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Review article

## Young Drivers and Their Passengers: A Systematic Review of Epidemiological Studies on Crash Risk



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### A B S T R A C T

**Purpose:** A systematic review of the literature was conducted to appraise the evidence from epidemiological studies of crash risk in young drivers accompanied by passengers, compared with solo driving.

**Methods:** Databases searched were the Cochrane Library, Embase, Scopus, Transportation Research Information Services, and Web of Science for studies published between January 1, 1989 and August 1, 2013. Epidemiological studies were selected for review if they focused on crashes of young drivers ( $\leq 24$  years old) and included both a no-passenger comparison group and some measure of exposure to enable calculation of estimates.

**Results:** Fifteen articles (17 studies) were selected; seven studies reported on fatal crashes and 10 on nonfatal or combined fatal/nonfatal crashes. Studies on fatal crashes showed increased risk, compared with solo driving, for young drivers with at least one passenger (significant estimates ranging from 1.24 to 1.89) and two or more passengers versus solo driving (1.70–2.92). Increased risk was also found for fatal crashes and for combined or nonfatal crashes with male versus female passengers (1.53–2.66) and for younger versus older drivers (1.42–3.14).

**Conclusions:** Results more clearly indicated an increased risk for passenger presence in fatal crashes than that in nonfatal or combined fatal/nonfatal crashes. Findings of this review, based on correlational studies, support licensing policies that limit the presence and number of young passengers for young drivers.

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### IMPLICATIONS AND CONTRIBUTION

This review found increased crash risk among young drivers carrying passengers, compared with solo driving, particularly for fatal crashes. The findings support the premise of graduated driver licensing programs limiting the presence and number of young passengers for young drivers.

**Conflicts of Interest:** Two authors (M.C.O. and B.G.S.-M.) were involved in one of the articles evaluated in this review.

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Traffic-related crashes are one of the main causes of morbidity and mortality for teenagers and young adults [1]. Some key studies have identified passenger presence and number of passengers as important factors associated with increased fatal crash risk for teenagers [2]. This knowledge was the basis for the establishment of restrictions on passenger presence and number of peer passengers in several jurisdictions where teenagers have access to independent driving before the age of 18 (e.g., Australia, Canada, Israel, United States).

Research evidence that passenger presence is associated with teenage drivers' crash risk was established from population-based epidemiological studies. This research, however, is inconsistent, with some studies reporting discrepant findings of protective or no significant association between passenger presence and young drivers' crash risk. Methodological and conceptual differences between studies may explain discrepant findings, including different age of licensing in different countries (before 18 years versus 18 years and older), sources of data (regional versus national; same databases used in multiple studies), types of crashes (fatal versus others), different age groups for drivers and passengers employed in the analyses, and measures of exposure (trips or mileage versus culpability/responsibility studies versus no exposure). A better understanding of the discrepant findings among epidemiological studies and a clearer picture of the factors affecting young drivers' crash risk is thus warranted and could help improve future development of graduated driver licensing (GDL) programs and psychosocial interventions, such as parent-teen and peer-based interventions.

A systematic review was conducted to examine the strength of the evidence for the relationship between presence and number of passengers as well as characteristics of drivers and passengers on crash risk for teenage and young adult drivers. Several research questions were examined. Compared with solo driving, in teenage and young adult drivers, what is the risk associated with (1a) one or more teenage or young adult passengers and (1b) one or more passengers, irrespective of passenger age. These questions were also examined for (2a) younger teenage drivers versus older teenage or young adult drivers and (2b) teenage or young adult drivers versus older drivers. Compared with solo driving, does the risk vary with (3) number of passengers; (4) driver gender; (5) passenger gender; and (6) gender of both passenger and driver.

## Methods

### *Inclusion criteria*

Studies were included in the review if the following criteria were met. First, the main outcomes were crashes. Second, the design of the studies was observational, including cross-sectional, case-control, and culpability/responsibility studies. In the present context, cross-sectional studies examined rates of drivers involved in a crash with passengers after accounting for exposure, compared with rates of drivers involved in a crash while solo driving after accounting for exposure. In case-control studies, drivers involved in a crash (cases) were compared with drivers with similar characteristics, but who were not involved in a crash (controls). More specifically, rates of cases and controls with passengers were compared with rates of cases and controls while solo driving. Culpability/responsibility studies are described by Asbridge et al. [3] as a variation of the case-control studies in which drivers' crash responsibility is considered. In these studies, rates of drivers at fault and not at fault with passengers were compared with rates of drivers at fault and not at fault while solo driving. Studies involving questionnaires, simulation, or observation on the road were not included. Third, studies examined the association between passenger presence and young drivers' ( $\leq 24$  years old) crash risk; any grouping of young driver ages was acceptable (e.g., 16, 17, 16–20, 18–24). Fourth, studies included a no-passenger comparison group (i.e., solo driving) and a measure of exposure (e.g., kilometers driven,

comparison of crashes at fault versus not at fault) enabling calculation of risk estimates or allowing the calculation of estimates from data presented in the publication. Finally, articles needed to be available as full reports, peer reviewed, and published in English in journals or in organized proceedings.

### *Literature search strategy and selection*

Relevant articles were identified by a comprehensive search performed by the research team guided by an experienced librarian. Databases searched were the Cochrane Library, Embase, Scopus, Transportation Research Information Services, and Web of Science for studies published between January 1, 1989 and August 1, 2013. An index term search was performed to ensure inclusion of all possible search terms. The following search terms (medical subject headings and text words) were used and adapted as appropriate for each database: (teen\* OR adolescent\* OR young adult\* OR novice\*) AND (driv\* OR vehicle OR traffic OR car\* OR automobile OR road\* OR safe\*) AND (passenger\* OR friend OR confederate OR peer OR occupant) AND (crash\* OR collision OR accident OR injur\* OR fatal\* OR death). Reference lists of selected articles and personal libraries of the team were also examined. The retrieved articles were examined in three stages by members of the research team for inclusion based on titles, abstracts, and full article reviews (see [Supplementary Figure 1](#)).

### *Data extraction and synthesis of results*

Two members of the team extracted information from the qualifying articles. Discrepancies in coding were discussed until consensus. Information collected from the articles is shown in [Table 1](#). We extracted authors' names, year of publication, country, study design, main outcome (e.g., fatal crashes), exposure (or types of comparison), database used and years, number of participants for main research question (Question 1a or Question 1b if no Question 1a), if studies included raw data, and age of drivers and passengers. [Table 1](#) also describes if the article answered each of the research questions in the present study (Questions 1–6) and if the main analysis was adjusted for important risk factors or if other risk factors were examined separately.

Meta-analysis was not attempted as many studies lacked raw data, used the databases from the same sources, with overlapping years, or were heterogeneous (e.g., different age groups for drivers and passengers, different types of crashes). We therefore included studies with no raw data but with risk estimates and confidence intervals (CIs). Estimates were extracted from articles when they either directly or partially addressed the research questions (results not in italics in the tables). The latter refers to situations in which estimates were provided in more detail than our initial research question. For example, Question 1 refers to the risk associated with the presence of one or more teenage or young adult passengers. If results were only provided for males and females separately, the tables report these estimates, and we inferred significance if all separate estimates were significant (i.e., 95% CIs did not include "1" or  $p < .05$ ). In these cases, and when raw data were provided, we also calculated estimates that directly answered the research question (results in italics in the tables), using the standard relative risk/odds ratio and 95% CI formulas. We did not attempt to estimate standard errors without raw data, and we did not contact authors of the articles to obtain data for this review. Calculations of estimates

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