save lives and money, nonuse of seat belts costs society as well as the individual). Further research to learn more about this relationship would be very useful. Such a reinterpretation of the seat belt issue would bring about a major change to American traffic safety culture.

Peer Influences

Peer influences refer to the exhibiting of behavior that is influenced by the beliefs and behaviors of peers, either through direct modeling or through pressure to behave in accordance with true or perceived peer norms (Lau, Quadrel, & Hartman, 1990; Ritzel et al., 2001). To that extent, peer influence can also be seen as an extension of the social norms theory discussed earlier. Some research findings show that peer influences tend to be more influential in shaping individual behavior than biological, personality, familial, religious, cultural, or any other type of influence (Ritzel, 2002). This is because the more similar one is to the norm population, the stronger the influence (Cialdini & Sagarin, 2005), and because people tend to associate with and feel more similar to their peers than to other segments of the population.

Most of the current research on peer influences looks at drinking and drug use in high schools and colleges (e.g., Clark & Lohéac, 2007; Neighbors et al., 2007; Perkins, 1997; Perkins & Wechsler, 1996; Scher et al., 2001). This research focuses on the influence of norms and perceived norms discussed earlier and suggests that interventions use social norms marketing to

correct the perceived norms among the target populations (Ritzel et al., 2001). Studies also point to students' high need for peer approval and a subculture that values autonomy and emancipation as key factors leading to nonuse of seat belts (Snyder & Spreitzer, 1991).

Though most peer influence research focuses on drinking and drug use, parallels to seat belts can be made. A key issue here is that peer influence functions in accordance with perceived norms, which often differ from actual norms. This provides a significant support for the social norms approach of intervention, whereby one need only present the correct peer norms to reduce pressure to conform to incorrect norms (Ritzel et al., 2001).

Parental Influences/Management

Parental influences on behavior have often been studied alongside peer influences, usually in regard to cigarette and alcohol use (e.g. Lau et al., 1990; Olds & Thombs, 2001). Although research on parental influences on seat belt use has been more limited, several studies show this influence to be most significant at an early age, and usually in conjunction with enforced seat belt laws. Parental influence has been shown to be a greater influence on teens' belt wearing behavior than peer pressure (e.g., Lau et al., 1990; Womack, 1997; Womack, Trout, & Davies, 1997). According to teens in focus groups, regular users of seat belts said they used seat belts because of how they were raised, which show some effects of early family socialization. This suggests that habitual belt use can be promoted with parental influence at an early age, in conjunction with enforcement of primary belt use laws. This is supported by other findings that show low seat belt use to be a result of failing to acquire the habit of wearing them, rather than any strong attitudes against buckling up (Knapper et al., 1976; Sutton & Hallett, 1989). Research on modeling also shows that passengers' use of seat belts is significantly related to the driver's belt use, again suggesting a weaker role for intentional nonuse of seat belts (Howell et al., 1990). Accordingly, many suggest that interventions that attempt to change attitudes toward seat belts cannot be effective without simultaneous efforts to change social norms and habits (Wittenbraker et al., 1983). It has also been suggested that effective approaches for improving seat belt use among teens should portray realistic consequences of not wearing seat belts, as teens are often not aware of the benefits of seat belts (Womack, 1997). Contrary to these studies on seat belt use, studies on interventions to reduce smoking and drinking suggest a stronger role for peer influences (e.g., Olds & Thombs, 2001). This is consistent with the finding that parental influence is important in shaping behavior at an early age. Seat belt use behavior begins early in life, while smoking and drinking behavior are usually initiated during adolescence at a time when peer influence has become more important.

The limited research available on parental influences on seat belt use clearly shows that parents can have a key role in developing in their children the habit of buckling up, while other research further supports the significance of these findings by highlighting the powerful contribution of habit to seat belt use. Very little is known about what happens when adolescents move out and function on their own, and when they may be faced with contradictory peer influences (e.g., Lau et al., 1990). More studies are necessary to investigate whether and to what extent these positive habits can withstand counter influences later on in life (e.g. peer influences), and whether parents can still exert some degree of influence later on in life.

Diffusion of Innovation

Diffusion of innovation refers to the rate and process by which new ideas or innovations spread through a population (Rogers & Shoemaker, 1971). Diffusion is a dynamic, evolving, multi-stage process, and includes spontaneous as well as planned and directed spread of ideas (Rogers, 2003). Diffusion theory proposes a four-step innovation-decision process: knowledge, persuasion, decision, and confirmation. The knowledge stage involves the individual's understanding of the innovation. The persuasion stage involves the development of an attitude towards the innovation. The decision stage involves the individual's choice to adopt or reject the innovation. The confirmation stage involves the individual's effort to seek reinforcement for the decision. Diffusion is also a type of social change in that the process of diffusion also involves alteration in the structure and function of a social system.

Diffusion theory has not been applied to seat belt use, per se, although some research discusses the diffusion of innovation for automobiles in general (e.g., Marchetti, 1983). Other studies have looked at the diffusion of policies and laws, such as belt use laws, showing conflicting evidence as to whether states adopt more comprehensive laws as a result of increased incidence of the problem targeted by the law (e.g., seat belt nonuse) or that states with such laws exhibit less of the problem to begin with and are thus more receptive to legislating such laws (Hays, 1996; Legge & Nice, 1993).

While diffusion theory has not been applied to seat belt use in particular, the underlying concepts seem appropriate for voluntary and compulsory efforts promoting health behavior (Nelson & Moffit, 1988). As such, seat belts can represent an innovation much like a mobile phone or other technological gadget, albeit one that for one reason or another has not diffused to the same extent. More empirical examinations of the diffusion of seat belts can therefore be informative, as diffusion theory could potentially inform efforts to increase seat belt use. However, more needs to be understood about the application of diffusion theory to belt use before the full extent of its benefit can be known. It may be that seat belts have yet to be fully adopted because some people still fail to understand the safety benefit they provide ("knowledge" stage)—or it may be that seat belts have yet to reach the level of comfort and convenience to be fully adopted by drivers ("decision" stage). The latter would be consistent with many findings that correlate seat belt use with comfort and convenience (e.g., Begg & Langley, 2000; Jonah, 1984). By tracing and comparing the history and diffusion of seat belts to other innovations, one can find patterns that could both help in better developing the seat belt as an innovation as well as in promoting its diffusion.

Attribution

Attribution theory has been extensively studied in the field of social psychology. It consists of a number of theories of how people explain causality of both their own behavior as well as that of others (Gilovich et al., 2006; Heider, 1958). Namely, it classifies explanations as either internal (dispositional) which account for causality by assigning responsibility of the action to the person, or external (situational) which assign responsibility to external factors (e.g. the weather).

In terms of traffic safety, attribution theory has often been used to explain how drivers attribute causes of traffic crashes (DeJoy, 1989; Eby & Molnar, 1998). Findings generally show that drivers tend to attribute causes of crashes in a way that makes them feel better. They often show a self serving bias by attributing good things to themselves and bad things to others or to the

situation. This pattern of attribution explains the feeling of invulnerability typical in American traffic safety culture, which has been argued to be a barrier to the promotion of traffic safety (Smith & Martin, 2007).

There is no body of research that applies attribution theory to seat belt use. However, an extension of the literature that shows attribution biases to account for the feeling of invulnerability of American drivers may also explain drivers' nonuse of seat belts. One idea is to expand the current research on actual traffic crashes to situations in which drivers are faced with imagining traffic safety decisions (e.g., to wear or not to wear a seat belt). Yet, while it is probable that attribution theory can explain trends in seat belt use, it is not clear if and how it may inform efforts to increase belt use. That is, it is not clear *how* one can change drivers' attribution style such that they feel more vulnerable and take more personal responsibility in their driving. Further research on attribution and traffic behavior would thus be useful to understand this relationship.

Conclusions

Overall, there is strong evidence that social influences can play an important role in seat belt use, both in terms of existing belt use as well as interventions to promote increased use. The literature on social influence suggests that one can increase seat belt use through targeting various mechanisms of social influence.

The most significant influence seems to involve social norms. Social norms can affect seat belt use in many ways. Of particular interest for efforts to increase belt use is the influence of incorrect, perceived norms; that is, when people overestimate the occurrence of risky behaviors among the reference population or underestimate the occurrence of safe behavior (e.g., perceive peers' rate of belt use to be lower than it actually is). Intervening in this domain is simple in that it calls for merely correcting the false perceptions of norms often shared by target subpopulations, such as high school and college students, which would remove the influence to engage in a previously overestimated risky behavior. One key advantage of focusing on social norms is that it can increase belt use with the least enforcement cost, and without explicit belt promotion campaigns or traffic safety messages. Such indirect influence avoids dealing with people's attitudes toward seat belts or mandatory belt laws.

Other types of social influences that have not been reviewed in this section include social norms as portrayed by the media (e.g., incidence of seat belt use versus nonuse in feature films and television programs). This influence may function similarly to peer-influence in that it also relies on social validation, but celebrity behavior can potentially carry much more authority and a corresponding power of influence to all age groups. Given mandatory belt laws and primary enforcement as a foundation, it is reasonable to say that social influences can gradually transform American traffic safety culture to one in which seat belt use is a standard social norm.

APPLICATIONS FROM RESEARCH ON OTHER RISKY BEHAVIORS

Examining the results of research on other risky behaviors can lead to the discovery of those techniques which successfully result in behavior change. This section focuses on risky behaviors, primarily among youth, that are not driving-related: alcohol use/abuse; unsafe sexual practice; smoking; illicit substance use; intentional self-harm and suicide; and violent criminal activity. For each of these behaviors we discuss prevalence, factors related to the behaviors, and intervention strategies. This review of other risky driving behaviors has an international focus as issues related to risky behaviors are often global and a broad perspective can yield additional lessons that could be applied to increasing belt use.

Alcohol Use/Abuse

Alcohol use is a major contributor to preventable illness and death worldwide. In Australia, alcohol is responsible for over 3,000 deaths and 72,000 hospitalizations each year (Chikritzhs, et al., 2003). In addition, about 50 percent of Australian males age 18-24 and 40 percent of females age 18-24 report being verbally abused by someone under the influence of alcohol, and 3.7 percent of females age 15-20 report being sexually abused by someone under the influence of alcohol (Roche, et al., 2007).

Young people outside of Australia are also vulnerable to acute or short-term alcohol-related harm. Risky alcohol use is estimated to account for 31.5 percent of all deaths among males age 15-29 in the developed world and 86 percent of the 3.6 million substance related deaths of both male and female 15-29 year olds worldwide (Toumbourou, et al., 2007). In 2000, alcohol use was responsible for 7.8 percent of the global burden of disease (as estimated by alcohol-attributable disability-adjusted life years), for people age 15-29, with males (13.1 percent) and developed countries (18.5 percent) accounting for a disproportionate amount of this burden. In the US, 1,700 college students age 18-24 died from alcohol-related unintentional injury in 2000; more than 500,000 suffered a drinking-related injury, and more than 600,000 were hit/assaulted by another drinking student (Hingson, Heeren, Winter, & Wechsler, 2005). In addition to unintentional injuries, risky drinking such as binge drinking (i.e., drinking five or more drinks on one occasion) has been found to be associated with alcohol poisoning, suicide, hypertension, pancreatitis, sexually transmitted diseases, meningitis, and other disorders (Courtney & Polich, 2009).

To address the adverse consequences associated with risky drinking in Australia, updated guidelines set by the National Health and Medical Research Council (2009) call for healthy males and females to 1) drink no more than two standard drinks on any day to reduce the lifetime risk of harm from alcohol-related disease or injury and 2) drink no more than four standard drinks on a single occasion to reduce the risk of alcohol-related injury arising from that occasion. In addition, the guidelines call for children under age 15 not to drink alcohol at all and young people age 15-17 to delay the initiation of drinking for as long as possible.

Prevalence of Alcohol Use

Data on the prevalence of alcohol use by Australians were recently collected through the 2007 National Drug Strategy Household Survey, the ninth in a series of surveys begun in 1985 (Australian Institute of Health and Welfare, 2008). In the 2007 survey, 25,000 Australians age 12 and older were asked about their knowledge of and attitudes toward drugs and alcohol, and their drug and alcohol use. Table 1 summarizes data relative to alcohol use among young Australians age 12-19 and 20-29. Rates of daily alcohol use increased with age among young people, while abstinence decreased sharply (from 67.5 percent among 12-15 year-olds to 9.2 percent among 18-19 year-olds).

Drinking status	Age 12-15 %	Age 16-17 %	Age 18-19 %	Age 12-19 %	Age 20-29 %
Males					
Daily	-	1.7	2.6	1.1	2.8
Weekly	1.0	20.0	46.7	17.3	55.7
<Weekly	28.8	50.9	40.9	37.4	30.3
Ex-drinker ¹	2.7	5.2	1.5	3.1	2.8
Abstainer ²	67.5	22.1	8.3	41.2	8.3
Total ³	100	99.9	100	100.1	99.9
Females					
Daily	0.5	-	0.7	0.4	1.7
Weekly	3.2	15.4	35.3	14.4	39.6
<Weekly	26.8	63.2	51.9	42.3	44.0
Ex-drinker ¹	2.1	3.0	1.9	2.3	5.8
Abstainer ²	67.4	18.4	10.2	40.6	8.9
Total	100	100	100	100	100

Adapted from Australian Institute of Health and Welfare (2008)

¹ Consumed at least a full serving of alcohol but not in the past 12 months.

² Never consumed a full serving of alcohol.

³ Total may not add to 100 due to rounding.

Chikritzhs, et al. (2003) examined trends in alcohol use and related harm for the Australian States and Territories from 1990 to 2001, building on and updating earlier data. Among their key findings were: 85 percent of total consumption by females age 14-17 and 18-24 was at a risky or high risk level for acute harm, and for males age 14-17, the estimate of such drinking was also high at 80 percent. A striking increase was observed in the proportion of girls age 14-17 drinking at risky or high risk levels for long-term harm (i.e., an average of more than 2 drinks per day); a rise from 1 percent in 1998 to 9 percent in 2001. In contrast, males age 18-24 were less likely to drink at risky or high risk levels, dropping from 9 percent in 1998 to 6 percent in 2001. Based on findings from the most recent National Drug Strategy Household Survey, risky and high risk drinking continued to be an issue in 2007 (Australian Institute of Health and Welfare, 2008).

In the US, the national Youth Risk Behavior Survey (YRBS) has been conducted for many years to monitor health risk behaviors among high school age students in grades 9-12 throughout the country. Results from the 2007 survey indicate that 75 percent reported having at least one drink

of alcohol on at least 1 day during their life, 44.7 percent reported having at least one drink on at least 1 day during the 30 days prior to the survey, and 26 percent reported having five or more drinks in a row within a couple of hours on at least 1 day during the 30 days prior to the survey (Centers for Disease Control and Prevention, 2008a,b).

Simons-Morton, et al. (2009) examined trends in alcohol use prevalence and “drunkenness” (i.e., asking students if they ever had so much alcohol that they were really drunk) from 1998-2006 among 15-year-olds in 24 countries and regions, including the US. They used data from the Health Behaviour in School-Aged Children (HBSC) Survey conducted in each country in 1998, 2002, and 2006. Trends varied considerably by country. In 2006, average monthly use ranged from less than 30 percent in four countries to over 50 percent in seven countries. Drunkenness ranged from less than 20 percent in three countries to over 40 percent in seven countries. Reporting at least monthly alcohol use across all countries declined from 45.3 percent to 43.6 percent and drunkenness declined from 37.2 percent to 34.8 percent, with considerable variability across countries with increases in some countries and decreases in others.

In another comparison of worldwide drinking, Smart and Ogborne (2000) reviewed high school alcohol use surveys among students age 13-17. Comparable data on high school students were found for 18 countries. Wide variation in drinking patterns across countries was evident. Reported drinking six or more times within the past month ranged from 4 percent to 28 percent, drinking five or more drinks on any day in the past month ranged from 14 percent to 61 percent, drinking in the last year from 51 percent to 94 percent, and drunk at least once per month from 1 percent to 58 percent. The authors also looked at per capita alcohol consumption. Results suggested that countries could be clustered with respect to student drinking habits and per capita alcohol consumption. Countries where relatively few students drank regularly had low per capita alcohol consumption, but where per capita consumption was high, frequent drinking among students was more common. However, heavy drinking was common in both cases.

O’Malley and Johnston (2002) examined alcohol use among college students in the US by comparing results of five surveys: Harvard School of Public Health College Alcohol Study (CAS), Core Institute (CORE), Monitoring the Future (MTF), National College Health Risk Behavior Survey (NCHRBS), and National Household Survey on Drug Abuse (NHSDA). Results were notably similar across surveys, with about 40 percent of college students reporting binge drinking and 70 percent reporting having had a drink in the past 30 days. The authors concluded that despite some improvement between 1980 and 1999, colleges need to do more to reduce heavy alcohol use among college students.

Risky drinking behavior among older adolescents and adults in the US has also been examined, using data from the Behavioral Risk Factor Surveillance System (BRFSS; Naimi, et al., 2003). The BRFSS is a series of state-based telephone surveys coordinated by the Centers for Disease Control and Prevention (in conjunction with state health departments) for adults age 18 and older in the US, with sample sizes ranging from 102,263 in 1993 to 212,510 in 2001. Rates of binge drinking were highest among those age 18-26. Overall, 47 percent of binge drinking episodes occurred among otherwise moderate drinkers (i.e., non-heavy drinkers) and 73 percent of all binge drinkers were moderate drinkers. In 2001, young adults age 21-25 and underage drinkers age 18-20 had the highest rates of binge drinking episodes (18.0 episodes/person/year and 15.3 episodes/person/year, respectively), and the largest increase (56 percent) in binge drinking between 1993 and 2001. Although some of the more recent US and worldwide trends discussed above appear more promising, continuing efforts to understand and reduce risky drinking among young people in Australia and elsewhere are clearly warranted.

Factors Related to Risky Drinking

The initiation, maintenance, and extent of alcohol use by young people are complex and multi-faceted behaviors (McBride, Midford, & Farrington, 2000). A number of individual, social, and environmental factors appear to influence alcohol use and are highlighted below. While a comprehensive review of these factors is beyond the scope of this report, a more in-depth discussion of influences on alcohol use, specifically within the context of Australian society, can be found in Roche, et al. (2007).

Individual factors

Patterns of alcohol use have been found to differ by sex. Wilsnack, Wilsnack, Kristjanson, Vogeltanz-Holm, and Gmel (2009) examined data from large general-population surveys of drinking behavior in 35 countries conducted between 1997 and 2007 using the same standardized questionnaire (25 countries) or questionnaires with comparable items. Overall drinking and high volume drinking were consistently more prevalent among males than females, although the exact ratios varied. Surveys in Australia and the US have also found sex differences in drinking among adolescents and young adults. For example, O'Malley and Johnston (2002) found alcohol use to be higher among male than female college-age students. Similarly, Naimi, et al. (2003) found that the rates of binge drinking among those who consumed alcohol in 2001 were more than twice as high for males age 18-20 and 21-25 (39.0 and 38.7) than for females of the same age (17.6 and 12.5). Results from the HBSC Survey (Simons-Morton, et al., 2009) add further evidence of sex effects, with males having higher prevalence rates of drinking and drunkenness than females in each survey year. However, the authors noted that the sex gap may be shrinking, as evidenced by the fact that male/female differences declined between 1998 and 2006 (41.2 percent versus 33.4 in 1998 and 36.7 versus 31.9 percent in 2006). In Australia, males age 14 and older were almost twice as likely as comparable females to drink daily in 2008, although among 12-15 year-olds, higher proportions of females than males used alcohol daily and weekly (Australian Institute of Health and Welfare, 2008).

Racial/ethnic differences in drinking prevalence have also been found. For example, O'Malley and Johnston (2002) reported that White students in the US had the highest rates, Black students the lowest and Hispanic in-between. Few studies have focused on Asian groups. Lum, Corliss, Mays, Cochran, and Lui (2009) examined differences among ethnic subgroups of Asian college students in the US in drinking behavior. Their sample was composed of 752 male and female undergraduate students between the ages of 18 and 27 who self-identified as Chinese, Filipino, Korean, or Vietnamese. Korean and Filipino students reported higher levels of alcohol consumption than the other groups. Being born in the US was a significant predictor of higher levels of alcohol consumption for females but not males. In Australia, risky or high risk drinking was found to be somewhat higher among indigenous young people age 18-24 than their non-indigenous counterparts, particularly for males (Australian Bureau of Statistics, 2006).

Socioeconomic status (SES) has been widely studied as an influence on alcohol use. Hanson and Chen (2007) reviewed 28 studies, 13 of which were considered "high quality" (N greater than 500, nationally representative, SES range consistent with national demographics) conducted from 1970 to 2007. Overall, the majority (57 percent) found no relationship between SES and alcohol use during adolescence (unlike the patterns reported in adult populations). Of the studies that did find an association, the direction was not consistent. The authors suggested that alcohol

use among adolescents may be more strongly influenced by peer social status than family social status.

Another individual factor that may help explain differences in alcohol use is brain development during adolescence. In a review of this literature, Spear (2002) found evidence that the brain of the adolescent is unique and differs from that of younger individuals and adults in important ways that may make them more sensitive to a number of alcohol effects. In particular, she noted that features of the adolescent brain may increase their sensitivity to stressors and therefore, their propensity to initiate alcohol use.

In a review by Baer (2002), increased levels of drinking among college students were found to be associated with impulsivity/sensation seeking, as well as negative emotional states (e.g., stress, anxiety). These findings are consistent with other reviews. For example, Kuntsche, Knibbe, Gmel, and Engels (2005) found that students who reported coping motives for drinking (e.g., to avoid or regulate unpleasant emotions) or enhancement motives (e.g., to enhance positive mood, for kicks or excitement, to get high, to feel good) were more likely to be heavy drinkers. In addition, drinking to cope with negative emotional states was particularly associated with alcohol problems. Gonzalez, Collins, and Bradizza (2009) explored the context of drinking motives and found that solitary heavy drinking (drinking while alone) was associated with depression and with higher rates of drinking problems than heavy drinking in social contexts.

Social factors

Social factors appear to play a critical role in alcohol use among young people. Social norms – our perceptions about what is “normal” behavior among those close to us – have been found to be a powerful influence on behavior (Berkowitz, 2005), and the study of social norms is well established in the social sciences (Moreira, Smith, & Foxcroft, 2009). With regard to drinking behavior, there is evidence that college students often misperceive their peer norms by overestimating the alcohol use of peers. Such misperceptions, in turn, lead to increased alcohol use (Perkins, 2007).

Kuntsche, et al. (2005) found that most young people report drinking for social motives (e.g., positive social use of alcohol such as camaraderie, as well as negative social motives such as drinking to fit in with peer group, not to feel left out, or peer pressure) and that such motives appear to be associated with moderate alcohol use. Roche, et al. (2007) conducted a comprehensive review of the literature on social and cultural factors that potentially influence alcohol use by young Australians age 14-24. They identified a number of social trends thought to impact the social and cultural world of young people and influence their drinking behavior that relate to major shifts in the structure of the family, roles of females, the labor market, and education. They concluded that although the family (parents and siblings) continues to play an important role in young people’s alcohol use, the picture has become increasingly complex. In particular, young people’s relationships with their peers have become more important as an influence on their behavior. This is due in part to the fact that many of the changes occurring in Australian society have effectively redefined the “youth” experience so that opportunities for leisure have increased along with greater involvement with peer groups.

Environmental factors

Although the complexity of drinking behavior is widely recognized, until recently, few studies have focused broadly on the various environmental factors that may influence alcohol use, including economic, political, and ecological factors (Dowdall & Wechsler, 2002). One important factor appears to be the alcohol environment on campus and in the surrounding community (e.g., drinking traditions, alcohol availability, price, advertising, outlet density, proximity to outlets). Presley, Meilman, and Leichliter (2002) reviewed the literature on relationship of college environments to student drinking. They identified several “institutional” variables that appear to influence individual student alcohol use, including affiliations (e.g., historically Black institutions, female institutions), presence of a Greek system, role of athletics on campus, 2 or 4 year designation, type of residence hall, institution size, location, overall quantity of drinking on campus, the pricing and availability of alcohol, and outlet density. They concluded, however, that current research is not sufficient to determine which factors have the greatest influence on alcohol use.

The influence of alcohol advertising on young people continues to be the subject of much debate. However, evidence is growing that alcohol marketing plays a significant role in young people’s decisions to drink and in how they drink (Jernigan & Mosher, 2005). While many econometric studies (statistical examination of the relationship between overall levels of alcohol use and overall levels of advertising) have failed to find an effect, more focused consumer studies (that examine how people’s drinking knowledge, attitudes, and behavior vary with their exposure to alcohol advertising) do show clear links between advertising and behavior (Hastings, Anderson, Cooke, & Gordon, 2005). In addition, these effects do not take into account the fact that advertising is only one component of a broader marketing strategy that often includes price promotions, distribution, point of sale activity, and new product development. Taking this into account, Hastings, et al. (2005) argue that the literature presents an increasingly compelling picture that alcohol marketing is having an effect on young people’s drinking.

Interventions for Alcohol Use

Historically, prevention efforts among college students have focused on educational strategies, but mounting evidence suggests that these strategies are not effective by themselves (e.g., Walters & Bennett, 2000). For example, a recent review of the literature found that cognitive-skills based interventions and brief motivational feedback (including mailed graphic feedback) were consistently more effective in reducing risky drinking among young people than informational/awareness interventions, and recommended that high-risk students should be targeted for such interventions either through brief screening in health care centers or through membership in an identified risk group (e.g., freshman, Greek organization members, athletes; Larimer & Cronce, 2002).

While the short-term effectiveness of many alcohol interventions has been frequently noted in the literature, evidence for long-term effects is more limited (e.g., Bruvold, 1993; Tobler & Stratton, 1997). A recent review by Skara and Sussman (2003) focused on long-term effects of nine alcohol intervention studies that followed adolescents for at least 2 years. Reductions in weekly alcohol use ranged from 6.9 percent to 11.7 percent and persisted for up to 15 years following the intervention. Program effects were less likely to decay among studies that delivered booster programming sessions (delivered through classroom lessons, newsletters, phone calls, media messages, or computer assignments, and ranging in frequency from one over

2 days to 15 delivered over 2 years). Foxcroft, Ireland, Lowe, and Breen (2002) reviewed and reanalyzed a number of longer-term evaluations (over 3 years of follow-up) and found one particular program, the Strengthening Families Programme, to offer promise, as well as programs incorporating culturally focused skills training.

Many interventions to reduce alcohol misuse among college students use a “social norms” approach intended to correct misperceptions that students may have about the extent to which their peers actually drink. Moreira, et al. (2009) conducted a systematic review of 22 controlled trials involving 7,275 college or university students randomly assigned to a social norms or control group. As described by the authors, the social norms interventions typically involved either social marketing (using universal, mass communications methods for educating students with regard to drinking behaviors) or personalized normative feedback to provide students with information about actual student drinking norms. Findings indicated that interventions delivered via the web or computer, or in individual face-to-face sessions, appeared to reduce alcohol misuse. The evidence was less convincing for group face-to-face sessions, and outcomes for mailed and group feedback were essentially no different than for the control intervention. Overall, significant effects were more apparent for short-term outcomes (up to 3 months). Two large studies showed contradictory results for social marketing. The authors cautioned that locations where alcohol outlet density is higher may promote higher alcohol use through more frequent promotions and easier access, thus undermining the effectiveness of interventions designed to reduce drinking.

While the majority of current efforts to reduce alcohol use have focused on individual and group programs (targeting knowledge, attitudes, and behavioral intentions), many would argue that more comprehensive interventions that include prominent environmental components are more likely to have significant impact (Boyd & Faden, 2002). To this end, several environmental strategies to reduce college drinking have been promoted including: 1) increasing compliance with underage drinking laws by decreasing social and commercial access to alcohol; 2) reducing consumption and risky alcohol use by placing restrictions on where and how alcohol is sold and distributed, how much alcohol costs, and where it is consumed; 3) decreasing specific types of alcohol-related problems, such as traffic crashes, by creating youth-specific blood alcohol content (BAC) laws; and 4) de-emphasizing the role of alcohol on campus by promoting academics and citizenship (Toomey & Wagenaar, 2002). Toomey and Wagenaar (2002) point to a body of studies using robust research designs that indicate that reducing alcohol availability through policy changes can reduce alcohol use and related problems among young people.

Sex and Unsafe Sexual Practices

Early unprotected sex among young people can lead to adverse consequences such as unintended pregnancy and sexually transmitted infections (STIs), including human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS; Dittus, Miller, Kotchick, & Forehand, 2004). These consequences carry high social, economic, and health costs for affected individuals, their children, and society (Centers for Disease Control and Prevention, 2009a). In the US, young people age 19-24 are at the greatest risk of contracting STIs (DiClemente & Crosby, 2003). HIV/AIDS continues to be a major global health problem, with an estimated 2.7 million people and 430,000 children under age 15 newly infected with HIV in 2008 worldwide (World Health Organization, 2009). Compared to other high-income countries, Australia’s HIV prevalence of 0.2 percent is relatively low. However, there has been a slow, steady increase in

new HIV diagnoses in Australia and New Zealand, with the rate of recently acquired HIV infections in Australia rising by roughly 50 percent between 1998 and 2007 in several regions of the country, although nationwide, total cases fell modestly between 2006 and 2008 (UNAIDS, World Health Organization, 2009). Annual notification rates of chlamydia and gonorrhea increased between 2000 and 2004, posing an increasing health problem for young Australians (National Centre in HIV Epidemiology and Clinical Research, 2005), and young people age 12-24 accounted for half of the STI notifications in 2005 (Australian Institute of Health and Welfare, 2007).

Evidence from US surveys of young people age 10-24 (Centers for Disease Control and Prevention, 2009a) also indicates that many young individuals engage in sexual risk behavior and experience negative reproductive health outcomes. In 2006, approximately 22,000 adolescents and young adults age 10-24 in 33 states were living with HIV/AIDS, and approximately 1 million adolescents and young adults age 10-24 were reported to have chlamydia, gonorrhea, or syphilis. One-quarter of females age 15-19 and 45 percent of those age 20-24 had evidence of infection with human papillomavirus between 2003 and 2004, and approximately 105,000 females age 10-24 visited a hospital emergency department for a nonfatal sexual assault injury between 2004 and 2006. There is also evidence that recent progress in reducing unsafe sexual practices appears to be slowing or even reversing (Centers for Disease Control and Prevention, 2009a). Such findings underscore the need for continued attention to the sexual risk behavior of young people and efforts to prevent and/or reduce unsafe sexual practices.

Incidence and Prevalence of Sex/Unsafe Sexual Practices

A major source of Australian prevalence data has been the National Survey of Secondary Students and Sexual Health, which interviews over 2,000 students in School Years 10 and 12 from across Australia (Smith, Agius, Dyson, Mitchell, & Pitts, 2003). The survey was recently updated (Smith, Agius, Mitchell, Barrett, & Pitts, 2009) and selected findings are presented in Table 2. Results indicate that over one-quarter of Year 10 students and over one-half of Year 12 students have had sexual intercourse. Almost three-quarters of each age group reported using a condom during their most recent sexual encounter, although a significant number of students reported having had sex without a condom at some time in their life. Among sexually active students, almost one-third of each age group reported having had sex with three or more partners in the past year.

Comparisons with the 2002 survey (the most immediate past survey; see Smith, et al., 2003) indicate several trends over time. There was an increase in self-reported sexual intercourse, as well as in the proportion of students reporting having had sex with three or more people in the past year. Condom use remained stable between 2002 and 2008. Differences between Year 10 and Year 12 students, in terms of older students being more likely to engage in sexual activity, persisted.

**Table 2: Self-reported Sexual Activity
among Year 10 and 12 Adolescents in Australia in 2008**

	Year 10 Students % Reporting Activity			Year 12 Students % Reporting Activity		
	Males %	Females %	Total %	Males %	Females %	Total %
Oral Sex	32.4	34.3	33.6	48.4	63.1	58.4
Ever had sexual intercourse	27.1	27.6	27.4	44.4	61.7	56.1
Sex without a condom	14.1	18.1	16.6	30.0	46.2	41.1
Sex with a condom	26.5	28.0	27.4	45.5	60.3	55.6
Of sexually active, 3+ partners in past year	36.1	25.4	29.3	38.2	27.2	30.0
Of sexually active,						
Always use condoms	66.1	56.0	56.5	50.7	43.7	46.8
Sometimes use condoms	27.0	42.1	35.6	40.7	48.5	46.9
Never use condoms	6.9	1.9	4.2	8.6	7.8	6.3
Condom used most recent sexual encounter	76.1	69.4	71.9	74.5	71.0	72.6
Drunk last time had sex	23.8	17.9	20.1	42.7	21.4	26.9

Adapted from Smith, et al. (2009)

In the US, the national Youth Risk Behavior Survey (YRBS) is conducted every 2 years and provides data representative of 9th through 12th grade students in public and private schools. Data from the 2007 survey (Centers for Disease Control and Prevention, 2008a,c) indicate that: 47.8 percent of students had ever had sexual intercourse; 14.9 percent had sexual intercourse with four or more people during their lifetime; 35.0 percent were currently sexually active; 61.5 percent used a condom during last sexual intercourse; 16.0 percent used birth control pills before last sexual intercourse; and 22.5 percent drank alcohol or used drugs before last sexual intercourse. While rates of reported sexual activity decreased between 1991 and 2007, they showed no change from 2005. Condom use increased from 1991 to 2003 but showed no change from 2003 to 2007, while use of alcohol/drugs before sexual intercourse decreased from 2001 to 2007 but showed no change during the last three years of that time period (2005 to 2007).

In one of the largest self-report surveys of health-related behavior among college students in the US (71,860 students on 107 campuses), the American College Health Association (2008) found that 49.1 percent of students had had vaginal intercourse one or more times in the past 30 days, 45.3 percent oral sex, and 5.2 percent anal sex. Among students who had had sexual intercourse, 52.8 percent reported using a condom during the last time. Among those who had had oral sex, 4.5 percent used a condom. Of those who had anal sex, 27.9 percent used a condom. A total of 15.8 percent reported having had unprotected sex after drinking alcohol.

Factors Related to Unsafe Sexual Practices

Similar to other risk behaviors among young people, the factors influencing unsafe sexual practices are varied, complex, and often inter-related. Individual and social factors have received the most attention in the literature and are highlighted here.

Individual factors

Sexual behavior among adolescents appears to be influenced by the timing of physical development, with early maturing girls having an earlier age of onset of sex, and being physiologically more susceptible to some STIs and more likely to have older and riskier male partners (e.g., Pedlow & Carey, 2004; Peters, et al., 2009). Chronological age also plays a role in sexual behavior. Older adolescents have been shown to report more sexual activity, have more partners, and in some studies, use condoms less consistently, at least in minority and mixed race samples (Kotchick, Shaffer, Forehand, & Miller, 2001). In addition, a lack of cognitive maturity, lack of life experience and skills, and egocentric thinking among adolescents, in general, can undermine decision making with regard to sex, although decision making ability does improve during adolescence (Pedlow & Carey, 2004).

While both young males and females engage in unsafe sexual practices, there are sex differences in their specific behaviors. For example, reviews of the literature by both Kotchick, et al. (2001) and Lewis, Miguez-Burbano, & Malow (2009) found that college-age males were more likely to report use of condoms but also to have had more sex partners. Among females, higher levels of condom use appear to relate to the ability to be assertive, intentions to use condoms, avoidance of substance use, and sex with a casual rather than primary partner (Lewis, et al., 2009). Research findings relative to differences by race/ethnicity are inconclusive and depend on the racial groups being compared and the risk behaviors being studied, and are often confounded by other factors such as SES, education, and access to health care (Kotchick, et al., 2001).

The influence of various beliefs and attitudes on sex and unsafe sex has also been studied. Peters, et al. (2009) found that initiation of sex was tied to the belief that it would lead to immediate gratification. On the other hand, individuals who perceived the health risks associated with sex were less likely to initiate it. Knowledge about the risks associated with unsafe sex (e.g., HIV transmission) appears to have little impact on condom use (Lewis, et al., 2009). There is some evidence that self-efficacy, the belief that one has the ability to perform a particular action effectively, although not studied as much as other factors, may be associated with fewer sexual partners, more condom use, and even greater resistance to pressure to engage in unwanted sex (e.g., Kotchick, et al., 2001; Lewis, et al., 2009; Peters, et al., 2009).

A number of studies have found an association between alcohol use and unsafe sexual practices. For example, a review by Cooper (2002) found that drinking among college students was strongly related to the decision to have sex and to indiscriminate forms of risky sex (e.g., having multiple or casual sex partners) but was inconsistently related to protective behaviors such as condom use. Drinking was more strongly associated with decreased protective behavior among younger individuals, on first intercourse experiences, and for events that occurred further in the past. The author concluded that future efforts to reduce alcohol use in potential sexual situations may decrease some unsafe sexual practices, but are less likely to affect protective behaviors directly. Sex and race differences in the relationship between drinking and unsafe sexual practices were not clear.

Past sexual victimization has also been identified as a possible influence on later sexual behavior (Kotchick, et al., 2001). Senn, Carey, and Vanable (2008) found that childhood sexual abuse (CSA) was associated with later sexual risk behaviors across a number of studies. This association was found among both males and females, adolescents and adults, and the general population and vulnerable populations (e.g., individuals who use drugs, have a mental illness or are incarcerated), as well as relatively high functioning populations such as college students. In particular, most studies found an association between CSA and sex trading, more sex partners, and an earlier age of first intercourse. Similarly, findings from a recent meta-analysis (Arriola, Loudon, Doldren, & Fortenberry, 2005) found an association between CSA and four HIV risk behaviors among females including unprotected sexual intercourse, sex trading, sex with multiple partners, and adult sexual revictimization, although effect sizes varied considerably and ranged only from small to moderate.

Social factors

There is evidence that peers can influence adolescents' attitudes, values, and sexual risk behavior. Specifically, adolescents whose peers engage in risky behavior are more likely to initiate sexual intercourse and engage in other risky behaviors (Kotchick, et al., 2001; Pedlow & Carey, 2004). At the same time, parents continue to play an important role in the sexual socialization of children and adolescents. Parenting behavior has been identified as an important source of influence on adolescent sexual activity, both indirectly through modeling and directly through parental monitoring, parent-adolescent relationship quality, and parent-adolescent communication (Kotchick, et al., 2001). Dilorio, Pluhar, and Belcher (2003) conducted one of the first comprehensive reviews on parent-child communication about sexuality, including 95 studies of adolescents age 11-18, conducted in the US (92 percent), Australia, Mexico, and Canada. The likelihood and quality of parent-child communication was affected by parental communication style and level of knowledge, as well as the sex of both the parent and child involved in the discussion. Findings relative to the effects of parent-child communication on delayed initiation of sexual intercourse among adolescents were inconclusive. The few studies focusing on increasing condom use and reducing partners were somewhat more promising, particularly when discussions occurred prior to first initiation of sex. More optimistic conclusions were reached by Dittus, et al. (2004). They pointed to a body of literature suggesting that parents and other family members play critical roles in shaping adolescent sexual behavior through their parenting practices, communication of expectations regarding adolescent sexual activity, and modeling of risk reduction strategies.

Interventions for Unsafe Sexual Practices

Most countermeasures to date have been designed to influence individual-level factors related to unsafe sexual practices such as assertiveness, communication skills, and self-efficacy. Few programs have attempted to intervene within the broader contexts in which adolescents form their attitudes, intentions, and values around sexuality (Dittus, et al., 2004). In addition, many countermeasures target younger adolescents because of the opportunity to intervene prior to the onset of sexual activity; influence peers' perceptions and norms; promote condom use at first intercourse (a predictor of future condom use); intervene at a time when female adolescents are physiologically most vulnerable to some STIs; and promote healthy sexual practices before risk behavior becomes established and more difficult to change (Pedlow & Carey, 2004). In addition, many interventions to reduce unsafe sex practices have as their ultimate goal the reduction of

HIV risk, because of the seriousness of this health risk. Several reviews of these interventions, as well as interventions targeted to older adolescents, have yielded promising but not totally unequivocal results.

A recent meta-analysis on the effects of 16 controlled HIV risk-reduction trials in the US involving sexually experienced adolescents (age 13-19) in both school and out-of-school settings was conducted by Mullen, Ramírez, Strouse, Hedges, and Sogolow (2002). The authors found a statistically significant protective effect of the interventions, both in and out of the classroom, in terms of the risk of having sex without condoms. The strongest effects were associated with interventions that took place in groups comprised of a homogeneous ethnic group. The authors suggested that this finding might be an indicator of the importance of cultural fit in approaching such a sensitive topic, with discussions being more effective among adolescents with similar perspectives. The meta-analysis did not find any program effects on number of sex partners.

Pedlow and Carey (2003) reviewed 23 HIV risk-reduction trials conducted in school, community, and health care settings. Intervention effects in reducing HIV risk were evaluated with one or more unsafe sexual practices including frequency of penetrative or unprotected sex, number of sexual partners, diagnosis of STIs, increased condom use or abstinence, and among sexually inexperienced youth, delay of onset of sex. Thirteen of the interventions (57 percent) achieved significant risk reduction effects. Collectively, across studies in which each specific outcome was measured, frequency of unprotected sex decreased in 75 percent of studies, condom use increased in 53 percent of studies, number of partners decreased in 27 percent of studies, and abstinence increased in only 14 percent of studies. The authors concluded that many adolescent HIV risk-reduction interventions have been effective but the effect sizes are small. They also cautioned that little is known about the specific factors associated with effective interventions.

Some of these potential factors were explored in a content analysis of 24 sexual risk-reduction trials among adolescents conducted by the authors (Pedlow & Carey, 2004). Results indicated that interventions were more effective in delaying the onset of sexual activity than in promoting abstinence among youth who were already sexually active. Interventions that included booster sessions, and/or focused on improving sexual communication, assertiveness, and negotiation skills were more effective in reducing most unsafe sexual practices. The authors concluded that interventions should take into account developmental transitions during adolescence, as they influence sexual behavior. The focus on building skills, rather than only providing information/education, supports a large body of evidence that education alone is not sufficient to reduce unsafe sexual practices (Johnson, Carey, Marsh, Levine, & Scott-Sheldon, 2003; Kotchick, et al., 2001).

A relatively new approach to reducing unsafe sexual practices is to base interventions on the Transtheoretical Model (TTM). TTM asserts that the adoption of healthy behaviors or elimination of unhealthy ones likely occurs through a series of stages of change over time and that these changes require the active use of different processes or strategies at each stage (Prochaska, Redding, Harlow, Rossi, & Velicer, 1994). Five stages are specified: 1) precontemplation (no awareness of problem or plan to change in next 6 months); 2) contemplation (awareness of problem, no specific plan but intent to take action in next 6 months); 3) preparation (plan to take major action in next 30 days, initial steps taken); 4) action (actual behavior change persisting for up to 6 months); and 5) maintenance (changed behavior lasting for 6 or more months; Prochaska, DiClemente, & Norcross, 1992). Horowitz (2003) conducted a systematic review of the literature on pregnancy and STI prevention efforts based on TTM. He concluded that age, partner type, sex, reasons for engaging in safer sex behavior, self-

efficacy, sexual assertiveness, and perceived advantages and disadvantages of condom use were related to stage of change. Results with regard to the effectiveness of such interventions in reducing unsafe sexual practices were inconclusive, however, because of the wide ranging differences in methodologies and samples.

Many efforts to reduce unsafe sexual practices have focused on males who have sex with males (MSM), given the risk that this type of sex carries for HIV. Johnson, et al. (2008) conducted a systematic review of interventions to reduce risk for sexual transmission of HIV among MSM that included individual counseling and/or social and behavioral support (such as peer education, assertiveness and relationship support, discussing attitudes and beliefs). They found that such behavioral interventions can lead to significant risk reduction in MSM, (particularly efforts to promote personal skills such as keeping condoms readily available, avoiding excess intoxicants, self-reinforcement for behavior change, and behavior self-management), but that continued research is needed to identify more conclusively which behavioral strategies are most effective.

Smoking

Tobacco use is a significant health problem around the world, and has been identified as the leading modifiable behavior contributing to mortality in the US (Mokdad, Marks, Stroup, & Gerberding, 2004) and elsewhere. Smoking is generally initiated in adolescence and findings from several studies in the US, as well as Australia and New Zealand, suggest that adolescent tobacco use may predict a range of early adult social and health problems (Mathers, Toumbourou, Catalano, Williams, & Patton, 2006). Thus, tobacco use is an important research topic and one that requires special attention with regard to the adolescent population.

Prevalence of Smoking

About one in 20 (5.6 percent) 12-19 year olds in Australia reported smoking daily in 2007. Females age 16-17 were almost twice as likely to report smoking daily as their male counterparts. For older age groups, males were more likely to report using tobacco on a daily basis. The 2007 daily and weekly combined smoking rates for males and females age 20-29 were the highest of any age group, although this age group also had a higher proportion that had never smoked (60.5 percent) than any of the older age groups.

Australian trends in the prevalence of smoking have recently been summarized, based on data from several national surveys (Scollo & Winstanley, 2008). Smoking prevalence has declined among both sexes in all age groups since 1980, and rates have converged across age groups as well. Up until 2004, the proportion of smokers age 18-24 had been very similar to those 25-29, but by 2007, the 18-24 age group had rates lower than any other age group except those age 60 and over. Despite these improvements, 19 percent of those age 18-24 currently smoke. Smoking prevalence among secondary students (age 12-17) has followed the same trend as older Australians, declining during the 1980s, leveling off in the early 90s, and then falling again between 1998 and 2005.

Given the early onset of smoking by many individuals, considerable efforts have been undertaken to monitor the prevalence of smoking among adolescents. One of the most comprehensive efforts to measure the prevalence of smoking among adolescents is the Global

Youth Tobacco Survey (GYTS), a world-wide collaborative surveillance initiative led by the World Health Organization (WHO), the US Centers for Disease Control and Prevention, and the Canadian Public Health Association (The Global Youth Tobacco Survey Collaborative Group, 2002). The GYTS is a self-administered school-based questionnaire most recently conducted in 132 counties and the Gaza Strip/West Bank region among adolescents age 13-15. Findings for the period 1999 to 2005 indicate that nearly two of every 10 students reported currently using any form of tobacco (17.3 percent), with reported use highest in American and European regions and lowest in the South-East Asian and Western Pacific regions (Centers for Disease Control and Prevention, 2006a). There were no statistically significant differences between the proportion of students reporting cigarette smoking (8.9 percent) or other tobacco use (11.2 percent). Males were more likely than females to report using any form of tobacco in Eastern Mediterranean, South-East Asian, and Western Pacific regions. Males were more likely than females to report smoking cigarettes in the African, South-East Asian, and Western Pacific regions. The report concluded that use of tobacco by adolescents is a major public health problem in all six WHO regions.

Another survey of adolescent smoking in 10 European countries and Canada (Hublet, et al., 2006) also raised concerns about adolescent smoking trends and their implications for public health. Findings from a school-based survey among 14-15 year-olds conducted in 1990-2002 indicated that the daily smoking prevalence among males in 2002 ranged from 5.5 percent in Sweden to 20.0 percent in Latvia. Among females, the daily smoking prevalence in 2002 ranged from 8.9 percent in Poland to 24.7 percent in Austria. Based on the full survey period, the authors identified three groups of European countries in different stages of the smoking epidemic curve: countries with a declining or stagnant trend, countries with an increasing trend followed by a decreasing trend, and countries with an increasing trend.

Recent trends among high school students in the US appear more promising. Results from the Monitoring the Future study, which has been surveying national samples of students in 8th, 10th, and 12th grade since 1991 (about 45,000 students in 400 schools each year) indicate that smoking rates in 2008 were at the lowest level since the early 1990s (Johnston, O'Malley, Bachman, & Schulenberg, 2009a; University of Michigan News Service, 2008). Across the three grades combined, monthly smoking prevalence declined from 13.6 percent in 2007 to 12.6 percent in 2008, with the declines greatest in the upper grades. Despite these encouraging trends, smoking remains a public health issue in the US. Findings from the Youth Risk Behavior Survey, a nationwide survey of students in grades 9-12, found that in 2007, 50.3 percent of students in grades 8-12 had tried cigarette smoking, with 20.0 percent of students reporting smoking cigarettes on at least 1 day in the past 30 days (Centers for Disease Control and Prevention, 2008d). In addition, the prevalence of smoking among young adults age 18-25 has been estimated at 40.8 percent and among adults age 26 and older at 25.2 percent in the US (Substance Abuse and Mental Health Services Administration, 2003). Thus, efforts to understand the influences on smoking and countermeasures to prevent smoking and/or help young people quit smoking are clearly warranted.

Factors Related to Smoking

Smoking is influenced by a host of individual, social, and environmental factors that come together in complex ways. The first drug used by young people is often tobacco (US Department of Health and Human Services, 1994), so understanding why young people begin smoking is also important for trying to reduce both tobacco smoking and other drug use. Key findings from the literature on factors associated with smoking are highlighted below. It is important to note that

most of these factors have been examined independently from one another. Thus, although research has documented a broad range of factors that may contribute to smoking by young people, what is missing is a clear understanding of the relative impacts of these factors, how they work together, and which factors are most influential in the progression from tobacco initiation to dependence (Baker, Brandon, & Chassin, 2004). While a comprehensive review of these factors is beyond the scope of this report, an in-depth discussion of influences on smoking, specifically within the context of Australian society, can be found in Scollo and Winstanley (2008).

Individual factors

There is evidence that smoking among young people is associated with a number of individual factors including age, ethnicity, education, and socioeconomic status (SES). A review of studies by Tyas and Pederson (1998) concluded that initiation and prevalence of smoking among adolescents typically increased with increasing age and grade in school, and that those who began smoking at a younger age were more likely to become regular smokers and less likely to quit smoking. Similarly, in Australia, a review of findings from several national surveys indicated that the prevalence of smoking among adolescents increased with age, with smoking prevalence relatively low among 12 year olds but increasing to 19 percent among males and 17 percent among females by age 17 (Scollo & Winstanley, 2008).

Differences in smoking prevalence have also been found by race/ethnicity (Hoffman, Sussman, Unger, & Valente, 2006). Among adult racial/ethnic groups in the US, Asians have the lowest prevalence and Hispanics have a significantly lower prevalence of smoking than American Indians/Alaskan Natives, non-Hispanic Blacks, and non-Hispanic Whites (Centers for Disease Control and Prevention, 2007). Similarly, US surveys of students in grades 9-12 indicate that overall, prevalence of lifetime daily cigarette use and current use is higher among White than Black and Hispanic students (Centers for Disease Control and Prevention, 2008e). In Australia, smoking prevalence among the Aboriginal and Torres Strait Islander populations is almost double that of the Australian population as a whole, with about half of the combined Aboriginal and Torres Strait Islander populations smoking on a daily basis (Scollo & Winstanley, 2008).

There is evidence that higher parental SES is inversely related to smoking status of adolescents in Australia and elsewhere, with disadvantaged groups being more likely to begin smoking and to continue smoking once initiated (Scollo & Winstanley, 2008; Tyas & Pederson, 1998). Further, personal income of adolescents themselves has been found to be positively related to smoking, presumably because it provides spending money that can be used to buy cigarettes (Tyas & Pederson, 1998). A related variable, education, has also been found to influence smoking, with higher levels of education associated with a decreased likelihood of smoking (Scollo & Winstanley, 2008).

Historically, the prevalence of smoking has been higher among males than females. However, several studies suggest that rates may be converging at least in North America, with equal or higher levels of smoking reported by females in countries with Western cultural orientation (e.g., Substance Abuse and Mental Health Services Administration, 2003; Tyas & Pederson, 1998; Warren, Jones, Erickson, & Asma, 2006). This trend has also been evident in Australia, with young males and females age 18-24 now sharing similar patterns of smoking, compared to the higher rates among males than females observed in the 1980s (Scollo & Winstanley, 2008). This convergence can be traced to increased initiation of smoking among young females and at the same time, decreasing rates of regular smoking among young males. Patterns are similar for

secondary students in Australia, with relatively equal proportions of males and females smoking at each year of age except among 16-year olds; in this age group, females are more likely to report regular smoking (Scollo & Winstanley, 2008).

The effects of individuals' beliefs and attitudes have also been examined but with less conclusive results. Peters, et al. (2009) found that the belief that smoking relaxes or helps reduce negative feelings is a consistent predictor of tobacco use, while perceived personal health risk had a protective effect against smoking. However, Baker, et al. (2004) cautioned that while studies support the influence of beliefs and attitudes, many fail to account for important issues such as attitudinal ambivalence, the full complexity of risk perceptions, and the role of affect at the time of decision making.

A number of studies have linked adolescent smoking to intrapersonal characteristics such as temperament, personality, and psychopathology, including peer self-control, rebelliousness, sensation seeking, impulsivity, and low self-esteem (Baker, et al., 2004; Scollo & Winstanley, 2008). In addition, a strong link between negative affect and smoking has been found, with preexisting depressive symptoms possibly setting the stage for smoking initiation which may then further exacerbate depression (Baker, et al., 2004). Other conditions associated with psychopathology that may influence smoking include disruptive behavior disorders (e.g., oppositional defiance disorder, conduct disorder, and attention-deficit/hyperactivity disorder), anxiety, and other substance abuse disorders (Scollo & Winstanley, 2008).

Social factors

Peer influence on adolescent smoking has been widely studied. Hoffman, et al. (2006) reviewed this literature and found peer influence to consistently emerge as a significant predictor of adolescent smoking in studies in the US, Australia, New Zealand, and elsewhere. Other reviews have found peer smoking, as well as affiliation with peers who engage in high levels of other problem behaviors and self-identification with a high-risk social group, to predict the onset of adolescent smoking (e.g., Baker, et al., 2004). It appears that perceived smoking by peers is more important than actual smoking (Peters, et al., 2009). Further research is needed to better understand the mechanism through which this influence occurs. While parental smoking also appears to influence adolescent smoking initiation, study results are less consistent and show weaker effects in overall magnitude than for peer smoking (Baker, et al., 2004). However, stricter parental norms and rules for adolescents were found to have a protective effect against smoking in at least one review (Peters, et al., 2009).

Environmental factors

While environmental factors associated with smoking have been less studied than individual and social factors, there is some evidence that access to cigarettes contributes to the initiation of smoking. Affordability appears to play an important role in access. Based on a review of several studies, Chaloupka and Pacula (2001) concluded that smoking by young people is relatively more responsive to price than smoking by older people. They report estimates that youth are up to three times more sensitive to price than adults, with a 10 percent price increase estimated to reduce youth smoking prevalence by 5 percent or more. However, some young people may be able to overcome the problems of availability and affordability by using unbranded, untaxed loose tobacco, known as "chop-chop" (Scollo & Winstanley, 2008). Another environmental influence on smoking among young people is advertising. A comprehensive review of studies on tobacco advertising concluded that tobacco advertising and

promotional activities are important catalysts in the smoking initiation process (Biener & Siegel, 2001). The authors suggested that tobacco advertisements may be particularly attractive to adolescents who, for one reason or another, are searching for an identity that the images are carefully designed to offer.

Interventions for Smoking

Sussman, Sun, and Dent (2006) conducted the first meta-analysis of teen cigarette smoking cessation studies, which combined results from 48 studies. Their work builds on five earlier systematic reviews of the literature on teen smoking cessation (Backinger, Fagan, Matthews, & Grana, 2003; Garrison, Christakis, Ebel, Wiehe, & Rivara, 2003; McDonald, Colwell, Backinger, Husten, & Maule, 2003; Sussman, Lichtman, Ritt, & Pallonen, 1999; Sussman, 2002). Sussman et al. (2006) defined “teen cigarette smoking cessation programming” as any type of programming in any setting that targeted young people age 12-19, focused on individuals who smoked at baseline, and encouraged them to quit smoking.

The studies contained in the meta-analysis represented five types of theoretical content: social influence; cognitive behavioral; motivational enhancement; medical; and other. As described by Sussman et al. (2006), social influence-oriented programs are intended to combat social influences that serve to promote or maintain smoking by providing refusal assertion skill instruction, instruction in awareness of tobacco industry promotions, discussion of media and peer social influences, and correction of social informational inaccuracies, as well as advocacy techniques. Cognitive-behavioral programs provide instruction in cognitive-behavioral self-monitoring and coping skills to quit and maintain cessation through smoking diaries and strategies for coping with stress (e.g., seeking out social support, relaxation, problem solving). Motivational enhancement programs include techniques to clarify individuals’ desire for change and reduce ambivalence to that change through the use of such strategies as motivational interviewing (in which individuals are given feedback and empathy using a non-judgmental approach), response-contingent reinforcement, and stages of change techniques. Medical programs employ strategies to ease the physical effects of withdrawal through medication or focus on recovery from addiction. The fifth type of program include theoretical content that does not fit within the other four categories such as an emphasis on restricting access to cigarettes through supply reduction (e.g., through price increases or restricted access) or techniques to clarify and remove conflicted affect to facilitate smoking cessation.

Results of the meta-analysis indicated that across studies, program conditions compared to control conditions appeared to give smokers a 2.90 percentage point advantage in quitting, increasing the probability of quitting smoking by 46 percent (9.14 percent versus 6.24 percent). Consistent with previous reviews, the authors found that cognitive-behavioral and motivation-theory-related programs had relatively higher quit rates; although unlike previous reviews, social influences programs also had relatively higher rates. The authors noted that it was unclear whether interventions that combine all three types of programming would be superior or whether different programming might be relatively effective with different youths (e.g., at different durations of lifetime smoking). They also found that classroom based programs were relatively effective, although they lacked a sufficient number of studies to evaluate the effectiveness of computer-based modalities. Program effectiveness was positively related to the number of sessions; there was no apparent incremental effect beyond five sessions. While the authors called for more teen smoking cessation research, they concluded that teen smoking cessation programming is effective.

In an update of their earlier work, Sussman and Sun (2009) reviewed 64 teen tobacco use cessation studies, focusing on program content, modalities of delivery, number of contacts, and expected quit rates at follow-up. Of the 64 studies, 47 were completed in the US, four in Australia, three in Canada, two in New Zealand, and the rest elsewhere. Results from the review yielded slightly higher outcomes than the previous analysis, although the effect size was still not large (4.26 percentage point advantage in quitting, increasing the probability of quitting smoking by 57 percent). Consistent with the earlier findings, effects were notable for social influences, cognitive-behavioral, and motivation enhancement programming. Relatively high quit rates were found for programs with at least five sessions. Effects were maintained at short-term (1 year or less) and longer-term follow-ups, as in 2006. The use of pharmacological approaches for young smokers failed to show an incremental effect in five of seven studies, in contrast to more promising findings from comparable studies of adult smokers. The authors also examined the use of electronic communication to assist in teen smoking cessation but again they lacked sufficient studies to reach meaningful conclusions. Similarly, they found only one study examining the effects of cigarette pricing on smoking cessation, although results suggested that a 10 percent increase in the real price of cigarettes would increase the probability of smoking cessation among young adults by approximately 3.5 percent. Based on their findings, the authors recommended that youth cessation programs: be delivered in a context structured for youth (e.g., school, sports club, health clinic); consist of at least five lessons; be as fun as possible including games, dramatizations, and use of alternative medicine concepts; emphasize cognitive-behavioral, motivation-theory related, and some social influences content.

While efforts to facilitate smoking *cessation* are clearly important, it is also critical to try to prevent adolescents from even trying cigarettes in the first place if possible. In fact, the drop in the smoking rates over the past 10 years found in the Monitoring the Future Study has been attributed in great part to the fact that fewer students even try cigarettes; thus it is critical to prevent smoking very early (Johnston, et al., 2009a).

A meta-analysis of 65 adolescent psychosocial smoking prevention programs targeted to students in grades 6-12 (Hwang, Yeagley, & Petosa, 2004) defined three types of such programs: social influence (SI; focusing on peer and media influences, social norms, expectations, acceptance, and social skills); cognitive-behavioral (CB; including elements of SI as well as at least two cognitive skills such as problem solving, decision making, assertiveness, self-control and/or other coping skills); and life skills (LS; SI and CB plus at least one affective skill such as self-confidence [efficacy], values clarification, and/or generic social skills). Overall, psychosocial smoking programs were found to be effective in reducing adolescent smoking in the US, with the best program effects being achieved by programs using either CB or LS modalities and/or a school-community incorporated program. Other reviews also point to the effectiveness of these types of program, at least in the short-term (e.g., La Torre, Chiaradia, & Ricciardi, 2005). However, evidence for long-term effects is more limited. In addition, there is little evidence that information alone is effective, even in the short-term (Thomas & Perera, 2006).

Two recent reviews focused on the long-term effects of adolescent smoking prevention programs (Skara & Sussman, 2003; Wiehe, Garrison, Christakis, Ebel, & Rivara, 2005). Skara and Sussman (2003) examined 25 long-term tobacco and drug use prevention studies that followed adolescents for at least 2 years. Most of the programs reported statistically significant program effects for smoking outcomes, indicating mean reductions in the percentage of baseline nonusers who initiated smoking in experimental versus control conditions ranging from 9-14.2 percent and lasting for up to 15 years. Program effects were less likely to decay among studies that delivered

booster programming sessions. Results from Wiehe et al. (2005) were not so promising. They examined only studies of school-based, randomized, controlled trials of smoking prevention with follow-up evaluation to age 18 or 12th grade and at least 1 year after the intervention ended. Eight of 177 studies met the selection criteria; only one of the eight showed a decreased smoking prevalence in the intervention group. Similarly, the highest quality and longest trial (the Hutchinson Smoking Prevention Project) examined in a systematic review by Thomas and Perera (2006) found no long-term effects from 65 lessons over 8 years.

The broad array of school-based programs has emerged largely because schools provide an efficient channel for reaching large numbers of young people. At the same time, the decision to begin or continue smoking is made within a broad social context, and is influenced by a broad range of factors. Thus, community interventions to influence adolescent smoking have also been developed that use a coordinated, multi-component approach (Sowden & Stead, 2003). Such programs might include age restrictions on tobacco purchase and mass media efforts, as well as school programs. A systematic review of community-based trials by Sowden and Stead (2003) found some evidence that coordinated, multi-component programs can reduce smoking among young people and that they do so more effectively than single strategies alone.

One component of community interventions that has received increasing attention in the US and elsewhere in recent years is mass media – that is, using anti-smoking advertising to reduce smoking prevalence among young people. A recent review of studies of this approach found that anti-smoking advertising appeared to have more reliable positive effects on those in pre-adolescence or early adolescence by preventing the start of smoking (Wakefield, Flay, Nichter, & Giovano, 2003). The authors concluded that the effectiveness of anti-smoking advertising can be influenced by a variety of individual, social, and environmental factors, and that there is no single “recipe” for anti-smoking advertising that leads to reductions in youth smoking. Similarly, an earlier systematic review of mass media interventions found some evidence that they can be effective in preventing the initiation of smoking by young people, but that overall, the evidence is not strong (Sowden, 1998).

Recent advances in communication technology provide opportunities to reach young people in new ways, not only to provide anti-smoking messages, but also to deliver other prevention and cessation strategies. Earlier reviews noted here did not have sufficient numbers of studies to reach any conclusions about the effectiveness of such programs. More recently, Walters, Wright, and Shegog (2006) examined 19 studies of computer and internet-based interventions for preventing or reducing smoking, and found mixed results, with nine studies (47 percent) reporting statistically significant or improved outcomes at follow-up compared to a comparison group. Few patterns emerged, although the format of computer-generated feedback reports was most consistently associated with improved outcomes. Further research in this area is needed.

Illicit Substance Use and Abuse

Illicit substance use and abuse is a major concern for all countries for at least three reasons. First, use of illicit substances, by definition, is a criminal behavior. Second, abuse of illicit substances can cause significant health problems. According to a report published by the Australian Government Department of Health and Ageing (Loxley et al., 2004), illicit drug use can lead to a number of problems with physical and mental health including: contraction of blood-borne disease; cancers; stroke; heart disease; depression; psychosis; and cognitive deficits.

Finally, illicit substance use and abuse has been linked to many other youth problem behaviors such as self-harm, suicide, violent crime, and unsafe sexual practices as discussed in other sections of this document. This section describes from an international perspective the prevalence of, factors related to, and countermeasures for reducing use and abuse of illicit substances. This review includes use of recreational drugs and prescription drugs that are not being taken as part of an appropriate medical regimen. Because alcohol and tobacco use for youth is illegal in many countries, these too can be considered illicit. Use of these substances, however, is covered in different sections of this report.

Prevalence of Illicit Substance Use

The University of Michigan in the US has been conducting an annual survey of illicit substance use among youth since 1975. It has been assessing use, perceived risk, disapproval, and availability of a number of illicit substances (see e.g., Johnston, et al., 2009a). This survey, titled *Monitoring the Future*, encompasses responses from more than 46,000 8th, 10th, and 12th grade students from more than 400 schools in the US. Data from this survey provide a comprehensive estimate of the prevalence of illicit drug use in the US.

Table 3 shows 2008 annual prevalence of illicit drug use (percent of respondents who reported using the drug in the past 12 months) by three grades and sex. Note that use of illicit drugs tends to increase with age, but this trend is not evident for all types of illicit drugs. For some drugs such as heroin and crack, use remains stable throughout the three grades. This table also shows that illicit drug use among youth in the US is generally only slightly more common for males than for females in each of the three grades. The most commonly used illicit substance is marijuana.

Drug	Males			Females		
	8 th Grade	10 th Grade	12 th Grade	8 th Grade	10 th Grade	12 th Grade
Any illicit drug	14.3	27.9	38.8	13.7	25.6	34.1
Marijuana	12.2	25.5	35.1	9.5	22.2	29.5
Inhalants[#]	7.0	5.4	4.4	11.0	6.3	3.2
Hallucinogen	2.2	4.7	7.8	2.0	3.1	3.9
LSD	1.4	2.2	3.7	1.2	1.3	1.6
Ecstasy (MDMA)	1.4	3.4	5.5	2.0	2.4	3.3
Cocaine	1.8	3.0	5.2	1.8	2.8	3.5
Crack	1.0	1.3	1.7	1.2	1.2	1.3
Heroin	0.9	1.0	1.0	0.7	0.6	0.4
Heroin w/ needle	0.6	0.6	0.6	0.4	0.4	0.6
Heroin w/out needle	0.6	0.8	0.7	0.6	0.4	0.3
Narcotics not heroin	na	na	10.6	na	na	7.9
OxyContin	2.3	3.8	5.3	1.8	3.5	4.0
Amphetamine	3.5	5.8	6.5	5.5	6.9	6.8
Ritalin	1.5	3.0	3.7	1.5	2.9	2.9
Methamphetamine	0.9	1.4	1.4	1.5	1.6	0.7
Tranquilizer	1.7	4.1	6.8	3.2	5.0	5.7
OTC cough/cold	2.7	4.9	6.3	4.3	5.7	4.7
Rohypnol (“roofie”)	0.6	0.3	1.5	0.3	0.6	0.8

* Data from Johnston, et al. (2009a).

Defined as any gas or fume inhaled for the purposes of getting high, which includes many household products (Johnston, et al., 2009b).

Factors Related to Illicit Substance Use and Abuse

In an effort to update their national illicit drug use prevention policies and programs, the Australian Government sponsored the National Drug Research Institute and the Centre for Adolescent Health to conduct a comprehensive synthesis of the literature on illicit drug use patterns, risk factors, and prevention strategies, so that a comprehensive and national prevention agenda could be developed. The resulting report (Loxley, et al., 2004) was a highly comprehensive and collaborative consideration of the scientific literature on illicit drug use and abuse, including sections on use by young people. One of the many conclusions from this report was that a national illicit drug use prevention strategy needs to acknowledge the following (Loxley, et al., 2004):

- Influences on patterns of drug use and harm occur at individual, family, peer, and community levels;
- Interventions will likely need to be implemented at these various levels;
- Consistency across diverse levels and sub systems in terms of interventions is important.

Social Disadvantage

The economic level of a family seems to play a complex role in whether or not a child begins using illicit drugs. On one hand, a cohort study in Christchurch, New Zealand found that low SES predicted marijuana use (as well as problem alcohol use) by 15 to 16 year olds (Fergusson & Horwood, 1997). This study also found evidence that poly-drug use by young people was predicted by factors often related to SES, such as being born to teenage parents, sole parents, and parents with fewer years of formal education. On the other hand, a longitudinal cohort study in two counties of New York found that higher level of paternal education was predictive of increased use of illicit drugs for young males (Kandel, Simcha-Fagan, & Davies, 1986). Similarly, a different US cohort study found that females raised in higher SES families were more likely to engage in poly-drug use during late adolescence, possibly because they were better able to afford them. The impact of SES on youth illicit drug use needs further research.

Parent/Family Drug Use

There is evidence that illicit drug use in families can be a risk factor for youth use of these drugs. For example, in the Christchurch Cohort study, poly-drug use at age 15 was associated with maternal prenatal use of drugs, tobacco, and alcohol (Fergusson & Horwood, 1997). Such findings suggest that maternal use of these substances might cause developmental problems in babies that eventually manifest in adolescent drug use problems. There is also evidence that substance use by parents can be learned and copied by youth. For example, a study in Australia found that mother's alcohol consumption patterns were predictive of higher poly-drug use by children age 15 and 16 (Williams, Sanson, Toumbourou, & Smart, 2000).

Sexual Abuse

Although the evidence is limited, the Christchurch Cohort study does provide some evidence that sexual abuse is a risk factor for illicit drug use. As described by Loxley et al. (2004), self-reported sexual abuse in childhood or adolescence predicted higher rates of illicit drug use by 15-to-21-year olds and marijuana use at age 15. Loxley et al. (2004) note these effects were robust and persisted even after adjustment for several confounding factors. Given the lack of research in this area, more is warranted before strong conclusions can be made.

Childhood Aggression

The results of some studies suggest that overly aggressive children are more likely to engage in later illicit drug use. For example, a cohort study in Australia found that children who were rated by their teachers as more aggressive at ages 11 and 12 were more likely to be engaging in illicit drug use at ages 15-16 than those children who were rated low in aggression (Williams, et al., 2000). Similarly, a cohort study in New York found that children whose mothers rated them as aggressive at age 8 were more likely to be poly-drug users at age 14 (Brook, Whiteman, Finch, & Cohen, 1996). Again, given the lack of studies on this factor, more research is needed to strongly conclude that childhood aggression is a risk factor for later illicit drug use.

Low Community Involvement

As children progress through adolescence and early adulthood, relationships with peers and adults play an important role in development. At least one study suggests that low involvement in structured community activities may be a risk factor for later use of illicit drugs. The

Australian Temperament Study (Williams, et al., 2000) found that children who had low involvement at age 13 or 14 in sport or community activities involving adults were more likely to get involved in poly-drug use. These effects were persistent even after adjusting the analyses for potential confounding factors such as SES. Again, more research is needed on this potential risk factor.

Disadvantaged Neighborhood

Youth illicit drug use is more common in disadvantaged neighborhoods. As discussed by Loxley et al. (2004), a number of literature reviews have found very high rates of youth illicit drug use in communities characterized by low SES, low income, and poor housing quality. Coincident with this finding is that the availability of illicit drugs in these communities is high.

Peer Drug Use

It is well-established that peers play an important role in adolescent development. There is evidence that use of illicit drugs by peers is a risk factor for use of illegal substances. For example, a cohort study in Victoria, Australia followed 2,032 students from 44 secondary schools for more than 3 years (Coffey, Lynskey, Wolfe, & Patton, 2000). The study collected self-reported data on use of marijuana (as well as alcohol and tobacco). This study found that both peer marijuana use and school-wide marijuana use predicted marijuana use by 15 year olds, and daily use of marijuana by 16 to 17 year old males. These effects were found even after adjusting for a number of factors related to youth drug use. Other studies have found similar results.

Family Dynamics

Throughout adolescent development, the family plays an important role in the likelihood of illicit drug use. As reviewed by Loxley et al. (2004), there is strong evidence of the following family-based factors in being protective against youth illicit drug use: high attachment to the family; low parental conflict; negative family attitude toward drug use; and high parental communication and monitoring.

Interventions

School-Based Programs

Most schools provide some manner of drug use prevention programming. A review of the effectiveness of such a wide array of programs is not possible here. However, an extensive literature review of school-based programs reached several conclusions about the structure, content, and delivery of such programs for the prevention of youth illicit drug use (Paglia & Room, 1999):

Structure of Programs:

- The program should be long term and intensive, starting as early as kindergarten and continuing through high school;
- Different approaches should be used for different sub-groups of students;
- Involve students in the development of the curriculum and implementation.

Content of Programs:

- Do not use knowledge-only and affective-only content, as this type of content is ineffective;
- Include content on why young people use drugs and skills for attaining the same outcomes without use of drugs (focus on and practice skill building);
- Content should be factual and non contradictory;
- Content should include discussion of actual normative behavior;
- Content should focus on developing life skills behaviors.

Delivery of Programs:

- Atmosphere should be tolerant and supportive, with no use of scare or fear tactics;
- Program should emphasize active learning, such as role playing and group discussions;
- Leader should be trusted by the students (peers can be effective);
- Content taught in the course should be reinforced by community, including parents and policies.

Mass Media

Mass media as an intervention against drug use is attractive because of its ability to reach a large audience and has been utilized extensively in this way. Indeed, teens report learning about drugs primarily through television (e.g., Mirzaee, Kingery, Pruitt, Heuberger, & Hurley, 1991). Unfortunately, mass media campaigns are difficult to properly evaluate and, therefore, few formal evaluations have been completed for programs specifically targeting illicit drug use. Some research has found that mass media campaigns, especially those in combination with an educational program, have lowered tobacco use among teens. Based on these studies, Paglia and Room (1999), present recommendations on how mass media might help prevent use of illicit drugs:

- Use multiple media outlets;
- Combine campaign with other prevention efforts;
- Use media to stimulate discussions;
- Have content be entertaining and promote a healthy lifestyle;
- Base content on the audience;
- Avoid fear or scare tactics;
- Use a credible non-celebrity spokesperson;
- Present factual information.

Sport and Recreation Programs

Given that low community involvement is a risk factor for illicit drug use, it is not surprising that programs have been developed to get young people involved in their communities. Indeed, there is some evidence that these programs can have a modest effect on reducing use of marijuana and other illicit drugs. According to Loxley et al. (2004), studies of Boys and Girls Clubs have found low incidence of illicit drug use as compared to settings where such clubs do not exist. Such conclusions, however, should be treated with caution as there could be other factors accounting for the differences. Thus, the effectiveness of involvement in community activities in preventing drug use should be considered unknown, but promising.

Intentional Self-Harm and Suicide

Because not all self-harm involves an intent to end one's life, the phrase "suicidal phenomena" is often used to categorize attempted suicide, intentional self-harm, and thoughts about suicide and self-harm (Evans, Hawton, Rodham, & Deeks, 2005). Contemporary thinking considers intentional self-harm to be a largely teen-related phenomenon (Fogarty, 2007). Research shows that the self-harm follows a progression that is typical of other problem adolescent behaviors, with the behavior starting in early adolescence (typically age 12), becoming most frequent in middle adolescence/young adulthood (age 16-25), and disappearing in early adulthood (McDougall & Brophy; 2006; Whitlock, Powers, & Eckenrode, 2006; Yip, 2006). Suicide, on the other hand, occurs in all age groups and its prevalence is highest in middle adulthood and late older adulthood in some countries such as the US (e.g., McKeown, Cuffe, & Schultz, 2006) and Australia, and more prevalent among youth in other countries, such as New Zealand and Canada. Suicidal phenomena are also predominately female (Evans, et al., 2005), although the actual act of committing suicide is much more common among males.

Incidence and Prevalence of Suicidal Phenomena in Youth

Evans, et al. (2005) conducted a comprehensive international review of population-based studies on the prevalence of adolescent suicidal phenomena. In this study, adolescence was defined as age 12 to 20. Their review included 128 studies and considered several aspects of nonfatal suicidal phenomena in youth including suicide attempts, intentional self-harm, planning a suicide, and thoughts of suicide. Results are summarized in Table 4. Mean prevalence was estimated for each behavior based on the available studies and indicates the percentage of adolescents estimated to have engaged in the behavior or thought about it. Prevalence ratios for females versus males are shown in the table, along with P-values showing the statistical significance of each ratio.

As can be seen in Table 4, suicidal thoughts and behaviors are common among youth, with about 30 percent at least having thought about suicide at some time during their lifetime. About 10 percent of youth in the studies reported having attempted to take their lives. The results for intentional self-harm were wide ranging, in part because of a lack of studies investigating this behavior. Lifetime intentional self-harm ranged from 4-30 percent in the seven studies that investigated this behavior, while intentional self-harm over the past year ranged from 20-32 percent in the two studies using this timeframe. A more recent population-based study in the US found that 46.5 percent of adolescents reported self-harm in the past year (Lloyd-Richardson, Perrine, Dieker, & Kelley, 2007). Thus, taken together, it is likely that intentional self-harm behaviors among adolescents are common, and may be more common than thoughts about suicide.

Analysis of prevalence by sex shows that all thoughts and behaviors were more common among females than males. This difference was statistically significant for suicide attempts, plans, and thoughts. Again, due to the paucity of population-based studies of intentional self-harm, the higher prevalence for females was not statistically significant. More recent data from the US found no statistically significant sex difference for intentional self-harm (Lloyd-Richardson, et al., 2007).

	Mean Prevalence %	Mean Prevalence Ratio: Female vs. Male	P
Suicide Attempts			
Lifetime	9.7	1.78	<0.001
Previous Year	6.4	2.08	<0.001
Intentional Self-harm			
Lifetime	13.2	1.25	0.09
Previous Year	26.0	--	--
Suicide Plan			
Lifetime	15.6	1.64	<0.001
Previous Year	12.4	1.58	<0.001
Suicide Thoughts			
Lifetime	29.9	1.38	<0.001
Previous Year	19.3	1.57	<0.001

The Evans et al. (2005) study did not include data on suicide attempts that were successful. Data from several sources confirm that across the lifespan, successful suicide attempts are about three to four times more common for males (e.g., Australian Bureau of Statistics, 2009; Centers for Disease Control and Prevention, 2009b; Statistics Canada, 2009). Table 5 shows national suicide prevalence rates (per 100,000 people) for three developed countries. As can be seen, suicide in adolescence is much more common for males, particularly for males age 20-24.

	Male	Female	Overall
Australia (2007)			
15-24 years	12.5	3.5	9.0
Canada (2005)			
15-19 years	13.4	6.3	9.9
20-24 years	20.1	5.9	13.2
USA (2006)			
15-19 years	11.6	2.8	7.3
20-24 years	21.0	3.6	12.6
15-24 years	16.1	3.2	9.8

Factors Related to Suicidal Phenomena

A number of risk and protective factors have been found to be related to self-harm and suicide.

Marital Status

A large-scale study of attempted suicide in the US during the 1980s found that the risk of attempted suicide was 11.3 times higher for people who were divorced or separated than for those who were married, widowed, or never married (Petronis, Samuels, Moscicki, & Anthony,

1990). Other large-scale studies have also found high risk of suicide attempts by those who are separated or divorced (e.g., Mościcki, O'Carroll, Rae, Locke, Roy, & Regier, 1988). A study in Oxford, England examined factors related to self-harm among 13,858 people over a 10-year period (Hawton, Harriss, Simkin, Bale, & Bond, 2003). The study found that risk of self-harm was higher for single females (relative risk: 4.3) and single males (relative risk: 5.6); divorced females (relative risk: 6.6) and divorced males (relative risk: 3.9); and for widowed females (relative risk: 0.9) and widowed males (relative risk: 1.7). Similar results have been found in other studies (e.g., Harris, Hawton, & Zahl, 2005; Welch, 2001). Risk of suicide is also related to marital status. A study by Smith, Mercy, and Conn (1988) examined the risk of suicide by marital status and age for all US residents over a 3-year period. The study found that for all age groups and for both males and females, married people had a lower risk of suicide than unmarried people. Further, males age 25-34 who were widowed had an exceptionally high rate of suicide. Other studies support these results (e.g., Gove, 1972; Kessler, Borges, & Walters, 1999).

Employment Status

Being unemployed appears to increase the risk of all types of suicidal phenomena. An extensive synthesis of the literature on suicide attempts found strong support that being unemployed increased the risk of suicide attempts and that risk increased with the duration of unemployment (Welch, 2001). The Oxford study found a 9-10 fold increase in the risk of self-harm among those who were unemployed (Hawton, et al., 2003). Platt (1984) and others (e.g., Blakely, Collings, & Atkinson, 2003) have established that unemployment is a risk factor for successful suicide in the US and many European countries, while others have noted that both suicide and attempted suicide rates increase during severe economic times (e.g., Ostamo, Lahelma, & Lönnqvist, 2001).

Substance Use

A number of studies have investigated the relationship between suicide attempts and use of licit/illicit substances, but the findings are not consistent. For example, a study of nearly 14,000 Americans who had attempted suicide found that active alcoholism and use of cocaine were associated with a higher risk of suicide attempts, whereas use of marijuana, sedative-hypnotics, and stimulants were not (Petronis, et al., 1990). A study of risk factors for attempted suicide among adolescents found an increased attempted suicide risk for use of alcohol, hallucinogen, cocaine, amphetamine, inhalant, and sedative hypnotics, but no increased risk with marijuana use (Kelly, Cornelius, & Lynch, 2002). A study of suicide among adolescents, based on interviews with survivors and analysis of medical records, found substance use in nearly one-half of suicides, predominantly alcohol (Schneider, 2009). A statewide survey of adolescents in South Carolina found that suicidal behavior was significantly more common among those adolescents who reported alcohol binge drinking, marijuana use, cocaine use, and illicit drug use, particularly intravenous drug use (Garrison, McKeown, Valois, & Vincent, 1993).

Mental Health Status

As might be expected, the risks of suicidal phenomena are associated with a number of mental health conditions. One review found that in studies of self-harmers who presented to hospitals, 90 percent had at least one psychiatric disorder, most commonly depression followed by substance abuse and anxiety disorders (Skegg, 2005). A different literature review also concluded that having a mental disorder was associated with suicidal phenomena (Welch, 2001).

This review found that the most common diagnoses among people who have engaged in suicidal phenomena were depression, panic and anxiety disorders, and, less commonly, schizophrenia, psychotic disorders, personality disorders, and adjustment disorders. Welch (2001) also noted that co-morbidity of disorders was common. Studies of attempted suicide have consistently found high risk among those with affective disorders, such as depression (e.g., Tondo, et al., 1999).

Interventions for Self-Harm and Suicide

As described by Skegg (2005), the management of self-harm behavior is quite varied. Skegg argued that the management of self-harm should be based on treating the underlying problem. The treatment can range from psychiatric hospital admission to resolving family support issues. Based on a comprehensive review of the literature, Skegg also stressed the need for aftercare to prevent the reoccurrence of self-harm behavior and presented the following general principles:

- Monitor patient for further suicidal or self-harm thoughts;
- Identify support available in a crisis;
- Come to a shared understanding of the meaning of the behavior and the patient's needs;
- Treat psychiatric illness vigorously;
- Attend to substance abuse;
- Help patient to identify and work toward solving problems;
- Enlist support of family and friends;
- Encourage adaptive expression of emotion;
- Avoid prescribing quantities of medication that could be lethal in overdose;
- Use assertive follow up in an empathic relationship;
- Affirm values of hope and caring for oneself.

As with self-harm, suicide prevention strategies are also quite varied. Suicide experts from 15 countries collaborated on a systematic review of more than 5,000 studies of suicide prevention strategies published up until June, 2005 (Mann, et al., 2005). This systematic review of literature categorized studies into five types of strategies: awareness and education; screening; treatment interventions; restriction of the means to attempt suicide; and media. The research for each area was reviewed and conclusions are presented below.

Awareness and Education

Awareness and education strategies are designed to increase knowledge of cues for recognizing suicide risk and improve understanding of the causes and risk factors. Suicide awareness and education programs have been developed for the general public, primary care physicians, and gatekeepers (those who have contact with potentially vulnerable populations). Mann, et al. (2005) reported that there are few studies that have evaluated the effects of awareness/education programs for the general public, but those that have show little evidence that general public awareness programs reduce suicide risk. Indeed, in some cases these programs may even have a harmful effect. Awareness and education programs targeted at primary care physicians have been more promising. According to Mann, et al. (2005), studies in several countries have shown that programs that help physicians identify and treat at-risk patients can substantially reduce suicide rates. Few programs for gatekeepers have been evaluated. However, two programs

targeted toward military institutions have reported success in reducing suicide risk among those in the military.

Screening

Screening refers to identifying people at risk for suicide attempts and directing them to treatment. According to Mann, et al. (2005), several studies have found that screening is effective in identifying and treating people with depression. There is a lack of research, however, on whether screening programs reduce suicide risk. Indeed, a systematic review of the literature on screening to reduce suicide risk, as opposed to depression, in the primary care setting found no studies that investigated suicide risk (Gaynes, et al., 2004). Thus, it appears that screening is effective at identifying those with risk factors for suicide, such as depression, but that screening has not been shown to reduce suicide itself. Mann, et al. (2005) cautioned that further research is needed on the cost effectiveness of screening for the general population for suicide risk before widespread adoption of such screening.

Treatment Interventions

Both pharmacotherapy and psychotherapy have been used as suicide prevention strategies. In their systematic review of the literature, Mann, et al., (2005) found few randomized control trials of the effects of medication (particularly anti-depressants) on suicide risk. However, data from several countries show that higher prescription rates of antidepressants correlate with decreasing suicide rates in both adults and youth. Mann, et al. (2005) noted that suicide rates were reduced the most in countries that had the greatest increase in selective serotonin reuptake inhibitor (SSRI) prescriptions. While the authors recognized that one cannot infer causation from these correlations, they noted that there is a plausible link between antidepressant use and decreased suicide risk. Psychotherapy also seems to be an effective treatment for reducing suicide risk. Mann, et al. (2005) found that when compared to normal aftercare, some forms of psychotherapy could reduce risk of subsequent suicide attempts by one-half.

Means Restriction

Means restriction refers to reducing access to the means by which a person may attempt to commit suicide, such as firearms or prescription medications. According to Mann, et al. (2005), suicide by specific means has been reduced when restrictions are placed on that mean, such as firearm control legislation, restrictions on pesticides, construction of barriers at jumping sites, and the introduction of lower toxicity antidepressants. Studies have yet to address whether these restrictions reduce suicide risk as a whole. It is possible that if one method is restricted, a person may substitute another method.

Media

According to Mann, et al. (2005), media can play both a positive and negative role in suicide prevention. On the positive side, media can help inform the general public and specialized groups about the risk factors and treatment options for suicide attempts. On the negative side, news coverage of suicides may encourage those who are at risk to attempt suicide. There is some evidence that suppressing news media about suicide can decrease suicide rates. For example, a study in Austria examined the effect of changing how media reported on subway suicides (Etzersdorfer & Sonneck, 1998). The program successfully got media to downplay or not report these types of suicide. The study found a more than 80 percent reduction in subway

suicides and suicide attempts with the reduction lasting for several years. Mann, et al. (2005) concluded that media-targeted campaigns are a potentially effective suicide prevention strategy.

Youth Criminal Activity

Criminal activity encompasses a wide range of activities from misdemeanors to felonies to capitol crime. Such a wide range of activities cannot be covered in this section. Instead, this section focuses on the four violent crimes of the eight “index crimes” defined by the US Federal Bureau of Investigation (FBI, 2009a,b,c,d,e): willful homicide, forcible rape, robbery, and aggravated assault. The other four index crimes are: burglary, larceny over \$50, motor vehicle theft, and arson.

Incidence and Prevalence of Criminal Activity

Table 6 shows arrest rates in the US for violent crimes by sex and age. Several trends are evident. Among males, both the rates and frequencies of aggravated assault were greater than other violent crimes for youth and for all ages, followed by robbery, rape, and murder, respectively. This trend was also found for females, with the exception that the murder rate was higher than the rate for rape for all ages. Among males, rape was slightly more common for youth and robbery was much more common for youth, while murder and assault were less common for youth. Among females, rape, robbery, and aggravated assault were all more common for youth, while only murder was less common for youth. Finally, the prevalence for all violent crime arrests was dramatically higher for males than for females. The differences in rates, however, depended on the crime. Rape was about 30 times more likely for males than for females whereas assault was only about 3 to 4 times more likely for males.

Table 6: US Youth Arrest Rates (per 100,000) and Total Arrests for Violent Crimes by Sex and Age*				
Crime	Males		Females	
	10-19 Years	All Ages	10-19 Years	All Ages
Murder				
2004	2.6 (555)	4.8 (6844)	0.3 (63)	0.6 (919)
2008	3.2 (686)	4.6 (6944)	0.2 (49)	0.6 (860)
Forcible Rape				
2004	11.9 (2552)	10.8 (15585)	0.4 (74)	0.2 (258)
2008	9.6 (2037)	9.3 (13938)	0.2 (31)	0.1 (166)
Robbery				
2004	58.8 (12598)	38.9 (56062)	6.5 (1328)	4.7 (7019)
2008	86.7 (18448)	45.4 (68043)	9.1 (1853)	5.8 (8958)
Aggravated Assault				
2004	132.2 (28316)	150.8 (217220)	42.9 (8730)	37.9 (56434)
2008	120.9 (25742)	139.9 (209688)	38.5 (7812)	37.0 (57057)

* Rates are derived from data obtained from the US Census Bureau (2009) and the US Federal Bureau of Investigation (FBI, 2009f).

Factors Related to Youth Violent Crime

In the late 1990s, the US Surgeon General directed three agencies (Centers for Disease Control and Prevention; National Institutes of Health; and the Substance Abuse and Mental Health Services Administration) to develop a comprehensive and highly collaborative review of the literature on youth violence. The resulting report, titled “Youth Violence: A Report of the Surgeon General,” is one of the most comprehensive syntheses of the scientific literature on the trends, causes, and prevention of youth violence (US Department of Health and Human Services, USDHHS, 2001). This report found that there was a high degree of general misunderstanding of the youth violence problem and discussed 10 myths of youth violence that were not supported by the literature synthesis:

- The epidemic of violent behavior that marked the early 1990s is over, and young people—as well as the rest of US society—are much safer today;
- Most future offenders can be identified in early childhood;
- Child abuse and neglect inevitably lead to violent behavior later in life;
- African American and Hispanic youths are more likely to become involved in violence than other racial or ethnic groups;
- A new violent breed of young superpredators threatens the US;
- Getting tough with juvenile offenders by trying them in adult criminal courts reduces the likelihood that they will commit more crimes;
- Nothing works with respect to treating or preventing violent behavior;
- In the 1990s, school violence affected mostly white students or students who attended suburban or rural schools;
- Weapons-related injuries in schools have increased dramatically in the last 5 years;
- Most violent youths will end up being arrested for a violent crime.

Race/Ethnicity

While there is clear evidence that youth violent crimes are more common among males, differences in violent crime between racial/ethnic groups are small in comparison. Table 7 shows youth arrest rate ratios for three US groups relative to Whites, along with the ratios for male versus female. As can be seen in this table, there is a much higher ratio of male to female arrests than non-White to White arrests. These data do, however, show that in the US, youth violent crime is greater among African American youths. The USDHHS (2001) report notes that data for Hispanic youths were not available, but some small scale studies (Prothrow-Stith & Weissman, 1991; Smith, Mercy, & Rosenberg, 1988; Sommers & Baskin, 1992; Zahn, 1988) have reported that murder arrest rates for Hispanic males are substantially higher than those for non-Hispanic White males. This difference, however, is less than the difference between African American males and White males.

Crime	Male: Female	African American: White	Native American: White	Asian: White
Murder	11.3	5.3	3.4	1.0
Forcible Rape	N/A	3.4	1.1	0.3
Robbery	10.0	6.4	1.1	0.7
Aggravated Assault	3.3	3.1	1.1	0.3

* Data from USDHHS (2001)

Gangs and Violence

There is evidence showing that youth violence is linked to membership in a gang. For example, Battin, Hill, Abbott, Catalano, and Hawkins (1998) conducted a longitudinal study of antisocial behavior among youth in Seattle, Washington. The sample was a multiethnic group of 808 children entering the fifth grade. Each year participating students completed a questionnaire on self-reported criminal offenses (including violent behavior), gang membership, and delinquent behavior of peers. The analyses compared the self-reported offense rates of three types of 15-year-olds: those with nondelinquent peers; those with delinquent peers; and those who were gang members. Self-reported violent crime was 7 times more likely among gang members than among those with nondelinquent peers, and 2.2 times more likely than among those with delinquent peers. Similar results have been found in other longitudinal studies (see e.g., Battin-Pearson, Thornberry, Hawkins, & Krohn, 1998).

Early-Onset versus Late-Onset

Researchers in youth violent crime have identified two developmental trajectories: early onset and late onset. In early onset violence, problem behaviors are found in early childhood (6-11 years) and these behaviors increase in severity with violent criminal behavior occurring before adolescence. When compared to those in the late-onset group, those in the early-onset group have more frequent and serious offenses and violence continues into adulthood (Stattin & Magnusson, 1996; Tolan & Gorman-Smith, 1998). Those in the late-onset trajectory do not engage in problem behavior until adolescence (12-14 years). Late-onset youth violence is more common than early onset. Fifty-five to 80 percent of male violent offenders aged 16-17 are in the late-onset group (D'Unger, Land, McCall, & Nagan, 1998; Elliott, Huizinga, & Morse, 1986; Huizinga, Loeber, & Thornberry, 1995; Nagin & Tremblay, 1999; Patterson & Yoerger, 1997; Stattin & Magnusson, 1996).

Violence and Other Problem Behaviors

Young people who commit violent crimes are likely to exhibit other problem behaviors. Various longitudinal studies of youth have shown that violent behavior co-occurs with several other problem behaviors including: non violent criminal behavior; substance abuse; reckless driving; and dropping out of school (Elliott, 1993; Huizinga & Jakob-Chen, 1998; Tolan & Gorman-Smith, 1998). Of these co-occurring behaviors, non violent criminal behavior is the most common. For example, Huizinga, et al. (1995) found that among violent youths, up to 92 percent engaged in property crimes, up to 82 percent were involved in public disturbance crimes,

and up to 45 percent were selling drugs. Substance use is also common with as many as 80 percent of violent youths using alcohol and more than one-half using marijuana or other illicit drugs (Elliott, et al., 1989; Huizinga & Jakob-Chen, 1998).

Mental Health

There appears to be only a weak link between mental illness and youth violence (USDHHS, 2001). Studies in both the US and elsewhere that attempted to establish this link tended to find that the occurrence of mental illness among violent youth is only slightly greater than among non violent youth (Arseneault, Moffitt, Caspi, Taylor, & Silva, 2000; Elliott, Huizinga, & Menard, 1989; Huizinga & Jakob-Chen, 1998). The USDHHS (2001) report concluded that more research is needed to understand the link between youth violence and mental illness.

Victims of Violence

Violent youth are also more likely to be victims of violent behavior. One study in Denver, Colorado found that 42 percent of youth violent offenders were also victims of violence (Huizinga & Jakob-Chen, 1998). It is important to note, however, that this relationship is not necessarily causal. Violent youth may live in more violent environments, live a lifestyle that exposes them to violence, and may experience violence from the victims of their own violence (USDHHS, 2001).

Risk and Protective Factors

In terms of youth violence, a risk factor is anything that increases the chances of a young person engaging in violent criminal behavior, while a protective factor is anything that decreases these chances. Based on a large body of scientific literature, the USDHHS (2001) report developed a set of risk and protective factors for the occurrence of violence at age 15-18. These factors are shown in Table 8. As seen in this table, factors are categorized by five domains: individual, family, school, peer group, and community. In addition, the factors are different depending upon the developmental trajectory of the onset of violent behavior. The report (USDHHS, 2001) notes several issues related to these factors: most of these factors are non biological and are believed to be learned; causal links among most factors and violence have not been established; factors do not occur in isolation but rather in clusters; and factors are likely to interact.

Table 8: Risk and Protective Factors for Violence at Ages 15-18 Years by Developmental Trajectory*			
Domain	Risk Factor		Protective Factor
	Early-Onset	Late-Onset	
Individual	General offences Substance use Being male Hyperactivity Antisocial behavior Exposure to television violence Low IQ Antisocial attitudes Dishonesty	General offences Restlessness Difficulty concentrating Risk taking Aggression Antisocial attitudes Crimes against persons Antisocial behavior Low IQ Substance abuse	Intolerant attitude toward deviance High IQ Being female Positive social orientation Perceived sanction for transgressions
Family	Low socioeconomic status or poverty Antisocial parents Poor parent-child relation Broken home Abusive parents Neglectful parents	Poor parent-child relation Low parental involvement Antisocial parents Broken home Low socioeconomic status or poverty Abusive parents Family conflict	Warm/supportive relation with parents or other adults Parent's positive evaluation of peers Parental monitoring
School	Poor attitude Poor performance	Poor attitude Poor performance Academic failure	Commitment to school Recognition for involvement in conventional activities
Peer Group	Weak social ties Antisocial peers	Weak social ties Antisocial peers Delinquent peers Gang membership	Peers who engage in conventional behavior
Community	None	Neighborhood crime Neighborhood drugs Neighborhood disorganization	None

* Table derived from USDHHS (2001), Box 4-1.

Interventions

As with many behavioral interventions, countermeasures for youth violence are infrequently evaluated with scientific rigor. Some meta-analyses and reviews of best practices have been published (e.g., Elliott & Tolan, 1999; Howell, 1995; Mendel, 2000; Sherman, et al., 1997; Wilson, Gottfredson, & Najaka, 2001). From these studies and others, the USDHHS (2001) report developed a list of model programs and promising approaches. The following are descriptions of programs and approaches for the prevention or reduction of youth violence that seem to be effective as determined by the USDHHS (2001) report.

Skills training programs for youth

Skills training programs attempt to prevent or reduce the likelihood of drug use among youth and, therefore, later violent behavior. Over the course of several years, these programs teach young people self-management skills, social skills, problem solving skills, alternative thinking

strategies, and skills related specifically to drug use. These programs generally include practice components where participants learn how to apply these skills. The USDHHS (2001) report identified two programs that met the highest criteria for effectiveness (Life Skills Training and The Midwestern Prevention Project) as well as several other programs that were considered promising approaches.

Parent Training Programs

Training programs that involve parents have also been shown to be effective in reducing youth violence. These programs generally include skills training for children, similar to what has already been described, parenting training for the parents, and communication training for both children and their parents. The USDHHS (2001) identified two such programs as promising: The Iowa Strengthening Families Program and Linking the Interest of Families and Teachers (LIFT).

Behavior Management Programs

Behavior management programs are school-based programs that identify and reward positive behaviors such as: school attendance; academic progress; pro-social behaviors; and classroom citizenship. Promising approaches for these programs are ones that establish clear rules and direction for students, use praise and approval, include behavior modeling, and use token reinforcement, self-reinforcement, and behavior shaping (USDHHS, 2001). The USDHHS (2001) report identified three promising programs: Seattle Social Development Project; The Bullying Prevention Program; and the School Transitional Environmental Program (STEP).

Other School-Based Programs

There are several other school-based approaches to preventing violence that should be noted. Programs that help schools plan, implement, and maintain programs that are known to positively impact academic success can also deter youth violence (USDHHS, 2001). Similarly, implementing programs that help students learn, such as cooperative learning programs, can be effective in reducing youth violence.

Positive Youth Development Programs

There is some evidence that programs designed to enhance positive youth development can be effective in reducing youth violence. Examples of such programs are Big Brother Big Sisters of America, Boys and Girls Clubs, and Boy/Girl Scouts. Although the USDHHS (2001) report cautions that evidence is limited, it does state that evaluations of Boys and Girls Clubs have found reductions in youth crime.

Ineffective Approaches

The USDHHS (2001) report also identified approaches that either do not work or do not include components that can be considered promising approaches. Because some of these programs are in widespread use in the US and elsewhere, a few will be noted here: home visitation; preventive intervention (targeting children with low academic achievement, family problems, or disciplinary problems); Drug Abuse Resistant Education (DARE); moral reasoning training; gun buyback programs; behavior redirection programs (directing high-risk youths to conventional activities such as sports); family clinical interventions; boot camps; residential programs; waivers to adult court; and shock programs (e.g., Scared Straight).

Conclusions

This section reviewed the results of research on risky behaviors outside the traffic safety area, particularly risky behavior for youth, to identify successful techniques for changing behavior that may be applied to promoting belt use by part time users. Several themes, lessons, and conclusions can be drawn from the review. First, risk behaviors generally do not occur in isolation. Instead, if a person engages in one risky behavior, he or she is likely to engage in other risk behaviors. For example, abuse of alcohol is related to unsafe sex, suicidal behavior, and criminal behavior. Similarly, lack of belt use has been associated with a constellation of unsafe driving behaviors.

One pervasive theme in traffic safety is that males are much more likely to engage in risky driving. When non-driving risky behaviors are considered, only some behaviors are more common for males. Males are more likely to engage in risky drinking, smoking, suicide, and crime. Females are more likely to engage in self-harm. Findings are less conclusive for unsafe sex and illicit drug use.

Some risky behaviors seem to be linked with individual traits such as aggression and sensation seeking. Many risky behaviors are clearly related to mental health status. Depression, in particular, seems to be closely tied to many of the risky behaviors reviewed here. It is important to note that in most cases the cause and effect relationship between mental health and risky behaviors is unknown; that is, poor mental health could lead to risky behaviors or the risky behaviors could lead to poor mental health.

Social factors also appear to play a role in whether a person engages in certain behaviors. Peer influence and social norms, in particular, are strongly related to many of the behaviors reviewed. Parenting and family life also seem to be important. Family or parenting problems have been linked to many, but not all, risky behaviors. On the other hand, being married and being employed may be protective factors for several risky behaviors such as suicide and self-harm.

Several conclusions can be drawn about the interventions for these risky behaviors. First, informational interventions by themselves are not effective. Interventions that teach skills, coping strategies, alternate behavioral strategies, and assertiveness appear to be at least partially effective in preventing risky behavior. Interventions that adjust perceived social norms can also be effective. Treatment of mental health disorders is another effective intervention strategy. Finally, at least for risky behaviors among youth, programs that teach parenting skills (such as parental monitoring) have been somewhat effective in reducing the incidence of risky behaviors.

THEORIES AND MODELS OF BEHAVIOR CHANGE

Introduction

A number of different psychological and social theories and models have been proposed in the past half-century to explain how individuals change their behavior. They come from areas of study as diverse as cognitive psychology, social psychology, clinical psychology, sociology, public health, and communication. This section addresses five of the most popular and most regularly applied theories and models of behavior change including the: 1) Theory of Reasoned Action (TRA) and the closely related Theory of Planned Behavior (TPB); 2) Health Belief Model (HBM); 3) Protection Motivation Theory (PMT); 4) Transtheoretical Model (TTM) or Stages of Change theory; and 5) Precaution Adoption Process Model (PAPM).

For each theory, key constructs are described and applications to seat belt use are examined. The theories are also compared and contrasted to see where they overlap, and to identify relative strengths and weaknesses. Fuller detail on the individual theories can be found in several comprehensive reviews including Gibbons, Gerrard, Blanton, and Russell (2003); Gielen, Sleet, and DiClemente (2006); Glanz, Lewis, and Rimer (2002); Schmidt, Schwenkmezger, Weinman, and Maes (1990); Weinstein (2003); and Weinstein, Lyon, Sandman, and Cuite (2003).

Some of the theories reviewed here are health specific, while others are more general (Kok & Schaalma, 2004). For example, TTM (Prochaska, 1979) was developed specifically in the context of psychotherapy. Similarly, HBM (Becker & Maiman, 1975; Becker et al., 1977) was developed to explain why individuals do not always take advantage of health screening that is available to them. In contrast, TRA and TPB (Fishbein, 1979; Fishbein & Ajzen, 1975) were developed to explain the psychological process involved in attitude formation and specifically the link between attitudes and behavior in many different contexts. Finally PMT (Hass, Bagley, & Rogers, 1975; Rogers, 1975) was developed to understand how people process fear appeals that are presented in communications about risk.

Despite their different origins, the theories are all representative of a transition in the fields of psychology and health from “stimulus-response” learning theories of Watson (1913) and Skinner (1953), which were developed in the early and mid 20th century to explain what happens when individuals (or animals) are rewarded or punished. This research and theory tradition asserted that understanding cognition was not important, and that all behavior could be understood through the series of rewards and punishments that lead people to do or not do certain behaviors. While some of the basic ideas of reinforcement remain in contemporary behavior change theories, and may seem appropriate for increasing seat belt use, the field of psychology began to move beyond such simplistic explanations of behavior during what is now referred to as the “cognitive revolution.” The behavior change theories discussed here all assume that there are cognitive and social processes that underlie health behavior, and that changing behavior is not as simple as adding a reinforcement or punishment. For information on the original social-cognitive theories that came out of the cognitive revolution, see Armitage and Conner (2000), Bandura (1997); Baranowski, Perry, and Parcel (2002); Simons-Morton and Nansel (2006); and Wyer and Srull (1994).

Theory of Reasoned Action and Theory of Planned Behavior

The Theory of Reasoned Action (TRA) is one of the original cognitively-oriented behavior change theories which grew out of work by Fishbein (e.g., Fishbein, 1979; Fishbein & Ajzen, 1975) on the link between attitudes and behavior. Of interest are both attitudes toward general objects (such as seat belts in general) and attitudes toward specific behaviors (such as wearing a seat belt; Ajzen & Timko, 1986; Fishbein 1979; Fishbein & Ajzen, 1975). Research in this area has found that behavioral prediction can be fairly strong (Armitage & Conner, 2001; Armitage et al., 1999). Bagozzi, Baumgartner, and Yi (1992) found that the predictive strength of attitudes differs by personality dispositions, with individuals who have an action orientation (i.e., high capacity to enact their intentions) showing a stronger link between attitudes and behavior than individuals with a state orientation (i.e., low such capacity). This does not discount other support for the link between attitudes and behavior, but simply underscores the multifaceted nature of the relationship. In terms of seat belt use, there is some evidence that individuals with negative opinions about belt use are less likely to use seat belts, although the relationship is not very strong and is not always supported (Fhaner & Hane, 1974; Loo, 1984) and may relate to risk perceptions (Jonah & Dawson, 1982; Stasson & Fishbein, 1990; Trafimow & Fishbein, 1994).

The Theory of Planned Behavior (TPB) extends TRA, by adding a component that accounts for people's perception that a behavior is under their control (Ajzen & Fishbein, 1980; Madden, Ellen, & Ajzen, 1992; Sideridis, Kaissidis, & Padelidiu, 1998). Perceived behavioral control has to do with whether an individual can simply act on a decision or whether there are structural or other non-psychological barriers to action. While seat belt use may appear to be under the volitional control of most people, there may be real barriers to exercising that control. For example, overweight or pregnant individuals may find seat belts so uncomfortable that they just cannot wear them. In taxis and other vehicles, the seat belts may be hard to reach or locate (e.g. buried in the seat), preventing individuals from putting them on.

Armitage and Conner (2001), in a meta-analysis of TPB studies, found evidence that perceived behavioral control can intervene between attitudes toward behavior and behavioral intentions. In their study, the inclusion of perceived behavioral control resulted in better prediction of behavioral intentions than when only attitudes and subjective norms were used to predict intentions. Predictions of behavioral intentions were slightly better than predictions of actual behavior, but both were still moderately strong. Work by Prentice-Dunn and Rogers, (1986) also supports findings from earlier TRA research that intentions accurately predict behavior if: they are measured at the same level of specificity; the intentions remain stable; and the behavior in question is under volitional control.

The key constructs of both TPB and TRA include attitudes toward health behavior, behavioral intentions, subjective norms, and self-efficacy (Montano & Kasprzyk, 2002; Sleet, Trifiletti, Gielen, & Simons-Morton, 2006). Behavioral intentions are self-reported intentions or "plans" to do a certain behavior in the future, and are generally captured in research through survey questions. With respect to seat belt use, a question might be: "How likely is it that you will wear a seat belt the next time you are riding in an automobile either as a passenger or as a driver? Would you say it is certain, very likely, somewhat likely, equally likely or unlikely, somewhat unlikely, very unlikely, or is it absolutely certain you will not wear a seat belt?"

Subjective norms are important components of TRA and TPB that serve to tie the internal psychological component of the theory to external social factors. This is because subjective

norms involve an individual's judgment about what other individuals important to that person will think of him or her taking on a specific health behavior (or stopping an unhealthy behavior). A subjective norm question relative to seat belt use might be "How supportive would your mother be of your decision to wear a seat belt? Would you say very supportive, somewhat supportive, somewhat unsupportive, or very unsupportive?" The concept of subjective norms may be a helpful one in efforts to increase seat belt use. If individuals do not decide to use seat belts for their own sake, they may be influenced by considering what another person who is important to them might think about their use or nonuse. For example, for parents of young children, or children with younger siblings, a message such as "They won't tell you, but they care if you wear it" might have impact in promoting seat belt use.

Finally, self-efficacy, or the belief that one can accomplish what one puts his or her mind to, needs to be present in order for behavior change to occur (Bandura, 1997). It is generally considered to be an important component of TRA/TPB, if not an explicit one (Montano & Kasprzyk, 2002), and is an essential part of social cognitive theory in general (Bandura, 1997). Other types of "efficacy" have been suggested, including behavioral efficacy or the degree to which one believes that a specific action will be effective (e.g., that wearing a seat belt will prevent injury; see Bandura, 1997; Schwarzer, 1992 for more detailed discussion of self-efficacy).

Much of the past research on TRA/TPB has focused on behavioral intentions rather than actual behavior (Becker & Gibson, 1998; Ellis & Arieli, 1999; Gastil, 2000), although some studies have included actual behavior as well, whether observed or self-reported (Gillmore et al., 2002; Millstein, 1996; Morrison, Golder, Keller, & Gillmore, 2002). One aspect of behavior that has generally not been addressed by TRA/TPB is an individual's previous behavior. It seems logical that people who currently or previously practiced a behavior will be more likely to practice that behavior in the future than those who have no experience with it. This construct has been studied more generally with regard to seat belt use (e.g., Budd, North, & Spencer, 1984), with previous belt use found to be a strong predictor of current use.

Several extensions of TRA/TPB have been proposed, such as the inclusion of personality characteristics (Bagozzi et al., 1992), the inclusion of attitudes of spouses (Lowe & Frey, 1983), and self orientations across cultures (Park & Levine, 1999). In addition, Conner and Christopher (1998) suggest including the following six additional variables in the theory: belief salience, past behavior and habit, perceived behavioral control (as opposed to self-efficacy), moral norms (as opposed to only subjective norms), self-identity, and affective beliefs.

Health Belief Model

The Health Belief Model (HBM) is a social cognitive theory similar to TRA and TPB (Janz, Champion, & Strecher, 2002). The model was originally developed to explain why individuals were not participating in disease detection and prevention programs in the 1960's and 1970's. HBM rests on a set of components tied to individuals' perceptions of health risks and behaviors, as well as their own ability to change. The basis for the focus on perceived rather than actual risks is that a risk only affects a person's behavior to the degree that the person recognizes the risk. A person could be reacting to a risk perceived as high when in fact there is only a very low risk. An example of this would be someone who avoids flying because he or she feels there is a high risk of a crash.

HBM combines the concepts of perceived susceptibility and perceived severity into what is called perceived threat (Janz et al., 2002). Susceptibility refers to the perceived likelihood of a negative health event (such as getting injured in a car crash), and severity refers to the magnitude of the outcome (such as how injured one thinks he or she will be). A person may perceive his or her susceptibility to be high (e.g., “It’s nearly certain I will get in a car crash today.”), but perceive the severity to be low (e.g., “But it will likely only be a fender bender.”), and thus have an overall low perceived threat. Overall threat might also be low if perceived susceptibility is low, but severity is high (e.g., if a plane falls out of mid air, everyone will die, but the chances of a plane falling out of mid air are extremely low).

Another construct of HBM has to do with a person’s perception of the efficacy of the health behavior (e.g., the treatment, regimen, or program being suggested to improve health). If people do not believe that a treatment is effective, then they are not likely to change their behavior. Sometimes, this term is referred to as behavioral efficacy (Janz et al., 2002). According to HBM, simply realizing that a treatment is effective is not enough to motivate behavior, even if the perceived threat is high. Perceived barriers may interfere with behavioral change. For example, a person who is trying to quit smoking may find it hard to do if his or her spouse smokes.

While HBM is now used to explain adoption of “life behaviors” like wearing a seat belt, it was originally designed to explain participation in one-time health behaviors, such as disease screening (Becker & Maiman, 1975; Becker et al., 1977). Another change to HBM is the inclusion of self efficacy as an explanatory variable for behavior change (see Rosenstock, Strecher, & Becker, 1988; Strecher, McEvoy DeVellis, Becker, & Rosenstock, 1986).

The concept of cues to action is a component of original HBM theory (Hochbaum, 1958) that has not been systematically tested. This posits that even given a psychological state that readies a person for behavior change (based on the concepts outlined above), behavior change will not occur unless certain cues are present. Using the example of quitting smoking, a cue could be increased difficulty in walking up stairs, or the presence of lung cancer. Additionally HBM includes a concept of barriers to behavior change that is not explicitly included in all health behavior change models.

Support for HBM constructs has been found in several studies when tested independently or compared against other “unorganized” predictors (see Aiken, West, Woodward, & Reno, 1994; Aiken, West, Woodward, Reno, & Reynolds, 1994). For example, studies of mammography screening and perceived susceptibility to breast cancer have found that tailoring messages to potential participants based on their beliefs about screening increased screening. Similarly, tailoring messages based on perceived susceptibility, benefits, and barriers also increased screening (Duan, Fox, Derosé & Carson, 2000, cited in Janz et al., 2002). However, in at least one study comparing the predictive power of HBM with TRA, the latter model was found to be a better predictor of males’ safe sex practices in Thailand (Vanlandingham, Suprasert, Grandjean, & Sittitjai, 1995).

A review of studies on HIV protective behavior by Janz et al. (2002) concluded that differences in the role of perceived susceptibility to HIV/AIDS could be accounted for by the different measures of susceptibility used in different studies, generally reflected by different wording of questions intended to measure perceived susceptibility. The authors recommended expanding susceptibility questions in research to include the conditions of action. For example, in terms of

seat belts, the question “If you do not wear a seat belt, how likely are you to get injured in a car crash?” is preferable to “How likely are you to be injured in a car crash?”

It is also possible that race and ethnicity may explain some differences in behavioral outcomes. In a few studies on mammography screening reviewed by Janz et al. (2002), it was found that African American females perceived different barriers to breast cancer screening than White females and exhibited higher levels of fatalism toward cancer (i.e., “I’ll get it if it’s meant to be”), suggesting a lower degree of self-efficacy. This is of interest for seat belt use research, given some study findings that belt use is lower among African American drivers than White drivers (e.g., Vivoda et al., 2004).

While HBM has not generally been applied to the issue of seat belt use, it may be useful to do so. HBM’s dual constructs of perceived susceptibility and perceived severity seem particularly relevant to efforts to increase seat belt use. Given the relatively low risk of a crash on any given trip, it may make sense for intervention efforts to emphasize the “severity” component (the chance and magnitude of injury, given that a crash has occurred) rather than the susceptibility to being involved in a crash. Alternatively, a high susceptibility message might be effective if the outcome were a traffic citation (a relatively frequent event) rather than a crash (a relatively rare event). The construct of “cues to action” could be used as well, in encouraging the development of a belt wearing habit. Individuals could remind themselves to put on their seat belt when they start their car (a potential cue) until it becomes an unconscious habit.

Protection Motivation Theory

Protection Motivation Theory (PMT) attempts to explain the role of a person’s “appraisals” of information and situations in their behavior change. PMT focuses on how people deal cognitively with fear communication and how that affects their behavior, and was developed to understand how individuals deal with fear messages (Maddux & Rogers, 1983; Rogers & Deckner, 1975; Rogers, 1975; Rogers, 1983). PMT differs from the other theories discussed so far in that its original intention was specifically to understand cognitive components of communication and resulting behavior (while TRA/TPB focused on the attitude-behavior link and the HBM focused on health beliefs). However, there are many similarities, and the application to health behavior (including seat belt use) is clear.

The key components of PMT are threat appraisal and coping appraisal. Threat appraisal refers to an individual’s judgment of the threat posed by an unhealthy behavior and is the basis for motivation. However, the individual’s coping resources (e.g., ability to deal with the threat) are often the determining factor in whether or not action is taken, or what kind of action is taken. The coping appraisal involves consideration of the individual’s self-efficacy and the efficacy of the behavior, or response efficacy. These appraisal constructs are crucial to determining whether an individual will be motivated toward taking health protective actions. Rippetoe and Rogers (1987) found that inducing high self-efficacy and response-efficacy lead to adaptive coping (as opposed to maladaptive coping).

Comparisons between PMT and HBM suggest two major differences (Prentice-Dunn & Rogers, 1986). One is the organization of concepts in the two models. According to Prentice-Dunn and Rogers (1986), HBM is organized as “catalogue of variables” in which each of the components is “added up” to predict whether a health behavior is performed. PMT, on the hand, proposes a dual process causal chain, one predicting a maladaptive or adaptive response and the other including

factors that increase or decrease each of those outcomes. The second distinction between HBM and PMT is the inclusion of emotional states in PMT. This seems to be an appropriate advance, given recent research on the role of emotion in decision making suggesting that intentions or actual behavioral movement toward healthier life styles may not always be completely rational (Isen & Labroo, 2002; Loo, 1984; Schwarz, 2000).

Milne, Sheeran, and Orbell (2000) conducted the first meta-analytic review of PMT to evaluate its effectiveness in predicting health-related intentions and behaviors. They included 27 studies involving the application of PMT to health-related behaviors such as breast-examination, smoking cessation, or adopting a healthy diet (with no studies identified on seat belt use). Both the threat and coping appraisal components of PMT were found to be significantly associated with intention, although the latter had greater predictive validity (with self-efficacy being the best predictor of intention and behavior). Health-related intentions were significantly associated with subsequent behavior. Overall, PMT was useful in predicting concurrent behavior but of less use in predicting future behavior.

Floyd, Prentice-Dunn, and Rogers (2000) also conducted a meta-analysis of PMT and found moderate support for each of the model components. Self-efficacy showed the strongest predictive power (influencing behavioral intentions) across studies. Neuwirth, Dunwoody, and Griffin (2000) found support for PMT, noting that in an experiment with a fictitious news report about the negative impact of fluorescent light on academic performance, level of risk, severity, and efficacy together produced the greatest intentions to take protective behavior. The authors also noted that providing information about the severity of the hazard's consequences led to more information seeking. It appears that just providing a little bit of information, in this particular form, led participants to seek out more information on their own. In another study of simulated risk information, Beck (1984) found that intentions to engage in protective behavior were influenced by the severity of the outcome, as well as the individual's belief or expectation that he or she could successfully master the behavior (self-efficacy).

In a study of exercise behavior, Plotnikoff and Higginbotham (2002) found, consistent with the earlier meta-analyses, that the coping appraisal components (e.g., self-efficacy and response efficacy) predicted exercise outcomes better than the threat component. This suggests that, for this behavior anyway, it is less about the information in the message and the perceived risk than it is about one's perceived ability to take action and the belief that the action will make a difference. Conversely, Umeh (2004) found that fear appeal and previous behavior predict safe sex behavior independently (with previous behavior accounting for 9 percent of the variance in behavior over and above PMT variables, a fairly large increase in statistical terms). The authors concluded that the intervening cognitive components of the coping appraisal are less important than the quality of the threat itself.

Transtheoretical Model (Stages of Change Theory)

The Transtheoretical Model (TTM) is one of a family of models that explicitly formalize stages of change that individuals go through when adopting health behaviors. Other theories of behavior change may implicitly include stages of change (in fact, all change has at least two stages, before the change and after the change), but TTM and other stages of change models break up behavior change into finer steps (stages) of progress. Reviews of TTM can be found in Prochaska (2006a, b); Prochaska, DiClemente, & Norcross (1992); and Prochaska, Redding, and Evers (2002). Fuller detail on stage theories in general can be found in De Vet, Brug, De

Nooijer, Dijkstra, and De Vries (2005); Dijkstra, Tromp, and Conijn (2003); and Weinstein, Rothman, and Sutton (1998).

TTM was developed originally to understand how psychotherapy leads to change in individuals who are in treatment (Prochaska, 1979; Prochaska, et al., 1992). Despite its origins, the TTM has become a theory for understanding general health behavior change, and has been applied to: smoking cessation (Prochaska, Delucchi, & Hall, 2004; Prochaska, Velicer, Prochaska, Delucchi, & Hall, 2006; Prochaska, Teherani, & Hauer, 2007); diet (Di Noia, Schinke, Prochaska, & Contento, 2006; Prochaska, Sharkey, Ory, & Burdine, 2005); breast cancer screening and skin cancer avoidance (Prochaska, Velicer, et al., 2005); and community and work health issues (Prochaska, 2007). Because there are generally stages that include “pre-treatment” individuals, TTM has more appeal outside of psychotherapy research than other “clinical theories” might.

Five specific stages are specified in TTM: 1) precontemplation, 2) contemplation, 3) preparation, 4) action, and 5) maintenance (Prochaska et al., 1992). Precontemplation is characterized by complete lack of awareness of a problem. Individuals in this stage have no plans to change behavior in the next 6 months and are often unaware of any problem (i.e., a “denial” stage). Individuals in the contemplation stage have moved beyond precontemplation in a couple of ways. First, they have realized that they have a problem. Second, they have thought seriously about changing, weighing the pros and cons of potential actions. No specific plan has yet been made or action yet taken, but individuals in this stage intend to take action in the next 6 months. In the preparation stage, individuals plan to take major action in the next 30 days, and have already begun to take initial steps. Between the contemplation stage and the preparation stage, a specific plan of action has been made. The action stage then involves the overt behavior change that has been planned. The behavior change can persist for up to 6 months, at which point individuals move into the maintenance stage (i.e., changed behavior lasting for 6 or more months). The maintenance stage is the only stage in which true change can be said to have occurred, with actions taken in the action stage not considered true change but rather initial movement toward a behavior change goal.

Stage progression is an important factor to include in any stage theory of health behavior or any intervention based on such a theory. Prochaska et al. (1992) proposed a spiral model of stage progression suggesting that as individuals progress through the stages, they may relapse and then re-progress through stages until they reach maintenance. One critique of stage progression in the TTM is Prochaska’s choice of time frames to define stage qualities. The 6-month and 30-day timeframes do not appear in every outline of the TTM by Prochaska. It is unclear where these timeframes come from, whether they apply to all behaviors, and whether they are averages, ideals, or something else. It seems reasonable that some behaviors might better be thought of in terms of “number of occurrences” (or opportunities) rather than in terms of arbitrary timeframes.

The qualities of each stage are also important. For stages to be distinct there needs to be something qualitatively different about individuals in each stage. Prochaska defined his stages clearly and developed what he called his “Strong Principle” to define the progress from precontemplation to action (i.e., a 1 standard deviation increase in the “pros” of behavior change and a 0.5 standard deviation decrease in the “cons” of behavior change; Prochaska, 2006a).

Prochaska et al. (2006a) note that two methods have been used to measure stages of change, one which produces a categorical variable indicating whether a person is in a stage, and the other producing a continuous measure for each stage (McConaughy, DiClemente, Prochaska, & Velicer, 1989; McConaughy, Prochaska, & Velicer, 1983). Using the latter method produces

four scales, rather than the five reported above, and a 4-stage model can be found in their earlier work (see Prochaska & DiClemente, 1983, 1985, 1986). As often happens in scientific literature, some debate has arisen about the construction of and support for the TTM. Prochaska (2006b), in clarifying the assumptions of TTM, asserted that it is not bound in rational decision making, and that learning and conditioning principles have always been a part of TTM.

While most of the studies using the TTM framework do not address seat belt use, some of the general findings are applicable to the study of belt use. One key finding of TTM research is that treatments or interventions should be matched to the stage that a given person (or group of people) is in (Prochaska et al., 1992). Because seat belt use interventions are likely to be group-based (population-based) interventions, such as public awareness campaigns, estimates of proportion of irregular belt users and nonusers in various stages of change would be a good place to start if TTM or other stages of change models are going to be used to develop belt use programs. Similarly, any technologies that are developed to increase belt use (e.g., reminder systems, control locks) could try to take into account the stage of change for which these interventions would be most efficacious. For example, a reminder alarm might not be effective for someone who does not view nonuse as a problem (precontemplation).

The Precaution Adoption Process Model (PAPM)

The Precaution Adoption Process Model (PAPM) is also a stage theory that hypothesizes seven stages of change from “unhealthy behavior” to “healthy behavior.” Although this theory closely resembles TTM, proponents of PAPM argue that it is distinct from TTM (Weinstein & Sandman, 1992, 2002a, b; Weinstein, Lyon, Sandman, & Cuite, 1998). The first obvious difference is the number of stages (seven versus five), but there are differences in the definition of the stages as well. The stages of PAPM are: unawareness of the problem; awareness but no serious thoughts of change; consideration of change but decision against; deciding whether to make a change; decision to make a change; acting on the decision; and maintaining change.

The first stage, lack of awareness of the problem, is a stage of denial, just like the first stage in the TTM. PAPM distinguishes between unawareness and awareness with no serious thought of change (stage two), putting them in two distinct stages. In the second stage of the PAPM, individuals have heard about their potential problem and begin to form an opinion about it, but are not personally engaged in planning to change. In stage three, change is considered, but decided against. In the fourth stage, individuals are deciding whether to make a change, and in the fifth stage, they have decided to adopt a change. They do not act on the change until stage six. Stage seven involves maintenance of the change.

The stages in PAPM are more circumscribed than those of TTM, particularly at the beginning of the change process. The TTM “precontemplation stage” is broken into three distinct stages in PAPM (unaware, aware no action, consider but decide against). Another difference between the two theories is that PAPM does not make specific statements about the amount of time a person has been (or will be) in a certain stage.

A criticism of PAPM might be that the stages in the model do not seem to be logically contiguous in time. For example, stage 4 (trying to decide whether to adopt a change) comes after stage 3 (considered a change but decided against it), without an explicit feedback loop at stage 3 that sends those people back to stage 2. Weinstein and others (Weinstein & Sandman, 2002; Weinstein & Sandman, 2002a, b; Weinstein et al., 2003) may have assumed this feedback

loop or something similar to Prochaska's circular model of progression through stages over time, although the mechanism for that process is not clearly identified.

Several cross-sectional studies using the PAPM framework have focused on radon testing as a preventive health behavior (e.g., Weinstein and Sandman, 1992; Weinstein et al., 1998; Weinstein et al., 2003; Weinstein & Sandman, 2002a, b). Weinstein and Sandman (1992) found that, across several different data sources, the factors that cause individuals to think about radon testing are different from the factors that influence the actual decisions they make (including both the decision not to test and the decision to test, as well as remaining undecided). The authors concluded that their data support a change process defined by stages rather than a continuous increase in likelihood of change. Similarly, Weinstein et al. (1998) tested an intervention to encourage home radon testing based on the finding that different information or actions is required to move individuals between different stages. A "risk intervention" was designed in which participants were presented with information about the risk of radon. This was intended to move undecided individuals to a decision to test for radon. A second "low-effort testing kit" was designed to move those who had decided to test, but not done it, to order a test kit. Predicted effects were found.

Radon testing may serve as a good parallel health behavior to seat belt use because of the lack of immediacy of the health problem. The health risks of radon are not immediately obvious, just as the potential for being injured in a crash may not be immediately obvious, and thus the need to take action toward appropriate health behavior (e.g., either testing for radon or wearing a belt) may not be clear.

To help inform practice, Weinstein and Sandman (2002a, b) outlined how interventions might be most effective at various stages:

- For Stage 1 and 2: Media messages should contain information about hazards and precautions.
- For Stage 2 to 3: Testimony of people experiencing hazard, messages from significant others, and personal experience with the hazard will be the strongest predictors of change.
- For Stage 3 to 4 or 5: Beliefs about hazard, personal susceptibility, precaution efficacy, social norms, fear and worry will be the strongest predictors of change.
- For Stage 5 to 6: Time, effort, and resources are needed in order for people to act. How-to information will be helpful, as will be reminders and cues. Assistance taking action may be required.

As with all behavior change theories, each of the PAPM stages can be applied to the progression from seat belt nonuse (or part-time use) to full-time use. However, Weinstein (1988) cautions against applying too many complex concepts and stages to behaviors that are more habitual than intentionally conscious. It is still unclear which category of behavior best suits seat belt use. It may be that seat belt use is both conscious and intentional for some people (nonusers and part-time users), and habitual for others (full-time users). Nevertheless, PAPM appears to have some usefulness as a framework for developing interventions to increase belt use. For example, it might be reasonable to think (and empirically verify) that most nonusers are in Stage 1 (unaware of the problem), and most part-time users are somewhere between Stage 2 and 6 (thus making

belt use infrequent, depending on how they feel on a given day or driving trip). Given this conclusion, the focus would then be on getting nonusers (Stage 1) to become aware of the problem (possibly through direct information campaigns), and getting part-time users (stage 2-6) to maintain their use.

Conclusions

The comparison of these theoretical models of behavior change raises the question of how they differ (see Table 9) and which one is best for changing seat belt use behavior. From the theoretical side, there appears to be increasing overlap between these distinct theories, so that what once were clear differences have become fuzzy. This is a trend in psychology and social/behavioral science on a larger scale, as researchers begin to change their focus from “theory-based” to “problem-based” (Sternberg, 2005; Sternberg & Grigorenko, 2001). This can make the job of application both easier (because the options from which to choose are sometimes more similar than different), and more difficult (because it may also be important to know which theory will work best for a particular situation). The literature on stages of change theories suggests that both theory application in research and intervention application in practice might be improved by taking into consideration the stage an individual is in when the intervention (or empirical study) is applied.

Table 9: Model/Theory of Behavior Change Comparison Table

Theory	Stages	Key Components and Mechanisms of Change	Applications to Health Behavior
TRA/TPB	None	Behavioral intentions are caused by attitudes toward behavior and subjective norms. Perceived behavior control also impacts behavioral intentions. Behavioral intentions are linked to actual behavior. Behavior explained by this theory must be under volitional control.	Smoking, condom use, weight loss, diet, giving blood, testicular self-exam, marijuana use, drinking low-fat milk, gambling, gang violence, breast feeding, drinking and driving, sexual behavior, breast self-exam, Lamaze child birth, physician and healthcare worker behavior, domestic violence.
HBM	None	Perceived threat consists of susceptibility and severity of consequences. Susceptibility and severity must both be high in order for threat to be high. Perceived benefit includes efficacy of the health behavior. If the efficacy of the health behavior is seen as high, a person is more likely to do that behavior. Barriers can keep a person from taking health behavior action even when threat and behavior efficacy are both high. Emphasis is placed on <i>perceived</i> threat and <i>perceived</i> efficacy. Cues to action may initiate health behavior. Self-efficacy is an independent component of the model.	Mammography screening, compliance with physician recommendation, HIV protective behavior.
PTM	None	Fear arousal (from fear of an outcome) results from threat appraisal (including: perceived vulnerability; perceived severity). Coping appraisal includes response efficacy and self-efficacy.	Safe sex, health compliance, exercise.

		Personal mastery of a behavior may relate to increased behavior, too.	
TTM	5	Five stages: 1) precontemplation, 2) contemplation, 3) preparation, 4) action, and 5) maintenance. The “Strong Principle” states that there is a 1 standard deviation increase in the “pros” of behavior change and 0.5 standard deviation decrease in the “cons” of behavior change that defines the progress from precontemplation to action. Individuals can progress and relapse and re-progress through stages in a circular fashion. The maintenance stage is the only stage at which true change can be said to have occurred.	Smoking cessation, diet, skin cancer prevention, mammography screening, and meat consumption during livestock epidemic.
PAPM	7	Seven stages: 1) unawareness of the problem, 2) awareness but no serious thoughts of change, 3) consideration of change but decision against, 4) deciding whether to make a change, 5) decision to make a change, 6) acting on the decision, and 7) maintaining change. PAPM distinguishes between unawareness and awareness with no serious thought of change, putting them in two distinct stages. TTM “Precontemplation stage” is broken into three distinct stages in PAPM (unaware, aware no action, consider but decide against).	Home radon testing, osteoporosis prevention.

POLICY/ENFORCEMENT/INCENTIVE

Policy to encourage seat belt use is informed by many factors, including those described in previous sections. This discussion of seat belt policy, enforcement, and incentive is divided into five subsections: mandatory belt use laws, enforcement of belt use laws, workplace policies, incentive programs, and insurance policies.

Mandatory Belt Use Laws

There is wide agreement that mandatory belt use laws work. When enforcement is highly publicized, primary belt laws have been shown to increase belt use, decrease fatalities and injuries, and save money (Alliance of American Insurers, 1982; Wortham, 1998). Primary laws can also establish seat belt use as the social norm, thus also setting the stage for social influence to promote compliance (Geller, 1988). Eventually, standard belt laws can also lead to habitual use of seat belts, as suggested by the prevalence of habitual belt use in states with belt laws. This is important because habitual belt use has been shown to be a significant contributor to continued belt use, as described earlier (e.g., Knapper et al., 1976; Sutton & Hallett, 1989). There is also evidence that mandatory belt laws can actually bring about more favorable attitudes toward seat belt use (e.g., comfort, convenience), though consistent nonusers may become more hostile (Fhaner & Hane, 1979). One potential problem with increased belt use is that it is sometimes accompanied by compensatory risky behavior, whereby a belt user may become more likely to engage in other risky driving behavior (such as speeding), as if to “compensate” for the protection brought by belt use (Mackay, 1985; Peltzman, 1975). However, other and more recent empirical studies found no evidence for such compensatory driving behavior (e.g., Cohen & Einav, 2003; Kunreuther, 1985). That said, even a compensatory increase in risky behavior may not necessarily translate into injury because it is accompanied by the protective behavior (e.g., belt use).

One of the main issues regarding mandatory belt use laws concerns the distinction between primary and secondary laws (Wortham, 1998). As of May, 2009, only 26 states, the District of Columbia, and Puerto Rico had primary laws, which allow law enforcement personnel to stop motorists on the basis of observing a seat belt violation (Pickrell & Ye, 2009b). The remaining states, with the exception of New Hampshire, have secondary laws, whereby an officer must observe some other violation first before stopping a vehicle. New Hampshire has a belt law that applies only to those under the age of 18. Data show that primary laws are considerably more effective in promoting seat belt use (Wortham, 1998). States with primary laws have average seat belt use rates of 88 percent, while the average in states with secondary laws is 77 percent (Pickrell & Ye, 2009b). Increases in belt use are significant as it is estimated that every 1-percentage point increase in the national seat belt use rate translates into 136 fewer occupant fatalities (Cohen & Einav, 2003). Predictions also suggest that if every state were to enforce primary belt use laws, there could be a savings of 1,736 lives a year, and as much as \$3 billion in medical and other costs to society (Wortham, 1998). There accordingly has been increasing incentive and pressure on states to upgrade to primary laws. Belt use rates aside, there are a number of underlying problems with secondary laws. They at best send a mixed message to drivers suggesting that violations for not wearing a belt may not be as important as other traffic violations (e.g., speeding). To that extent, advocates for belt use laws argue against the concept

of secondary enforcement, maintaining that a law is either a [primary] law, or it is not a law (Wortham, 1998).

So why then are so many states still short of having primary belt use laws? As discussed in the section on national culture, one argument against mandatory laws has to do less with their effectiveness and more with their legitimacy, which basically questions the state's right and/or duty to enforce such laws (Geller, 1985; Wilson, 1984). To that extent, states that enforce primary seat belt laws have had to first evolve to a status where such laws are acceptable to the majority of the public (Fisher, 1980). Thus, convincing voters that the balance between individual rights and public safety, though a delicate one, points in favor of primary belt enforcement, will be an important first step in moving secondary enforcement states to primary enforcement (Booz, 1986).

Belt Enforcement

Enacting primary belt laws is only a step toward increasing belt use (Geller, 1988). Enforcement is also critical, as use rates often start to drop after a period of time (Cope, Johnson, & Grossnickle, 1990). Data from Hawaii suggest that enforcement is the major factor in achieving a high rate of compliance (Kim, 1991). There is also evidence that *perceived* enforcement of belt laws contributes more to compliance than actual enforcement (NHTSA, 1998; Shinar & McKnight, 1985). Highly visible enforcement, which is enforcement combined with effective media support, greatly increases the perceived risk of apprehension, even if the actual risk is only slightly higher. This is consistent with empirical data showing that enforcement of seat belt laws needs to be highly publicized for maximum compliance (Fell et al., 2005). This is also consistent with the argument against secondary enforcement mentioned above, as it underscores the importance of drivers' belief in the seriousness of the seat belt laws, which is undermined when a state stops short of passing primary laws. Still, to reach and maintain a high rate of belt use, more comprehensive approaches to seat belt promotion are necessary. This includes behavioral approaches such as incentives and disincentives, rewards and positive reinforcers, commitment, education and media campaigns, as well as simple reminder systems (Geller, 1988). Much is known about these individual mechanisms of behavior change, as is discussed elsewhere in this report. Finally, there exists strong evidence that current media campaigns are ineffective in that they emphasize the relatively low-probability loss dimension, whereas the recommendation is to emphasize instead the relatively high probability of a crash happening over time rather than on a single trip (Kunreuther, 1985).

Workplace Policies

Workplace policies that encourage or even require employees' seat belt use have great payback potential to corporations and government institutions, as the financial cost for each employee fatality is estimated at \$120,000 in direct payments, not including productivity losses and other related expenses, most of which can be avoided or reduced with regular seat belt use (Geller, 1986).

Campaigns to promote seat belt use in the workplace have been shown to be effective in increasing belt use among employees, and reducing fatalities and injuries, particularly in the short run (Cope, Grossnickle, & Geller, 1986; Eddy, Fitzhugh, Wojtowicz, & Wang, 1997;

Geller, 1986; Johnston, Hendricks, & Fike, 1994). Yet, the relapse rate remains above baseline. These programs often use incentive approaches that follow three basic patterns that rely on extrinsic motivation: direct and immediate rewards, direct and delayed rewards, and indirect rewards. A fourth intrinsic strategy relies on commitment rather than rewards. In one review of 28 workplace seat belt programs, it was found that all patterns of intervention significantly increased employee seat belt use (Geller, 1986). It was also found that only the intrinsic (no reward) intervention maintained an exceptionally high belt use rate, both in the immediate and long-term. However, this intervention also involved greater cost for implementation. Some programs have been successful in combining commitment and incentive strategies, but still showed smaller relapse with commitment (e.g., signing a pledge card) than without (e.g., Nimmer & Geller, 1988). Other findings also show that seat belt use often declines after termination of workplace intervention, although the relapse rate tends to remain above the baseline rate (Eddy et al., 1997).

There seems to be strong evidence for the superiority of workplace interventions that rely on intrinsic motivation, e.g., commitment through pledge-cards, as opposed to reward incentives (e.g., Nimmer & Geller, 1988). To the extent that intrinsic incentives utilize both behavioral as well as cognitive mechanisms, it is not surprising that they maintain greater and longer-lasting behavior change. It would therefore be worthwhile to investigate more techniques and more cost-effective ways to administer interventions that are based on intrinsic motivation. It would be useful to find ways to popularize workplace promotion programs among all sizes and types of corporations to ensure the greatest rate of belt use in the general population. The review of the literature also shows that most of the empirical data come from dated studies, thus underscoring the need to conduct more current reviews of workplace programs.

Incentive Programs

Incentive programs for belt use capitalize on the delivery of rewards for belt use rather than punishment for nonuse (Streff, 2004). This type of extrinsic motivation has been shown to promote a rewarded behavior under the assumption that people act to maximize rewards and minimize costs, and that concrete, immediate rewards are more influential than ones which are abstract or remote (Elman & Killebrew, 1978). Another underlying principle suggests that smaller, more frequent rewards can be more effective for shaping behaviors than less frequent, greater rewards (Hunter & Stutts, 1982).

Impetus for applying incentives to seat belt use grew out of the realization that the acknowledged safety benefits of belt use alone are not sufficient to make most drivers buckle up (Elman & Killebrew, 1978). Further support came from behavior theorists who argued that positive consequences (e.g., rewards for use) are more effective in promoting belt use than negative consequences (e.g., punishment for nonuse). This is especially true for practical purposes as the latter punishment approach would have to be carried out consistently and indefinitely to maintain its effects (which is a real difficulty with belt law enforcement). This behavioral approach to learning developed out of the early work by Skinner, whose research in operant conditioning showed that voluntary behavior can be reinforced by rewarding good behavior and punishing bad behavior (Skinner, 1953). Data show incentive programs to be highly effective in increasing belt use, as discussed in the previous section on workplace policies. The problem is that the most common incentive programs are reward-based, which tend to show less long-lasting increases in belt use than the more intrinsic, no-reward programs that rely instead on individuals' commitment to wear seat belts (e.g. Roberts, Fanurik, & Wilson, 1988). Incentive programs

have also been shown to be relatively cost-effective in that the probability of reward payments can be lowered without sacrificing the increase in belt use rates. Furthermore, findings suggest that behavior change can be improved and maintained by scheduling the short-term incentive and reward programs intermittently, and combining the intervention with education and information campaigns (Geller, 1986; Streff, 2004). It is surprising that some studies have failed to show the beneficial effect of rewards and commitment altogether, showing instead that “awareness” sessions were sufficient to produce behavior change (e.g., Cope et al., 1986).

In spite of some conflicting results, research on incentive programs generally suggest promising results, particularly when reward incentive interventions are intermittent, when the incentives are intrinsic (e.g., commitment), or when combined with other interventions (e.g., education). One issue of concern is that the literature on incentives is dated; more current data are needed to ensure that improvements in seat belt use rates related to the increase in mandatory belt laws and other factors do not influence the ways in which drivers respond to incentives. Also, it is important to investigate the trade-offs between reward and non-reward strategies given that recommendations for effective behavior change differ across studies (see Geller, 1986). Finally, the issue of the counter-incentive to seat belt use, that is, the fact that people are usually rewarded for nonuse by reaching their destination unharmed almost every time they drive unbuckled, appears to be understudied and may help inform incentive and/or other belt promotion strategies (Hunter & Stutts, 1982).

Insurance Policies/Rules

From an economic perspective, the insurance industry has a vested interest in promoting seat belt use (Coonley & Gurvitz, 1983). This is usually done either through reduced premiums (for regular belt use or for vehicles with automatic restraint systems), increased compensation to those injured while wearing a seat belt, or premium refunds to those who incur relatively low medical costs in a given year. These incentives can be administered by any type of insurance, namely, auto, health, life, or worker’s compensation (Coonley & Gurvitz, 1983; Kunreuther, 1985).

Survey results indicate that many nonusers would comply with belt use laws to avoid driver license points and the subsequent rise in insurance premiums, but would be indifferent to higher fines (Reinfurt, Williams, Wells, & Rodgman, 1995). On the other hand, studies show no increase in seat belt use when insurance companies increase compensation to clients injured or killed in a vehicle crash while using a seat belt (Robertson, 1984). This difference may be explainable on the basis of the different types of insurance incentives, with premium reduction being a more tangible incentive than compensation since the latter involves the probability of being in a crash which has already been shown to be problematic for motivating drivers. Either type of incentive is complicated by the difficulty of verifying belt use, as self-reported figures tend to exceed actual usage for both regular use (to warrant reduced premium) or use during a crash (to warrant increased compensation). However, there is evidence that another type of incentive, premium refunds for policyholders who have incurred relatively low medical expenses in a given year may be effective (Kunreuther, 1985). While this incentive does not explicitly target seat belt use, it benefits from easy verification and assumes that policyholders concerned with financial incentives would be enticed to use seat belts as well as practice other safe driving behaviors.

The premium refund strategy seems to be the most promising of the three insurance incentives in terms of both belt use promotion as well as validation. However, no data are available that compare its effectiveness to the other two incentives, increased compensation and reduced premium. It also would be of value to look at better ways of validating policyholders' reported use of seat belts, either through more personal human contact or through other ways of self-report, or possibly use of data from on-board vehicle computers. Finally, much of the data on insurance incentives are dated, and thus more recent comprehensive studies would be very useful in determining the current effectiveness of insurance incentives.

Conclusions

The findings on policy and enforcement demonstrate the need for maintaining and upgrading mandatory belt use laws to primary enforcement across the US. If promoting seat belt use among all drivers is the objective, this would be best accomplished by speeding and ensuring the adoption of legislation mandating primary enforcement in states with secondary laws. The major obstacle seems to be resistance towards mandatory safety measures by those who view them as intrusions and infringements of freedom. It may be possible to make the case for a compromise that accommodates both mandatory laws as well as American ideals. Such a campaign can be easily started in school—as early as pre-school—and would eventually bring to fruition an American value that respects traffic safety regulation as well as individualism. However, it appears from the findings that even mandatory laws do not guarantee full compliance. At the same time, having a consistent policy of primary enforcement from coast to coast sends the right message to nonusers of seat belts, in effect changing the social norm of the US to one where regular seat belt use is standard. One need not expect immediate compliance, but combined with other strategies (e.g., incentives, social norms, education), belt use rates are likely to reach new highs.

Incentives work, and are worth the implementation costs, whether they are implemented in the workplace, through insurance policies, or as stand-alone seat belt campaigns. It would be valuable to study more extensively the effectiveness of different incentive strategies to determine the best combination of intrinsic and extrinsic strategies. However, their effectiveness is not likely to surpass the combined effectiveness of mandatory laws and education because incentive programs, by definition, are specific to particular, detached, institutions and programs, making them difficult to influence long-standing lifestyle changes. However, there is evidence that a combination of interventions can have substantially better increases in belt use rates (Johnston et al., 1994). It is unquestionable that these interventions, when combined, can bring about various levels of immediate to long-term increases in belt use as drivers and passengers begin to collect rewards and get accustomed to new social norms.

COMMUNICATION AND EDUCATION

Nearly all efforts to increase use of seat belts involve the transmission of information to both inform the public and persuade them to use seat belts on every trip. This section focuses on general topics of communication and education in relation to promoting the use of seat belts. The section focuses on the four pre-eminent communication approaches to promote belt use: risk communication; public information and education programs; public information and education as supplement to law enforcement; and marketing. Many communication and education programs have been developed and implemented to inform the public about the importance of wearing a seat belt. Often included in these programs are risk communication and marketing strategies. Risk communication involves informing the public about the dangers of not wearing a seat belt. Marketing techniques can be utilized to increase the effectiveness of media campaigns. This section examines these four topics both in a general way and with specific application to belt use promotion research.

Risk Communication

Risk communication has been defined as “a complex, multidimensional, evolving approach to communicating with the public about issues that pose a threat to health safety or the environment” (Aakko, 2004, p. 25). The purposes of risk communication generally include raising the public’s awareness of the risk, educating the public, motivating the public to take action, and obtaining the public’s trust (Bier, 2001). Covello and Allen (1988) developed seven cardinal rules for risk communication: make the public a partner; carefully plan and evaluate the design; listen to the concerns of the public; be honest, frank, and open; involve credible sources; meet the media’s needs; and speak with clarity and compassion.

The spokesperson is an important aspect of a risk communication campaign. Spokespersons viewed as credible and trustworthy usually exhibit the following qualities: caring and empathy, dedication and commitment, competence and expertise, and honesty and openness (Aakko, 2004). A spokesperson’s credibility is not only affected by his or her actions but also by the actions of the institution(s) represented (Covello, 1992). Physicians and university professors are often viewed as credible and trustworthy spokespeople because they are seen as being motivated by higher goals (i.e., healing or truth and knowledge) and as independent of those for whom they consult (Covello, 1992). They are therefore free to hold their own beliefs.

Trust is a particularly important part of any effective risk communication message. It is essential to gain the public’s trust from the start because once trust is gone, it becomes difficult to get back (Covello, 1992). Trust is believed to involve three components: fairness, competence, and efficiency. The message must be perceived as fair to the public and not focused on a particular group of interest. Those designing and implementing a risk communication program must be viewed as competent. Finally, the public must feel the program is efficient and that money is not wasted in implementing the program (Lofstedt, 2003).

The development of the message itself is a critical stage in the design of a risk communication campaign, so every attempt should be made to create the most effective communication possible. The message should be clear and use non-technical language so that every member of the target audience can understand it (Arkin, 1989; Covello, McCallum, & Pavlova, 1989). The message should also contain concrete images, examples, and anecdotes as well as visual aids to attract attention and make the message real to the audience (Covello et al., 1989). It is important to use

consistent messages if there are multiple campaigns, so that the audience does not become confused or lose trust (Arkin, 1989). One should carefully consider the tone and appeal of the message and be sure to avoid fear or anxiety appeals (Covello et al., 1989). It is important that the message meets the specific concerns and needs of the public (Arkin, 1989; Covello et al., 1989; Frewer, 2004). The message should be reinforced through delivery by multiple media outlets, including television, radio, billboards, and so on. Whenever possible, the message should include information on how to avoid or reduce the risk but at the very least provide the audience with avenues for seeking further information (Covello et al., 1989).

Careful consideration should be taken when deciding which channels to use for delivering the risk communication message. It is important to make sure that the selected channel will deliver the message to the intended audience and that the message itself is appropriate for the selected channel. The selected channels should be credible to the target audience. The message should utilize multiple media sources and social networks in order to have the broadest reach. Program implementers should work with the media in order to establish good relationships for future campaigns (Covello et al., 1989).

It is important to consider the target audience when planning a risk communication campaign. Surveys and focus groups can be used to examine the values, beliefs, and knowledge of the target audience (Covello et al., 1989). The risk communication message should acknowledge the public's fears and anxieties about the health risk through words and actions (Covello et al., 1989). It is also important to evaluate risk perception when designing a risk communication message (Gray & Ropeik, 2002; Ropeik, 2004; Williams & Noyes, 2007). For example, people tend to be more afraid of a risk that is new to them as opposed to a risk with which they are familiar (Gray & Ropeik, 2002). Particular attention should be paid to the literacy level of the target audience when designing a risk communication program, especially if written materials will be distributed (Rudd, Comings, & Hyde, 2003).

In addition to the message itself, the medium presenting the message, and the target audience, there are other considerations that risk communication programs must take into account. Among these are what have been deemed "risk minimizers" and "risk amplifiers;" that is, organizations or people outside of the program who attempt to skew the risk in their favor. Both risk minimizers and amplifiers typically have a vested interest in the issue at hand and attempt to steer the media to portray the risk in a way that is favorable for their cause. Risk minimizers attempt to make the risk seem less hazardous, while risk amplifiers try to attract the media to play up the risk (Palfreman, 2001).

A promising approach for distributing risk communication messages has been referred to as the entertainment-education approach. This approach involves embedding the risk communication message within an entertainment medium, such as a soap opera or song. This can be accomplished through designing an entertainment program that incorporates the message or by getting existing programs to incorporate the message into their programming. This approach can send the message to the audience, perhaps without the realization that such a message is being sent (Backer, Rogers, & Sopory, 1992).

Public Information and Education (PI&E)

PI&E programs are aimed at changing behavior through educating people about the importance of an issue. For seat belts, these programs often include information regarding the reduction in injuries from automobile crashes due to seat belt use, as well as the costs accrued when belts are not worn and the injuries that can result from nonuse. PI&E programs can also be used to supplement enforcement efforts by providing information about the risks of getting caught for not using a seat belt. Many PI&E programs regarding seat belt use have been implemented in a variety of settings. This section discusses important aspects of designing an effective PI&E program and describes the effectiveness of previously implemented PI&E programs to increase seat belt use.

PI&E programs can involve a variety of components such as: public service announcements and other media campaigns targeted at low-use audiences; information workshops and high-visibility media spokespersons; newspapers and talk shows; seat belt honor roll awards programs and surveys sponsored by corporations; and the distribution of seat belt awareness information at community events and through audio and video media (Stefani, 2002). Several factors should be taken into consideration when designing an effective PI&E program: the issues need to be promoted because they are often not high on people's priority lists; the program should be developed with the information needs, interests, problems, and characteristics of the target audience in mind; the information should be easily available; the program can be strengthened by incorporating activities that require personal interaction and community involvement; and the information should be presented to a large audience and reinforced through the use of media campaigns (Filderman, 1990).

Statewide campaigns using the media to send educational messages appear to be effective at increasing seat belt use but it is often the case that more than one program is implemented at a time, making it difficult to determine which particular aspect or component of the campaign was responsible for the change in belt use (Clarke, Collingwood, & Martin, 1993). Beyond the overlap issue is the fact that most PI&E programs include multiple components. Rarely is an intervention based solely on educating the public because PI&E programs alone are rarely sufficient to change behavior. Educational campaigns often include some type of incentive for those who comply with the message of the program or are used to supplement other efforts, such as enforcement campaigns.

There are, however, a few stand-alone PI&E interventions that can be found in the literature. One of these programs involved a brief education session and short video presentation targeting mothers already attending a nutrition education program (Saunders & Pine, 1986). This stand-alone PI&E program was successful in increasing seat belt use among those females attending the session. Another program involved education in a workplace setting which led to increased seat belt use for passengers and drivers (Grant, 1990). Another study compared the effects of an educational program with and without the inclusion of incentives for wearing seat belts and found that the incentive did not alter the effectiveness of the educational program. Significant increases were found regardless of the presence of an incentive for wearing seat belts (Lehman & Geller, 1990).

PI&E programs that include the addition of incentives appear to be successful at increasing belt use (Campbell, Hunter, & Stutts, 1984; Cotton, McKnight, & McPherson, 1985; Hunter, 1986).

The Belt Use Campaign for Law Enforcement (BUCLE) included information, instruction, and incentive components in an attempt to increase belt use among law enforcement officers. As a result of the program, seat belt use increased significantly (Cotton et al., 1985). *Safety Belts Pay Off*, a campaign including education accompanied by incentives, also increased seat belt use in an urban community (Hunter, 1986).

Comprehensive community programs seem to be effective at increasing seat belt use (Froseth & Klenow, 1986; Marchetti, Hall, Hunter, & Stewart, 1992). One such program using PI&E presentations; a mascot; school programs; television, newspaper, and radio promotions; a state employee program; and an incentive program was successful in significantly increasing belt use (Froseth & Klenow, 1986). Another comprehensive program involved three main components: a workplace-based program focused on increasing seat belt use at several local businesses, a high-school-based program focused on spreading the message to elementary students, and a community program focused on spreading the word to the whole community (Marchetti et al., 1992). These three components working together were able to successfully increase belt use among drivers and passengers.

School-based education programs can also be effective at increasing seat belt use (Morrow, 1989; Wilkins, 2000). However, deviation from the suggested presentation format may decrease the effectiveness of the program as was the case with an intervention aimed at children in grades K-12 which only increased belt use among families in the low income group, perhaps due to low compliance with suggested instruction methods for the program at different schools (Hazinski, Eddy, & Morris Jr., 1995).

Many PI&E programs have been conducted in an attempt to increase the public's knowledge about the importance of wearing seat belts. However, it remains unclear as to which aspects of the programs are successful in changing behavior, and why PI&E programs by themselves do not have a bigger impact on people's behavior.

PI&E as a Supplement to Enforcement

It is common for PI&E programs to coincide with seat belt use law enforcement programs. These campaigns are generally effective at increasing seat belt use in a short amount of time (NHTSA, 2001). PI&E programs as a supplement to enforcement are often referred to as Highly Visible Enforcement (HVE) programs. When HVE programs are used to increase belt use, they should include the following components: observations of seat belt use before enforcement and throughout the remainder of the program; advertising that informs the public of the upcoming enforcement period (and of the importance of wearing a seat belt); highly visible enforcement during the enforcement period; and announcement of the results to the public (Helmick, Likes, Nannini, & Pham, 2002; NHTSA, 2001). The advertising accompanying the campaigns serves as a way to inform the public about the importance of wearing a seat belt, not just as a reminder that enforcement of belt laws is being increased.

There are numerous worldwide examples of successful PI&E campaigns that were used as a supplement to enforcement campaigns. The current and most effective program in the US, the *Click It or Ticket* campaign, has been shown to be highly effective in raising belt use (e.g., Solomon, 2002). The *There's No Excuse – So Belt Up* campaign conducted in Australia resulted in significant increases in seat belt use, particularly for rear seat passengers and those in rural towns (Wise & Healy, 1990). The *Buckle Up NOW!* Campaign in New York was also successful

at increasing seat belt use from 63 percent at baseline to 90 percent in just 3 weeks (NHTSA, 2001). *Buckle Up Kentucky: It's the Law and it's Enforced* was successful at increasing seat belt use by 6 percentage points (Agent & Green, 2004). A STEP conducted in the Netherlands resulted in increased seat belt use in the community receiving the campaign (Gundy, 1987). Another campaign conducted in several communities in Virginia was successful in increasing seat belt use from 52 percent at baseline to 73 percent at the end of the campaign (Roberts & Geller, 1994). The *US-31 SAVE* campaign was effective at increasing belt use from 56.7 percent to 65.1 percent (Streff, Molnar, & Christoff, 1992). The *Vehicle Injury Prevention* program in Texas successfully increased seat belt use by 15 percentage points (Hanfling, Bailey, Gill, & Mangus, 2000).

Marketing

Marketing is often an important part of any campaign aimed at increasing seat belt use. This section discusses marketing in terms of effective components of successful marketing campaigns as well as specific campaigns designed to increase seat belt use. Marketing is defined as a “process by which individuals and groups obtain what they need and want through creating and exchanging products and value with others.” (Kotler & Armstrong, 1997, pg. 4).

There are five steps involved in designing an effective marketing campaign: identify the target audience; determine sought response; choose a message; choose the channel to send the message; and collect feedback. When creating the marketing message one must choose which type of appeal to use (rational, emotional, moral) and the type of structure and format of the message (Kotler & Armstrong, 1997). Wansink (2000) describes four steps to improving marketing campaigns: examine why people don't buy the product; examine why people do buy the product; identify the target consumer for the product; and determine product, promotion, place, and price.

The effectiveness of the advertisement will depend in part on the level of involvement of individuals being targeted. If they are highly involved, that is, they are seeking information about the topic, they will require less repetition of the message than individuals who have low involvement and are not actively seeking information about the topic. When an advertisement has proven to be effective, future promotions should play off the old advertisement because people will be familiar with the concept. Making use of slogans and spokespersons in an advertisement can increase the effectiveness of the advertisement because these aspects will stick with consumers and they may recall the product whenever they hear the slogan or see the spokesperson (Sutherland & Sylvester, 2000).

Affect plays an important role in a consumer's response to advertising campaigns. Consumers often make decisions about products based on their emotions and not necessarily on the benefits offered by the product (Darke, Chattopadhyay, & Ashworth, 2006). Males and females respond differently to emotion-evoking advertisements, particularly when viewing the advertisement in a social setting. In one study, males reported lower ratings for advertisements that exhibited stereotype-incongruent emotions but only when they viewed the advertisement in the presence of another male (Fisher & Dubé, 2005). Females' ratings of the advertisements were not affected by the presence of a member of either sex or by the type of emotion contained in the advertisement.

Findings from another study suggested that messages which contain elements of social desirability may be more effective when viewed in a social setting (Puntoni & Tavassoli, 2007). This means that choosing when to air a campaign should be an important element of designing the campaign. Another important component of designing an advertisement is the consideration of consumers' mode of processing information. As described by Thompson and Hamilton (2006), consumers may use an imagery processing mode, in which they think about themselves using the advertised product, or they may use an analytic processing mode, in which they carefully weigh the positive and negative attributes of the product. The authors conclude that advertisements are more effective when the content of the advertisement matches the consumer's mode of information processing because the easier processing makes the message more persuasive to the consumer (Thompson & Hamilton, 2006).

One important area of marketing, social marketing, has become increasingly popular as a method of delivering interventions. Kotler, Roberto, and Lee (2002) define social marketing as "...the use of marketing principles and techniques to influence a target audience to voluntarily accept, reject, modify, or abandon a behavior for the benefit of individuals, groups, or society as a whole" (pg. 5). Some similarities between commercial sector marketing and social marketing include: a customer-oriented approach, facilitation of a voluntary exchange of resources, marketing research, audience segmentation, consideration of the 4Ps (price, product, place, promotion), and measurement of results to improve campaign (Lefebvre & Flora, 1988; Kotler et al., 2002). However, there are also significant differences between the two. In commercial sector marketing, the marketing process is aimed at selling goods and services. In social marketing the process is used to sell behavior change. The primary focus of commercial marketing is financial gain; the focus in social marketing is individual or societal gain. The competition in the commercial market is generally another organization that offers similar goods or services. The competition for the social market may also include the current behavior of the target market (Kotler et al., 2002).

There are four questions that should be asked when designing a social marketing campaign (Marshall, Bryant, Keller, & Fridinger, 2006): Who is it that needs to be reached through the campaign—who is the target audience? What is it that the campaign is helping the audience to do? What factors need to be addressed to change the behavior? What strategies can be used in the campaign to promote behavior change? Just as with commercial sector marketing, the impact of the campaign depends on the individual. The impact of a social marketing campaign is influenced by the individual's involvement with the issue, the believability of the advertisement, and the attitude the individual holds about the particular issue (Griffin & Cass, 2004).

Many campaigns have been designed in conjunction with PI&E programs and other programs to increase seat belt use. The role of advertising for increasing seat belt use is to: increase and maintain the salience of the issue; reinforce beliefs about the efficacy of seat belts; remind part-time or nonusers of the importance of wearing a seat belt; and inform people about other interventions such as enforcement campaigns (Austroads, 2001).

The results of advertising campaigns to increase seat belt use are mixed. It appears that simply airing advertisements is not enough to change seat belt use. The seat belt campaign, *Make it Click*, consisting of radio and television advertisements reminding people to buckle up, was not successful in increasing belt use. Increases in belt use only came about when an incentive was added to the campaign (Cope, Moy, & Grossnickle, 1988). A study examining the effectiveness of different media for presenting public service announcements about seat belts found that radio seemed to be the most successful strategy for increasing seat belt use (Gantz, Fitzmaurice, &

Yoo, 1990). Four television commercials created and aired during an era of low belt use were found not to have any impact on seat belt use (Robertson, Kelley, O'Neill, & Wixom, 1972).

McDaniel (1998) describes seven rules that highly effective marketers have for designing transportation related campaigns. First, they are customer-oriented, that is, they know who their target audience is and what they need and desire. Second, they examine the existing market and conduct research to explore it. Third, they focus the campaign to the target audience. Fourth, they are able to come up with innovative campaigns that will grab the attention of the audience. Fifth, they make it clear how the consumer will benefit from the ideas or products presented in the advertisements. Sixth, they continue to expand the campaign to increase its effectiveness. Finally, they build good relationships with consumers by gaining the public's trust and keeping it.

Conclusions

One promising aspect of risk communication seems to involve an entertainment-education approach. As mentioned earlier, this approach involves embedding a risk communication message into an entertainment program. Television programs and movies could easily integrate seat belt use messages into their programs by having all characters wear seat belts when in a vehicle. A program could be created that revolves around the challenges a family faces when one member is severely injured in a car crash because he or she was not wearing a seat belt. The entertainment-education approach could also serve to change the social norms that are in place about seat belt use. Highlighting a teen's use of his/her seat belt while riding in a vehicle could lead teens to realize that it will not make them any less cool if they wear their seat belt. This approach has the potential to make seat belt use the norm.

Research shows that public information and education programs alone are not generally effective at increasing seat belt use. The addition of another component, such as incentives or advertising, appears to increase the effectiveness of PI&E programs. This should be taken into consideration when designing a seat belt campaign. These PI&E campaigns seem to be important components of any seat belt campaign and should continue to be evaluated to determine the most effective components.

PI&E programs appear to be particularly effective when coupled with enforcement campaigns. They serve as an opportunity to inform the public about the upcoming enforcement activities, as well as to educate the public about the importance of wearing a seat belt. Effects of PI&E as a supplement to enforcement can be seen even after the campaign ends, suggesting that these programs are very useful. Guidelines are available for the design of PI&E programs and should be followed when designing these types of campaigns.

Given that individual differences have such an impact on the effects of advertising, it seems clear that one advertisement message will not impact every member of the target audience. To exert the most influence on behavior, seat belt campaigns need to include multiple advertisements covering a wide range of styles. Multiple advertisement styles will lead to a larger portion of the audience getting the intended message due to their interest being captured by a particular advertisement. A campaign may be most beneficial if it takes several different approaches in its design. It also appears that radio may be a very important medium for communicating seat belt messages. Perhaps this is due to the fact that many people listen to their radios while they are driving their vehicles. However, the recent popularity of satellite radio, with the absence of

advertisements, may limit opportunities to spread seat belt messages via radio. Strict adherence to fundamental marketing guidelines may increase the effectiveness of seat belt use campaigns. Discussion of public information and education programs provides insight into several areas that have potential for increasing seat belt use. The entertainment-education approach to presenting risk communication messages is a very promising area for seat belt research. Including a public service message in a popular television show or creating a show around a public issue provides a unique opportunity to spread a message in a format that already has the public's attention. Creating seat belt use campaigns based on social marketing principles is another promising approach for increasing seat belt use. Social marketing presents opportunities to create a message in such a way that it will alter the audience's behavior. Finally, public information and education programs that have been effective in the past, and include enforcement and community components, can be used as a starting point in developing new programs to increasing seat belt use.

TECHNOLOGY

As discussed in previous sections, there are a variety of self-reported reasons for not using a seat belt on every trip, including discomfort, lack of convenience, forgetting, and simply not wanting to be told what to do by an outside authority. The overarching goal for developing belt use promotion technologies is to minimize these reasons for nonuse. Short of an ignition interlock that disallows a vehicle to be started until the belt is fastened, there is no single system that will elevate belt use in the US to 100 percent. Rather, a combination of technologies is needed to increase use to an acceptable level. For example, if a commercial truck driver is not persuaded to wear a belt solely based on the physical or legal risk associated with belt nonuse, then a monitoring system could be implemented to introduce the risk of sanctions by his or her employer for nonuse. If a driver is prone to forgetting to buckle up regardless of his or her understanding of risk, then a reminder system could be implemented to encourage belt use. Technologies are also being developed to minimize discomfort and to increase the effectiveness of belts. The technologies examined in this section include four-point belt systems, belt integrated seats, belt reminder systems, interlock systems, automatic belts, and monitoring systems.

Seat Belt Design

Designing equipment for the entire driver and occupant population is difficult because dimensions of the human body vary greatly. Often the designers will target 95 percent of the population, excluding the extreme 2.5 percent on either side of the anthropometrically average human (Olson & Dewar, 2002). Individuals with extreme dimensions, either large or small, may experience discomfort because the equipment was not designed to accommodate their size. A nationwide telephone survey of part-time seat belt users found that the most frequent self-reported reason for belt nonuse was discomfort or inconvenience (Eby et al., 2004). The 2007 MVOSS also reported that discomfort was the most frequently cited factor among drivers who rarely or never use belts, further indicating that belt use is influenced by seat and belt design (Boyle & Lampkin, 2008).

Balci, Shen, and Vertiz (2001) used survey data to determine that females, people over the age of 40, people of short stature, and participants over the 66th percentile in terms of weight had the highest frequency of complaints about belt design. The US Department of Transportation conducted a similar survey in 1989 and arrived at the same conclusions concerning frequent complainers (Finn, Rodriguez, Macek, & Beauregard, 1989). Eby et al. (2004) asked individuals what specifically made the seat belts uncomfortable for them and the most common response was that the belts cut into their necks. The most significant problems reported by Balci et al. (2001) were the belt getting stuck in the door, awkward negotiation when pulling a belt around a coat, and belt twisting. The survey also found that many issues arose with increased age, such as the location of the shoulder belt height adjustment, which required too much joint motion.

To minimize discomfort, several approaches have been suggested. One way to limit discomfort and provide additional safety measures is the belt integrated seat. A belt integrated seat includes an actual seat and belt combined into one component, instead of the belt being anchored to the car frame. Many of these designs involve a four-point seat belt as well, similar to what motor racing sport vehicles currently use. Cremer (2003) used a 95 percent anthropometric dummy in

tests of a double-shoulder four-point belt integrated seat in front and rear crashes. The study found that the four-point integrated seat provided better protection than the currently used system. Improvements included better wearing comfort for people of varying heights and increased comfort for males and females due to the symmetrical belt. However, there are weaknesses in the four-point integrated belt system such as its initiation which requires two hands, and its uncommonness in assembly line production, which raises its price (Cremer, 2003).

Other studies have tested either just the four-point belt or a three-point integrated seat belt. Working with Ford Motor Company, Rouhana et al. (2003) tested a four-point belt system and reported significant potential to reduce thoracic injury risk. However, the study also found several problems with the system, specifically the potential effects on neck tissue, the belt's interactions in far-side impacts, and the latch-buckle junction's potential effects on the fetus of pregnant occupants. Park and Park (2001) tested a three-point belt integrated seat and reported that although the initial testing and simulation of the integrated system suggests that its safety performance is generally excellent, more research is required for reliable performance indices.

An Australian study on commercial vehicles found that one of the key contributors of discomfort to commercial vehicle drivers was the B-pillar (National Transport Commission, NTC, 2005). The B-pillar forms the vertical post between the front and rear doors and the seat belt is often anchored there in commercial vehicles. Discomfort arises because commercial trucks have suspension seats and when the seats move vertically, the seat belt often locks and tightens on the driver (NTC, 2005). NTC (2005) recommends the use of suspension seats with integrated seat belts to increase belt use among commercial drivers.

Another device meant to make seat belts more comfortable and increase safety is the inflatable seat belt which integrates an airbag into a seat belt. Ford Motor Company and BF Goodrich Company have developed such seat belts and describe the benefits as reduced head injury due to a traditional airbag, additional cushion, wide distribution of force, and pre-positioning of the occupant in a crash (BF Goodrich Company, 2000; Ford Motor Company, 2006). Seat belt designers have also been looking at new polyester materials to make belts more comfortable. For example, Honeywell International Inc. has developed a "smart fiber" that would function the same way as the pretensioners and force limiters that are currently used by automobile manufacturers. The fiber has the potential to provide a better seat belt and to save money by eliminating the currently used mechanical devices (Honeywell International Inc., 2001).

Seat Belt Reminder Systems

For the past 30 years, the US Federal Government and automobile manufacturers have developed and implemented numerous technologies for promoting belt use, with varying success. In 1972, the Federal Government pioneered the use of buzzer and light systems to encourage belt use. However, observational studies showed the systems to be ineffective (Robertson, 1975). The US required vehicles sold after August, 15 1973 to include a passive restraint system and most vehicle manufacturers opted to implement an ignition interlock system (Buckley, 1975). The interlock law turned out to be very effective in increasing belt use (Robertson, 1974; 1975), but public opposition led Congress to rescind the legislation in 1975 (Dillon & Galer, 1975). Since 1975, all new vehicles in the US have been required to display a 4 to 8 second signal if the driver does not buckle up after starting the vehicle. However, this 4 to 8 second warning system has been found to be ineffective (Robertson & Haddon, 1974; Westefeld & Phillips, 1976).

Most 2006 model year vehicles have extended reminder systems beyond the 4 to 8 seconds, although there are differences in the system designs (Insurance Institute for Highway Safety, 2006). One of the most studied extended reminder systems is Ford Motor Company's BeltMinder.™ It is activated either when the engine is started or when the vehicle is going 3 mph or faster. While the occupant is unbelted, the system sounds a chime while flashing a "buckle seat belt" warning light in 6 second bursts every 30 seconds, for up to 5 minutes. Williams, Wells, and Farmer (2002) observed 12 Ford-owned dealerships in Oklahoma and found that the BeltMinder™ system increased belt use by 5 percentage points. Honda Motor Corporation also developed a belt reminder system that lasts for at least 9 minutes or until the seat belts are fastened. Ferguson, Wells, and Kirley (2007) observed five dealerships in the greater Philadelphia area and reported belt use increased by 5.6 percentage points. Based on an estimated seat belt effectiveness of 48 percent in preventing fatalities (Kahane, 2000), a national increase in belt use of 5.6 percentage points would have prevented 736 driver deaths in 2004 (Ferguson et al., 2007). When the observed participants in both the Ford and Honda studies were asked if they wanted a similar reminder in their next vehicles, a majority said yes (79 percent in the Ford survey and nearly 90 percent in the Honda study; Williams & Wells, 2003; Ferguson et al., 2007). Many other automobile manufacturers, such as DaimlerChrysler, General Motors, and Toyota Motor Corporation, have also developed extended reminder systems (Transportation Research Board, 2003).

The key to designing a good seat belt reminder system is to find a proper balance between effectiveness and acceptability (Eby et al., 2004). Although perhaps effective, a highly intrusive system would be unacceptable and the driver would not want the system in the vehicle. For different population groups, this balance may vary. Young, Mitsopoulos, and Regan (2004) attempted to understand what sort of intelligent transportation systems were acceptable to young drivers (age 17 to 25) in Australia. The study found that the young participants deemed the concept of a seat belt reminder system acceptable if it did not include an interlock, had a low false alarm rate, and could differentiate between young children and other weights, such as a bag of groceries (Young et al., 2004).

In research sponsored by Toyota Motor Corporation, Eby et al. (2004) gathered qualitative data to develop a model of an advanced seat belt reminder system (Figure 3). In this model, the system changes its signal and presentation method to become increasingly intrusive as the trip progresses and the driver remains unbuckled. The model was developed by first categorizing drivers by their belt use (full-time, part-time, or hardcore nonuser). Part-time users were further separated into two groups by their reason for nonuse: cognitive/personal (e.g., forgetting or not in the habit) or low perceived risk (e.g., only driving a short distance or not driving on public road). When the ignition is started, the system assumes the driver is a full-time belt user and displays nothing. As the trip proceeds and the driver does not fasten his or her belt, the system becomes increasingly intrusive until it finally shuts down the entertainment system. The criteria for effectiveness and acceptability differ for each type of driver.

<i>Example Metrics</i>	Car not started 0 seconds Start of trip	Car started, not in gear < 10 mph; 4- 8 seconds	Car starts moving 11- 25 mph 2- 3 minutes	Car on patrolled roadways > 25 mph 5 minutes
<i>Safety Belt Use Group</i>	Full-time user	Part-time user: cognitive/personal	Part-time user: low perceived risk	Full-time nonuser
<i>System Goals</i>	System invisible to driver	Effectiveness and user acceptability are maximized	Effectiveness is minimized; acceptability is minimized	Acceptability is minimized
<i>Type of System Engaged</i>	No system engaged	Reminder system	Annoyance system	Interlock system
<i>System Signal Type</i>	No signal	User selected	Buzzer	Shut off entertainment system
<i>Signal Presentation Method</i>	No signal	Repeats at a constant interval	Intensity increases the faster the vehicle moves	A warning signal prior to interlock

Figure 3: Framework proposed for in-vehicle technology designed to promote seat belt use. As the trip progresses without the driver buckling up, more intrusive systems are engaged (Eby et al., 2004).

The three main reasons cited for opposition to the 1973 interlock law were problems with the proper functioning of the system when no front-right passenger was present, safety concerns associated with preventing drivers from rapidly starting a vehicle in the event of an emergency, and the relative ease of disabling the ignition interlocks (Eby et al., 2004). Learning from the failure of the US interlock law, Turbell et al. (1996), a Swedish group, established the some basic principles for a new interlock system. These guidelines were: the system should be invisible to normal belt users; it should be more difficult and cumbersome to cheat the system than to use the seat belt; it should be difficult to disable, it must be reliable and robust; it should cover all seating positions; the crash risk should not be increased by any malfunction; and it should be able to be retrofitted onto older vehicles (Turbell et al., 1996).

Seat Belt Interlock Systems

Although NHSTA is currently banned from requiring an ignition interlock system, there are other less intrusive, but still potentially effective, systems that could be implemented. These systems include disabling the environmental controls, the entertainment system, windows, cruise control, or ability to shift gears. Introducing speed caps when unbuckled or allowing insurance agencies to issue discounts for drivers of interlock-enabled vehicles are other examples of ideas for interlock systems. Little research has been conducted concerning different interlock systems.

Automatic Seat Belts

During the 1980's, the federal government required automobile manufacturers to include passive occupant protection systems in their vehicles. In response, the automotive industry developed

automatic seat belt systems in which the motorized shoulder belt automatically positions itself after the driver starts the vehicle. Several studies found that automatic belt systems increased use of shoulder belts (Streff & Molnar, 1991; Williams, Teed, Lund, & Wells, 1989, 1992). Although the use of the shoulder belts increased, the lap belts were still manual and lap belt use did not increase from the non-motorized system (Schmidt, Ayres, & Young, 1998). The motorized belts were also less effective than the three-point seat belt and were not well liked by consumers. Later, when the federal government clarified its definition of “passive occupant protection” to include air bags, automatic belts were mostly eliminated from new vehicles.

Seat Belt Monitoring Systems

Monitoring technologies are another potentially promising area for increasing belt use. Devices such as the DriverRight® 600, DriveCam, and systems by Cybergraphy Technology Inc. are examples of monitoring systems that, when installed in vehicles, can record seat belt use (Intec Marketing Sendirian Berhad, 2002; Cybergraphy Technology Inc., n.d.). Many of these devices include video feeds and are intended for employers or parents who wish to monitor their employees or children. Some of the devices also allow for live internet data, a feature that makes sense for casual monitoring. Monitoring systems may not provide a widespread solution for belt use, but might prove useful for commercial vehicle drivers and young drivers who both have relatively low belt use rates (Eby, Fordyce, & Vivoda, 2002; Glassbrenner, 2005b). Knowing that they are being monitored may help these groups develop better seat belt habits.

Currently, more than 70 percent of all new passenger vehicles contain event data recorders (EDR). These EDRs are similar to the black boxes that record flight data in airplanes. There are many obvious privacy concerns that arise with use of EDR data but, if used correctly and in appropriate circumstances, EDRs could provide an effective way of recording seat belt use. However, most of these black box-type recorders are typically reserved for crash reconstruction and involve a fairly cumbersome process to check data. There has been little research conducted on the potential use of recording devices for monitoring or enforcing seat belt use.

Conclusions

To have a significant effect on belt use in the US, a seat belt technology must be effective, acceptable to the general public, and capable of being mass-produced by the automobile industry. As described earlier, four-point belts are not currently ready for mass production and are not a practical solution. Belt integrated seats have potential but they may be most effective in commercial vehicles, due to the relatively high production costs of an overhaul for regular passenger vehicles. Automatic seat belts and interlock systems have been introduced in the past to increase belt use, but have both been phased out of production. Automatic seat belts did not increase lap belt use and ignition interlock systems were too unacceptable to the driving population.

There is a wealth of information regarding belt reminder systems. The majority of this research is theoretical and does not include real world testing. The automobile industry may have unpublished research concerning the actual implementation of these systems, but this information is not widely available. Extensive reminder systems, like those by Honda and the Ford Motor Company, have already been shown to raise use rates. Whether or not theoretical systems like the one suggested by Eby et al. (2004) will raise belt use has not been evaluated, but such systems represent a promising area for research.

Little theoretical or field research has been conducted concerning monitoring systems. Research opportunities include exploring the relationship between teen drivers and parents or commercial employees and employers, and how acceptable a monitoring system would be to these groups. Monitoring systems also vary in intrusiveness, from live video feeds to electronic sensors. Understanding the system that maximizes acceptability is important. Many automobiles already include data recorders so production is not an issue. Although using these recorders on a daily basis may prove exhaustive, the systems could be effective for certain driving populations, mainly commercial and young drivers who have some of the lowest belt use rates. On the other hand, monitors may be found to be ineffective and unacceptable to consumers. This widely used technology is readily available and shows potential for future research.

CONCLUSIONS

This review covered a wide variety of areas that could play a role in better understanding the potential mechanisms underlying the decision to use a seat belt, including individual belt use characteristics; social influences on belt use; applications from other risky behaviors; theories and models of behavior change; policy, enforcement, and incentives; communication and education; and technology. As stated in the introduction, the overall goal of this project is to develop testable strategies, based on basic and applied research, for influencing risk perception to move motor vehicle occupants from part-time to full-time use of seat belts. The purpose of the present literature review is to provide a common background for understanding part-time belt users' decision making and to guide the selection of the most promising research topics to be explored during the course of this project. The Faculty Oversight Committee and UMTRI project personnel (collectively, the oversight group) provided the following comments, suggestions, and observations on the state of the seat belt use field and future directions for research topics.

As can be seen from this review, it is clear that efforts to understand belt use need to extend well beyond simply considering risk perception. While risk perception plays an important role in decision making relative to belt use, there are a myriad of other factors that contribute to the decision on whether or not to use a seat belt. Many of these factors have only recently begun to receive research attention (e.g., social norms, decision management, and habit formation). It is vital to take these factors into account as efforts are undertaken to get the more resistant part-time users to use belts all of the time.

In general, the oversight group commented that while there were many findings related to nonuse of belts, little work has been done to prioritize these results. The oversight group thought that work should be done to better clarify the numbers of deaths and injuries that could be prevented with belt use and that these numbers should be provided to the various nonuse or part-time use groups. The oversight group noted that numbers rather than rates are what are most likely to influence policy makers. Along these same lines, the oversight group noted that these numbers should be translated into solid cost savings estimates.

The oversight group observed that there is a missing underlying meaning to many of the variables that are known to influence the use of seat belts. For example, it is well established that males use belts less often than females, but good empirical data are lacking that address why males use belt less often. In general, the oversight group thought that a better understanding of traffic safety culture and cultural norms regarding belt use was needed. The oversight group thought that research methods borrowed from anthropology (e.g., ethnographic observational field methods) might be useful in gathering this information. The oversight group also suggested an evaluation of "viral media" such as *youtube.com* to gather cultural norm information.

The oversight group commented that a better understanding of perceived risk in the decision to use seat belts was needed. The oversight group noted that for some people, risk is seen as positive. For other nonusers, risk may not be a part of the decision at all or people simply do not think about using a seat belt at all. Further, there may be some nonusers who are having so many problems in their lives (e.g., financial, personal) that the use or nonuse of a belt is highly unimportant compared to the other things on their minds.

The oversight group also talked about the acquisition of belt use as an automatic behavior (habit). There was a suggestion that product marketing methods might be a way to influence the formation of a belt use habit. The oversight group also agreed that policy and enforcement is a good way to increase belt use behavior, but also thought that further research might help to identify more effective policy.

The oversight group recognized the potential for technology to influence belt use and commented that new technology should be developed based on the reasons for use of belts by full time users and non-use of belts by part-time users. Furthermore, this technology should be tested with appropriate groups.

Finally, the oversight group discussed several issues related to where belt use promotion interventions might have their greatest effect. Of particular interest were commercial vehicle operations, where some research shows that trucking companies with belt use policies that are enforced have high belt use. The oversight group thought that more research should be done in this area. The oversight group also suggested that certain target groups of part-time users might be most effectively reached through interventions at schools, churches, and community organizations.

When asked to prioritize the most promising research topic areas for yielding products or programs to increase belt use in the part-time user population, the following four topics were mentioned:

- Understanding social norms/culture related to nonuse of seat belts, using ethnographic (anthropological) field measures;
- Development of technology to promote seat belt use in real-world applications;
- Understanding habit formation and policy decisions to promote seat belt use;
- Increasing seat belt use among occupational groups, such as commercial carriers.

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