Int J Public Health 53 (2008) 40–45
1661-8556/08/010040-6
DOI 10.1007/s00038-007-6083-0

Original article

Road traffic injuries among young car drivers by country of origin and socioeconomic position

Marie Hasselberg, Lucie Laflamme

Karolinska Institutet, Department of Public Health Sciences, Division of International Health, 171 77 Stockholm, Sweden

Submitted: 4 July 2006; Revised: 1 June, 16 September 2007; Accepted 21 November 2007

Summary

Objectives: The study examines the relationship between country of birth, socioeconomic position, and the risk of being injured as a young car driver.

Methods: The study consists of a nationwide follow-up of young people in Sweden in which individual census records on country of birth and household socioeconomic position were linked to the Hospital Discharge Register so as to identify subjects' road traffic injuries (RTIs) as car drivers. Multivariate analyses were conducted using Cox regression, with hospital admission due to RTI as car driver as the dependent variable.

Results: There are no significant differences in injury risks between foreign-born and Swedish-born drivers, but clear socioeconomic differences were found. Young drivers from manual worker families have 80 % higher risk for RTIs compared to drivers in families with salaried employee parents (RR 1.83, CI 1.63-2.05).

Conclusions: The results do not support the idea that type of country of origin constitutes a significant marker of risk level for RTI as novice car driver. On the other hand, the results reconfirm that, in Sweden, the risk of RTI among young drivers from different socioeconomic backgrounds varies.

Keywords: Country of origin – Country of birth – Socioeconomic position – Road-traffic injuries – Young drivers – Gender.

It is well known that young car drivers run a higher risk of being involved in road traffic crashes and suffering road traffic injury than older drivers. It is less known that, among young drivers, road traffic injuries are far more common among those coming from lower socioeconomic groups [1–4]. As this latter finding has been little replicated, we do not know whether it is specific for one or many countries. Yet it is definitely echoed in an ample body of research showing that, for many categories of road users, road traffic injury mortality and morbidity are not distributed randomly across people from different socioeconomic groups, tending to be more concentrated among young people – and people in general – from low socio-economic groups (see reviews in [5–7]). The mechanisms lying behind those differences are not well understood. One set of explanations that gain support in the current literature is that of differential exposure across groups, expressed either in quantitative (e.g., miles driven) or qualitative (e.g., environment or vehicle) terms [5–6]. If these explanations hold true, young people from less privileged socioeconomic groups would be more frequently injured in traffic because e.g., they drive to a greater extent than their more privileged peers and/or they drive in more dangerous environments or less crash proof vehicles.

An alternative set of explanations relates to differences in susceptibility, implying that behaviour and safety practice – rather than environment and duration of exposure – are responsible for the differences observed. In the current debate in Sweden, there are some who put forward the view that these differences are not as much related to individual socioeconomic group as they are to individual "origin" [8], i.e. ethnic background or country of origin. This would be part of a population-wide pattern whereby, because of their genetic make-up or their "culture", people from minority groups or immigrants would be at higher risk compared to their native peers. This difference would confound the differences otherwise observed in health and safety outcomes. Whether the above is transferable to traffic safety issues among young people is uncertain and remains to be investigated in the Swedish context. If the hypothesis holds true, it would mean that the socioeconomic differences observed between young people from different groups would be a – more or less partial – reflection of their "origin".

Int J Public Health 53 (2008) 40–45

Operationalising the notion of "origin" is a complex task and there is an ongoing discussion within public health research about the appropriate measures and terms for origin, race and ethnicity, but there is still no consensus on the issue [9-10]. Studies in the field have mainly been conducted in settings like the United States where the correlation is strong between socioeconomic position and country of origin or racial group and most studies have tested whether socioeconomic status confounded the effect of "race" on traffic injuries. In one study, the excess risk of motor-vehicle-related deaths observed among black people (age 18–64 years) disappeared after adjustment for socioeconomic variables (income-to-needs, education, occupation/employment status) [11], suggesting that socioeconomic factors rather than "cultural" ones are involved. Yet, in another study, the excess risk found among black Americans for car occupant fatalities (age 25–64 years) persisted after adjustment for educational attainment [12].

In Europe, a Swedish national study on crash morbidity revealed considerable socioeconomic differences among young drivers up to 24 years. The excess risk for young people from lower socioeconomic groups was not affected after controlling for parental type of country of origin (see above, [1]). Yet, we still do not know whether there are differences in risk levels of road traffic injuries between youths with different "country" backgrounds, and if so, whether those differences are larger than those between young people from different socioeconomic backgrounds.

These questions are the main object of the current study, conducted on a cohort of Swedish young people. It investigates whether country of birth affects the risk of being injured as a young car driver. Both country of birth of the parents and of the young driver are considered. Attention is also paid to both the individual and combined effect of country of birth and socioeconomic position.

Methods

Study population

This population-based cohort study encompasses all individuals born in 1970, 1971 and 1972, found in the Swedish Population and Housing Census of 1985. The population was restricted to children living in a family household, excluding those (few) living in institutions or the like, for a study population of 334,070 subjects. Given the focus on car drivers' injury experience, only those subjects obtaining a driving licence within the follow-up period (1988–1996) were included in the study. In Sweden, driving licenses are not issued to people under the age of 18 years. The age of those being issued a licence was obtained from the National Driver's Licence Register and linked to the data set. Subjects for whom individual or parental country of birth was lacking (in the Swedish Population and Housing Census; see below) were also excluded. After those exclusions, 275,265 subjects remained in the study population. Subjects' country of birth and socioeconomic status were identified (see below) and they were also followed up in the Swedish Hospital Discharge Register in search of road traffic injuries as car drivers for the period 1988–1996 (when subjects were aged 18–26 years).

Country of origin

Sweden is a multicultural country with nearly 11 % immigrants, the majority of whom come from Finland. Ethnic background is measured by country of birth in the current study. Information on country of birth of the parents and subjects were obtained from the Swedish Population and Housing Census of 1985. Information on country of birth was linked to the census from the Register of Total Population in Sweden. For immigrants, the information is registered at the time of immigration. For women registered in Sweden who give birth abroad, the child will be registered as Swedish-born [13].

In the current study, country of birth was first aggregated according to a categorisation used by the National Road Administration and the Transport Research Institute in Sweden, based on the average income per capita and number of motor vehicles per person in each country [14]. Although this categorisation comprised 9 groups of countries, we initially used 8 such groups (see Table 1) because given the small numbers of subjects, the Soviet Union was included in the group "former East European countries".

Further country groupings were needed subsequently because, of the 2,011 subjects treated in hospital for injuries as a car driver during the follow-up period (see Table 1), the vast majority were Swedish-born (97 %). Since the number of injuries among drivers from other groups of countries was too low to be meaningful from a statistical standpoint (1 % from other Western countries and 2 % from all the other countries) the countries were aggregated into three groups: Sweden, Western countries and the rest of the world.

Country of birth of the parents was divided into children with at least one Swedish-born parent or both parents born in other countries. Swedish-born subjects and parents born in Sweden were used as a reference group in the analyses.

Socioeconomic position

Information on parental socioeconomic characteristics was gathered from the Population and Housing Census of 1985. Each parent's social class was defined according to a classification used by Statistics Sweden (based on occupation, [15]). Also, in line with earlier studies considering children's

Country of birth	Number of persons (n = 275,265)	Rate of injury (per 100,000 person years)	% of injuries (n = 2,011)
Sweden	266,809	67.7	97.0
Other Western countries	3,084	72.1	1.0
Mediterranean countries within Europe	839	72.5	0.3
Former East Europe	944	31.2	0.2
Middle East and North Africa	574	36.4	0.2
Africa south of Sahara	279	35.7	0.1
Central- and South America	622	50.9	0.2
Asia and Oceania	2,114	94.2	1.0

Table 1 Number of persons, rate of injuries and percent of injuries by country of birth during the period 1988–1997

socioeconomic position (SEP), the family's weighted socioeconomic group has been used based on the "dominance" principle developed by Erikson [16]. This principle is built on the conception of a dominance relationship between different work categories and their influence on the ideology, attitudes and consumption patterns of the family, and also which category is most important for the child's life prospects.

Accordingly, each subject was allocated to one of the following five socioeconomic groups: Intermediate and high-level salaried employees; assistant non-manual employees; manual workers; the self-employed including farmers (self-employed without employees or small-scale entrepreneurs; small-scale and medium-scale farmers); and others (such as students, persons on sickness and disability pensions, and the long-term unemployed). In the analyses, children from families with intermediate and high level salaried employees were used as the reference group.

Traffic injuries

Drivers who had sustained traffic injuries during the follow-up period were identified in the Swedish Hospital Discharge Register, following the International Classification of Diseases, Version 9 (ICD-9, E819A, 17). Case selection was based on diagnosis of main condition at first discharge. This entailed that for any one subject, it was only possible to have one injury during the entire follow up. A total of 2,011 injuries were identified.

Data analyses

Age at time of obtaining a driver's license was used to compile the period over which subjects were exposed to the risk of a car crash. The information was gathered from the National Driving Licence Register, administered by the Swedish National Road Administration. This register contains information on, for example, the date of issue of licence and types of vehicles covered. Person-years at risk were assessed by adding up the years each subject was free from a car crash during the follow-up period (1988–1996).

Relative risks with 95 % confidence intervals were used to estimate the effect of country of birth and socioeconomic position on road traffic injury (RTI). Multivariate analyses were conducted using the Cox regression model, with hospital admission due to RTI as car driver as the dependent variable. A test of the moderating effect of gender and socioeconomic position on the association between country of birth and RTI was also conducted. The statistical analyses were carried out using the SPSS software package (Version 11.5).

The study was reviewed and approved by the Karolinska Institutet's ethics committee Nord.

Results

Age at time of obtaining a driver's licence

Table 2 shows that more young men than women acquire a driving licence at an early age, and that more young women than men do not have a driver's licence by the age of 31.

A higher proportion of Swedish-born subjects acquire their driving licence between 18 and 19 years of age compared with foreign-born subjects. There are also more foreign-born subjects without a driving licence at the age of 31. Subjects born in Central and South America have the lowest proportion of driver's licence holders at age 19 and the highest proportion without a driving licence by the age of 31.

With two exceptions, the proportion of persons acquiring a driving licence early is comparable across socioeconomic groups. The exception concerns children of the self-employed (including farmers), more of whom take their driver's licence between 18 and 19 years of age. Also, there are fewer people in this group without a driver's licence by the age of 31. Subjects belonging to the group "others" have a special profile, with a lower proportion of driver's licence holders at age 19, and even at age 31, compared to other socioeconomic groups.

Int J Public Health 53 (2008) 40–45

Table 2 Age at driving licence by gender, socioeconomic group, and country of birth during the period 1988–2001

	Up to 19 years %	Diff 95 % CI	20–24 years %	Diff 95 % CI	25–29 years %	Diff 95 % CI	No licence taken by age of 31	Diff 95 % CI
Gender								
Male	79		7		3		11	
Female	66	13 (11.9–12.5)	12	–5 (–4.6—4.2)	5	–2 (–2.2—1.9)	17	–6 (–6.0—5.5)
Country of birth								
Sweden	74		9		4		13	
Other Western countries	48	26 (24.7–27.5)	12	–3 (–4.2—2.3)	6	–2 (–2.4—1.1)	34	–21 (–22.4—9.7)
Mediterranean countries within Europe	45	29 (26.5–32.0)	19	–10 (–11.8—7.5)	8	–4 (–5.7—2.7)	28	–15 (–17.6—12.7)
Former East Europe	47	27 (23.8–29.0)	15	–6 (–7.5—3.9)	8	–4 (–5.1—2.3)	30	–17 (–19.2—14.5)
Middle East and North Africa	41	33 (29.7–36.3)	23	–14 (–16.8—11.1)	11	–7 (–8.7—4.5)	25	–12 (–15.1—9.2)
Africa south of Sahara	41	33 (28.3–37.0)	13	–4 (–6.8—0.8)	7	–3 (–4.4–0.0)	39	–26 (–30.4—21.7)
Central- and South America	22	52 (49.4–53.4)	13	–4 (–6.2—2.9	10	–6 (–7.6—4.6)	53	–40 (–43,0—38.2)
Asia and Oceania	55	19 (17.3–21.0)	16	–7 (–8.0– –5.4)	6	–2 (–2.8—1.1)	23	–10 (–11.9—8.8)
Socioeconomic group								
Non-manual employees	74		10		4		12	
Manual workers	71	3 (3.2–4.0)	9	1 (0.5–1.0)	4	0 (–0.3–0.1)	16	4 (4.5—4.0)
Self-employed (including farmers)	84	–10 (–9.7—8.8)	6	4 (3.3–3.9)	2	2 (1.6–2.0)	8	4 (3.5–4.2)
Others	54	20 (19.6–21.0)	12	–2 (–2.7—1.7)	7	–3 (–2.8—2.1)	27	–15 (–16.3—15.0)
Total	73		9		4		14	

Relative risks in different groups of drivers

Table 3 shows the rate of injuries and relative risks among drivers born in different countries. There are no significant difference in the risk of being injured as a car driver between foreign-born and Swedish-born drivers. Nor are there any differences in RTI risks between drivers with Swedish-born and foreign-born parents.

In contrast with these results there are clear socioeconomic differences in the risk of being injured as a car driver. Young drivers in manual worker families run a 80 % higher risk of being injured in RTIs as car drivers (RR 1.83, CI 1.63-2.05). Children of self-employed (including farmers) run nearly a 90 % higher risk for RTIs (RR 1.88, CI 1.63-2.18) compared to children in the reference group. RRs for the unspecified group, "others" were double those of children in the reference group (RR 2.10, CI 1.74-2.53). Neither gender nor socioeconomic position modified the non-elevated injury rates found for foreign-born drivers.

Discussion

Main findings

The results showed that socioeconomic position was found to be a significant determinant while country of origin was not. The consistent differences between socioeconomic groups in

Household characteristic	Rate of injury (per 100,000 person years)	RR (95 % CI)
Country of birth of the driver		
Sweden	67.7	1.00
Other Western countries	72.0	0,83 (0.52–1.32)
Other countries	65.6	0.82 (0.58–1,18)
Country of birth of the parents		
Sweden	67.2	1.00
Other countries	71.2	0.92 (0.60–1.39)
Socioeconomic group of the household		
Intermediate and high level salaried employees	46,8	1.00
Assistant non-manual employees	65,4	1.41 (1.21–1.63)
Manual workers	83,5	1,83 (1,63–2,05)
Self-employed (including farmers)	84,7	1.88 (1.63–2,18)
Unspecified population (Others)	97.0	2,10 (1.74–2,53)

Table 3 Incidence and relative risks for road-traffic injuries among young drivers aged 18–26 by country of birth and household socioeconomic group (1988–1996)

the risk of RTIs shown in earlier studies are evident also in this study. However, the study gives no support to the hypothesis of differences due to country of origin, be it in absolute or in relative terms for RTIs among young drivers in Sweden. Neither is there an interaction effect between country of origin and SEP regarding the risk of RTIs.

In other words, the results suggest that drivers from different "country" backgrounds do not face – or expose themselves to – different problems in the traffic environment compared with their native peers. On the contrary, a higher proportion of foreign-born subjects acquire their driving licence at an older age compared to Swedish-born subjects. And there are more foreign-born subjects without a driving licence at the age of 31.

In addition, young drivers' experience of road traffic injuries leading to hospitalisation is not much influenced by their country of origin – or category of country. In that sense, the study procures no support for a higher susceptibility for RTIs among foreign born young people or those with foreign-born parents. Whether this has to do with the country's licensing system (higher age at licensing than many other countries, and therefore lower initial risk), its immigration policy (more integrative) or the youth culture itself that cuts across all groups of young people, remains to be determined.

While our results are not easily comparable to those of other studies dealing with wider age ranges or different injury types, they echo other studies focusing on overall injury mortality [18] or overall motor-vehicle-related fatality [10, 19].

Limitations

The study base can be regarded as well representative of the Swedish population of young people followed up, since the rate of missing cases for the Swedish Population and Housing Census of 1985 is as low as 0.8 % [13]. As for the outcome measure, in Sweden's Hospital Discharge Register, the missing-case rate is estimated to range between 1 % and 2 %. For the period under study, the external code was missing in around 3 % of cases, and studies of validity have shown that registered diagnosis might be wrong in about 10 % of cases [20]. We have no reason to believe that cases of missing information or misclassification show a particular pattern regarding different countries or social groups, which suggests that they are unlikely to affect the results obtained.

This study was based on the injury diagnosis at first discharge meaning that each subject could only be registered for one injury during the follow-up period. However there is no reason to believe this fact has affected our results. Another Swedish study has shown that the number of injury repeaters is low and that their socioeconomic distribution is very similar to that of the once-injured [21].

An important limitation of the study is the lack of precision in the measure of traffic exposure across groups of young people. In the absence of data on kilometres driven at individual level, we have used age at being issued a licence to determine exposure duration (a proxy for driving debut). Since the results show that this age varies between Swedish-born and foreign-born drivers and drivers, adjustment for this may control for some of the variation in traffic exposure between the groups. Whether other differences in exposure, in magnitude or in kind, may confound our results remains to be assessed.

Information on country of origin was available for each subject and their parents. The study population was defined when the subjects were 13, 14 and 15 years, meaning that they had lived in Sweden before they were eligible for a driving licence and that most of them probably had learnt to drive

Int J Public Health 53 (2008) 40–45

in Sweden. We did not have information concerning whether the subjects moved in and out of Sweden during the follow-up period.

Finally, the classification of country originally planned for could not be used because of the limited number of injured cases in several of them. While this is an indication in itself of the low level of injuries incurred in those groups, the aggregations might have obscured some significant differences. Aggregated groups can increase heterogeneity with a greater range of differences within groups of drivers than between groups.

In light of the above, the results obtained herein show that, in the Swedish context, socioeconomic position is a stronger determinant than country of origin for the experience of motor-vehicle-related injuries among young car drivers.

Conclusion

Despite a lack of precise exposure data, this study reconfirms that, in Sweden, young drivers from different socioeconomic backgrounds do not run the same risk of road traffic injury leading to hospitalisation. This is not the case for country of origin groups, where similar injury risks were found irrespective of whether young people (or their parents) are born in or outside Sweden. The socioeconomic patterning of road traffic injuries among young people deserves particular attention from public health and road safety authorities.

Acknowledgements

This study was funded by the National Road Administration in Sweden.

References

1. *Hasselberg M, Laflamme L, Ringbäck Weitoft G* (2001). Socioeconomic differences in road traffic injuries during childhood and youth: a closer look at different kinds of road user. J Epidemiol. Community Health *55*: 858–62.
2. *Laflamme L, Engström K* (2002). Socioeconomic differences in Swedish children and adolescents injured in road traffic incidents: cross sectional study. BMJ *324*: 396–7.
3. *Hasselberg M, Laflamme L* (2003). Socioeconomic background and road traffic injuries: a study of young car drivers in Sweden. Traffic Injury Prev *4*: 249–54.
4. *Hasselberg M* (2004). The Social Patterning of Road Traffic Injuries during Childhood and Youth. Doctoral thesis, Karolinska Institutet, Stockholm.
5. *Laflamme L* (1998). Social inequality in injury risks. Knowledge accumulated and strategies for the future. Swedish National Institute of Public Health, Stockholm: 33.
6. *Laflamme L, Diderichsen F* (2000). Social differences in traffic injury risks in childhood and youth-a literature review and a research agenda. Injury Prevention *4*: 293–8.
7. *Cubbin C, Smith GS* (2002). Socioeconomic inequalities in injury: critical issues in design and analysis. Annu Rev Public Health *23*: 349–75.
8. *Forward S, Kos-Dienes D, Obrenovic S* (2000). Immigrants in traffic – an attitude study in the counties of Värmland and Skaraborg. Swedish National Road and Transport Research Institute. VTI rapport 545. Linköping (in Swedish with English summary).
9. *Bhopal R* (2005).Glossary of terms relating to ethnicity and race: for reflection and debate. JECH *58*: 441–5.
10. *Kaplan JB, Bennett T* (2003). Use of race and ethnicity in biomedical publication. JAMA *28*: 2709–16.
11. *Cubbin C, LeClere FB, Smith GS* (2000). Socioeconomic status and the occurrence of fatal and non-fatal injury in the United States. Am J Public Health *90*: 70–7.
12. *Braver ER* (2003). Race, Hispanic origin, and socioeconomic status in relation to motor vehicle occupant death rates and risk factors among adults. Accident Anal Prev *35*: 295–309.
13. Statistics Sweden (1989). Population and Housing Census 1985. Part 9: The planning and processing of the Population and Housing Census. Official Statistics of Sweden, Stockholm.
14. *Yahya MR* (2001). Immigrants and traffic safety (prestudy). An analysis of existing public data source in Sweden. Swedish National Road and Transport Research Institute. VTI meddelande 907, Linköping Sweden (in Swedish with English summary).
15. Statistics Sweden (1983). Swedish socioeconomic classification. Reports on statistical coordination. 1982: 4 Statistics Sweden, Örebro (in Swedish with English summary).
16. *Erikson R* (1984). Social class of men, women and families. Sociology *18*: 500–14.
17. International Classification of Diseases (1986). Ninth revision (ICD-9), Swedish version. Nordstedts Tryckeri, Stockholm.
18. *Hussey JM* (1997). The effects of race , socioeconomic status, and household structure on injury mortality in children and young adults. Matern Child Health J *1*: 217–27.
19. Onwuachi-Saunders C, Hawkins DF (1993). Black-white differences in injury. Race or social class? Ann Epidemiol *3*: 150–3.
20. Official Statistics of Sweden (1999). Health and Diseases. Hospitalisation due to injuries and poisoning in Sweden 1987–1996. The National Board of Health and Welfare, Centre for Epidemiology. Nordstedts Tryckeri, Stockholm.
21. *Hasselberg M, Laflamme L* (2005). The social patterning of injury repetitions among young car drivers in Sweden. Accid Anal Prev *37*: 163–8.

Address for correspondence

Marie Hasselberg, PhD
Karolinska Institutet
Department of Public Health Sciences
Division of Social Medicine
Norrbacka
SE-171 76 Stockholm
Sweden
Tel.: +46 8 737 37 82
Fax: +46 8 737 38 78
e-mail: marie.hasselberg@ki.se