RESEARCH REPORT

Injury mortality among ethnic minority groups in the Netherlands

I Stirbu, A E Kunst, V Bos, E F van Beeck

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See end of article for authors' affiliations

Correspondence to:
Dr I Stirbu, Department of Public Health, Erasmus MC, University Medical Centre Rotterdam, PO Box 1738, 3000 DR Rotterdam, Netherlands; i.stirbu@erasmusmc.nl

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Objectives: To prepare a comprehensive overview of ethnic differences in injury related mortality in the Netherlands and to determine the role of area income and urbanisation degree.

Methods: Data for the period 1995–2000 were obtained from the population and cause of death registries. Injury related death rates were compared for persons from Turkish, Moroccans, Surinamese, and Antillean/Aruban origin with rates for the native Dutch population.

Results: Compared with the native Dutch population, all ethnic minorities combined had an increased mortality for all injuries together (RR = 1.29). Ethnic minorities experienced a significantly higher risk of death from pedestrian accidents (RR = 1.87), drowning (RR = 2.58), poisoning (RR = 1.76), fire and scalds (RR = 1.95), and homicide (RR = 3.24). Mortality for cyclists (RR = 0.53) and motorcycle drivers (RR = 0.47) was significantly lower among ethnic minorities compared with the native Dutch. Adjustment for area income and urbanisation decreased the mortality risk difference for most of the non-traffic injuries, but showed a difference in risk for car driver and passenger accidents (RR = 1.37). Compared with the native Dutch inhabitants, Surinamese and Antillean/Aruban population had a higher risk of total injury mortality (RR = 1.33 and 1.53 respectively), while Turkish and Moroccans had increased risk only for selected conditions. Inequalities in injury mortality were the highest among children and young adults, but persisted in the age group above 50 years old.

Conclusion: Ethnic differences in injury mortality in the Netherlands strongly depended on type of injury, ethnic group, sex, and age. Policies should be aimed at the prevention of high risk injuries among the most vulnerable ages and ethnic groups.

An accumulation of evidence over the past decade points to differences in morbidity and mortality of ethnic minorities compared with the majority population in many countries.^{1–3} Descriptive epidemiological data on injury incidence and mortality consistently show increased rates among indigenous people,⁴ such as Indians and Alaska natives in the USA,⁵ Aboriginals in Australia,⁶ and Maori in New Zealand.⁷ In addition, occasional evidence suggests that migrant populations, especially children, also experience a higher injury risks.^{8–10} Increased risks for ethnic minority groups are often ascribed to socioeconomic factors or inequalities in medical care.¹¹ In many instances, however, there is no clear cut explanation. Few studies include national level data, or cover all age groups, sexes, and ethnic minority groups.

About 10% of the population in the Netherlands is of non-Western origin with the largest representation of Turkish, Moroccan, Surinamese, and Antillean/Aruban immigrant groups. Ethnic minorities in the Netherlands more often live in low income urbanised areas, which are known to have higher injury mortality rates.¹² Previous Dutch studies found ethnic variations in mortality, including mortality from external causes.^{2–10} Children of foreign descent are particularly vulnerable to pedestrian injuries and drowning compared with the native Dutch children.¹⁰ Ethnic variations in injury incidence and mortality beyond childhood have hardly been studied, although an increased risk of homicides among adult immigrants has been reported.^{2–13} Limited to specific age groups, type of injuries, and selected determinants, previous Dutch studies thus failed to provide a comprehensive picture of ethnic variations in injury mortality and its major risk factors.

This study is the first to investigate and measure the magnitude of ethnic differences in mortality from a broad

range of injuries among different age groups and sexes in the Netherlands. We also analyse the part that area income and urbanisation play in this association and we estimate which part of injury mortality in the Netherlands would have been avoided if all ethnic groups would have similar injury mortality rates as the native Dutch population.

METHODS

Numbers of deaths and population at risk for the period 1995–2000 were obtained from the cause of death register and the municipal population register that includes all inhabitants of the Netherlands with a legal status. These registers were linked using a personal identification number. An open cohort design was used: people were allowed to enter or leave the study (because of birth, death, migration, or administrative corrections) throughout the study period. All deaths that occurred abroad were excluded from the analysis. The data included information on the cause of death, sex, age, marital status, area income (household equivalent income of the neighbourhoods classified into deciles),¹⁴ and urbanisation degree (address density per square kilometre classified into five categories).

Country of birth of the person and both parents was used to measure ethnicity, according to the definition used by Statistics Netherlands.¹⁵ If at least one parent was born abroad, the person was considered to be of non-Dutch origin. In mixed ethnic families, the country of birth of the mother prevailed. We compared death rates of the four largest ethnic minority groups residing in the Netherlands (Turkish, Moroccan, Surinamese, and Antillean/Aruban) with native Dutch.

All injuries were classified into three main categories with a further distinction in specific causes of death: traffic related injuries (car driver and passenger, pedestrian, cyclist,

Table 1 Background characteristics by ethnic group and sex

	Dutch	Turkish	Moroccans	Surinamese	Antilleans/Arubans
Men					
Person years (PY) 1995–2000 ($\times 1000$)	38593.79	905.08	780.55	816.18	264.64
Total number of deaths	368882	2034	1325	2895	576
Total number of injury related deaths	13409	262	216	369	133
Urbanisation: % living in highly urbanised area	33.2	74.8	77.3	80.0	68.8
Area income: % living in low income area	16.5	58.7	56.1	50.8	43.8
Women					
Person years (PY) 1995–2000 ($\times 1000$)	39592.23	812.04	667.16	878.59	268.16
Total number of deaths	369982	951	621	2395	487
Total number of injury related deaths	7770	71	62	144	35
Urbanisation: % living in highly urbanised area	34.9	74.1	77.0	80.4	68.9
Area income: % living in low income area	16.7	58.2	55.6	49.4	43.0

motorcycle driver, other), non-traffic injuries (drowning, poisoning, fire and scalds, fall, other), and intentional injuries (suicide, homicide, undetermined event) (table 2). All causes of death were coded according to the *International Classification of Diseases* (ICD), 9th revision for the year 1995 and 10th revision for the period 1996–2000. Although there is some variability in the codes between ICD revisions, the changes were judged small enough to permit comparability over time.

Relative risks that compared injury mortality rates of ethnic minorities with that of the native Dutch population were calculated using Poisson regression (Stata software, version 7). Relative risks were adjusted for five-year age groups and sex. We performed an additional adjustment to estimate the contribution of area income and urbanisation on ethnic differences in injury related mortality.

The population attributable risk (PAR) was calculated to assess the reduction in cause specific injury mortality rates that would occur if minority ethnic groups experienced the injury mortality rates of the native Dutch population. To calculate PAR, we derived cause specific relative risks for all minority groups combined from the Poisson regression analysis.¹⁶

RESULTS

The native Dutch population contributed the most person time and the largest number of injury related deaths to the analysis (table 1). Turkish, Moroccans, and Surinamese groups were about equally large and Antilleans/Arubans were about three times smaller. All ethnic minorities were

more likely to live in poorer and more urbanised areas than the native Dutch population.

All ethnic minorities combined and the native Dutch population followed a similar general pattern with intentional injuries constituting the largest subcategory in absolute numbers of death (8630 for Dutch and 711 for ethnic minorities) and suicide being the most frequent cause of death (table 2). In both ethnic groups, for most causes men experienced a two to three times higher number of deaths from injuries than women.

We found total injury related mortality for the studied ethnic minorities combined to be significantly increased (RR = 1.29) compared with the native Dutch population (table 3). Among traffic injuries, only pedestrian accidents had higher relative risk (RR = 1.87), while relative risks for almost all non-traffic and intentional injuries were significantly increased for ethnic minorities. Mortality among cyclists and motorcycle drivers, in comparison, had a significantly lower risk for ethnic minorities compared with the native Dutch population.

Additional adjustment for urbanisation and area income produced several important effects. In some cases it explained a major part of the mortality difference: a reduction in relative risk of about 50% and more was seen in case of total injury related mortality (RR decreased from 1.29 to 1.11, when adjusted for all factors), the non-traffic injuries group (RR from 1.51 to 1.26), accidental fire/scalds (RR from 1.95 to 1.35), the intentional injuries group (RR from 1.57 to 1.11), homicides (RR from 6.41 to 3.24), and events of undetermined intent (RR from 2.11 to 1.22). In case

Table 2 Absolute numbers of injury related deaths for ethnic minorities and native Dutch population by sex

		Dutch		Ethnic minorities combined	
ICD10 codes		Men	Women	Men	Women
Total injury related mortality		13409	7770	980	312
Traffic injuries		4417	1673	253	72
Car driver and passenger accidents	V40–V49 V50–V79 Y85	1960	736	148	31
Pedestrian accidents	V01–V09	366	245	33	21
Cyclists accidents	V10–V19	774	388	15	13
Motorcyclists accidents	V20–V29, V30–V39	819	125	33	2
Other traffic injuries	V80–V99	498	179	24	5
Non-traffic injuries		3298	3161	203	53
Accidental drowning	W65–W74	291	89	54	10
Accidental poisoning	X40–X49	307	81	38	8
Accidental fire and scalds	X00–X09, X10–X19	182	170	16	8
Accidental falls	W00–W19	1769	2422	46	16
Other non-traffic injuries	W20–49 W75–84 W85–99 X20–29, X30–39	749	399	49	11
Intentional injuries		5694	2936	524	187
Suicides	X60–X84, Y87.0	5036	2606	283	108
Homicides	X85–Y09, Y87.1	439	234	218	70
Events of undetermined intent	Y10–Y34, Y87.2, Y89.9	219	96	23	9

ICD, International Classification of Diseases.

Table 3 Relative risk by cause of death for ethnic minorities compared with native Dutch population. Men and women combined (PY total population = 83578420)

	Relative risk* (95% confidence intervals)			
	Adjusted for age and sex	Adjusted age, sex, and area income	Adjusted age, sex, and urbanization	Adjusted for all factors†
Total injury related mortality	1.29 (1.22,1.37)	1.11 (1.04,1.17)	1.23 (1.16,1.31)	1.11 (1.04,1.18)
Traffic injuries	0.86 (0.77,0.96)	0.84 (0.75, 0.94)	1.15 (1.02,1.29)	1.07 (0.95,1.20)
Car driver and passenger accidents	0.99 (0.85,1.15)	1.00 (0.85,1.17)	1.48 (1.26,1.74)	1.37 (1.17,1.62)
Pedestrian accidents	1.87 (1.40,2.49)	1.65 (1.22,2.23)	1.86 (1.38,2.52)	1.71 (1.25,2.33)
Cyclists accidents	0.53 (0.36,0.78)	0.51 (0.34,0.74)	0.67 (0.45,0.98)	0.61 (0.42,0.91)
Motorcyclists accidents	0.47 (0.34,0.66)	0.46 (0.32,0.65)	0.62 (0.44,0.88)	0.58 (0.41,0.82)
Other traffic injuries	0.70 (0.48,1.01)	0.70 (0.48,1.03)	0.94 (0.64,1.38)	0.89 (0.60,1.31)
Non-traffic injuries	1.51 (1.33,1.72)	1.32 (1.16,1.50)	1.37 (1.20,1.56)	1.26 (1.11,1.44)
Accidental drowning	2.58 (1.96,3.39)	2.21 (1.65,2.97)	2.80 (2.09,3.77)	2.51 (1.84,3.41)
Accidental poisoning	1.76 (1.30,2.40)	0.97 (0.70,1.34)	1.03 (0.75,1.42)	0.76 (0.55,1.05)
Accidental fire and scalds	1.95 (1.27,2.99)	1.50 (0.97,2.35)	1.53 (0.98,2.37)	1.35 (0.86,2.11)
Accidental falls	1.07 (0.83,1.38)	0.99 (0.77,1.29)	0.98 (0.76,1.26)	0.95 (0.73,1.23)
Other non-traffic injuries	1.26 (0.97,1.65)	1.15 (0.87,1.51)	1.35 (1.03,1.78)	1.25 (0.95,1.65)
Intentional injuries	1.57 (1.45,1.69)	1.21 (1.12,1.32)	1.29 (1.19,1.39)	1.11 (1.03,1.21)
Suicides	1.00 (0.90,1.11)	0.80 (0.72,0.89)	0.85 (0.76,0.95)	0.75 (0.68,0.84)
Homicides	6.41 (5.56,7.39)	3.97 (3.39,4.65)	4.11 (3.53,4.79)	3.24 (2.75,3.80)
Events of undetermined intent	2.11 (1.46,3.06)	1.43 (0.97,2.11)	1.50 (1.02,2.20)	1.22 (0.82,1.81)

*Ethnic minorities compared with the native Dutch population; †Age, sex, area income, and urbanisation degree.

of poisoning, full adjustment resulted in a complete disappearance of the higher relative risk for ethnic minorities (RR from 1.76 to 0.76). For some other conditions, however, the relative risk increased as a result of full adjustment, as in case of car driver and passenger related accidents (from RR = 0.86 to 1.37). Inequalities in neither drowning nor pedestrian accidents were influenced by urbanisation and area income.

Overall, a higher risk of injury related mortality for ethnic minorities was seen among men, but not among women (RR 1.17 compared with 0.96, table 4). After control for age, area income, and urbanisation men from ethnic minority groups had an excess risk of death from car driver and passenger related accidents, pedestrian accidents, drowning, other non-traffic injuries, and homicides. Women from ethnic minorities only experienced a higher risk of death from pedestrian accidents, drowning, and homicide.

If ethnic minority groups would experience the same injury related death rates as the native Dutch population, the injury related mortality rate in the total Dutch population would remain almost constant (table 4). A reduction of 1.2% in injury mortality would occur among men and 0.3% increase

in injury mortality would occur among women in the total Dutch population. Across all injuries the PAR varied from -5.2% to 15.4%. It was the highest for homicides and drowning in both men and women and took the highest negative values in accidents related to cyclists and motorcycle drivers.

There were large variations in the relative risks of death from injuries according to age group (table 5). The excess risk of total injury related mortality among ethnic minorities was the highest in childhood and young adult age group and gradually reduced with increasing age. Compared with the native Dutch population, children from ethnic minority groups were more vulnerable to non-traffic injuries, especially drowning (RR = 2.90) and accidental fire and scalds (RR = 3.66). Ethnic minorities aged 15-24, in contrast with the native Dutch group of the same age, experienced the largest inequalities in the risk of death from drowning (RR = 5.51) and intentional injuries, especially homicides (RR = 4.55). For the ethnic minority adult population we also found an increased risk of death in traffic related injuries, especially in the car driver and passenger and pedestrian death risks (RRs = 1.58 and 2.92, respectively). The excess

Table 4 Relative risk and population attributable risk by cause of death and sex for ethnic minorities compared with native Dutch population

	Relative risk* (95% confidence intervals)		PAR (%)	
	Men (PY = 2766450)	Women (PY = 2625950)	Men	Women
Total injury related mortality	1.17 (1.09,1.26)	0.96 (0.85,1.09)	1.2	-0.3
Traffic injuries	1.11 (0.97,1.27)	0.96 (0.75,1.24)	0.8	-0.3
Car driver and passenger accidents	1.51 (1.26,1.81)	0.98 (0.67,1.44)	3.5	-0.1
Pedestrian accidents	1.54 (1.04,2.29)	2.04 (1.24,3.36)	3.7	6.5
Cyclists accidents	0.51 (0.30,0.86)	0.81 (0.45,1.45)	-3.6	-1.3
Motorcyclists accidents	0.63 (0.44,0.90)	0.26 (0.06,1.07)	-2.7	-5.2
Other traffic injuries	0.96 (0.62,1.48)	0.65 (0.26,1.63)	-0.3	-2.4
Non-traffic injuries	1.33 (1.14,1.55)	1.01 (0.76,1.34)	2.3	0.1
Accidental drowning	2.56 (1.82,3.59)	2.22 (1.06,4.64)	10.1	7.5
Accidental poisoning	0.73 (0.51,1.04)	0.94 (0.43,2.06)	-2.0	-0.4
Accidental fire and scalds	1.63 (0.93,2.86)	1.10 (0.51,2.35)	4.3	0.7
Accidental falls	1.07 (0.79,1.45)	0.68 (0.41,1.11)	0.5	-2.2
Other non-traffic injuries	1.38 (1.01,1.89)	0.98 (0.52,1.84)	2.7	-0.1
Intentional injuries	1.19 (1.08,1.31)	0.95 (0.81,1.11)	1.3	-0.3
Suicides	0.80 (0.70,0.90)	0.67 (0.54,0.81)	-1.5	-2.2
Homicides	3.54 (2.93,4.28)	2.51 (1.84,3.43)	15.4	9.1
Events of undetermined intent	1.10 (0.69,1.76)	1.57 (0.75,3.29)	0.7	3.6

*Ethnic minorities compared with the native Dutch population, adjustment for age, area income, and urbanisation degree. PAR, population attributable risk.

Table 5 Relative risk by cause of death and age group for ethnic minorities compared with native Dutch population. Men and women combined

Age groups	Relative risk* (95% confidence intervals)			
	0-14	15-24	25-49	50+
Total injury related mortality	1.51 (1.20,1.88)	1.36 (1.19,1.56)	1.07 (0.98,1.16)	0.82 (0.70,0.97)
Traffic injuries	1.05 (0.68,1.62)	1.02 (0.82,1.26)	1.27 (1.07,1.52)	1.04 (0.75,1.43)
Car driver and passenger accidents	1.65 (0.72,3.77)	1.18 (0.88,1.59)	1.58 (1.26,1.98)	1.29 (0.78,2.15)
Pedestrian accidents	1.20 (0.56,2.57)	1.53 (0.76,3.09)	2.92 (1.72,4.96)	1.71 (0.89,3.29)
Cyclists accidents	0.62 (0.26,1.48)	0.59 (0.23,1.52)	1.04 (0.53,2.06)	0.65 (0.30,1.37)
Motorcyclists accidents	0.76 (0.07,7.87)	0.76 (0.48,1.18)	0.47 (0.25,0.87)	0
Other traffic injuries	1.31 (0.29,5.99)	0.98 (0.48,2.01)	0.70 (0.38,1.28)	1.47 (0.64,3.39)
Non-traffic injuries	2.13 (1.57,2.89)	1.24 (0.76,2.01)	0.94 (0.76,1.17)	0.98 (0.74,1.28)
Accidental drowning	2.90 (1.84,4.58)	5.51 (1.70,17.84)	2.48 (1.44,4.25)	1.10 (0.39,3.07)
Accidental poisoning	0	0.69 (0.23,2.07)	0.71 (0.49,1.03)	1.79 (0.68,4.71)
Accidental fire and scalds	3.66 (1.47,9.12)	0.50 (0.07,3.89)	0.54 (0.19,1.55)	1.69 (0.78,3.69)
Accidental falls	1.89 (0.86,4.15)	0.83 (0.28,2.47)	0.71 (0.44,1.17)	0.75 (0.51,1.11)
Other non-traffic injuries	1.25 (0.69,2.26)	1.68 (0.69,4.08)	1.26 (0.80,1.98)	1.14 (0.63,2.04)
Intentional injuries	0.99 (0.57,1.73)	1.83 (1.52,2.21)	1.04 (0.93,1.15)	0.64 (0.50,0.82)
Suicides	1.04 (0.33,3.27)	1.25 (0.98,1.60)	0.71 (0.62,0.81)	0.43 (0.31,0.59)
Homicides	1.04 (0.53,2.04)	4.55 (3.22,6.44)	3.44 (2.79,4.25)	2.44 (1.49,4.0)
Events of undetermined intent	0.72 (0.13,4.05)	0.54 (0.11,2.60)	1.24 (0.75,2.04)	1.41 (0.64,3.12)

*Ethnic minorities compared with the native Dutch population, adjustment for age, sex, area income, and urbanisation degree.

mortality from drowning among migrants groups was high in all age groups, except the oldest. Homicide was high in all age groups except the youngest.

Not all ethnic groups had similar rates of injury related mortality. As table 6 shows, the Surinamese and Antillean population seemed at an increased risk of the total injury related mortality (RRs above 1.30), while the total injury mortality of Turkish and Moroccan groups did not significantly differ from the native Dutch population (RR = 0.91). Car driver and passenger, pedestrian, drowning, and homicide mortality remained increased among almost all ethnic minority groups. In contrast with Turkish and Moroccans, Antillean/Aruban and, especially, Surinamese populations had higher risks of death from almost all non-traffic injuries (most RRs above 1.20) and higher rates from suicides. Compared with other ethnic groups, Antillean/Aruban had an exceptionally high homicide rate (RR = 7.13).

DISCUSSION

Our results show that, compared with the native Dutch population, ethnic minorities combined had an increased injury mortality rate. Ethnic minorities experienced a higher risk of death from pedestrian accidents, drowning, poisoning,

fire and scalds, and homicides. Mortality for cyclists and motorcycle drivers was significantly lower among ethnic minorities compared with the native Dutch. Adjustment for urbanisation and area income decreased the mortality risk difference for most non-traffic injuries, but showed the difference in risk for car driver and passenger accidents.

What this paper adds

Ethnic differences in injury mortality in the Netherlands are not uniform and strongly depended on type of injury, ethnic group, sex, and age. Compared with the native Dutch population, all ethnic minorities combined had an increased mortality for all injuries together. Area income and urbanisation have an important role in explaining ethnic differences in injury mortality. Surinamese and Antillean/Aruban population differ in their injury mortality risks from Turkish and Moroccans. Inequalities in injury mortality were the highest among children and young adults, but persisted in the age group above 50 years old.

Table 6 Relative risk by cause of death for different ethnic groups compared with native Dutch population. Men and women combined (PY ethnic minorities combined = 5392400)

	Relative risk* (95% confidence intervals)			
	Turkish	Moroccan	Surinam	Antillean/Aruban
Total injury related mortality	0.91 (0.81,1.01)	0.91 (0.81,1.03)	1.33 (1.22,1.46)	1.53 (1.32,1.79)
Traffic injuries	1.05 (0.86,1.28)	1.15 (0.93,1.41)	0.93 (0.74,1.16)	1.31 (0.96,1.79)
Car driver and passenger accidents	1.37 (1.05,1.78)	1.43 (1.07,1.90)	1.19 (0.88,1.61)	1.74 (1.16,2.61)
Pedestrian accidents	1.92 (1.19,3.10)	1.86 (1.11,3.12)	1.69 (1.02,2.78)	0.68 (0.17,2.74)
Cyclists accidents	0.42 (0.19,0.94)	0.95 (0.53,1.70)	0.35 (0.14,0.85)	1.13 (0.47,2.72)
Motorcyclists accidents	0.45 (0.23,0.87)	0.35 (0.16,0.80)	0.64 (0.35,1.16)	1.43 (0.74,2.77)
Other traffic injuries	1.03 (0.56,1.88)	1.26 (0.69,2.32)	0.61 (0.27,1.37)	0.30 (0.04,2.13)
Non-traffic injuries	1.02 (0.79,1.32)	0.98 (0.74,1.30)	1.68 (1.40,2.02)	1.14 (0.74,1.76)
Accidental drowning	2.28 (1.42,3.68)	2.43 (1.47,4.01)	3.11 (1.97,4.92)	1.77 (0.65,4.77)
Accidental poisoning	0.37 (0.17,1.78)	0.52 (0.26,1.06)	1.21 (0.79,1.85)	1.18 (0.52,2.65)
Accidental fire and scalds	1.09 (0.48,2.50)	0.86 (0.31,2.34)	1.95 (1.07,3.55)	1.24 (0.31,5.03)
Accidental falls	0.89 (0.53,1.49)	0.44 (0.20,0.99)	1.23 (0.88,1.71)	0.82 (0.34,1.99)
Other non-traffic injuries	0.90 (0.53,1.54)	1.01 (0.58,1.77)	1.89 (1.29,2.76)	0.91 (0.34,2.43)
Intentional injuries	0.83 (0.71,0.97)	0.81 (0.68,0.97)	1.41 (1.25,1.58)	1.83 (1.50,2.22)
Suicides	0.54 (0.43,0.67)	0.43 (0.33,0.56)	1.12 (0.97,1.30)	0.97 (0.73,1.30)
Homicides	2.57 (1.99,3.32)	2.73 (2.08,3.57)	3.18 (2.52,4.02)	7.13 (5.36,9.47)
Events of undetermined intent	0.48 (0.18,1.31)	1.47 (0.77,2.81)	1.58 (0.90,2.75)	1.79 (0.66,4.84)

*Ethnic minorities compared with the native Dutch population, adjustment for age, sex, area income, and urbanisation degree.

Injury mortality among ethnic minorities was lower for cyclist accidents, motorcycle driver accidents, and suicides. Compared with the native Dutch inhabitants, Surinamese and Antillean/Aruban population had a higher risk of total injury mortality, while Turkish and Moroccans had increased risk only for selected conditions. Inequalities in injury mortality were the highest among children and young adults, but persisted in the age group above 50 years old.

In interpreting the results of our study, some potential limitations should be considered. Firstly, the power of the study was too limited to show with statistical significance possible ethnic differences for specific injuries, age-sex groups, and ethnic groups. Secondly, all deaths that occurred abroad were excluded from the analysis. We should therefore emphasise that our results are restricted to injury related deaths that occurred within the Netherlands. Injury related deaths abroad, which may be considerably higher among ethnic minority groups, require specific research, as they require specific approaches for injury prevention.

Several factors might have played a part in explaining the ethnic differences in injury mortality found in our study.

Higher levels of car driver and passenger related accident mortality among minority groups could probably be explained by a higher injury risk per kilometre travelled instead of a higher rate of exposure. Ethnic minorities, who mostly live in urban areas, possess and use cars less often than native Dutch inhabitants. This may compensate for a potentially higher injury risk per kilometre travelled among ethnic minorities. This higher risk is suggested by the increase in relative risk (from 0.99 to 1.48) after adjustment for urbanisation and an excess risk among men ($RR = 1.51$), primary car users, but not among women ($RR = 0.98$).

A higher risk per kilometre travelled could be partly related to a more risky driving behaviour, such as speed limit excess and less common use of car safety equipment, as is frequently found among ethnic groups in other countries.^{17, 18} This is supported by the general more risk taking behaviour as seen from the higher criminality among ethnic minorities¹⁹ and also could be related to less frequent use of these protective measures in immigrants' countries of origin. In contrast with the findings in the USA,²⁰ driving under the influence of alcohol is less likely among ethnic minority groups in the Netherlands as alcohol consumption is consistently lower in these groups²¹ because of religious reasons. Less frequent drink driving behaviour is an important consideration for future interventions.

Mortality during traffic accidents is also highly dependent on the age of the car. Newer car models are more often equipped with functional built in safety equipment such as multisided airbags, headrests, ABS systems, speed alerts, and other technologies that help to prevent the collision and to protect against death and severe injuries in case of a collision. Ethnic minorities might have fewer possibilities to procure newer car models because of their lower income, compared with Dutch.²²

Bicycles and motorcycles serve as important means of transportation for the Dutch population, especially in densely populated areas. The amount of kilometres ridden by cyclists grows every year. According to CBS data, there were 187 billion kilometres ridden by cyclists in 2000, which is an increase by 6% compared with 1995.²³ Bicycle and motorcycle use in countries where immigrant populations originate from is much less frequent than in the Netherlands. Ethnic minorities do not favour these types of transportation even after immigration to the Netherlands. This might explain their lower risk of cyclist and motorcyclist mortality, compared with the Dutch population.

Less frequent use of bicycles and motor vehicles makes immigrant groups, especially women, take more often the

role of pedestrians. High pedestrian exposure among ethnic minority groups might explain their increased mortality, a phenomenon that has been seen also in other countries.²⁴⁻²⁶ The observed higher risk among ethnic minority women compared with men ($RR = 2.04$ and 1.54 respectively) provides additional support to the above suggestion.

Drowning was more frequent among ethnic minorities of all ages up to 50, with the highest relative risk found among young adults aged 15-24 ($RR = 5.51$). The ability to swim seems an obvious explanation for the observed difference in drowning mortality risks. In Amsterdam only 56% of the 13-14 year old Turkish and Moroccan girls had a swimming certificate compared with over 95% of the native Dutch children.²⁷ Although swimming is a part of the school curriculum, not every school has appropriate facilities and lessons often have to be arranged and covered privately, which is not always an option for the ethnic minority families. Because higher risks of drowning are not only restricted to younger age groups, but persist at older ages, swimming educational programmes for ethnic minorities of all ages are warranted.

Differences in risk of death from traffic and, especially, non-traffic injuries could be also related to differential mortality from occupational accidents. As ethnic minorities are more often employed in low skilled manual jobs where they are often exposed to occupational hazards, it is plausible that there are differences in mortality from occupational injuries between ethnic minorities and the native Dutch population. This suggestion is supported by the fact that we found an excess of risk of death from fire, scalds and non-traffic injuries especially among ethnic minority men.

The high homicide mortality risks for ethnic minorities found in our study are in line with the data from earlier Dutch publications.^{2, 28-29, 31} Several factors could be involved. Firstly, homicide is related to criminal affairs,²⁸ and therefore, higher involvement in criminal acts might partly explain the above finding. According to the court registries, 31% of prosecutions in the year 2000 occurred among first generation immigrants who were directly involved in criminal acts (an 11 times higher rate than that of the Dutch population).³² Turkish people were the least involved in criminal acts, while Antilleans were the most involved.^{30, 32} Secondly, a lower socioeconomic position of the migrants, stress associated with work, discrimination, and culture shock were previously suggested to explain high homicide rates among ethnic minorities.^{30, 31} Thirdly, psychosocial disorders, especially frequent among Surinamese and Antilleans could add to the explanation of the increased homicide risks.³³ Fourthly, family attitudes and rearing practices could lead to a more aggressive behaviour. A study of adolescents in Rotterdam found that only 30% of Antilleans and 52% of Surinamese teenagers were growing up in a full (with two parents) family, whereas that was the case for 77% of the Dutch.³⁴ Additionally, ethnic minority teenagers, especially Antilleans,

Policy implications

The results of this study point to areas that require priority attention from policy makers. Activities should be aimed at prevention of car and pedestrian accidents, drowning, and homicides among ethnic minority groups most at risk. The study also shows opportunities for preventive activities that target the native Dutch population. International cooperation and exchange of findings both at scientific and policy levels is warranted and may contribute to explaining inequalities and developing effective ways to reduce them.

more often expressed an aggressive and violent behaviour, committed vandalism or theft, or possessed a weapon.³⁴

Compared with the native Dutch population, the risk of death from suicides is consistently lower among Turkish and Moroccan minorities. Cultural norms, higher religiousness, and strong and supportive family ties could have an important role in explaining the low risks. The situation is different for the young adults of Surinamese and Antillean descent, for who the suicide mortality risks are higher compared with the native Dutch population (RR = 1.58 and 1.38 respectively, data not shown). The latter could be partly associated with the higher rates of mental disorders in these populations.³³

We found an increased risk of death from events of undetermined intent among ethnic minorities (RR unadjusted = 2.11). This finding might be partly attributed to a slightly less accurate cause of death registration among ethnic minorities than among the native population. Differential misclassification of causes of death by ethnic origin could have resulted in an incorrect estimate of the difference in homicide and suicide mortality between ethnic minority groups and the native Dutch population. Apart from intentional injuries, we do not have reasons to suspect occurrence of differential misclassification among other causes of death.

Access to healthcare is an important factor for injury mortality, as prompt and high quality emergency services may prevent death. In the Netherlands no pronounced inequalities in access to health care facilities were found for ethnic minorities,^{35,36} therefore, such inequalities are unlikely to play a part in explaining ethnic differences in injury mortality.

The results of this study point to areas that require priority attention from both researchers and policy makers. Activities should be aimed at prevention of car and pedestrian accidents, drowning, and homicides among ethnic minority groups most at risk. Up to 15% of homicide deaths and 10% of drowning would have been avoided in the general Dutch population if ethnic minorities had the same mortality rates for these causes as the native Dutch inhabitants. Additional research is needed to establish the specific determinants for the increased mortality among ethnic groups and to identify ways to effectively tackle them.

The study also shows opportunities for preventive activities that target the native Dutch population. A substantial percentage of lives of bicycle and motorcycle riders would have been saved among the native Dutch people if they had mortality rates similar to the ones of ethnic minorities. Although safety helmets were shown to protect cyclists against heavy injuries and death,^{37–39} their use among native Dutch is still low,⁴⁰ thus warranting appropriate interventions.

The results of our analysis cannot be directly generalised to other countries because of differences in migrants groups and national context. None the less, similar patterns may be seen, for example, among the Turkish and Moroccan migrants living in Germany and France. In addition, some of the priority areas identified in our study, such as the high mortality from pedestrian accidents, poisoning, and fire, may be similar in other countries with a different configuration of migrant groups. Our study, therefore, needs replication in other European countries where injuries among migrant groups have not yet been described in detail. International cooperation and exchange of findings may contribute to explaining these inequalities and developing effective ways to reduce them.

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Authors' affiliations

I Stirbu, A E Kunst, V Bos, E F van Beeck, Department of Public Health, Erasmus MC, University Medical Centre Rotterdam, Rotterdam, Netherlands

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REFERENCES

- 1 Carballo M, Nerukar A. Migration, refugees, and health risks. *Emerg Infect Dis* 2001;7(suppl 2):556–60.
- 2 Bos V, Kunst AE, Keij-Deerenberg IM, et al. Ethnic inequalities in age- and cause-specific mortality in the Netherlands. *Int J Epidemiol* 2004;33:1112–19.
- 3 Singh G, Siahpush M. All-cause and cause-specific mortality of immigrants and native born in the United States. *Am J Public Health* 2001;91:392–9.
- 4 Berger LR. Injury prevention and indigenous peoples. *Inj Prev* 2002;8:175–6.
- 5 Quinlan KP, Wallace LJ, Furner SE, et al. Motor vehicle related injuries among American Indian and Alaskan Native youth, 1981–92: analysis of a national hospital discharge database. *Inj Prev* 1998;4:276–9.
- 6 Cercarelli LR, Knuiman MW. Trends in road injury hospitalisation rates for Aboriginal and non-Aboriginal people in Western Australia, 1971–97. *Inj Prev* 2002;8:211–15.
- 7 Roberts I, Street S, Judson J, et al. Critical injuries in paediatric pedestrians. *N Z Med J* 1991;104:247–8.
- 8 Agran PF, Winn DG, Anderson CL, et al. Family, social, and cultural factors in pedestrian injuries among Hispanic children. *Inj Prev* 1998;4:188–93.
- 9 Anderson CL, Agran PF, Winn DG, et al. Demographic risk factors for injury among Hispanic and non-Hispanic white children: an ecologic analysis. *Inj Prev* 1998;4:33–8.
- 10 Schulp TW, van Steenberg JE, van Driel HF. Influences of ethnicity on perinatal and child mortality in the Netherlands. *Arch Dis Child* 2001;84:222–6.
- 11 van Beeck EF, Mackenbach JP, Looman CW, et al. Determinants of traffic accident mortality in the Netherlands: a geographical analysis. *Int J Epidemiol* 1991;20:698–706.
- 12 Dougherty G, Pless IB, Wilkins R. Social class and the occurrence of traffic injuries and deaths in urban children. *Can J Public Health* 1990;81:204–9.
- 13 Sorenson SB, Shen H. Mortality among young immigrants to California: injury compared to disease deaths. *J Immigr Health* 1999;1:41–7.
- 14 Bos V, Kunst AE, Mackenbach JP. [Socio-economic differences in mortality in the Netherlands: analysis on the basis of neighbourhood data]. *Tijdschrift voor Gezondheidswetenschappen* 2002;80:158–65.
- 15 Keij-Deerenberg I. [Numbers of foreigners according to several definitions]. *Maandstatistiek bevolking* 2000;5:14–7.
- 16 Kunst AE, Mackenbach JP. *Measuring socio-economic inequalities in health*. Copenhagen: WHO, 2000.
- 17 Thuen F, Sam DL. [Use of safety equipment among immigrant children in Norway. A comparison with Norwegian children.]. *Tidsskr Nor Lægeforen* 1994;114:195–8.
- 18 Grossman DC, Sugarman JR, Fox C, et al. Motor-vehicle crash-injury risk factors among American Indians. *Accid Anal Prev* 1997;29:313–19.
- 19 Blom M, Oudhof J, Bijl RV, et al. [Criminality suspects. A closer look at foreigners and natives]. Den Haag: Rapport Ministerie van Justitie, 2005.
- 20 Campos-Outcalt D, Bay C, Dellapenna A, et al. Pedestrian fatalities by race/ethnicity in Arizona, 1990–1996. *Am J Prev Med* 2002;23:129–35.
- 21 Reijneveld SA. Reported health, lifestyles, and use of health care of first generation immigrants in the Netherlands: do socioeconomic factors explain their adverse position? *J Epidemiol Community Health* 1998;52:298–304.
- 22 Statistics Netherlands CBS. [Foreigners in the Netherlands]. Voorburg: Statistics Netherlands CBS, 2004:63–6.
- 23 Statistics Netherlands CBS. Cyclists cover more kilometres in 2003. <http://www.cbs.nl/en/publications/articles/webmagazine/archive/artikel.asp?jr=2004&id=1470k&dt=24-05-2004>.
- 24 Roberts I, Norton R, Tava B. Child pedestrian injury rates: the importance of "exposure to risk" relating to socioeconomic and ethnic differences, in Auckland, New Zealand. *J Epidemiol Community Health* 1996;50:162–5.
- 25 Macpherson A, Roberts I, Pless IB. Children's exposure to traffic and pedestrian injuries. *Am J Public Health* 1998;88:1840–3.
- 26 Posner JC, Liao E, Winston FK, et al. Exposure to traffic among urban children injured as pedestrians. *Inj Prev* 2002;8:231–5.
- 27 van der Wal M, Pauw-Plomp H. *Ethnicity and swimming skills of secondary school children in the Netherlands*. Amsterdam: Report Municipal Health Service, 1996.
- 28 Nieuwbeerta P, Leistra G. [Murder and homicide in the Netherlands: an overview for the period 1992–2001]. *Tijdschrift voor Veiligheid en Veiligheidszorg* 2003;2:36–57.
- 29 Huiskamp N, Vis H, Swart W, et al. [The health map of foreigners]. Rotterdam: Report Municipal Health Services, 2000.
- 30 Koppelaar H, Bos CA, Broer J. [High mortality due to infectious diseases and unnatural causes of death among asylum seekers in the Netherlands, 1998–1999]. *Ned Tijdschr Geneesk* 2003;147:391–5.
- 31 Leuw E. [Criminal convicts among ethnic minorities: a description of convicts by ethnic origin in 1998]. Den Haag: Rapport Ministerie van Justitie, 1997.
- 32 Tilburg W, Grapendaal M. [Criminality in relation to the integration of ethnic minorities]. Driebergen: Rapport Korps Landelijke Politiediensten, 1997:16–23.

- 33 **Selten JP**, Slaets JP, Kahn RS. Schizophrenia in Surinamese and Dutch Antillean immigrants to The Netherlands: evidence of an increased incidence. *Psychol Med* 1997;**27**:807–11.
- 34 **van de Looij-Jansen PM**. [Youth monitor of Rotterdam. Students of the secondary education]. Rotterdam: Report Municipal Health Services, 2002.
- 35 **Uniken Venema HP**, Garretsen HF. Health and health care use of Turkish and Dutch inhabitants of the Netherlands. *Scand J Soc Med* 1994;**22**:201–3.
- 36 **Stronks K**, Ravelli AC, Reijneveld SA. Immigrants in the Netherlands: equal access for equal needs? *J Epidemiol Community Health* 2001;**55**:701–7.
- 37 **Maimaris C**, Summers CL, Browning C, et al. Injury patterns in cyclists attending an accident and emergency department: a comparison of helmet wearers and non-wearers. *BMJ* 1994;**308**:1537–40.
- 38 **Bostrom L**, Nilsson B. A review of serious injuries and deaths from bicycle accidents in Sweden from 1987 to 1994. *J Trauma* 2001;**50**:900–7.
- 39 **Jacobson GA**, Blizzard L, Dwyer T. Bicycle injuries: road trauma is not the only concern. *Aust N Z J Public Health* 1998;**22**:451–5.
- 40 **Seijts GH**, Kok G, Bouter LM, et al. Barriers to wearing bicycle safety helmets in the Netherlands. *Arch Pediatr Adolesc Med* 1995;**149**:174–80.

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