Injury-related mortality in South African children, 1981 - 1985

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Summary

Data on all registered deaths in children < 15 years in the RSA (excluding Transkei, Bophuthatswana, Venda and Ciskei) were analysed for 1981 - 1985. Variations in age, sex and population group pattern for different causes of injury were evaluated. Injury accounted for 8% of deaths in children < 15 years and was the leading cause of death between the ages of 5 years and 14 years (accounting for 43% of deaths). Motor vehicle accidents were the most important cause of injury deaths in all age groups except < 1 year, when accidental choking and suffocation resulted in more deaths. Drowning accounted for 19% of injury deaths and burns for 11%. In 14% of injury deaths it was not determined if the injury was accidental or purposefully inflicted. In all age and population groups deaths among boys outnumbered girls. The impact and pattern of injury varied considerably between age and population groups and reasons for these findings are discussed.

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As infectious diseases are controlled and exposure to technology increases, injury becomes a major source of childhood mortality.[1] Today injury is the major cause of death in children between the ages of 1 year and 15 years in all industrialised as well as in many developing countries.[1] In some developing countries an increase in exposure to technology without adequate safety controls has resulted in dramatic increases in injury mortality.

Overall disease patterns in South African children are similar to those in other developing countries.[2] However, there are wide discrepancies between population groups, which can largely be explained by socio-economic factors.[3-5] In addition, South Africa has a large, rapidly expanding urban population that is exposed to technological hazards experienced in industrialised settings.

South African national childhood trauma statistics have not previously been analysed in depth, and morbidity data other than those for road accidents are not available. A study was performed using available mortality data to describe the extent and pattern of childhood injuries in order to alert health authorities to the need for intervention.

It must be stressed at the outset that mortality statistics alone underestimate the extent, and distort the pattern of causes, of childhood injury. For example, in a large American study, for every child who died of injuries there were 45 hospital admissions and 1 300 casualty department visits.[6] Furthermore, certain types of injury with a high case fatality, e.g. road accidents and drowning, are over-represented and other injuries with high incidence and low fatality such as falls and cuts are under-represented.

Subjects and methods

Data on all registered deaths in the RSA in children < 15 years from 1981 to 1985 were analysed. Computerised data were supplied by Central Statistical Services (CSS), Pretoria, which does not collect statistics for the 'independent states' of Transkei, Bophuthatswana, Venda and Ciskei. Data for these regions have not been published. CSS records are based on information extracted from Death Register forms and relate only to registered deaths. Deaths are classified in accordance with a detailed statistical classification[7] based on the 9th revision of the *International Classification of Diseases* (ICD).[8] In South Africa, CSS have extended the detailed list to include the following codes: accidents in sport (839); mine accidents (849); violent deaths, unspecified as to whether accident, suicide or homicide (889); suicide and self-inflicted poisoning by motor vehicle exhaust gas (979).

The term 'injury' was used to include all External Causes (E code) as defined in the ICD.[8] This included accidents, poisoning and violence. Intentional injuries were included together with unintentional injuries, since there is a great deal of overlap between these groups and the aetiological agents are similar.[9,10]

In this study, injuries have been grouped together in a way that has practical relevance. The codes included in each cause group analysed are shown in the Appendix (p. 403). The year in which the death occurred and not the registration date were used throughout the analysis.

Proportional mortality for all population groups* for each cause was calculated to assess the relative importance of different causes of injury related deaths.

Age, sex, population groups and cause-specific mortality rates were calculated for whites, coloureds and Asians. Rates for blacks were not calculated as it is known that both the death[2,12,13] and the population data[14] are underestimated and the resulting bias would therefore be impossible to predict. Population data for whites, coloureds and Asians were obtained from the 1980[15] and 1985[16] Population Census Reports of the CSS. The population size was estimated by linear interpolation of the census data for each age, sex and population group combination. The age groups used were < 1 year, 1 - 4 years, 5 - 9 years and 10 - 14 years. No corrections have been made for census undercount, since this has been assumed to be small in the children of these population groups.

Since there was considerable fluctuation in rates and proportions from year to year, averages for the period 1981 - 1985 were calculated.

All computations were undertaken on an IBM mainframe computer using the SAS package of programs.[17]

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* The categories used were black, white, coloured (mixed racial origins) and Asian, based on the South African Population Registration Act of 1950. This stratification has been used because of its close association with socio-economic conditions.[11] Data directly relating injury to social class are not available.

Results

Between 1981 and 1985, a total of 14 118 children under 15 years of age died from injury, an average of 2 824/year. These deaths resulted in an average of 64 619 potential years of life < 65 years being lost annually.

Table I shows the relative importance of injury compared with other major causes of death in childhood. Injury was the most important cause of death in South African children between 5 years and 14 years of age. In whites and Asians it was also the leading cause of death in the 1 - 4-year age group (Table II). Table II shows the variation in the impact of injury as a cause of death between the population groups of the RSA.

The proportion of deaths due to injury was higher for boys than for girls in all age and population groups except Asian girls aged 5 - 9 years among whom injuries represented 64,2% of deaths compared with 63,6% in boys. The ratio of the number of boys to girls dying from injury ranged from 1,3:1 in children < 1 year steadily increasing to 2,1:1 in the 10 - 14-year age group. The impact of different causes of injury followed the same general pattern in boys and in girls.

Fig. 1 shows the major causes of death from injury in children < 15 years. Road accidents, drowning, undetermined causes and burns were the major contributors to injury mortality. The group called 'undetermined' (ICD codes 889 and 980-989) represents deaths in which it was not determined whether the injury was accidental or purposefully inflicted. The majority of deaths in this group were injuries by 'other and unspecified' means (ICD code 988).

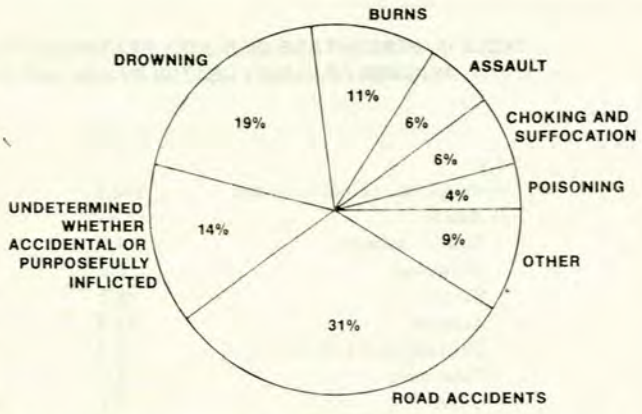

Fig. 1. Major causes of injury mortality in children aged 0 - 14 years in the RSA, 1981 - 1985.

The variations in the overall pattern with age and population group are shown in Table III, together with the annual

TABLE I. RANK ORDER AND THE PROPORTION OF DEATHS DUE TO MAJOR CAUSES[13] IN CHILDREN < 15 YEARS OF AGE, RSA — 1981 - 1985

Rank order	< 1 yr	(%)	1 - 4 yrs	(%)	5 - 9 yrs	(%)	10 - 14 yrs	(%)
First	**Infectious**	**33**	**Infectious**	**42**	**Injury**	**43**	**Injury**	**43**
Second	**Perinatal**	**31**	**Respiratory**	**17**	**Infectious**	**15**	**Ill-defined**	**13**
Third	**Ill-defined**	**14**	**Ill-defined**	**13**	**Ill-defined**	**13**	**Infectious**	**12**
Fourth	**Respiratory**	**13**	**Injury**	**11**	**Respiratory**	**10**	**Respiratory**	**8**
Fifth	**Congenital**	**3**	**Endocrine,* nutritional, immunity**	**11**	**Nervous system†**	**6**	**Nervous system**	**8**
Average No. annual deaths	**24 112**		**8 512**		**1 932**		**1 679**	

*Includes malnutrition.
†Includes unspecified meningitis.

TABLE II. PERCENTAGE OF DEATHS DUE TO INJURY AND RANKING OF INJURY AS CAUSE OF DEATH BY AGE AND POPULATION GROUP, RSA — 1981 - 1985

	Blacks	Whites	Coloureds	Asians
< 1 yr				
Total deaths 1981 - 1985	**91 967**	**4 848**	**21 828**	**1 918**
% due to injury	**1,3**	**5,2**	**1,8**	**2,5**
Rank order of injury as cause of death	**8**	**5**	**6**	**6**
1 - 4 yrs				
Total deaths 1981 - 1985	**33 777**	**1 474**	**6 880**	**427**
% due to injury	**8,1**	**49,5**	**14,4**	**26,7**
Rank order of injury as cause of death	**5**	**1**	**3**	**1**
5 - 9 yrs				
Total deaths 1981 - 1985	**7 012**	**827**	**1 552**	**271**
% due to injury	**36,4**	**57,0**	**58,7**	**63,8**
Rank order of injury as cause of death	**1**	**1**	**1**	**1**
10 - 14 years				
Total deaths 1981 - 1985	**5 933**	**864**	**1 359**	**237**
% due to injury	**36,8**	**59,1**	**56,8**	**48,5**
Rank order of injury as cause of death	**1**	**1**	**1**	**1**

TABLE III. PERCENTAGE OF INJURY DEATHS DUE TO MAJOR CAUSES AND THE ANNUAL AVERAGE NUMBER OF INJURY DEATHS BY AGE AND POPULATION GROUP, RSA — 1981 - 1985

	Blacks	Whites	Coloureds	Asians	All groups
< 1 yr					
Average No. of injury deaths	232,2	50,8	77,2	9,4	369,6
% due to					
Road accidents	9,9	21,3	9,8	19,2	11,7
Drowning	6,7	9,5	8,3	6,4	7,4
Burns	18,8	1,6	10,9	4,3	14,4
Assault	13,6	3,2	12,4	6,4	11,7
Choking and suffocation	19,4	47,2	37,8	36,2	27,5
Poisoning	4,1	1,6	0,8	2,1	3,0
Other	8,5	5,1	11,4	4,3	8,6
Undetermined	19,0	10,6	8,6	21,3	15,7
1 - 4 yrs					
Average No. of injury deaths	549,0	145,8	197,8	22,8	915,4
% due to					
Road accidents	19,8	24,6	29,7	43,0	23,3
Drowning	18,8	42,7	22,1	5,3	23,0
Burns	23,9	3,4	12,5	21,1	18,1
Assault	4,4	4,8	6,7	1,8	4,9
Choking and suffocation	4,2	6,9	3,6	3,5	4,5
Poisoning	9,1	2,2	5,8	4,4	7,2
Other	6,6	6,7	9,1	3,5	7,1
Undetermined	13,2	8,8	10,4	17,5	12,0
5 - 14 yrs					
Average No. of injury deaths	948,0	196,4	336,6	57,6	1 538,6
% due to					
Road accidents	34,5	53,4	45,0	51,7	39,8
Drowning	21,9	12,7	21,2	9,4	20,1
Burns	6,2	3,0	5,2	3,8	5,5
Assault	6,1	5,0	6,8	5,6	6,1
Choking and suffocation	1,6	2,2	1,3	0,4	1,5
Poisoning	2,7	1,4	1,7	1,7	2,3
Other	10,2	10,6	9,3	3,5	9,8
Undetermined	16,9	11,7	9,6	24,0	14,9

ICD E codes included in each group are shown in the Appendix.

average number of injury deaths in each group. Road deaths were the leading cause of injury mortality in children between the ages of 1 year and 14 years. In children < 1 year, choking and suffocation (inhalation of food and other objects and mechanical suffocation) was the largest category (27%). Drowning resulted in over 20% of deaths in all age groups > 1 year, while burns and poisoning had greatest impact on children < 5 years. The percentage of deaths due to assault was highest in children < 1 year (11,6%) and over 10 years (8,5%).

The percentage due to undetermined causes was higher for blacks and Asians than for whites and coloureds. At all ages road deaths had a smaller impact on the black population than on the other groups, while burns had a greater impact on blacks, coloureds and Asians than on whites. White children aged 1 - 4 years were most vulnerable to drowning, but this remained an important cause of death in black and coloured children after this age. A smaller percentage of deaths among Asian children were due to drowning than in the other groups.

Road deaths included passengers, pedestrians and bicycle riders. The proportion of pedestrians varied with age and population group (Table IV). Only 0,4% of road deaths involved bicycles.

The all-injury annual mortality rates for three South African population groups are shown in Table V, together with rate ratios relative to the white population and a comparison with USA rates.[18]

TABLE IV. PERCENTAGE OF ROAD DEATHS INVOLVING PEDESTRIANS BY AGE AND POPULATION GROUP, RSA — 1981 - 1985

	Blacks	Whites	Coloureds	Asians
< 1 yr	23	2	13	0
1 - 14 yrs	43	16	39	18

Table VI shows the age, sex, population group and cause-specific annual mortality rates for the white, coloured and Asian populations for 1981 - 1985. In most cases, mortality rates for coloureds were considerably higher than for whites and Asians and rates for boys were greater than those for girls.

Data from other countries are presented in Table VII. These comparison rates are averages of 5 developed countries outside Europe and 17 developing countries — mostly in Latin America.[19]

Between 1981 and 1985 a total of 221 children under the age of 15 years died from firearm or explosive injuries (accidental, intentional, suicide and undetermined, E922, 965, 955, 985). Most of these deaths occurred in the 10 - 14-year group and the majority (80%) were boys. Most firearm or explosive deaths were due to assault (54%), and in 26% it was undeter-

TABLE V. ANNUAL INJURY MORTALITY RATES AND RATE RATIOS FOR THREE POPULATION GROUPS, RSA — 1981 -1985 (PER 100 000 POPULATION) AND COMPARISON WITH RATES IN THE USA

Age group (yrs)	White		Coloured		Asian		USA[18]
	Rate	RR	Rate	RR	Rate	RR	rate
< 1	68,1	1,0	118,9	1,7	51,1	0,8	33,9
1 - 4	46,1	1,0	72,9	1,6	30,1	0,7	25,4
5 - 9	23,7	1,0	55,3	2,3	35,2	1,5	14,4
10 - 14	23,5	1,0	43,7	1,9	23,9	1,0	16,2

RR = mortality rate ratios calculated for the three population groups with respect to the mortality rate of whites.

mined whether these deaths were intentional or not. Eleven per cent were 'accidental' and 9% were suicide.

Discussion

Deaths are known to be under-registered[2,12,13] and in the case of blacks by as much as 50%.[13] These results therefore need to be regarded as an underestimate of the extent of childhood injury mortality. The proportional mortality also needs to be interpreted with care as the under-registration of deaths may not necessarily have been consistent over all cause groups. The small number of deaths in the Asian population and the small population size result in a wide range of proportional data and mortality rates, which makes interpretation for this subgroup difficult.

TABLE VII. AGE, SEX AND CAUSE-SPECIFIC ANNUAL MORTALITY RATES FOR OTHER DEVELOPED AND DEVELOPING COUNTRIES — 1981[19] (PER 100 000 POPULATION)

	Developed countries		Developing countries	
	Boys	Girls	Boys	Girls
1 - 4 yrs				
Road accidents	8,1	6,6	5,5	4,1
Drowning	9,0	4,8	7,1	4,8
Burns (fire)	4,6	3,4	4,0	3,5
Poisoning	0,4	0,6	1,0	0,7
All unintentional injuries	30,1	20,3	26,2	19,5
5 - 14 yrs				
Road accidents	8,5	4,7	7,4	4,0
Drowning	3,7	0,8	4,6	2,1
Burns (fire)	1,2	1,1	0,8	1,3
Poisoning	0,3	0,2	0,4	0,3
All unintentional injuries	18,5	8,5	20,0	11,3

TABLE VI. AGE, SEX, POPULATION GROUP AND CAUSE-SPECIFIC ANNUAL MORTALITY RATES FOR THREE POPULATION GROUPS, RSA — 1981 - 1985 (PER 100 000 POPULATION)

	Whites		Coloureds		Asians	
	Boys	Girls	Boys	Girls	Boys	Girls
< 1 yr						
All injuries	83,0	52,3	135,3	102,1	63,2	38,1
Road accidents	17,2	11,6	12,2	11,2	14,7	4,5
Drowning	8,4	4,4	14,6	5,0	4,2	2,2
Burns	2,1	—	14,6	11,2	2,1	2,2
Assault	2,6	1,7	20,1	9,3	4,2	2,2
Choking and suffocation	38,6	25,3	47,5	42,4	21,1	15,7
Poisoning	1,6	0,6	0,6	1,3	2,1	—
Other	3,1	3,9	13,4	13,7	4,2	—
Undetermined	9,4	5,0	12,2	8,1	10,5	11,2
1 - 4 yrs						
All injuries	55,8	36,0	84,0	61,7	34,5	25,6
Road accidents	12,6	10,0	24,4	18,9	15,2	10,7
Drowning	25,8	13,3	20,2	12,1	1,6	1,6
Burns	1,6	1,6	10,6	7,7	7,3	5,3
Assault	2,7	1,7	5,2	4,6	0,5	0,5
Choking and suffocation	3,9	2,4	2,9	2,4	1,1	1,1
Poisoning	1,2	0,8	4,1	4,3	2,2	0
Other	3,2	3,0	7,4	6,9	1,0	1,1
Undetermined	4,7	3,4	9,3	5,9	5,2	5,3
5 - 14 yrs						
All injuries	30,1	16,8	64,9	33,6	35,9	23,3
Road accidents	15,1	10,0	26,8	17,6	17,4	13,2
Drowning	4,2	1,7	15,3	5,5	3,7	1,9
Burns	1,1	0,3	2,9	2,2	1,2	1,0
Assault	1,3	1,0	5,0	1,7	2,9	0,4
Choking and suffocation	0,7	0,4	0,9	0,4	0,2	—
Poisoning	0,5	0,2	1,1	0,7	0,2	0,8
Other	4,0	1,0	7,0	2,2	1,6	0,4
Undetermined	3,3	2,3	6,0	3,4	8,6	5,6

In the period under review, injury accounted for 8% of all childhood deaths. It was the leading cause of mortality in the 5 - 14-year age group and previously this has been shown to be the case in persons up to the age 34 years.[2] In children under 5 years, infections (mainly gastro-enteritis), malnutrition, respiratory disease and perinatal causes accounted for 72% of deaths. Since 90% of childhood deaths occurred in this age group, these were the major causes of mortality in South African children. In the white population, and to a lesser extent in Asians, these diseases have been controlled and the pattern resembles that found in industrialised countries where injury plays a greater relative role from a younger age. For example, in the USA injury is the leading cause of death among children > 9 months old[20] and accounts for up to 58% of deaths between the ages of 10 years and 14 years.[20]

The mortality rates shown in Tables V and VI, although not representative of the country as a whole, are considerably higher than those found in other countries. The comparison rates (Table VII)[19] are averages and there are subgroups in these countries that have rates both higher and lower than the average. The South African all-injury death rates are also 1,5 - 3,8 times higher than in the USA[18] depending on age and population group (Table V).

Boys were at greater risk of injury than girls in all population groups. This finding is consistent with published data from other countries and has been documented many times.[9,19,21,22] It is interesting to note that the difference between the sexes was apparent even in children < 1 year. Both socialisation and inherent physiological and psychological differences[22] have been suggested as reasons for more hazardous behaviour in boys than in girls.

As in most other countries from which data are available,[9,19,23] road accidents accounted for the largest proportion of injury-related deaths (31%). This was followed by drowning, undetermined causes, and burns. The large size of the undetermined group makes complete interpretation difficult and highlights the artificiality of the distinction between intentional and unintentional injuries. Although the assault group included homicide, legal execution and war-related deaths, 99,7% were homicides (E960-969). Although political violence has increased over this period, it has not been possible to quantify the effect on injury deaths reported in this study.

The substantial differences in the pattern of injury found between different age groups are largely determined by developmental factors.[24] These include physical and cognitive immaturity as well as behavioural characteristics of young children. These developmental factors interact closely with socio-economic, environmental, psychological and cultural factors in the causation of injury.

The association of socio-economic factors with injury patterns has been frequently documented.[9,25-27] The differences between population groups described in this study can largely be attributed to socio-economic factors although cultural factors also play a role.

Overall, coloured children — especially boys — were at far greater risk of injury death than children of other groups. This was especially so in the case of assault in children < 1 year and burns in children < 5 years where the mortality rates for coloured boys were approximately 7 times those for white boys. White children aged 1 - 4 years were more at risk of drowning and black, coloured and Asian children were more at risk from burns. Road deaths played a smaller role in black and coloured children than in whites and Asians, while assault played a greater role in black and coloured children's groups, as it does in the adult population.[28]

The high proportion of pedestrian compared with passenger deaths in coloureds and blacks reflects a lower car-ownership rate as well as a deficiency of safe play areas for these children.[29] The high incidence of drunken driving in South Africa no doubt contributes to the high road mortality. In contrast with the USA[18] and Australia,[23] bicycles play a very small role in South African road deaths.

The incidence of fire burns is closely related to overcrowding, the type of housing, electrification and cooking facilities,[30] as well as to the availability of fire department services.[31] Socially disadvantaged communities are therefore at risk, as in the USA.[18,31]

There was a clear difference in the age pattern of drowning between population groups. Whites followed the pattern found in Australia[32,33] and in white American children,[18] i.e. children aged 1 - 4 years are most at risk. In contrast, coloured and black children between the ages of 5 years and 14 years are also at risk and in these groups drowning constitutes 21% of injury deaths. The drowning mortality rate of coloured boys aged 5 - 14 years was 3,6 times that of white boys. Black American children also follow this pattern.[18] These findings can be understood when the drowning site is considered. Sixty-two per cent of white South African drowning deaths in children < 15 years occur in swimming pools, mostly privately owned, while only 8% of coloured and black drownings occur at these sites and 67% occur in dams and rivers (J. de Wet — An analysis of drownings in South Africa in children 0 - 14 years for the year 1986 — unpublished data, Child Safety Centre, University of Cape Town). In children < 5 years most submersions occur in and around the home,[34] while older children have access to dams and rivers. Older coloured and black children are further at risk because usually they cannot swim.

Although this study goes some way towards describing the South African situation, the important limitations inherent in using only registered deaths as a data source need to be addressed. In many industrialised countries, e.g. the USA, Australia, and the UK, large injury surveillance systems exist to collect data on both morbidity and mortality. These systems are exceedingly costly and as they too have their limitations[35] they may not necessarily be appropriate in the South African situation.

Deaths from injury are potentially preventable.[8,21,36] It is critical that preventive programmes against childhood injuries, which target high-risk groups, increase public awareness, and introduce safety legislation to reduce environmental hazards, be implemented. Since the incidence of childhood injury is closely linked to socio-economic conditions, it is important that these programmes are appropriate to the needs of the communities concerned and take account of social, economic and political realities.

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REFERENCES

1. Manciaux M, Romer CJ. Accidents in young children, adolescents and young adults: a major public health problem. *World Health Stat Q* 1986; **39:** 227-231.
2. Bradshaw D, Botha H, Joubert G, Pretorius JP, Van Wyk R, Yach D. Review of South African mortality (1984). South African Medical Research Council, Technical Report No. 1, May 1987.
3. Wyndham CH. Deaths from accidents, poisoning and violence — differences between the various population groups in the RSA. *S Afr Med J* 1986; **69:** 556-558.
4. Molteno CD, Kibel MA. Postneonatal mortality in the Matroosberg Divisional Council area of the Cape Western Health Region. *S Afr Med J* 1989; **75:** 575-578.
5. Bourne DE, Rip MR, Woods DL. The spatial variation of mortality among children under 5 years of age in South Africa. *S Afr Med J* 1989; **75:** 565-570.
6. Gallagher SS, Finison K, Guyer B, Goodenough S. The incidence of injuries among 87 000 Massachusetts children and adolescents: results of the 1980-81 Statewide Childhood Injury Prevention Program Surveillance System. *Am J Public Health* 1984; **74:** 1340-1347.

7. Department of Statistics. *Statistical Classification of Diseases, Injuries and Causes of Death* (Manual No. 07-03-15). Pretoria: Government Printer, 1979.
8. World Health Organisation. *Manual of the International Statistical Classification of Disease, Injuries and Causes of Death.* 9th revision. Geneva: WHO, 1978.
9. Haddon W, Baker SP. Injury control. In Clark DW, MacMahon B, eds. *Preventive and Community Medicine.* Boston: Little, Brown, 1981: Ch. 8, 109-140.
10. Rivara FP. Epidemiology of violent deaths in children and adolescents in the United States. *Pediatrician* 1985; **12:** 3-10.
11. Myers JE, Macun I. The social context of occupational health in South Africa. *Am J Public Health* 1989; **79:** 216-224
12. Wyndham CH. Cause- and age-specific mortality rates from accidents, poisoning and violence. *S Afr Med J* 1986; **69:** 559-562
13. Botha JL, Bradshaw D. African vital statistics — a black hole? *S Afr Med J* 1985; **67:** 977-981.
14. Mostert WP, Van Tonder JL, Hofmeyr B. *Rekonstruksie van die Sensus-ouderdomstrukture van die Suid-Afrikaanse Swart Bevolking, 1936-1985.* Report No. S-153. Pretoria: Human Sciences Research Council, 1986.
15. Central Statistical Services. *Sample Tabulation Report* (No. 02-80-02). Pretoria: Government Printer, 1980.
16. Central Statistical Services. *Population Census Report* (No. 02-85-01). Pretoria: Government Printer, 1985.
17. SAS Institute. *SAS User's Guide: Statistics.* Version 5 Edition. Cary, NC: SAS Institute Inc., 1985.
18. Waller AE, Baker SP, Szocka A. Childhood injury deaths: national analysis and geographic variations. *Am J Public Health* 1989; **79:** 310-315.
19. Taket A. Accident mortality in children, adolescents and young adults. *World Health Stat Q* 1986; **39:** 232-256.
20. National Center for Health Statistics. *Vital Statistics of the United States, 1984.* Hyattsville, Md: US Department of Health and Human Services, Public Health Service, NCHS, 1987.
21. Withers BF, Baker SP. Epidemiology and prevention of injuries. *Emerg Med Clin North Am* 1984; **2:** 701-715.
22. Rivara FP, Bergman AB, LoGerfo JP, Weiss NS. Epidemiology of childhood injuries: II. Sex differences in injury rates. *Am J Dis Child* 1982; **136:** 502-506.
23. McDermott FT. Prevention of road accidents in Australia. *Pediatrician* 1983-85; **12:** 41-45.
24. Zuckerman BS, Dury JC. Developmental approach to injury prevention. *Pediatr Clin North Am* 1985; **32:** 17-29.
25. Mare RD. Socioeconomic effects on childhood mortality in the United States. *Am J Public Health* 1982; **72:** 539-547.
26. Townsend P, Davidson N. *Inequalities in Health: The Black Report.* Harmondsworth, Middx: Penguin, 1982: 126-129.
27. Keeling JW, Golding J, Millier HK. Non-natural deaths in two health districts. *Arch Dis Child* 1985; **60:** 525-529.
28. Wyndham CH. Deaths from accidents, poisoning and violence — differences between the various population groups in the RSA. *S Afr Med J* 1986; **69:** 556-558.
29. Peacock WJ. Head injuries in children (Editorial). *S Afr Med J* 1984; **66:** 789.
30. De Wet B, Davies MRQ, Cywes S. Die oorsake van brandwonde by kinders. *S Afr Med J* 1977; **52:** 967-972.
31. Gulaird JA, Sattin RW, Waxweiller RJ. Deaths from residential fires 1978-84. *MMWR* 1988; **37**(SS-1) 39-45.
32. Pearn J, Nixon J, Wilkey I. Freshwater drowning and near drowning accidents involving children: a five-year total population study. *Med J Aust* 1976; **2:** 942-946.
33. Nixon J, Pearn J, Wilkey I, Cororan A. Fifteen years of child drowning — a 1967 - 1981 analysis of all fatal cases from the Brisbane drowning study and an 11-year study of consecutive near drowning cases. *Accid Anal Prev* 1986; **18:** 199-203.
34. Pearn J, Wong R, Brown J, Ching Y-C, Bart R, Hammar S. Drowning and near drowning involving children: a five-year total population study from the city and county of Honolulu. *Am J Public Health* 1979; **69:** 450-454.
35. Tursz A. Epidemiological studies of accident morbidity in children and young people: problems of methodology. *World Health Stat Q* 1986; **39:** 257-267.
36. Milliner N, Pearn J, Guard R. Will fenced pools save lives? A 10-year study from Mulgrave Shire, Queensland. *Med J Aust* 1980; **2:** 510-511.

Appendix I

ICD E codes (9th revision) used in analysing injury mortality statistics (includes all external causes — E800 - E999)

Injury	Code
Road traffic (motor vehicle) accident injuries	**810 - 829**
Pedestrians	**814**
Pedal cycles	**826**
Drowning	**910**
Burns	
Fire	**890 - 899**
Scalds	**924 - 926**
Assault	
Homicide	**960 - 969**
Legal execution	**970 - 978**
War-related	**990 - 999**
Choking and suffocation	**911 - 913**
Poisoning (accidental)	**850 - 869**
Injuries undetermined whether accidentally or purposefully inflicted	**980 - 989, 889***
Other	
Transport other than motor vehicle	**800 - 807**
	830 - 838
	840 - 845
	846 - 848
Mines	**849**
Falls (accidental)	**880 - 888**
Nature	**900 - 909**
Machinery	**919**
Struck by object or person accidentally caught in between objects	**916 - 918**
Sharp instruments	**920**
Firearms (accidental)	**922**
Sport	**839**
Iatrogenic	**870 - 879**
	930 - 949
Suicide	**950 - 959**
	979*
Miscellaneous	**839, 914, 915, 921, 923, 927 - 929**

*Additional codes used by Central Statistical Services, Pretoria.