Karolinska Institutet
Department of Public Health Sciences
Division of Social Medicine
Norrbacka, 2nd Floor
SE-171 76 Stockholm
Sweden

2004

KI-REPORT 2004:2

Theses for Degree of Master in Safety Promotion

Joel Monárrez-Espino

Curriculum Vitae

Joel Monárrez-Espino, a Mexican physician and Epidemiologist, started working in injury epidemiology in the year 2000 in the project ”Data analysis of the European Home and Leisure Accident Surveillance System” at the Institute of Public Health North-Rein Westphalia, Germany. In 2003 he joined the first master program in Safety Promotion at Karolinska Institutet where he successfully finished with the presentation of his thesis ”Gender differences in car-to-car crash patterns resulting in drivers’ injury among young adults in Sweden” in May 24th 2004. He has written 2 scientific articles, 2 reports, and presented 4 papers at international meetings on safety promotion and injury prevention.

Joel.Monarrez@kbh.uu.se

Gender Differences in Car-To-Car Crash Patterns Resulting in Drivers' Injury Among Young Adults in Sweden

An explorative descriptive analysis of injured drivers

Thesis defence: Joel Monárrez-Espino

Supervisor: Prof. Lucie Laflamme

Contents

Abstract

Background: Road traffic injuries are the world leading injury-related cause of dead and burden of disease in males, and the leading cause of death in people aged 15-29 years in high-income countries from Europe. There is persuasive data pointing to the importance of gender in road traffic accident and injury epidemiology. However, very little information is available regarding gender differences in road traffic crashing patterns.

Objective: This study aimed at investigating the gender differences in car-to-car crash patterns resulting in drivers' injury among young Swedish adults aged 18 to 25 years between 1988 and 1997.

Methods: A register-based cohort of persons born in Sweden between 01.01.70 and 31.12.72 was followed-up. Study subjects for analyses were limited to those drivers having their first car-to-car crash accidents leading to injury between 01.01.88 and 31.12.1997, namely, young male and female adult drivers aged 18-25 years. The data was obtained mainly through the police reporting system for motor vehicle accidents, from hospital register data, and from the national census. Record linkage between these registers was made using the Swedish personal identification number. The topics covered in the analysis included the time, place and outcome of the crash; the characteristics of the crashed car and driving license used; the environmental conditions at crash; and the hospitalization of the injured drivers. Explorative descriptive analyses focused on gender differences regarding the accident occurrence pattern.

Results: Driving men crashed almost twice as often as women. Men were slightly younger than women when the crash occurred. Crashes occurred most often in the summer and less often in the spring irrespective of sex. Saturday and Monday were the most and least common crashing day in both sexes, respectively, but female involvement tended to be higher in the midweek. Women crashed more often between 9.00-16.00 and men between 17.00-04.00. Men tended to crash bigger size cars compare to women who crashed small-size cars. Younger drivers, irrespective of sex, crashed older vehicles than older drivers, but men tended to crash slightly older cars than women. Accidents occurred most often in the west and least often in the north in both sexes, and the Stockholm region showed the largest male involvement. Women crashed more often in densely built-up areas compared to men. The time elapsed from the license issue date to the crash was increasing and slightly longer among males compared to female drivers. Most men who crashed obtained their driving license at a younger age than women irrespective of the driver's age at crash. The mean number of killed, and severely and mildly injured was significantly higher in male compared to female drivers. When applicable, driving men were more likely to be intoxicated with alcohol than women. Women tended to crash more often when raining and snowing, and when the road surface was covered by ice or snow. Men crashed more frequently during darkness. Women tended to crash more often in roads with lower speed limits compared to men who did so at higher speed limit roads. Men crashed more often when overtaking/lane exchange, catching up, and meeting, and women did so when turning, and crossing roads. Driving men were hospitalized on average 1.34 more days than women. Two-thirds of the driving women were hospitalized only for one or two days, but men tended to remain for a longer period of time.

Conclusion: The study adds evidence to the importance of gender in road traffic accidents in young adults in Sweden. The data presented here could be relevant as it can provide important insights regarding the necessity to focus preventive efforts, such as targeted education for men and women during their driving training.

Introduction

In the year 2000, an estimated 1.26 million people in the world died as a result of road traffic injuries, corresponding to one quarter of all injury deaths (WHO, 2002). Worldwide, road traffic injuries are the leading injury-related cause of dead and burden of disease in males, and the leading cause of death in people aged 15-29 years in high-income countries from Europe (Peden *et al.*, 2002).

The increased morbidity and mortality rate associated to road traffic crashes among young drivers has been attributed to age-related factors, including lifestyle (Gregersen & Berg, 1994; Berg *et al.*, 1999) and lack of driving experience (Cooper *et al.*, 1995; Gregersen *et al.*, 2000), which have led to modifications in the driving education system and licensing mechanisms, devised to neutralize the effects of these factors.

There is also persuasive data pointing to the importance of gender in road traffic accidents and injury epidemiology. Some of the most compelling subjects discussed and published during the last 12 years looking directly or indirectly at the role of gender in road traffic accidents and injuries include the following:

Motor vehicle accident occurrence: The evidence suggests that men are more likely to be involved in motor vehicle accidents than women, especially among young drivers.

In a study from South Africa, the male to female ratio for motor vehicle collisions was 2.5:1 (Meel, 2003). A study from Australia showed odds ratio of 2.4 (1.5-3.8) and 2.8 (1.8-4.5) for men having had one and two or more crashes as drivers, respectively, compared to women (Turner & McClure, 2003). Among young Swedish drivers (18-24 years), women had a lower risk of being involved in an accident during late night than men (Åkerstedt & Kecklund, 2001). In Slovenia, diving women cause fewer accidents than males (Bilban, 1998). Studies from the U.S. showed that men have a consistently higher risk of crash involvement per mile driven than women (Massie *et al.*, 1997), and that young drivers are far more crashing-prone than other drivers per vehicle-mile driven (Kweon & Kockelman, 2003).

Injuries from motor vehicle accidents: Studies have shown higher rates of injuries resulting form motor vehicle accidents among men.

In Sweden, from 1987 to 2000, males had 2.1 times the incidence of head injury compared to females, many of which were attributed to transportation accidents (Kleiven *et al.*, 2003). From 1987 to 1999, males had 8 times the incidence of injuries compared to females due to motorcycle and moped crashes (Aare & Holst, 2003). In a study from the U.S., the ratio of males to females hospitalized as a result of motor vehicle crash injuries was 1.33 (1.26-1.41) (Tavris *et al.*, 2001).

Mortality from motor vehicle accidents: All studies show higher fatality rates for males, though some point to the need to consider exposure, as this might relate to the lower fatal crash involvement.

The mortality rates from motor vehicle accidents from 26 countries for persons aged 15-34 years from 1955 to 1994 were higher in males compared to females (Heuveline & Slap, 2002). A study form the U.S. showed that if a female and a male suffer similar potentially lethal physical impacts – other factors being equal–, female fatality risk in those aged 20-35 years exceeds male risk by 28% (Evans, 2001). Studies from the U.S. showed that men had a higher risk than women of experiencing a fatal crash (Massie *et al.*, 1995; Li *et al.*, 1998). Injuries, including motor vehicle related injuries, are the leading cause of death for females to age 34 in the U.S., and are responsible for more years of potential life lost than any other cause of death (Schnitzer & Runyan, 1995). In Slovenia, female drivers

cause less fatal accidents (Bilban, 1998), and in the U.S., women had higher involvement rates than men in non-fatal crashes (Massie *et al.*, 1997).

Reckless driving behavior: Optimistic judgments of driving competence, inattentive driving and accident risk have been implicated in the involvement of young males in traffic crashes.

A study showed that, unlike women, men perceived driving as relevant to their self-esteem (Taubman-Ben-Ari & Findler, 2003). For drivers in loss of control crashes in a study from the U.S., male rates exceeded female rates in all age groups, with a peak in the group 15-24 years (Tavris *et al.*, 2001). Male divers tended to be more optimistic when judging their driving skills and perceived their behaviors as generally less serious and less likely to results in accidents than females, according to a study from the U.S. (DeJoy, 1992). In addition, another study from the U.S. showed that men using cellular phones while driving had significantly higher rates for many traffic accidents than females (Violanti, 1997).

Alcohol and motor vehicle accidents: Although alcohol-related crashes and fatalities have decreased over the last decade, and drunken driving and alcohol abuse in traffic is still mainly a male problem, increased alcohol consumption and increased driving in women have raised concerns about an eventual increase in mortality due to drunken driving among women.

In Canada, an increase in per capita alcohol consumption of 1 liter was followed by an increase in accident mortality (including motor vehicle accidents) of 5.9 in males and 1.9 in females per 100,000 inhabitants (Skog, 2003). There is some evidence indicating that males and females differ in their ability to predict impairment levels for driving prior to consuming a given amount of alcohol (Van Tassel & Manser, 2000). A study looking at the drunkest drivers in Sweden showed that 9% were women and 91% men (Jones, 1999). In northern Sweden, 86% of the female inebriated drivers (men, 98%) and 68% of sober drivers (men, 78%) initiated the crash. Blood alcohol was found in 10% of the women (men, 32%) with a mean alcohol concentration of 1.1 g/kg (men, 1.9 g/kg). No evidence for an increase in the number of women in alcohol-related traffic fatalities over the 10-year period studied was found (Ostrom *et al.*, 1995). In the U.S., females are an increasing proportion of alcohol-involved drivers in both fatal and nonfatal crashes (Waller & Blow, 1995).

Trauma post-accident: Few studies have looked at the higher posttraumatic symptoms presented by women after motor vehicle accidents compared to men.

A study from Australia showed that acute stress and posttraumatic stress disorders in motor vehicle accident survivors were more frequent in women than in men (Bryant & Harvey, 2003). Women were at greater risk for re-experiencing symptoms of intense feelings of distress in situations similar to the motor vehicle accident and physical reactivity to memories of the motor vehicle accident (Fullerton *et al.*, 2001).

Socio-economic status in motor vehicle accidents: Socio-economic status and gender appear to interact in the risk of accidents.

A study from the U.S. showed that a poor educational level relates to a differential risk of dying when traveling in motor vehicles between men and women (Braver & Race, 2003). There is evidence of an interaction effect between socioeconomic status and gender in traffic injury risks (Laflamme & Diderichsen, 2000; Hasselberg 2004).

Sweden has internationally been in the front line of road traffic accident and injury prevention. Improvements in the vehicles and the physical environment together with legislative measures have largely been responsible for the reduced rates of accidents, injuries, and injury-related death caused by crashes in traffic.

The reliable epidemiological surveillance systems of accidents and injuries, the possibility

for record linkage between different datasets through the unique national registration number, and the efficient collaboration across institution have been critical for researchers to expand and deepen the knowledge on road traffic accidents and injuries in Sweden. This has eventually influenced the decisions taken at various levels of prevention.

However, more knowledge is needed focusing on gender differences on road traffic accidents and injuries in Sweden, particularly among young adults. For instance, although it is known that the death rates between males and females in Sweden contrast considerably, with men having 1.9 times higher risk of death when exposed to road traffic (Statistics Sweden, 2000), very little information is available regarding the gender differences in the road traffic accident patterns. Nonetheless, this information could be very relevant as it can provide important insights regarding the necessity to target preventive efforts to the most vulnerable.

Objective

This study aimed at investigating the gender differences in car-to-car crash accident patterns resulting in drivers' injury among young Swedish adults aged 18 to 25 years between 1988 and 1997.

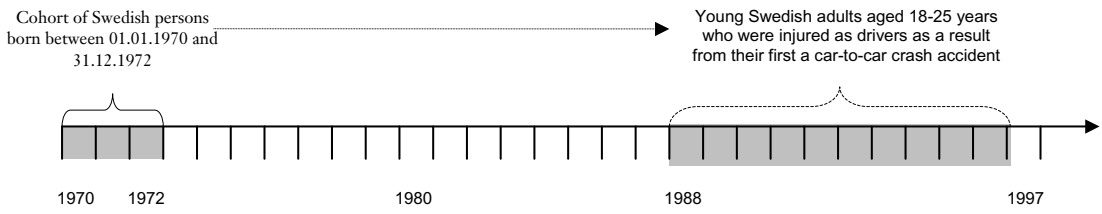
Methodology

Study Design

Register-based population cohort. All persons born in Sweden between January 1st 1970 and December 31st 1972 based on the Swedish Population and Housing Census of 1985 were followed-up retrospectively. Individual records from this census were linked to road-traffic-crash data contained in a register held by the Swedish national Road Administration, in which police reports on car crashes are recorded. In addition, specific data regarding hospitalization was linked from the National Hospital Discharge Register. The data used were already extracted from the registries and available for analyses. More methodological details regarding the data linkage can be seen elsewhere (Hasselberg & Laflamme, 2003; Hasselberg & Laflamme, 2004).

Study Subjects

Study subjects for analyses were limited to those drivers having their first car-to-car crash accidents leading to injury between January 1st 1998 and December 31st 1997, namely, young male and female aged 18-25 years as shown in the following figure. Thus, each driver could only be registered for a single crash during the study period.



Sample Size

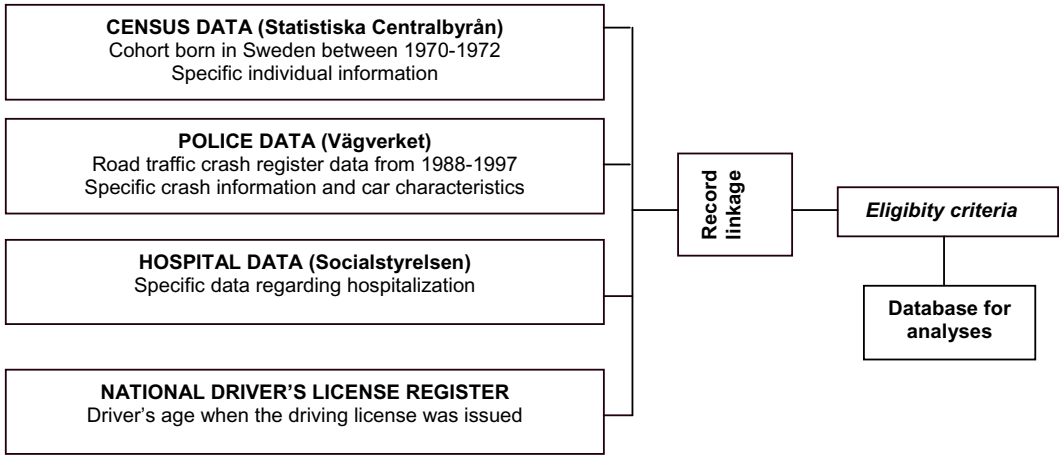
A total of 329 716 persons born in Sweden between 1970-1972 and nearly 26 000 crashes occurred in the country between 1988 and 1997. However, as mentioned above, four eligibility criteria were used for the purpose of these analyses, which included:

(1) First registered crash
(2) Car-to-car crashes
(3) Crashes where the driver was injured
(4) Crashes involving drivers aged 18-25 years

Therefore, a total of 3611 drivers, 2240 men and 1371 women were included in the analyses, accounting for around 1.3% and 0.8% of the total cohort, respectively (male to female ratio for car-to-car crashes ≃1.6:1). The analyses looking at hospitalization patterns included 532 persons, 334 men and 198 women.

Record Linkage

The data was obtained mainly through the police reporting system for motor vehicle accidents, from the Swedish population and housing census information, and from the National Hospital Discharge Register. Record linkage between databases (figure below) was made using the unique Swedish personal identification number.



Data Extraction and Coding

Table I presents the definition, type, and defined values for the variables included within each topic covered in these analyses. Some variables were re-coded from its original format into fewer categories to make the results more comprehensible.

The road-traffic-crash register contained information including the date, time, and place of the crash, the speed limit, type of injury event and severity, and the weather and road conditions at the time of the crash. It also included information of the car crashed, and data regarding possible alcohol intoxication by the driver in association to the crash. Data concerning the driver's age at the time of obtaining the driver's license was linked from the National Driver's license Registry.

Table I. Topics covered, variable definition, variable type, and defined values in the analyses

Topics covered	Variable definition	Variable type	Defined values
Identification	Identification code	Continuous	
	Sex	*Binary*	*Male – Female*
	Date of birth	Date	Month – Day – Year
	Date of crash	Date	Month – Day – Year
	Exact age	Continuous	Years with two decimals
	Age in years	Discrete	18 to 25 years
Crash time	Year of occurrence	Discrete	1988 to 1998
	Season of the year	Nominal	Spring, Summer, Fall, Winter
	Month of the year	Nominal	January to December
	Day of week	Nominal	Monday to Sunday
	Time of the day	Nominal	1-4, 5-8, 9-12, 13-16, 17-20, 21-24 hours
Crash place	Swedish region	Nominal	N, Central, Stockholm, W, Mälardalen, SE, Skåne
	Type of traffic area	Nominal	Densely, non-densely build-up area, unknown
	Swedish state (Län)	Nominal	25 different states
Car characteristics	Size	Nominal	Big, middle, small, compact, jeep, unknown
	Year model	Continuous	Year without decimals
Driving license	Issue date	Date	Month – Day – Year
	Time from issue date to crash	Continuous	Years with two decimals
	Years from issue date to crash	Discrete	Years without decimals
	Type of license	Binary	B, other, undetermined
	Age when license was obtained	Continuous	Years with two decimals
Crash outcome	Outcome of the crash	Nominal	Death, serious injury, minor injury, no injury
	Number of people death	Continuous	Number
	Number of people severely injured	Continuous	Number
	Number of people mildly injured	Continuous	Number
	Weather conditions	Nominal	Dry, haze/fog/mist, rain, rain/snow, snow, unknown
Alcohol use	Suspicion of alcohol intoxication	Nominal	Yes, no, unknown
Environmental conditions	Road surface conditions	Nominal	Dry, wet, ice/snow, thin ice, slush, unspecified
	Lighting conditions	Nominal	Daylight, darkness, sunrise/sunset, unspecified
	Road speed limit	Ordinal	30, 40, 50, 70, 90, 110 km/hr, unknown
	Action performed at crash	Nominal	11 categories (e.g. turning, overtaking, etc.)
	Number of in-patient days	Continuous	Number
Hospitalization	Hospitalized time	Nominal	1, 2, 3, 4, 5, 6, 7 days, 1-2, 3-4 weeks, 1-2 months
	Type of hospitalization	Binary	Urgent, programmed
	Main diagnosis	Nominal	Various categories based on ICD-10/11

As to the outcome of the crash, minor injuries included those that did not require hospital management, severe injuries comprised those requiring hospital care (e.g. broken bone, crush injury, gash, serious wound, concussion, internal injury, etc.), and fatal injuries covered not only deaths on the crash site, but also those occurring within 30 days of the accident. Hospitalization was defined as a hospital registration within the next 24 hours after the crash occurrence.

Statistical Analyses

Data was entered, linked and analyzed in the SPSS® computer software version 10.1 (SPSS Inc., Chicago, Illinois). Descriptive statistics of the studied variables within the covered topics were presented using tables, bar graphs, and box plot graphs. Table II presents the source of the information and the type of analyses performed within each topic covered.

Table II. Topics covered, data sources, and analyses performed

Topics covered	Data source	Analyses preformed
Age at crash	Census data	Mean differences, proportions, rankings
Crash time	Police reports	Proportions
Car characteristics	Police reports	Ranking, proportions, distribution differences
Crash place	Police reports	Proportions, rankings
Driving license	Other register	Proportions, distribution differences
Injury outcome	Police reports	Mean differences, proportions
Alcohol involvement	Police reports	Proportions, distribution differences
Environmental conditions at crash	Police reports	Proportions
Hospitalization	Hospital register	Mean differences, proportions, distribution differences

Bivariate analyses focused on sex differences between injured female and male drivers. Means with 95% confidence intervals were calculated, and mean differences were identified using t-tests and analyses of variance. Pearson chi-squared tests were used to detect differences between proportions. Correlation coefficients were used to explore the association between continuously distributed variables. The probability level at which differences were considered significant was 0.05.

Ethical Considerations

The use of secondary data might create ethical concerns if there is any possibility to establish the identity of the research participants, especially regarding issues such as mortality, misconduct, alcohol abuse and alike. However, the number with which the individuals were identified was held in strict confidence to prevent any disclosure of the participants' identity.

Although no inform consent was obtained for the original data, as the information was collected under regular working conditions at the different institutions involved, namely, police, hospitals or statistic surveillance, consent was obtained from the institutions involved

to use and pool their registers. In addition, KI ethics committee reviewed and approved the main research proposal to built up the original datasets, including the one used here.

All ethical, legal and medical confidentiality aspects were carefully considered. The data from these different registries was linked for the purpose of these analyses, the datasets were electronically stored and no individual names can be recognized.

Results

Demographics (Age)

There was a small but significant mean difference between male and female drivers, with women being 0.2 years younger when the crash occurred (Table 1).

Table 1. Mean difference in the driver's age at the time of the accident stratified by sex

Sex	N	Mean age	95% confidence interval
Male	2240	21.5*	21.4-21.6
Female	1371	21.7*	21.6-21.8
Total	3611	21.5	21.5-21.6

*t-student p value = 0.01

Car-to-car crashes were more frequent among male compared to female drivers, but showed a similar trend – except for females aged 18 years– with highest absolute numbers at younger ages. Within each age group category, male drivers accounted for 58-70% of the accidents, with higher proportions at younger ages (Figure 1).

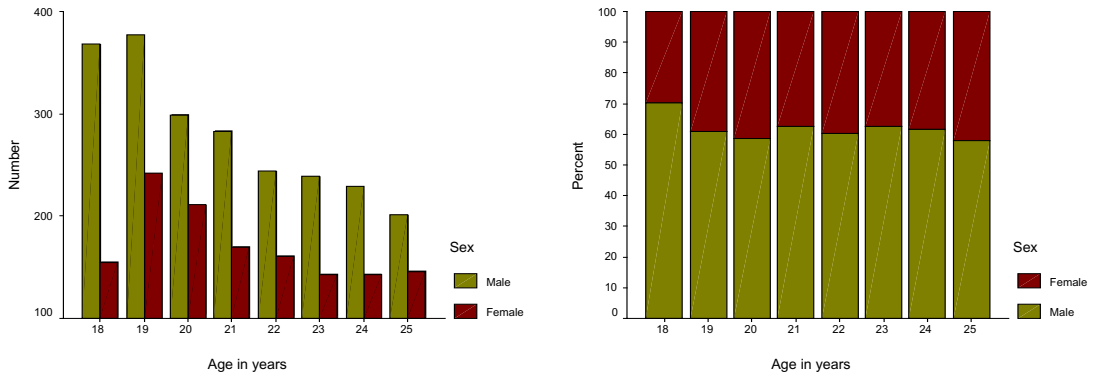


Figure 1. Driver's age when the accident occurred stratified by sex, as the total number of car-to-car accidents and as percent from each age category of injured drivers

Crash Time

Season

Slightly more crashes (≃27%) occurred during the summer in both male and female injured drivers, followed by winter in females (26%) and fall crashes (25.7%) in males. Spring accidents were the least common in both sexes (≃23%). Within each season, males were consistently more involved in crashes (60.4-63.7% *vs.* 36.3-39.6%) than females (Figure 2).

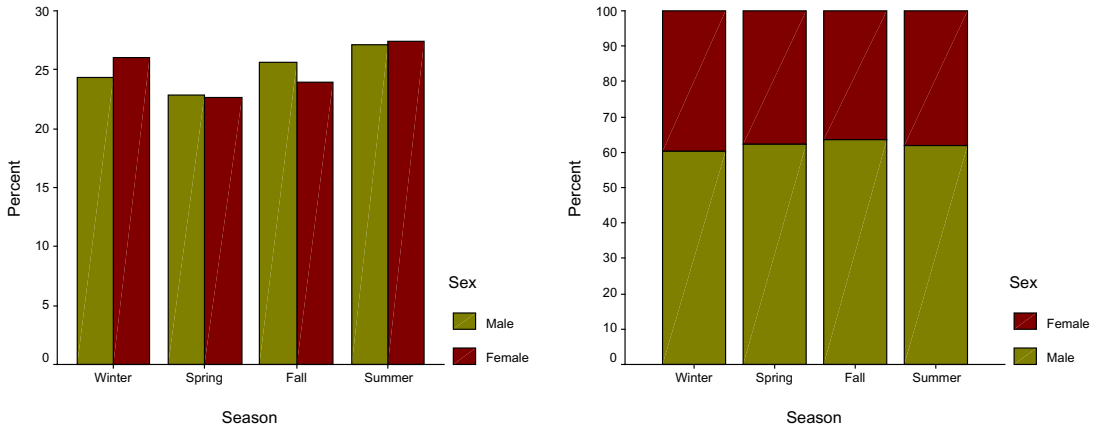


Figure 2. Percentage of crashes by season from the total male and female drivers and within each season

Month

The month with highest and lowest crash occurrence was December and April among male drivers, respectively, and February and July for female drivers, respectively. The month with the biggest difference between male and female drivers' crash occurrence were February (8.3 *vs.* 9.7%) and July (6.3 *vs.* 8.5%). Within each month, males were consistently involved in more accidents (58.4-68.7% vs. 31.3-41.6%) than females (Figure 3).

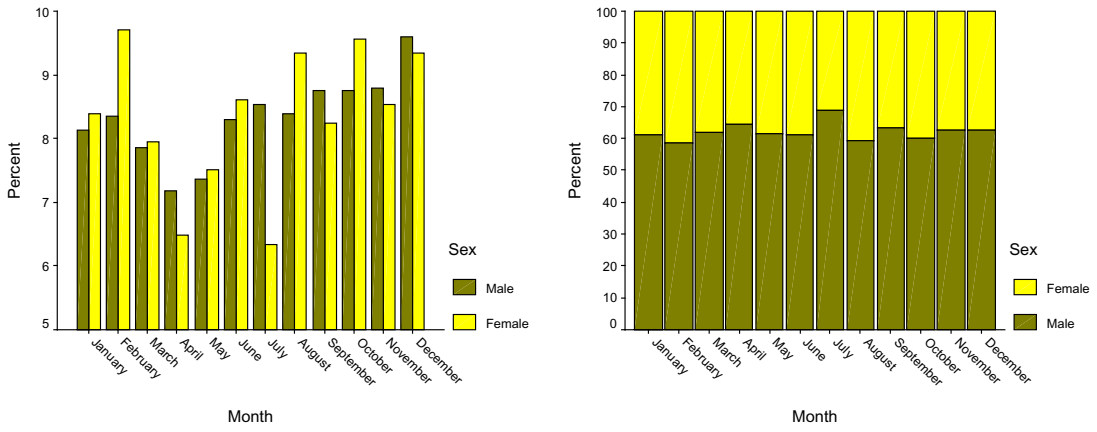


Figure 3. Percentage of crashes by month from the total male and female drivers and within each month

Weekday

Saturday was the most common (18.7%) and Monday the least common day (10-12%) when the accidents occurred among both, male and female drivers. Within each day, males consistently registered more crashes (59.3-65.8% *vs.* 34.2-40.7%) than female divers, but women's involvement tended to be higher in the midweek (Figure 4).

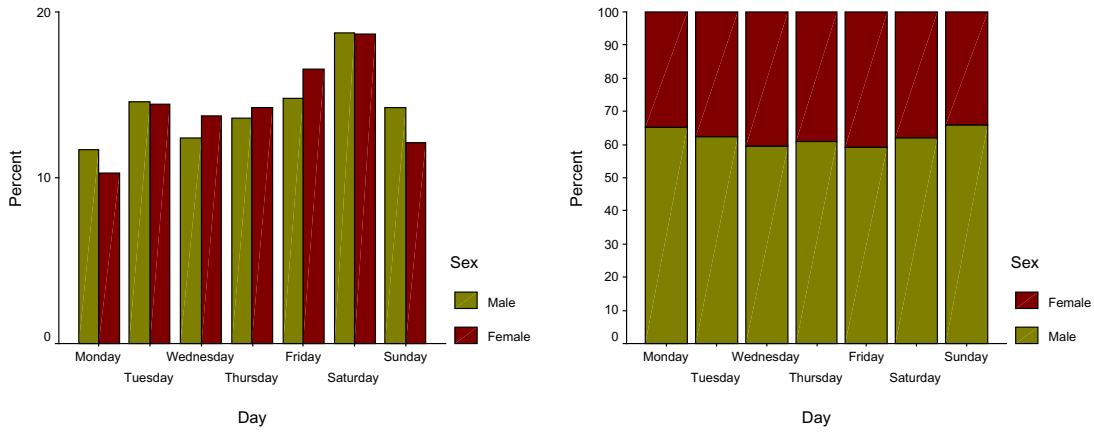


Figure 4. Percentage of crashes by day of the week from the total male and female drivers and within each day

Daytime

Female drivers tended to crash more often from 09.00 to 16.00 hrs in contrast with male drivers who registered more crashes between 17.00 to 04.00 hrs. Within each time category, men consistently caused more accidents than women, but women's involvement between 01.00 and 04.00 hrs was notably lower; only 18.9% of the crashes that occurred in this time schedule caused by driving women (Figure 5).

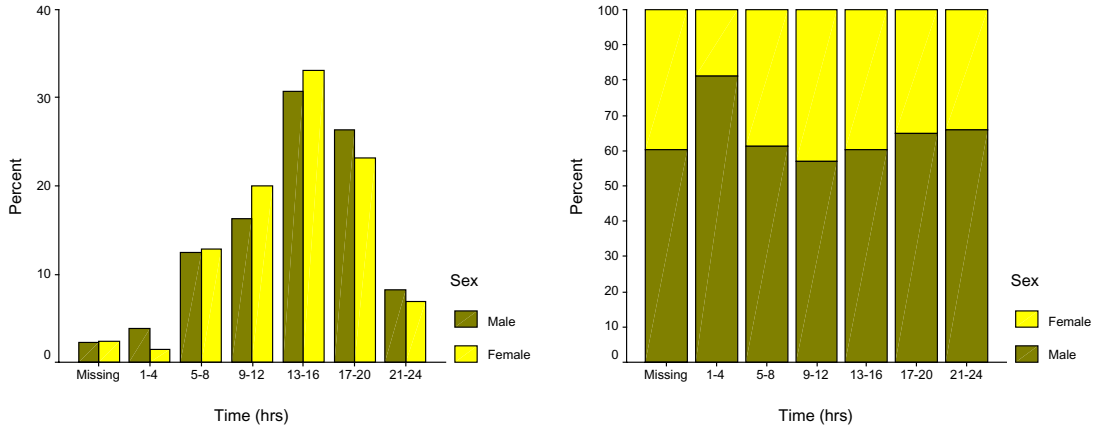


Figure 5. Percentage of crashes by time of the day from the total male and female drivers and within each time category

Table 2 presents the number of accidents according to the characteristics in which the crash occurred stratified by sex.

Table 2. Crash occurrence characteristics including season, month, day and time of the week

Characteristics	Sex (% row) [% column]		
	Male	Female	Total
Season			
Winter	545 (60.4)[24.3]	357 (39.6)[26.0]	902 (25.0)
Spring	512 (62.3)[22.9]	310 (37.7)[22.6]	822 (22.8)
Fall	575 (63.7)[25.7]	328 (36.3)[23.9]	903 (25.0)
Summer	608 (61.8)[27.1]	376 (38.2)[27.4]	984 (27.3)
Month			
January	182 (61.3)[8.1]	115 (38.7)[8.4]	297 (8.2)
February	187 (58.4)[8.3]	133 (41.6)[9.7]	320 (8.9)
March	176 (61.8)[7.9]	109 (38.2)[8.0]	285 (7.9)
April	161 (64.4)[7.2]	89 (35.6)[6.5]	250 (6.9)
May	165 (61.6)[7.4]	103 (38.4)[7.5]	268 (7.4)
June	186 (61.2)[8.3]	118 (38.8)[8.6]	304 (8.4)
July	191 (68.7)[8.5]	87 (31.3)[6.3]	278 (7.7)
August	188 (59.5)[8.4]	128 (40.5)[9.3]	316 (8.8)
September	196 (63.4)[8.8]	113 (36.6)[8.2]	309 (8.6)
October	196 (59.9)[8.8]	131 (40.1)[9.6]	327 (9.1)
November	197 (62.7)[8.8]	117 (37.3)[8.5]	314 (8.7)
December	215 (62.7)[9.6]	128 (37.3)[9.3]	343 (9.5)
Day of the week			
Monday	262 (65.0)[11.7]	141 (35.0)[10.3]	403 (11.2)
Tuesday	327 (62.3)[14.6]	198 (37.7)[14.4]	525 (14.5)
Wednesday	278 (59.7)[12.4]	188 (40.3)[13.7]	466 (12.9)
Thursday	304 (60.9)[13.6]	195 (39.1)[14.2]	499 (13.8)
Friday	331 (59.3)[14.8]	227 (40.7)[16.6]	558 (15.5)
Saturday	419 (62.1)[18.7]	256 (37.9)[18.7]	675 (18.7)
Sunday	319 (65.8)[14.2]	166 (34.2)[12.1]	485 (13.4)
Time of the day			
1-4	86 (81.1)[3.9]	20 (18.9)[1.5]	106 (3.0)
5-8	278 (61.1)[12.7]	177 (38.9)[13.2]	455 (12.9)
9-12	364 (57.0)[16.6]	275 (43.0)[20.6]	639 (18.1)
13-16	689 (60.3)[31.5]	454 (39.7)[33.9]	1143 (32.4)
17-20	589 (65.0)[26.9]	317 (35.0)[23.7]	906 (25.7)
21-24	184 (65.9)[8.4]	95 (34.1)[7.1]	279 (7.9)

Crash Place

Region

Driving men and women showed similar occurrence distribution regarding region where crashes occurred. The majority of accidents took place in the western part of the country, contrasting with the least affected northern region, irrespective of sex. Within each region, Stockholm showed the largest male involvement accounting for 68.2% of the total (Figure 6).

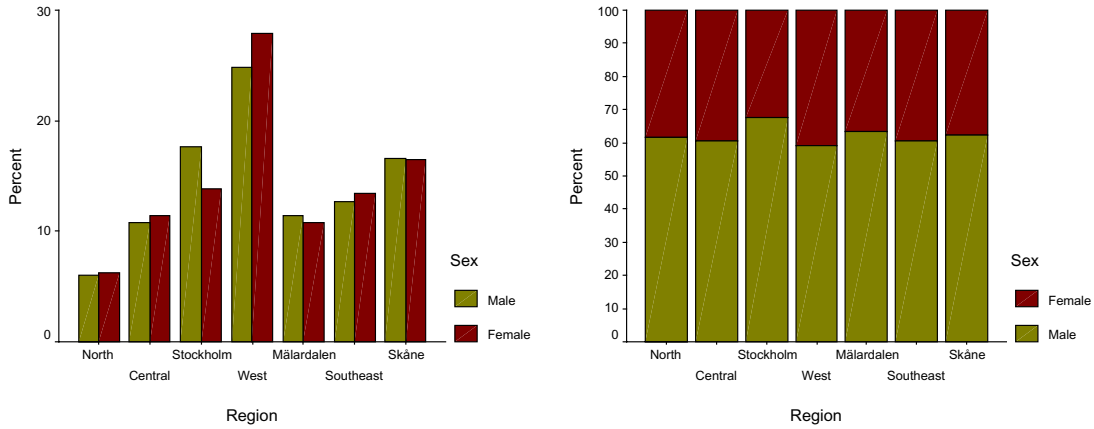


Figure 6. Percentage of crashes by Swedish region from the total male and female drivers and within each region

Traffic Area

Male drivers tended to crash slightly more often in not densely built-up area in contrast with female drivers who crashed more often in densely built-up area. Within each type of traffic area, men accounted for around 60% of crashes (Figure 7).

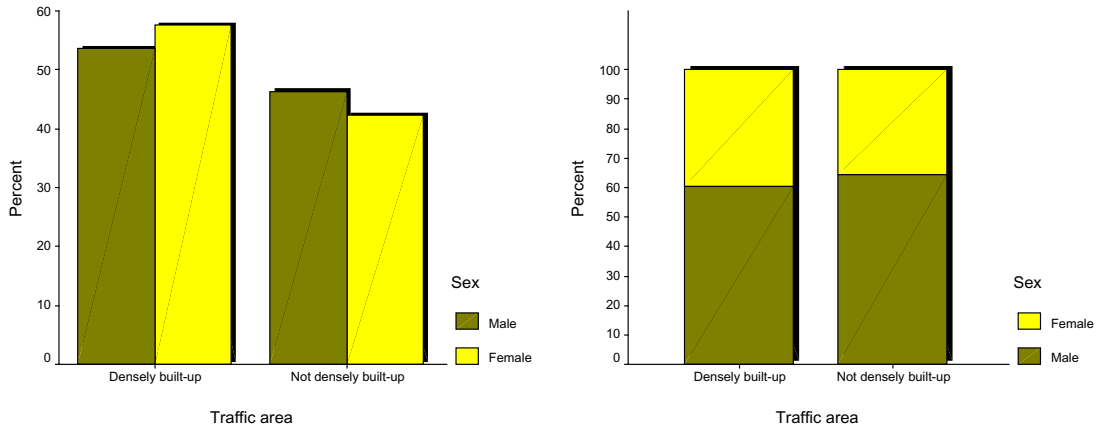


Figure 7. Percentage of crashes by traffic area from the total male and female drivers and within each type of traffic area

State (Län)

The most affected states included G & B V Gotaland (19.1%), Malmohus Skåne (16.6%) and Stockholm (15.8%) accounting together for more than half of the total accidents in the country, irrespective of sex. However, the states of Vestmanlands and Jonkopings showed the highest differential for male drivers with two-thirds of the crashes caused by men. Conversely, in the states of Gotlands and Jamtlands, more than half of the accidents were caused by female drivers (Table 3).

Table 3. Swedish state (Län) where the accident occurred by sex of the injured person

Swedish state	Sex (% row) [% column]		
	Male	Female	Total
G & B V Gotaland	409 (59.4)[*18.3*]	280 (40.6)[*20.4*]	689 (19.1)
Malmohus Skåne	372 (62.2)[*16.6*]	226 (37.8)[*16.5*]	598 (16.6)
Stockholm	390 (**68.2**)[*17.4*]	182 (**31.8**)[*13.3*]	572 (15.8)
Vestmanlands	70 (**67.3**)[3.1]	34 (**32.7**)[2.5]	104 (2.9)
Jonkopings	84 (**67.7**)[3.8]	40 (**32.3**)[2.9]	124 (3.4)
Gotlands	5 (**41.7**)[0.2]	7 (**58.3**)[0.5]	12 (0.3)
Jamtlands	20 (**48.8**)[0.9]	21 (**51.2**)[1.5]	41 (1.1)
Uppsala	58 (65.2)[2.6]	31 (34.8)[2.3]	89 (2.5)
Sormalands	46 (60.5)[2.1]	30 (39.5)[2.2]	76 (2.1)
Ostergotlands	94 (60.6)[4.2]	61 (39.4)[4.4]	155 (4.3)
Kronobergs	34 (56.5)[1.5]	24 (41.4)[1.8]	58 (1.6)
Kalmar	34 (58.6)[1.5]	32 (48.5)[2.3]	66 (1.8)
Blekinge	37 (57.8)[1.7]	27 (42.2)[2.0]	64 (1.8)
Hallands	69 (57.5)[3.1]	51 (42.5)[3.7]	120 (3.3)
Varmlands	79 (60.3)[3.5]	52 (39.7)[3.8]	131 (3.6)
Orebro	82 (60.7)[3.7]	53 (39.3)[3.9]	135 (3.7)
Dalarnas	68 (57.6)[3.0]	50 (42.4)[3.6]	118 (3.3)
Gavleborgs	58 (62.4)[2.6]	35 (37.6)[2.6]	93 (2.6)
Vasternorrlands	95 (65.5)[4.2]	50 (34.5)[3.6]	145 (4.0)
Vasterbottens	47 (56.6)[2.1]	36 (43.4)[2.6]	83 (2.3)
Norrbottens	89 (64.5)[4.0]	49 (35.5)[3.6]	138 (3.8)
Total	2240 (62.0)	1371 (38.0)	3611

Car Characteristics

Car year model

Figure 8 presents box plot graphs distributions of the car year model stratified by sex and driver's age at crash. A trend with sex and age was seen. Driving men tended to crash older cars compared to women across the different age groups. On the other hand, younger drivers, either male or female, tended to crash older vehicles.

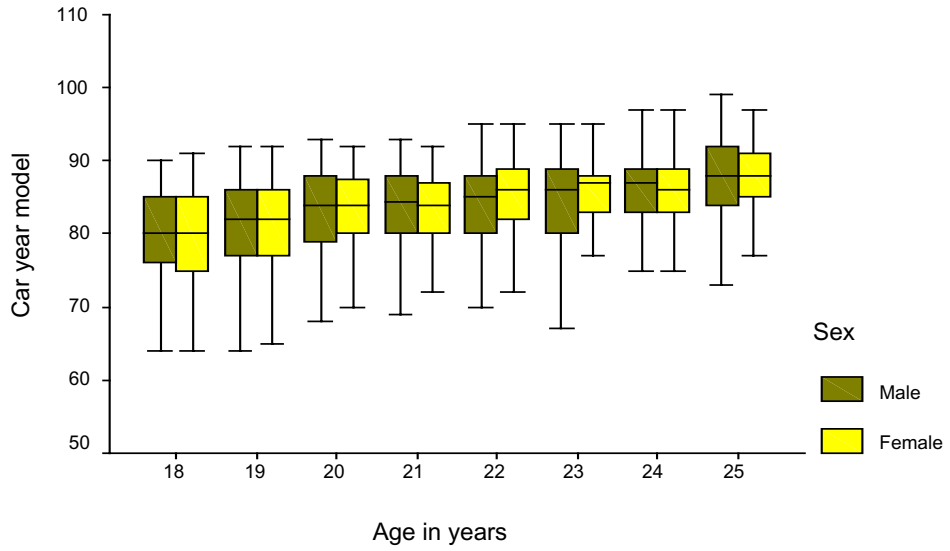


Figure 8. Car year model when the accident occurred (box plots graphs by sex and age)

Car Size

Most female drivers who crashed their cars drove a small-size car (32.6%) in contrast with male drivers who drove big-size cars (33.1%). Within each car size category, driving men accounted for most of the crashes except for compact car crashes caused by 53.9% of women (Figure 9).

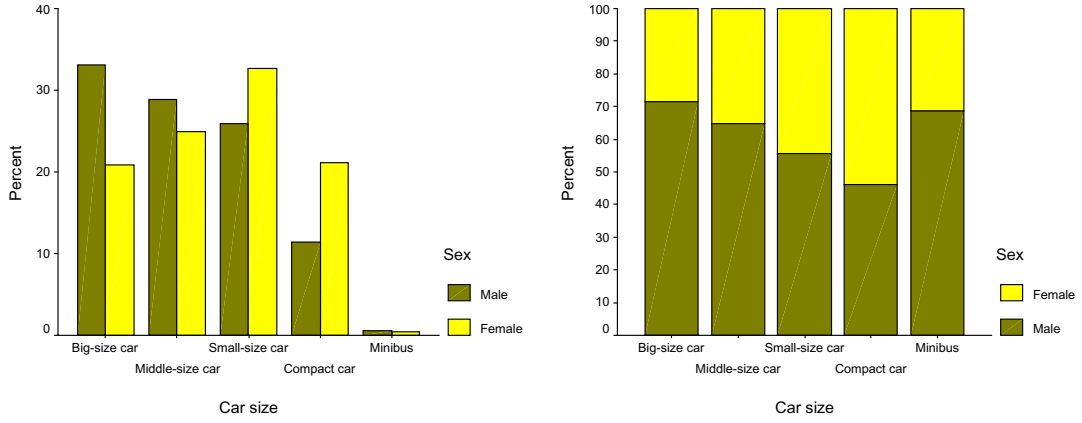


Figure 9. Percentage of crashes by car size from the total male and female drivers and within each car category

Table 4 presents the number of accidents according to the car size in which the crash occurred stratified by sex. Very few city jeeps and minibuses were crashed accounting for less than 1% of the total crashed vehicles.

Table 4. Number and proportion of accidents according to car characteristics stratified by sex

	Sex (% row) [% column]		
Car size	Male	Female	Total
Big-size car	686 (71.5)[33.1]	273 (28.5)[20.9]	959 (28.4)
Middle-size car	599 (64.8)[28.9]	325 (35.2)[24.8]	924 (27.3)
Small-size car	538 (55.8)[25.9]	427 (44.2)[32.6]	965 (28.5)
Compact car	237 (46.1)[11.4]	277 (53.9)[21.2]	514 (15.2)
Minibus	11 (68.8)[0.5]	5 (31.3)[0.4]	16 (0.5)
City jeep	0 (0)[0]	1 (100)[0.1]	1 (0.0)
Not known	3 (100)[0.1]	0 (0)[0]	3 (0.1)

Driving License

Issue date to crash date

Almost all female drivers who crashed their cars (96%) had a conventional driving license type B compared to 23% of males who had other higher-level license. There was a significant (p 0.000) mean difference (4 months) in the time elapsed from the driver's license issue date to the crash date in both sexes (Table 5).

Table 5. Mean difference in months elapsed from driver's license issue date to crash date by sex

Sex	N	Mean (SD)[1]	95% CI for Mean
Male	2204	40.2 (29.4)	38.9-41.4
Female	1360	36.2 (26.9)	34.7-37.6
Total	3564	38.6 (28.5)	37.7-39.6

[1] Mean difference: p 0.000

Except for the age 18 years, in all other ages at crash, the time elapsed from the driving license issue date to the crash date was increasing and slightly longer among males compared to female drivers. There were few 18-year old male drivers that crashed their cars before getting their license (Figure 10).

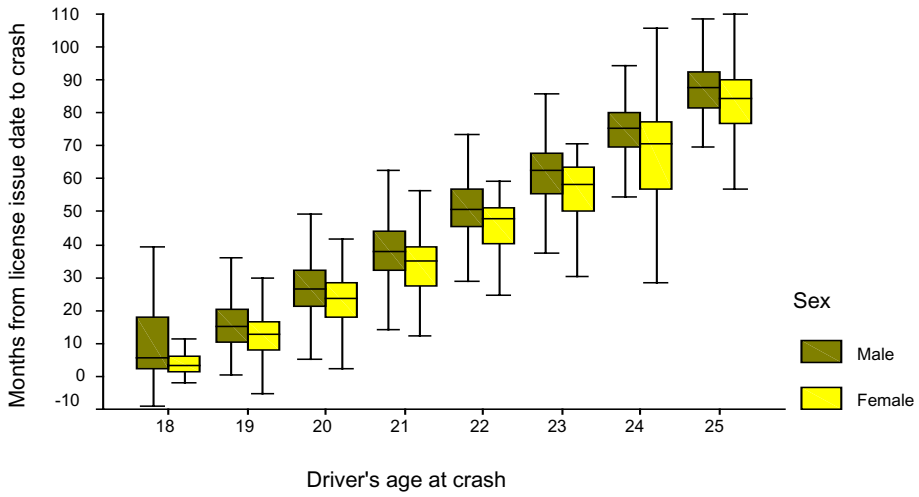


Figure 10. Time elapsed in months from the license issue date to the crassh date (box plots graphs by sex and age)

Issue Date to Age at Crash

Most male drivers that crashed obtained their driving license at a younger age (early eighteens) than female drivers (late 18's or early 19's) irrespective of the drivers's age at crash. However, unlike men, the distribution of age when the driver's license was issued for women was more clearly skewed towards the higher ages (Figure 11).

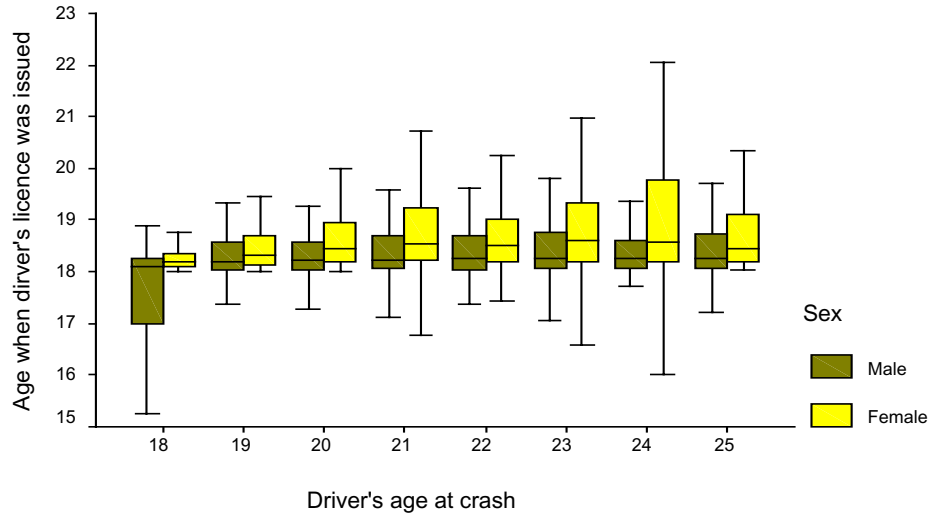


Figure 11. Drivers' age at crash and driver's licence date (box plot graphs by age and sex)

Crash Outcome

Driving men suffered significantly more serious injuries (16.7%) as a result of the crash compared to 14.2% of the women (Table 6).

Table 6. Difference in the proportions of serious and minor injury between male and female drivers

Drivers' sex	Type of injury outcome		Total
	Serious	Minor	
Male	373 (16.7)*	1867 (83.3)	2240
Female	195 (14.2)*	1176 (85.8)	1371
Total	568 (15.7)	3043 (83.4)	3611

* Pearson Chi-squared: p 0.05

The mean number of killed, and severely and mildly injured was significantly higher in male compared to female drivers (Table 7).

Table 7. Mean difference in the number of killed, and number of severely and mildly injured persons between male and female drivers causing the accident

Driver	N	Type of injury outcome: Mean (SD)		
		Killed	Severely injured	Mildly injured
Male	2240	0.03 (0.18)	0.42 (0.89)	1.70 (1.30)
p value		*0.04*	*0.000*	*0.000*
Female	1371	0.01 (0.12)	0.27 (0.68)	1.51 (1.06)
Total	3611	0.02 (.16)	0.37 (0.82)	1.63 (1.22)

Alcohol involvement

Alcohol and Sex

Male divers were more likely to be intoxicated than females (p 0.000). The percentage of male and female drivers potentially intoxicated with alcohol was 2.5% and 0.4%, respectively (Table 8).

Table 8. Difference in the proportions of male and female drivers with suspicious alcohol influence at the moment of the crash

Sex	Alcohol suspicion			Total
	No	Yes	Unknown	
Male	2156 (96.3)	57 (2.5)*	27 (1.2)	2240
Female	1345 (98.1)	5 (0.4)*	21 (1.5)	1371
Total	3501 (97.0)	62 (1.7)	48 (1.3)	3611

* Pearson Chi-squared: p 0.000

Alcohol and Injury Outcome

Overall, 3.9% of the serious injuries as a result of a crash were associated with alcohol suspicion, compared to 1.3% of the minor injuries (Table 9).

Table 9. Difference in the proportion of serious and minor injury between male and female drivers

Injury outcome	Alcohol suspicion		Total
	No	Yes	
Serious	540 (96.1)	22 (3.9)*	562
Minor	2961 (98.7)	40 (1.3)*	3001
Total	3501 (98.3)	62 (1.7)	3563

* Pearson Chi-squared: p 0.000

Figure 12 presents the total number and the proportion of persons (including non-drivers) who resulted mildly/severely injured, and killed during the crash stratifying by sex of the driver who crash the vehicle. Male drivers tended to be responsible for more persons (~2) mildly and severely injured, and killed than female drivers.

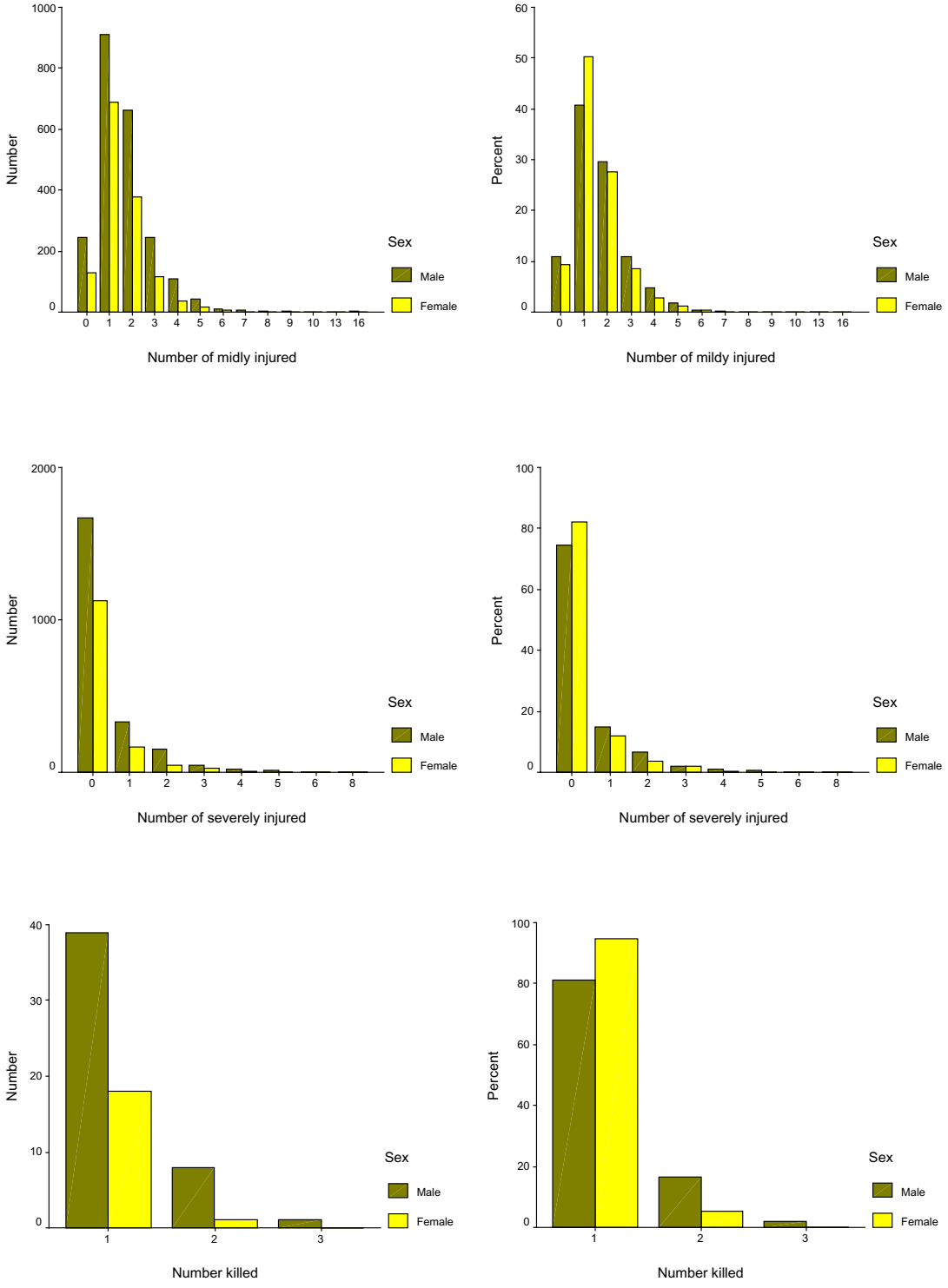


Figure 12. Total number of persons and percentage of those mildly and severely injured, and killed as result of the accident stratified by sex of the driver

Environmental Conditions at Crash

Most crashes occurred under dry weather for both male (80.3%) and female (76.9%) drivers, but women tended to crash more often when raining and snowing. Likewise, women tended to crash slightly more often when the road surface was covered by ice or snow. Men cashed more frequently during night. Driving women tended to crash more often in roads

with lower speed limits (<70) compared to men who did so at higher speed limit roads. As to the action performed during the accident, men crashed more often when overtaking/ lane exchange, catching up, and meeting, and women did so when turning, and crossing roads (Table 10).

Table 10. Characteristics of the crash including weather, road surface, lighting, speed limit, and action performed when the accident occurred stratified by sex

Characteristics	Number (% column)		
	Male	Female	Total
Weather conditions			
Dry/fair weather	1798 (80.3)	1054 (76.9)	2852 (79.0)
Haze, fog, mist	78 (3.5)	46 (3.4)	124 (3.4)
Rain	239 (10.7)	170 (12.4)	409 (11.3)
Rain mixed with snow	39 (1.7)	32 (2.3)	71 (2.0)
Snowfall	73 (3.3)	61 (4.4)	134 (3.7)
Unknown	13 (0.6)	8 (0.6)	21 (0.6)
Road surface conditions			
Dry road	1170 (52.2)	685 (50.0)	1855 (51.4)
Wet/humid road	684 (30.5)	394 (28.7)	1078 (29.9)
Thick ice/packed snow	79 (3.5)	64 (4.7)	143 (4.0)
Thin ice (visible road)	189 (8.4)	126 (9.2)	315 (8.7)
Snow, slush	101 (4.5)	93 (6.8)	194 (5.4)
Unspecified	17 (0.8)	9 (0.7)	26 (0.7)
Lighting conditions			
Daylight	1457 (65.0)	971 (70.8)	2428 (67.2)
Darkness	622 (27.8)	291 (21.2)	913 (25.3)
Sunset/sunrise	160 ((7.1)	107 (7.8)	267 (7.4)
Unknown	1 (0.0)	2 (0.1)	3 (0.1)
Road speed limit (km/hr)			
30	11 (0.5)	5 (0.4)	16 (0.4)
50	1007 (45.0)	678 (49.5)	1685 (46.6)
70	671 (30.0)	367 (26.8)	1038 (28.7)
90	468 (20.9)	269 (19.6)	737 (20.4)
110	78 (3.5)	51 (3.7)	129 (3.6)
Unknown	5 (2.0)	1 (0.1)	6 (0.2)
Action performed			
Overtaking/lane exchange	171 (7.6)	79 (5.8)	250 (6.9)
Catching up	471 (21.0)	266 (19.4)	737 (20.4)
Meeting	447 (20.0)	226 (16.5)	673 (18.6)
Turn off, same course/direction	212 (9.5)	164 (12.0)	376 (10.4)
Turn off, opposite course/direction	213 (9.5)	145 (10.6)	358 (9.9)
Crossroad, no turn off	395 (17.6)	251 (18.3)	646 (17.9)
Crossroad, turn off	275 (12.3)	209 (15.2)	484 (13.4)
Crossroad, existing turnoff unknown	24 (1.1)	9 (0.7)	33 (0.9)
U-turn	32 (1.4)	22 (1.6)	54 (1.5)
Total	2240	1371	3611

Hospitalization

In-patient time

Overall, 532 drivers were hospitalized as a consequence of the crash (the ratio male to female was 1.68:1). Male drivers were hospitalized on average 1.34 more days than female drivers (p 0.02) as shown in table 11. However, there was no statistically significant difference in the mean number of hospitalization days in either men or women by driver's age when the accident occurred (Table 11).

Table 11. Mean difference in hospitalization days due to the accident stratified by driver's age at crash and sex

	Age at crash	N	Mean days*	95% confidence interval
	18	68	5.49	2.9-8.0
	19	69	4.49	2.6-6.3
	20	51	3.31	2.4-4.2
M	21	43	4.30	2.4-6.2
e	22	37	4.08	0.9-6.2
n	23	29	3.45	1.9-4.9
	24	26	3.88	1.3-6.4
	25	11	5.27	-0.1-10.6
	Total	334	4.33**	3.5-5.1
	18	25	3.76	2.0-5.4
	19	47	2.13	1.4-2.7
W	20	39	3.67	1.4-5.8
o	21	26	1.69	0.7-2.5
m	22	17	2.88	0.8-4.9
e	23	23	3.09	1.2-4.9
n	24	10	3.50	0.0-6.9
	25	11	5.09	-0.7-10.9
	Total	198	2.99**	2.3-3.6

*p value for F test (ANOVA) in males was 0.8 and 0.3 in females

**p value for t-student test between total men vs. women was 0.02

The mean distribution tended to show higher means, more hospitalized days, at younger and older ages, and lower means, less hospitalized days, at middle ages, especially among male drivers (Figure 13).

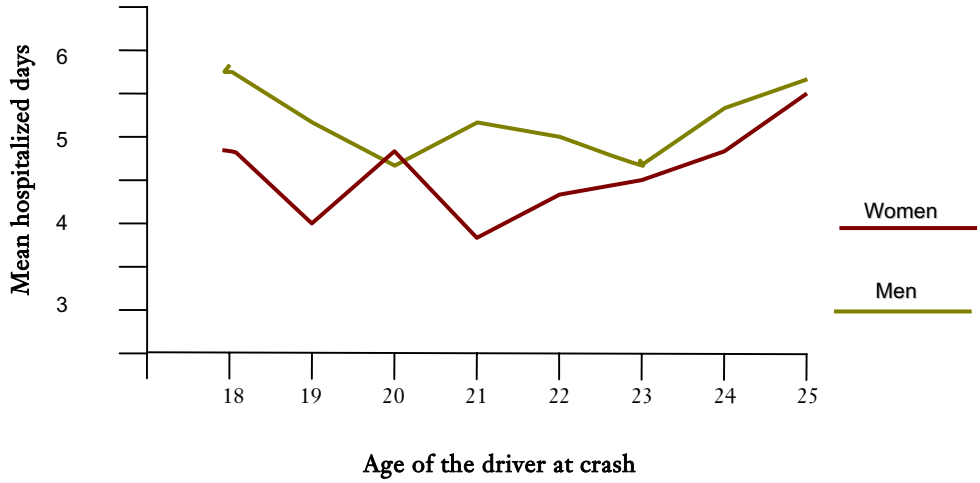


Figure 13. Mean hospitalization days due to the accident stratified by driver's age at crash and sex

Figure 14 shows the total number and the proportion of driver hospitalized as a result of the crash stratifying by sex and hospitalization category. More male drivers were hospitalized compared to females in all the stratified hospitalization categories. Two-thirds of the driving women who required in-patient care remained at the hospital for one or two days, but men tended to be hospitalized for a longer time; 14.5% of the men had to stay for more than a week compared to 8% of the women.

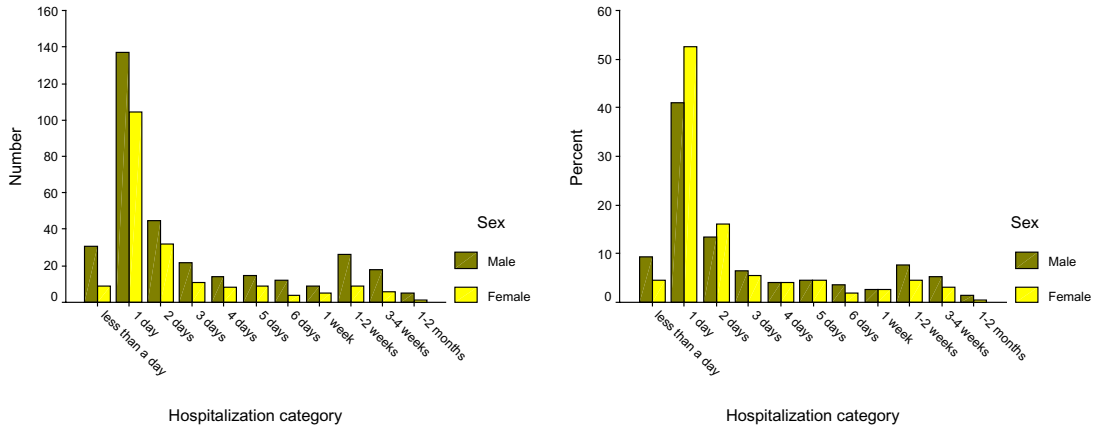


Figure 14. Number of persons and percentage of those hospitalized stratified by sex of the driver

There was no significant correlation between the number of days hospitalized as a consequence of the crash and the age of the driver in either men or women. However, the correlation was a slightly positive for women and negative for men as shown in figure 15.

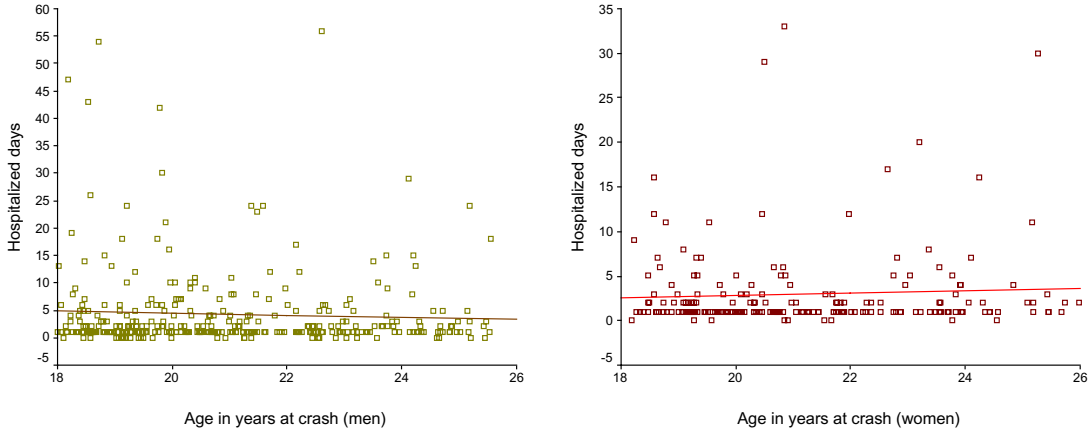


Figure 15. Correlation between the number of days hospitalized and the age of the driver at crash stratified by sex (men r= ”0.05 p0.3 n=334; women r=0.05 p0.4 n=198)

Although not reaching statistical significance, the proportion of injured male drivers admitted to the hospital as urgent admissions was slightly lower than among females (86.2 vs. 88.4%) as shown in Table 12.

Table 12. Type of hospital admission of the injured drivers stratified by sex

Type of hospital admission	Number (%)		Total
	Male	Female	
Urgent	281 (86.2)*	168 (88.4)*	449 (87.0)
Programmed	45 (13.8)	22 (11.6)	67 (13.0)
Total	326 (63.2)	190 (36.8)	516

* Pearson Chi-squared: p 0.2

Discussion of Findings

The current study was undertaken to explore potential sex differences in car-to-car crash accident patterns resulting in drivers' injury among young Swedish adults aged 18 to 25 years between 1988 and 1997.

A population-based cohort, constructed through record linkage of various sources of data, using the Swedish personal identification number, was already available for these analyses. A total of 3611 drivers, 2240 men and 1371 women were included, which accounted for around 1.3% and 0.8% of the total cohort, respectively.

These analyses were able to replicate various findings previously published regarding differences in motor vehicle accidents between driving men and women. Overall, it confirms that male drivers are more likely to be involved in motor vehicle collisions than women (Bilban, 1998; Meel, 2003; Turner & McClure, 2003). In this study, the male to female ratio for car-to-car crashes was 1.6:1.

The study also showed that the number of persons killed as a result of the accident was significantly higher in driving men compared to women as other have noted (Massie *et al.*, 1995; Bilban, 1998; Li *et al.*, 1998; Statistics Sweden, 2000; Heuveline & Slap, 2002). Male driving was also linked to more people severely and mildly injured, similar to other Swedish (Kleiven *et al.*, 2003) and US findings (Tavris *et al.*, 2001). In addition, driving men were also more likely to be intoxicated with alcohol than women during the crash, as it has been reported in Sweden before (Jones, 1999).

Men crashed more often when overtaking, changing lane, catching up, and meeting compared to women, and tended to crash more often in roads with higher speed limits. These findings relate to the more reckless driving behavior among men, as previously suggested (De Joy, 1992; Tavris *et al.*, 2001).

Relevant demographic findings included the fact that driving men were slightly but significantly younger than women when the cash occurred.

As to the crash timing, crashes occurred most often in summer and less often in spring in both sexes. Saturday and Monday were the most and least common crashing day in both sexes, respectively, but female involvement tended to be higher in the midweek. Finally, women crashed more often between 9.00-16.00 and men between 17.00-04.00, and most crashes occurring between 01.00-04.00 were caused by men as pointed out in a previous Swedish study among young drivers (Åkerstedt & Kecklund, 2001).

Regarding the characteristics of the crashed car, men tended to crash – not to drive, as this information was not presented here – bigger, and slightly older cars compared to women.

As to the crash place, accidents occurred most often in the West and least often in the North of Sweden in both sexes, with the Stockholm region being the one with the largest male involvement. In addition, women crashed more often in densely built-up area compared to men.

The analyses also showed that women tended to crash more often when raining and snowing, and when the road surface was covered by ice or snow.

On the subject of driving license, most women had a conventional type B license compared to men who also had many higher level driving licenses. The time elapsed from the license issue date to the crash was increasing and slightly longer among males compared to female drivers. However, it is worth noting that, although the drivers' licensing age could be used as a proxy for driving debut, no actual exposure information concerning duration, vehicle characteristics, or driving conditions is available.

Lastly, most men who crashed obtained their driving license at a younger age (early eighteens) than women (late eighteens and early nine teens) irrespective of the driver's age at crash.

The results for the hospitalization analyses (the missing-case rate for the Hospital Discharge Register has been estimated to be only 1-2% (National Board of Health and Welfare, 1999)) showed that driving men were hospitalized on average 1.34 more days than women. In fact, two-thirds of the driving women were hospitalized only for one or two days, but men tended to remain for a longer period of time.

There was a lack of correspondence between the severity of the injury, as assessed by the police report, and the type of hospital admission (urgent vs. programmed) of the injured drivers. Urgent admissions were slightly higher among female drivers. One would expect that if men suffered from more severe injuries than women, these would tend to be hospitalized more urgently. The reason for this could be in part explained by differences in the criteria used by the police and hospital personnel to classify drivers in either category.

In summary, these analyses add evidence to the importance of gender in road traffic accidents in young adults in Sweden. The data presented here could be relevant as it can provide important insights regarding the necessity to focus preventive efforts to design and implement prevention programs, such as targeted education for men and women during their driving training.

Further analytic investigations taking advantage of this cohort design are needed to fully understand to role of gender in car-to-car accidents among young Swedish adults. Building rates (using the population at risk in the denominator) is therefore mandatory to establish risk differences in the crash patterns resulting in drivers' injury between male and female drivers.

References

Aare M, von Holst H. Injuries from motorcycle- and moped crashes in Sweden from 1987 to 1999. Inj Control Saf Promot. 2003 Sep;10(3):131-8.

Akerstedt T, Kecklund G. Age, gender and early morning highway accidents. J Sleep Res. 2001 Jun;10(2):105-10.

Berg HY, Eliasson K, Palmkvist J, Gregersen NP. Learner drivers and lay instruction. How socioeconomic standing and lifestyle are reflected in driving practice from the age of 16. Transportation Research. 1999:167-79.

Bilban M. The influence of gender on traffic accidents–the case of the Republic of Slovenia. Coll Antropol. 1998 Dec;22(2):551-62.

Braver ER. Race, T. Hispanic origin, and socioeconomic status in relation to motor vehicle occupant death rates and risk factors among adults. Accid Anal Prev. 2003 May;35(3):295-309.

Bryant RA, Harvey AG. Gender differences in the relationship between acute stress disorder and posttraumatic stress disorder following motor vehicle accidents. Aust N Z J Psychiatry. 2003 Apr;37(2):226-9.

Cooper PJ, Pinili M, Chen W. An examination of the crash involvement rates of novice drivers aged 16 to 55. Accid Anal Prev. 1995;27:89-104.

DeJoy DM. An examination of gender differences in traffic accident risk perception. Accid Anal Prev. 1992 Jun;24(3):237-46.

Evans L. Female compared with male fatality risk from similar physical impacts. J Trauma. 2001 Feb;50(2):281-8.

Fullerton CS, Ursano RJ, Epstein RS, Crowley B, Vance K, Kao TC, Dougall A, Baum A. Gender differences in posttraumatic stress disorder after motor vehicle accidents. Am J Psychiatry. 2001 Sep;158(9):1486-91.

Gregersen NP, Berg HY. Lifestyle and accidents among young drivers. Accid Anal Prev. 1994;6:297-303.

Gregersen NP, Berg HY, Engström I, Nolén S, Nyberg A, Rimmö PA. Sixteen years age limit for learners in Sweden: an evaluation of safety effects. Accid Anal Prev. 2000;2:25-35.

Hasselberg M, Laflamme L. Socioeconomic background and road traffic injuries: a study of young car drivers in Sweden. Traffic Injury Prevention 2003;4:249-54.

Hasselberg M. The Social pattering of road traffic injuries during childhood and youth. Doctoral thesis at Karolinska Institutet, 2004.

Hasselberg M, Laflamme L. The social pattering of inyury repetitions among young car drivers in Sweden. Accid Anal Prev 2004 (in press).

Heuveline P, Slap GB. Adolescent and young adult mortality by cause: age, gender, and country, 1955 to 1994. J Adolesc Health. 2002 Jan;30(1):29-34.

Jones AW. The drunkest drinking driver in Sweden: blood alcohol concentration 0.545% w/v. J Stud Alcohol. 1999 May;60(3):400-6.

Kleiven S, Peloso PM, von Holst H. The epidemiology of head injuries in Sweden from 1987 to 2000. Inj Control Saf Promot. 2003 Sep;10(3):173-80.

Kweon YJ, Kockelman KM. Overall injury risk to different drivers: combining exposure, frequency, and severity models. Accid Anal Prev. 2003 Jul;35(4):441-50.

Laflamme L, Diderichsen F.Social differences in traffic injury risks in childhood and youth – a literature review and a research agenda. Inj Prev. 2000 Dec;6(4):293-8.

Li G, Baker SP, Langlois JA, Kelen GD. Are female drivers safer? An application of the decomposition method. Epidemiology. 1998 Jul;9(4):379-84.

Massie DL, Campbell KL, Williams AF. Traffic accident involvement rates by driver age and gender. Accid Anal Prev. 1995 Feb;27(1):73-87.

Massie DL, Green PE, Campbell KL. Crash involvement rates by driver gender and the role of average annual mileage. Accid Anal Prev. 1997 Sep;29(5):675-85.

Meel BL. Gender-related traumatic deaths in Transkei: incidence and causes. Med Sci Law. 2003 Jul;43(3):215-20.

National Board of Health and Welfare. Health and Diseases: Hospitalization due to injuries and poisoning in Sweden 1987-1996. National Board of Health and Welfare, Centre for Epidemiology, Official Statistics of Sweden. Nordstedts, Stockholm, 1999.

Ostrom M, Sjogren H, Eriksson A.Role of alcohol in traffic crashes involving women: passenger car fatalities in northern Sweden. J Stud Alcohol. 1995 Sep;56:506-12.

Peden M, McGee K, Krug E (Eds). Injury: a leading cause of the global burden of disease, 2000. Geneva, World Health Organization, 2002.

Taubman - Ben-Ari O, Findler L. Reckless driving and gender: an examination of a terror management theory explanation. Death Stud. 2003 Aug-Sep;27(7):603-18.

Tavris DR, Kuhn EM, Layde PM. Age and gender patterns in motor vehicle crash injuries: importance of type of crash and occupant role. Accid Anal Prev. 2001 Mar;33(2):167-72.

Turner C, McClure R. Age and gender differences in risk-taking behaviour as an explanation for high incidence of motor vehicle crashes as a driver in young males. Inj Control Saf Promot. 2003 Sep;10(3):123-30.

Schnitzer PG, Runyan CW. Injuries to women in the United States: an overview. Women Health. 1995;23(1):9-27.

Skog OJ. Alcohol consumption and fatal accidents in Canada, 1950-98. Addiction. 2003 Jul;98(7):883-93.

Statistics Sweden. Road Traffic Injuries 2000. Swedish Institute for Transport and Communication Analysis. Official Statistics of Sweden, 2001

Van Tassel WE, Manser MP. Participant-predicted, observed, and calculated peak blood alcohol levels: a gender-specific analysis. Annu Proc Assoc Adv Automot Med. 2000;44:367-77.

Violanti JM. Cellular phones and traffic accidents. Public Health. 1997 Nov;111(6):423-8.

Waller PF, Blow FC. Women, alcohol, and driving. Recent Dev Alcohol. 1995;12:103-23.

WHO (World Health Organization). The injury chart book: a graphical overview of the global burden of injuries. Geneva, WHO, 2002.

Index of Tables and Figures

Tables

Figures