Peer Passengers: How Do They Affect Teen Crashes?

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Article history: Received July 7, 2011; Accepted October 18, 2011

Keywords: Adolescence; Automobiles; Distracted driving; Novice driver; Occupants; Teen driving; Traffic accidents

Abstract

Purpose: The specific mechanisms by which peer passengers increase teen drivers’ crash risk are not completely understood. We aimed to provide insight on the two primary hypothesized mechanisms, distraction and promotion of risk-taking behavior, for male and female teen drivers and further for select driver–passenger gender combinations.

Methods: From the National Motor Vehicle Crash Causation Survey (2005–2007), we analyzed a nationally representative sample of 677 drivers aged 16–18 years (weighted n = 277,484) involved in serious crashes, to compare the risk of specific distraction-related and risk-taking-related precrash factors (documented via on-scene crash investigation) for teens driving with peer passengers and teens driving alone.

Results: Compared with males driving alone, those with peer passengers were more likely to perform an aggressive act (risk ratio, RR [95% confidence interval] = 2.36 [1.29–4.32]) and perform an illegal maneuver (RR = 5.88 [1.81–19.10]) just before crashing; risk taking increased regardless of passenger gender. Crash-involved males with passengers were also more likely to be distracted by an exterior factor (RR = 1.70 [1.15–2.51]). Conversely, females with passengers were more often engaged in at least one interior nondriving activity (other than conversing with passengers) (RR = 3.87 [1.36–11.06]), particularly when driving with opposite-gender passengers. Female drivers, both with and without passengers, rarely drove aggressively or performed an illegal maneuver before crashing.

Conclusions: Passengers may affect male teen driver crashes through both distraction and risk-promoting pathways, and female involvement primarily through internal distraction. Results of this and future studies investigating peer–driver interactions may guide development of passenger-related crash prevention efforts to complement already existing Graduated Driver Licensing passenger restrictions.

Teen drivers have the highest motor vehicle crash involvement rates of any age group and are four times more likely (per mile driven) than older drivers to be involved in a fatal crash [1,2]. It has also been well established that carrying peer passengers increases the crash risk of teen drivers, with risk increasing with the number of peer passengers [3–5]. Further, differences in fatal crash risk by driver and passenger gender have been observed, with particularly high risks observed among male teen drivers with male peer passengers [3,6,7]. These findings are in contrast to the stable or decreased crash and fatality rates observed in older drivers with passengers and in teen drivers with older or younger passengers [1,8].

The specific mechanisms by which peer passengers increase teen drivers’ crash risk are not completely understood. Current literature supports two hypothesized mechanisms: (1) explicit or implicit encouragement of risk taking [9,10] and (2) distraction [11]. These theories have been supported by direct observation studies [9,10], laboratory-based experimental studies [12–14].
Eligible crashes were limited to those that occurred between 6 AM and midnight, resulted in injury or property damage, were responded to by the Emergency Medical Service (EMS) system, had both police and one of the case vehicles (i.e., first 3 vehicles involved in crash) at the scene, included a case vehicle that was a towed passenger vehicle, and had an available police accident report. Given that EMS and police response are likely indicators of a higher crash severity level, crashes in this study will henceforth be referred to as “serious crashes.”

NMVCCS methodology and data collection

Specific details relating to the study’s objectives, study design, and sampling design have been described by NHTSA [18,19] and in a previously published manuscript [20]; however, we provide a brief overview of NMVCCS methods here. NMVCCS used an accident cause analysis method originally proposed by Perchonok [21], who described the events leading up to a crash as a chain of successive cause-effect events (see Blower and Campbell for an applied scenario [22], pp 6–7). The study used a multistage sampling procedure, with the sampling frame including dimensions of both geographic area and 6-hour time of day–day of week “time blocks.” Once a specific time block was selected, NMVCCS researchers, in coordination with EMS providers and police, were dispatched to the scene of each crash until an eligible crash was found or the time block expired; no more than one eligible crash was investigated in a specific time block. The response rate for the study period was defined as the number of time blocks with a sampled (i.e., included in NMVCCS) crash divided by the number of time blocks with a crash; this was calculated to be 72.8% (5,470 time blocks with a sampled crash/7,515 time blocks with a crash) [S.D. Stern, National Center for Statistics and Analysis, NHTSA, oral communication, June 2010] [19].

On arriving at a crash scene, NMVCCS researchers gathered extensive data via surveys and photographs of the crash scene and vehicles and structured interviews with police, crash participants, drivers or their proxy, and witnesses. Using information collected from these sources, researchers documented the presence or absence of a wide variety of driver-, vehicle-, environmental-, and roadway-related crash-associated factors, or precrash factors believed to increase the probability of crash occurrence; no determination was made on the scene as to whether a particular factor contributed to the crash. Driver-related crash-associated factors of interest included those related to distraction: (1) inattention (focusing on internal thoughts, daydreaming), (2) interior nondriving activity (activity inside vehicle, other than conversing with passengers, that interfered with driver’s attention to the driving task, e.g., looking at actions/movements of occupants; looking at objects; eating/drinking; retrieving objects from floor, seat, or other location; dialing/hanging up phone; and texting), and (3) exterior factor (driver removed his/her focus away from driving task to focus on a factor exterior to vehicle, e.g., looking at other traffic, looking at previous crash), as well as two factors related to risk taking: (a) aggressive act (exhibited specific patterns of aggressive behavior, including speeding, tailgating, and weaving) and (b) illegal maneuver (maneuvers that are illegal and clearly unsafe, e.g., failure to obey a traffic control device, initiated illegal U-turn). A crash-associated factor was noted as being present if one or more of the specific acts or activities classified under that factor was present (e.g., tailgating and speeding were separate acts classified under “aggressive acts”). More detailed definitions of these variables can be found elsewhere [23]. To maximize accuracy of variables, NMVCCS researchers received extensive initial and ongoing training to ensure that data were collected systematically; a minimum of 3 months of training was required of all field researchers that focused on procedures to objectively identify, collect, and document crash data. Further, NHTSA established multiple quality control measures, including case review by an NMVCCS quality control team [18].

Study sample selection

The current study focused on drivers aged 16–18 years who were involved in a serious crash while driving a passenger vehicle either alone or only with passengers aged 14–20 years. We excluded teens with older or younger passengers, teens driving a vehicle other than a passenger vehicle, and teens with license and teen drivers’ reports of peer distraction and encouragement of risky driving [11,15,16]. Several of these studies have also reported statistical interactions between passenger and driver gender; specifically, the presence of male passengers leads to riskier driving behaviors, regardless of driver gender, but particularly when traveling with a male driver [9,10].

Notably, few prior studies have investigated the specific role of peer passengers among teen crashes. Williams et al [5] reported an increase in the frequency of speeding, driver error, and single-vehicle crashes among teens in fatal crashes with peer passengers (compared with solo drivers), and Aldridge et al [8] found that crash-involved teens carrying passengers were more likely to travel at unsafe speeds compared with those driving alone or with passengers of other ages. However, these studies relied solely on police accident report data, which may not have been collected systematically across jurisdictions, are limited in scope, may overassign culpability to teens because of their age, and may have issues with accuracy [17].

Having detailed information on the circumstances and social environment in teens’ vehicles in the moments leading up to a crash would help significantly advance our understanding of how peer passengers contribute to teen driver crashes. Several unique features of the National Highway Traffic Safety Administration’s (NHTSA) recently conducted National Motor Vehicle Crash Causation Survey (NMVCCS), including its identification of precrash factors via surveys of vehicles and the crash scene and structured on-scene interviews with crash participants, make it an excellent data source to provide insight on the two primary mechanisms by which peer passengers are hypothesized to increase crash risk. Thus, we analyzed data on NMVCCS crashes to compare the likelihood of select distraction-related and risk-taking–related precrash factors among teens who were driving with peer passengers compared with those driving alone. Given prior findings suggesting that passenger effects may differ by driver and/or passenger gender [9–11], we investigated these factors separately for male and female drivers and further for select driver–passenger gender combinations.

Methods

NMVCCS study design

The NMVCCS, a study of 5,470 crashes conducted by NHTSA between July 2005 and December 2007, was designed to identify contributing vehicle, driver, and environmental precrash factors to inform development of crash avoidance technologies [18]. Eligible crashes were limited to those that occurred between 6 AM and midnight, resulted in injury or property damage, were responded to by the Emergency Medical Service (EMS) system, had both police and one of the case vehicles (i.e., first 3 vehicles involved in crash) at the scene, included a case vehicle that was a towed passenger vehicle, and had an available police accident report. Given that EMS and police response are likely indicators of a higher crash severity level, crashes in this study will henceforth be referred to as “serious crashes.”
permits (i.e., learner permits). Figure 1 describes the selection of subjects from the main NMVCCS study for inclusion in the study sample.

**Statistical analyses**

Chi-square tests were used to determine associations between demographic and crash characteristics and passenger status (with peers vs. alone). We then estimated the gender-specific weighted proportion of crashes involving each crash-associated factor by passenger status. Drivers with "unknown" values (i.e., researchers had insufficient information to determine if factor was present) were excluded from analyses of that specific factor; the frequencies of unknown values for the precrash factors of interest were as follows: .50% for illegal maneuvers, 4.2% for aggressive acts, 16.4% for exterior factors, 17.4% for interior non-driving activities, and 20.2% for inattention. A two-stage weighting procedure, incorporating design weights and appropriate adjustments, was applied to ensure the NMVCCS sample was representative of similar types of crashes in the United States [19]. Risk ratios (RRs) and 95% confidence intervals (CIs) were used to compare the likelihood of these factors among teens with peer passengers and those driving alone. We further examined relative risks for select driver–passenger gender combinations (e.g., male alone, male driver–male passengers only, male driver–female passengers only); this analysis should be considered somewhat exploratory, given small sample sizes for gender combinations. All statistical analyses were performed using SAS-callable SUDAAN Release 10.0.1 (Research Triangle Institute, Research Triangle Park, NC). This study involved analysis of de-identified, publicly available data, and thus was exempted from institutional review board approval.

**Results**

**Sample characteristics**

Six hundred seventy-seven teens (weighted \( n = 277,484 \)) were involved in 656 serious crashes (21 crashes involved 2 teen drivers) (weighted \( n = 270,042 \)) while driving alone or with peer passengers. Just over half (50.4%) of the crash-involved teen drivers were reported on the police crash report to have at least a possible injury, although teen driver fatalities were rare (.4%). The majority of them (weighted percent \( 73.0\% \)) were driving alone at the time of their crash. Among those driving with peers, 28.9% had more than one peer in the vehicle (Table 1). Most teen drivers in both groups were in a multivehicle crash (\( p < .97 \)), were driving a passenger car (\( p < .46 \)), had a current and valid license (\( p < .45 \)), and were wearing their seat belt (\( p < .56 \)). Additionally, a similar proportion of the two groups were determined to be inexperienced (i.e., had less than 1 year of driving experience or, based on the researcher’s best judgment, was determined to have a lack of training or experience driving; \( p < .83 \)). Finally, males who were in a serious crash were more likely than females to be driving with peer passengers (60.2% vs. 49.3%; \( p < .003 \)).

Regarding the distribution of peer passenger gender, of the 137 male teen drivers with peer passengers, 83 were carrying only male peers (weighted percent = 62.6%) and 38 had only female peers (weighted percent = 35.3%); the remaining 16 (weighted percent = 8.5%) had passengers of mixed genders. Meanwhile, of the 89 females driving with peers, 31 had only male passengers (weighted percent = 40.1%), 46 had only female passengers (weighted percent = 44.5%), and 12 (weighted percent = 15.4%) had passengers of mixed genders.
Passengers appear to alter the precrash environment differently for male and female teen drivers. Male drivers involved in serious crashes had higher rates of risk-taking behaviors with peer passengers of both genders than when driving alone. They also experienced an increased risk of external distraction and an increased risk of internal distraction when they were with fe-

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**Table 1**

Characteristics of teen drivers involved in serious crashes, by passenger status

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Passenger status</th>
<th>Driving alone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Only peer passengers</td>
<td>Unweighted N Weighted</td>
</tr>
<tr>
<td>Total</td>
<td>226</td>
<td>100.0%</td>
</tr>
<tr>
<td>Age, years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>58</td>
<td>25.9%</td>
</tr>
<tr>
<td>17</td>
<td>85</td>
<td>34.1%</td>
</tr>
<tr>
<td>18</td>
<td>83</td>
<td>37.0%</td>
</tr>
<tr>
<td>Vehicle type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger car</td>
<td>160</td>
<td>71.7%</td>
</tr>
<tr>
<td>SUV</td>
<td>38</td>
<td>18.9%</td>
</tr>
<tr>
<td>Minivan</td>
<td>10</td>
<td>3.6%</td>
</tr>
<tr>
<td>Pickup truck</td>
<td>18</td>
<td>5.6%</td>
</tr>
<tr>
<td>License status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current and valid</td>
<td>210</td>
<td>92.2%</td>
</tr>
<tr>
<td>Invalid/suspended/revoked license</td>
<td>16</td>
<td>7.8%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>137</td>
<td>60.2%</td>
</tr>
<tr>
<td>Female</td>
<td>89</td>
<td>39.8%</td>
</tr>
<tr>
<td>Number of peer passengers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1</td>
<td>151</td>
<td>71.0%</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>21.4%</td>
</tr>
<tr>
<td>3 or more</td>
<td>20</td>
<td>7.5%</td>
</tr>
<tr>
<td>Number of vehicles involved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-vehicle crash</td>
<td>64</td>
<td>28.3%</td>
</tr>
<tr>
<td>Multi-vehicle crash</td>
<td>162</td>
<td>71.7%</td>
</tr>
<tr>
<td>Restraint status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belt used</td>
<td>203</td>
<td>91.5%</td>
</tr>
<tr>
<td>Unrestrained</td>
<td>15</td>
<td>6.0%</td>
</tr>
<tr>
<td>Unknown</td>
<td>8</td>
<td>2.5%</td>
</tr>
<tr>
<td>Driver inexperienced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>125</td>
<td>56.7%</td>
</tr>
<tr>
<td>No</td>
<td>81</td>
<td>32.4%</td>
</tr>
<tr>
<td>Unknown</td>
<td>20</td>
<td>11.0%</td>
</tr>
</tbody>
</table>

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Risky driving-related factors

As shown in Figure 2, one-third of male drivers with peer passengers performed at least one aggressive act just before their crash, more than twice the proportion of males driving alone (33.5% vs. 14.2%, RR = 2.36 [1.29–4.32]). Of those who acted aggressively, speeding was by far the most common act for both groups (85.4% of males with passengers and 94.5% for solo males). Males were also almost six times more likely to perform an illegal maneuver in the presence of peer passengers compared with driving alone (RR = 5.88 [1.81–19.10]). Conversely, aggressive acts were rare among female teen drivers, regardless of passenger status, and female drivers with passengers were no more likely than those driving alone to have performed an illegal maneuver.

When the effects of driver–passenger combinations on risk-taking–related precrash factors were explored (Figure 3), we found that the prevalence of an aggressive act among male drivers was almost three times higher in the presence of female passengers than without passengers (40.3% vs. 14.2%, RR = 2.84 [1.95–4.14]), and although not statistically significant, over twice as high in the presence of other males (30.5% vs. 14.2%, RR = 2.15 [0.59–7.82]). Additionally, male drivers with same-gender passengers were more likely to have made an illegal maneuver than males driving alone (RR = 7.82 [2.14–28.62]), with the majority failing to obey a traffic control device.

Discussion

Passengers appear to alter the precrash environment differently for male and female teen drivers. Male drivers involved in serious crashes had higher rates of risk-taking behaviors with peer passengers of both genders than when driving alone. They also experienced an increased risk of external distraction and an increased risk of internal distraction when they were with fe-
male passengers. These findings suggest passengers may affect male driver crashes through both distraction and risk-promoting pathways. Conversely, passengers of female teen drivers appear to affect crashes primarily through internal distraction. Female drivers, both with and without passengers, rarely drove aggressively or performed an illegal maneuver just before crashing.

Several direct observation studies have assessed passenger effects on certain risk-taking behaviors among teen drivers, including speed and headway (distance from preceding vehicle). Their results demonstrated an important modifying role for both driver and passenger gender, with a particular risk-increasing role for male passengers [9,10]. Together, these studies found that compared with male solo drivers, males drive less safely with male passengers and more safely with female passengers; compared with solo female drivers, females with male passengers drive less safely. Studies assessing risky driving indicators among crash-involved teens, however, are not entirely consistent with these findings. Williams et al [5] reported that among male teen drivers, a higher proportion of fatal crashes involving male passengers were single-vehicle crashes (a frequently used indicator of risky driving-related crashes) than fatal crashes involving female passengers; however, this difference was not observed for female drivers. Another study comparing police-reported crashes of male drivers with male passengers, female drivers with female passengers, and vehicles with mixed genders did not observe passenger gender effects on teen drivers’ propensity to cause single-vehicle crashes [8].

Similar to Williams’ findings, this study of serious crashes found that male passengers increased the likelihood of risk-taking in crash-involved male drivers, but not in female drivers. The discrepancy between studies with respect to the effect of male peer passengers on female drivers may suggest that general driving measures like “increased speed” and “decreased headway” are stronger indicators of willful risky driving, or perhaps stronger markers for further engagement in more extreme crash-related risky driving behaviors, among male drivers with male passengers than among female drivers with male passengers. This notion is indirectly supported by developmental studies showing that teen males may be more susceptible to peer influence compared with teen females [24,25]. Altogether, the aforementioned studies, in conjunction with studies demonstrating a particularly high risk of crash involvement among males driving with same-gender peers [3,7], highlight the gravity of male passenger carriage among male teen drivers.

The specific role of peer passengers on driver distraction is less understood, given that in-vehicle distractions are more difficult to directly observe. However, we know from teen surveys that peer passenger distractions are a common occurrence. More than one in three California public school seniors surveyed reported being distracted by passengers while driving [11]. In another nationally representative survey, 94% reported seeing (at least sometimes) passenger behaviors that would distract the driver, including nearly half who saw passengers encouraging the driver to speed [15]. In this study, we found that passengers increase the likelihood of distraction for both male and female teen drivers involved in a crash. Further, our finding that a significant proportion of distracted drivers were reportedly distracted directly by the movements or actions of their passengers makes this issue particularly salient. It is also important to note that these proportions are likely underestimates as they do not include distractions stemming from conversations with passengers (only the presence of a conversation with a passenger was noted). Drivers were also particularly distracted in the presence of opposite-gender passengers, possibly because of the increasing importance and novelty of developing opposite-gender friendships and romantic partnerships during this developmental period.

NMVCCS’ unique data collection methodology advances our ability to understand peer driver–passenger interactions occurring in the moments before a serious crash. However, there are several notable potential limitations. Similar to most crash studies, data were not collected on a noncrash involved comparison group. Thus, although this study provides important insight on the relationship between risky driving and involvement in

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**Figure 2.** Frequencies and risk ratios (95% CI) for the association between teen driver crash-associated factors and passenger status, by driver gender.
crashes with and without peer passengers, its design precludes interpretation of crash-associated factors specifically as risk factors for crashes. In addition, due to operational challenges, crashes occurring between midnight and 5:59 AM were not included in NMVCCS. It is possible that precrash social interactions between specific driver–passenger gender groups differ during the late night and early morning hours than at other times. (Our analyses of a separate nationally representative sample of serious crashes during the same period as this study showed that 8.2% of crashes involving teens aged 16–18 years with passengers and 5.9% involving teens with no passengers occurred during these hours [26].) Additionally, there was insufficient information to determine the presence/absence of distraction-related factors in 15%–20% of drivers. This was because unlike risky driving-related factors, which could be determined from other sources (and thus had < 1% “unknowns”), distraction-related factors relied on interview data. Our inspection of NMVCCS crash narrative summaries revealed that the most common reasons for missing teen driver interviews were the drivers’ unavailability (often due to transportation to a medical facility and nonresponse to follow-up contact attempts) and parental refusal. It is difficult to surmise what effect these missing data might have on the observed distribution of distraction-related factors and the extent to which this differs among subgroups. Additionally, the illegality of electronic equipment use in many jurisdictions may have led to its underreporting by drivers on study interviews and to police, and thus underestimation of the risk of nondriving interior activities. Therefore, caution should be noted in interpreting our findings related to distraction-related factors. Finally, our sample size was limited, particularly in analyses of driver–passenger gender combinations. This precluded further detailed analyses of these groups, and led to wide CIs for some point estimates. Despite these limitations, this study provides ample direction for future research. In particular, as it becomes more feasible for larger-scale studies to incorporate in-vehicle technology, there exists tremendous potential for future studies to even further advance our knowledge of the gender-specific dynamics that exist between teen drivers and their passengers.

**Conclusion**

This study takes an important step in formally linking two complementary bodies of literature. The first provides epidemiologic studies confirming peer passengers increase crash risk for both male and female teen drivers [5] and showing an increase in crash risk for teen drivers who are distracted or performing risky driving behaviors [27,28]. The second, grounded in our understanding of how adolescents interact with and are influenced by one another [29,30], identified distraction and risk promotion as the two likely mechanisms by which passengers affect teen driving behavior [9–16]. Frequently, we combine this information to cite distraction and risk promotion as the primary mechanisms by which passengers increase teen driver crash risk. In truth, however, few studies have evaluated the role of peer passengers in the context of crash involvement. Thus, we still know little about the specific ways in which peer–driver interactions contribute to crashes, especially in the case of distraction, and further how these interactions differ by the gender makeup of vehicle occupants [29]. Insight provided by the results of this study and future studies investigating these interactions may be helpful in
guiding development of passenger-related crash prevention efforts and interventions to complement already existing Graduated Driver Licensing passenger restrictions.

Acknowledgments

This article was written as part of the Young Driver Research Initiative, a collaborative research program between the Center for Injury Research and Prevention at The Children’s Hospital of Philadelphia and State Farm Insurance Companies. State Farm provided financial support for this research. The findings and conclusions are those of the authors and do not necessarily represent the views of State Farm. The sponsors had no role in the design and conduct of the study; in the collection, management, analysis, and interpretation of the data; or in the preparation, review, or approval of the manuscript. The authors thank Megan Fisher-Thiel, M.P.H., at the Center for Injury Research and Prevention for help in coordinating this work and formatting the manuscript, and Seymour Stern and Mark Mynatt of the National Highway Traffic Safety Administration for their guidance on NMVCCS methodology.

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