THE 2ND INJURY MORTALITY SURVEY:

A national study of injury mortality levels and causes in South Africa in 2017

Report prepared for the National and Provincial Departments of Health

SEPTEMBER 2021

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CONTENTS

CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

KEY MESSAGES

- Road traffic deaths decreased significantly between 2009 and 2017.
- Homicides account for more than a third of injury deaths, with rates seven times the global average and no substantial decrease since 2009.
- The 2017 Injury Mortality Survey (IMS) findings have been validated by alternative routine data, collected by the police and road traffic authorities.
- The findings by manner of death are more specific to informing national and provincial injury prevention efforts than official death notification data.
- The findings highlight the role of alcohol in homicide and road traffic mortality.

INTRODUCTION

Injuries contribute greatly to South Africa's quadruple disease burden (HIV/AIDS, communicable- and non-communicable diseases and injuries). The first nationally representative study of injury mortality in South Africa for 2009 found more than three times as many deaths from homicide and road traffic injury than were recorded in vital registration data. Under-reported and misclassified injury deaths may lead to mis-informed prioritisation strategies for injury prevention. Hence the need for routine national surveys on injury-related deaths, to monitor change and to identify injury prevention priorities.

AIM AND OBJECTIVES

This study aimed to establish the cause-specific incidence of fatal injury for 2017.
The specific objectives were to:

- describe the incidence of fatal injury rates in South Africa by age, sex and cause
- compare the provincial injury mortality rates for fatal injuries

METHODS

The study population was all persons who died of a non-natural (injury) cause during the year 2017 and had a legally required post-mortem exam at a state-owned mortuary within South Africa. We conducted a retrospective descriptive study, utilising routine data collected through the post-mortem investigation process at sampled mortuaries for eight of South Africa's nine provinces. These data were combined with complete caseload data from the Western Cape province's Forensic Pathology Services surveillance system.

A multi-stage stratified cluster sample was drawn for the eight provinces, using mortuaries as the primary sampling unit (cluster). A sampling frame of 121 mortuaries was used to draw a representative sample that was stratified by mortuary size. Sixty-five mortuaries were selected for inclusion supplemented by 16 from the Western Cape, providing a complete sample of 81 mortuaries. All non-natural deaths were included from small and medium mortuaries. At large mortuaries all child and adult female homicides were included, and every second case was selected for other deaths.

Fieldwork was conducted from 20 January to 25 March 2020 at 64 sampled facilities and extended to 3 July 2020 at a single facility due to the effects of the Covid-19-related national lockdown.

Analysis weights were calculated and the realised sample of 22 822 non-natural deaths were estimated to a weighted total of 54 734 non-natural deaths. Mortality rates were calculated for sex and age using 2017 population estimates for South Africa, and age-standardised rates by the direct method using the WHO world standard population.

KEY FINDINGS

- The 2017 IMS estimated a national age-standardised injury mortality rate of 100.3 per 100 000 population (95%CI: 94.4 to 106.1).
- Road traffic mortality decreased significantly by 29%, from 36.1 to 25.6 per 100 000 population between 2009 and 2017.
- Homicide decreased by 10%, from 38.4 to 34.5 per 100 000, with no change in the firearm homicide rate (11.2 per 100 000) between 2009 and 2017.

Homicide

- Age-standardised rates were highest in Eastern Cape (EC), Western Cape (WC) & KwaZulu-Natal (KZN) provinces
- Age-specific homicide rates were highest for 15-29 & 30-44 years
- Male homicide was 6.6 times higher than females
- One-third of male and one-quarter of female homicides were firearm-related
- Approx. 60% of sharp force & 30% of firearm homicide had blood alcohol levels ≥0.05 g/100ml

Road Traffic

- Rates were highest in the Free State (FS), Limpopo (LP) & KZN and lowest in WC and Gauteng (GT)
- Deaths peaked among those 30-44 years
- Overall one-fifth were drivers, one-third of male deaths were pedestrians & nearly half of female deaths were passengers
- Nearly 60% of deaths occurred over weekends (Fri to Sun)
- Nearly half of driver deaths tested, had blood alcohol levels ≥0.05 g/100ml

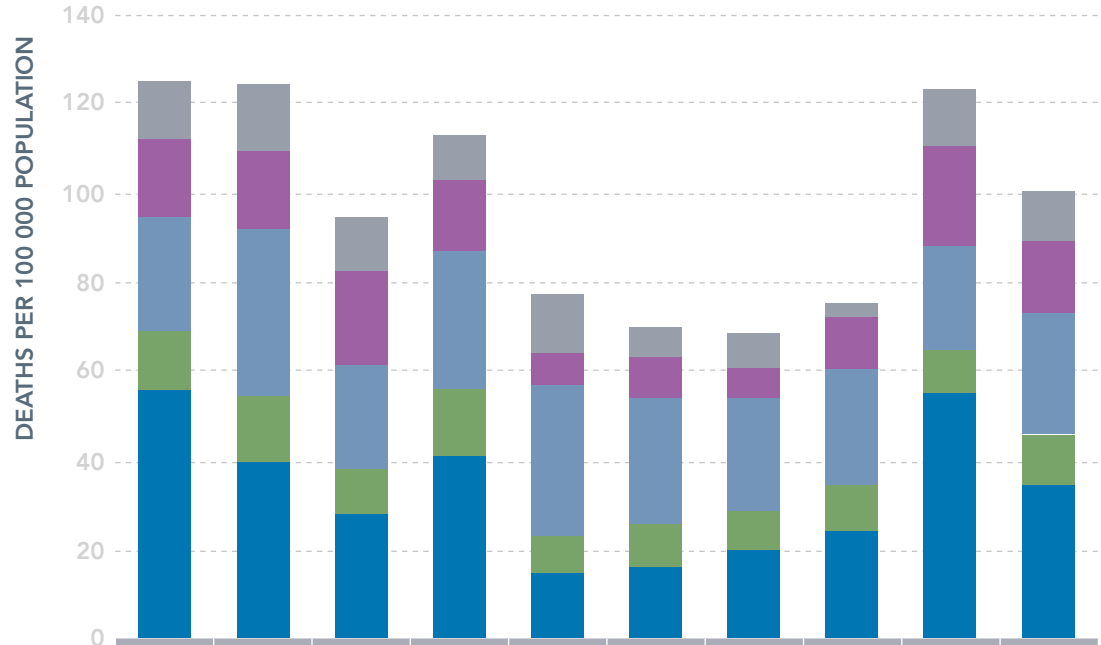
Suicide

- Rates were highest in KZN and FS province
- Female suicide peaked: 15-19 years and males: 25-29 years
- Male suicide was 4.5 times higher than females
- Hanging was the leading mechanism for both sexes
- Approx. one-third of deaths related to suicide occurred on a Sunday & Monday

Other unintentional deaths

- Rates were highest in WC and GT province
- Leading manner of injury death for children < 5 years
- Drowning and burns were leading mechanisms for males, while for females, surgical/medical and burns were highest
- Male deaths were 2.3 times higher than females
- Nearly one-third of deaths occurred on a Saturday & Sunday

AGE-STANDARDISED INJURY MORTALITY RATES, 2017 IMS



	EASTERN CAPE	FREE STATE	GAUTENG	KWAZULU-NATAL	LIMPOPO	MPUMALANGA	NORTH WEST	NORTHERN CAPE	WESTERN CAPE	SOUTH AFRICA
Undetermined	13.0	15.1	12.2	10.0	13.2	6.6	7.8	3.1	12.8	11.2
Other unintentional	17.5	17.6	21.0	16.1	7.1	9.2	6.6	11.8	22.5	16.2
Transport	25.5	37.6	23.3	30.9	34.0	28.4	25.5	26.1	23.4	27.2
Suicide	13.4	14.7	10.2	15.1	8.3	9.6	8.8	10.2	9.7	11.3
Homicide	55.8	39.6	27.9	41.0	14.7	16.0	19.8	24.2	55.0	34.5

BACKGROUND

Injury is a major contributor to South Africa's quadruple burden of disease and accounts for nearly 10% of all causes of death. Homicide and road traffic deaths are among the 10 leading single causes of all deaths nationally and contribute greatly to premature mortality (Msemburi et al., 2016). The previous Injury Mortality Survey (IMS) collected a nationally representative sample of injury deaths for 2009 (Matzopoulos et al., 2015) and demonstrated the utility of data collected from the post-mortem investigation process to describe the fatal injury profile. The study reported significantly more road traffic deaths (24% more) and homicide (13% more) in comparison to the Road Traffic Management Corporation (RTMC) and the South African Police Service (SAPS) respectively. A comparison of the study's results (Prinsloo, Bradshaw, Joubert, Matzopoulos, & Groenewald, 2017) with that captured by Statistics South Africa (Stats SA) from the Department of Home Affairs' (DHA) death notification forms, identified the atypical reporting of the vital registration cause of death profile as a result of misclassified and ill-defined injury deaths, as previously described (Bradshaw et al., 2011; Pillay-van Wyk, Bradshaw, Groenewald, & Laubscher, 2011; Joubert, Rao, Bradshaw, Vos, & Lopez, 2013; Groenewald et al., 2015; Groenewald et al., 2016; Matzopoulos, Groenewald, Abrahams, & Bradshaw, 2016).

Under-reporting or misclassification of the leading causes of injury deaths may lead to mis-informed prioritisation strategies for injury prevention. Hence the need for routine national surveys on injury-related[1] deaths, to monitor change and to identify injury prevention priorities. As a result, the national burden of disease (BoD) estimates have been relied upon since 2000 (Bradshaw et al., 2003; Bradshaw et al., 2004; Norman, Matzopoulos, Groenewald, & Bradshaw, 2007; Msemburi et al., 2016; Pillay-van Wyk et al., 2016) to monitor injury mortality trends nationally. This was previously informed by smaller mortuary-based studies and recently by the 2009 IMS (Matzopoulos et al., 2015), for the 2012 national BoD study.

National BoD mortality trends indicate that South Africa's homicide rate nearly halved between 1997 and 2012, but the road traffic mortality rate remained constant during this period. The 2012 national BoD estimates report a similar rate for homicide and road traffic at approximately 35 per 100 000 population (Msemburi et al., 2016). The decrease in the homicide rate was substantially attributed to the decrease in firearm deaths (Abrahams, Jewkes, & Mathews, 2010; Matzopoulos, Thompson, & Myers, 2014), as a result of stricter enforcement of firearm legislation (Firearms Control Act, 2004) introduced in 2002. The high rate of road traffic mortality, however, requires intervention to meet the global Sustainable Development Goal (SDG) targets for injury and violence, which was to halve road traffic deaths and injuries by 2020 (WHO, 2016).

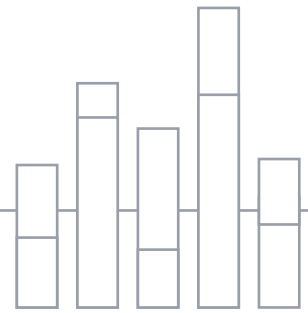
This report serves as a follow-up to the 2009 IMS and follows a similar template to the preceding study, with additional analyses on multiple injuries, legal intervention and sexual assault for homicide, the concentration of alcohol for homicide and road traffic deaths and provincial injury mortality rates. The results will inform the injury profile for the forthcoming 3rd national BoD study and may also assist in refining global BoD measures, as the 2009 IMS estimated significantly different homicide and road traffic mortality than the corresponding estimates from the global BoD study (GBD Compare, 2013).

[1] *Injury-related and non-natural deaths are used interchangeably.*

AIMS AND OBJECTIVES

The aim of this study was to establish the cause-specific incidence of fatal injury for the year 2017.

The specific objectives were to:



Describe the incidence of fatal injury rates in South Africa for 2017 by age, sex and cause.

Compare the provincial injury mortality rates for fatal injuries.

METHODS

Study design

This was a retrospective, descriptive study conducted in a nationally representative sample of mortuaries in eight of the nine South African provinces, which was combined with routinely captured, prospective data from the Western Cape province's Forensic Pathology Services (FPS), which maintains full coverage of medico-legal mortuaries in the province, utilising a coding system that was compatible with the current survey. Post-mortem folders and registers for patients who died an unnatural death during 2017 were reviewed.

Study population

The study population was all persons who died of an unnatural manner during the year 2017 and had a legally required post-mortem at a medico-legal mortuary. These mortuaries are maintained by the Forensic Pathology Services within each provincial health department. A post mortem examination or autopsy is performed for all unnatural deaths to determine the likely cause. Upon completion, the pathologist issues a death certificate and the body is released for burial (South African Government, 2021). Foetuses and deaths from natural causes were excluded once basic demographic information was captured. The sampling frame was the list of all medico-legal mortuaries operating in South Africa for the year 2017 for eight of the nine provinces. Data for the Western Cape province was available via a routinely collected FPS electronic mortuary surveillance database.

Sampling

The multistage stratified cluster sample was drawn for the eight provinces using mortuaries as the primary sampling unit (cluster). A sampling frame of 121 mortuaries (58 641 folders) across eight provinces that were operating in South Africa in 2017 was used to draw a representative sample of mortuaries (Table 1). The mortuaries were stratified by size prior to sampling. Mortuary size categorisation was established by the Gender and Health Research Unit for the sampling frame of the mortuary study on Female and Child Homicide (Abrahams, Mathews, Jewkes, Martin, & Lombard, 2012; Abrahams, Mathews, Martin, Lombard, & Jewkes, 2013), namely, small (up to 500 bodies), medium (501–1 500 bodies) and large (>1 500 bodies).

Table 1: Description of sampling frame, and selected mortuaries and post mortem folders by strata, province and mortuary size

Province	Mortuaries (selected)			Total	Post mortem folders (expected)			Total
	Small	Medium	Large		Small	Medium	*Large	
Eastern Cape	8 (4)	8 (3)	1 (1)	**17 (8)**	2 988 (1 586)	5 333 (1 672)	1 832 (916)	**10 153 (4 174)**
Free State	9 (5)	2 (2)		**11 (7)**	1 524 (1 004)	1 866 (1 894)		**3 390 (2 898)**
Gauteng	3 (2)	3 (2)	4 (2)	**10 (6)**	981 (723)	5 131 (2 696)	10 376 (2 506)	**16 488 (5 925)**
KwaZulu Natal	29 (14)	7 (3)	3 (2)	**39 (19)**	4 172 (2 187)	4 654 (2 076)	5 201 (1 490)	**14 027 (5 753)**
Limpopo	8 (4)	4 (2)		**12 (6)**	1 903 (934)	2 819 (1 137)		**4 722 (2 071)**
Mpumalanga	16 (8)	2 (2)		**18 (10)**	3 157 (1 049)	1 253 (1 244)		**4 410 (2 293)**
North West	6 (3)	2 (2)		**8 (5)**	2 050 (711)	1 571 (1 557)		**3 621 (2 268)**
Northern Cape	5 (3)	1 (1)		**6 (4)**	1 265 (423)	565 (356)		**1 830 (779)**
Total	**84 (43)**	**29 (17)**	**8 (5)**	**121 (65)**	**18 040 (8 617)**	**23 192 (12 632)**	**17 409 (4 912)**	**58 641 (26 161)**

**Second level of sampling with every second folder*

A second level of sampling was applied according to the size of the mortuaries. For small and medium mortuaries all records were included. In the large mortuaries, except for child (<18 years) and adult female homicides, every second folder was selected. This resulted in 65 mortuaries being selected for inclusion for an expected sample of 26 161 records, obtained via a preliminary body count list from mortuaries. Data for an additional 16 mortuaries in the Western Cape Province were sourced from the FPS electronic mortuary surveillance database to provide a complete national sample of 81 mortuaries.

Data collection

At each sampled mortuary, all cases were identified from the mortuary register or from the computer administration system where available. Data were collected for all cases that presented at the mortuary from 00:00 on 1 January 2017 to 23:59 on 31 December 2017 using a Tablet form data capture system, Kobotools (Kobotoolbox, 2018).

An initial questionnaire was designed in Excel to capture the required data that were collected as part of the routine post-mortem investigation procedure. The mortuary death register number and the death notification number (BI-1663) were collected as identifiers for case follow-up and checking in the event of data capture errors. The primary source of the data was the post-mortem reports, and ancillary documentation including police reports and hospital records that appear in case folders.

The questionnaire included demographic information, province, date of death, manner[2] and mechanisms of the injury death (i.e. firearms, sharp force, poison ingestion, burns, drowning, etc.). In addition, circumstances

[2] *For manner of death, International Classification of Disease version 10 (ICD-10) was used with an additional category of Transport, separated from the Other unintentional deaths.*

surrounding the death, for instance as to whether the death occurred in custody and whether the death was work-related were captured. For homicide in particular, information on whether multiple injuries were inflicted during assaults were recorded, whether the death was related to a legal intervention, whether there was any evidence of sexual assault and any suspicion of pregnancy. Where the homicide was related to a concealed pregnancy/abandoned foetus, the gestational age, body mass, body length and the place where the foetus was abandoned was recorded and will be published in a separate report. Blood alcohol data were collected from the post-mortem folders where available. The police CAS number and police station where the death was reported was collected for all non-natural deaths and will be used as follow-up with the investigating police officers during Phase 2 of this study, which focuses on perpetrators of male homicide, femicide and child homicide.

Appointment of Geospace International (Pty) Ltd for data collection

Geospace International (Pty) Ltd was appointed on 01 November 2019 via a Service Level Agreement (SLA) with the South African Medical Research Council, to develop the supplied questionnaire on the digital Kobotools platform for data capture, to supply fieldworkers and to manage the data collection and preliminary data cleaning process. The data were fully secured on the Kobotools platform, before handover to the project team for further cleaning and analysis.

Pilot testing of the digital questionnaire

While the questionnaire was enhanced from the routine instrument developed and used for the previous Injury Mortality Survey (Matzopoulos et al., 2013), the electronic data collection tool, data management and quality control software were tested by members of the project team, Geospace staff and fieldworkers. This allowed for the review and finessing of the questionnaire and training materials prior to their use for fieldworker training.

Fieldwork training

Training of fieldworkers was conducted by project members from 15-17 January 2020 at the South African Medical Research Council in Pretoria and at the Pretoria Forenics Pathology Services (FPS). Fieldworkers were trained on the purpose and importance of the study, sampling strategy, research ethics, post-mortem investigation procedures, the structure of post-mortem folders and the possibility of vicarious trauma from reviewing traumatic information. Further training included Kobotools digital data capture using Tablets, the fieldworkers' roles and responsibilities in the field, the SAMRC project organisational structure, the logistics of the project, and the reporting structure within the project team. A practical exercise was incorporated into the training whereby the field workers visited the Pretoria FPS and had access to post mortem folders to digitally capture the required information. An operational manual was provided to each fieldworker, which included information on all topics discussed during the training.

Fieldwork

Fieldwork was completed for 64 of the 65 sampled mortuaries between 20 January and 25 March 2020, when the Covid-19 related national lockdown interrupted data collection at the final mortuary. The final data capture was completed at the remaining mortuary between 30 June and 03 July 2020.

Data management and quality control

Data checks were incorporated in the data-capture application, for example, consistency between the manner of death and cause of death, and accuracy of capturing the death registration number. Data captured by individual fieldworkers were uploaded to a central web-based data set on the Kobotools platform. Geospace staff members and SAMRC project team members conducted preliminary data quality checks throughout fieldwork and feedback was provided to the fieldwork team. SAMRC project team members continued with data cleaning on the final dataset in preparation for data analysis.

Analysis weights

Analysis weights were applied to account for the selection probabilities of mortuaries within survey strata (mortuary size) and the sample realisation. Weight calculations were based on the number of mortuaries randomly selected in each stratum of the total number of facilities in the 8 provinces. The strata used to determine the selected sample were used to calculate the sample weights.
Weight calculations were performed in Microsoft Excel 2007 using the formula:
Weight = realisation weight (RW) x sampling fraction (SF) x 1/ primary sampling unit probability (PSUP)
where:
RW = expected sample/realised sample for each mortuary
SF= 2 for mortuaries that had half their post-mortem folders surveyed
SF= 1 for mortuaries that had all their post-mortem folders surveyed

$$\text{PSUP} = \frac{\text{Total no. of mortuaries selected for stratum}}{\text{Total no. of mortuaries in stratum}}$$

Data analysis

After cleaning the data and finalizing the weighted estimates, it was analysed using Stata version 14 (Stata/IC 14.1, 2015).

By using standard methods for analysing survey data, national estimates for the proportion of deaths for overall homicide, road traffic deaths and other injury categories were computed. The analysed data took into account the survey design and the sampling weights of mortuaries.

Mortality rates were calculated for sex and age using 2017 population estimates for South Africa, provided by Dorrington (2013). Age-standardised rates were calculated from age-specific mortality rates using the WHO world standard (Ahmad et al., 2001), and missing age redistributed.

Overview of expected and realised caseload

During the fieldwork, small discrepancies in the numbers of folders expected in each mortuary were found for 2017 in the 65 facilities that were visited. Overall, there were 25 959 cases, which is 202 fewer cases (0.8%) than had been expected (N = 26 161). Among the cases, 3 137 (12.1%) were concluded to have been natural deaths. The number of cases drawn, compared to the anticipated sample from each mortuary, is shown in Table I of Appendix I.

Information on the status of the record (whether found or not) was recorded if the death was non-natural. Of the 22 822 non-natural cases sampled, 954 (4.2%) had missing folders, 278 (1.2%) had missing post mortem information within the folder and in 19 (0.1%) cases the body was only stored at the mortuary. For the missing folder and storage cases, it was assumed that the manner of death (i.e. whether homicide, suicide, transport, other unintentional or undetermined) was the same after the post mortem as indicated in the death register, but no detail on the mechanism of death (i.e. firearm, poison ingestion, pedestrian, burns, etc.) was available. The provincial distribution of the realized caseload is shown in Table II of Appendix I.

The rest of the analysis in this report will focus on the 30 996 non-natural deaths, comprising the 22 822 non-natural deaths that were recorded during the fieldwork and the 8 174 non-natural deaths drawn from the Western Cape's database.[3] This reflected a total of 54 734 non-natural deaths when the sampling weights were applied.

[3] *The Western Cape's database is drawn from a mortuary-based surveillance system that is fully institutionalised within the province's Forensic Pathology Service. It provides routine injury mortality data that is compatible with the IMS coding for all mortuaries in the Western Cape.*

ETHICAL CONSIDERATIONS AND PERMISSIONS

Ethical approval for the study was obtained from the South African Medical Research Council's Health Research Ethics Committee. As study subjects are deceased and records were reviewed posthumously at mortuaries, informed consent was not necessary. However, the confidentiality of the deceased was ensured at all times and the name of the deceased was not captured. The field workers were trained in confidentiality protocols and on the importance and responsibilities of maintaining confidentiality. The fieldworker could not access the information captured after it was uploaded and the data were stored behind the SAMRC firewall on a password-protected database.

Permission to undertake the study was sought from each Provincial Department of Health. Access to the mortuaries in each province was granted by the respective Provincial Health Research Committees, and forensic pathologists representing the different provinces were also notified of the study. The head of each mortuary was approached to arrange access to death registers and post-mortem reports at the sampled mortuaries, and the study commenced once all agreed.

RESULTS

Main findings

Geographic and Demographic characteristics

Table 2 and Figure 1 show the number and distribution of South Africa's non-natural deaths by province. Overall, the largest weighted proportion of non-natural deaths were recorded for Gauteng (24.9%) followed by KwaZulu-Natal (21.3%), while the Northern Cape had the lowest proportion of non-natural deaths (1.5%) in 2017.

Table 2: Non-natural deaths by province, South Africa 2017

Province	Unweighted		Weighted	
	N	%	N	%
Eastern Cape	3 472	15.2	7 729	14.1
Free State	2 633	11.5	3 361	6.1
Gauteng	5 340	23.4	13 620	24.9
Kwazulu Natal	4 876	21.4	11 655	21.3
Limpopo	1 968	8.6	3 936	7.2
Mpumalanga	2 034	8.9	2 974	5.4
North West	1 902	8.3	2 493	4.6
Northern Cape	597	2.6	792	1.5
Western Cape			8 174	14.9
Total	**22 822**	**100.0**	**54 734**	**100.0**

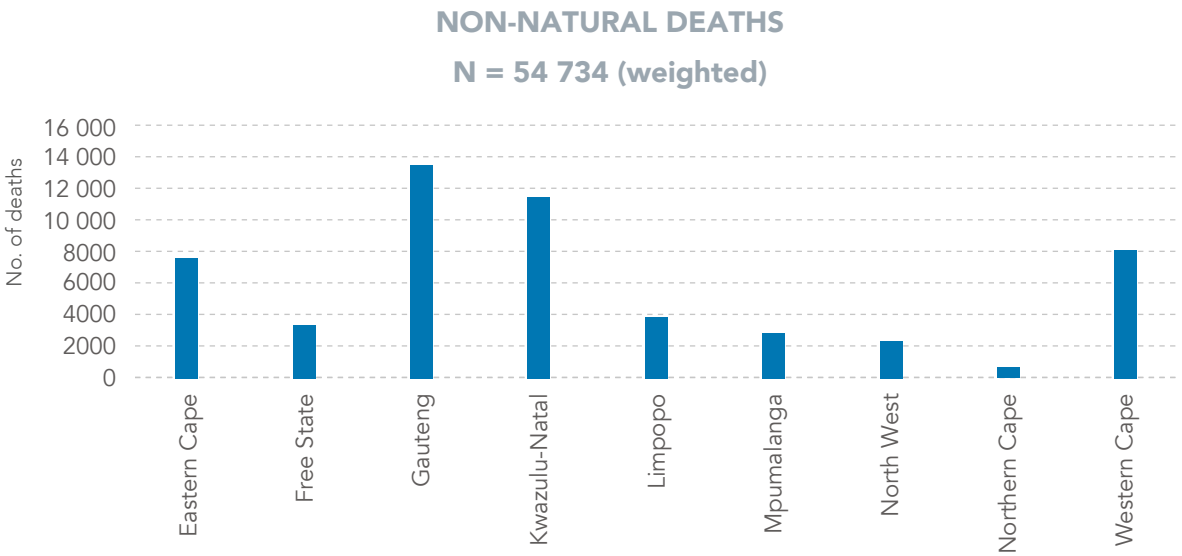


Figure 1: Distribution of non-natural deaths by province (weighted analysis), South Africa 2017 (N = 54 734)

The age profile for non-natural deaths indicated an increase from the age of 15 years, and peaked between the ages of 20 and 34 years, which accounted for 42.3% of deaths, after which it declined among the older ages (Table 3). The age-sex profile differed: females under 15 years of age had a higher proportion of non-natural deaths than males, both sexes had similar levels for the 15–19 year age group and more male than female non-natural deaths were found between 20–34 years. There were nearly four male non-natural deaths for every female death.

Table 3: Age distribution of non-natural deaths by sex, South Africa 2017

	Sex (weighted)							
	Male		Female		Unknown		Total	
Age	n	%	n	%	n	%	N	%
<1	509	1.2	440	3.9	11	3.1	961	1.8
1–4	769	1.8	568	5.0	3	0.9	1 340	2.5
5–9	682	1.6	360	3.2	0	0.0	1 042	1.9
10–14	620	1.4	312	2.7	0	0.0	933	1.7
15–19	2 255	5.3	778	6.8	9	2.4	3 041	5.6
20–24	5 662	13.2	1 095	9.6	5	1.4	6 762	12.4
25–29	7 239	16.8	1 250	11.0	2	0.6	8 491	15.5
30–34	6 611	15.4	1 253	11.0	6	1.7	7 871	14.4
35–39	4 727	11.0	883	7.7	10	2.7	5 619	10.3
40–44	3 339	7.8	732	6.4	3	0.9	4 074	7.4
45–49	2 591	6.0	691	6.1	8	2.2	3 289	6.0
50–54	2 023	4.7	642	5.6	9	2.5	2 674	4.9
55–59	1 549	3.6	502	4.4	2	0.5	2 053	3.8
60–64	1 277	3.0	466	4.1	0	0.0	1 743	3.2
65–69	854	2.0	351	3.1	0	0.0	1 205	2.2
70–74	520	1.2	282	2.5	0	0.0	803	1.5
75–79	364	0.9	236	2.1	0	0.0	601	1.1
80–84	160	0.4	161	1.4	2	0.6	323	0.6
85+	163	0.4	176	1.6	3	0.8	342	0.6
Unknown	1 069	2.5	218	1.9	281	79.8	1 568	2.9
Total	**42 985**	**100.0**	**11 398**	**100.0**	**352**	**100.0**	**54 734**	**100.0**

Apparent manner of death in initial mortuary register vs post-mortem

The apparent manner of death in the mortuary register as compared to the apparent manner determined after the post-mortem investigation differed marginally across all manners of death (Table 4). The proportion of undetermined deaths had a marginal decrease from 11.3% in the register to 10.8% following the post-mortem investigation. This did not include the Western Cape deaths, supplied by the Western Cape FPS electronic mortuary surveillance database, which did not include the apparent manner of death as recorded in the register, prior to the post-mortem investigation.

Table 4: Apparent manner of death, register vs post-mortem (excludes the Western Cape)

Apparent manner of death	Register (weighted*)		After post-mortem (weighted*)	
	n	%	n	%
Homicide	15 780	33.9	15 697	33.7
Suicide	5 455	11.7	5 533	11.9
Transport	13 267	28.5	13 308	28.6
Other unintentional	6 795	14.6	7 007	15.1
Undetermined	5 263	11.3	5 016	10.8
Total	**46 560**	**100.0**	**46 560**	**100.0**

**Western Cape deaths for 2017 were supplied by the Western Cape Forensic Pathology Services database and not included in the register vs weighted post-mortem numbers above.*

Apparent manner of death, after post-mortem

The analyses to follow will include weighted estimates for all non-natural deaths, including the Western Cape data. Homicide (35.6%), followed by transport (27.1%), were the leading apparent manners of death. The proportion of other unintentional deaths (15.3%) were higher than suicide (11.3%) (Figure 2). For 10.7% of cases, the apparent manner of death could not be determined. The apparent manner of death for each province is shown in Figures I-IX in Appendix II.

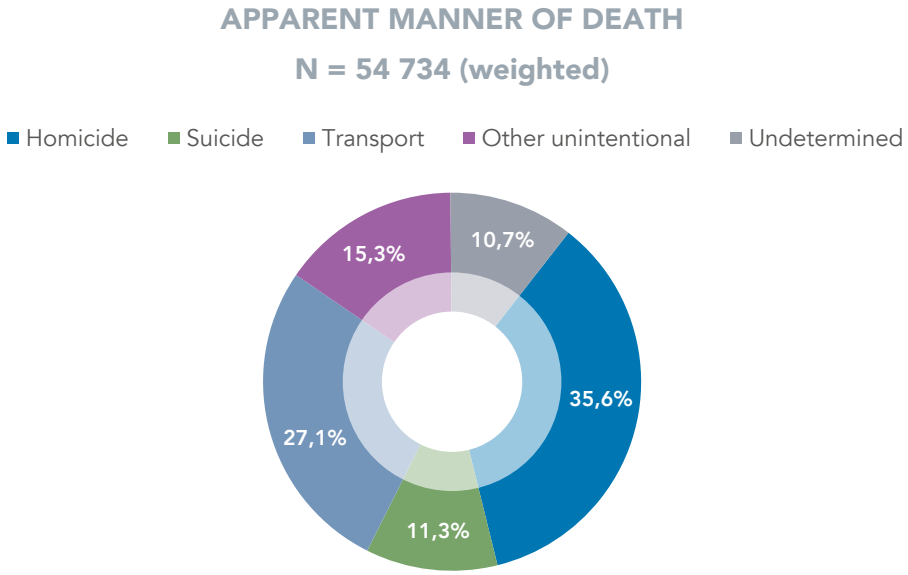


Figure 2: Apparent manner of death after post-mortem (weighted analysis), South Africa 2017 (N = 54 734)

Table 5 shows that nearly 80% of non-natural deaths were male and approximately 21% were female. The M:F ratio was highest for homicide, with 6.5 male deaths for every female death. This was followed by suicide (4.2), transport deaths (3.4) and other unintentional deaths (2.3).

Table 5: Sex distribution by apparent manner of death, South Africa 2017

	Apparent manner of death (weighted)											
	Homicide		Suicide		Transport		Other unintentional		Undetermined intent		Total	
	n	%	n	%	n	%	n	%	n	%	N	%
Male	16 835	86.4	4 982	80.7	11 473	77.3	5 845	69.8	3 850	65.7	42 985	78.5
Female	2 583	13.3	1 184	19.2	3 359	22.6	2 515	30.0	1 757	30.0	11 398	20.8
Undetermined	59	0.3	9	0.2	16	0.1	18	0.2	250	4.3	352	0.6
Total	**19 477**	**100.0**	**6 175**	**100.0**	**14 848**	**100.0**	**8 378**	**100.0**	**5 857**	**100.0**	**54 734**	**100.0**

Work-related injuries

Death as a result of work-related injuries was reported in 339 (0.8%) of the non-natural death post-mortem folders (Table 6). Of these, 63.5% were other unintentional injuries, 20.2% were transport-related and 13.5% were homicide. As a result of the small number of cases recorded, these deaths were included among the analysis of each apparent manner of death and not reported elsewhere.

Table 6: Work-related injuries* by Apparent manner of death, South Africa 2017

Manner of death (weighted)	Yes		No		Unknown		Total	
	n	%	n	%	n	%	N	%
Homicide	46	13.5	14 646	34.6	270	22.4	14 962	34.1
Suicide	0	0.0	5 301	12.5	33	2.7	5 334	12.1
Transport	68	20.2	12 167	28.7	632	52.3	12 867	29.3
Other unintentional	215	63.5	6 173	14.6	154	12.8	6 542	14.9
Undetermined	9	2.8	4 108	9.7	118	9.8	4 236	9.6
Total	**339**	**100.0**	**42 395**	**100.0**	**1207**	**100.0**	**43 940**	**100.0**

**Death as a result of injury, which have occurred during hours of employment. This was not specifically recorded in the Western Cape database.*

Death in custody

Death in custody was reported in 140 (0.3%) of the non-natural death post-mortem folders (Table 7). Of these, 37.7% were suicide, 27.1% were homicide, 16.0% were other unintentional and 12.6% were transport deaths.

Table 7: Death in custody* by Apparent manner of death, South Africa 2017

Manner of death (weighted)	Yes		No		Unknown		Total	
	n	%	n	%	n	%	N	%
Homicide	38	27.1	14 918	34.1	6	9.6	14 962	34.1
Suicide	53	37.7	5 282	12.1	0	0.0	5 334	12.1
Transport	18	12.6	12 837	29.4	12	20.6	12 867	29.3
Other unintentional	22	16.0	6 514	14.9	5	8.8	6 542	14.9
Undetermined	9	6.5	4 192	9.6	35	61.0	4 236	9.6
Total	**140**	**100.0**	**43 743**	**100.0**	**57**	**100.0**	**43 940**	**100.0**

**Death in custody refers to those non-natural deaths that occurred in police or correctional services custody and was only captured if specifically stated in the post-mortem folder. This variable was not specifically recorded in the Western Cape database.*

NATIONAL AND PROVINCIAL INJURY MORTALITY RATES

Age-specific and age-standardised injury mortality rates are summarised in Table 8. The national age-standardised mortality rate for all injuries was 100.3 per 100 000 population and the rate for males was nearly four times higher than for females. The age-specific all-injury mortality rate peaked in the 30–44 year age group at 136 per 100 000 and the rate for children under 5 years of age (40.1 per 100 000) was double the rate in the 5–14 year age group (19 per 100 000). The provincial age-standardised all-injury mortality rate (Table 9) was highest in the Eastern Cape (125.2 per 100 000), followed by the Free State (124.7 per 100 000) and the Western Cape (123.6 per 100 000).

National and Provincial Homicide rates

The national age-standardised homicide rate was 34.5 per 100 000 population (Table 8). When the age-specific rates for homicide were compared, the 15–29 and 30–44 year age groups were highest at 57 and 52.5 per 100 000 respectively. The high rates for these age groups were largely due to the high number of homicides among males, who overall had a homicide rate that was 6.6 times higher than for females. The provincial age-standardised homicide rate (Table 9) was lowest in Limpopo (14.7 per 100 000) and highest in the Eastern Cape (55.8 per 100 000) and the Western Cape (55 per 100 000). The high homicide rate in the Western Cape is largely due to the high rate of firearm homicide (23.2 per 100 000) (Table 9).

National and Provincial Road Traffic mortality rates

The national age-standardised road traffic mortality rate of 25.6 per 100 000 population (Table 8) was 1.3 times lower than the national homicide rate. Road traffic mortality rates were generally higher from the age of 15 years and peaked in the 30–44 year age group at 37.5 per 100 000 population. The male road traffic mortality rate (40.9 per 100 000) was 3.6 times higher than for females (11.5 per 100 000). The provincial age-standardised road traffic mortality rate (Table 9) was lowest in the Western Cape (20.7 per 100 000) and Gauteng (20.8 per 100 000) and highest in the Free State (35.5 per 100 000), Limpopo (32.3 per 100 000) and KwaZulu-Natal (30 per 100 000).

National and Provincial Suicide rates

The national age-standardised suicide rate (Table 8) was 11.3 per 100 000 population and the suicide rate for males was 4.5 times higher than for females. The age-specific suicide rate showed a peak in the 30–44 year age group at 16.4 per 100 000 population. The provincial age-standardised suicide rate (Table 9) was highest in KwaZulu-Natal (15.1 per 100 000) and the Free State (14.7 per 100 000).

National and Provincial Other unintentional injury mortality rates

The national age-standardised other unintentional injury (Table 8) mortality rate (16.2 per 100 000) was higher than the national, age-standardised suicide rate and peaked among the elderly. It was the leading manner of non-natural death for children under 5 years of age. The provincial age-standardised other unintentional injury mortality rate (Table 9) was highest in the Western Cape (22.5 per 100 000) and Gauteng (21 per 100 000).

Table 8: National age-specific and age-standardised injury mortality rates* (per 100 000 population), South Africa 2017

	0-4			5-14			15-29			30-44			45-59			60-69			70-79			80+			Total Age std.		
	M	F	P	M	F	P	M	F	P	M	F	P	M	F	P	M	F	P	M	F	P	M	F	P	M	F	P
Homicide	5.3	3.0	4.2	2.3	1.4	1.9	101.2	12.1	57.0	93.0	11.8	52.5	55.4	9.5	30.4	37.3	9.8	21.6	30.2	9.1	17.2	19.1	14.5	16.0	60.6	9.2	34.5
-firearm	0.7	0.3	0.5	0.8	0.3	0.5	29.3	3.3	16.4	35.4	3.2	19.3	22.5	2.7	11.7	15.7	3.3	8.6	6.8	2.0	3.8	7.7	0.9	3.0	20.5	2.4	11.2
-non-firearm	4.6	2.7	3.7	1.6	1.1	1.3	71.8	8.8	40.6	57.6	8.6	33.2	33.0	6.8	18.7	21.6	6.5	13.0	23.5	7.2	13.4	11.3	13.5	12.9	40.1	6.8	23.3
Transport	8.1	6.3	7.2	8.7	5.9	7.3	48.0	12.9	30.6	64.8	14.6	39.7	55.3	15.0	33.4	45.5	12.0	26.3	45.5	11.8	24.8	32.0	9.1	16.6	43.8	12.0	27.2
-road traffic	7.6	6.3	7.0	8.3	5.7	7.0	44.9	12.4	28.8	60.7	14.1	37.5	52.0	14.1	31.4	42.9	11.8	25.1	43.6	10.5	23.4	29.6	8.4	15.0	40.9	11.5	25.6
-other transport	0.6	0.0	0.3	0.4	0.2	0.3	3.1	0.4	1.7	4.1	0.4	2.3	3.2	1.0	2.0	2.6	0.2	1.2	1.8	1.3	1.5	2.2	0.6	1.5	2.9	0.5	1.7
Suicide	0.0	0.0	0.0	2.5	1.0	1.7	24.6	6.1	15.4	27.6	5.3	16.4	22.3	5.5	13.1	22.4	3.8	11.7	17.2	3.8	9.0	23.2	3.6	9.7	19.1	4.2	11.3
Other unintentional	19.2	13.9	16.6	9.7	3.5	6.6	16.8	5.8	11.4	24.7	7.3	16.0	27.4	9.1	17.5	41.2	15.5	26.4	45.1	25.0	32.8	62.6	38.2	45.7	23.9	9.2	16.2
Undetermined	11.6	12.2	12.1	1.7	1.2	1.5	10.6	5.3	8.0	17.0	5.6	11.3	20.0	5.8	12.4	26.2	8.3	16.0	25.5	10.2	16.1	22.2	9.5	13.8	15.8	6.3	11.2
All injuries	44.2	35.4	40.1	24.9	13.0	19.0	201.2	42.1	122.4	227.0	44.5	136.0	180.3	44.9	106.8	172.6	49.3	102.0	163.6	60.0	99.9	159.1	74.8	101.7	163.0	41.0	100.3

**Rates sub-categories may not add up due to rounding*
M= Male F= Female P= Persons

Table 9: Age-standardised injury mortality rates* (per 100 000 population) by province, 2017

	EC			FS			GT			KZN			LM			MP			NW			NC			WC		
	M	F	P	M	F	P	M	F	P	M	F	P	M	F	P	M	F	P	M	F	P	M	F	P	M	F	P
Homicide	98.6	18.0	55.8	70.4	10.2	39.6	47.4	7.1	27.9	75.4	11.2	41.0	27.7	3.9	14.7	27.1	5.3	16.0	32.8	5.9	19.8	39.4	8.9	24.2	101.4	9.3	55.0
-firearm	18.0	4.2	10.4	15.5	1.6	8.4	20.4	2.1	11.4	28.2	3.8	15.0	8.5	0.8	4.2	7.3	0.6	3.8	6.2	0.8	3.6	2.3	0.0	1.2	44.0	2.6	23.2
-non-firearm	80.6	13.8	45.4	54.9	8.6	31.2	27.0	5.0	16.5	47.2	7.4	26.1	19.2	3.2	10.4	19.8	4.6	12.2	26.5	5.0	16.3	37,0	8.9	23.1	57.4	6.7	31.9
Transport	43.3	10.7	25.5	56.4	20.8	37.6	36.7	9.8	23.3	50.5	14.1	30.9	59.5	13.6	34.0	46.1	12.3	28.4	38.5	12.4	25.5	38.4	14.0	26.1	38.5	9.1	23.4
-road traffic	41.8	10.6	24.7	52.8	20.0	35.5	32.7	9.0	20.8	48.8	13.8	30.0	56.5	13.1	32.3	45.0	12.1	27.9	37.0	12.1	24.6	35.7	13.1	24.3	33.5	8.6	20.7
-other transport	1.5	0.2	0.8	3.6	0.8	2.1	4.0	0.8	2.4	1.7	0.3	0.9	4.8	0.5	1.7	1.1	0.2	0.6	1.5	0.3	0.9	2.7	0.9	1.8	5.0	0.6	2.7
Suicide	25.5	3.1	13.4	24.5	6.2	14.7	16.0	4.3	10.2	26.5	5.3	15.1	15.6	2.7	8.3	16.2	3.5	9.6	14.3	3.2	8.8	15.9	4.8	10.2	15.2	4.6	9.7
Other unintentional	29.1	7.7	17.5	28.5	8.0	17.6	28.5	13.7	21.0	24.6	9.1	16.1	11.5	3.7	7.1	12.5	6.1	9.2	9.9	3.3	6.6	17.1	7.0	11.8	31.7	14.1	22.5
Undetermined	19.9	6.7	13.0	24.0	6.8	15.1	16.2	7.4	12.2	15.1	5.2	10.0	21.5	5.9	13.2	9.9	3.7	6.6	10.2	4.7	7.8	4.3	1.6	3.1	15.0	9.7	12.8
All injuries	216.3	46.4	125.2	203.7	52.0	124.7	144.7	42.3	94.6	192.1	44.8	113.0	135.8	29.7	77.2	111.7	30.8	69.8	105.7	29.5	68.5	114.9	36.4	75.4	201.7	46.8	123.6

**Rates sub-categories may not add up due to rounding*
M= Male F= Female P= Persons
Provinces: EC: Eastern Cape, FS: Free State, GT: Gauteng, KZN: KwaZulu-Natal, LM: Limpopo, MP: Mpumalanga, NW: North-West, NC: Northern Cape, WC: Western Cape

Mechanism of non-natural deaths for each apparent manner of death

The following section provides a more detailed profile of the non-natural deaths according to each apparent manner of death (homicide, suicide, transport, other unintentional injuries and injury deaths due to undetermined intent). In all cases, it is the weighted numbers that have been applied to reflect the estimated total of 54 734 injury deaths occurring in 2017.

HOMICIDE

Of the estimated 19 477 homicides, 16 835 (86.4%) were male (Table 10). Overall, 54% of homicides occurred between the ages of 20 and 34 years. Homicide peaked in the 25–29 year age groups for both males and females, thereafter decreasing with advancing age (Figure 3 and Table 10). Approximately 2% of homicides were perpetrated against children younger than 15 years of age. For less than 1% of homicides, the sex of the decedent was unknown and was not included in Figure 3 below.

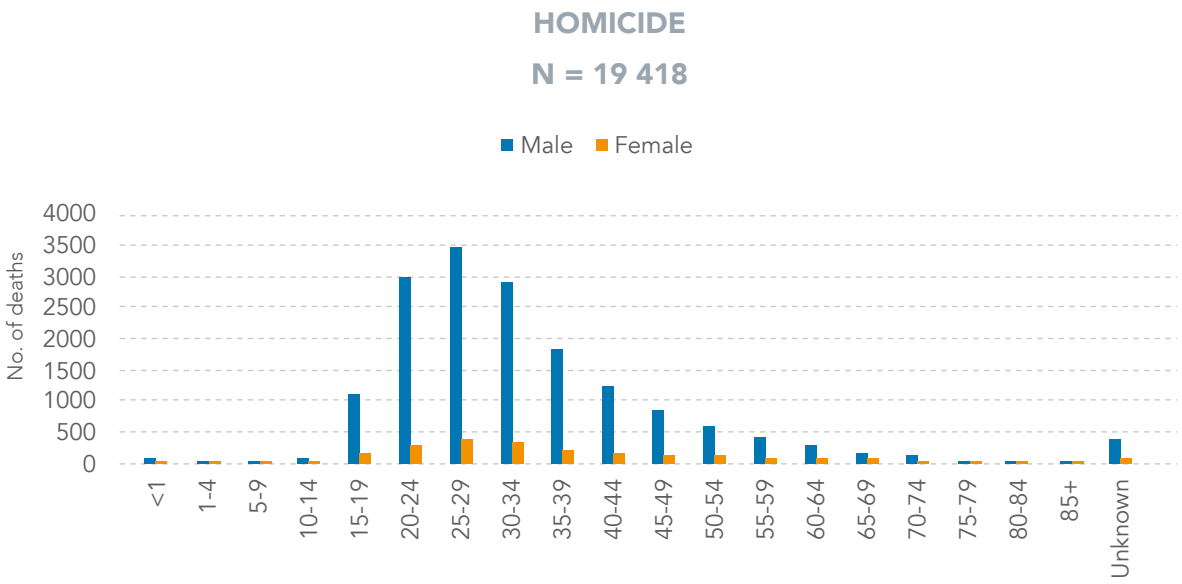


Figure 3: Distribution of homicides by age and sex, South Africa 2017 (N* = 19 418)
** The N in Fig. 3 excludes unknown sex.*

Table 10: Age distribution of homicide by sex, South Africa 2017

	Homicide (weighted)							
	Male		Female		Unknown		Total	
Age	n	%	n	%	n	%	N	%
<1	107	0.6	49	1.9	2	3.4	158	0.8
1–4	46	0.3	35	1.4	0	0.0	81	0.4
5–9	47	0.3	26	1.0	0	0.0	73	0.4
10–14	75	0.5	44	1.7	0	0.0	119	0.6
15–19	1 129	6.7	161	6.2	2	3.4	1 292	6.6
20–24	3 007	17.9	326	12.6	1	1.7	3 334	17.1
25–29	3 485	20.7	411	15.9	1	1.7	3 897	20.0
30–34	2 942	17.5	342	13.3	6	9.9	3 291	16.9
35–39	1 838	10.9	234	9.1	0	0.0	2 071	10.6
40–44	1 232	7.3	184	7.1	0	0.0	1 415	7.3
45–49	866	5.1	146	5.6	2	3.5	1 013	5.2
50–54	607	3.6	144	5.6	0	0.0	750	3.9
55–59	421	2.5	98	3.8	0	0.0	519	2.7
60–64	290	1.7	92	3.6	0	0.0	381	2.0
65–69	171	1.0	70	2.7	0	0.0	242	1.2
70–74	114	0.7	40	1.5	0	0.0	154	0.8
75–79	49	0.3	39	1.5	0	0.0	88	0.5
80–84	26	0.2	29	1.1	0	0.0	55	0.3
85+	12	0.1	37	1.4	0	0.0	49	0.3
Unknown	371	2.2	77	3.0	45	76.4	493	2.5
Total	**16 835**	**100.0**	**2 583**	**100.0**	**59**	**100.0**	**19 477**	**100.0**

Table 11 shows that sharp force was the leading mechanism of homicide for both males (42.0%) and females (34.3%). For males, this was followed by firearms (33.4%) and blunt force (18.5%). This was similar for females, where firearms (25.5%) were the second leading mechanism of homicide, followed by blunt force (21.1%). Overall, 32.2% of homicides were firearm-related. Strangulation deaths were higher in females (7.1%) than in males (1.0%). Concealed pregnancies/abandoned foetuses accounted for 1% of the homicides. Less than 1% of homicides were due to a legal intervention (data not shown).

Table 11: Mechanism of homicide by sex, South Africa 2017

	Homicide (weighted)							
	Male		Female		Unknown		Total	
Mechanisms	n	%	n	%	n	%	N	%
Sharp force (cut / stabbed)	7 071	42.0	885	34.3	5	8.2	7 961	40.9
Firearm Discharge	5 616	33.4	659	25.5	0	0.0	6 275	32.2
Blunt force (beaten with object, punche	3 111	18.5	544	21.1	6	10.2	3 661	18.8
Strangled	171	1.0	184	7.1	0	0.0	355	1.8
Fire /other burn	125	0.7	43	1.7	0	0.0	168	0.9
Concealed pregnancy/abandoned foetus	99	0.6	68	2.6	30	51.7	197	1.0
Poison, ingestion	37	0.2	21	0.8	2	3.5	60	0.3
Asphyxiated/Suffocated	37	0.2	45	1.8	0	0.0	82	0.4
Pushed from height	11	0.1	2	0.1	0	0.0	13	0.1
Drowning, immersion	9	0.1	4	0.2	0	0.0	13	0.1
Poison, gassing	8	0.1	0	0.0	0	0.0	8	0.0
Electrocution	3	0.0	2	0.1	0	0.0	5	0.0
Crushing	2	0.0	0	0.0	0	0.0	2	0.0
Maternal death/abortion-related	0	0.0	5	0.2	0	0.0	5	0.0
Other	53	0.3	31	1.2	8	12.8	91	0.5
Missing folder/Storage	451	2.7	86	3.3	8	13.6	546	2.8
Unknown	31	0.2	4	0.2	0	0.0	36	0.2
Total	**16 835**	**100.0**	**2 583**	**100.0**	**59**	**100.0**	**19 477**	**100.0**

Table 12 and Figure 4 show a comparison of firearm and non-firearm (i.e. sharp force, blunt force, strangled, etc.) homicide by province. The Western Cape, followed by Gauteng and KwaZulu-Natal had the highest proportion of firearm homicide, with more than one-third of deaths being due to a single mechanism. Overall for homicide nearly one-quarter (4 378 deaths) occurred in Gauteng, followed by KwaZulu-Natal, and the Western Cape. The Eastern Cape also had high levels of homicide but had a similar profile of firearm and non-firearm deaths to other provinces with lower levels of homicide.

Table 12: Firearm and non-firearm homicide by province, South Africa 2017

	Homicide (weighted)					
	Firearm		Non-firearm		Total	
Province	n	%	n	%	N	%
Eastern Cape	626	18.2	2 818	81.8	3 444	100.0
Free State	235	21.3	870	78.7	1 105	100.0
Gauteng	1 783	40.7	2 595	59.3	4 378	100.0
Kwazulu Natal	1 520	35.2	2 798	64.8	4 318	100.0
Limpopo	210	28.1	538	71.9	748	100.0
Mpumalanga	159	22.6	546	77.4	705	100.0
North West	131	17.7	610	82.3	741	100.0
Northern Cape	12	4.5	247	95.5	258	100.0
Western Cape	1 600	42.3	2 180	57.7	3 780	100.0
Total	**6 275**	**32.2**	**13 202**	**67.8**	**19 477**	**100.0**

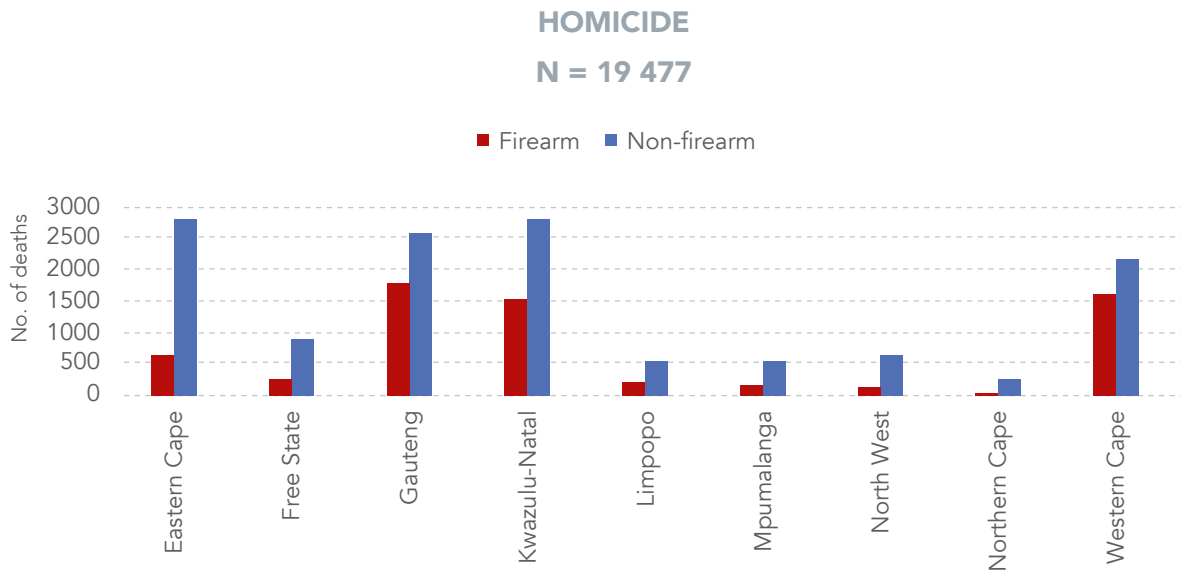


Figure 4: Firearm and non-firearm homicide by province, South Africa 2017 (N = 19 477)

Multiple injuries were noted for 15% of the 18 735 homicides for which this information was recorded (Table 13). This information was not specifically captured in the Western Cape database, except for less than 1% of cases. Nearly 15% of males and 16.7% of females had multiple injuries. The Free State province had the highest proportion of multiple injuries (35.9%), followed by the Eastern Cape (24.4%).

Table 13: Multiple types of injuries for homicide by sex and province, South Africa 2017

Sex (weighted)	n	%
Male (n= 16 286)	2 426	14.9
Female (n= 2 428)	405	16.7
Undetermined (n= 20)	2	9.8
Province (weighted)		
Eastern Cape (n= 3 336)	815	24.4
Free State (n= 1 069)	384	35.9
Gauteng (n= 3 913)	690	17.6
Kwazulu-Natal (n= 4 263)	811	19.0
Limpopo (n= 736)	38	5.2
Mpumalanga (n= 681)	35	5.1
North West (n= 709)	35	4.9
Northern Cape (n= 248)	7	3.0
Western Cape* (n= 3 780)	18	0.5
Total (n= 18 735)	**2 833**	**15.1**

**The Western Cape database did not include this as a specific variable for capture, hence data for particular variables may be under-represented.*

A sexual assault kit was used during the post-mortem process, for 366 (2%) of the 18 667 homicides for which this was recorded (Table 14). This was done for 12.7% of female homicide and less than 1% of male homicide.

Table 14: Sexual Assault kit used

Sex (weighted)	n	%	Total*
Male	62	0.4	16 254
Female	304	12.7	2 393
Undetermined	0	0.0	19
Total	366	2.0	18 666

**Unknown removed from total*

The monthly distribution of homicides is shown in Figure 5 for males and females, excluding the cases with unknown sex. For males, homicide levels were consistently high throughout the year, with a peak in December (11.3%) and some monthly variation. Female homicide did not have any noticeable peaks, but was highest in April (10.2%) and December (10.2%).

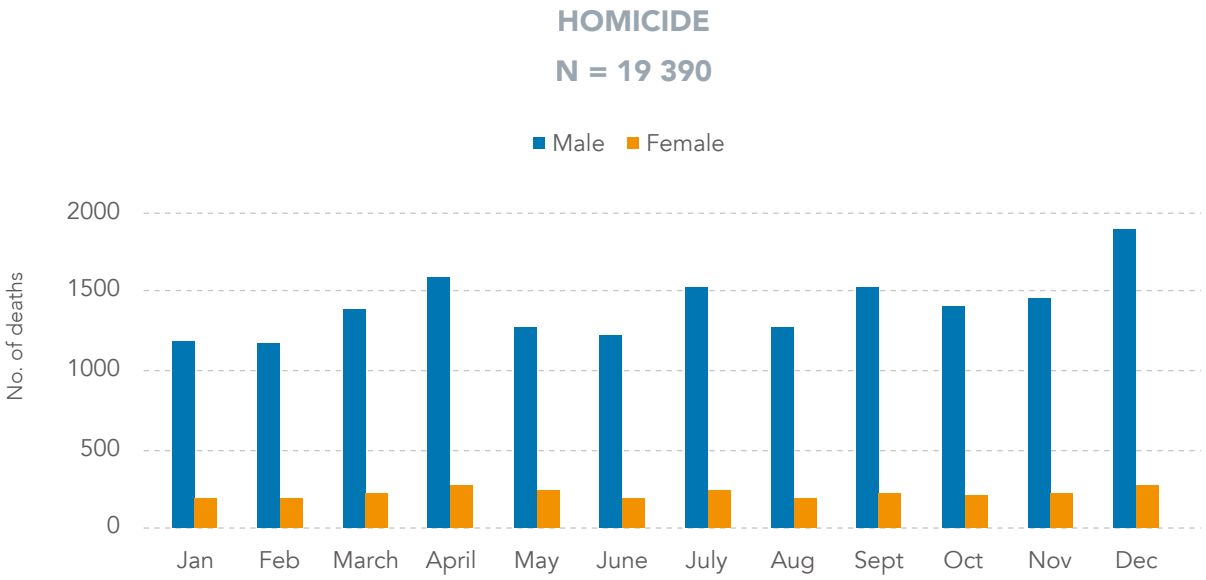


Figure 5: Distribution of homicide by month and sex, South Africa 2017 (N = 19 390)

Figure 6 indicates that deaths peaked on Sundays for both sexes, and nearly 58% of the deaths occurred over the weekend (Friday to Sunday).

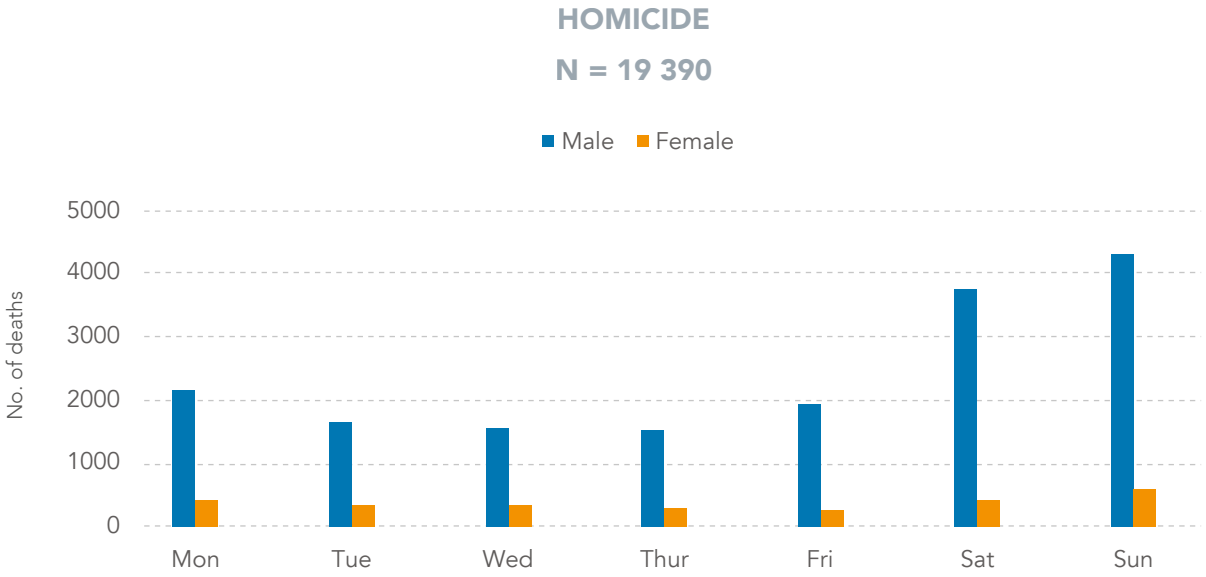


Figure 6: Distribution of homicide by week and sex, South Africa 2017 (N = 19 390)

The blood alcohol concentration (BAC) was tested and recorded in the post-mortem folder for 3 363 homicides (17.3% of all homicides) (Table 15). Of these, more than half tested positive for alcohol and most of these (46.1% of the total) were in excess of the driving limit (≥0.05 g/100ml) when tested. Sharp force homicide had the highest proportion (61.1%) with high alcohol levels. In addition, excessive BACs were recorded for more than 60% of homicides that occurred on a Saturday and Sunday, and more than 50% of homicides during July and December.

Table 15: Blood Alcohol Concentration* by leading mechanism of homicide, day- and month of death

	0 g/100ml %	0.01-0.049 g/100ml %	≥0.05 g/100ml %
Homicide with available BAC results* (n= 3 363)	47.2	6.7	46.1
Leading mechanism of homicide			
Sharp force (n= 1 559)	34.1	4.8	61.1
Firearms (n= 1 302)	60.3	8.3	31.4
Blunt force (n= 415)	53.9	9.3	36.8
Strangled (n= 36)	54.4	15.2	30.4
Day of death			
Monday (n= 428)	55.2	6.0	38.8
Tuesday (n= 317)	69.9	7.6	22.6
Wednesday (n= 320)	74.6	4.7	20.7
Thursday (n= 267)	72.4	5.1	22.5
Friday (n= 349)	59.4	8.5	32.1
Saturday (n= 815)	26.2	8.6	65.3
Sunday (n= 866)	31.8	5.6	62.6
Month of death			
January (n= 223)	48.1	8.3	43.6
February (n= 269)	46.8	8.0	45.2
March (n= 230)	50.5	5.4	44.0
April (n= 316)	44.8	8.9	46.3
May (n= 267)	54.4	6.9	38.6
June (n= 260)	50.1	1.9	48.0
July (n= 330)	38.1	7.7	54.2
August (n= 287)	50.0	4.5	45.5
September (n= 263)	49.5	7.0	43.5
October (n= 270)	45.1	5.9	49.0
November (n= 323)	54.6	6.8	38.6
December (n= 325)	37.9	8.3	53.8

**Results reflect only those cases where the BAC was recorded in the post-mortem folder*

SUICIDE

Of the estimated 6 175 suicides, 80.7% were male (Table16). Figure 7 and Table 16 show that suicides peaked among those between 25 and 29 years of age (16.8%), followed by the 30–34 year age group (15.8%). For females, suicide peaked at the younger ages of between 15 and 19 years (14.1%), and for males between 25 and 29 years (18.1%). Overall, more than half of all suicides occurred between the ages of 20 and 39 years.

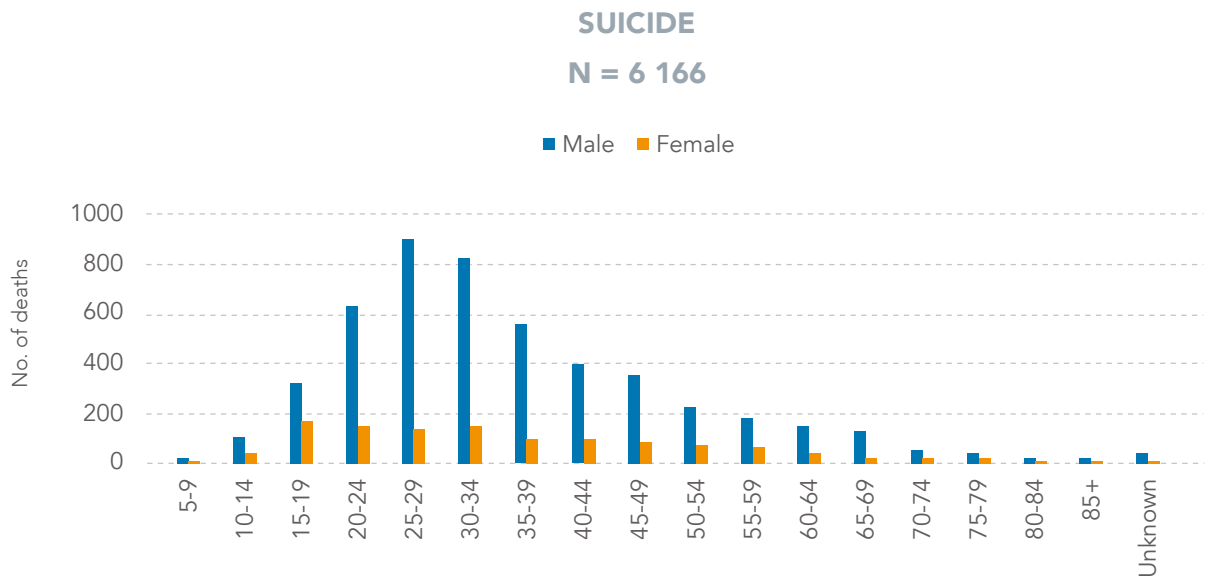


Figure 7: Distribution of suicide by age and sex, South Africa 2017 (N = 6 166)

Table 16: Age distribution of suicide by sex, 2017

	Suicide (weighted)							
	Male		Female		Unknown		Total	
Age	n	%	n	%	n	%	N	%
5-9	18	0.4	7	0.6	0	0.0	25	0.4
10-14	112	2.2	44	3.7	0	0.0	156	2.5
15-19	320	6.4	167	14.1	0	0.0	486	7.9
20-24	634	12.7	146	12.3	0	0.0	780	12.6
25-29	900	18.1	139	11.8	0	0.0	1 039	16.8
30-34	827	16.6	147	12.5	0	0.0	975	15.8
35-39	556	11.2	100	8.5	2	22.2	658	10.7
40-44	399	8.0	91	7.7	0	0.0	490	7.9
45-49	359	7.2	85	7.2	0	0.0	444	7.2
50-54	221	4.4	77	6.5	0	0.0	298	4.8
55-59	180	3.6	62	5.3	0	0.0	243	3.9
60-64	152	3.1	39	3.3	0	0.0	191	3.1
65-69	123	2.5	24	2.0	0	0.0	147	2.4
70-74	51	1.0	18	1.5	0	0.0	69	1.1
75-79	42	0.8	16	1.3	0	0.0	58	0.9
80-84	22	0.4	13	1.1	0	0.0	34	0.6
85+	25	0.5	4	0.3	0	0.0	29	0.5
Unknown	40	0.8	6	0.5	7	77.8	53	0.9
Total	**4 982**	**100.0**	**1 184**	**100.0**	**9**	**100.0**	**6 175**	**100.0**

Table 17 shows that hanging was the leading mechanism of suicide for both males (77.2%) and females (45.0%). For females, this was followed closely by poison ingestion (36.0%), while for males it was poison ingestion (8.7%) and firearms (7.4%). Females had a similar proportion of firearm suicides (7.1%) than males.

Table 17: Mechanism of suicide by sex, South Africa 2017

	Suicide (weighted)							
	Male		Female		Unknown		Total	
Mechanisms	n	%	n	%	n	%	N	%
Hanging	3 846	77.2	532	45.0	0	0.0	4 379	70.9
Poison, ingestion overdose)	435	8.7	426	36.0	2	22.2	863	14.0
Firearm Discharge	369	7.4	84	7.1	0	0.0	453	7.3
Poison, gassing	62	1.3	14	1.2	0	0.0	76	1.2
Jumped from height	43	0.9	22	1.9	0	0.0	65	1.1
Sharp force (cut / slit)	42	0.9	21	1.8	0	0.0	64	1.0
Fire /other burn	19	0.4	16	1.4	0	0.0	35	0.6
Railway pedestrian	11	0.2	3	0.3	0	0.0	14	0.2
Other	12	0.2	7	0.6	0	0.0	19	0.3
Missing folder/storage	134	2.7	58	4.9	7	77.8	198	3.2
Unknown	9	0.2	0	0.0	0	0.0	9	0.1
Total	**4 982**	**100.0**	**1 184**	**100.0**	**9**	**100.0**	**6 175**	**100.0**

Figure 8 shows that male suicides peaked in December (11%) and was lowest in February (6.4%). There were no strong peaks observed for females. However, suicide was generally highest in July and September (9.6% and 10.2% each), with the lowest proportion noted in March (6.5%). Figure 9 shows that suicide deaths peaked on a Sunday for males, accounting for 18.3% of suicides and a Monday for females (17.4%). Overall, approximately one-third of suicides occurred on Sundays and Mondays.

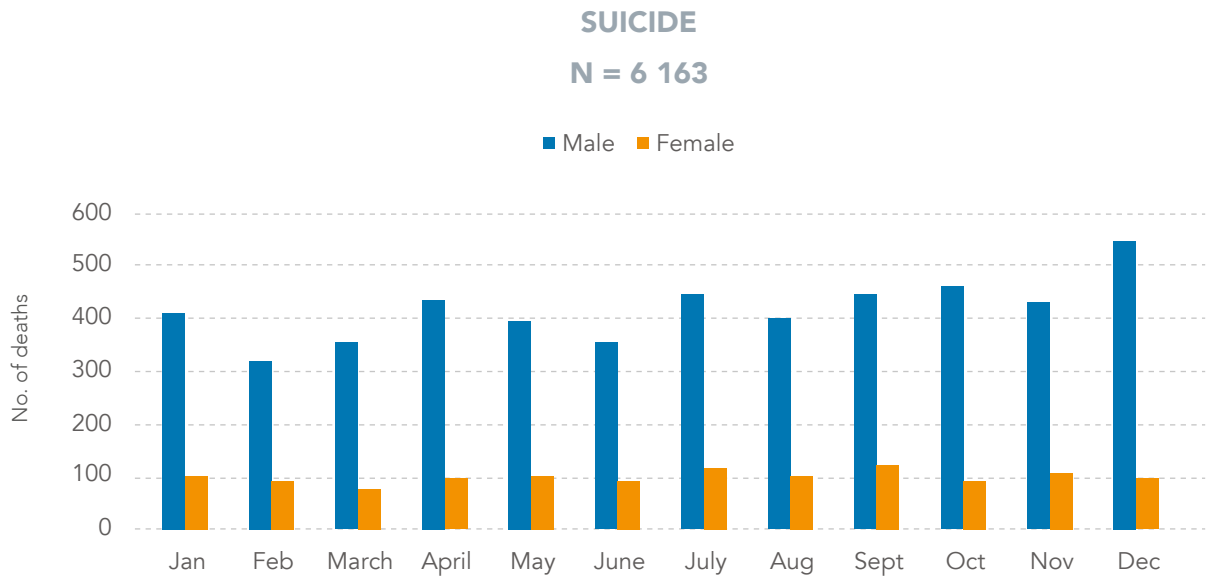


Figure 8: Distribution of suicide by month, South Africa 2017 (N = 6 163)

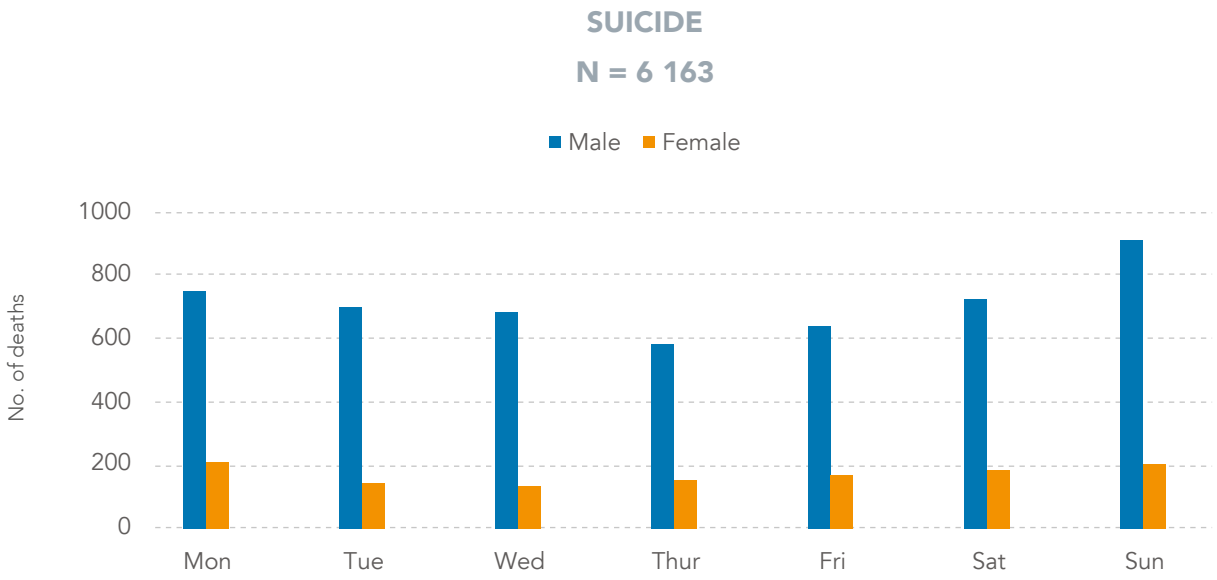


Figure 9: Distribution of suicide by week and sex, South Africa 2017 (N = 6 163)

TRANSPORT

Transport deaths constituted the second largest category of injury mortality after homicide and accounted for 27.1% of injury-related deaths. Road traffic injuries are an important sub-set (see Table 18) of transport injuries, accounting for 94% of all transport deaths. As they are often described independently of other transport injuries, this section provides separate tabulations and figures for road traffic injuries alongside those for all transport deaths including road, rail, water- and air-travel deaths.

Pedestrians (32.7%) were the leading category of male road traffic deaths, but for females, passenger deaths were the leading category, accounting for 48.3% (Table18). The category of road traffic deaths was unspecified for 14.1% of cases. For other transport deaths, rail pedestrian (33.8%) was the leading category. The folder was missing for 3% of all transport deaths, hence the percentage of missing folder information was noted under the "other transport" category.

Table 18: Mechanism of road traffic and other transport deaths by sex, South Africa 2017

	Transport (weighted)							
	Male		Female		Unknown		Total	
Mechanisms	n	%	n	%	n	%	N	%
Road traffic injuries:	**10 708**	**100.0**	**3 222**	**100.0**	**9**	**100.0**	**13 939**	**100.0**
MV pedestrian	3 634	33.9	924	28.7	4	42.9	4 563	32.7
MV passenger	2 359	22.0	1 555	48.3	3	32.2	3 917	28.1
MV driver	2 711	25.3	248	7.7	0	0.0	2 959	21.2
MV unspecified	1 495	14.0	462	14.3	2	25.0	1 960	14.1
MC driver	373	3.5	17	0.5	0	0.0	390	2.8
MC passenger	4	0.0	12	0.4	0	0.0	15	0.1
Bicycle	131	1.2	3	0.1	0	0.0	134	1.0
Other transport injuries:	**765**	**100.0**	**137**	**100.0**	**7**	**100.0**	**909**	**100.0**
Rail pedestrian	276	36.1	31	22.8	0	0.0	307	33.8
Rail passenger	36	4.7	2	1.5	0	0.0	38	4.2
Aviation casualty	19	2.5	2	1.1	0	0.0	20	2.2
Other	57	7.5	8	5.8	0	0.0	65	7.2
Missing folder/storage	342	44.7	93	67.7	7	100.0	441	48.5
Unknown	36	4.6	2	1.1	0	0.0	37	4.1
Total	**11 473**	**100.0**	**3 359**	**100.0**	**16**	**100.0**	**14 848**	**100.0**

For both road traffic and other transport injuries, the overwhelming majority of deaths were male (77% and 84% respectively). For road traffic injuries, 41.5% of deaths were recorded among those between 20 and 34 years of age, after which it declined (Figure 10 and Table 19). Other transport deaths peaked between 20–34 years for males, and the 30-34 and 50-54 year age groups for females (Figure 11). For all transport deaths, the M:F ratio peaked in the 25-29 years age category at 5:1.

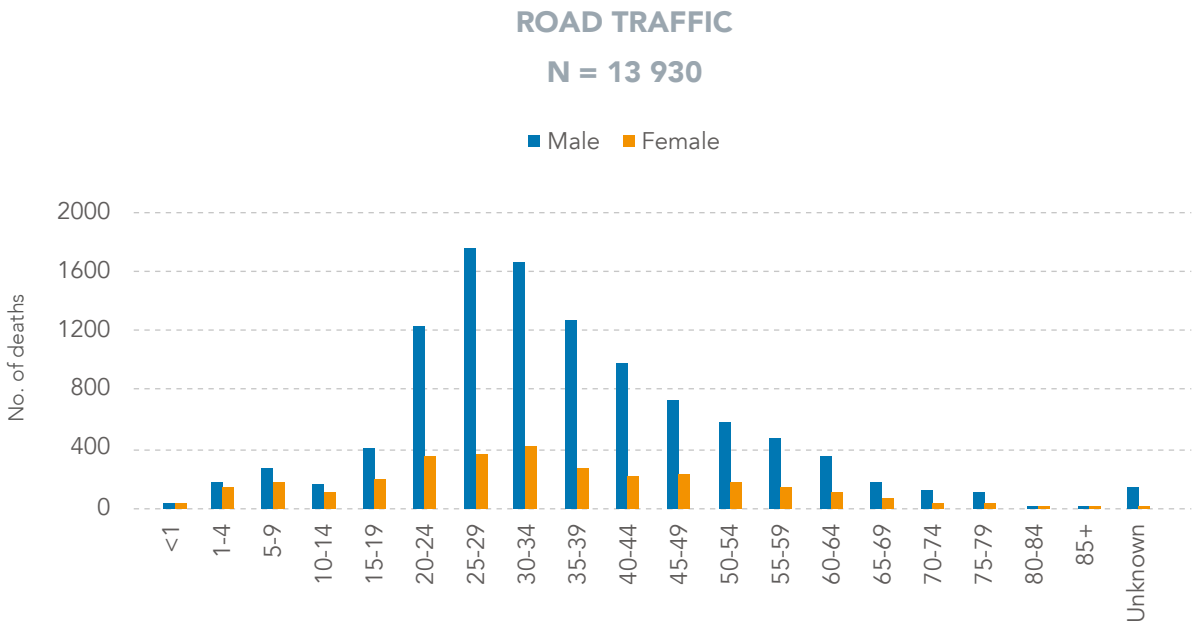


Figure 10: Distribution of road traffic deaths by age and sex, South Africa 2017 (N = 13 930)

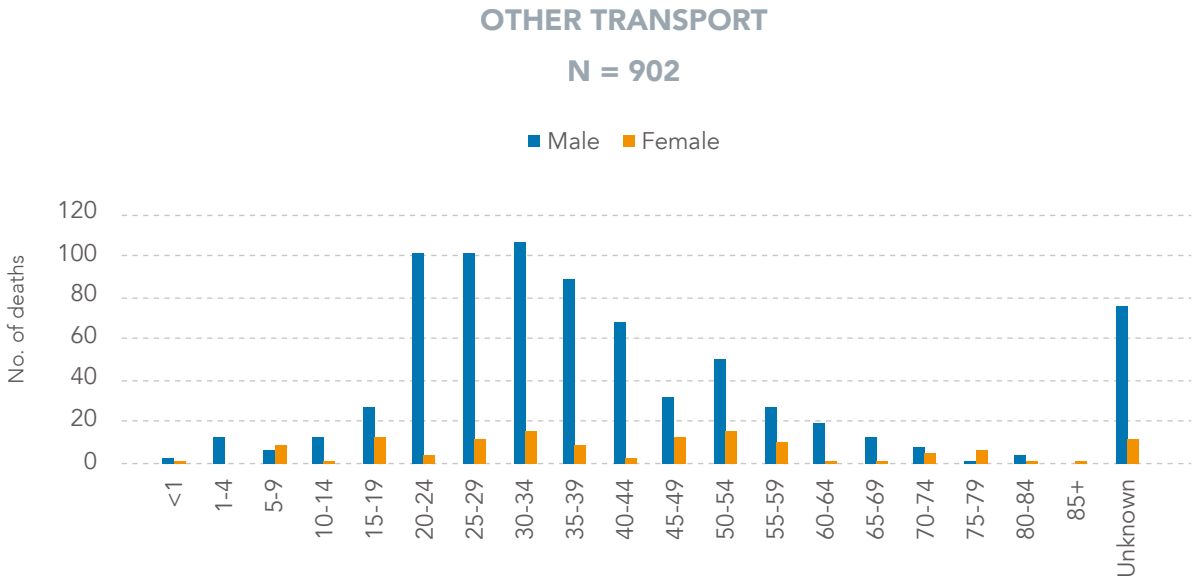


Figure 11: Distribution of other transport deaths by age and sex, South Africa 2017 (N = 902)

Table 19: Age distribution of transport and road traffic deaths by sex, South Africa 2017

	Transport (weighted)								Road traffic (weighted)							
	Male		Female		Unknown		Total		Male		Female		Unknown		Total	
Age	n	%	n	%	n	%	N	%	n	%	n	%	n	%	N	%
<1	42	0.4	35	1.1	0	0.0	77	0.5	39	0.4	34	1.1	0	0.0	74	0.5
1–4	193	1.7	145	4.3	0	0.0	338	2.3	180	1.7	145	4.5	0	0.0	325	2.3
5–9	278	2.4	189	5.6	0	0.0	468	3.2	271	2.5	181	5.6	0	0.0	452	3.2
10–14	177	1.5	116	3.5	0	0.0	293	2.0	164	1.5	115	3.6	0	0.0	279	2.0
15–19	433	3.8	224	6.7	0	0.0	657	4.4	406	3.8	211	6.5	0	0.0	617	4.4
20–24	1 326	11.6	360	10.7	0	0.0	1 687	11.4	1 224	11.4	356	11.0	0	0.0	1 580	11.3
25–29	1 857	16.2	369	11.0	0	0.0	2 226	15.0	1 754	16.4	357	11.1	0	0.0	2 111	15.2
30–34	1 781	15.5	428	12.8	0	0.0	2 210	14.9	1 674	15.6	412	12.8	0	0.0	2 086	15.0
35–39	1 365	11.9	278	8.3	3	15.6	1 645	11.1	1 276	11.9	268	8.3	3	26.8	1 547	11.1
40–44	1 042	9.1	232	6.9	2	14.6	1 274	8.6	974	9.1	229	7.1	0	0.0	1 203	8.6
45–49	765	6.7	255	7.6	0	0.0	1 022	6.9	732	6.8	241	7.5	2	25.0	976	7.0
50–54	628	5.5	202	6.0	0	0.0	830	5.6	578	5.4	186	5.8	0	0.0	764	5.5
55–59	497	4.3	159	4.7	0	0.0	655	4.4	469	4.4	148	4.6	0	0.0	617	4.4
60–64	358	3.1	112	3.3	0	0.0	470	3.2	339	3.2	111	3.4	0	0.0	450	3.2
65–69	204	1.8	85	2.6	0	0.0	290	2.0	191	1.8	84	2.6	0	0.0	275	2.0
70–74	136	1.2	52	1.6	0	0.0	188	1.3	128	1.2	48	1.5	0	0.0	176	1.3
75–79	110	1.0	50	1.5	0	0.0	160	1.1	108	1.0	44	1.4	0	0.0	152	1.1
80–84	34	0.3	25	0.8	0	0.0	59	0.4	29	0.3	23	0.7	0	0.0	53	0.4
85+	31	0.3	16	0.5	3	16.7	49	0.3	31	0.3	15	0.5	0	0.0	46	0.3
Unknown	216	1.9	25	0.8	9	53.1	250	1.7	140	1.3	13	0.4	5	48.2	158	1.1
Total	**11 473**	**100.0**	**3 359**	**100.0**	**16**	**100.0**	**14 848**	**100.0**	**10 708**	**100.0**	**3 222**	**100.0**	**9**	**100.0**	**13 939**	**100.0**

Road traffic deaths peaked in July for males and in December for females (Figure 12). For males, this was followed by another peak in April and September. For females, road traffic deaths were also high in April and September. Other transport deaths were high for males, and peaked in June, July and October (Figure 13).

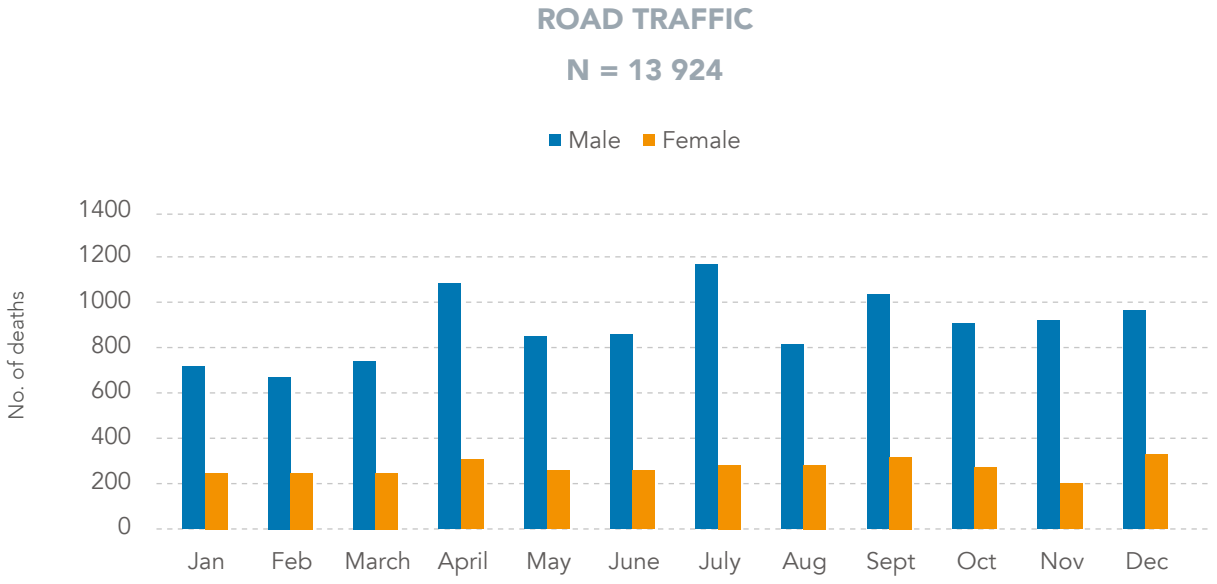


Figure 12: Distribution of road traffic injury deaths by month and sex, South Africa 2017 (N = 13 924)

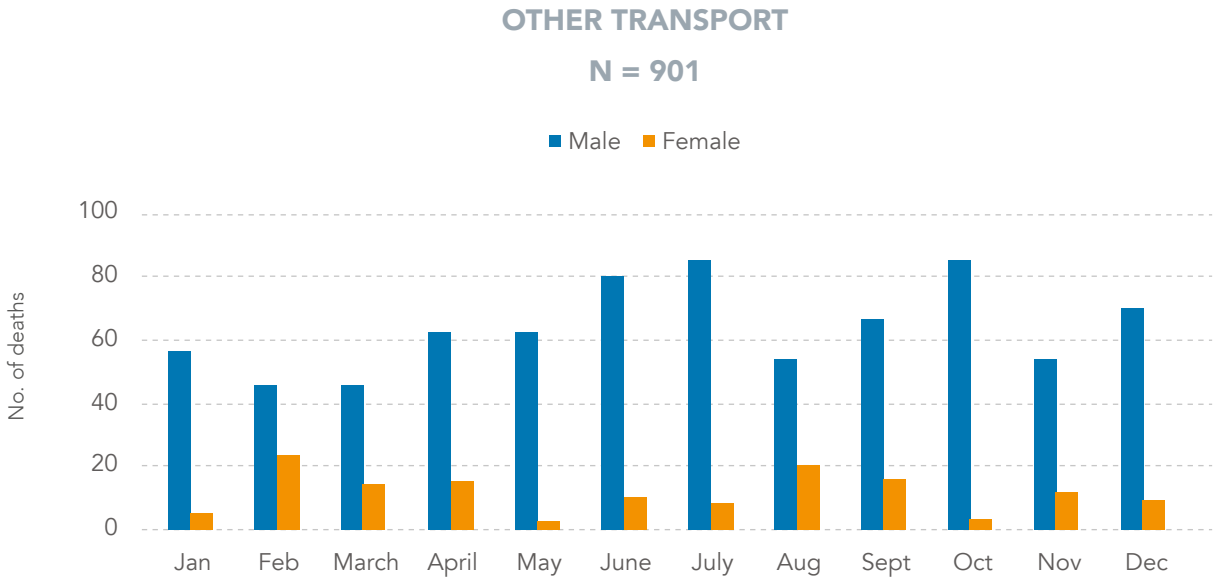


Figure 13: Distribution of other transport deaths by month and sex, South Africa 2017 (N = 901)

There were distinct weekend peaks for both road traffic and other transport deaths (Figure 14 and Figure 15). Friday, Saturday and Sunday together, accounted for nearly 60% of all road traffic injury deaths.

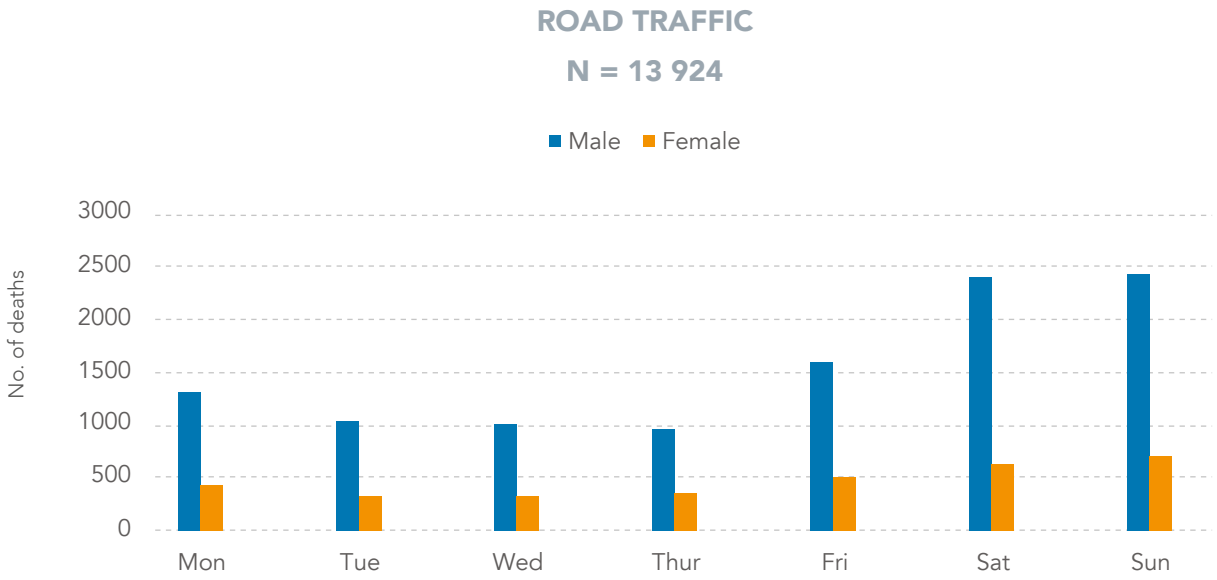


Figure 14: Distribution of road traffic injury deaths by week and sex, South Africa 2017 (N = 13 924)

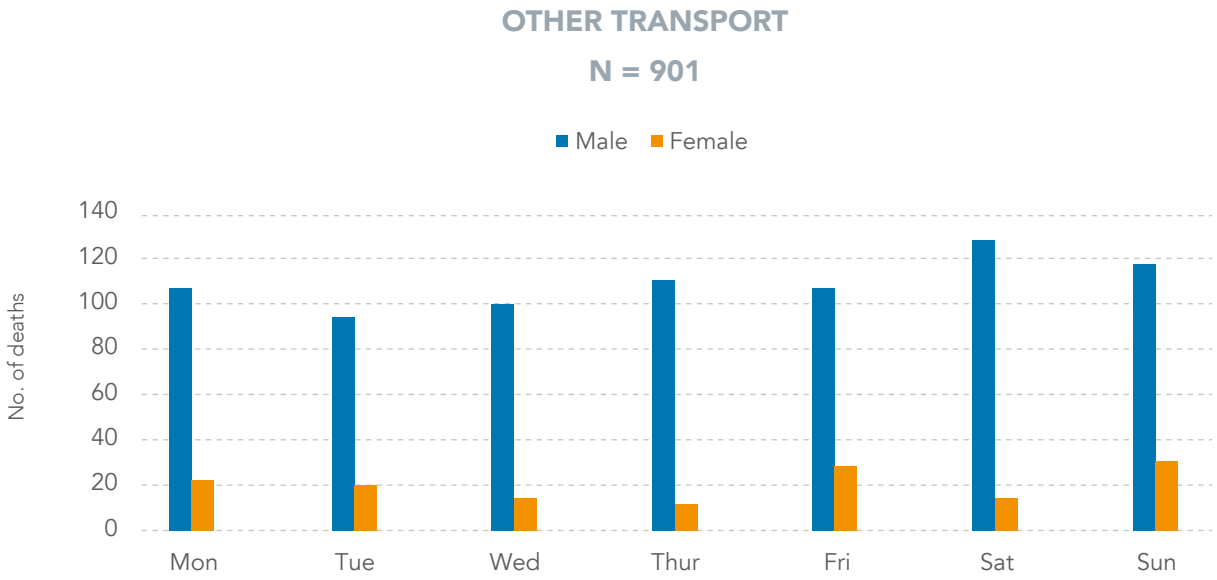


Figure 15: Distribution of other transport deaths by week and sex, South Africa 2017 (N = 901)

Blood alcohol concentration (BAC) was tested for 2 391 road traffic injury deaths (17.2%) (Table 20), and excessive BAC levels were particularly recorded for road traffic deaths that occurred on a Saturday and Sunday, and during April, June, July and September.

Table 20: Blood Alcohol Concentration* for road traffic injuries by day- and month of death

	0 g/100ml %	0.01-0.049 g/100ml %	≥0.05 g/100ml %
Road traffic injury deaths with available BAC results (N= 2 391)	51.4	5.1	43.5
Day of death			
Monday (n= 289)	75.0	2.3	22.7
Tuesday (n= 244)	71.0	4.5	24.5
Wednesday (n= 207)	63.7	6.6	29.8
Thursday (n= 177)	63.8	6.8	29.4
Friday (n= 324)	57.0	7.3	35.8
Saturday (n= 543)	36.6	4.8	58.6
Sunday (n= 607)	34.8	4.6	60.6
Month of death			
January (n= 135)	63.6	3.7	32.7
February (n= 170)	68.5	6.5	25.0
March (n= 161)	57.0	6.5	36.5
April (n= 253)	42.2	7.7	50.1
May (n= 192)	55.6	1.6	42.8
June (n= 229)	49.5	1.3	49.1
July (n= 244)	46.9	3.5	49.6
August (n= 202)	55.8	7.7	36.6
September (n= 221)	44.6	3.2	52.3
October (n= 213)	45.0	9.9	45.1
November (n= 196)	48.8	3.4	47.9
December (n= 174)	51.6	5.8	42.6

**Results reflect only those cases where the BAC was recorded in the post-mortem folder*

Figure 16 illustrates the progressive levels of alcohol intoxication by the leading road user categories. Drivers had the highest proportion of alcohol positive cases, where 49% tested above the legal limit of 0.05 g/100ml of alcohol for driving. In addition, 46.2% of pedestrian fatalities had blood alcohol levels of 0.05 g/100ml and above.

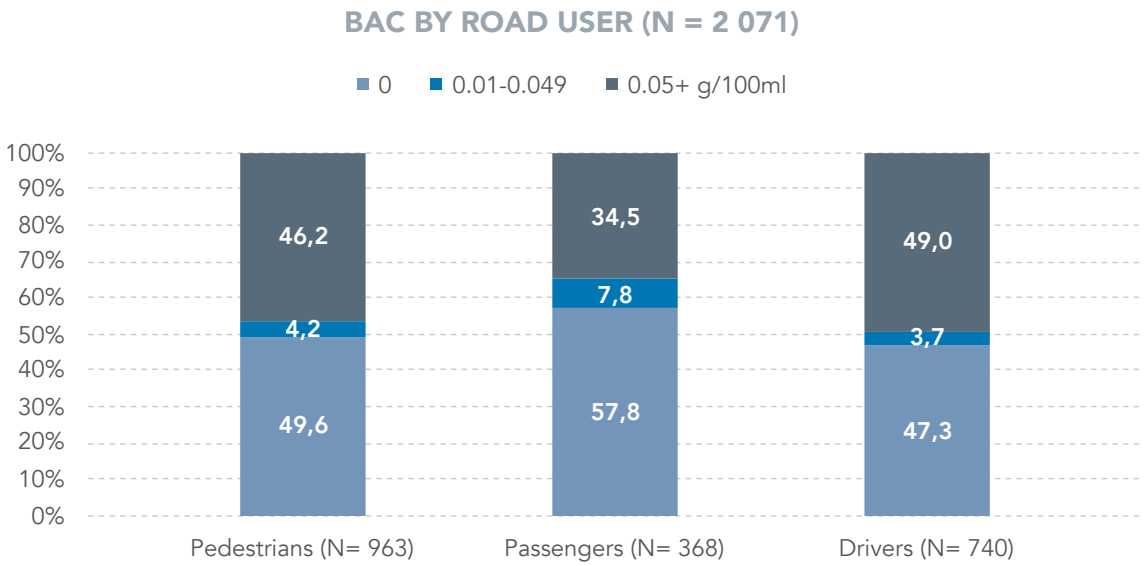


Figure 16: BAC levels by leading road user categories (N= 2 071)

OTHER UNINTENTIONAL

Of the 8 378 other unintentional deaths, 69.8% were male (Table 21). Figure 17 shows that the overall peak was among the 30-34 year age group (9.8%), which was largely due to the peak for males of that age group (10.9%). Other unintentional deaths were high between the ages of 25 and 39 years, and for children peaked in the 1-4 year age group (8.4%). Age was unknown for 1.5% of other unintentional deaths.

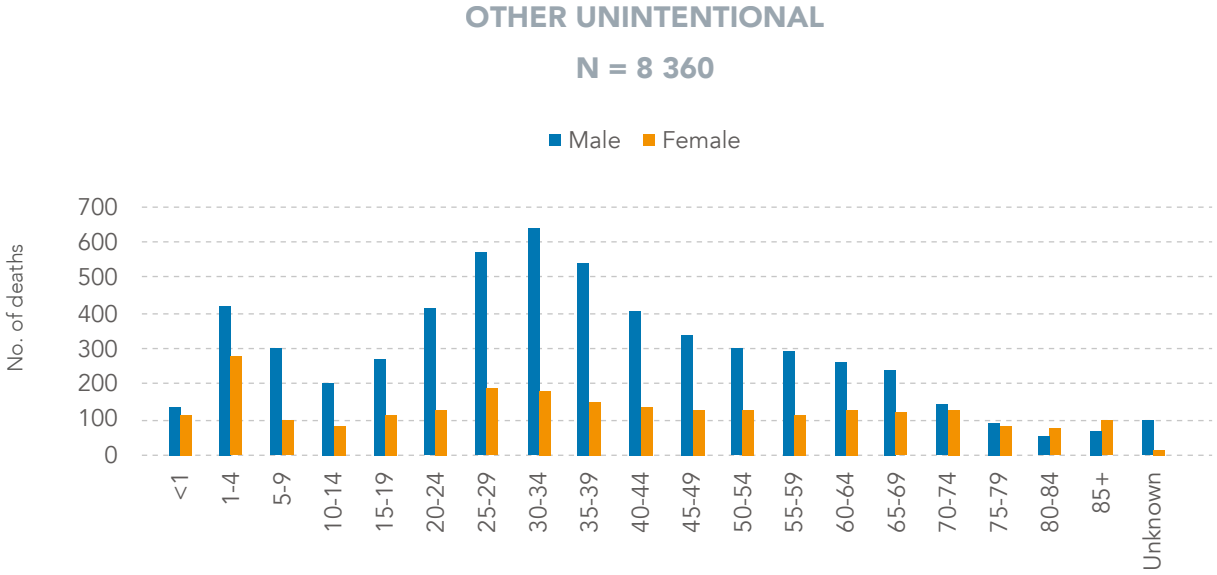


Figure 17: Distribution of other unintentional fatal injuries by age and sex, South Africa 2017 (N = 8 360)

Table 21: Age distribution of other unintentional fatal injuries by sex, 2017

	Other unintentional (weighted)							
	Male		Female		Unknown		Total	
Age	n	%	n	%	n	%	N	%
<1	135	2.3	113	4.5	2	11.0	250	3.0
1–4	420	7.2	284	11.3	0	0.0	704	8.4
5–9	303	5.2	99	3.9	0	0.0	401	4.8
10–14	205	3.5	84	3.3	0	0.0	289	3.5
15–19	275	4.7	113	4.5	3	16.6	391	4.7
20–24	416	7.1	128	5.1	0	0.0	544	6.5
25–29	577	9.9	190	7.5	1	5.5	768	9.2
30–34	638	10.9	183	7.3	0	0.0	821	9.8
35–39	547	9.4	155	6.2	1	5.5	704	8.4
40–44	412	7.0	134	5.3	0	0.0	546	6.5
45–49	340	5.8	131	5.2	0	0.0	472	5.6
50–54	302	5.2	127	5.1	2	11.0	432	5.2
55–59	292	5.0	113	4.5	2	9.9	407	4.9
60–64	264	4.5	132	5.3	0	0.0	397	4.7
65–69	245	4.2	123	4.9	0	0.0	368	4.4
70–74	148	2.5	130	5.2	0	0.0	278	3.3
75–79	96	1.6	86	3.4	0	0.0	182	2.2
80–84	59	1.0	74	2.9	0	0.0	133	1.6
85+	69	1.2	98	3.9	0	0.0	166	2.0
Unknown	102	1.7	17	0.7	7	40.4	126	1.5
Total	**5 845**	**100.0**	**2 515**	**100.0**	**18**	**100.0**	**8 378**	**100.0**

Table 22 shows that surgical/medical complications (20.8%) were the leading mechanism of other unintentional deaths followed by burns (20.7%) and drowning (18.4%). A higher proportion of males drowned (22.1%), while females had a higher proportion of surgical/medical complication deaths (31.1%).

Table 22: Mechanism of other unintentional fatal injuries by sex, South Africa 2017

	Other unintentional (weighted)							
	Male		Female		Unknown		Total	
Mechanism	n	%	n	%	n	%	N	%
Surgical/Medical	963	16.5	782	31.1	0	0.0	1 745	20.8
Fire /other burn	1 157	19.8	574	22.8	3	16.6	1 734	20.7
Drowning, immersion	1 293	22.1	240	9.6	7	40.4	1 541	18.4
Fall	532	9.1	164	6.5	1	5.5	697	8.3
Electrocution	323	5.5	125	5.0	0	0.0	448	5.3
Asphyxiated / Suffocated	218	3.7	62	2.5	0	0.0	280	3.3
Poison, ingestion	188	3.2	122	4.8	0	0.0	309	3.7
Blunt force	130	2.2	33	1.3	0	0.0	162	1.9
Crushing	111	1.9	25	1.0	0	0.0	136	1.6
Mining	94	1.6	0	0.0	1	5.5	95	1.1
Natural/Environmental	75	1.3	29	1.1	0	0.0	103	1.2
Animal contact	75	1.3	15	0.6	0	0.0	90	1.1
Lightning	71	1.2	59	2.4	0	0.0	130	1.6
Poison, gassing	47	0.8	16	0.6	0	0.0	63	0.8
Circumcision	26	0.4	0	0.0	0	0.0	26	0.3
Sharp force (cut)	26	0.4	5	0.2	0	0.0	31	0.4
Exposure/hypothermia	25	0.4	5	0.2	2	9.9	32	0.4
Machinery	18	0.3	3	0.1	0	0.0	21	0.3
Firearm Discharge	12	0.2	0	0.0	0	0.0	12	0.1
SIDS	7	0.1	4	0.2	0	0.0	11	0.1
Explosive blast	6	0.1	0	0.0	0	0.0	6	0.1
Maternal death	0	0.0	59	2.3	0	0.0	59	0.7
Other	22	0.4	13	0.5	0	0.0	34	0.4
Missing folder/Storage	323	5.5	138	5.5	4	22.1	465	5.6
Unknown	104	1.8	44	1.8	0	0.0	148	1.8
Total	**5 845**	**100.0**	**2 515**	**100.0**	**18**	**100.0**	**8 378**	**100.0**

Figure 18 shows that other unintentional deaths peaked in July for males, and were high during October to December. For females, other unintentional deaths were high in August and from October to December.

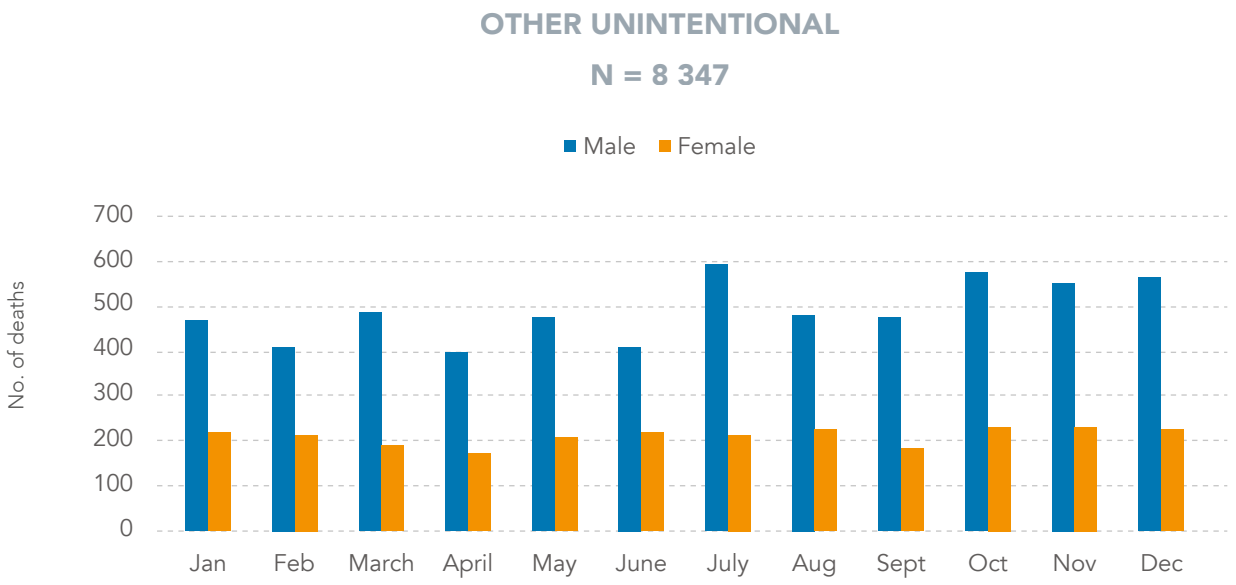


Figure 18: Distribution of other unintentional by month and sex, South Africa 2017(N = 8 347)

For males, other unintentional deaths peaked on Sundays, while the peak for females was on Saturdays (Figure 19). Nearly one-third of other unintentional deaths occurred on a Saturday and Sunday, but deaths were also high during the early period of the week.

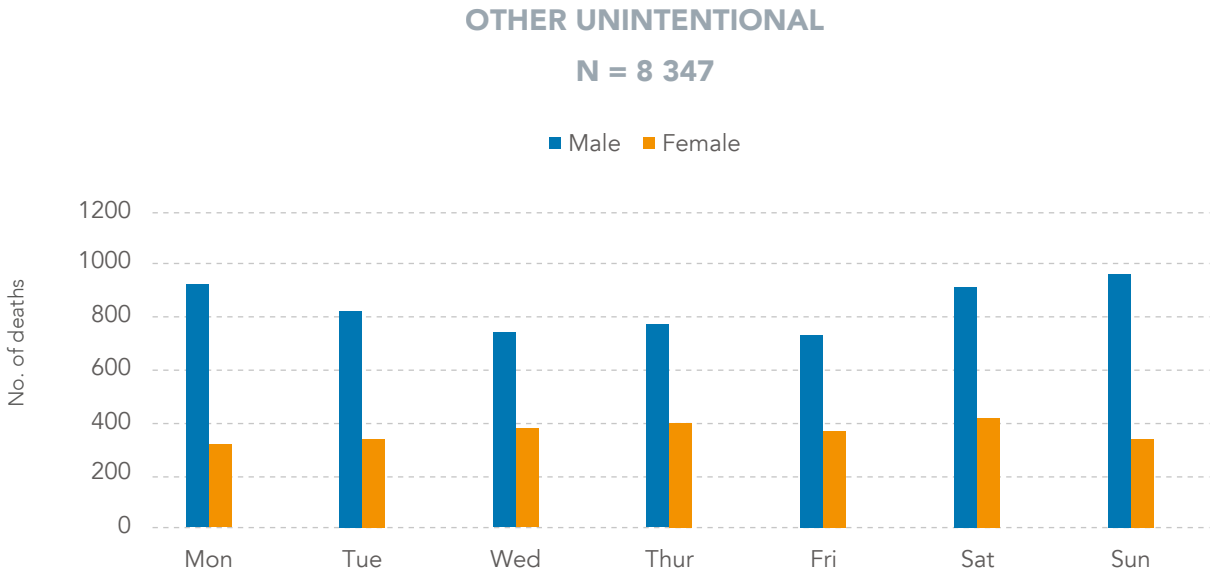


Figure 19: Distribution of other unintentional by week and sex, South Africa 2017 (N = 8 347)

UNDETERMINED DEATHS

Of the 5 857 undetermined deaths (Table 23), 65.7% were male and overall the peak was among the 30–34 year age group (9.8%). Figure 20 indicates that undetermined deaths were high between the ages of 25 and 39 years, after which it declines. For children, undetermined deaths peaked in the <1 year age group (8.1%). Age was unknown for 11.0% of undetermined deaths.

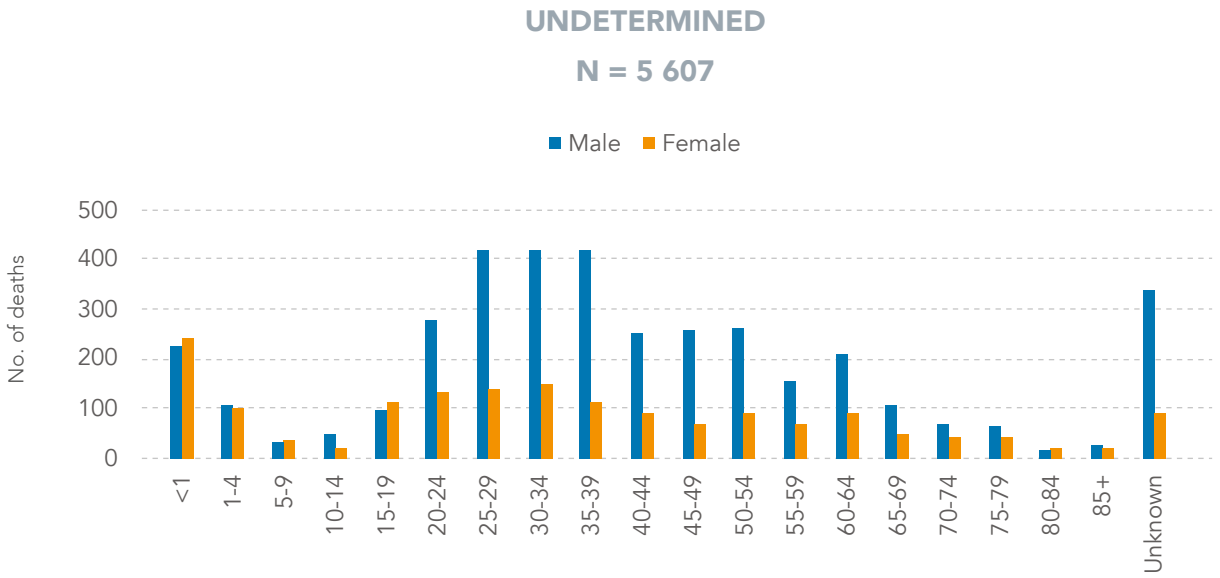


Figure 20: Distribution of undetermined deaths by age and sex, South Africa 2017 (N = 5 607)

Table 23: Age distribution of undetermined deaths by sex, South Africa 2017

	Undetermined intent (weighted)							
	Male		Female		Unknown		Total	
Age	n	%	n	%	n	%	N	%
<1	225	5.8	243	13.8	7	2.8	475	8.1
1–4	110	2.9	104	5.9	3	1.2	217	3.7
5–9	36	1.0	39	2.2	0	0.0	75	1.3
10–14	52	1.4	24	1.4	0	0.0	76	1.3
15–19	99	2.6	113	6.4	4	1.4	215	3.7
20–24	279	7.2	135	7.7	4	1.6	417	7.1
25–29	420	10.9	142	8.1	0	0.0	562	9.6
30–34	422	11.0	152	8.7	0	0.0	574	9.8
35–39	421	10.9	115	6.6	4	1.6	540	9.2
40–44	255	6.6	91	5.2	3	1.2	349	6.0
45–49	261	6.8	74	4.2	4	1.4	338	5.8
50–54	265	6.9	93	5.3	7	2.7	365	6.2
55–59	159	4.1	70	4.0	0	0.0	228	3.9
60–64	213	5.5	91	5.2	0	0.0	304	5.2
65–69	110	2.9	48	2.7	0	0.0	158	2.7
70–74	71	1.8	43	2.4	0	0.0	113	1.9
75–79	68	1.8	46	2.6	0	0.0	113	1.9
80–84	19	0.5	21	1.2	2	0.8	42	0.7
85+	26	0.7	22	1.3	0	0.0	48	0.8
Unknown	340	8.8	93	5.3	213	85.3	646	11.0
Total	**3 850**	**100.0**	**1 757**	**100.0**	**250**	**100.0**	**5 857**	**100.0**

The leading mechanisms of undetermined deaths were poison ingestion (11.0%) followed by blunt force and burns (Table 24). Females had a higher proportion of poison ingestion deaths 14.0%) compared to males. For males, death due to blunt force, burns and hanging were higher than for females. These mechanisms indicate that the deaths could be contributed to varying apparent manners of death. For more than half of undetermined deaths, the mechanism was recorded as other or unknown.

Table 24: Mechanism of deaths of undetermined intent by sex, South Africa 2017

	Undetermined intent (weighted)							
	Male		Female		Unknown		Total	
Mechanism	n	%	n	%	n	%	N	%
Poison, ingestion	398	10.3	245	14.0	2	0.8	645	11.0
Blunt force	273	7.1	71	4.1	2	0.8	347	5.9
Fire /other burn	151	3.9	20	1.1	0	0.0	210	3.6
Natural/Environmental	146	3.8	58	3.3	2	0.8	206	3.5
Hanging	112	2.9	13	0.7	0	0.0	124	2.1
Drowning, immersion	66	1.7	23	1.3	0	0.0	89	1.5
Fall/push/jump	48	1.3	0	0.0	0	0.0	68	1.2
Asphyxiated/ strangled	41	1.1	36	2.1	2	0.8	79	1.4
Surgical/Medical	39	1.0	51	2.9	0	0.0	90	1.5
Poison, gassing	29	0.8	17	0.9	0	0.0	46	0.8
Firearm discharge	24	0.6	4	0.2			28	0.5
Abandoned baby	23	0.6	22	1.3	9	3.6	54	0.9
Sharp force	18	0.5	2	0.1	0	0.0	20	0.3
Railway passenger	12	0.3	2	0.1	0	0.0	14	0.2
MV Pedestrian	4	0.1	0	0.0	0	0.0	4	0.1
Explosive blast	2	0.1	58	3.3	2	0.8	2	0.0
Maternal death/abortion-related	0	0.0	12	0.7	0	0.0	12	0.2
Other	873	22.7	469	26.7	31	12.4	1 372	23.4
Missing folder/Storage	453	11.8	223	12.7	105	41.9	781	13.3
Unknown	1 140	29.6	433	24.6	95	38.1	1 668	28.5
Total	**3 850**	**100.0**	**1 757**	**100.0**	**250**	**100.0**	**5 857**	**100.0**

COMPARISON WITH OTHER NATIONAL AND GLOBAL DATA SOURCES

The results set out in the preceding sections describe the raw and weighted data from the survey. In this section, the 2017 IMS results are compared to other data sources that might provide useful comparisons, namely:

- Comparison with 2009 IMS
- profile and completeness of death certification data reported by Stats SA
- murder (i.e. homicide) and road traffic mortality statistics from the South African Police Services (SAPS) and the Department of Transport (DoT) -as recorded by the Road Traffic Management Corporation (RTMC) respectively
- 2017 Global Burden of Disease injury mortality rates

Comparison with 2009 Injury Mortality Survey

Our findings, which document the changes in the injury profile between 2009 in 2017, demonstrate the importance of regular information on non-natural mortality. The 2017 IMS reports an 8% decrease in the age-standardised all injury mortality rate, from 109 (95% CI: 97.1-121.0) to 100.3 (95% CI: 94.4-106.1) per 100 000 population (Table 25). The decrease in all injury mortality was mainly due to the significant (29%) reduction in road traffic mortality from 36.1 (95% CI: 30.9-41.3) per 100 000 in 2009 to 25.6 (95% CI: 24.2-26.9) per 100 000 in 2017. There was a marginal decrease in the age-standardised rate for homicide and no change in the national firearm homicide rate, but given that homicide declined, firearms now account for a greater share. The national suicide rate decreased by 15.7%, while the other unintentional injury mortality rate increased by 16.7%. However, these findings need to be considered alongside the considerable increase in deaths ascribed to undetermined causes, which increased by nearly two-thirds when compared to 2009. If the deaths are distributed proportionally across the different injury categories it affects the scale of the percentage change in mortality from 2009 to 2017 in each category.

Table 25: National age-standardised injury mortality rates (per 100 000 population), 2009 vs 2017

	2009 IMS Rate (95% CI)	2017 IMS Rate (95% CI)	% Change
Homicide	38.4 (33.8-43.0)	34.5 (32.0-36.9)	-10.2%
-firearm	11.2 (9.9-12.6)	11.2 (9.8-12.6)	0%
Suicide	13.4 (11.6-15.2)	11.3 (10.4-12.3)	-15.7%
Transport	37.1 (31.1-41.2)	27.2 (25.7-28.7)	-26.7%
-road traffic	36.1 (30.9-41.3)	25.6 (24.2-26.9)	-29.1%
Other unintentional	13.5 (11.8-15.2)	16.2 (13.2-19.1)	16.7%
Undetermined	4.6 (3.5-5.7)	11.2 (9.7-12.6)	58.9%
All injuries	**109 (97.1-121.0)**	**100.3 (94.4-106.1)**	**-8.0%**

Profile and completeness of Stats SA death certification

Our findings also resolve some of the anomalous reporting from vital registration, which are the source data for the Global Burden of Disease Study presented in 5.4.4. This is demonstrated by comparing the 2017 IMS apparent manner of injury death profile with death notification data from Stats SA (2020) for the corresponding period (Figure 21). The coding regimen adopted by Stats SA artificially increases other unintentional injury deaths to 69.3% of the total. Stats SA recodes deaths of unknown intent to ICD code X59 (an unintentional category) as is the norm in high income countries, but the practice is questionable in countries with high levels of violence, such as South Africa[4].

The 2017 IMS captured the cause of death directly from post-mortem records and were able to allocate the specific manner of death to other categories (Figure 21). The current survey recorded approximately 6.5% more injury deaths than were recorded by Stats SA in the corresponding period (54 734 vs. 51 164). The 95% confidence interval for the 2017 IMS total injuries: 51 376–58 093, is marginally outside the number reported by Stats SA (Figure 21). These findings are consistent with the comparison of the 2009 IMS, which recorded 6% more injury deaths than Stats SA for the corresponding period (Matzopoulos et al., 2013).

[4] *see Prinsloo et al. 2017. In addition the effect of this misclassification with regard to gunshot wounds specifically has been presented by Matzopoulos et al. (2016).*

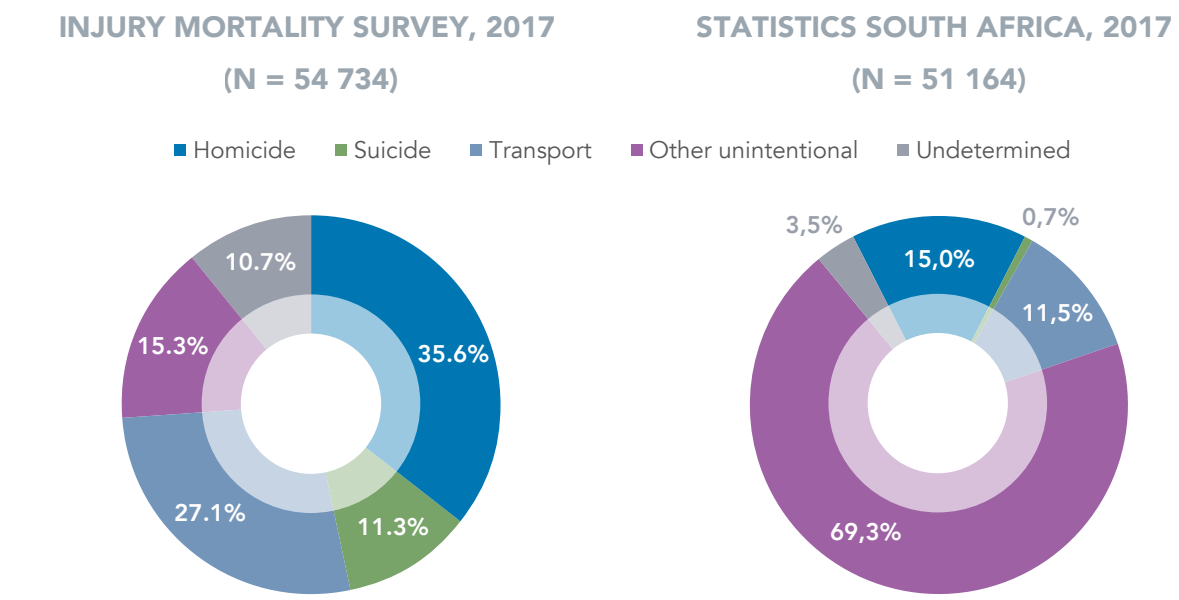


Figure 21: Apparent manner of injury deaths, Stats SA 2017 (N = 51 164)
Source data from: Stats SA (2020)

SAPS Murder and RTMC road traffic mortality statistics

Comparing the results to alternative routine data collected by specialist agencies such as the police and road traffic authorities serve as a form of validation for our study and also the alternative routine data. For example, with regard to homicide the police recorded 20 336 murders during the 2017 financial year. The reporting period was not an exact match – the police reported annual statistics according to an April 2017 to March 2018 financial year – and the police definition of murder may differ slightly from the public health derived "homicide" due to interpersonal violence recorded in this report, however the two categories were broadly comparable (SAPS Crime Statistics, 2019). The 20 336 murders recorded by the police during this period was only 4% higher and not significantly different from the estimated 19 477 homicides in our survey (95% CI: 18 153 to 20 800). Similarly, the RTMC estimated that there were 14 050 road deaths in 2017 (Road Traffic Management Corporation, 2017), which was only 1% more than the estimated 13 939 road deaths in the 2017 IMS and also not significantly different (95% CI: 13 483–14 395). In comparison to the 2009 IMS, where murders recorded by police, and deaths from the RTMC were significantly 13% and 24% lower than estimated by the 2009 IMS respectively (Matzopoulos et al., 2015), the very close estimates may represent improvements in official reporting from these agencies.

National and Global injury mortality rate estimates from the Global Burden of Disease Study

Our findings differ from the recent country estimates from the Global Burden of Disease (GBD) Study (Global Burden of Disease Collaborative Network, 2020) and demonstrate the importance of deriving estimates from empirical rather than modelled data. In Table 26, which compare the IMS 2017 rates with the GBD 2017 estimates for South Africa, the overall injury mortality rate in the IMS 2017 is 3% higher. In order to compare rates by manner of death the IMS 2017 undetermined deaths were distributed proportionally across the other

injury categories. The IMS had a 16% higher homicide rate than the 2017 GBD estimates and the 2017 IMS firearm homicide rate was more than double. Rates for the other categories: suicide, transport and road traffic injuries were lower at 5%, 9% and 11% respectively, and the other unintentional injury rate 7% higher in the 2017 IMS.

In comparison to the global injury mortality rate estimates for 2017 in the GBD, the IMS 2017 all injury mortality rate of 100.3 per 100 000 was 80% higher than the global average. This was largely attributable to SA's exceptionally high homicide rate, which was 7 times the global average.

Table 26: South African and Global injury mortality rates (per 100 000 population)

	2017 IMS Rate (95% CI)	2017 IMS Adjusted* Rate (95% CI)	2017 GBD# Rate for South Africa (95% CI)	2017 IMS Adjusted*: GBD SA Ratio	2017 GBD# Global Rate (95% CI)	2017 IMS Adjusted*: GBD Global Ratio
Homicide	34.5 (32.0-36.9)	38.7 (35.4-42.2)	33.3 (28.5-38.5)	1.16	5.5 (5.2-5.9)	7.04
-firearm	11.2 (9.8-12.6)	12.6 (10.9-14.4)	5.2 (4.3-6.8)	2.42	2.4 (2.3-2.6)	5.30
Suicide	11.3 (10.4-12.3)	12.7 (11.5-14.1)	13.4 (10.9-16.4)	0.95	9.8 (9.0-10.6)	1.30
Transport	27.2 (25.7-28.7)	30.5 (28.5-32.8)	33.4 (27.1-37.8)	0.91	16.8 (14.7-18.1)	1.82
-road traffic	25.6 (24.2-26.9)	28.7 (26.8-30.8)	32.4 (26.3-36.6)	0.89	15.7 (13.8-16.9)	1.83
Other unintentional	16.2 (13.2-19.1)	18.2 (14.6-21.9)	17.0 (15.2-18.8)	1.07	23.0 (20.2-25.0)	0.79
Undetermined	11.2 (9.7-12.6)	-	-	-	-	-
All injuries	**100.3 (94.4-106.1)**	**100.3 (94.4-106.1)**	**97.4 (86.4-109.0)**	**1.03**	**55.6 (50.7-59.6)**	**1.80**

**2017 IMS age-standardised rates for Undetermined deaths were proportionally redistributed across categories*
#Source: 2017 Global injury mortality rates (Global Burden of Disease Collaborative Network, 2020)

DISCUSSION

The key findings from this survey, in relation to findings from the 2009 IMS, was the overall decrease in the national all injury mortality rate, from 109 to 100.3 per 100 000 population. This was largely attributable to the significant, 29% decline in road traffic deaths. The decrease in the rate for suicide was more marked than that for homicide, with no change in the rate for firearm homicide.

Male homicide was 6.6 times higher than females, with one-third of male, and one-quarter of female homicides attributed to firearm violence. Homicide rates differ substantially by province, with higher rates recorded in the Eastern Cape, Western Cape and KwaZulu-Natal provinces, all with major urban centres. Even though KwaZulu-Natal ranks third highest for homicide, a substantial decrease in the mortality rate was noted, as for Gauteng, when compared to the findings of the 2009 IMS (Matzopoulos et al., 2015). This was not so for the Western Cape however, where a substantial increase in the homicide rate since 2009 is largely attributable to the increase in fatal firearm violence. A previous study (Matzopoulos et al., 2018) ascribed this increase to the illegal supply of guns by an ex-police officer and firearm dealer, to gangs in the Western Cape (Dolley, 2014; Petersen, 2016). Phase 2 of the 2017 IMS will explore the victim-perpetrator relationships and motive for homicides through follow-up investigation of police records.

The substantial road traffic mortality rate declines were observed for most provinces, except for KwaZulu-Natal and Limpopo, where only marginal reductions were noted. These two provinces have large rural areas, and previous sub-analysis of the 2009 IMS data found a significantly lower likelihood of transport deaths in metro (urban) compared to non-metro (rural) areas (Prinsloo, 2019). This could be due to factors such as quicker access to emergency care in urban areas, whereas rural roads tend to be more remote, leading to delayed emergency response times in the case of road traffic crashes. In addition, rural roads tend to have poorer road conditions and longer travel distances, which may lead to higher driver speeds and increased severity upon impact (Maio, Green, Becker, Burney, & Compton, 1992; Weiss, Ellis, Ernst, Land, & Garza, 2001; Clark, 2003; Peek-Asa, Zwerling, & Stallones, 2004). There are other rural provinces, however, where greater reductions in road traffic mortality were noted in this study, and the reasons for this should be investigated.

The significant decrease in road traffic mortality represents promising progress towards achieving global road injury reduction targets (WHO, 2016), but the reasons are not well-understood. Determining whether it arises from a reduction in alcohol use and/or speed or improved road traffic law enforcement or any other intervention presents an interesting avenue for future research.

Temporal patterns were observed for both homicide and road traffic deaths, with deaths clustered on weekends and during holiday periods. These periods also coincided with higher proportions of alcohol-related deaths. A similar weekend pattern was observed for the 2009 IMS (Matzopoulos et al., 2013), but limited blood alcohol data for the deceased was available at the time and could not be reported on. For this current study, only one-fifth of blood alcohol results for homicide and road traffic deaths were readily available within post-mortem

folders for data capture. The linking of blood alcohol results from forensic chemistry laboratories, with post-mortem information for injury deaths could help to inform and support policies aimed at reducing alcohol-related injury deaths.

While there was a larger reduction for suicide as opposed to homicide for the two comparative surveys, suicide continue to be noted for children 14 years and younger with no substantial change. A provincial comparison between 2009 and 2017 showed the most notable decrease in overall suicide rates was for the largely rural provinces of the Northern Cape and North West. Previous analysis for deaths in 2009 found no significant differences in suicide for metro and non-metro areas nationally (Prinsloo, 2019), but this could change when the most recent provincial findings are investigated. The increase in other unintentional injury mortality rates in comparison to the 2009 IMS appears to be the result of an increase in surgical/medical procedures. The reason for this increase is not clear.

What can perhaps be deemed as a limitation of this study, is the large percentage increase in undetermined deaths, compared to the previous survey. More than half of undetermined deaths had no mechanism of injury specified. While it is likely that the manner of death could remain undetermined after the post-mortem process, specification of the likely mechanism or context surrounding the death, could improve the quality of mortality statistics.

Nevertheless, the survey estimates provide a very different cause profile for non-natural deaths compared to the Stats SA 2017 death notification report findings (Stats SA, 2020). Our findings were validated by alternative routine data from the police and road traffic authorities. However, the vastly different findings when compared to vital registration data for specified injury categories, points to the need to use mortuary data for decision making in the preventive response to injuries. Unlike in 2009, there was no significant difference between our survey estimates and the routine data reported by the police and RTMC. Whether or not this is a singular occurrence or indicative of a more fundamental improvement in data collection methods will only be evident if similar findings are sustained across multiple surveys. Either way, the broadly comparable estimates for these two important subcategories suggests that our survey data are also likely to provide more accurate mortality estimates for other injury causes such as suicide, and unintentional injuries such as falls, burns and drownings.

Our findings indicate the substantial impact of alcohol on homicide and road traffic mortality. The recent success in reducing trauma admissions to hospitals, through alcohol sales bans during the Covid-19 pandemic, has highlighted the influence of alcohol on trauma and the impact of reducing access to alcohol (Matzopoulos, Walls, Cook, & London, 2020; Moultrie et al., 2021). Routine monitoring of alcohol-related trauma in clinical settings, through the use of accurate and cost-effective alcohol diagnostics for testing, could inform government's response to policy to reduce the injury burden.

Another all-injury survey is planned to collect a representative sample of injury deaths for 2020, to assess the impact of restrictions including countrywide lockdowns, curfews, travel restrictions and alcohol sales bans on different injury types, including homicide and road traffic injury mortality. There is also considerable interest in the incidence of suicide for South Africa during 2020. Internationally, suicide was reported to have decreased during the early months of the COVID-19 pandemic, despite earlier concerns (Pirkis et al., 2021). In the meantime, the results of the current 2017 survey provide useful data to inform forthcoming national burden of disease estimates and to stimulate the uptake of injury prevention policies and interventions to reduce the incidence of fatal injuries.

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APPENDIX I

Table I: Expected cases versus realised cases by mortuary

Province	Mortuary	Sample (unweighted)		
		Expected	Actual	Difference (%)
Eastern Cape	Mdantsane	427	417	-2,3
Eastern Cape	Grahamstown	550	529	-3,8
Eastern Cape	Mount Road	510	509	-0,2
Eastern Cape	Mthatha*	916	984	7,4
Eastern Cape	Bizana	414	409	-1,2
Eastern Cape	Mount Frere	374	365	-2,4
Eastern Cape	Bhisho	612	618	1,0
Eastern Cape	Lusikisiki	371	364	-1,9
Northern Cape	Kimberley	356	352	-1,1
Northern Cape	De Aar	299	297	-0,7
Northern Cape	Calvinia	48	48	0,0
Northern Cape	Springbok	76	76	0,0
Free State	Bloemfontein	1 003	988	-1,5
Free State	Kroonstad	179	176	-1,7
Free State	Welkom	891	888	-0,3
Free State	Ficksburg	131	129	-1,5
Free State	Harrismith	179	178	-0,6
Free State	Bethlehem	227	220	-3,1
Free State	Phuthaditjhaba	288	285	-1,0
KwaZulu - Natal	Pietermaritzburg*	666	640	-3,9
KwaZulu - Natal	Ulundi	148	148	0,0
KwaZulu - Natal	New Hanover	116	117	0,9
KwaZulu - Natal	Manguzi	120	120	0,0
KwaZulu - Natal	Phoenix*	824	784	-4,9
KwaZulu - Natal	Madadeni	352	350	-0,6
KwaZulu - Natal	Mosvold	66	66	0,0
KwaZulu - Natal	Estcourt	307	309	0,7
KwaZulu - Natal	KwaDukuza	698	687	-1,6
KwaZulu - Natal	Richards Bay	671	666	-0,7

Province	Mortuary	Sample (unweighted)		
		Expected	Actual	Difference (%)
KwaZulu - Natal	Umzimkhulu	178	173	-2,8
KwaZulu - Natal	Port Shepstone	707	700	-1,0
KwaZulu - Natal	Pongola	118	117	-0,8
KwaZulu - Natal	Harding	201	199	-1,0
KwaZulu - Natal	Ixopo	187	182	-2,7
KwaZulu - Natal	Bulwer	110	109	-0,9
KwaZulu - Natal	Kokstad	128	126	-1,6
KwaZulu - Natal	Paulpietersburg	56	56	0,0
KwaZulu - Natal	Nkandla	100	100	0,0
NorthWest	Klerksdorp	677	663	-2,1
NorthWest	Koster	117	116	-0,9
NorthWest	Phokeng	880	873	-0,8
NorthWest	Lichtenburg	283	284	0,4
NorthWest	Potchefstroom	311	301	-3,2
Gauteng	Pretoria*	957	926	-3,2
Gauteng	Bronkhorstpruit	268	268	0,0
Gauteng	Springs	1 279	1 397	9,2
Gauteng	Carletonville	455	439	-3,5
Gauteng	Roodepoort	1 417	1 385	-2,3
Gauteng	Johannesburg*	1 549	1 551	0,1
Mpumalanga	Volkrust	109	107	-1,8
Mpumalanga	Ermelo	229	219	-4,4
Mpumalanga	Bethal	124	124	0,0
Mpumalanga	Standerton	138	136	-1,4
Mpumalanga	Mmamethlake	71	71	0,0
Mpumalanga	Themba	641	617	-3,7
Mpumalanga	Lydenburg	82	79	-3,7
Mpumalanga	Tintswalo	164	163	-0,6
Mpumalanga	Witbank	603	594	-1,5
Mpumalanga	Belfast	132	130	-1,5
Limpopo	Nkhensani	141	140	-0,7
Limpopo	Maphutha-malatji	133	129	-3,0
Limpopo	Letaba	378	370	-2,1
Limpopo	Lebowakgomo	601	595	-1,0
Limpopo	Mokopane	536	523	-2,4
Limpopo	Elim	282	278	-1,4
Total sample (unweighted)		**26 161**	**25 959**	

**For the large mortuaries, the expected sample was 50% of the total body count.*

Provincial distribution of realised caseload

The extent to which the findings from this survey can be extrapolated to the total deaths for 2017 for South Africa depends on its representativeness. Table II compares the structure of the survey sample by province to the deaths reported in mortuaries for 2017. The results suggest that the sample is quite well representative of the population from which it was drawn.

Table II: Characteristics of the weighted sample* compared with total deaths reported in mortuaries for 2017

Province	Weighted sample*		Total deaths for 2017	
	N	%	N	%
Eastern Cape	9 500	17.9	10 153	17.3
Free State	3 654	6.9	3 390	5.8
Gauteng	15 142	28.5	16 488	28.1
KwaZulu Natal	13 552	25.5	14 027	23.9
Limpopo	4 070	7.7	4 722	8.1
Mpumalanga	3 269	6.2	4 410	7.5
North West	2 938	5.5	3 621	6.2
Northen Cape	1 055	2.0	1 830	3.1
Total	**53 179**	**100.0**	**58 641**	**100.0**

**Weighted sample includes a small proportion of natural deaths which were excluded. The weighted sample excludes the Western Cape, as data were available from the province's FPS database.*

Of the 29 207 cases for which cause of death information was available, 22 822 (78.1%) were due to non-natural causes, 5 377 (18.4%) were due to natural causes, 183 (0.6%) were stillbirths and for 825 (2.8%) the death was recorded as Sudden Infant Death Syndrome (SIDS). A further 11 496 deaths were available from the Western Cape database, of which 8 174 (71.1%) were due to non-natural causes.

Figure I and Figure II show the cause of death breakdown of the unweighted and weighted number of deaths respectively[5]. Of the total 37 381 unweighted deaths, 30 996 (82.9%) were non-natural and 6 385 (17.1%) were natural. Stillbirths accounted for 2.9% and SIDS accounted for 12.9% of the natural deaths. When weighted, the total number of deaths was 64 601, of which 84.7% were non-natural.

[5] *The unweighted numbers indicate the number of cases observed from the survey sample, while the weighted numbers indicate the estimated total numbers representative of the country. It is the weighted data that provide results that should be interpreted for policy formulation.*

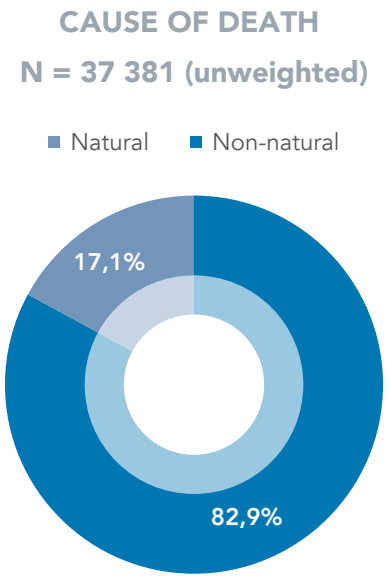

Figure I: Cause of death (unweighted analysis), South Africa 2017 (N = 37 381)

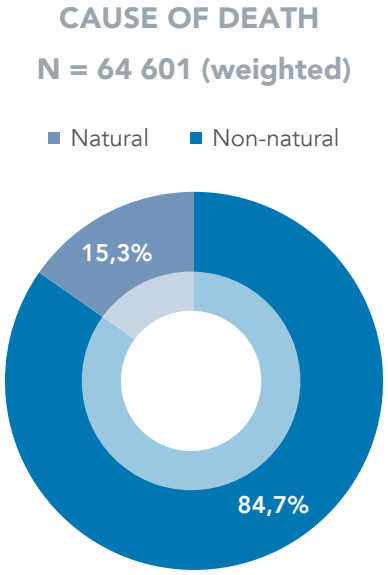

Figure II: Cause of death (weighted analysis), South Africa 2017 (N = 64 601)

APPENDIX II

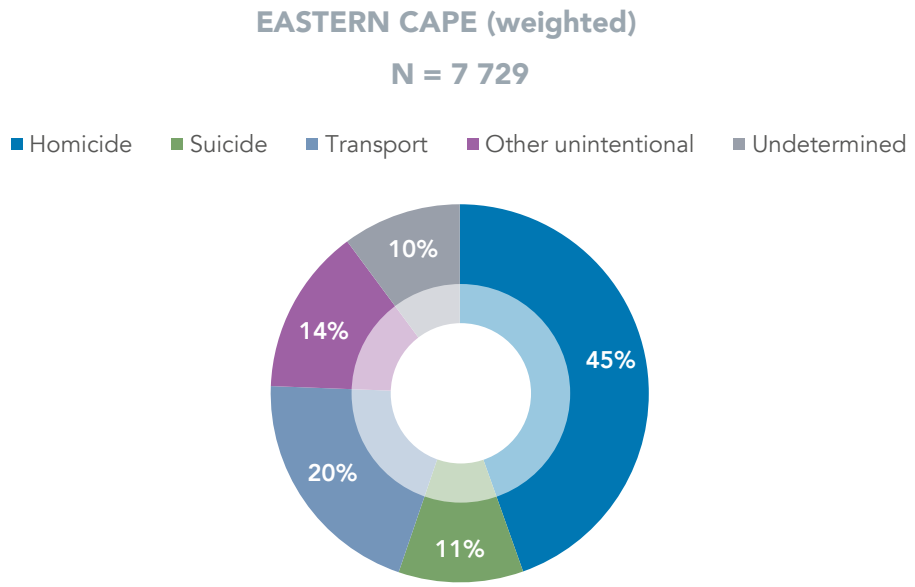

Figure I. Apparent manner of death (weighted analysis), Eastern Cape province (N= 7 729)

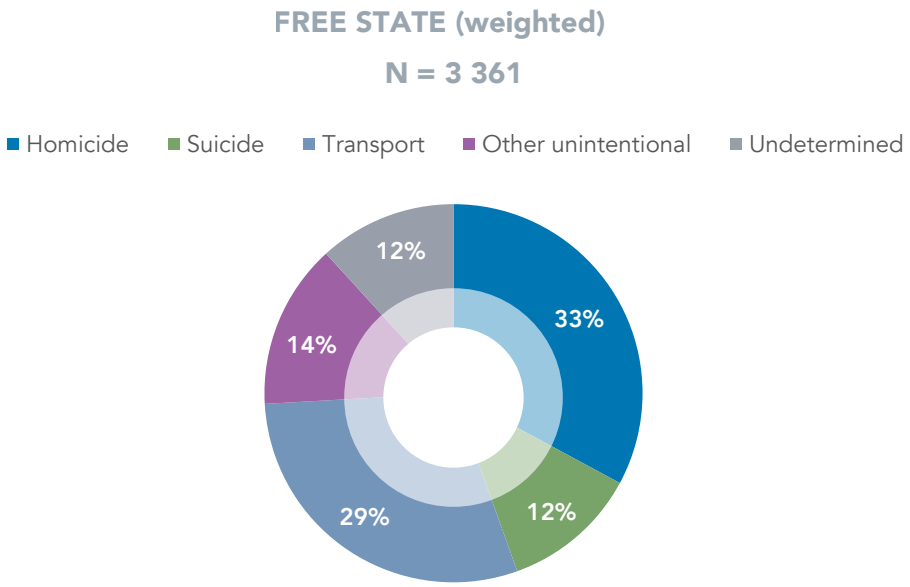

Figure II. Apparent manner of death (weighted analysis), Free State province (N= 3 361)

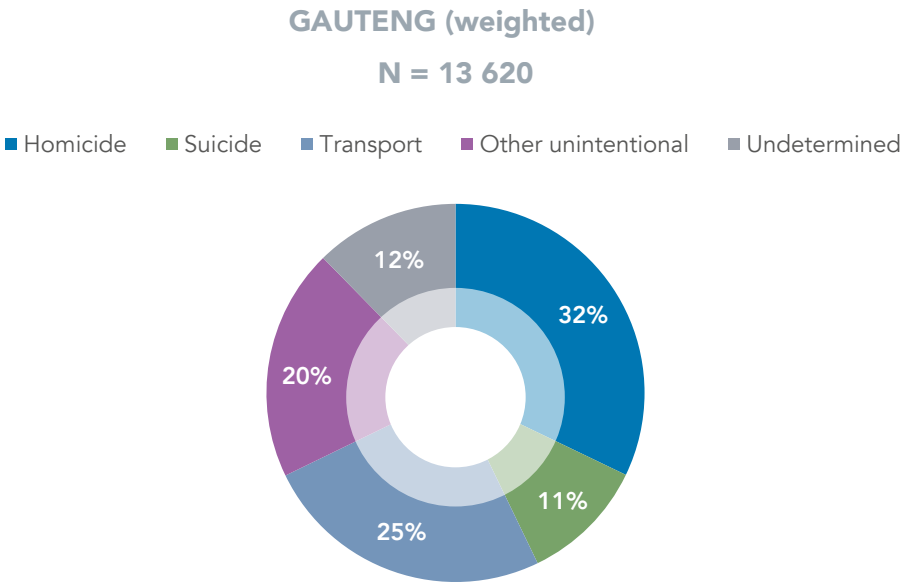

Figure III. Apparent manner of death (weighted analysis), Gauteng province (N= 13 620)

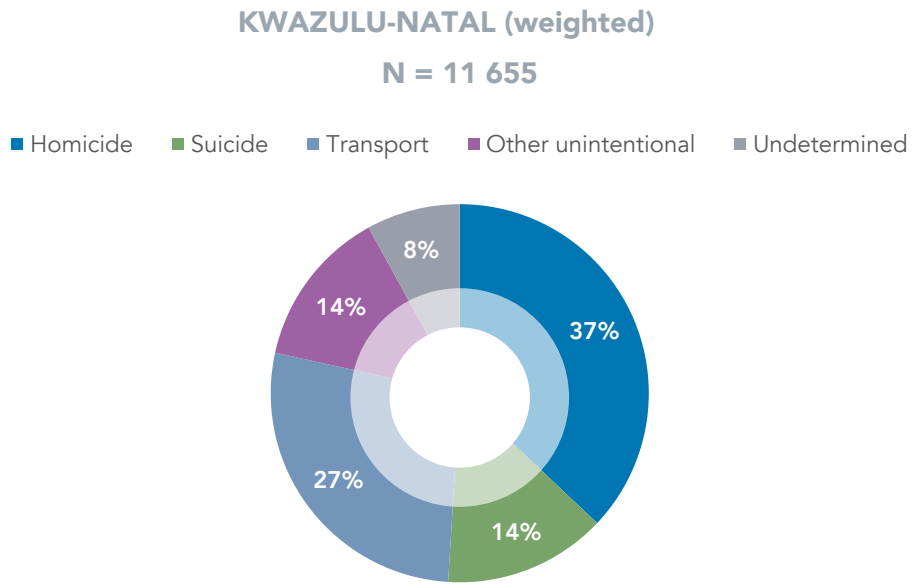

Figure IV. Apparent manner of death (weighted analysis), KwaZulu-Natal province (N= 11 655)

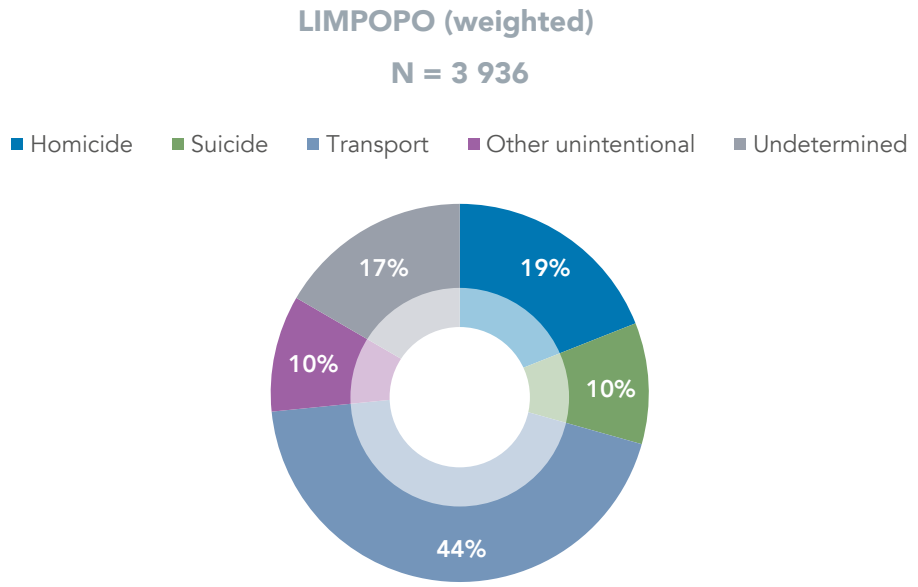

Figure V. Apparent manner of death (weighted analysis), Limpopo province (N= 3 936)

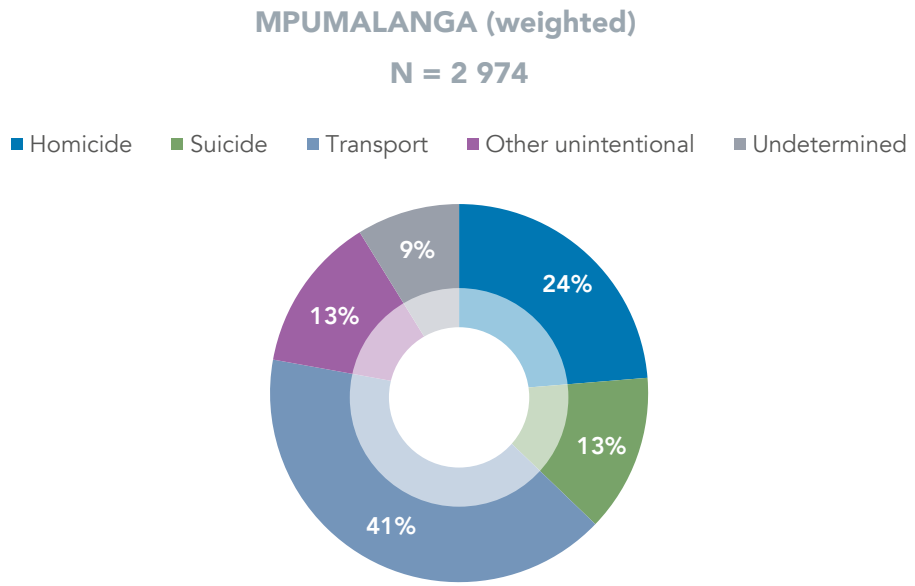

Figure VI. Apparent manner of death (weighted analysis), Mpumalanga province (N= 2 974)

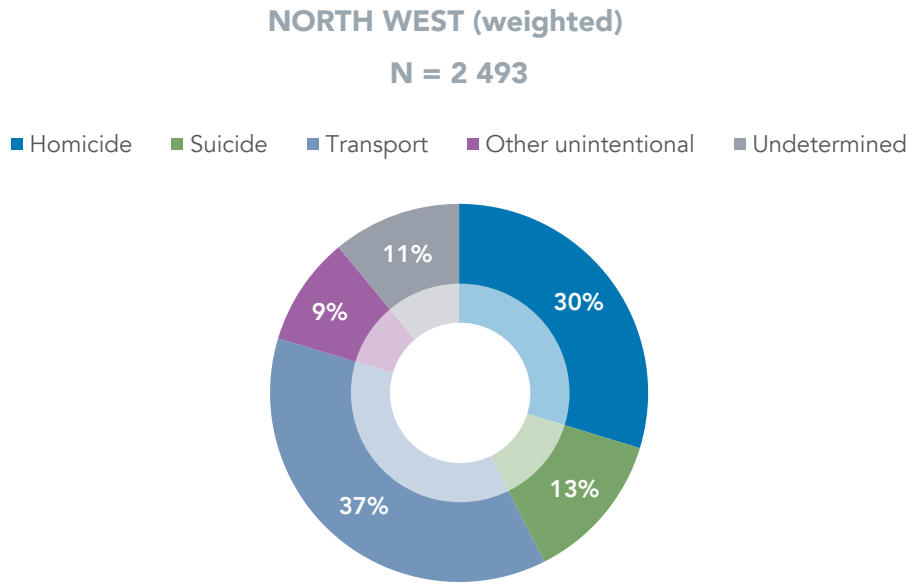

Figure VII. Apparent manner of death (weighted analysis), North West province (N= 2 493)

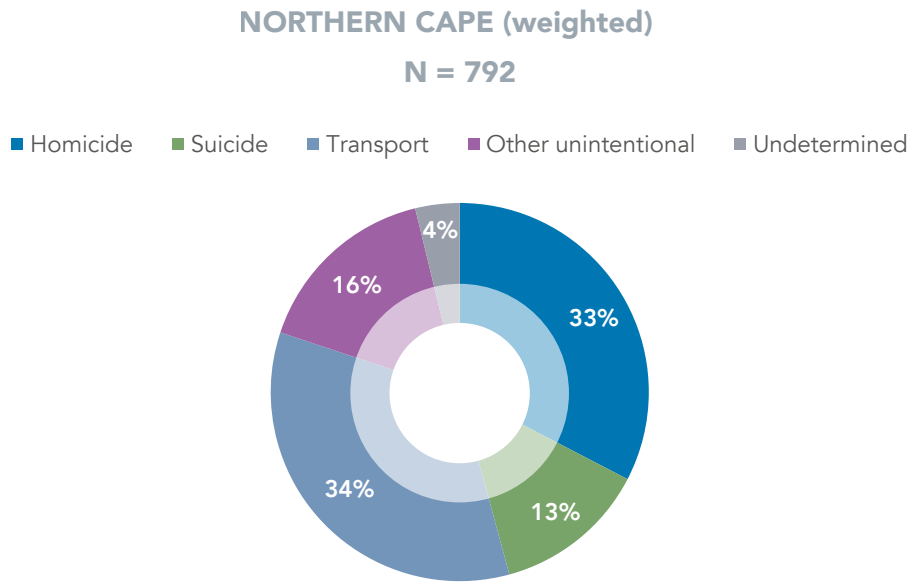

Figure VIII. Apparent manner of death (weighted analysis), Northern Cape province (N= 792)

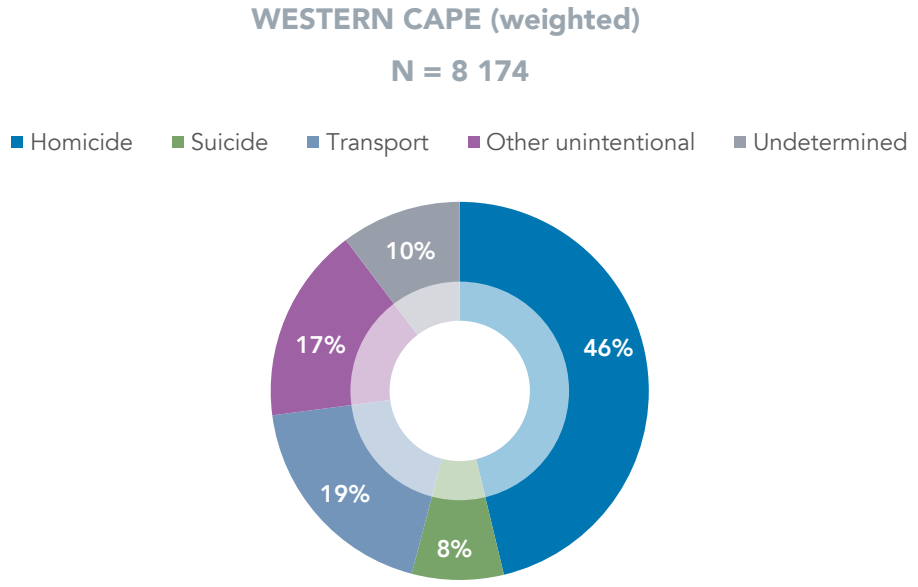

Figure IX. Apparent manner of death (weighted analysis), Western Cape province (N= 8 174)

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