Teen Driving
Motor-Vehicle Crashes and Factors That Contribute

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Abstract: The motor-vehicle crash risk of novice teen drivers is unacceptably high. This article examines the historical trends in fatal crash rates for male and female teen drivers as compared to adult drivers by both population and person-miles driven. The effect of motor-vehicle policies on teen driver crashes, characteristics of teen driver crashes, and combinations of these crash characteristics are also examined. A framework of seven categories of influences on teen driving behavior is presented, including the following elements: driving ability, developmental factors, behavioral factors, personality factors, demographics, the perceived environment, and the driving environment. Because a complex set of different factors influence teen drivers' behavior, comprehensive, multilevel interventions are needed to reduce teen drivers' exposure to high-risk driving conditions and to address factors identified in the framework.
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Introduction

The safety of teen drivers has too often been neglected in books and publications on adolescent health, even though motor-vehicle crashes are the greatest single public health threat to teens in many countries, including the U.S. According to the Web-based Injury Statistics Query and Reporting System,[1] in 2004 crashes accounted for 41% of all deaths among teens aged 13–19 years in the U.S. In contrast, other unintentional injuries accounted for 15%, homicide accounted for 15%, and suicide for 14% of all teen deaths. Awareness of the health threat posed by crashes needs to be raised among public health practitioners working with teenagers so that new interventions can be developed and existing programs can be enhanced to reduce teens' involvement in motor-vehicle crashes. This article summarizes data on the motor-vehicle risk of teen drivers, historical trends in teen driver crashes, the effect of policies on teen driver crashes, characteristics of teen driver crashes, and combinations of crash characteristics. Finally, this article addresses multiple factors that contribute to teen driving behavior in a conceptual framework, and offers implications for the prevention of teen driver crashes.

Excess crash risk is a major contributor to teen mortality and morbidity.[2,3] In spite of the success of graduated driver licensing (GDL)[4] and other programs, the rates of traffic crashes, injuries, and fatalities[2] and the economic cost of crashes involving teen drivers[5,6] are unacceptably high. Teen drivers have the highest crash rate per mile driven of any age group.[7] Male teens have an especially high rate of fatal crashes and an even higher rate of nonfatal injury crashes.[7] Crash rates are highest among the youngest drivers,[7] declining with each year of increasing age but not reaching the lowest levels until after age 30.

Among teen drivers in 2000, those aged 16 years had the highest crash involvement rate—35 crashes per million miles traveled—followed by those aged 17, 18, and 19, at 20, 14, and 13 crashes per million miles traveled, respectively.[3] Thus, per mile traveled, drivers aged 16 years had nearly three times as many crashes as did those at 19. In comparison, drivers aged 45–54 had four crashes per million miles traveled. Fatal crashes followed a similar pattern, with drivers aged 16 having 13 fatal crashes per million miles traveled and those aged 17, 18, and 19 having eight, six, and six fatal crashes per million miles, respectively.[3] Thus, per mile traveled, drivers aged 16 had more than twice as many fatal crashes as did those at 19. In comparison, drivers aged 45–54 years had one to two fatal crashes per million miles traveled. Fatalities are not the only lasting outcome of teen crashes. Although youth are more resilient than adults, especially the elderly, teens who survive injuries received in crashes often experience significant deficits in quality of life, and these deficits occupy a larger portion of their lives than do injuries to older individuals.[8]

Historical Trends in Teen Driver Crashes

Historical trends of crash rates among teens and among adult drivers provide perspective on the current situation.

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Trends in crash rates are presented by combining data from the Fatality Analysis Reporting System (FARS, www-nrd.nhtsa.dot.gov/departments/nrd-01/summaries/FARS_98.html); the U.S. census; the National Household Travel Survey(NHTS;www.bts.gov/programs/national_household_travel_survey/); and the National Personal Travel Survey (NPTS) conducted by the U.S. Department of Transportation. Crash rates differ in the information they provide,depending on how they are estimated; therefore, in this paper trends in crash rates are presented and results compared using several methods. Rates depict the prevalence of crashes based on some standard unit of exposure. Exposure can be represented at a global level using population size, total vehicle miles driven, or average miles driven per capita. Exposure can also be measured at the level of the individual as person-miles driven, time spent driving, or a combination of the two. Measures of individual exposure, however, are very expensive and difficult to obtain. As a result, population-level exposure measures are more commonly used. No single method of calculating rates fully depicts crashes, but different methods of estimating rates serve unique purposes by providing answers to different questions. By examining rates estimated using several different approaches, a fuller perspective emerges.

Trends in Crash Rates Based on Population

U.S. census data for the 30-year interval from 1975 to 2004 and fatal-crash data from FARS were used to calculate rates of driver involvement in fatal crashes per population for those aged 15–19 years and those aged 45–54. Adults aged 45–54 were selected for comparison because they have the lowest crash rates of any age group. To control for changes in the population sizes between the age by gender groups and across years, rates were calculated by standardizing the four groups to a common population size (e.g., the population of male teens) for 1975, and then standardizing all years to the group sizes for 1975. Rates per 100,000 population were then calculated using the standardized data. This process was needed because the variation in events (fatal crashes) increases with population size. If rates are compared without standardizing to common group sizes, the rates would be biased by the differences in population size between the groups and changes in group sizes across the years examined. By standardizing to a common population size, the rate estimates were adjusted for differences across groups and variation across years in the sizes of the four populations being compared.

The largest changes in crash rates per population occurred among male teens (Figure 1). Crash rates in this group peaked in 1978 at 9.1 fatal crashes per 100,000 population. Over the next 5 years, the rate among male teens declined rapidly to 6.0 fatal crashes per 100,000 population and remained relatively stable thereafter. Among female teens there was a gradual

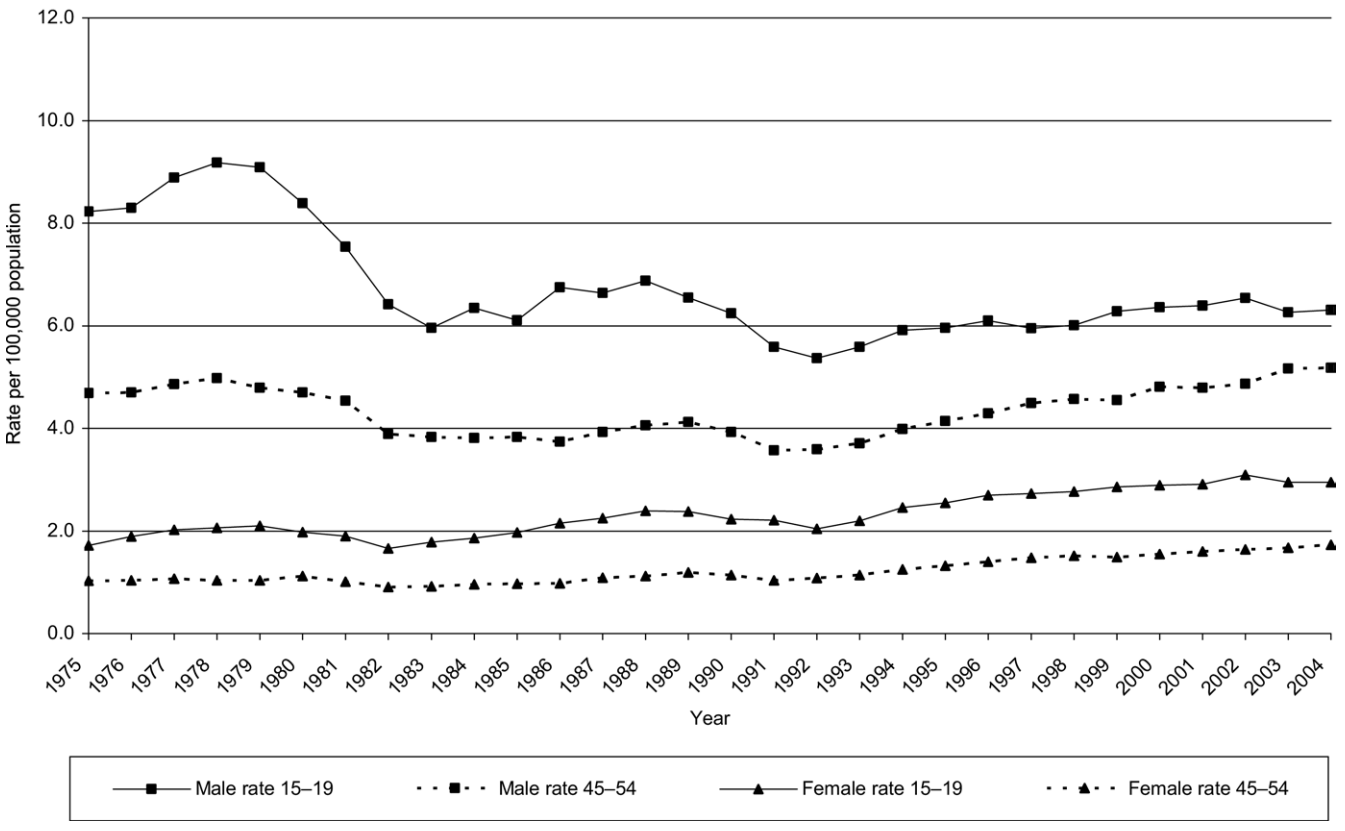

Figure 1. Driver involvement in fatal crashes by age and gender per population

increase in rates from 1.7 fatal crashes per 100,000 population in 1975 to 2.9 per 100,000 population in 2004. These trends indicate that, since 1983, there has been no overall reduction in fatal crash rates among male and female teens. In fact, after 1992 the crash rates increased steadily. Rates for adult men varied over the interval examined, with an overall increase from 4.8 to 5.2 fatal crashes per 100,000 population from 1975 to 2004. Rates for adult women experienced a pattern similar to that of female teens, increasing steadily from 1.2 to 1.9 fatal crashes per 100,000 population.

Trends in Crash Rates Based on Miles Driven

Data on fatal crash rates tell different stories depending on how the rates are calculated, as illustrated by the following three examples. First, Mayhew and associates[9] used annual FARS data from 1975 to 1998 and NPTS data for 1977, 1983, and 1990 to examine trends in the number of licensed drivers, miles driven, and crash rates among women from 1975 to 1998. Analyses based solely on the numbers of licensed drivers suggested that fatal crash rates among women remained essentially unchanged from 1975 to 1997, at about 17 per 100,000 licensed drivers. Yet mileage data showed that the number of miles driven by women increased steadily, from 378 billion miles in 1975 to 886 billion in 1995. When rates were calculated based on average miles driven, women showed a steady decline from 2.9 fatal crashes per 100 million miles driven in 1977 to 1.6 per 100 million miles driven in 1995.

Second, data from the NPTS and NHTS were used to examine fatal crash rates per person-mile driven from 1989 to 2004 for male and female drivers aged 15–19 and 45–54 years (Figure 2). When calculated in this manner, the picture that emerges is different from that in Figure 1. Male teens still have the highest fatal crash rates, but in Figure 2 they show an overall descending trend. Female teens now have the next highest rates, which, although varying slightly over the interval examined, show little overall change. At the bottom of the figure are adult men and women, whose crash rates per mile driven are the lowest and show gradual increases over time. When examined in this manner, it appears that fatal crashes among teen drivers declined for male teens, but essentially all of this reduction was prior to 1992.

Finally, current research being conducted by the authors provided the opportunity to examine crash rates in a third way, based on person-miles driven (PMD). Using Michigan State Police crash data, the 1990 and 1995 NPTS, and the 2001 NHTS for the northern Midwest region, crash rates per PMD were estimated for Michigan drivers. The results provide yet another perspective on crash rates. Examining all crashes from 1990 to 2001, adult men (aged 45–65) had 6.2 crashes per 100,000 PMD, while adult women had 12.8 crashes per 100,000 PMD. Crash rates of teens aged 16–19 were 14.9 for male teens and 22.5 for female teens per 100,000 PMD. Using the same data, casualty crash (fatal and nonfatal injury crashes) rates were 1.6 and 3.7 per 100,000 PMD for adult men and women, respectively, and 4.1 and 7.0 per 100,000 PMD for male and female teenage drivers, respectively. Unlike the results of other methods of estimating crash rates, when rates are calculated based on individual, age-specific PMD, female drivers—both teenage and adult—are involved in more casualty crashes, as well as more crashes overall, than male drivers.

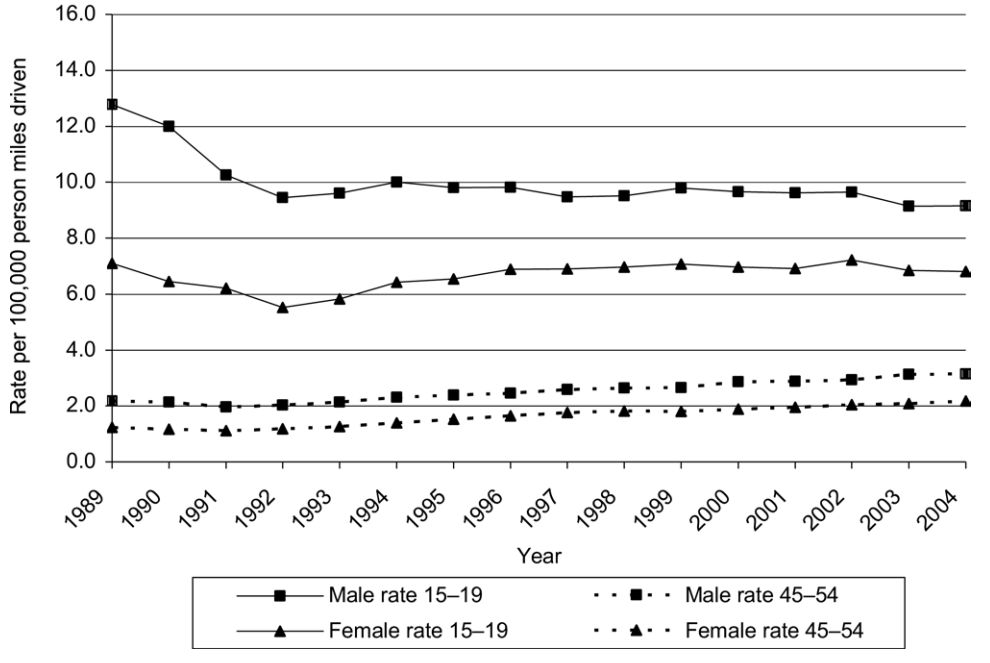

Figure 2. Driver involvement in fatal crashes by age and gender per person-miles driven

Motor-Vehicle Policies and Their Effect on Teen Drivers

The data on crash rates presented above suggest that, although efforts to curb crashes may have had limited success in reducing crash rates, such efforts may have prevented the rates from increasing at a greater pace. In fact, they may be responsible for teens showing no increase in crashes since 1994, when crash rates are measured in person-miles driven (Figure

2). Some efforts that have been made in the U.S. include traffic safety campaigns and changes in motor-vehicle safety design, roadway design, and the process of licensing of teens. Some of these efforts primarily targeted teens, while others have had a broader influence, resulting in changes in adult driving behavior as well.

The strengthening of seatbelt laws increased the traffic safety of both teens and adults. Most states initially introduced secondary seatbelt laws, which only allow citations for non-use of seatbelts to be issued to drivers/passengers when the vehicle is stopped for the violation of another law. Primary laws allow officers to stop vehicles solely for seatbelt law violations. Secondary seatbelt laws led to seatbelt use of 74% nationwide, and the introduction of primary seatbelt laws led to usage rates of about 85% in most states.[10,11] While not affecting crash rates, these changes in seatbelt laws have reduced injuries to teens, as well as to adults.

Alcohol laws have contributed to reduced drinking and driving among teens. The establishment of the minimum legal drinking age of 21 in all of the states lowered teens' access to alcohol and has likely contributed to observed reductions in alcohol-related crashes involving teens.[12,13] A vivid demonstration of the effectiveness of minimum-drinking-age laws in reducing drinking and driving by teens resulted when New Zealand recently lowered its minimum legal drinking age from 20 to 18. This change resulted in an immediate increase in teens' alcohol-related crash involvement, including that of under-drinking-age teens.[14]

The introduction of zero tolerance laws for young drivers was followed by a reduction in single-vehicle nighttime crashes (a proxy for alcohol-involved crashes),[15] alcohol-related crashes,[13] and self-reported drinking and driving[16] by teens. In addition, the adoption of the 0.08 blood alcohol concentration (BAC) standard in all states[17] lowered alcohol-related crashes.[13] Teen drivers have lower rates of drinking and driving than drivers in their twenties, but the passage of strict alcohol laws undoubtedly deters teen drinking and driving and reduces teen drivers' involvement in fatal alcohol-related crashes.[18,19]

Graduated driver licensing[20] has reduced the crash involvement of teen drivers. If the age groups of teens were disaggregated in Figures 1 and 2 to single age groups, this effect would likely be evident for those aged 16 and 17 years, because the greatest effect of GDL is among the youngest and least experienced drivers.[21] Currently all states have some form of GDL program in place, but the content and quality of these programs is inconsistent. The Insurance Institute for Highway Safety has rated the state programs, finding only one to be of poor quality, 11 of marginal quality, 11 of fair quality, and 28 of good quality.[22] Although there is room for improvement in GDL programs, evaluations have consistently shown the effectiveness of GDLs in reducing the crash risk of teen drivers.[21]

Factors That Increase Teens' Crash Risk

Passengers

Teen drivers often have passengers, because cars are an important mode for socializing. Because of the social function of motor vehicles in teens' lives, teens often travel in motor vehicles with other teens, either as the driver or the passenger of a teen driver. Given that teens often drive with passengers and drive less safely than adults, it is not surprising that the number of crashes that claim the lives of children begins to climb sharply at age 13 and peaks at age 17–18.[3] Not only are teen drivers involved in more crashes when a passenger is present, the crashes are more likely to be judged the fault of teen drivers.[3,23–27] The increased crash risk associated with passengers is completely unique to teen drivers, having the obverse effect for adults.[3,26,27]

Nighttime and Weekend Driving

Nighttime driving is more hazardous than daytime driving for all age groups of drivers but has an especially marked impact on the crash involvement of teen drivers.[25] Teen drivers have diurnal crash patterns that are distinct from those of adults. For teen drivers, crashes peak at 7 AM and remain elevated until 9 AM. This is followed by another spike that begins to increase at 1 PM, peaks at 3 PM, and remains elevated until 7 PM. Fatal crashes have the same morning and afternoon spikes, but the number of fatal crashes remains elevated until midnight, after which they descend slowly to a low at 4 AM.[3,28] For all drivers, the risk of a motor-vehicle crash increases on the weekend.[29] For teen drivers, there is a large increase in the risk of crashes of all types on Friday and Saturday.[30–32]

Drinking and Driving

Teens (aged 16–20 years) represent 16% of drivers who are involved in fatal crashes and have BACs greater than 0.08. This is a lower involvement rate than any other age group except those over 55 years.[19] Nevertheless, driving under the influence of alcohol is one of several factors that elevate teen drivers' risk of a motor-vehicle crash.[25,27,33] Teens are less experienced drivers and less experienced drinkers than adults. Teens drink and drive less often than adults but place themselves and others at greater risk when they do drink and drive.[3,34] This excess risk is apparent in their involvement in alcohol-related fatal crashes, which increases more sharply with rising BACs for teens than for adults.[3,18,35]

Non-Use of Seatbelts

Teens have the lowest rates of seatbelt use of any age group.[2,36–40] In 2004, seat belt use by teens aged ≥16 years averaged approximately 10 percentage points lower than that of both adults and children (aged 8–15

years).[41] As a result, nearly two thirds of teens killed or injured in crashes in 2004 were not wearing a seatbelt.[42]

Combinations of Crash Risk Factors

Driving entails a complex set of skills and behaviors and often may be executed in the presence of more than one risk factor. These data indicate that, whether a teen or adult is driving, when risk factors co-occur crash risk increases. The authors have examined the effect of combinations of crash characteristics on risk ratios comparing crash rates of drivers aged 16–19 years with those of drivers aged 45–65 years.[43] The data for this study are from Michigan State Police crash records for 1989–1996, the 1990 and 1995 NPTS, and the 2001 NHTS. Crash data were used to create crash types by combining specific crash characteristics. These characteristics were selected on the basis of their proximity to driver behavior (e.g., speeding, alcohol-involved); conditions at the time of the crash (e.g., nighttime, raining); the in-vehicle environment (e.g., passengers present); and the severity of the crash (e.g., resulted in casualties). These crash characteristics were also selected because they could be addressed through policies and laws, driver education/training, or other interventions. Using these data, the authors examined the risk ratios of several of the crash characteristics just reviewed and identified how the co-occurrence of these characteristics influences teen drivers' risk levels. Risk ratios were calculated to compare the crash rates of male teens with male adult drivers, and female teens with female adult drivers.

As previously noted, passenger presence poses considerable excess risk for teen drivers.[3,26,27] When having a passenger on board is combined with other risk factors, the overall risk level increases. For example, risk ratios for teens driving with at least one passenger were 3.6 for male and 2.8 for female drivers compared with adult male and female drivers, but driving with at least one passenger increased the teens' chance of a road-departure crash to 13.1 for male and 6.0 for female drivers compared with adult drivers. Similarly, driving at night increased male teen and female teen drivers' risk of a crash 4.2 and 3.3 times, respectively, but driving at night on the weekend increased teens' crash risk 5.1 times for male and 4.4 times for female drivers. Drinking and driving increased the risk of a crash 2.4 times for male teen and 2.0 for female teen drivers, but drinking and driving with passengers at night increased the teens' crash risk to 9.5 times for male and 7.5 times for female drivers compared with adult drivers. These data indicate that although the rate of fatal alcohol-involved crashes is lower for teens than for drivers in their twenties to forties,[19] the combination of drinking and driving with other crash risk factors results in a substantially higher crash risk for teen drivers.

Conceptual Approach to Understanding Teen Driving

The population crash data presented above highlight a serious public health problem yet portray only part of the teen driving picture. An understanding is needed of why teen crash risk is higher and why some teens are more likely to crash than others. Teen driving overall and the factors that contribute to an individual teen's driving must be understood in order to develop and implement public health approaches, strategies, and policies that will ultimately reduce teen motor-vehicle crashes and their consequences. Although there has been excellent progress in engineering approaches to vehicle safety and roadway design, the behavior of individual drivers remains a challenge in preventing traffic crashes, especially among teen drivers. That behavior is thus the focus of the conceptual framework below, which categorizes and describes some of the multiple factors that affect teen driving.

To understand and influence behavior, theoretical approaches are essential. Although several theories have been applied to driving behavior, the following approaches are particularly useful in understanding teen driving behavior and are incorporated into the framework described below. Social learning theory is based on the idea that people behave in ways they have learned by receiving positive reinforcement, and social cognitive theory employs a dynamic, reciprocal model in which behavior, personal factors, and environmental influences all interact.[44] Problem behavior theory[45] has demonstrated in adolescents and young adults that although behavior is influenced by multiple factors, behaviors viewed as problems sometimes serve a developmental purpose. Ecologic models view behavior in a whole system, highlighting the influence of physical and environmental factors in addition to social and individual factors.[46,47] The conceptual framework outlined below draws from this background of theories.

Of the many factors influencing teens' driving, some factors, such as driving inexperience, affect all novice teen drivers, putting them at higher risk of crash than adult drivers. Other factors, such as propensity for sensation seeking, affect a subset of teens, putting them at higher risk of crash than other teen drivers. These factors are categorized (Figure 3) and discussed briefly below. First, the particular driving behaviors of teens are specified. Then, the various factors that may affect teens' driving behavior are described, including driving ability, physical and psychosocial development, behavioral factors, personality characteristics, demographic factors, the perceived environment, and the driving environment. Research has identified significant relationships among many of these factors and young people's driving behavior, traffic offenses, and crashes.

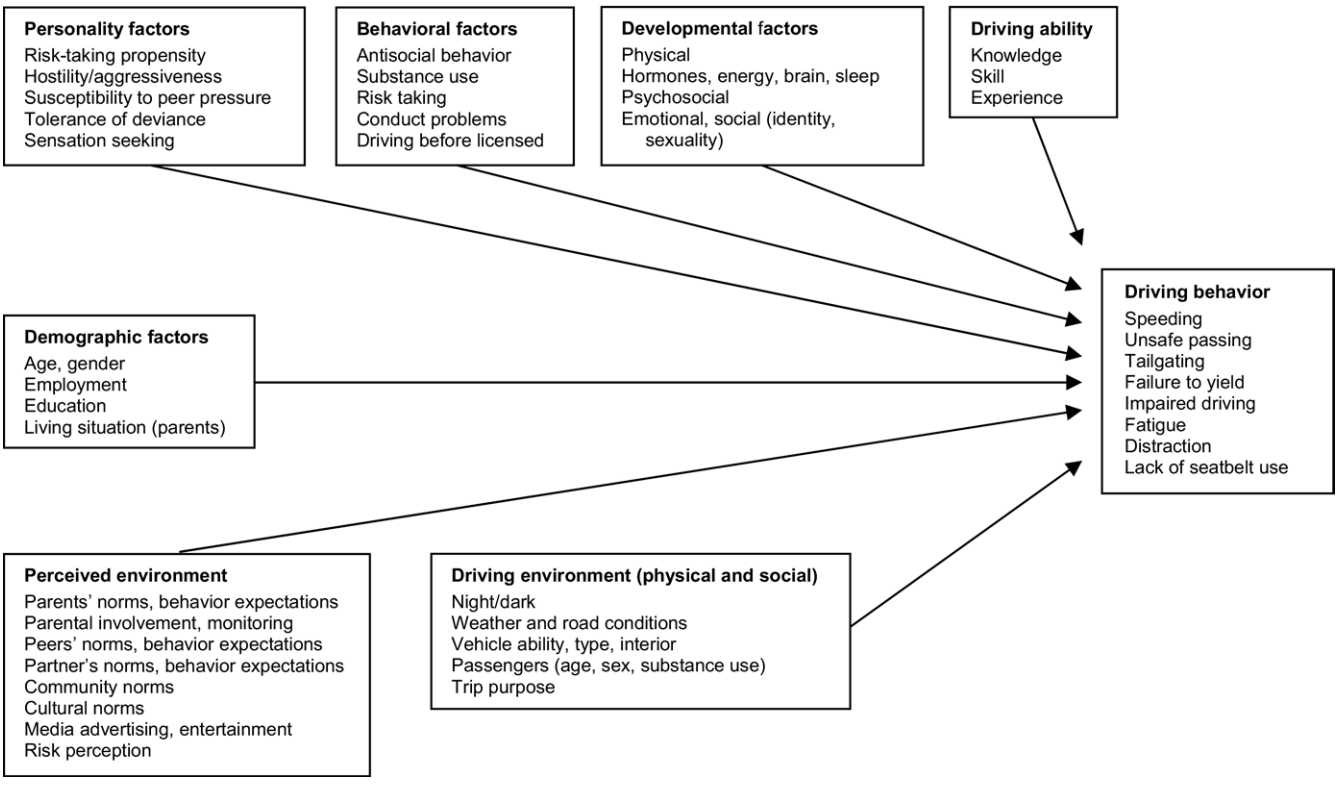

Figure 3. Factors that affect teen driving behavior

Driving Behavior

Several driving behaviors seem particularly common and risky for teen drivers. Teen drivers tend to speed, follow vehicles too closely, make illegal lane changes, and weave through traffic, putting themselves and others at risk.[48] Teens, more frequently than older, more experienced drivers, fail to yield the right of way at controlled intersections (e.g., yield and stop signs, traffic lights).[48–50] Teen drivers are also less likely to perceive hidden traffic risks and to react to them appropriately.[51]

Impaired driving from drinking alcohol (or using drugs) is more of a problem among young adults than teens, as evident in alcohol-related crash data.[7] Driving can also be impaired, however, by fatigue or distraction. Drowsy or sleepy driving is more frequent among young drivers than among older, more experienced drivers.[3] Most adolescents do not sleep enough. This sleep loss interferes with functioning[52] and is associated with increased risk-taking and unsafe behaviors.[53]

Teen drivers are also easily distracted from the driving task and are inexperienced at judging the driving demand in relation to additional tasks.[54,55] Using a cell phone, radio, and CD and other players, as well as eating, drinking, smoking, and interacting with passengers, are other distractions from driving that teens may not appreciate as dangerous.

In addition, teen drivers and their passengers put themselves at increased risk of injury in crashes by wearing their seat belts less often than older, more experienced drivers and passengers.[7] The reasons for not using a proven safety measure are not entirely clear.[42]

Driving Ability

Driving is a complex psychomotor task, and basic ability is necessary for a person to drive and to avoid crashes while driving. Driving ability is acquired through knowledge, skill development, and experience. New drivers must acquire knowledge of rules of the road and how to manage and control a vehicle. This knowledge is often gained in driver education or training, with some behind-the-wheel driving. Driver education is currently under scrutiny, as the need for a more science-based approach and evaluation is acknowledged.[56,57] Novice drivers must learn skills in car-handling and essential maneuvers (e.g., starts, stops, turns, staying within the driving lane, speed control), and achieve competence in those skills through practice, mostly supervised by an experienced driver (typically the teen's parent) over an extended time period.

Even when basic knowledge and skills have been acquired, much experience is necessary for driving ability to become satisfactory.[58] Novice teen drivers are less able to recognize[58] and detect risks than are more experienced drivers.[59] This deficit, at least in part, is due to driving inexperience and a lack of knowledge about potential hazards. Visual scanning

patterns of novice teen drivers are also different from those of more experienced drivers. Teens tend to fix their attention on individual hazards and scan for hazards close to their vehicle, scanning for more-distant hazards less than experienced drivers do.[60]

Crash and offense rates that are initially high decline rapidly as teens gain essential experience and skill driving independently.[38,61,62] Their initial lack of experience and skill presents a "Catch-22." The only way teens can gain driving experience and increase their skills is by driving,[63] and yet the first months of independent driving are particularly hazardous. Traffic safety experts have had to focus on measures that reduce the exposure of teens to high-risk situations while they gain driving experience.

Developmental Factors

Developmental issues are prominent during the time teens are learning to drive and during their early years of driving. Teens are entering puberty, as well as still developing and growing physically.[64] Recent research reveals that an individual's brain may not be fully developed until age 25, especially the prefrontal cortex where impulse inhibition, decision making, and judgment are centered.[65] The sleep patterns and needs of young people are also different from those of adults. Teens' biorhythms tend to demand that they fall asleep later at night and wake later in the morning than do adults.[66] Yet most high schools, to which many teens drive themselves, have early morning start times. Some teens are affected by attention-deficit hyperactivity disorder (deficits in sustained attention or persistence, resistance to distraction, voluntary motor inhibition, and regulation of activity level relative to same-age peers). This developmental disorder has been shown to relate to poorer driving performance.[67]

In addition to these physical developments, teens are also undergoing psychosocial changes.[68] Teens are developing emotionally, testing their limits and abilities, seeking their identities as individuals, and evolving in their relationships with peers. Their social life and sexual identity are of keen importance. All these issues are brought into the car with teens and may affect their driving behavior.

Behavioral Factors

As teens develop, they may adopt conventional or problem behaviors. Engaging in antisocial behavior is associated with risky driving among teens.[69] Those teens who report early access to and use of tobacco, alcohol, or marijuana do more risky driving and more drinking and driving.[69–78] Risk-taking behavior and conduct problems have been linked to motor-vehicle crash injuries,[79] as has driving before being licensed.[80] Further, teens with better grades in school tend to have less risky driving behavior.[70,74]

Personality Factors

Several personality factors are related to risky driving among young people. Teens who have a risk-taking propensity or sensation-seeking personality,[77,81–83] who have a tendency toward hostility and aggression,[83] or who are more susceptible to peer pressure are likely to have more crashes.[84] Another measure of interest is tolerance of deviance—the acceptance of behaviors that most others consider wrong or immoral. Those young people with a high tolerance of deviance—who do not consider deviant behavior to be wrong—have more traffic crashes.[70,84–86] In a study comparing the personalities of teen male drivers with crashes to those without crashes, Vavrik[87] found that the former had higher risk-taking and lower harm-avoidance scores. Driver confidence–adventurousness predicted the likelihood of crashing among teen drivers.[80] Thus, personality characteristics may influence risky driving behavior indirectly, by affecting attitudes toward traffic safety.[88]

Demographic Factors

Risky driving varies among different groups of teens. For example, even though novice drivers of any age in general have more crashes early on, age at licensure is a contributor to crash risk, and younger licensees have more crashes.[89–91] Male teenage drivers are more likely to be involved in fatal crashes,[7] to engage in risky driving,[79,92] and to report drinking and driving[78] than are female teenage drivers. Young people who are employed are more likely to report drinking and driving. More driving problems, including drinking and driving, are found among those with less education, but the relationship can differ by gender.[93] Teen drivers who report that they live with both parents have less risky driving than those who live with only one parent, perhaps because two parents have greater ability than one parent to monitor and be involved in their teen's behavior.[72–74]

Perceived Environment

Teens' perceptions of their environment are complex influences on driving behavior. For their entire lives, teens have been developing perceptions of what is "normal" or expected driving behavior, and these perceptions strongly influence their driving. Perceptions that come from individuals, as well as perceptions that come from broader sources, are relevant.

From birth on, most youngsters are driven around in a car by their parents. Parents' driving strongly influences the subsequent driving of young people, which has been shown to be similar to that of their parents.[94–97] Parents can play a key role in their teen's driving education and training,[98] but parents are often unaware of the risks of teen driving.[99] Parents' expec-

tations of their young drivers are important and affect driving behavior. Parents who are involved in their teen's life and who monitor, nurture, have high expectations, and are not overly permissive tend to have youngsters who drive with fewer crashes and offenses[70,73,74,100] and who drink and drive less.[78] Parents in states with GDL programs establish and enforce more appropriate teen driving limits.[101,102] Teens whose parents set limits on the teen's early driving, in the context of an intervention program, have less risky driving behavior and fewer offenses and crashes.[103] Beyond parents, support from other adults in school and the community can also protect teens from drinking and driving.[78]

Other individuals who can greatly influence the driving of teens are their peers.[104] As mentioned earlier, teens who are susceptible to peer pressure have more offenses and crashes.[84] Having friends involved with alcohol early is related to teens' problem driving.[72,73] How peers drive understandably influences teens' own driving.[105] Peer passengers influence teen driving, as seen in the negative influence on male drivers of young male passengers and in the moderating effect of female passengers.[106] Further, the norms and expectations of a partner (girl- or boy-friend, significant other, or spouse) influence driving.

Beyond parents, peers, and partners is the wider world perceived by the teen driver—that of the community, the culture, and the media. Teens' perceptions of driving risk are developed from these sources—how dangerous it is to drive; how likely it is to crash; how likely it is that someone could get injured or killed; or how likely one is to be ticketed, fined, or jailed for a particular driving infraction. Teens, especially males, are more likely to underestimate the risk in driving and underestimate their crash risk than are other drivers (both similarly aged peers and adults).[33,107,108] Teens exposed to the negative, risky driving behaviors of their friends, siblings, and parents view those behaviors as less risky.[105] Community norms and traffic safety enforcement influence teens' perceptions and therefore their driving. The U.S. culture promotes car-oriented expectations, and not always in ways that promote safe driving. Racecar driving is very popular entertainment. Even young teenagers expect to drive a car, own a car, and often actually need a car for transportation to meet basic needs. The media, both advertising and entertainment, promote fast driving and performance driving more than safe driving. Finally, youngsters spend a lot of time with video games, many of which encourage aggressive behavior or car racing, with effects on young people's subsequent driving behavior.[109]

Driving Environment

The environment, both physical and social, in which teens drive has several features related to risky driving. The physical environment of driving at night (in the dark), as mentioned above, is more risky for young people than for older, more experienced drivers.[3] Although not completely understood, this environmental factor has a considerable effect. Bad weather, as well as road types and conditions with which the novice teen driver has had little experience, may also present problems.

Teen ownership of vehicles is high[110] and is related to more driving and higher crash rates.[110,111] Teens who have unsupervised access to vehicles[101] or own vehicles have more risky driving behavior and traffic violations.[110,111] Vehicles owned by teens are often neither the safest nor the type recommended for young drivers,[110,111] who may not have the driving experience to handle SUVs, large vans, or pickup trucks. Newer, heavier vehicles with more safety features may be better than older, lighter vehicles at preventing injuries to teen occupants involved in a crash.[110] Further, physical aspects of the vehicle interior can be important. Being familiar with vehicle controls and having essentials, such as sunglasses, within easy reach are important. Finally, avoiding unsafe actions with food, beverages, cigarettes, cell phones, radios, and CD and other players are especially important for young novice drivers.

Little is known, more is being learned, and much can be imagined about what goes on inside vehicles driven by teens. This social context is an important influence on teens' driving, as the increased crash risk in the presence of passengers indicates.[3] Teenage passengers, particularly male passengers, are related to more risky driving.[106] Social interaction very likely distracts a teen driver from the driving task. Conversation, or merely the presence of particular passengers, may lead to different driving behaviors. The purpose of a driving trip could be related to risky driving. Trips to school or work or to do errands may not lead to as much risky driving as trips for recreational or entertainment purposes.

Discussion and Conclusion

Teen drivers in the U.S. are at considerable excess risk of motor-vehicle crashes compared with adult drivers. This excess risk has existed for many years, despite some success in traffic safety efforts. Potential interventions to prevent the risky teen driving behavior that can lead to crashes should be based on research. Crash statistics highlight certain conditions, such as nighttime and passenger presence, that increase crash risk for teen drivers. These factors lend themselves to prevention efforts such as GDL (gaining experience in low-risk driving conditions by imposing night and passenger restrictions) and affect all novice teen drivers.[112,113] The combinations of factors that were found to increase teen crash risk compared with adult crash risk (e.g., drinking and driving with passengers at night)

also suggest that decreasing exposure to those factors would reduce crashes. Education of teens and parents about these risks is also indicated.

As described in the framework above, many complex factors influence the way teenagers drive. These factors include driving ability, developmental factors, behavioral factors, personality characteristics, and demographic factors, as well as the perceived environment and the driving environment. Much has been learned about the factors related to teen driving, but research is needed to fill in gaps in existing knowledge. Recommendations for interventions should be based on research, with sound programs developed using a conceptual framework such as the one presented here, and a strong theoretical foundation. Prevention efforts are needed that target behaviors and characteristics of individual teens that place them at higher risk of crash than other teen drivers. The risky driving behavior itself (e.g., speeding) could be targeted directly, or one or more of the factors that influence the driving behavior could be targeted by prevention efforts.[114] Some of these predisposing factors, such as parental monitoring or community norms, lend themselves to being changed more than others. Factors that cannot be changed, such as personality or living situation, can be used to guide, inform, or tailor interventions to prevent youthful risky driving.

Research is needed to understand young drivers' viewpoints and their interpretations of the relationships in the framework, as well as their views of potential interventions. For instance, not wearing seatbelts may serve a developmental purpose, such as "looking cool," for some young people. Interventions would not be successful without an understanding of the "purpose" of such a behavior, so that safer ways to "be cool" could be promoted. Research can provide a strong basis for determining relevant factors for interventions, and their effectiveness, as well as the best way to adapt existing programs to promote teen driver safety. Thus, programs can build on what is known while contributing further to the growing knowledge base being gathered for the purpose of protecting novice teen drivers. The complex teen driver situation cannot be addressed with any single, simple solution, but requires a multilevel, comprehensive approach.

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