Keeping our heads above water: A systematic review of fatal drowning in South Africa

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Background. Drowning is defined as the process of experiencing respiratory impairment from submersion/immersion in liquid, and can have one of three outcomes – no morbidity, morbidity or mortality. The World Health Organization African region accounts for approximately 20% of global drowning, with a drowning mortality rate of 13.1 per 100 000 population. The strategic implementation of intervention programmes driven by evidence-based decisions is of prime importance in resource-limited settings such as Africa.

Objective. To review the available epidemiological data on fatal drowning in SA in order to identify gaps in the current knowledge base and priority intervention areas.

Methods. A systematic review of published literature was conducted to review the available epidemiological data describing fatal drowning in SA. In addition, an internet search for grey literature, including technical reports, describing SA fatal drowning epidemiology was conducted.

Results. A total of 13 published research articles and 27 reports obtained through a grey literature search met the inclusion and exclusion criteria. These 40 articles and reports covered data collection periods between 1995 and 2016, and were largely focused on urban settings. The fatal drowning burden in SA is stable at approximately 3.0 per 100 000 population, but is increasing as a proportion of all non-natural deaths. Drowning mortality rates are high in children aged <15 years, particularly in those aged <5.

Conclusions. This review suggests that SA drowning prevention initiatives are currently confined to the early stages of an effective injury prevention strategy. The distribution of mortality across age groups and drowning location differs substantially between urban centres and provinces. There is therefore a need for detailed drowning surveillance to monitor national trends and identify risk factors in all SA communities.

At the turn of the millennium, drowning was the third leading cause of unintentional injury-related death globally, with an estimated mortality rate of 7.4 per 100 000 population.15 The drowning mortality rate for the World Health Organization (WHO) African region was considerably higher at 13.1 per 100 000 population16 and in 2012 was found to account for 20% of global drowning globally.17 Drowning is defined as the process of experiencing respiratory impairment from submersion/immersion in liquid and can have one of three outcomes – no morbidity, morbidity or mortality.18 Non-fatal drowning incidents are often associated with significant morbidity and socioeconomic burden from severe pulmonary and neurological sequelae.14 Taking both morbidity and mortality into account, the WHO global burden of disease study estimates that 125 500 years of healthy life (disability-adjusted life-years) were lost due to drowning in South Africa (SA) in 2012.18

Drowning prevention is a key priority for the International Lifesaving Federation (ILS), the Royal Life Saving Society, and their member organisations such as Lifesaving South Africa (LSA). The first phase in proven injury prevention models is establishing the extent of the injury burden through appropriate surveillance.19 Well-designed surveillance programmes will inform the second phase of such models: the identification of risk factors and predisposing conditions.20 The strategic implementation of intervention programmes driven by evidence-based decisions is of prime importance in resource-limited settings such as SA. However, the 2007 ILS World Drowning Report15 indicates the absence of reliable drowning surveillance in the developing world, particularly in Africa.

Objective
To systematically review the available epidemiological data on fatal drowning in SA in order to identify gaps in the current knowledge base and priority intervention areas.

Methods
A systematic review of published literature was conducted to identify the available epidemiological data describing fatal drowning in SA. The EBSCOhost, Medline (via PubMed), Web of Science, Scopus, Science Direct, Safety Lit and Cochrane Systematic Reviews databases were searched in March 2017. The EBSCOhost database search included the Academic Search Premier, Cumulative Index to Nursing and Allied Health Literature, Africa Wide Information, General Science Abstracts and PsyInfo databases. Articles in which ‘drown’, ‘immersion injur’ or ‘submersion injur’ appeared anywhere in the title, abstract or keywords together with the exact term ‘South Africa’ anywhere in the article were retrieved (Table 1). Searches were limited to English articles published after 1994.

After removing duplicates, two authors separately screened the titles and abstracts for indications that articles may include epidemiological data on fatal drowning in SA collected after the end of apartheid in 1994 (Fig. 1). Articles were excluded if drowning epidemiology data

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were collected in or before 1994 for three reasons: (i) the historical exclusion of data from the former homeland states during the apartheid era; (ii) the recognised under-registration of deaths in the black population during the apartheid era; and (iii) the effects of migrant labour on the estimation of population size during this time. The full text of remaining articles was reviewed by two authors separately. Where it was possible to separate the data, only data on unintentional drowning were included. Where it was not possible to separate the data, this is noted in the results. The bibliographies of included articles were screened for additional articles of relevance, which were submitted to the same review process before inclusion. Thirteen published research articles were included in this review (Table 2). In addition, an internet search for grey literature describing SA fatal drowning epidemiology was conducted (March 2017). The websites of Statistics South Africa (Stats SA), the South African Medical Research Council (SAMRC; www.mrc.ac.za), the SA government departments of Home Affairs (http://www.home-affairs.gov.za) and Health (www.health.gov.za), the South African Police Service (www.saps.gov.za), the National Sea Rescue Institute (NSRI; http://www.nsvri.org.za/) and LSA (http://www.lifesaving.co.za/) were searched for relevant data using a search strategy specific to the context of each website. Epidemiological data collected before 1994 were excluded. Twenty-seven additional sources of information were screened and included in this review (Table 3). These included public or technical reports from Stats SA, the SAMRC Violence, Injury and Peace Research Unit (VIPRU) and LSA.

There was a large variation in design, data collection and reporting in the retrieved information, and consequently direct comparison and meta-analysis were not possible. Where appropriate, descriptive statistics including means and standard deviations (SDs) were computed in Microsoft Excel (Microsoft Office for Mac 2011, version 14.6.7, Microsoft, USA), and linear regression was performed using GraphPad PRISM (version 5.02, GraphPad Software, USA).

Results
The systematic search and review strategy retrieved 13 published research articles, and a further 27 reports obtained through a grey literature search, that met the inclusion and exclusion criteria (Fig. 1). These 40 articles and reports covered data collection periods between 1995 and 2016, and were largely focused on urban settings. Drowning surveillance was the primary aim in only seven of the included articles and reports. The drowning burden in SA

In the included articles and reports, the majority of data reported were sourced from Stats SA (n=12) and the SAMRC-VIPRU National Injury Mortality Surveillance Sys-
tem (NIMSS) \((n=17)\), both of which are based on vital registration records. Fig. 2 shows the number of fatal accidental drownings per year as indicated in the annual Stats SA P0309.3 report on mortality and causes of death in SA between 1997 and 2015. \([20-31]\) In the most recent 5 years between 2011 and 2015, there was an average of 1 541 \((SD 81)\) fatal drownings per year, with a mean drowning mortality rate of 2.87 \((0.23)\) per 100 000 population (Fig. 2). Although the absolute number of fatal drownings increased significantly between 1999 and 2015 \((r^2=0.419; \ p=0.012)\), the drowning mortality rate per 100 000 population remained consistent \((r^2=0.243; \ p=0.087)\).
Drowning mortality is consistently higher in children aged <15 years than in adults. On average, 43.2% (SD 2.0%) of drownings described
in the NIMSS annual reports occurred in children aged <15 years (Table 4).[32-37] Morris et al.[35] reported that 55% of drowning deaths in Pretoria involved children aged <18 years. This was consistent with data from rural settings such as the Africa Centre, where 65% of drownings occurred in children aged <15 years.[31] LSA published two circulars analysing fatal drowning incidents reported in the SA media in 2015 (n=232, representing 16% of fatal drownings)[30] and 2016 (n=249).[31] The highest proportion of reported incidents occurred in children aged <10 years (33.0% in 2015 and 29.1% in 2016). In an investigation of unintentional drowning mortality across 60 countries, the age-standardised death rates for SA were the highest in the age group 0 - 4 years (4.4 per 100 000 population, 95% confidence interval (CI) 4.1 - 4.8). Interestingly, this was followed by adults aged >65 years (3.2 per 100 000, 95% CI 2.8 - 3.6) and then children aged 5 - 14 years (2.9 per 100 000, 95% CI 2.7 - 3.1).[37] Similarly, the NIMSS annual reports consistently report the highest proportion of drowning fatalities occurring in the age group 1 - 4 years (Table 4). In Donson and Van Niekerk's[38] city-level analysis of NIMSS data, the highest age-adjusted drowning mortality rates were 6.3 per 100 000 population in children aged 0 - 4 years, and 2.2 per 100 000 in children aged 5 - 14 years. The age group 0 - 4 years had the highest drowning mortality rate in all five cities investigated, the rate being particularly high in the inland cities of Johannesburg (9.3 per 100 000 population) and Pretoria (6.9 per 100 000).[38] In a separate analysis of drowning in Pretoria, 19% of all drowning fatalities occurred in the age group 1 - 2 years and 13% occurred in children aged <1 year.[39] Pretorius and Van Niekerk[40] investigated the occurrence of injury mortality in Gauteng in developmentally meaningful age groups. Drowning accounted for 9.4% of injury mortality in infancy (0 - 1 years), 16.8% in early childhood (2 - 3 years), 13.4% in preschool children (4 - 6 years), 13.1% in school-age children (7 - 12 years) and 3.0% in adolescence (13 - 19 years), with the highest mortality rate observed in early childhood (1.29 per 100 000 population).

**Drowning mortality differs between males and females**

Drowning mortality was consistently higher in males than in females across all included articles and reports. Burrows et al.[38] observed that the difference in mortality rate by sex was highest for drowning when compared with other fatal injuries in SA.

### Table 4. Summary of drowning mortality data from the NIMSS Annual Reports, 2002 - 2008[32-37]

| Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | Mean (SD) |
|------|------|------|------|------|------|------|------|-----------|
| NIMSS coverage* | 37 mortu- aries in 6 provinces (35 - 40) | 36 mortu- aries in 7 provinces (36) | 35 mortu- aries in 7 provinces (36) | 21 mortu- aries in 6 provinces (39) | 39 mortu- aries in 7 provinces (48 - 56) | 62 mortu- aries in 8 provinces (39 - 52) | n/a | |
| Non-natural deaths, N | 25 494 | 22 248 | 23 938 | 23 541 | 33 484 | 31 177 | 26 647 (4 581) | |
| Drowning as a proportion of non-transport unintentional injury fatalities, % (n) | 16.2 (408) | 16.5 (430) | 15.2 (357) | 14.9 (652) | 14.4 (784) | 15.4 (0.9) | |
| Age group (years) accounting for highest proportion of fatal drowning (%) | 1 - 4 (22.8) | 1 - 4 (19.5) | 1 - 4 (20.7) | 1 - 4 (19.9) | 1 - 4 (16.6) | n/a | |
| Proportion of drowning fatalities that occurred in children aged <15 years, % | 44.0† | 41.9 | 46.0† | 42.9 | 44.3 | 40.2 | 43.2 (2.0) | |
| Cape Town | † | † | 37.3 | 28.0 | 32.9 | † | 32.7 (4.7) | |
| eThekwini/Durban | † | † | 36.3 | 33.3 | 42.0 | † | 37.2 (4.4) | |
| Johannesburg | † | † | 61.4 | 57.6 | 38.1 | † | 52.4 (12.5) | |
| Tshwane/Pretoria | † | † | 55.2 | 64.7 | 55.3 | † | 58.4 (5.5) | |

NIMSS = SAMRC-VIPRU National Injury Mortality Surveillance System; SD = standard deviation; n/a = not applicable; SA = South Africa.

*There are nine provinces in SA. The figures in parentheses indicate the estimated NIMSS coverage (%) of all non-natural deaths in SA.

†Not available.

‡Estimates taken from graphical data.
children. In Pretoria, 79% of fatal drowning victims were male.\textsuperscript{15} The male-to-female ratio ranged between 2.8\textsuperscript{14} and 4.0\textsuperscript{16} and was highest in the 45 - 59, 15 - 29 and 30 - 44 years age groups.\textsuperscript{15} Donson and Van Niekerk\textsuperscript{16} reported an age-adjusted drowning mortality rate of 3.4 per 100 000 population in males compared with 0.9 per 100 000 in females in an urban setting. This was consistent with observations in a rural setting, where Garrick \textit{et al.}\textsuperscript{33} reported a drowning mortality rate of 6.2 per 100 000 person-years in males compared with 3.4 per 100 000 in females.

### Drowning risk factors

Drowning occurred disproportionately in the summer months of December, January and February\textsuperscript{13,14}; Donson and Van Niekerk\textsuperscript{16} reported that just under half (48.9% (SD 3.2%)) of drowning incidents occurred over weekends (Fridays to Sundays – Sundays 17.9%, Saturdays 17.2%), mostly between 12h00 and 19h59 (59.0% (SD 47%)).

With the exception of the coastal city of Port Elizabeth, where 76.4% of drownings occurred in the sea, approximately half of drowning incidents occurred in and around the home (Johannesburg 51.6%, Pretoria 46.7%).\textsuperscript{16} This was particularly the case in young children, with 70.0% of drownings in children aged 0 - 4 years occurring in or around the home in buckets, bathtubs and swimming pools.\textsuperscript{46} In the inland city of Pretoria, infants were more likely to drown in swimming pools (56%) and buckets (17%), while an even higher proportion of drownings in toddlers occurred in swimming pools (69%).\textsuperscript{11} Fatal drowning in older children, adolescents and adults was more evenly distributed between swimming pools, dams and rivers.\textsuperscript{19} There was a paucity of data regarding activity prior to drowning. In media reports compiled by LSA, the activity prior to drowning was unknown in 21.6% of cases. Victims were swimming in 27.8% of cases, playing near water in 13.5% and fishing in 9.4%.\textsuperscript{13,14}

Few studies reported on blood alcohol content (BAC) at the time of drowning. In Pretoria, alcohol was detected in 42% of drowning fatality cases in which blood alcohol analysis was undertaken, of which 35% (n=37 males, n=3 females) had a BAC >0.05 g/100 mL.\textsuperscript{13} Similarly, Donson and Van Niekerk\textsuperscript{16} observed that alcohol was detected in 40% of drowning fatality cases in which blood alcohol analysis was undertaken; of these, 85% had levels >0.05 g/100 mL. One-third of cases in which alcohol was detected had a BAC consistent with being ‘drunk’ to ‘very drunk’, and males were 11 times more likely than females to have a positive BAC result.\textsuperscript{13}

### Discussion

This systematic review aimed to identify and review the available epidemiology data on fatal drowning in SA in order to identify gaps in the current knowledge base and priority intervention areas. It has highlighted the lack of current and routine drowning surveillance in SA. The results provide an overview of the drowning burden in SA. Although many of the included data are outdated, the analysis of vital registration records from Stata SA reports suggests that the drowning mortality rate in SA is stable at ~3.0 per 100 000 population. It is, however, interesting to note that the proportion of non-natural deaths accounted for by drowning is increasing. This may be due to sustained and focused public health efforts to reduce the burden of other injuries such as burns and road traffic injuries. The population-attributable risk for fatal drowning in children is >40% for both sex and city in SA,\textsuperscript{16} indicating substantial potential for drowning risk reduction by identifying and targeting high-risk locations and risk factors through similar drowning prevention programmes. The mortality rate presented here is just under half that reported for global drowning estimates (7.4 per 100 000 population).\textsuperscript{16} However, there is a large variation in global drowning mortality, with drowning rates in low- and middle-income countries reported to be over three times higher than those in high-income countries.\textsuperscript{2} In an analysis of 60 countries, SA ranked 21st in all-age drowning mortality but among the top 10 for child drowning mortality.\textsuperscript{17}

Drowning mortality rates are high in SA children aged <15 years, particularly in those aged <5 years. This is consistent with global patterns, where male children aged <5 years have been found to have the highest drowning mortality rates.\textsuperscript{31} The high proportion of drownings that occur in and around the home in this age group highlights the need for campaigns to increase awareness and implementation of safety measures around the home including barriers to access, improved supervision and water safety education.\textsuperscript{32} There is a paucity of local legislation regulating residential pool safety measures,\textsuperscript{34} which clearly highlights the need for policy engagement in local government structures. In addition, addressing broader socioeconomic determinants of health such as infrastructure and formal housing development, as well as improving access to sanitation, may have a significant effect on drowning in SA.\textsuperscript{35} There is very limited evidence describing activity prior to drowning, which appears to be unknown in a substantial proportion of drowning incidents in SA. This is consistent with the findings of a recent systematic review describing global risk factors for fatal river drowning\textsuperscript{36} which reported a scarcity of published studies describing activity prior to drowning.

A recent study by Joanknecht \textit{et al.}\textsuperscript{37} described a retrospective chart review of immersion injuries admitted to Red Cross War Memorial Children’s Hospital (RCWMCH) in Cape Town, SA. This study was not included in the current review as it largely reports on non-fatal drowning injuries. However, the drowning risk factors and trends described are worth noting in comparison with the results presented here. RCWMCH admits children up to 14 years of age, and 60% of admissions for immersion injuries were of children aged <5 years (70.7% male). Similar to the findings for fatal drowning presented here, the majority of drowning incidents occurred in and around the home (60.5%), but were only witnessed in 19% of cases.\textsuperscript{38} The authors further described an interesting relationship between location of drowning, age and first language in these children. In particular, children aged <5 years were more likely than older children to drown in buckets, baths and private swimming pools, while the majority of older children drowned in rivers, public swimming pools and the ocean.\textsuperscript{39} The highest proportion of drownings in Afrikaans- and English-speaking children occurred in private swimming pools, while among Xhosa-speaking children the highest proportion occurred in public swimming pools and buckets.\textsuperscript{39} First language may be used as a gross proxy for population group. The majority of South Africans living in informal settlements are from the black and coloured population groups,\textsuperscript{37} and this uniquely SA pattern of drowning prevalence is therefore likely to be a result of specific racialised socioeconomic determinants of health. In homes without a plumbed water supply, water for cooking and cleaning must be collected from central collection points daily and is kept in buckets around the home. Although not supported by the evidence presented in this review, poor infrastructure in these settlements may create additional drowning risks such as large puddles associated with water leaks, uncovered storm-water drains and open grey/black-water channels.\textsuperscript{40} Members of low-income households are also not likely to have access to private swimming pools, and therefore make use of public swimming pools and bodies of water accessible to the public.
The ratio of male-to-female drowning reported here is higher than that reported globally, where males are generally twice as likely to drown as females, but is consistent with the higher drowning prevalence in males globally. The high ratio of male to female drowning is particularly pronounced in adulthood, and this observation may be explained by increased risk-taking behaviour in males, particularly in teenagers and during early adulthood. This is supported by the observation that adult males were more likely than females to be under the influence of alcohol at the time of death. There were limited data describing drowning risk factors other than sex and age. The prevalence of drowning was highest in the warmer summer months, during weekends and during the mid- to late afternoon. Although no exposure data are available, it can reasonably be hypothesised that this pattern reflects the higher exposure during these times. The limited data available suggest that 40% of drowning victims, males in particular, will test positive for blood alcohol at the time of death. Globally, alcohol use around bodies of water has been identified as a significant risk factor for drowning in adolescents and adults.

Study limitations

There are several limitations to the data presented in this review. First, the majority of the data included were extracted from vital registration records or medicolegal autopsy records and therefore exclude cases where the body was not recovered after drowning. Such cases are likely to be biased towards drowning incidents in large bodies of water and may therefore affect the distribution of drowning across locations. Second, there is inconsistency in the separation and annotation of unintentional and intentional drowning incidents. Although this review has attempted to include only data relating to unintentional drowning, there are cases noted in the results where it was not possible to do so. Donson and Van Niekerk have previously reported that 79.9% of deaths from drowning in SA were unintentional, and it can therefore be assumed that, where included, intentional drowning deaths are under-represented in the data. Third, the data presented here are mainly focused on urban SA, and data on drowning in rural areas are conspicuous in their paucity.

Conclusions

The SA public health system is laden with a high infectious disease burden and a high prevalence of injury, including violence, transport-related injuries and burns, and there are limited resources for injury prevention programmes outside these high-priority areas. It is therefore imperative that drowning prevention initiatives are evidence-based and effective. This review suggests that SA drowning prevention initiatives are currently confined to the early stages of an effective injury prevention strategy. The results presented suggest that drowning mortality and the distribution of mortality across age groups and drowning location differ substantially between urban centres and provinces. However, there are few supporting data sources for these findings. In addition, there is very little exploration of other risk factors such as activity prior to drowning and the role of alcohol consumption. Evidence suggests that epidemiological studies describing specific risk factors associated with location of, and activity prior to, drowning are needed to inform targeted intervention strategies. Furthermore, there is a gap in the evidence base relating to risk factors for adult drowning. There is therefore a need for consistent and detailed drowning surveillance in SA in order to monitor national trends as well as identify risk factors in all SA communities and allow for temporal and spatial comparison of drowning epidemiology at both a national and international level.

1. Polder MJ, McGee K. The epidemiology of drowning worldwide. Int Control Safe Promot 2018;13(1):195-199. https://doi.org/10.1093/christmas/105.1.195-199.
2. World Health Organization. Global Report on Drowning: Preventing a Leading Killer. Geneva: WHO, 2014. http://www.who.int/violence_injury_prevention/drowning_prevention/drowning_report_2014/en/ (accessed 15 January 2017).
3. Idris AHI, Berg RA, Birzen J, et al. Recommended guidelines for uniform reporting of data from drowning. Circulation 2003;108(20):2540-2547. https://doi.org/10.1161/01.CIR.0000090658.70101.64.
4. Sosmanam PK, Vahnilas A. Neurologic long-term outcome after drowning in children. Scand J Trauma Resusc Emerg Med 2012;20(55):1-7. https://doi.org/10.1186/2047-7241-20-55.
5. Jonknecht L, Argent AJ, van DeK M, van All R. Drowning in South Africa: Local data should inform prevention strategies. Prehosp Surg Int 2013;15(2):123-130. https://doi.org/10.1155/2013/1483567.
6. Department of Health Statistics and Information Systems. WHO Methods and Data Sources for Country-Level Causes of Death. Geneva: World Health Organization, 2014. http://www.who.int/healthinfo/statistics/EccoliSC_method.pdf (accessed 15 January 2017).
7. Finch C. A new framework for research leading to sports injury prevention. J Sci Med Sport 2006;9(1):5-9. https://doi.org/10.1016/j.jsams.2005.02.009.
8. World Health Organization. Preventing Drowning: An Implementation Guide. Geneva: WHO, 2017. http://www.who.int/violence_injury_prevention/drowning/drowning_prevention_guide/en/ (accessed 29 April 2017).
9. International Life Saving Federation. World Drowning Report 2007. Leuven: ILF, 2007. http://ilsf.org/drowning-prevention/library/world-drowning-report (accessed 4 December 2017).
10. Kibel SM, Joubert G, Bradshaw D. Injury-related mortality in South African children, 1981 - 1985. S Afr Med J 1990;79:389-403.
11. Bhetta JL, Bradshaw D. African vital statistics – a black hole? S Afr Med J 1985;67:977-981.
12. Davis S, Smith LS. The epidemiology of drowning in Cape Town – 1980 - 1983. S Afr Med J 1985;68:729-742.
13. Lu T-H, Lenette P, Walker S. Quality of cause-of-death reporting using ICD-10 drowning codes: A descriptive study of 69 countries. BMC Med Res Methodol 2010;10:10. https://doi.org/10.1186/1471-2288-10-30.
14. Madl BL. Drowning deaths in Mabhitla area of South Africa. Med Sci Law 2009;49(4):329-332. https://doi.org/10.1258/msl.2008.07-329.
15. Muir M, Kim DK, Ton-Petruolo L, Saryan G. Drowning in Pretoria, South Africa: A 10-year review. Forensic Leg Med 2016;37:66-70. https://doi.org/10.1016/j.flem.2015.10.010.
16. Donson J, van Niekerk A. Unintentional drowning in urban South Africa: A retrospective investigation, 2001 - 2005. Int J Inj Cont Safe Promot 2013;8(3):218-226. https://doi.org/10.1080/17487389.2013.810674.
17. Lin C-Y, Wang Y-F, Lu T-H, Kawach I. Unintentional drowning mortality, by age and body of water: An analysis of 60 countries. Int J Prev 2013;21(3):45-59. https://doi.org/10.1186/1542-6414-2013-041.
18. Lifesaving South Africa. Drowning statistics: January 2016 - December 2016. Durban: LSA, 2017. http://lifesaving.co.za/html/176deaths/b071/101.dph (accessed 15 March 2017).
19. Lifesaving South Africa. Drowning statistics: January 2016 - December 2016. Durban: LSA, 2017. http://lifesaving.co.za/download-result.php?filename_download=1483535132drowning-stats-jan-2016-dic-2016.pdf (accessed 15 January 2018).
20. Statistics South Africa. Mortality and causes of death in South Africa, 1997 - 2003. Findings from death notification. Statistical release PS09.3. Pretoria: Stats SA, 2006. http://www.statssa.gov.za/?page_id=1854&PPN=P0309.3&SCH=4327 (accessed 15 March 2017).
