

# Where have all the gun deaths gone?

R Matzopoulos,<sup>1,2</sup> PhD; P Groenewald,<sup>1</sup> MB ChB; N Abrahams,<sup>3</sup> PhD; D Bradshaw,<sup>1,2</sup> DPhil

<sup>1</sup> South African Medical Research Council Burden of Disease Research Unit, Cape Town, South Africa

<sup>2</sup> School of Public Health and Family Medicine, Faculty of Health Sciences, University of Cape Town, South Africa

<sup>3</sup> South African Medical Research Council Gender and Health Research Unit, Cape Town, South Africa

**Corresponding author:** R Matzopoulos (richard.matzopoulos@mrc.ac.za)

**Background.** The low number of firearm assaults and overall assault-related deaths in Statistics South Africa's death notification reports is incongruous with other recently released data, including police crime statistics.

**Methods.** We conducted a review of all gunshot injuries recorded in death notifications from 1997 to 2013, including all cases in which the underlying cause of death was ascribed to cause-specific codes in the 10th revision of the *International Statistical Classification of Diseases and Related Health Problems* (ICD-10) that referred to a gunshot injury.

**Results.** We identified 105 694 gunshot-related injury deaths over the 17-year period, an average of 6 217 per annum. The total annual number of gunshot injuries increased from 1997 to 2000, at which point firearm-related deaths peaked at 9 540 recorded cases. Thereafter there was a steadily decreasing trend (interrupted only in 2006 and 2008) until 2011, when 3 793 deaths were attributed to gunshot-related injuries as the underlying cause – a decrease of >60% from the peak in 2000.

**Conclusion.** The cause-specific profile for gunshot injury deaths in this study indicated extensive misclassification, which explained the near-absence of these injuries among assault cases. However, the trend in gunshot-related injury deaths irrespective of intent provides further support for the hypothesis that stricter gun control, coinciding with the implementation of the Firearms Control Act of 2000, accounts for this decrease.

*S Afr Med J* 2016;106(6):589-591. DOI:10.7196/SAMJ.2016.v106i6.10379

Gun violence denialists recently dismissed the findings of two studies presented at a seminar co-hosted by Gun Free South Africa, the Institute for Security Studies and the African Policing Civilian Oversight Forum. Abrahams *et al.*<sup>[1]</sup> compared the profile of female homicides from two representative national samples collected in 1999 and 2009 and Matzopoulos *et al.*<sup>[2]</sup> presented surveillance data from South Africa (SA)'s five major cities from 2001 to 2005, the period for which comprehensive injury mortality surveillance data were available. Both studies concurred that there had been a significant reduction in firearm homicides relative to other types of homicide, which coincided with stricter gun control espoused by the Firearms Control Act of 2000 (FCA), and that this, in the absence of any other plausible explanation or identified confounding factors, was the probable cause of the decrease.

The denialists took exception to the source of the data – both studies used postmortem examinations that have been shown to provide a more comprehensive mortality profile for occupational injuries,<sup>[3]</sup> female homicides,<sup>[4]</sup> railway injuries<sup>[5]</sup> and road injuries<sup>[6]</sup> than official sources. Instead they referred to Statistics South Africa (SSA)'s death notifications data that ostensibly offered conflicting results. Their disquiet may have arisen from their interpretation of SSA's 2014 release *Mortality and Causes of Death in South Africa 2013: Findings from Death*

*Notification*,<sup>[7]</sup> which describes gun deaths as being involved in only 1.7% of assault-related deaths (i.e. homicides) and has been touted by denialists to downplay the importance of firearms in homicide.<sup>[8,9]</sup> Despite this report ironically seeming to provide further evidence of the FCA's having effected a decrease, the low number of firearm assaults and overall assault-related deaths is incongruous with other recently released data including police crime statistics,<sup>[10]</sup> a recent survey of injury mortality from postmortem investigations<sup>[11]</sup>

and data provided by the National Department of Health (NDoH) in response to a question in the National Assembly.<sup>[12]</sup>

## Methods

We conducted a review of all gunshot injuries recorded in SSA death notifications from 1997 to 2013. We included all cases in which the underlying cause of death was ascribed to cause-specific codes in the 10th revision of the *International Statistical Classification of Diseases and Related Health Problems*

**Table 1. Injury-related ICD-10 codes corresponding with gunshot injuries included in SA death notification**

Underlying cause	Description
W32	Accidental handgun discharge
W33	Accidental rifle, shotgun and larger firearm discharge
W34	Accidental discharge from other and unspecified firearms
X72	Intentional self-harm by handgun discharge
X73	Intentional self-harm by rifle, shotgun and larger firearm discharge
X74	Intentional self-harm by other and unspecified firearms
X93	Assault by handgun discharge
X94	Assault by rifle, shotgun and larger firearm discharge
X95	Assault by other and unspecified firearms
Y22	Undetermined intent: handgun discharge
Y23	Undetermined intent: rifle, shotgun and larger firearm discharge
Y24	Undetermined intent: other and unspecified firearm discharge

(ICD-10)<sup>[13]</sup> that referred to a gunshot injury, whether intentionally (including self-harm and assault) or unintentionally inflicted or inflicted with undetermined intent (Table 1).

## Results

We identified 105 694 gunshot-related injury deaths over the 17-year period, an average of 6 217 per annum. The total annual number of gunshot injuries increased from 1997 to 2000, at which point firearm-related deaths peaked at 9 540 recorded cases. Thereafter there was a steadily decreasing trend (interrupted only in 2006 and 2008) until 2011, when 3 793 deaths were attributed to gunshot-related injuries as the underlying cause – a decrease of >60% from the peak in 2000 (Fig. 1). Deaths from gunshot-related injuries increased in 2012 and again in 2013 – the first consecutive year-on-year increases since 2000.

Intentionally inflicted gunshot injuries, whether from self-harm or assault, accounted for just 2.2% of gunshot-related injury deaths over the study period. Until 2006, most gunshot-related injury deaths (between 76% and 94% annually) were recorded as due to undetermined intent, a category that accounted for <1% of all gunshot-related deaths from 2008 onwards (Table 2). In contrast, unintentional gunshot injury deaths resulting from 'accidental discharge' increased from 5 - 27% of all gun-related deaths occurring annually between 1997 and 2006 to 89 - 99% from 2007.

## Discussion

This study clearly shows that firearms remain an important cause of injury-related mortality and should be considered as providing a minimum estimate, given that complete cause-of-death information is not always provided in death notification. The cause-specific profile for gunshot injury deaths in this study indicates that extensive misclassification is the reason for the near-absence of these injuries among assault cases. There can be no other explanation for the arbitrary reallocation of gunshot injuries from undetermined to unintentional causes other than the application of a new coding rule from 2007, which was alluded to in the 2010 death notification report.<sup>[14]</sup> The allocation of injury deaths with limited information on intent to unintentional causes has been observed in national<sup>[12]</sup> and provincial studies<sup>[15]</sup> and is also a common cause of information loss for injury-related mortality data internationally.<sup>[16]</sup> A recent study in the Western Cape, which linked death notification forms with postmortem reports, showed that homicides generally,

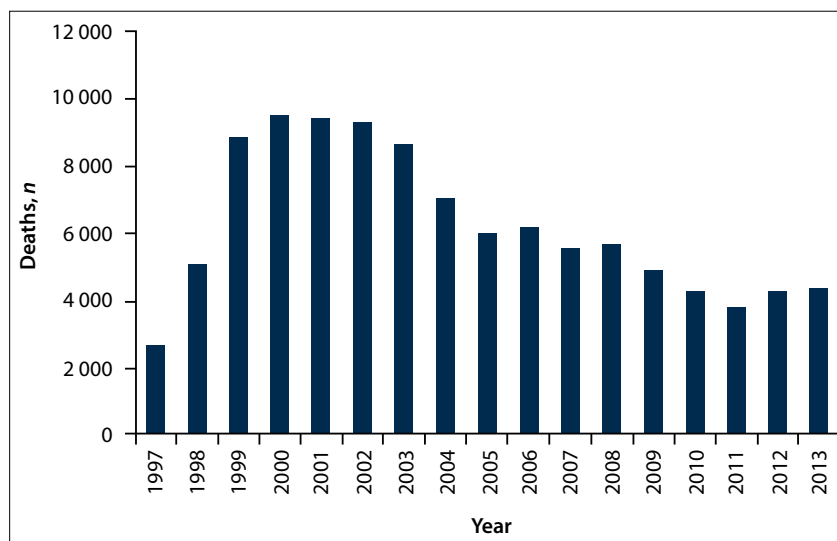


Fig. 1. Annual gunshot deaths for all causes in SA, 1997 - 2013 (N=105 694).

Table 2. Gunshot injuries included in SA death notification by broad cause of death category, 1997 - 2013 (N=105 694)

Year	Intentional, self-harm (X72 - X74), n (%)	Intentional, assault (X93 - X95), n (%)	Unintentional (W32 - W34), n (%)	Undetermined intent (Y22 - Y24), n (%)
1997	5 (0.2)	8 (0.3)	615 (23)	2 044 (76.5)
1998	21 (0.4)	15 (0.3)	771 (15.1)	4 297 (84.2)
1999	48 (0.5)	41 (0.5)	2424 (27.2)	6 395 (71.8)
2000	32 (0.3)	44 (0.5)	729 (7.6)	8 735 (91.6)
2001	56 (0.6)	446 (4.8)	1 712 (18.3)	7 154 (76.4)
2002	15 (0.2)	83 (0.9)	481 (5.2)	8 696 (93.8)
2003	22 (0.3)	103 (1.2)	477 (5.5)	8 067 (93.1)
2004	54 (0.8)	216 (3.1)	601 (8.6)	6 152 (87.6)
2005	32 (0.5)	151 (2.5)	1 132 (18.7)	4 732 (78.3)
2006	44 (0.7)	224 (3.6)	460 (7.4)	5 482 (88.3)
2007	25 (0.4)	136 (2.4)	4 946 (88.9)	458 (8.2)
2008	34 (0.6)	28 (0.5)	5 584 (98.2)	41 (0.7)
2009	29 (0.6)	35 (0.7)	4 836 (98.6)	5 (0.1)
2010	27 (0.6)	35 (0.8)	4 210 (98.5)	4 (0.1)
2011	33 (0.9)	44 (1.2)	3 710 (97.8)	6 (0.2)
2012	28 (0.7)	68 (1.6)	4 190 (97.6)	9 (0.2)
2013	36 (0.8)	88 (2)	4 230 (97.1)	3 (0.1)
1997 - 2013	541 (0.5)	1765 (1.7)	41 108 (38.9)	62 280 (58.9)

and gunshot injuries in particular, were prone to misclassification.<sup>[15]</sup>

National and international burden of mortality estimations (e.g. the National Burden of Disease Study in SA and the Global Burden of Disease Study) adjust and model death registration data to account for underreporting and misclassification and to reallocate poorly defined 'garbage codes'.<sup>[17,18]</sup> For the second National Burden of Disease Study, the South

African Medical Research Council (SAMRC) conducted a nationally representative retrospective descriptive study of medicolegal postmortem investigation data from mortuaries for 2009 to provide a more accurate cause-specific injury profile. This study estimated that 98% of firearm deaths were intentionally inflicted and that most of these deaths (88%) were homicides,<sup>[12]</sup> which is consistent with statistics compiled by the NDoH.<sup>[13]</sup>

The predominance of homicides (i.e. assault-related deaths) in these data means that in considering the mortality trend for gunshot injuries in death registration, it is acceptable to ignore the cause-specific profile. The overall trend is consistent with the female homicide and urban homicide data drawn from forensic pathology laboratory data<sup>[1,2]</sup> and consequently provides further support for the hypothesis that stricter gun control coinciding with the implementation of the FCA was the cause of the decrease in gunshot injury deaths from 2000 to 2010. The FCA's unambiguous intent was to reduce the number of firearms in the country. It included provisions for restrictions and prohibition on particular types of firearm, and background checks to establish the physical and mental capacity of potential owners to use a firearm responsibly. Its promulgation was followed by increased hand-ins of previously licensed weapons, amnesties for illegal weapons, an audit of state-owned firearms and special operations to recover unlicensed weapons. According to gun law expert Martin Hood, it was from April 2003 that police had instituted a more restrictive licensing regimen, which saw a 70 - 80% reduction in firearm licences being issued.<sup>[19]</sup>

It is unclear exactly which aspect of the FCA may have been most instrumental in causing the decrease. However, the increasing number of gunshot-related deaths for 2012 and 2013, which is confirmed by NDoH data,<sup>[13]</sup> corresponds with the police fast-tracking the finalisation of more than a million firearm-related applications for firearm licences, licence renewals for individuals and competency certificates between November 2010 and July 2011.<sup>[20]</sup> There have also been several high-profile cases of firearms bypassing formal licensing and being sold illegally,<sup>[21-24]</sup> including by corrupt police officials, all of which points to lax enforcement and easy access to firearms being the cause of the increase.

**Acknowledgements.** We are grateful to SSA, which provided these data to the SAMRC, SAMRC colleagues Tracy Glass (Burden of Disease Research Unit) and Ria Laubscher (Biostatistics Unit), who collated and consolidated the data, and Paul Oxley of Gun Owners of South Africa, who brought the data to our attention.

**Conflicts of interest.** RM serves on the board of Gun Free South Africa, but receives no remuneration for his service to the organisation.

## References

1. Abrahams N, Mathews S, Martin LJ, Lombard C, Jewkes R. Intimate partner femicide in South Africa in 1999 and 2009. *PLoS Med* 2013;10(4):e1001412. DOI:10.1371/journal.pmed.1001412
2. Matzopoulos RG, Thompson M Lou, Myers JE. Firearm and nonfirearm homicide in 5 South African cities: A retrospective population-based study. *Am J Public Health* 2014;104(3):455-460. DOI:10.2105/AJPH.2013.310650
3. Lerer LB, Myers JE. Application of two secondary documentary sources to identify the underreporting of fatal occupational injuries in Cape Town, South Africa. *Am J Ind Med* 1994;26(4):521-527. DOI:10.1002/ajim.4700260409
4. Abrahams N, Jewkes R, Martin LJ, Mathews S, Vetten L, Lombard C. Mortality of women from intimate partner violence in South Africa: A national epidemiological study. *Violence and Victims* 2009;24(4):546-56. DOI:10.1891/0886-6708.24.4.546
5. Lerer LB, Matzopoulos R. Meeting the challenge of railway injury in a South African city. *Lancet* 1996;348(9028):664-666. DOI:10.1016/S0140-6736(96)02100-9
6. Chokotho LC, Matzopoulos R, Myers JE. Assessing quality of existing data sources on road traffic injuries (RTIs) and their utility in informing injury prevention in the Western Cape Province, South Africa. *Traffic Inj Prev* 2013;14(3):267-273. DOI:10.1080/15389588.2012.706760
7. Statistics South Africa. Mortality and Causes of Death in South Africa, 2013: Findings from Death Notification. Statistical release P0309. Pretoria: SSA, 2014.
8. Gun Servant. Firearm related death in South Africa is negligible. <http://gunservant.com/2014/12/13/firearm-related-death-in-south-africa-is-negligible/> (accessed 22 November 2015).
9. Joubert G. A letter to Msholozzi. 2015. <http://gunservant.com/2015/11/05/a-letter-to-msholozzi/> (accessed 22 November 2015).
10. South African Police Service. Crime Report 2010/2011: SAPS Together Squeezing Crime to Zero: SAPS Members, My Family – Together Pushing Back the Frontiers of Evil. Pretoria: SAPS, 2011.
11. Matzopoulos R, Prinsloo M, Pillay-van Wyk V, et al. Injury-related mortality in South Africa: A retrospective descriptive study of postmortem investigations. *Bull World Health Organ* 2015;93(5):303-313. DOI:10.2471/BLT.14.145771
12. Republic of South Africa National Assembly. Question No. 3408 (Internal question paper No. 37, 4 September 2015). 2015. <https://pmg.org.za/files/RNW3408-151026.docx> (accessed 24 November 2015).
13. World Health Organisation. International Statistical Classification of Diseases and Related Health Problems, 10th Revision version for 2007. Geneva: World Health Organization, 2007. <http://www.who.int/classifications/apps/icd/icd10online/> (accessed 24 November 2015).
14. Statistics South Africa. Mortality and Causes of Death in South Africa, 2008: Findings from Death Notification. Statistical Release P309.3. Pretoria: SSA, 2010.
15. Groenewald P, Azevedo V, Daniels J, et al. The importance of identified cause-of-death information being available for public health surveillance, actions and research. *S Afr Med J* 2015;105(7):528-530.
16. Bhalla K, Harrison JE, Shahraz S, Fingerhut LA. Availability and quality of cause-of-death data for estimating the global burden of injuries. *Bull World Health Organ* 2010;88(11):831-8C. DOI:10.2471/BLT.09.068809
17. Naghavi M, Makela S, Foreman K, O'Brien J, Pourmalek F, Lozano R. Algorithms for enhancing public health utility of national causes-of-death data. *Popul Health Metr* 2010;8(9):1-14. DOI:10.1186/1478-7954-8-9
18. Pillay-van Wyk V, Laubscher R, Msemburi W, et al. Second South African National Burden of Disease Study: Data Cleaning, Validation and SA NBD List. Cape Town: Burden of Disease Research Unit, South African Medical Research Council, 2014.
19. Ellis E. Licence applicants stick to their guns. *Star* 1 September 2003:13.
20. South African Police Service. Annual Report 2011/2012. Pretoria: SAPS, 2012.
21. Serrao A. Cop implicated in gun licence 'scam'. *Star* 5 February 2013. <http://www.iol.co.za/news/crime-courts/cop-implicated-in-gun-licence-scam-1464585> (accessed 24 November 2015)
22. Serrao A. Cop, guns linked to gangsters. *Star* 23 March 2015. <http://www.iol.co.za/news/crime-courts/cop-guns-linked-to-gangsters-1.1835604> (accessed 24 November 2015).
23. Baadjies M. 'Dirty cop sold us 200 guns'. *Daily Voice* 15 July 2015. <http://mobi.iol.co.za/#/article/dirty-cop-sold-us-200-guns-1.1885760> (accessed 24 November 2015).
24. Serrao A, Maphumulo S. Firearm shop suspects nabbed at airport. *Star* 12 July 2013. <http://beta.iol.co.za/news/crime-courts/firearm-shop-suspects-nabbed-at-airport-1545671> (accessed 24 November 2015).

Accepted 2 December 2015.