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A Model for Preventing Serious Traffic Injury in Teens

Or ''Keep Those Teenagers Out of Our ICU!''

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Traffic crashes are the leading cause of injury, disability, and death in the youth of the United States. Risky driving, behind-the-wheel behaviors when operating a motor vehicle in a manner that may lead to harm or injury to oneself or others, contributes to the human and economic cost of risky driving. An acute or critical care hospitalization provides an ideal opportunity for nurses to initiate prevention strategies with parents and teens to reduce risky driving.
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Approximately 6,000 teenagers die each year in the United States as a result of traffic crashes.[1] Although the risk of drinking and driving has become reasonably well acknowledged by teens and their parents,[2] why are adolescents still dying in large numbers on the roads of the United States? Public relations messages such as ''Friends don't let friends text message and drive''[3] point to the issue at hand: teens die in traffic crashes for many reasons besides alcohol and drug use, and *risky driving* is a concept that includes many behaviors, such as speeding, driver error, and inattention, besides substance misuse and abuse.[4,5]

With the growing number of empirical studies elucidating the causes of teen traffic injury[6] has come an understanding that acute and critical care settings are appropriate venues for interventions targeted not only to manage critical conditions but also to prevent them.[7,8] Contact with a critical care practitioner can serve as a ''teachable moment'' or ''window of opportunity'' to help teens and their families consider safe driving behaviors. The primary purposes of this article were to (1) define the concept of *risky driving*, (2) describe a conceptual model drawn from the scientific literature that can guide interventions for parents and teens, (3) explain the types of interventions that can be initiated to reduce teen driving injury, and (4) discuss the role of the critical care practitioner during a teachable moment to reduce risky driving by teens. In short, we need to reduce risky driving by teens, thereby ''keeping those teenagers out of our intensive care units (ICUs)'' because teens have learned to modify their own risky driving behaviors.

TEEN RISKY DRIVING: DEFINITION AND CONTRIBUTING BEHAVIORS

Risky driving has been defined in a variety of ways in the literature. Dula and Geller used several terms to describe the concept, including *aggressive* and *dangerous driving*.[9] They defined *risky driving* as behind-the-wheel behaviors that have the potential to endanger

others and comprised of intentional acts of aggression toward others, negative emotions experienced while driving, and risk taking. Shope and Bingham used different terms such as *problem driving*, *risky driving*, and *high-risk driving behavior*.[6,10] They linked a number of behaviors to risky driving, including driving ability; teenagers' development, personality, and demographic factors; perceived environment; and the driving environment. For this article, we will define *risky driving* as illegal or dangerous behind-the-wheel behaviors (decisions, actions, reactions, and/or performance) that are associated with operating a motor vehicle in a manner that may lead to harm or injury to oneself or others. For the purpose of this discussion, we will not include adolescents younger than 16 years who drive before they are legally licensed because the injury prevention strategies associated with these young, unlicensed drivers are quite different from those appropriate for young, licensed drivers.

Risky driving is associated with several health compromising behaviors in teenagers. The prevalence of these behaviors, and their association with traffic injury, is important to the understanding of risky driving. The behaviors include driver error, driver inattention, safety belt nonuse, sleep deficit/drowsy driving, speeding, substance use, and traffic law violations (see Table 1).

Risky driving is associated with several health compromising behaviors in teenagers.

Role of Passengers

In a landmark study published in 2000, Chen and colleagues emphasized the role of passengers in teen traffic crashes and traffic deaths.[27] They found that compared with 16- and 17-year-old drivers without passengers, the relative risk of death per 10 million trips in a vehicle was 1.39 for drivers with one passenger, 1.86 for those with 2 passengers, and 2.82 for those with 3 or more passengers. In a similar study, other investigators found that compared to experienced drivers, 16-year-old drivers were more than 4 times more likely to be carrying 2 or more passengers when involved in fatal crashes.[18]

The association between the number of passengers and crash risk among drivers may be due to risky driving.[23] Investigators studied vehicles leaving parking lots in 10 high schools and found that teenage drivers drove faster compared to the general traffic and had shorter spaces between successive vehicles. They also found that both male and female teenage drivers had shorter spaces between vehicles when they were accompanied by a male passenger, and the highest rate of risky driving (speed ≥15 mi/h over the speed limit) occurred in teen male drivers with teen male passengers. The investigators conclude that a teenage driver may be more inclined to drive aggressively or in a risky manner because he/she perceives that the male teen passenger would view such driving as desirable or expected.[23] The context of the vehicular trip is also important. Stone and Runyan found that crash rates during the lunch hour were significantly higher for teenagers in counties that allowed students to drive off campus during lunch than in those counties where off-campus lunches were not allowed. Lunch-time crashes included significantly more passengers than crashes during other times of the day.[28] The message is clear: teens who drive with passengers place themselves and others at greater risk for death than do teens who drive alone.

ROLE OF INJURY PREVENTION IN THE ACUTE AND CRITICAL CARE UNIT

Increasingly, healthcare providers are considering the concept of providing prevention services in acute care settings such as the ICU or emergency department (ED).[8,29,30] The rationale for expanding prevention services into acute care areas can be stated as follows: (1) acute care areas already perform some prevention services such as tetanus immunizations and blood pressure screening; (2) EDs are widely accepted to be the safety net for patients without other access to the health system, and they may be the only source of prevention services for a highly vulnerable population; (3) unexpected circumstances leading to an acute care encounter with a healthcare practitioner often create a teachable moment, thus making prevention interventions even more effective than they would be in other settings; and (4) unmet needs for prevention measures will undoubtedly result in more ED and acute care visits of even higher acuity.[31]

The move toward injury prevention in acute care provides an opportunity for critical care nurses to reconsider their responsibility in the area of injury prevention. Nurses come into contact with hundreds of parents and teens each year as patients, family members, and visitors. Given that traffic injuries are the leading cause of death and disability for 15- to 19-year-old adolescents in the United States,[32] all healthcare providers have a responsibility to initiate health prevention strategies to reduce risky driving in teens. In short, prevention interventions for teens during a hospital visit have the potential to reduce death and disability from vehicular injury. We propose the model below for risky driving in teens. This model not only explains the

TABLE 1 Behaviors That Contribute to Risky Driving in Teens

Behaviors That Contribute to Risky Driving	Prevalence and Other Statistics
Driver error	Involved in 74% of fatal crashes for 16-y-old drivers, 73% of fatal crashes for 17-y-old drivers, and 71% of fatal crashes for 18-y-old drivers
The physical movements of the vehicle that are indicative of driver mistakes such as improper lane changes, passing on the wrong side, or overcorrecting[11,12]	Increases as the young driver carries more passengers in the car: when driving alone, 71% of 16- and 17-y-old drivers involved in fatal crashes made driving errors, but the percentage increases to 85% when 3 or more passengers are in the vehicle[11]
Driver inattention	Emerging technology (cell phones, MP3 players, text messaging) presents risks for young drivers
Distraction from the forward roadway: when a driver focuses on secondary tasks not necessary to perform the primary driving task or takes nonspecific eye glances away from the forward roadway; does not include a driver who is required to shift attention away from the forward roadway to check blind spots, the center mirror, or instrument panel[13]	In drivers of all ages, between 13% and 50% of all crashes are attributed to driver inattention[14] 94% of teens report seeing other teens in the car of a young driver distracting the driver in some way[15] The highest risks for all drivers (in descending order of risk) are dialing a hand-held device, talking/listening to a hand-held device, reading, eating, applying makeup, reaching for a moving object, and an insect in the vehicle[13] The following percentage of teens list these factors as the most common distractions that they see when their peers are driving: other teens in the car (93%), driver on cell phone (89%), loud music (85%), driver or passengers dancing and/or singing (79%), passengers acting wild (69%), driver using hand-held device (53%) Because technology is changing so quickly, there is little literature on the role of technology in traffic crashes involving teens, but the following are known: 21% of crashes in college students occurred while the driver was on a cell phone[16] High rate of early adoption of new technology, peer pressure, risk taking tendencies, poor ability to detect hazardous situations, and underdeveloped vehicle control skills leave teen drivers vulnerable to distractions from technology[14] A growing number of national news stories are making the link between text messaging while driving and teen traffic fatalities
Safety belt nonuse	In June 2006, seat belt use in the United States was 81%, up from 58% in 1994[17]
Lack of seat belt compliance, or driving a vehicle without a buckled safety restraint	48% of teens involved in fatal crashes were not wearing seat belts[18] 79% of teens reported wearing a seat belt often or always when driving and 70% when riding as a passenger; only 65% reported consistently wearing a seat belt both as a driver and passenger[15]
Sleep deficit	Moderate to severe drowsiness is a more significant risk for a crash or near-crash for all drivers than driver inattention[13]
Driver averages less than 7 h a night of sleep	75% of teens report seeing fatigued driving by teens[15]
Drowsy driving	Most drowsy driving-related crashes are attributed to young drivers[19]
Driver exhibits slack musculature in the facial muscles and limited overall body movement as well as a noticeable reduction in eye scanning behaviors; a severely drowsy driver will also have extended eye lid closures and difficulty keeping the head in a lifted position	Combination of inexperience, sleep restriction, and youthfulness may have acute and chronic effects on driving performance[19,20]

TABLE 1 continued

Behaviors That Contribute to Risky Driving	Prevalence and Other Statistics
Speeding	
Legal definition of *speeding* is exceeding the posted speed limit. Law enforcement officers seldom write citations for speeds less than 5 mi/h or sometimes 10 mi/h over the posted limit.[22] National databases use the following definition for speed-related crashes: driver charged with a speeding-related offense; officer indicates racing, driving too fast for conditions, or exceeding the posted limit was a contributing factor in the crash[21]	Contributing factor to 30% of all fatal crashes, and up to 40% of teenage drivers involved in fatal crashes[11,21] Half of teen respondents to a survey report driving 10 mi/h over the speed limit at least sometimes; 92% reported that they observed teen drivers speeding[15] Contributes to crashes because it reduces a driver's ability to steer safely around curves or objects in the road, extends the distance necessary to stop, and increased the distance a vehicle travels while the driver reacts to a dangerous situation[21] More common in male teens than other groups: the rate of driving ≥15 mi/h above the posted speed limit for male teens driving other male teen passengers is double the rate of general traffic rates[23]
Substance use	Alcohol use, even at low levels, is known to be associated with vehicular crashes[7,24]
Ingestion of alcohol, illicit substances, or mind-altering medications or substances before driving a vehicle	50% of teens report seeing drunk driving by teens[15]
Legal intoxication in most states is defined as a person having a blood alcohol concentration ≥80 mg/dL[25]	Marijuana use is associated with vehicular crashes[26]
Alcohol-related vehicular crashes are defined as those crashes when the driver has a blood alcohol concentration of ≥10 mg/dL	Teens report seeing their peers more often drive fatigued than drive drunk; 75% reported seeing a teen driver tired, 68% reported seeing the driver smoke a cigarette, 50% reported the driver had been drinking alcohol, 41% the driver had smoked pot[15]
Traffic Law Violations (excluding speeding)	Although speeding is more highly associated with fatal crashes in teenagers, reckless offenses, and traffic law violations occur in approximately 30%-40% of traffic fatalities in novice drivers[18]
Driving behaviors that warrant a citation, such as unlawful turning or passing, red light and stop sign violations, or negligent or willful recklessness.[18] The legal definition of *reckless driving* varies by state but usually involves carelessness, lack of caution, and disregard of the rights or safety of others at a speed or in a manner to endanger people or property	

factors related to risky driving but also provides a framework for the appropriate nature and timing of interventions to reduce vehicular injury.

MODEL FOR RISKY DRIVING IN TEENS

Interventions that are used by a practice discipline such as nursing are best guided by a conceptual model that is based on the scientific literature. The model (see Figure 1) represents the relationships among a cluster of behaviors, characteristics, and moderators that contribute to the primary concept of interest, risky driving in teens. The definition of a *moderator* is a variable that affects the direction and/or strength of the relationship between a predictor (independent) variable such as peer norms or school performance and a criterion (dependent) variable indicating consequences of risky driving such as injury or traffic citations. The model also describes the consequences of risky driving, including physical and psychological injury, criminal justice outcomes, and the cost of risky driving.

Precursors

A precursor is a variable that precedes or occurs before the development of risky driving. A number of demographic factors are particularly important. Young male drivers are more likely to drive in a risky manner and be involved in fatal crashes than more experienced drivers and young female drivers.[6,33] Teens who have more positive psychosocial adjustment, such as performing well in school, seem to have less risky driving.[34] Those who are employed are more likely to report having driven after drinking, whereas teens living with both parents have less risky driving than those who live with only one parent, possibly because a single parent has more difficulty monitoring the teen than do 2 parents.[6,35] In children and adolescents, 2 psychological disorders, oppositional defiant disorders and conduct disorders, are related to risky driving.[36,37] Oppositional defiant disorder is a disruptive pattern of behavior characterized by defiant, disobedient, and hostile behaviors directed toward adults in positions

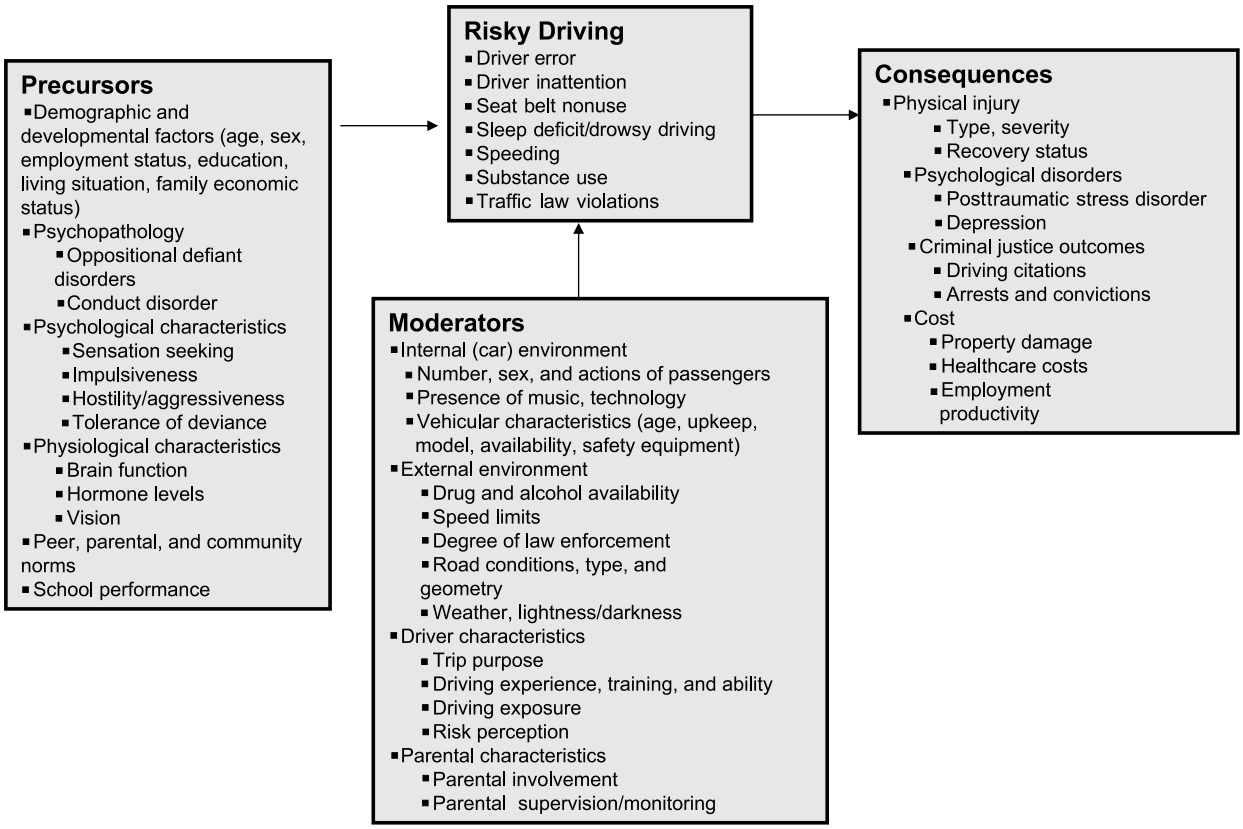

Figure 1. Model that explains risky driving in teens.

of authority, whereas conduct disorders involve persistent antisocial behavior such as stealing, vandalism, lying, truancy, and substance use. Other factors known to affect driving include peer, parental, and community norms. Teens perceive what is expected by their peers, parents, and community when it comes to driving, but most important are parental expectations and role modeling; most teens drive in a manner similar to their parents.[38]

In children and adolescents, 2 psychological disorders are related to risky driving.

Both psychological and physiological characteristics are relevant to risky driving. Developmental factors such as hormonal levels, brain growth, visual acuity, reaction time, and biorhythms can all affect driving behaviors. Psychological development is important as well. Personality characteristics such as sensation seeking, impulsivity, hostility, and aggressiveness also contribute to risky driving. In young adults, greater risk-taking propensity, hostility, aggression, and tolerance of deviance (acceptance of behaviors others find acceptable) are significant predictors of a risky driving, driving aggression, and drinking/driving.[39] As Shope[6] noted, teen drivers are still developing emotionally, seeking their identity as individuals, and evolving in their peer relationships. All these factors are brought into the car with teens when they get behind the wheel.

Moderators

Both internal and external environmental factors moderate or affect the degree of risky driving. As noted earlier, risky driving in teens increases with the number and actions of the passengers.[18,23,27] Recent reports have indicated that the availability of technology such as cellular phones and MP3 players (MP3 is the acronym derived from Moving Picture Experts Group and a subsystem called MPEG audio Layer-3 or MP3) contribute to risky driving because they detract the driver's attention from the road.[13,14] The age, condition, and upkeep of the vehicle; the presence or absence of air bags or seat belts; and how often the vehicle is available to the teen all affect risky driving. As such, teens who

own vehicles drive more miles, drive smaller and older vehicles, and have higher crash risks than other teens.[40]

Many external factors relate to risky driving. Poor weather conditions, narrow and winding roads (rural roads especially), and driving in the dark are all associated with increased crash risk.[41,42] When roads are regularly patroled by the police to enforce speed limits, less risky driving occurs. The availability of drug and alcohol is directly related to the extent of driving under the influence that occurs with teen drivers.[11] The purpose of the trip is also relevant. For example, high school students leaving school over lunch hour have a higher risk of fatal crash than other people on the road at the same time.[28] Some experts suggest that trips to school, to work, or to do errands might be less risky than trips associated with entertainment.[6]

Driving experience is clearly important to crash risk, but the precise role of driver training is still under investigation. Every parent who has taught a teenager to drive recognizes that novice drivers need to learn how to initiate a start, maintain position on the road, maneuver the vehicle through turns, and control vehicle speed. Vehicular crashes decrease as novice drivers gain experience,[43] but more research is needed on the role of risky driving in novice drivers. Parents play a predominant role in a teen's driving behaviors. Their expectations of a teen driver have a strong influence on teen risky driving. Those parents who monitor their child's driving and are not overly permissive tend to have teens with fewer crashes and driving citations.[6,34,44] Parental reviews of teen driving each week and parental-teen driving contracts have both demonstrated a reduction in crash risk for teens (see section on intervention below).[41,45]

Consequences

Vehicular injury is the leading cause of death and disability in teens and accounts for 36% of all teen deaths.[1] In addition, nearly 400,000 teens are seen each year in EDs for traffic-related injuries, many of which cause either short-term or long-term disability. The Centers for Disease Control and Prevention reports that teens and young adults aged 15 to 24 years represent only 14% of the US population but account for 30% ($19 billion) of the total costs of motor vehicle injuries among males and 28% ($7 billion) of the total costs of motor vehicle injuries among females.[32,46] In addition to healthcare costs, the economic cost of vehicular crashes is enormous when considering property damage, loss of employment and productivity, legal and court costs, emergency services, and traffic delays. In 2000, the last time the National Highway Traffic Safety Administration reported on the economics of vehicular crashes, the cost was more than $230 billion per year.[47]

In addition to injury, the consequences of vehicular injury can be significant and life changing. The long-term consequences can lead to depression and other psychological disorders. Even minor injury can lead to depression.[48] Risky driving in teens can also lead to traffic violations, arrests, and convictions, which can present obstacles in the teen's future.

In summary, the factors related to risky driving are complex and interrelated. The primary behaviors that comprise risky driving are driver error, driver inattention, seat belt nonuse, sleep deficit, speeding, substance use, and traffic law violations. These behaviors have precursors, moderators, and consequences. By understanding their interrelationships, healthcare providers and practitioners can best evaluate which interventions have been successful and which might be appropriate to use in the acute care setting.

EFFICACY OF INTERVENTIONS TO REDUCE INJURY DUE TO RISKY DRIVING

Healthcare practitioners, police departments, community action groups, and government agencies have long committed time and resources directed toward prevention strategies to reduce teen risky driving, driving injuries, and traffic fatalities. Several models of injury prevention that are relevant to critical care practice are currently under investigation to determine if they improve risky driving in teens. Goals for driving education[49] and parental involvement[50] seem to have the most promise. Other strategies, such as graduated driver licensing, which generally increases the period of the learner's permit, and police involvement are not described because they are outside the realm of acute and critical care common clinical practice.

The goals for driving education model of prevention of teen risky driving is based on the theory that driving requires 4 separate levels of skill in which the higher levels affect behavior on the lower levels. The fourth level, goals for life and skills for living, deals with long-range plans for oneself and would affect driving based on personality factors such as self-control, motives, choices, and behaviors. The third level, goals and context of driving, refers to the goals of the trip and the environment surrounding the trip. The second level is mastery of traffic situations and describes knowledge of different traffic rules, hazards, and interactions with other road users. Finally, the first level is vehicle maneuvering, which describes the basics of driving.[49] This model can be used by healthcare providers to explain to teens and parents that driving is more than vehicular maneuvering and involves not only speed adjustment and difficult weather conditions but also planning and self-control. Driving is also placed in a broader context that, when risky driving is used, can

affect a teen's long-term goals such as employment or college acceptance.

Parental Involvement

Although the mechanisms and behaviors that parents use for novice teen driving are not particularly well understood,[50] some parental interventions reported in the peer-reviewed literature show promise to reduce risky driving in teens. What is known is that (1) the more miles driven, the higher the risk of a crash; (2) crash risk is highest in the first month of licensure; and (3) crash risk declines sharply for about 6 months after licensure.[51] The amount of unstructured, supervised driving practice by parents varies by state and partly depends on driver education and licensing requirements. Parental supervision before licensure averages 40 to 75 hours depending on the state. Evidence from studies in the United States and Europe evaluating the effects of supervised practice on teen driving outcomes is inconclusive.[50] Intuitively, however, most experts acknowledge that supervised practice for novice drivers exposes young drivers to a range of experiences, and hence driving exposure (nature and quantity of driving) is an important predictor of traffic injury.[34,43,50] In particular, supervised practice should include more than driving exposure, it should also provide teens with experiences in a range of driving conditions, managing distraction, and learning visual scanning across the entire roadway in a variety of road settings.

Parental supervision before licensure averages 40 to 75 hours depending on the state.

In their review of parental involvement in novice teen driving, Simons-Morton and Ouimet[50] summarized the important parental activities that reduced teen risk: restricting driving in poor weather conditions and late at night, limiting the number of passengers the teen can carry in the vehicle, limiting trips by finding out when the teen was leaving and where he/she would be going, and refusing to condone a teen's desire to break graduated licensure rules. Interventions to increase parental driving supervision of independent driving are increasingly of interest to injury prevention scientists. One such program, the Checkpoints Program, is designed to increase limits that parents set on teens. Parents limited teen driving at night for the first month, riding with passengers for 4 months, driving on high-speed roads for 4 months, and had overall limits on driving for the first 9 to 12 months. These limits were found to be effective in reducing traffic violations, in particular when in combination to specific consequences if the limits were not followed.[43,50]

Several structured parental interventions, or interventions that combine several strategies including parental interventions, have been effective in decreasing adverse events such as traffic crashes or citations in teens. McGehee and colleagues[41] found that by pairing an event-triggering video device within a vehicle with a weekly review by parents of the video, parents were able to teach their novice teen drivers how to lower their risk. This ingenious study involved a video camera within the vehicle that was turned on whenever the vehicle exceeded lateral or forward threshold accelerations.[41] Parents received a tape and could review and discuss all mistakes the teen make while driving.

In short, parents with safe driving habits themselves, who expose their novice teen drivers to a variety of conditions and driving challenges and who develop a driving contract, are likely to limit teen risky driving. Driving exposure is positively related to crash risk in the first months after licensure; thus, driving limits are crucial in the first 6 months of driving. When a contract spells out expectations, limitations, and consequences for deviating from the agreement, teens are less likely to exhibit risky driving. Parents need to emphasize that teens need to abide by state laws about driving at night, carrying passengers, and abiding by the legal age requirement for alcohol use. Parents' own behaviors in following the law have a direct relationship to the development of risky driving in teens.

APPLYING THE MODEL AND INTERVENTIONS TO CRITICAL CARE PRACTICE

Acute and critical care practitioners frequently come in contact with parents and teens. Providing interventions that promote health and reduce risky driving is an important part of their practice. Given the prevalence of traffic injuries in teens and the critical need to reduce the human and economic cost of vehicular injury, disability, and death, an organized effort by trauma nurses in particular has the potential to reduce the terrible cost of traffic injury.

One strategy is to apply the principles of individual counseling and health teaching. A brief discussion with parents of teens, or the teens themselves, about the factors involved with risky driving (such as driver error and driver inattention), how they contribute to injury, and ways to prevent risky driving is appropriate. Brief counseling sessions about a health compromising behavior initiated by a healthcare provider such as a nurse or physician is known to be effective even if it lasts for only a few minutes.[7] This is particularly the case if the nurse uses empathy and provides a menu of choices to help change the behavior.

One important area to discuss with teens is their perception of their own risk. The following areas of

discussion for teen focus groups might be helpful as talking points with teens on safety behaviors. First, although crashes for drivers aged 16 to 20 years are overrepresented during high school rush hours, students indicated that showing off and racing typically happen during these hours, which are not considered high-risk times of the day by teens. Second, some behaviors are seen as risky, and others are not. Teens indicated that the following behaviors were risky: driving after drinking, driving while reading, driving while putting on makeup, driving without a seat belt, and tailgating. Teens indicated that the following behaviors were not risky: driving with multiple friends, listening to loud music, and eating while driving.[52] This information might be contrasted to the following study results. The highest risks for all drivers (in descending order of risk) are dialing a hand-held device, talking/listening to a hand-held device, reading, eating, applying makeup, reaching for a moving object, and having an insect inside the vehicle.[13] By using this feedback from students themselves and comparing the information found by scientists, teens may be more willing to discuss risky driving with healthcare practitioners.

Many acute and critical care units provide pamphlets about visiting hours or provide information about health promotion behaviors such as smoking cessation. Nurses who work in a trauma ICU might consider putting together materials about parental-teen driving agreements. The information might emphasize the following:

1. Teens whose parents limit initial independent driving privileges engage in less risky driving and are less likely to have traffic citations and crashes.
2. Parental limits should be strictest at the time of licensure and 1 month after. The extent of initial limits predicts future parental limits, teen risky driving, traffic citations, and traffic crashes.
3. The easiest limits for parents to set seem to be related to trip conditions and permission to drive;
4. The most difficult limits for parents to set seem to be related to the number of passengers, nighttime driving, and driving in poor weather conditions.[50] With this information in hand and recommendations on how to set up a teen-parent contract, parents might be interested in attempting this activity with their teens.

SUMMARY

Vehicular injury is the leading cause of death and disability among teenagers, and risky driving plays a critical role in injury occurrence. Acute and critical care nurses have a mandate to use their contact with teens and parents to reduce the epidemic of teen injuries by raising the issue during a hospital stay. A great deal of injury science has occurred that can guide interventions about injury prevention and safety. By using the strength of the evidence and by recommending to teen and parents that they initiate driving contracts in the first months of licensure, critical care nurses can ensure the health of our youth and support their safe transition from childhood to young adulthood.

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