Gender differences in crash characteristics among young drivers admitted to hospital in NSW

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Abstract

Young drivers are over represented in crash and casualty statistics, and there are gender specific differences in fatality risk among young adults. Males have consistently higher rates of death than females, even when exposure differences are controlled. Crash characteristics in serious injury crashes have been studied less extensively. This analysis examines gender differences in crash characteristics among seriously injured drivers aged 17-25 years in crashes in NSW. A linked hospital and police record dataset was utilised. Logistic regression was used to examine crash characteristics and outcomes by gender. Of 2886 young drivers admitted to hospital over three years, 59% were male and 41% were female. Overall, 3% had been unrestrained, but young males were more likely to have been unrestrained (OR 2.4, 95% CI 1.6-3.6) and to have been in serious crashes (OR 2.6, 95% CI 1.8-3.5) than young females. Males were also more likely to have been in loss of control crashes (OR 2.3, 95% CI 2.0-2.6) and were twice as likely to have been in single vehicle crashes than females (OR 1.9 95% CI 1.7-2.2). Males were also more often in older vehicles than females (OR 1.4, 95% CI 1.1-1.5). There were also differences in the pattern of injury with males more likely to have head injury (OR 2.0 95% CI 1.7-2.4). There are significant differences in crash characteristics of young male and female drivers who are injured in crashes in NSW. Increased understanding of factors underpinning these differences is needed. Gender specific interventions may be warranted.

Introduction

Young drivers are over represented in crash and casualty statistics and there are gender specific differences in risk among young adults. Young males have consistently higher rates of death than young females, even when differences in exposure are taken into account (OECD, 2006). Differences in crash risk between younger and older drivers is often attributed to physiological, psychological, and behavioural differences associated with ageing (Islam and Mannering, 2006) and for young drivers, contributors to increased crash risk largely revolve around driving inexperience (McCartt et al, 2009), risk taking behaviours (Islam and Mannering, 2006) and neuro-biological development (Carskadon, 2011; Johnson and Jones, 2011). Understanding how these differences manifest in differences in crash characteristics among young male and female occupants might provide insight into modifiable factors that could be addressed to keep young drivers safe.

Injury outcome is highly dependent on a number of specific crash characteristics, such as crash severity, crash type and availability and use of occupant protection features (Abdel-Aty and Keller, 2005; Augestein et al, 2003). A small number of studies have examined variations in crash characteristics by gender among young occupants; however, these have largely been done using North American data. These have reported differences in crash type and crash severity among seriously and fatally injured young male and female drivers (Ulfarsson and Mannering, 2004), with males more likely than females to be involved in single vehicle crashes (Laapotti, and Keskinen, 1998). There has been no recent study of crash characteristics among injured occupants aged 17-25 years using Australian data.

Available occupant protection features will also likely influence injury outcome. There is growing evidence that younger drivers tend to drive older vehicles than middle aged drivers (Cammisa et al, 1999; Ferguson, 2003; Keall and Newstead, 2011). In Australia, Keall and Newstead (2011) also have presented data suggesting variations in age of vehicles driven by young males and females, with females generally more likely to drive newer vehicles. Use of occupant protection systems, like seat belts, also influence injury outcomes. Seat belt wearing rates are generally quite high in Australia, but lower usage rates persist among young people (Petroulias, 2011), and there have been no current studies examining variations in seat belt use by gender. Evidence from other countries do however suggest that young male occupants are more likely to be unrestrained than young female occupants (OECD, 2006).

Using linked hospital and police record data, this paper examines differences in characteristics and injury outcomes for young adult male and female drivers aged over 17-25 years injured in crashes in NSW over a three-year period.

Methods

The data used in this analysis was drawn from a set that was constructed to study the profile of rear seat and front seat occupant injury for passengers aged 9 years and over for the years 2005-2007 in NSW (Brown & Bilston, 2014), and to examine characteristics and injury outcomes of drivers and passengers of different ages (Brown et al, 2014a). As described previously (Brown et al, 2014), the data sources used were the NSW Admitted Patient Data Collection (APDC) and the NSW Centre for Road Safety’s police-record-based Traffic Accident Database System (TADS) and Road Crash Analysis (RCA), and data linkage was conducted at the Centre for Health Record Linkage (CHeReL: cherel.org.au). Data linking identified 13756 linked cases in the APDC and the TADS/RCA datasets. This represented approximately 70% of the APDC records identified as involving a motor vehicle occupant aged 9 years or older for the years 2005-2007. After removal of duplicates and transfers, 12518 cases remained, representing 63% of the total APDC motor vehicle occupant data set. For this analysis, all data for drivers aged 17-25 years were extracted from the final linked dataset.

Table 1 summarises the crash variables used in this analysis. Vehicle model year groups were chosen for consistency with previous research (e.g. Bilston et al, 2010) based on introduction of major new safety technologies. Two proxy measures for crash severity were included: the presence of a fatality in the crash; and, the prevailing speed limit at the crash location, used as a proxy for travel speed. The crash type variable was constructed from the Road User Movement codes (RUM codes) included in the TADS/RCA data by grouping the 86 RUM codes into 10 crash types, as listed in Table 1. A code describing whether or not the crash involved single or multiple vehicles was also constructed. Mortality and injury (body regions injured) were derived from the APDC and were used as outcome variables. Presence of injury to the categories: head; neck; thorax; abdomen and lower torso; shoulder and upper arm; elbow and forearm; wrist and hand; hip and thigh; knee and lower leg; and, ankle and foot regions were coded as 'yes' if there was at least one injury in that region, and 'no' if there was no injury to that region. The number of injuries to each region was not coded.

Table 1. Crash variable definitions, source of information and coding

Variable	**Categories**	**Coding/definitions**	**Extracted from**
Gender	Male		APDC
	Female		
Restraint status	Restrained	Includes lap sash and lap only belts	TADS/RCA
	Unrestrained	Recorded as unrestrained	
	Unknown	Unknown or not reported	
Vehicle age groups	<1990	Constructed from vehicle year of manufacture	TADS/RCA
	1990-1996		
	>1996		
Fatal crash	Yes	At least one person died during the crash	TADS/RCA
	No	No fatalities in the crash	
Crash Type	Pedestrian	Constructed from 9 RUM codes; crash involved a pedestrian.	TADS/RCA
	Intersection	Constructed from 10 RUM codes; all intersection crashes	
	Vehicles from opposing directions	Constructed from 7 RUM codes; crashes between vehicles travelling in opposite directions	
	Vehicles from same direction	Constructed from 9 RUM codes; crashes between vehicles travelling in the same direction	
	Manoeuvring	Constructed from 10 RUM codes; crashes while vehicle performs a manoeuvre, e.g after a u-turn or reversing.	
	Overtaking	Constructed from 7 RUM codes; crash after a vehicle overtakes another.	
	On path	Constructed from 9 RUM codes; crash into stationary obstruction/animal	
	Off path on straight	Constructed from 7 RUM codes; driver loses control on straight.	
	Off path on curve	Constructed from 10 RUM codes; driver loses control on curve.	
	Miscellaneous	Constructed from 8 RUM codes for otherwise unclassified crashes.	
Single Vehicle	Yes	Crash involved one vehicle	TADS/RCA
	No	Crash involved more than one vehicle	

Descriptive techniques were used to explore characteristics of the injured young drivers (17-25 years) by gender. This included restraint status, age of vehicle, severity of the crash, type of crash and mortality outcome. The significance and strength of associations were tested using univariate logistic regression. Mortality and pattern of injury by gender were also explored using multivariate logistic regression while controlling for crash characteristics. Odds ratios (OR) and 95% confidence intervals (CI) were calculated. All analysis was conducted in SPSS (IBM SPSS Statistics v21.0).

Results

Of 12518 people aged over 9 years admitted to hospital in NSW between 2003 and 2005, 2886 were drivers aged 17-25 years. Of these, 59% were male and 41% were female. Overall, 88% of these young drivers were restrained, 3% were unrestrained and restraint use was unknown for 9%. Of the 81 injured young drivers who were unrestrained, 65 (80%) were males and 16 (20%) were females. Ignoring those for whom restraint use was unknown (n=3127), males aged 17-25 years were more than twice as likely to have been unrestrained than females aged 17-25 years (OR 2.4, 95% CI 1.6-3.6).

The young male drivers were also more likely to have been driving cars manufactured before 1996 (OR 1.4, 95% CI 1.1-1.5) and to have been in crashes where at least one person died (OR 2.6, 95% CI 1.8-3.5) compared to young female drivers. Males were also twice as likely to have been in single vehicle crashes compared to females (OR 1.9 95% CI 1.7-2.2), and also left road/overtaking crashes (OR 2.3, 95 % CI 2.0-2.6).

Table 2 provides details of mortality and injury outcomes for young male and female drivers.

Table 2: Mortality and injury to different body regions for male and female occupants (note: body region injured includes injuries of all severities).

Variable	Categories	Males *n* (%)	Females *n* (%)
Fatally Injured	Yes	34 (1.8)	13 (0.8)
	No	1885 (98.2)	1532 (99.2)
Body Region	Head	1011 (52.7)	523 (33.9)
	Neck	314 (16.4)	417(27.0)
	Thorax	528 (27.5)	422 (27.3)
	Abdo/Lumbar	520 (27.1)	515 (33.3)
	Shoulder/Upper arm	354 (18.4)	249 (16.1)
	Elbow/Forearm	254 (13.2)	132 (8.5)
	Wrist/Hand	252 (13.1)	112 (7.2)
	Hip/Thigh	222 (11.6)	147 (9.5)
	Knee/Lower Leg	434 (22.6)	274 (17.7)
	Ankle/Foot	160 (8.3)	146 (9.4)

Ignoring those cases where restraint status was unknown or there was missing data for any crash characteristic (n =2581), and controlling for crash characteristics as listed in Table 1, young male drivers were 3 times more likely to be fatally injured than young female drivers (OR 3.1, 95% CI 1.2-7.6). Note, due to collinearity, crash type and single/multiple vehicle crash variables could not be included in the same model. These therefore were tested in the models individually and neither was significantly associated with mortality when adjusting for all other variables. In fact, the only other variable found to have a significant association was restraint status; with unrestrained young drivers 4.6 times more likely than restrained young drivers to be fatally injured (95% CI 1.5-14.0 when crash type included, and 95% CI 1.4-12.8 when single/multiple vehicle variable included).

As shown in Table 2, the most commonly injured region for the drivers aged 17-25 years was the head, followed by the thorax, abdominal/lumbar/pelvic region and the knee/lower leg. Also as shown in Table 2, the pattern of injury varied by gender, with more head injury in males and more neck and abdominal injury in females. Controlling for crash characteristics, the logistic regression (Table 3) confirmed that male drivers were twice as likely as female drivers to sustain injury to the head (OR 2.0, 95% CI 1.7-2.4) but less likely to sustain injury to the abdominal/lower torso region (OR 0.8, 95%CI 0.7-9.5) and the neck (OR 0.6 95% CI 0.5 -0.7).

Regardless of driver gender, the logistic regression also indicated that head injury was more likely in: drivers of older vehicles (year of manufacture ≤1996); unrestrained occupants; fatal crashes; and, crashes involving loss of control or overtaking. For abdominal/lower torso injury, thoracic injury and neck injury, vehicle age and restraint status appeared less important, rather the significant factors, apart from gender were crash severity both in terms of travel speed and whether or not there was a fatality in the crash. Crash type was also significant for neck injury with neck injury being less likely in crashes involving loss of control or overtaking.

Table 3: Binary logistic regression models for head injury, thoracic injury, abdominal/lower torso and neck injury

		Head Injury			Thorax Injury		
Variable	**Value**	**Yes (%)**	**No (%)**	**OR (95%CI)**	**Yes (%)**	**No (%)**	**OR (95%CI)**
Vehicle Age	>1996	704 (63.4)	820 (55.7)	Reference	429 (60.9)	1095 (58.3)	Reference
	</= 1996	406 (36.6)	651 (44.3)	1.3 (1.1-1.6)	275 (39.1)	782 (41.7)	1.1 (0.9-1.3)
Restrained	Yes	1069 (94.9)	1467 (98.5)	Reference	690 (96.9)	1846 (97)	Reference
	No	57 (5.1)	22 (1.5)	2.9 (1.7-4.9)	22 (3.1)	57 (3)	0.97 (0.6-1.6)
Travel Speed	Per km/h[I]	1.0 (0.99-1.00)			0.998 (0.996-1.001)		
Fatal Crash	Yes	80 (7.1)	55 (3.7)	Reference	54 (7.6)	81 (4.3)	Reference
	No	1046 (92.9)	1434 (96.3)	0.6 (0.4-0.9)	658 (92.4)	1822 (95.7)	0.5 (0.4-0.8)
Gender	Male	765 (62.9)	720 (48.4)	2.0 (1.7-2.4)	408 (57.3)	1077 (56.6)	1.0 (0.8-1.2)
	Female	361 (32.1)	769 (51.6)	Reference	304 (42.7)	826 (43.4)	Reference
Crash Type	Control/OT	704 (62.5)	721 (48.4)	1.6 (1.3-1.9)	384 (53.9)	1041 (54.7)	1.0 (0.8-1.2)
	Other	422 (37.5)	768 (51.6)	Reference	328 (46.1)	862 (45.3)	Reference
		Abdo/Lumbar/Back/Pelvis Injury			**Neck Injury**		
Variable	**Value**	**Yes (%)**	**No (%)**	**OR 95%CI)**	**Yes (%)**	**No (%)**	**OR (95%CI)**
Vehicle Age	>1996	443 (59.1)	1081 (59.0)	Reference	331 (57.3)	1193 (59.6)	Reference
	</= 1996	306 (40.9)	751 (41.0)	1.04 (0.9-1.2)	247 (42.7)	810 (40.4)	0.96 (0.8-1.2)
Restrained	Yes	736 (97)	1800 (97)	Reference	575 (98.1)	1961 (96.6)	Reference
	No	23 (3)	56 (3)	0.9 (0.6-1.6)	11 (1.9)	68 (3.4)	0.8 (0.4-1.5)
Travel Speed	Per km/h[I]	0.997 (0.994-0.999)			0.997 (0.995-1.000)		
Fatal Crash	Yes	67 (8.8)	68 (3.7)	Reference	12 (2)	123 (6.1)	Reference
	No	692 (91.2)	1788 (96.3)	0.37(0.3-0.5)	574 (98)	1906 (93.9)	2.7 (1.5-4.9)
Gender	Male	409 (53.9)	1076 (58.0)	0.8 (0.7-0.95)	259 (44.2)	1226 (60.4)	0.6 (0.5-0.7)
	Female	350 (46.1)	780 (42.0)	Reference	327 (55.8)	803 (39.6)	Reference
Crash Type	Control/OT	398 (52.4)	1027 (55.3)	0.95 (0.8-1.1)	278 (47.4)	1147 (56.5)	0.8 (0.6-0.95)
	Other	361 (47.6)	829 (44.7)	Reference	308 (52.6)	882 (43.5)	Reference

[I]OR for each kilometre per hour increase

Discussion

This analysis demonstrates that there are significant variations in crash characteristics and outcomes by gender among young injured drivers admitted to hospital in NSW. Males were more likely to be involved in more serious and loss of control crashes, as well as being more likely to be unrestrained and in older vehicles than females. Controlling for crash characteristics, being male and being unrestrained significantly increased the odds of sustaining fatal injuries. There also appeared to be an overall difference in the pattern of injury between young males and females, with males more likely to sustain head injury and females more likely to experience abdominal/lower torso and neck injury.

The association between non-restraint use and increased odds of fatal injury is not surprising, but reinforces the need promote seat belt use among young drivers. While non-use was only recorded in 3% of the injured drivers, most of this non-use involved males, indicating particular efforts should be directed to encouraging seat belt use among young male drivers. However, it is important to note that most of the fatally injured young drivers were restrained (72%) indicating the importance of also addressing other areas of crash protection for drivers in this age group.

In our recent analysis of crash characteristics by age (Brown et al, 2014a) we saw injured occupants aged 17-25 years were significantly more likely to have been in older vehicles than older occupants (>25 years) and this aligned with previous research demonstrating that younger drivers tend to drive older vehicles (Cammisa et al, 1999; Ferguson, 2003; Williams and Leaf, 2006). However, we also found that young females were less likely to be in the oldest vehicles than young males, as similarly reported recently for several Australian states and New Zealand (Keall and Newstead, 2011). This type of gender variation contradicts the commonly cited cost barriers to modern vehicles among young drivers (Keall and Newstead, 2011) and highlights that there are likely other differences between young males and females driving vehicle choice. While we did not find vehicle age to be significantly associated with mortality, we did find vehicle age influenced the likelihood of head injury. Protecting the head is a high priority in crash protection because even among survivors injuries to this body region can be associated with long term disability. There is a need for more work into what drives vehicle choice among young drivers because most work in this area to-date has focused on factors involved in parental choice of vehicles for their children or young drivers as a single group (Cammisa, 1999; Hellinga et al, 2008; Rivara et al, 1998). A better understanding of the reasons underlying the gender differences found here could provide insight into potential ways to move young drivers into more modern vehicles; important because of the reductions in injury risk associated with more modern occupant protection technologies (Rivara et al, 1998; Hellinga et al, 2008), and also the reductions in crash risk with advanced crash avoidance technologies like electronic stability control (Broughton, 2003; Farmer, 2006; Farmer and Lund, 2004; Lie et al, 2006).

Univariate analysis demonstrated males were more likely to be in single vehicle crashes and crashes involving overtaking and loss of control. Many of these crashes may be assisted by modern crash avoidance technologies (Broughton, 2003; Farmer, 2006; Farmer and Lund, 2004; Lie et al, 2006) . While these crash types are often associated with increased fatality risk, we did not find a significant association between crash types and mortality. Instead we found being male and being unrestrained to be the only significant factors for mortality. This may reflect limitations with the analysis, such as poor control of crash severity through the use of sub-optimal measure for crash severity and the lack of detail about crash orientation. However, others also have reported inherent differences in crash risk by gender. Newgard (2008) reported that females have a lower risk of serious injury up to about age 60 when their probability of injury starts to rapidly rise compared to males. Our observations with regard to injury pattern align somewhat with Newguard's findings; however, we were unable to include a measure of injury severity by body region and it would be interesting to repeat our analysis of injury pattern variations taking the severity of injury to different body regions into account to investigate this potential phenomenon further.

Regardless of any potential inherent gender variation in injury severity risk, this analysis has demonstrated clear differences in the types of crashes among injured male and female drivers, as well as differences in restraint status and the vehicles being driven. While further study is required to understand what underlies these differences, it is possible that similar differences in risk-taking behaviours and neuro-biological development acknowledged to exist between younger and older drivers might also exist between young drivers of different genders. It may therefore be appropriate to investigate the use of gender specific interventions to reduce crash and injury risk among young drivers.

As in any research, there are a number of limitations that must be kept in mind when reviewing the results of this analysis. As noted above, due to limitations in the police data, only a de facto measure of crash severity could be used, and the two measures used (fatal crash, posted speed limit) are less accurate than a direct measure of delta v. Furthermore the police data do not contain information on impact direction (e.g. frontal impact, side impact rollover, etc), so this factor could not be included in the analysis. The restraint use information was also based on information recorded by general duty and traffic duty police officers and was not verified by in-depth investigation. Also, restraint status was unknown for approximately 10% of occupants. There was also no data regarding alcohol involvement available for analysis. Similarly, limitations in the data prevented discrimination between injuries of different severities as the level of detail required to code injuries using a system such as AIS was not always available in the hospital data set.

CONCLUSION

Young male drivers are more likely to be fatally injured, to sustain injuries to the head, to be in older vehicles, crashes of higher severity and crashes involving loss of control or overtaking than young female drivers. Males are also significantly more likely to be unrestrained in these crashes. There is clearly more work to be done to increase restraint use among young adults, particularly males. There is also need for further research into the physiological, behavioural or neuro-biological differences that underpin variations in crash characteristics and injury outcome between young male and female drivers. In particular, better understanding of how young adults can be encouraged to use more modern vehicles and how this might be practically facilitated is needed. The clear variations in crash characteristics, restraint status and types of vehicles being driven by young male and female drivers suggest gender specific interventions to reduce crash involvement and injury may be warranted.

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REFERENCES

Abdel-Aty M., Keller, J., Exploring the overall and specific crash severity levels at signalized intersections. *Accid Anal Prev* Vol 37 Issue 3, 2005, pp. 417-425

Augestein, J., Perdek, E., Startton, J., Digges, K., Bahouth, G., Characteristics of crashes that increase the risk of serious injuries. in *47th Annual Proceedings Association for the Advancement of Automotive Medicine*, Vol. 47, 2003, pp. 561-576.

Bilston, L.E., Du, W., Brown, J., A matched-cohort analysis of belted front and rear seat occupants in newer and older model vehicles shows that gains in front occupant safety have outpaced gains for rear seat occupants *Accid Anal Prev* Vol 42, 2010, pp.1974–1977

Broughton, J., The benefits of improved car secondary safety. *Acc Anal Prev* Vol 35, 2003, 527-535

Brown, J., & Bilston, L. E. The scope and nature of injuries to rear seat passengers in NSW using linked hospital admission and police data. *Traffic Injury Prevention*, 2014;15(5):462-9

Brown J; Senserrick T; Bilston LE (2014a), Restraint use and injury patterns among young drivers and passengers aged 17-25 years admitted to hospital in NSW, Australia, in *TRB 93rd Annual Meeting Compendium of Papers*, 2014 NTOC Forums & Traffic Signal Library., presented at Transportation Research Board 93rd Annual Meeting, Washington D.C., 12 - 16 January 2014,

Cammisa, M.X., Williams, A.F., Leaf, W.A., Vehicles driven by teenagers in four states. *Journal of Safety Research* Vol 30, 1999, pp. 25-30

Carskadon, M.A., Sleep in adolescents: the perfect storm. *Pediatric Clinics of North America*, 2011, Vol 58, Issue 3, pp. 637-647.

Farmer, C.M., Lund, A., Trends over time in the risk of driver death: What if vehicle designs had not improved. *Traffic Injury Prevention* Vol 7, 2006, pp.335-342

Farmer, C.M., Effect of electronic stability control on automobile crash risk. *Traffic Injury Prevention* Vol 5, 2004, pp.317-325

Ferguson, S.A., Other risk factors for young drivers- how graduated licensing does, doesn't or could address them. *Journal of Safety Research* Vol 34, 2003, pp.71-77

Hellinga, L.A., McCart,. A.T., Haire, E.R., Choice of teenagers' vehicles and views on vehicle safety: survey of parents of novice teenage drivers. *J Safety Res* Vol 38, 2008, pp.707-713

Islam, S. and Mannering, F., Driver aging and its effect on male and female single-vehicle accident injuries: some additional evidence. *Journal of Safety Research* Vol 37, 2006, pp267-276

Johnson, S.B. and Jones V.C., Adolescent development and risk of injury: using developmental science to improve interventions. *Injury Prevention*, Vol 17, Issue 1, 2011, pp50-54.

Keall, M.D., Newstead, S., Passenger vehicle safety in Australasia for different driver groups *Acc Anal Prev* Vol 43, 2011, pp. 684-689

Laapotti, S., Keskinen, E., Differences in Fatal Loss-of-Control Accidents Between Young Male and Female Driver, *Acc Anal & Prev*, Vol. 30, Issue 4, 1998, pp. 435-442.

Lie. A., Tingvall, C., Krafft, M., Kullgren, A., The effectiveness of electronic stability control (ESC) in reducing real life crashes and injuries. *Traffic Injury Prevention* Vol 7, Issue 1, 2006, pp. 38-43

McCartt, A. T., Mayhew, D. R., Braitman, K. A., Ferguson, S. A., Simpson, H. M., Effects of age and experience on young driver crashes: review of recent literature. *Traffic Injury Prevention*, Vol 10, 2009, pp 209-219

Newgard, C.D., Defining the 'older' crash victim: The relationship between age and serious injury in motor vehicle crashes. *Acc Anal Prev* Volume 40, 2008, pp. 1498-1505

Organisation for Economic Co-operation and Development (OECD). *Young Drivers: The Road to Safety*. Paris, France: OECD Publishing; 2006.

Petroulias, T., *Community Attitudes to Road Safety: 2011 Survey* Report Road Safety Report 5, Australian Government Department of Infrastructure and Transport 2012 Centre for Road Safety (CRS) *Road traffic crashes in New South Wales: statistical statement for the year ended 31 December 2011* Transport for NSW, 2011.

Rivara, F.P., Rivara, M.B., Bartol, K., Dad, may I have the keys? Factors influencing which vehicles teenagers drive. *Paediatrics* Vol 102, 1998, e57

Ulfarsson G.F., Mannering F.L., Differences in male and female injury severities in sport-utility vehicle, minivan, pickup and passenger car accidents, *Acc Anal Prev* Vol 36, 2004, pp.135-147.

Williams, A.F., Leaf, W.A., Simons-morton, B.G., Hartos, J.L., Vehicles driven by teenagers in their first year of licensure. *Traffic Injury Prevention* Vol 7, Issue 23, 2006, pp.23030