

# Epidemiology of non-fatal injuries due to external causes in Johannesburg-Soweto

## Part II. Incidence and determinants

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### Summary

A total of 3 535 trauma cases were enumerated in Johannesburg-Soweto between 1989 and 1990 in the course of 271 hospital ward rounds and 43 casualty watches. The overall trauma incidence was 2 886 new cases per annum per 100 000 population, rising to 19 872 for coloured males aged 20 - 24 years and to 8 761 for black males aged 20 - 24 years. Overall the male/female ratio was 2,9 rising to 6 or more in adolescence (15 - 19) for blacks and coloureds. There were some 156 new resident cases of trauma daily; half these were victims of interpersonal violence, and coloureds constituted 22% of this group, although forming only 8% of the denominator population. With regards to cause, most trauma among blacks and coloureds arose from interpersonal violence and significantly less from transport accidents. Among blacks injured in transport accidents (the majority of which involved motor vehicles) most were pedestrians, whereas most whites injured in such accidents were occupants of vehicles. For all groups trauma was most likely to be incurred 'in the street' although for white and coloured women the home was most dangerous. The implications of these and related findings for treatment and prevention are briefly reviewed.

*S Afr Med J* 1991; 79: 472-479.

The methodology and materials used in this prospective hospital-based survey of non-fatal injuries due to external causes in Johannesburg-Soweto were outlined in part I of this article (p. 466).<sup>1</sup> Here the results are presented. The emphasis is on using descriptive statistics to give a breakdown of trauma by incidence rates and causes, and an overview of the distribution of trauma in relation to various demographic, temporal and geographical variables.

Most results are presented for the four 'official' South African race categories, Asian, black, coloured, and white. These categories have neither the ethnic nor cultural substance the state claims for them. None the less, they have become central to the ideology of all South Africans and thus powerfully shape the social, economic and political institutions of the country and also the daily experience and consequent risk

factors of its people. Thus, despite the fanciful statutory elaboration of race distinctions in South Africa, the concept of race has become a social reality.

### The sample

During the 271 ward rounds and 43 casualty watches conducted between 8 June 1989 and 24 August 1990, 3 535 patients were sampled. Of these, 99 were excluded because they did not meet the diagnostic criteria and/or were interviewed more than 24 hours post-trauma. Of the 3 436 eligible cases, 754 (21,9%) were non-resident, giving an overall resident/non-resident ratio of 4,6. Of patients identified during casualty watches, the percentages of Asian and white non-residents (34,6% and 32,4% respectively) were substantially higher than the percentages of coloured (20,5%) and black (17,6%) non-residents. Among patients sampled during ward rounds, 42,6% of those classified as white were non-residents, whereas only approximately 20% of the patients in each of the other three race categories were non-residents.

### Incidence rates for non-fatal injuries

#### Crude incidence

Raw case counts obscure the relative proportions between groups defined in terms of age, sex and race. It was therefore necessary to calculate crude incidence rates per 100 000 population. As this requires that all cases be drawn from a target population of known size, the 754 cases not resident in the catchment area were excluded. Also excluded from these calculations were 51 cases where the relevant data were missing, and all 17 cases (of which 3 were Asian, 3 coloured and 11 white) identified during casualty watches at private hospitals — the very small number of sampling days on which these cases were found artificially inflated annualised estimates for the race, sex and age groups in which they appeared. Crude incidence rates for all trauma were therefore based on a total of 994 resident cases identified during casualty watches at state hospitals, and for crude inpatient incidence rates on a total of 1 620 resident admissions seen during ward rounds at both state and private hospitals.

**All trauma.** Table I presents estimates by age, sex and race of the annualised incidence and crude incidence rates per 100 000 population for all trauma, using data from the casualty watches.

Table I shows that the estimated total of new trauma cases resident in Johannesburg-Soweto during the survey year was 56 892 (95% confidence interval (CI)  $\pm$  798), the majority being males aged between 25 and 34 years. The overall incidence rate for all trauma was 2 886/100 000 population. The highest incidence rate for all trauma was for coloured men aged 20 - 24 years. Overall, incidence followed an age gradient, rising to a peak at age 20 - 24 years, gradually declining, and again rising sharply after 75 years. In interpreting these

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TABLE I. ANNUALISED INCIDENCE ( $\pm$  95% CI) AND CRUDE RATE PER 100 000 FOR ALL TRAUMA AMONG JOHANNESBURG-SOWETO RESIDENTS, BY RACE, SEX AND AGE

Age (yrs), sex	Race														
	Asian			Black			Coloured			White			All races		
	Annual	CI	Rate	Annual	CI	Rate	Annual	CI	Rate	Annual	CI	Rate	Annual	CI	Rate
<b>0 - 9</b>															
Female	61	$\pm$ 77	867	462	$\pm$ 250	386	244	$\pm$ 173	1 393	348	$\pm$ 201	1 005	1 114	$\pm$ 178	623
Male	122	$\pm$ 115	1 703	974	$\pm$ 326	822	731	$\pm$ 288	4 110	713	$\pm$ 274	2 092	2 540	$\pm$ 240	1 430
Both	183	$\pm$ 96	1 289	1 436	$\pm$ 288	603	974	$\pm$ 231	2 763	1 061	$\pm$ 237	1 545	3 654	$\pm$ 169	1 025
<b>10 - 14</b>															
Female	52	$\pm$ 77	1 487	365	$\pm$ 211	679	183	$\pm$ 154	1 924	278	$\pm$ 201	1 340	878	$\pm$ 159	1 003
Male	61	$\pm$ 77	1 642	783	$\pm$ 288	1 562	670	$\pm$ 288	7 168	574	$\pm$ 274	2 567	2 087	$\pm$ 217	2 441
Both	113	$\pm$ 77	1 567	1 148	$\pm$ 250	1 105	852	$\pm$ 221	4 525	852	$\pm$ 237	1 976	2 965	$\pm$ 188	1 714
<b>15 - 19</b>															
Female	52	$\pm$ 77	1 713	357	$\pm$ 211	550	235	$\pm$ 173	2 597	383	$\pm$ 237	1 529	1 026	$\pm$ 178	1 007
Male	0	$\pm$ 0	0	2 305	$\pm$ 471	3 929	1 391	$\pm$ 361	15 922	1 061	$\pm$ 347	4 428	4 757	$\pm$ 332	5 032
Both	52	$\pm$ 38	830	2 661	$\pm$ 341	2 156	1 626	$\pm$ 267	9 147	1 444	$\pm$ 292	2 947	5 783	$\pm$ 255	2 943
<b>20 - 24</b>															
Female	0	$\pm$ 0	0	1 339	$\pm$ 384	1 826	461	$\pm$ 250	5 185	374	$\pm$ 237	1 351	2 174	$\pm$ 235	1 920
Male	278	$\pm$ 211	8 578	4 818	$\pm$ 691	8 761	1 557	$\pm$ 384	19 872	1 731	$\pm$ 405	6 251	8 383	$\pm$ 445	8 084
Both	278	$\pm$ 106	4 246	6 157	$\pm$ 537	4 798	2 018	$\pm$ 317	12 063	2 105	$\pm$ 321	3 914	10 557	$\pm$ 340	5 141
<b>25 - 34</b>															
Female	61	$\pm$ 115	1 033	2 452	$\pm$ 494	1 792	870	$\pm$ 327	6 343	426	$\pm$ 237	1 039	3 809	$\pm$ 303	1 929
Male	296	$\pm$ 211	4 855	8 862	$\pm$ 944	6 777	2 218	$\pm$ 458	19 114	1 539	$\pm$ 386	3 755	12 914	$\pm$ 556	6 817
Both	357	$\pm$ 163	2 976	11 314	$\pm$ 719	4 227	3 087	$\pm$ 393	12 196	1 965	$\pm$ 311	2 397	16 723	$\pm$ 429	4 322
<b>35 - 44</b>															
Female	52	$\pm$ 77	1 194	2 113	$\pm$ 452	2 660	296	$\pm$ 211	3 504	435	$\pm$ 237	1 184	2 896	$\pm$ 260	2 245
Male	61	$\pm$ 115	1 352	3 984	$\pm$ 630	4 725	670	$\pm$ 288	10 100	800	$\pm$ 310	2 210	5 515	$\pm$ 363	4 189
Both	113	$\pm$ 96	1 274	6 098	$\pm$ 541	3 723	965	$\pm$ 250	6 407	1 235	$\pm$ 274	1 693	8 411	$\pm$ 312	3 227
<b>45 - 54</b>															
Female	61	$\pm$ 77	2 138	557	$\pm$ 288	1 139	122	$\pm$ 115	2 072	348	$\pm$ 201	1 126	1 087	$\pm$ 178	1 228
Male	0	$\pm$ 0	0	1 893	$\pm$ 433	4 303	183	$\pm$ 154	3 788	704	$\pm$ 274	2 405	2 780	$\pm$ 257	3 437
Both	61	$\pm$ 38	1 082	2 450	$\pm$ 361	2 638	304	$\pm$ 135	2 845	1 052	$\pm$ 237	1 749	3 867	$\pm$ 217	2 283
<b>55 - 64</b>															
Female	0	$\pm$ 0	0	305	$\pm$ 211	890	122	$\pm$ 115	3 367	330	$\pm$ 201	1 293	757	$\pm$ 140	1 162
Male	0	$\pm$ 0	0	1 044	$\pm$ 365	3 713	122	$\pm$ 115	4 489	278	$\pm$ 201	1 244	1 444	$\pm$ 184	2 639
Both	0	$\pm$ 0	0	1 348	$\pm$ 288	2 163	244	$\pm$ 115	3 848	609	$\pm$ 201	1 270	2 200	$\pm$ 162	1 836
<b>65 - 74</b>															
Female	0	$\pm$ 0	0	174	$\pm$ 154	1 095	122	$\pm$ 115	6 216	478	$\pm$ 237	2 428	774	$\pm$ 158	2 015
Male	0	$\pm$ 0	0	0	$\pm$ 0	0	183	$\pm$ 154	15 151	278	$\pm$ 201	1 936	461	$\pm$ 122	1 429
Both	0	$\pm$ 0	0	174	$\pm$ 77	547	304	$\pm$ 135	9 619	757	$\pm$ 219	2 220	1 235	$\pm$ 140	1 747
<b>&gt; 75</b>															
Female	0	$\pm$ 0	0	61	$\pm$ 77	1 245	122	$\pm$ 115	11 544	757	$\pm$ 310	5 465	939	$\pm$ 169	4 653
Male	61	$\pm$ 77	22 991	113	$\pm$ 85	2 313	61	$\pm$ 77	13 469	322	$\pm$ 201	4 649	557	$\pm$ 122	4 443
Both	61	$\pm$ 38	9 195	174	$\pm$ 81	1 779	183	$\pm$ 96	12 121	1 078	$\pm$ 256	5 193	1 496	$\pm$ 145	4 573
<b>All ages</b>															
Female	339	$\pm$ 211	1 029	8 185	$\pm$ 439	1 295	2 774	$\pm$ 254	3 487	4 157	$\pm$ 320	1 507	15 455	$\pm$ 607	1 515
Male	878	$\pm$ 346	2 643	24 775	$\pm$ 763	4 197	7 784	$\pm$ 417	10 945	8 001	$\pm$ 447	3 118	41 437	$\pm$ 989	4 356
Both	1 218	$\pm$ 279	1 839	32 960	$\pm$ 601	2 697	10 558	$\pm$ 336	7 007	12 157	$\pm$ 383	2 283	56 892	$\pm$ 798	2 886

TABLE II. ANNUALISED INCIDENCE ( $\pm$  95% CI) AND CRUDE RATE (/100 000) FOR INPATIENT TRAUMA AMONG JOHANNESBURG-SOWETO RESIDENTS, BY RACE, SEX AND AGE

Age (yrs), sex	Race														
	Asian			Black			Coloured			White			All races		
	Annual	CI	Rate	Annual	CI	Rate	Annual	CI	Rate	Annual	CI	Rate	Annual	CI	Rate
<b>0 - 9</b>															
Female	24	$\pm$ 18	347	264	$\pm$ 52	220	49	$\pm$ 26	279	26	$\pm$ 39	75	363	$\pm$ 42	203
Male	24	$\pm$ 18	341	407	$\pm$ 65	343	86	$\pm$ 34	482	38	$\pm$ 39	112	555	$\pm$ 51	313
Both	49	$\pm$ 18	344	671	$\pm$ 59	281	134	$\pm$ 30	381	64	$\pm$ 39	93	918	$\pm$ 47	258
<b>10 - 14</b>															
Female	6	$\pm$ 8	174	42	$\pm$ 26	78	37	$\pm$ 22	385	25	$\pm$ 26	120	109	$\pm$ 23	125
Male	0	$\pm$ 0	0	180	$\pm$ 43	359	79	$\pm$ 30	846	33	$\pm$ 48	146	291	$\pm$ 37	341
Both	6	$\pm$ 4	84	222	$\pm$ 35	213	116	$\pm$ 26	614	57	$\pm$ 37	133	401	$\pm$ 30	232
<b>15 - 19</b>															
Female	12	$\pm$ 12	400	90	$\pm$ 34	139	24	$\pm$ 18	268	27	$\pm$ 39	106	153	$\pm$ 27	150
Male	19	$\pm$ 16	592	571	$\pm$ 77	973	164	$\pm$ 41	1876	118	$\pm$ 83	491	871	$\pm$ 65	921
Both	31	$\pm$ 14	493	661	$\pm$ 56	535	188	$\pm$ 30	1059	144	$\pm$ 61	294	1024	$\pm$ 46	521
<b>20 - 24</b>															
Female	6	$\pm$ 8	184	327	$\pm$ 47	446	24	$\pm$ 18	273	51	$\pm$ 48	186	409	$\pm$ 37	361
Male	73	$\pm$ 30	2 252	1 090	$\pm$ 101	1 981	195	$\pm$ 45	2 489	194	$\pm$ 84	700	1 552	$\pm$ 82	1 496
Both	79	$\pm$ 19	1 207	1 416	$\pm$ 74	1 104	220	$\pm$ 31	1 312	245	$\pm$ 66	456	1 960	$\pm$ 59	954
<b>25 - 34</b>															
Female	12	$\pm$ 12	207	410	$\pm$ 65	299	91	$\pm$ 34	665	71	$\pm$ 57	173	584	$\pm$ 52	296
Male	183	$\pm$ 30	3 007	1 994	$\pm$ 131	1 525	506	$\pm$ 63	4 357	435	$\pm$ 95	1 062	3 118	$\pm$ 105	1 646
Both	195	$\pm$ 21	1 630	2 403	$\pm$ 98	898	597	$\pm$ 49	2 357	506	$\pm$ 76	617	3 701	$\pm$ 79	957
<b>35 - 44</b>															
Female	6	$\pm$ 8	139	194	$\pm$ 45	244	37	$\pm$ 22	433	50	$\pm$ 39	136	286	$\pm$ 38	222
Male	36	$\pm$ 22	809	1 184	$\pm$ 99	1 405	116	$\pm$ 38	1 743	157	$\pm$ 80	434	1 494	$\pm$ 77	1 134
Both	43	$\pm$ 15	479	1 378	$\pm$ 72	842	152	$\pm$ 30	1 009	207	$\pm$ 60	284	1 780	$\pm$ 58	683
<b>45 - 54</b>															
Female	6	$\pm$ 8	214	163	$\pm$ 41	333	18	$\pm$ 16	311	13	$\pm$ 26	43	201	$\pm$ 31	227
Male	12	$\pm$ 12	438	417	$\pm$ 66	947	55	$\pm$ 26	1 136	53	$\pm$ 57	181	537	$\pm$ 51	664
Both	18	$\pm$ 10	325	580	$\pm$ 53	624	73	$\pm$ 21	683	66	$\pm$ 41	110	737	$\pm$ 41	435
<b>55 - 64</b>															
Female	12	$\pm$ 12	708	60	$\pm$ 30	177	0	$\pm$ 0	0	58	$\pm$ 57	227	131	$\pm$ 26	201
Male	6	$\pm$ 8	400	285	$\pm$ 42	1 014	30	$\pm$ 22	1 122	66	$\pm$ 65	294	387	$\pm$ 36	708
Both	18	$\pm$ 10	563	346	$\pm$ 36	554	30	$\pm$ 11	481	124	$\pm$ 61	258	518	$\pm$ 31	432
<b>65 - 74</b>															
Female	0	$\pm$ 0	0	18	$\pm$ 16	114	18	$\pm$ 16	928	46	$\pm$ 57	236	83	$\pm$ 21	216
Male	0	$\pm$ 0	0	60	$\pm$ 30	381	0	$\pm$ 0	0	33	$\pm$ 48	226	93	$\pm$ 23	288
Both	0	$\pm$ 0	0	79	$\pm$ 23	248	18	$\pm$ 8	574	79	$\pm$ 52	232	176	$\pm$ 22	249
<b>&gt; 75</b>															
Female	0	$\pm$ 0	0	24	$\pm$ 18	490	18	$\pm$ 16	1 731	125	$\pm$ 78	899	167	$\pm$ 26	826
Male	6	$\pm$ 8	2 300	6	$\pm$ 8	125	6	$\pm$ 8	1 347	26	$\pm$ 39	376	44	$\pm$ 18	353
Both	6	$\pm$ 4	920	30	$\pm$ 13	307	24	$\pm$ 12	1 616	151	$\pm$ 59	725	211	$\pm$ 22	645
<b>All ages</b>															
Female	85	$\pm$ 34	259	1 604	$\pm$ 124	254	316	$\pm$ 57	397	492	$\pm$ 134	178	2 497	$\pm$ 104	245
Male	360	$\pm$ 50	1 084	6 242	$\pm$ 237	1 057	1 236	$\pm$ 107	1 739	1 152	$\pm$ 195	449	8 990	$\pm$ 191	945
Both	445	$\pm$ 42	673	7 845	$\pm$ 180	642	1 553	$\pm$ 82	1 030	1 644	$\pm$ 165	309	11 487	$\pm$ 148	583

findings, it must be noted that the rates of Asians in all age ranges, and in all race groups for children and for the elderly, are based on small samples, as the large confidence intervals show.

**Inpatient trauma.** Table II presents estimates by age, sex and race of the annualised incidence and crude incidence rates per 100 000 population for inpatient trauma, using data from the ward rounds.

The overall estimated annualised incidence of inpatient trauma among residents was 11 487 (95% CI ± 148). The highest rates for inpatient trauma clustered among men and women aged 20 - 34 years, with the age-related pattern of increasing incidence for people over 75 years also evident. Among inpatients, the incidence rates for trauma among Asian children and black female children aged 0 - 9 years was elevated relative to that for children aged 10 - 14 years.

Comparison of the annualised incidence figures for all trauma with those for trauma leading to admission show that overall there were approximately 5 outpatients for every inpatient; among whites the ratio was approximately 7, and for blacks it was approximately 4. For all trauma, the ratio of men to women was 2,7, and this varied between 3,0 for blacks and 1,9 for whites. For trauma leading to admission it was 3,6, varying between 4,2 for Asians and 2,3 for whites.

**Age-adjusted incidence**

To permit comparison between different race categories, Fig. 1 presents age-adjusted incidence rates for all trauma and for inpatient trauma.

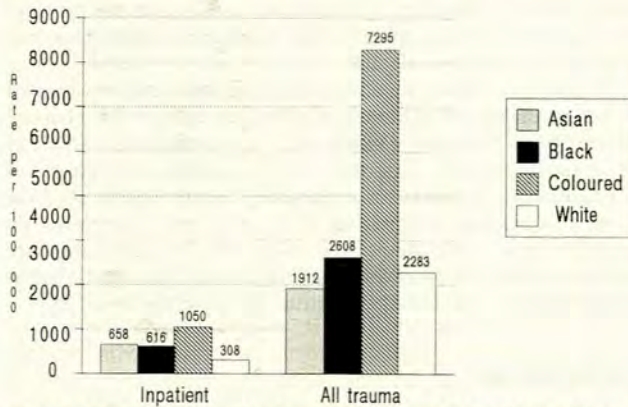


Fig. 1. Age-adjusted incidence rates by race for all trauma and inpatient trauma.

The highest age-adjusted incidence rate for all trauma occurred among coloureds (7295), and was almost 4 times as high as the lowest age-adjusted incidence rate of 1911 for Asians. For trauma leading to hospital admissions, the highest incidence rate of 1030 occurred among coloureds, and was approximately 1,5 times as high as the rates for Asians and blacks, which in turn were twice as high as the rate for whites (308).

**Determinants of non-fatal injuries**

**Causes**

Fig. 2 gives the percentage distribution of all resident cases by cause of injury.

Interpersonal violence accounted for the largest proportion of injuries (50%), with accidents (such as falling or being cut while preparing food) second (27%). Transport accidents

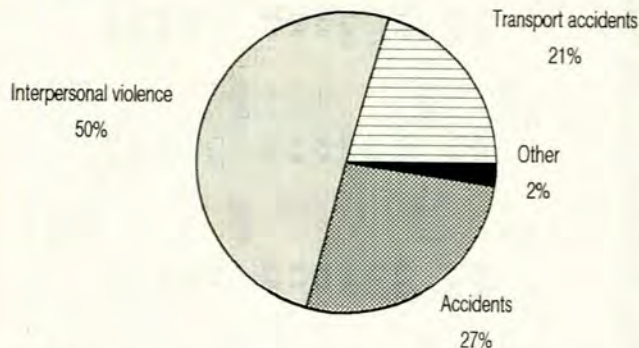
TABLE III. CAUSES AND MECHANISMS OF INJURIES AMONG JOHANNESBURG-SOWETO RESIDENTS (%) BY RACE AND SEX

Sample size	Asian				Black				Coloured				White				All races			
	F		M		F		M		F		M		F		M		F		M	
Transport	17	41,2	50	34,0	368	28,5	1 245	20,3	92	10,9	285	10,5	120	16,7	232	23,8	597	23,5	1 812	19,5
Occupant	71,4	28,6	88,2	11,8	34,0	66,0	35,4	64,6	50,0	50,0	53,3	10,5	75,0	25,0	77,8	22,2	42,9	57,1	46,3	53,7
Pedestrian	5,9		38,0		39,4		60,2		41,3		63,5		9,2		28,4		32,7		56,0	
Violence	0,0		52,6		53,8		53,4		57,9		65,7		9,1		24,2		51,8		53,7	
Sharp instrument	0,0		10,5		16,6		14,8		13,2		9,4		27,3		22,7		16,4		14,3	
Blunt instrument	0,0		26,3		9,7		6,0		18,4		10,5		54,5		27,3		13,8		8,6	
Fists/feet	0,0		5,3		2,8		13,0		2,6		4,4		0,0		7,6		2,6		10,9	
Firearm	100,0		0,0		15,2		8,3		7,9		8,3		9,1		16,7		13,8		8,7	
Other	0,0		5,3		2,1		4,5		0,0		1,7		0,0		1,5		1,5		3,8	
Unknown	47,1		28,0		31,3		17,3		44,6		22,8		73,3		44,0		42,2		21,9	
Accidents	75,0		71,4		53,0		53,0		5,6		53,8		79,5		57,8		66,7		55,1	
Falls	0,0		7,1		0,9		7,0		0,0		3,1		0,0		4,9		0,4		5,8	
Machinery	12,5		0,0		7,0		8,8		2,4		7,7		6,8		9,8		6,3		8,6	
Sharp instrument	0,0		0,0		13,0		6,0		2,4		4,6		0,0		2,0		6,3		4,5	
Hot liquids	12,5		14,3		26,1		25,6		19,5		30,8		13,6		25,5		2,0		26,0	
Other	5,9		0,0		0,8		2,2		3,3		3,2		0,8		4,3		1,3		2,6	
Other causes	100,0		100,0		100,0		100,0		100,0		100,0		100,0		100,0		100,0		100,0	
Total																				

Indented figures represent sums of sub-categories. F = female, M = male.

TABLE IV. OCCUPATION OF TRAUMA PATIENTS RESIDENT IN JOHANNESBURG-SOWETO (%), BY RACE AND SEX

	Asian		Black		Coloured		White		All races	
	F	M	F	M	F	M	F	M	F	M
Sample size	22	58	388	1 312	103	315	141	288	654	1 973
Preschool	18,18	10,34	6,44	2,82	9,71	4,13	4,26	3,47	6,88	3,35
Scholar	18,18	1,72	12,63	11,59	15,53	17,46	10,64	14,24	12,84	12,62
Student	0,0	5,17	2,58	4,04	2,91	0,32	2,13	6,60	2,45	3,85
Unskilled labourer	0,0	6,90	28,87	20,58	4,85	5,08	1,42	1,39	18,20	14,90
Semi-skilled labourer	4,55	32,76	7,99	22,71	11,65	20,63	3,55	11,46	7,49	21,03
Artisan	0,0	0,0	0,26	1,91	0,97	6,03	0,71	12,85	0,46	4,11
Professional	0,0	1,72	1,29	0,99	0,0	0,32	4,96	13,89	1,83	2,79
Pensioner	4,55	3,45	2,58	1,30	10,68	3,17	32,62	7,64	10,40	2,58
Informal sector	0,0	1,72	1,29	1,75	0,0	1,27	0,71	1,04	0,92	1,57
Unemployed	50,00	15,52	33,51	27,74	34,95	29,84	17,73	9,72	30,89	25,09
Office worker	4,55	10,34	1,29	0,99	8,74	5,71	15,60	9,38	5,66	3,24
Private enterprise	0,0	5,17	0,0	1,14	0,0	0,32	3,55	4,17	0,76	1,57
Other	0,0	1,72	0,26	1,14	0,0	3,17	1,42	2,08	0,46	1,62
Unknown	0,0	3,45	1,03	1,30	0,0	2,54	0,71	2,08	0,76	1,67
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Fig. 2. Percentage distribution of injuries by cause ( $N = 2\ 409$ ).

(almost all of which were motor vehicle accidents involving occupants or pedestrians) were third (21%), and other causes, such as sports and self-inflicted injuries, were fourth (2%). The ratio of trauma due to interpersonal violence versus trauma due to accidents was 1,9, and that of interpersonal violence versus transport accidents 2,4. However, as for incidence rates, these overall figures obscure differences between race and sex categories. These are displayed in Table III, which shows the causes of non-fatal injuries among residents by race and sex, as a percentage.

The percentages of black and coloured males injured in incidents of interpersonal violence (60,2% and 63,5% respectively) were more than twice as high as the percentage of white males injured in such incidents (28,4%), with sharp instruments predominating in all cases. The highest percentages of gunshot injuries occurred among black (13%) and white (7,6%) males. The majority of black and coloured females were injured in incidents of interpersonal violence, with sharp instruments predominating in all cases. White females were most often injured in accidents, and of the 9,2% who sustained injuries due to violence, over half were caused by fists and feet. Most Asian females were injured in accidents (47,1%) and vehicle accidents (41,2%). Overall, there was a convergence in aetiological profiles for white and Asian males on the one hand, and black and coloured males on the other (this has also been observed by Bulhan<sup>2</sup>). In contrast, the aetiological profiles for females showed less dramatic convergence by racial classification.

### Intoxicating substances

Patients were asked if they had been using any intoxicating substances at the time of injury; 15,8% of the male and 5,8% of the female patients injured in transport accidents answered yes. For patients injured in incidents of interpersonal violence, 39,6% of the males and 25,9% of the females said they had been using intoxicants. Of patients injured in accidents and those who sustained trauma due to other causes, less than 10% said they were intoxicated. Alcohol was involved in the majority of cases, and where other drugs were mentioned, this was usually in addition to alcohol.

Because self-report measures of intoxication can be assumed to be unreliable, the accuracy of these percentages was checked against body fluid osmolality levels for a consecutive sample of 80 trauma patients admitted to the casualty department of Baragwanath Hospital on a Saturday night; 48,8% of these were intoxicated, suggesting that self-report measures do underestimate the frequency with which intoxicants are involved. However, it must be stressed that a Saturday night is probably not representative of other nights of the week.

### Occupation

Table IV gives the percentage distribution of resident trauma victims by occupation, sex and race.

The majority of male and female victims were employed, the percentages for this category varying between a high of 50% for Asian females and a low of 9,7% for white males. However, the percentage of women classified as unemployed is an overestimate, because housewives were incorrectly classified as unemployed.

### Geographical and temporal determinants

#### Suburb and scene of injury

Data for the background population resident in Johannesburg-Soweto do not include suburb-specific population totals. Consequently, incidence rates by suburb of injury cannot be calculated, and no statements can be made about the relative risk between suburbs. Table V gives the percentage distribution of injuries by cause for the 5 suburbs (out of a total of 668 in the catchment area) in which the highest percentages of injuries occurred, and, for comparison, figures for an amalgamation of 4 lower- to middle-income and 5 upper-income white suburbs. The majority of injuries occurred in central Johannesburg and

**TABLE V. DISTRIBUTION OF INJURIES AMONG JOHANNESBURG-SOWETO RESIDENTS (%) BY CAUSE, FOR SELECTED SUBURBS**

Suburb	No.	%	Cause of injury (%)			
			Violence	Accidents	Transport	Other
Johannesburg*	306	12,7	56,5	23,5	17,6	2,3
Eldorado Park†	220	9,1	59,5	26,4	11,8	2,3
Diepkloof‡	132	5,5	61,4	21,9	15,2	1,5
Medowlands‡	119	4,9	63,0	18,5	18,5	0,0
Orlando East‡	110	4,6	53,6	18,2	27,3	0,9
Lower/middle-income White§	64	2,4	29,7	37,5	39,1	1,6
Upper-income white¶	38	1,4	28,9	34,2	21,0	2,6

\* Central Johannesburg, including Argyle, Hillbrow, Wanderers View and Burghersdorp, Hillbrow (with a population of approximately 40 000), is one of the major high-rise apartment complexes in South Africa.

† Eldorado Park is a coloured township of approximately 150 000 residents, and is some 30 km from central Johannesburg.

‡ Suburbs of Soweto, a dormitory township for black South Africans. Established by the state in 1939, it is about 20 km from central Johannesburg.

§ An amalgamation of 4 lower/middle-income white Johannesburg suburbs.

¶ An amalgamation of 5 upper-income white Johannesburg suburbs.

**TABLE VI. SCENE OF INJURIES AMONG JOHANNESBURG-SOWETO RESIDENTS (%), BY RACE AND SEX**

	Asian		Black		Coloured		White		All races	
	F	M	F	M	F	M	F	M	F	M
Sample size	22	57	388	1 324	103	315	141	288	654	1 984
Work	0,0	8,8	5,4	6,2	1,9	2,9	4,3	9,4	4,4	6,2
Home	36,4	29,8	41,2	21,4	52,4	27,3	54,6	25,3	45,7	23,1
Sportsfield	0,0	3,5	0,3	1,8	4,9	2,5	0,7	5,2	1,1	2,5
Street	54,5	50,9	43,8	54,0	19,4	45,4	29,1	40,3	37,2	50,6
School	0,0	0,0	0,5	1,0	5,8	1,0	0,7	2,4	1,4	1,2
Station	0,0	0,0	1,3	3,9	0,0	0,6	0,0	0,0	0,8	2,7
Shop	0,0	1,8	1,3	1,8	0,0	1,9	2,1	1,0	1,2	1,7
Bar/shebeen	0,0	0,0	1,0	1,7	1,9	4,8	0,7	1,4	1,1	2,1
Other	9,1	5,3	5,2	8,2	13,6	13,7	7,8	14,9	7,2	10,0
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

F = female; M = male.

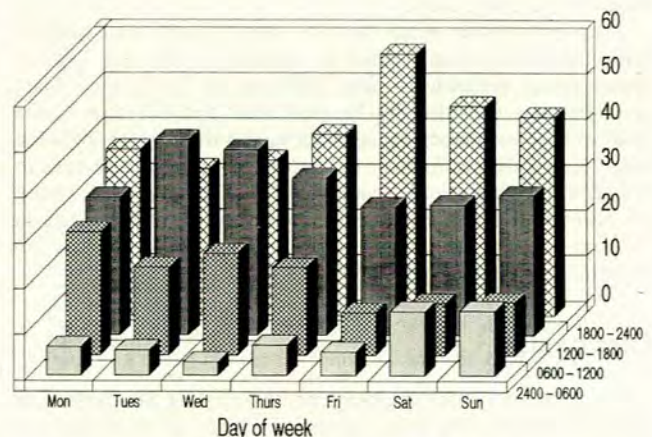
the coloured township of Eldorado Park. Interpersonal violence was the predominant cause of injuries in all black suburbs and in central Johannesburg. Injuries in the white suburbs were more evenly distributed between causes, with injuries due to interpersonal violence accounting for substantially fewer injuries than in the other areas.

Table VI displays the scene of injuries by race and sex as a percentage.

Among males, the majority of cases in all race groups were injured 'on the street'. The majority of coloured and white females, and just under half of the black females, were injured at home. These results are consistent with those of an earlier analysis of the data for 600 victims of interpersonal violence in the catchment area excluding Soweto,<sup>3</sup> which showed that male victims of assault were most often attacked by strangers while walking at night, whereas the majority of women were attacked at home by their spouses or lovers.

### Time of day and day of week

Fig. 3 gives the percentage distribution of injuries by time of day and day of week. From Friday to Monday, injuries peaked in the evenings between 18h00 and 24h00, whereas midweek peaks occurred earlier, between 12h00 and 18h00. Injuries sustained during the mornings (06h00 - 12h00) peaked during weekdays (except Fridays), whereas on weekends this time period accounted for the lowest percentage of injuries.



**Fig. 3. Percentage distribution of injuries by time of day and day of week (N = 2 251).**

### Major diagnoses for non-fatal injuries

Fig. 4 displays the percentage distribution of major diagnoses by body region, following the taxonomy of ICD-10.<sup>4</sup>

Of all major diagnoses 22,6% involved wounds to the head and face, most of which were open wounds and contusions, with just under a third involving intracerebral injuries varying

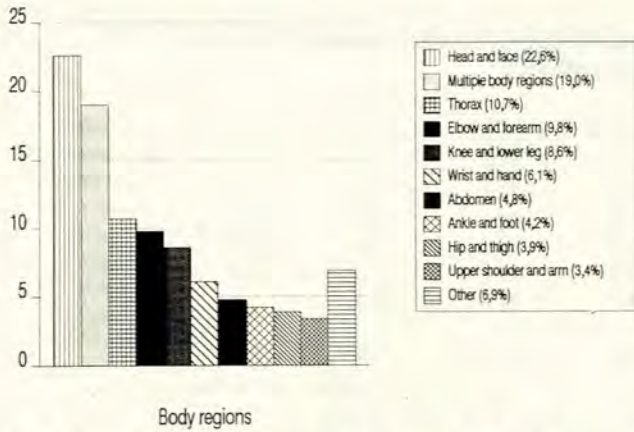


Fig. 4. Percentage distribution of diagnoses by body regions ( $N = 2\ 652$ ).

in severity between mild concussion and severe traumatic brain injury (see Nell and Brown<sup>5</sup> for a review of the incidence and causation of traumatic brain injury in Johannesburg). The majority of injuries to multiple body regions (almost invariably including the head and thorax), the thorax, the abdomen, and the wrist and hand, were also open wounds and contusions. Fractures predominated among injuries to the elbow and forearm, hip and thigh, and knee and lower leg. Injuries of the foot and ankle were evenly distributed between fractures and dislocations. Of the injuries classified as other, 3.1% were burns and corruptions not specified by body region.

Injuries to the head and face (mostly open wounds) were sustained by 28.9% of victims of interpersonal violence. A further 19.8% of injuries due to interpersonal violence were open wounds, contusions and superficial injuries of the thorax, findings that are consistent with sharp instruments constituting the highest proportion of weapons used in such attacks. Among patients injured in transport accidents, 22.3% received head and face injuries, and 19.6% had sustained specified injuries to multiple body regions. For injuries due to accidents and other causes, diagnoses showed less clustering into specific categories than for the above causes.

Data concerning injury severity were of very poor quality, with the information needed to calculate a Revised Trauma Score being available in only 19.6% of all 3535 cases. Data were seldom recorded by hospital staff for Glasgow Coma Scale (GCS) estimation on admission, and those given included many unreliable estimates: fieldworkers reported one case in which a fully conscious quadriplegic was given a GCS rating on admission of 11, because he could not move his limbs in response to verbal commands. Consequently, no data on severity are reported here.

## Discussion

This exploratory study supplements the existing South African epidemiological data base for major causes of morbidity by identifying groups most at risk for trauma and providing relatively fine-grained information regarding such risk factors as sex, race, cause and bodily site of injury, suburb and scene of injury, and time of day. For Johannesburg, these findings link with a previous investigation of the epidemiology of traumatic brain injury and its consequences.<sup>5</sup>

## Estimated annualised incidence rates

In general, the incidence rates by age and sex within each race category and for the sample as a whole conform to national and international trends, with incidence rates peaking

among males aged 20 - 34 years, and with those aged 75 years and more showing higher incidence rates than people in the younger age ranges. However, it must be stressed that the annualised incidence totals used in these calculations are underestimates, because they include only the number of patients presenting at hospitals within 24 hours of injury, and therefore exclude those who first present for treatment later, and those who seek treatment elsewhere or not at all. The highest underestimate is likely to be for the annualised incidence and rate of all trauma among blacks — fieldworkers noted that at Hillbrow and Baragwanath Hospitals the proportions of casualty patients injured more than 24 hours before presenting for treatment were higher than at the other hospitals.

## Relative geographical mobility

The finding that there were substantially fewer black and coloured non-residents than whites and Asians enumerated during casualty watches suggests a higher mobility for the latter groups, and in turn raises the question of hospital accessibility for blacks and coloureds. Considered in relation to observations by the fieldworkers that more black patients presented 24 hours or longer after injury, and that the outpatient/inpatient ratio of 4 for blacks is substantially lower than the 7 for whites, the question of relative ease of hospital access for these four groups must be considered. The observational and quantitative data suggest that blacks and coloureds present at casualty departments with relatively more serious injuries than whites and Asians, among whom private transport is more readily available, and that presentation of blacks is often delayed to an extent inconsistent with optimal care.

In this light, better trauma care would be attained if in black and coloured areas 24-hour clinic casualty services were initiated with a wider geographical spread than the present situation, in which casualty services for this population are concentrated at three tertiary hospitals (Baragwanath, Coronation and Hillbrow).

## Age and sex distribution

Overall, the male/female trauma ratio is 2.9, rising very sharply in the 15 - 19 year age group for blacks (7.1) and coloureds (6.1). This raises the possibility that among these adolescents, 'macho' acting-out of violence, for which males are differentially socialised, may peak. As previously noted, for both sexes and people in all race categories, incidence rates follow an age gradient, increasing linearly through to age 20 - 24 years, declining to age 74 and rising sharply again after age 75. This implies that to maximise the efficacy of prevention strategies these should be targeted at higher primary and lower secondary schools, with the groundwork for such interventions being laid in the lower standards. Within such strategies, images of maleness and their meanings for the assertion of power and dominance should be explored in ways that might help male adolescents direct these needs in personally and socially constructive directions.

A detailed analysis aetiological aspects of trauma among the elderly is likely to generate prevention strategies appropriate to this age group.

## Distribution by race categories and causes

In the survey year (1989 - 1990), an estimated 56 892 residents of Johannesburg-Soweto presented for treatment at hospital casualty departments within 24 hours of sustaining some form of trauma. This gives a daily average of 156 new resident cases, and, with injuries due to interpersonal violence accounting for 50% of all cases, a daily average of 78 new victims of violence. Of these 78 victims of interpersonal violence, only 8 (10%) were likely to be Asian and white,

despite the fact that together these groups constitute 30% of the background population. In contrast, 17 (22%) of these victims were likely to be coloured, although people classified as coloured make up a mere 8% of the denominator population. The remaining 68% of these victims of violence were black, against the fact that blacks constitute 62% of the background population.

These findings are disturbing but not surprising, given the well-documented observation that interpersonal violence the world over,<sup>6</sup> and in colonial societies in particular,<sup>2,5,7,8</sup> occurs most frequently among people subject to the dual pressures of structurally entrenched economic and racial inequalities. They imply that prevention strategies, if not integrated with socio-political changes leading to a more equitable distribution of power and resources among all members of society, are likely to be of limited efficacy in reducing these high levels of interpersonal violence among blacks and coloureds.

### Causes of injury

Table III raises major prevention issues. Closely following the data previously assembled on the causation of traumatic injury,<sup>5</sup> transport-related injuries (of which nearly all are motor vehicle accidents) differentially prejudice black pedestrians and white vehicle occupants; again the Asian pattern follows that for whites, while among coloureds, occupants and pedestrians are at equal risk. The high incidence of pedestrian motor vehicle accidents among blacks is cause for acute concern. Such injuries almost invariably give rise to significant diffuse traumatic brain injury because of the succession of violent accelerative and decelerative forces to which the victim is subjected, first instantaneously acquiring the momentum of the moving vehicle and then decelerating with equal violence as the body strikes the ground or a solid object. Prevention in this area has traditionally focused on driver and pedestrian education, but until the basic physical requirements of adequate and well-kerbed pavements and effective traffic law enforcement have been met, education alone can do little to attenuate these rates.

Beyond its implications for the prevention of motor vehicle accidents, the most compelling question raised by Table III and in the preceding analysis of incidence rates and causes by race relates to the race-specific causation of trauma, and especially the direction in which this is likely to move in coming decades, as South Africa enters an era of social upliftment for the underprivileged and release from the burdens of colonialism. Whether the colonial masters will approach the trauma distribution of today's disenfranchised, or vice versa, is an interesting question.

### Occupation

No conclusions about relative trauma risk by occupation can be drawn in the absence of base data for the occupational structure of each category specified in Table IV. As such denominator data become available, the numerators provided by Table IV will provide a useful comparative indicator of relative risk.

### Geographical and temporal determinants of trauma

By suburb, the data show that trauma due to interpersonal violence accounts for more than 50% per cent of injuries in central Johannesburg, increasing to 63% in the black and coloured suburbs of Eldorado Park and Soweto. In contrast, interpersonal violence accounted for less than 30% of injuries in the lower middle- and upper-income areas of white Johan-

nesburg selected for comparison. For white and coloured women, the home is the place of greatest risk; blacks and Asians are more likely to be injured in unspecified places outside the home ('in the street'). All males are most at risk 'in the street', whites while driving motor vehicles, blacks and coloureds while walking. Fig. 3 indicates that the evening and night hours are times of greatest risk over weekends (Friday - Sunday), with the afternoon and early evening (12h00 - 18h00) posing a greater risk on Tuesdays and Wednesdays. To generate prevention strategies tailored to local needs, these global data concerning the geographical and temporal determinants of trauma must be more closely defined.

### Body region

When the high frequency of head and face injuries (22,6%) is augmented by the frequency of head injuries in the 'multiple body regions' category (19%), the medical and psychosocial significance of traumatic brain injury caused by these head insults is again highlighted.<sup>5</sup> Two factors exacerbate the psychosocial consequences of head injuries: firstly, decelerative injuries to the unmarked head in motor vehicle occupants produce lasting diffuse damage, and such head injuries are characteristically underenumerated by hospital personnel; second, an increasing weight of evidence suggests that mild and very mild head injury (which is frequently sustained in assaults involving hands and fists) produces significant and lasting psychosocial depletion.<sup>9</sup>

### Conclusion

Beyond contributing to the existing data base concerning the risk factors and causes of non-fatal trauma in South Africa, the findings of this survey (presented in more detail in a technical report<sup>10</sup>), confirm that the low-cost methodology employed in the survey can be usefully applied in other geographical areas and to other problems. Finally, perhaps the most important contribution likely to be made by such epidemiological surveys is to set explanatory processes in motion and generate testable hypotheses for more effective treatment and prevention tailored to local needs and risk factors.

The authors thank all hospital superintendents and other personnel who made the survey possible. We are also grateful to Dr G. Reinach for his advice concerning the computation of certain statistics, and to Professor C. Manganyi for his contributions during the planning stages.

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