UNDER FIVE MORTALITY RATE

Findings from Census 2011 and other data sources

Report: 03-09-13

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Preface

Despite substantial progress in reducing child mortality, child survival remains a concern worldwide and in South Africa. Child mortality estimates are crucial for planning and monitoring national and global health strategies, policies and interventions on child health and well-being. This report presents an analysis of under-five mortality rates in South Africa using Census 2011 household deaths data.

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Acknowledgement

Executive summary

Under five mortality is an important indicator of child health and a measure of a population's socio-economic well-being (Masuy-Stroobant & Gourbin, 1995). Although there have been numerous studies on child mortality at the national level, few studies have focused on child mortality at the sub-national level. This is due to under reporting of deceased children in most developing countries (UN, 2008). Additionally, South Africa has not yet achieved complete reporting of births and deaths in the civil registration system and as a result, estimation of mortality is often derived from Census and survey data by employing indirect demographic estimation techniques or through modelling.

This paper uses household deaths data collected from the 2011 Census to investigate the levels and spatial differentials in the under five mortality rate (U5MR) in South Africa. In Census 2011, questions on household deaths in the last 12 months were asked. Due to the nature of variables in the household deaths, life tables were used to derive the under five mortality rates.

Findings from this study highlight a downward trend in U5MR nationally from 75 deaths in 2006 to 34 deaths per 1 000 live births in 2016. Differentials in U5MR by population group were the lowest amongst the White (14,8), Asian/Indian (21,8) population groups, Coloureds (30,2) and Black Africans (52,4) had higher U5MR. The Under five mortality differentials by province shows clear spatial differentials in South Africa. At provincial level, Western Cape and Gauteng had the lowest Under five Mortality rate of 24,5 and 34,3 deaths per 1 000 live births, while Free State and KwaZulu-Natal had the highest Under five mortality rate at 68,4 and 62,6 deaths per 1 000 live births. The estimates in this paper refers to 12 months before the Census.

The thematic report is organised into four chapters. Chapter 1 provides a general introduction of the study and a review of existing literature on the levels, trends and differentials of under-five mortality. Chapter 2 describes the data source and methodology. Chapter 3 presents the findings of the study, and Chapter 4 focuses on discussions and conclusion.

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Acronyms and Abbreviations

BMR   Bureau of Market Research

CARe   Centre for Actuarial Research

DHIS   District Health Information System

MRC   Medical Research council

NDP   National Development Plan

PMTCT   Prevention of mother-to-child transmission

RMS   Rapid Mortality Surveillance

SDG   Sustainable Development Goals

U5MR   Under Five mortality rate

Definitions of terms

Child mortality rate - Probability of dying between exact age one and four.

Infant Mortality rate - Probability of a live birth dying before age one.

Synthetic cohort life table approach - Mortality probabilities for small age segments based on real cohort mortality experience combined into common age segments.

Under five mortality rate - Probability of dying between birth and exact age five.

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 Introduction

This thematic report focuses on the analysis of the under-five mortality rate using household deaths from Census 2011. The purpose of the report is to investigate the pattern in the levels and spatial differentials in under five mortality rate in the country. The analysis is disaggregated by population group, sex of the child and province of the household reporting the death.

1.2 Overview

Studies from the United Nations Inter-agency Group for Child Mortality Estimation (UN-IGME), show that every year worldwide millions of children under 5 years of age die, mostly from preventable causes such as pneumonia, diarrhoea and malaria (UN, 2018). In almost half of the cases, malnutrition plays a key role, while unsafe water, sanitation and hygiene amongst others are significant contributing factors (UN, 2018). For this reason, child mortality is a key indicator not only for child health and well-being, but also for the overall progress towards the Sustainable Development Goals (SDGs) (UN, 2017).

The SDG target for child mortality represents a renewed commitment to the world's children: By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1 000 live births and under five mortality to at least as low as 25 per 1 000 live births.

Indicator 3.2.1 of SDGs talks about the reduction of under-five mortality rate (UN, 2018). The National Development Plan (NDP) 2030 and the Medium Term Strategic Framework (MTSF) 2014-2019 vision and trajectory envisions a long and healthy life for all South Africans with the target of achieving an infant mortality rate of less than 20 per 1 000 live births, and an under 5 mortality rate of less than 30 per 1 000. The SDGs with the notion of leaving no one behind also advocates for aggregated data in order to monitor progress for the whole populations at all levels. Therefore, reliable and timely estimates of childhood mortality are needed to help countries monitor progress towards achieving the set targets.

South Africa's past mortality trends and future estimates have been developed by individual researchers and independent groups such as the Centre for Actuarial Research (CARe), The Inter-agency Group for child mortality Estimation (IGME), The Medical Research council (MRC), and Bureau of Market research (BMR) What is common among these estimates is that infant and under five mortality rates were declining in South Africa until around 1992-1993 after which they increased, although there is much uncertainty about the estimates (Dorrington & Darikwa, 2011).

The major problem one might come across in reviewing South Africa's estimates of child mortality as computed by different researchers over time is the diverseness of the estimates. Different researchers have come up with different estimates, even using the same data and similar methods of estimation. Researches that reviewed different studies on child mortality estimation in South Africa (Darikwa 2009; Nannan, Dorrington, Laubscher et al. 2012) indicate that the main reason for this problem, is the inadequate and poor quality of data available, especially for the estimates of child mortality before 1996 when there was less nationally representative data. The South African vital registration is incomplete, thus indirect estimation techniques are mostly used to estimate childhood mortality (Darikwa and Dorrington, 2011).

Research has shown that South Africa has witnessed a downward trend in child mortality until the early 1990s, after which it appeared to have levelled off at least until the early 2000 (Nannan et al; 2012). The downward trend was evident from the 1960s. Garenne & Gakusi (2005) found that since the mid-1960s, South Africa experienced one of the most rapid declines in child mortality reported in Africa from 188 deaths per 1 000 live births in 1968 to 48 per 1 000 live births in 1992 (Garenne & Gakusi, 2005, Nannan, 2012).

Based on model estimates of child mortality, the UN Inter-agency Group for Child mortality Estimation (UNGME) (2018) highlighted that South Africa's U5MR in the period 1974-2018 fell from 156,2 to 44,5 deaths per 1 000 live births. Additionally, the 2018 Mid-year population estimates also indicated that the under-five mortality rate (U5MR) declined from 80,1 deaths per 1 000 live births to 45,0 deaths per 1 000 live births between 2002 and 2018 (Stats SA, 2018).

A number of researches have also documented that because of the HIV pandemic there had been a reversal of child mortality beginning from mid-1990 and lasting to 2005, after which it has started to decline at a higher rate due to the introduction of the prevention of mother-to-child transmissions programme (PMTCT) programme (Dorrington, Johnson, Bradshaw et al., 2006; Dorrington et al. 2012; Kerbera, et al. 2013).

In 2001, the investigation of child mortality by Dorrington, Moultrie and Timaeus (2004), found that the data quality compromised the estimation process to such an extent that it was not possible to derive reliable estimates. From the 2007 Community Survey data, a detailed analysis undertaken by Darikwa (2011) suggested that the under 5 mortality rate remained stable between 2000 and 2006, assuming that the children ever Born/Children Surviving estimates were slightly low and the household deaths estimates was slightly high, the U5MR was found to be approximately 75 per 1 000 live births in 2006 (Darikwa, 2009, Nannan, 2012).

The literature on Infant Mortality Rate (IMR) differentials by population group in South Africa shows that black Africans and coloureds have high IMR, whilst Indians/Asians and whites have low IMRs. In 2011 Census, the results from Stats SA indicated that IMR was high amongst Black African (38,5 per 1 000 live births, and lowest amongst White at 8,3 per 1 000 live births). The levels are consistent with literature regarding the dynamics of the different population groups in the country (Stats SA, 2015). Results from Udjo (2014) also indicate provincial disparities in under-five mortality rates in South Africa. In light of this, it is important to understand the levels of U5MR below national level.

The objective of the paper are to produce U5MR from 2011 Census household deaths data by population group, sex of the child, and province; to document the spatial distribution of under-five mortality in South Africa and lastly to discuss the levels and trends in under five mortality rate implied by the data and show how consistent they are with estimates produced from other sources.

CHAPTER 2: MATERIALS AND METHODOLOGY

The main source of data for analysis is Census 2011 household deaths. Section I of the questionnaire collected information on deaths in the last 12 months in the households including the age and sex of the deceased. The data on lifetime fertility and survival of children was not be used in this study because disaggregation by sex showed implausible patterns. This has already been alluded to in the estimation of mortality monograph (Stats SA, 2015).

A distinction between child mortality indicators is important as they are often confused. The United Nations Children's Fund (UNICEF) on their list of basic indicator definitions, defines under-five mortality rate as the probability of dying between birth and exactly five years of age expressed per 1,000 live births, whilst Infant mortality rate is defined as the probability of dying between birth and exactly one year of age expressed per 1,000 live births. The Infant mortality rate was covered in details as published by (Stats SA, 2015) and will not be presented here.

It should be noted that the under-five mortality rate as defined here is, strictly speaking, not a rate (i.e. the number of deaths divided by the number of population at risk during a certain period of time) but a probability of death derived from a life table and expressed as a rate per 1 000 live births. In deriving under five mortality rates, there are two main demographic approaches of estimating child mortality (direct and indirect) that could be applied to the Census 2011 data. However, as the number of children surviving was found to be implausible; the Brass children ever born/children surviving method of estimating child mortality could not be used in this report. However, a life table is deemed feasible given the variables in the reported household deaths data.

The deaths reported by households and the population of children under the age of 5 are used to compute under-five mortality rates. This is achieved by calculating a complete life table for children aged 0 to 4 years. The method involves calculating the probability of dying (nqx) between ages x and $x + 1$ by using the number of children dead between ages x and $x + 1$ in the 12 months before the Census, for $x < 5$, and the Census estimate of the population aged between x and $x + 1$ at the time of the Census. This method has been adapted from UN-IGME's levels and trends of Child Mortality in 2006 working paper (UN, 2006).

2.1 Data Quality

The accuracy of estimating childhood mortality rates directly from deaths reported by households in a Census has not been thoroughly tested in developing countries (Dorrington, Moultrie and Timæus, 2004). In South Africa the method has been applied to the 2001 Census data (Dorrington, Moultrie and Timæus, 2004) and 2007 Community Survey data (Darikwa, 2009), Census 2011 (Kamangira, 2014), Census 2011 (Zewdie, 2014), and (Nannan, 2017).

Dorrington, Moultrie and Timæus (2004) noted that deaths reported by households have a poor record of estimating child mortality rates accurately. They thus caution researchers against using these data in isolation but advised that these data could be used in combination with data from other sources to identify consistencies. Should there be consistency the data can then be used in conjunction with the estimate from the other data source to come up with the level of mortality and the patterns of mortality. The major limitations of reported household deaths data also arises from incompleteness of death reporting by age and possible over-reporting of deaths.

2.2 Completeness of registered deaths under 5 relative to Census 2011

Completeness is a measure of the extent to which births and deaths that occur in a country in a given year are registered by the civil registration system (WHO, 2010). South Africa has yet not achieved complete reporting of births and deaths in the civil registration system. In South Africa death registrations were 94% complete for adults 15 years and older in 2007 – 2011 reporting period (Stats SA, 2014). The extent of official completeness of child deaths registration under 5, however, is less certain, but it is apparent that it has risen significantly in recent years.

The measurement of registration coverage of deaths for children are not frequently available. Yet, knowledge of the level of registration coverage is important in evaluating national health programs which use mortality rates as targets for attaining health goals. In South Africa, there are currently no standard tools or approaches to determine the completeness of reporting of childhood deaths. In this report Census 2011 deaths compared to the registered deaths to get an estimate of completeness of childhood deaths.

Figure 1: Percentage completeness of registered deaths measured against Census 2011
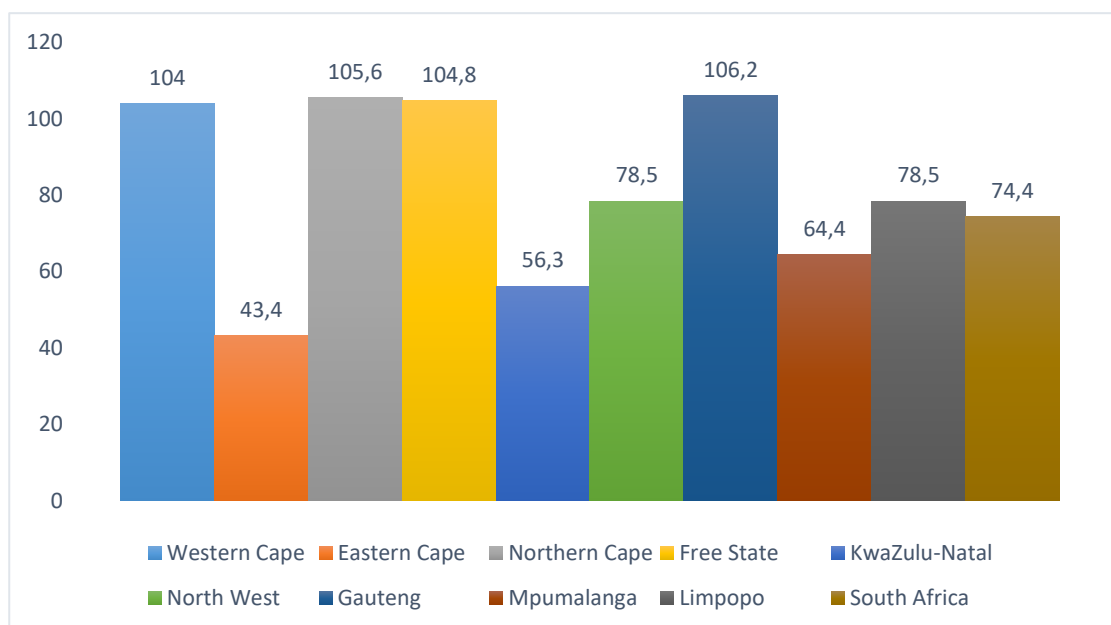
Figure 1 shows estimated completeness of registered deaths, relative to Census 2011 household deaths. It indicates that at the national level, completeness of deaths for children under 5 was 74,4% complete. Provincially, Eastern Cape (43,4%) and KwaZulu-Natal (56,3%) had the lowest percentage of completeness. Western Cape, Gauteng, Northern Cape and Free State Provinces indicates completeness of just above 100% completeness. While Limpopo and Mpumalanga's completeness was above 60%.

CHAPTER 3: RESULTS

3.1 Introduction

The results are shown by sex, population group and by province. These estimates apply for the period 12 months before Census 2011. Part one presents the distribution of deaths by selected variables, while part two presents the under-five mortality rates.

3.2 Distribution of reported deaths for children under 5

Table 1: Distribution of deaths for children under 5 by province, Census 2011

Province	Number	Percentage
Western Cape	2 831	5,2
Eastern Cape	7 760	14,2
Northern Cape	1 239	2,3
Free State	4 015	7,4
KwaZulu-Natal	14 843	27,2
North West	4 774	8,7
Gauteng	8 591	15,7
Mpumalanga	5 223	9,6
Limpopo	5 306	9,7
Total	**54 580**	**100,0**

Overall, 54 580 deaths for children under 5 were reported by households during Census 2011. Kwazulu-Natal reported the highest number of deaths for children under 5 (14 843), followed by Gauteng (8 591). The absolute number of deaths can not be compared by province as the mortality levels are affected by population size.

Due to the difficulties in establishing completeness of deaths below province level, the number of deaths for children under five have have been attached as Appendix and mortality rates were not derived at district level.

Table 2: Distribution of deaths for children under 5 by month and year of death, Census 2011

Months	2010	2011	Total	%
January		3 663	**3 663**	6,7
February		3 915	**3 915**	7,2
March		4 276	**4 276**	7,8
April		4 216	**4 216**	7,7
May		4 125	**4 125**	7,6
June		5 464	**5 464**	10,0
July		4 565	**4 565**	8,4
August		4 386	**4 386**	8,0
September		4 999	**4 999**	9,2
October	3 765	2 933	**6 698**	12,3
November	3 950		**3 950**	7,2
December	4 322		**4 322**	7,9
Total	**12 037**	**42 542**	**54 579**	**100,0**

Table 2 shows the distribution of deaths by month and year of death. The findings shows that exactly 12,3% of deaths for children under 5 years were reported in October and the Census night was between 9 and 10 October 2011. This was followed by the month of June (10%). The peak in June is consistent with the May to June peak described in the various Rapid Mortality Surveillance report by the Medical Research Council.
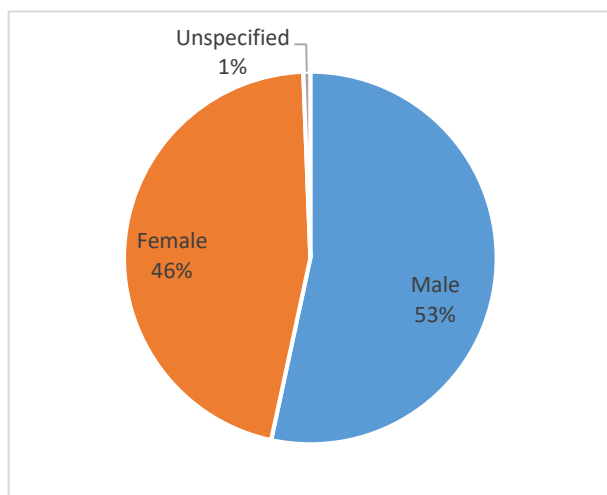
Figure 2: Deaths <5 by sex of child

Figure 3: Deaths <5 by geo-type
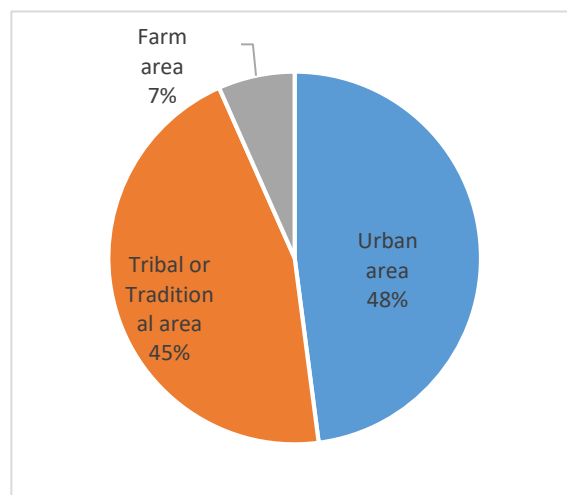
Figure 4: Deaths <5 by Natural/ Unnatural causes
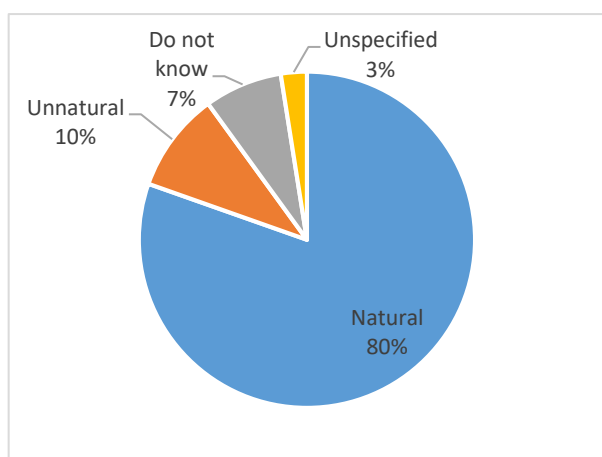
Figure 5: Deaths <5 by Population group
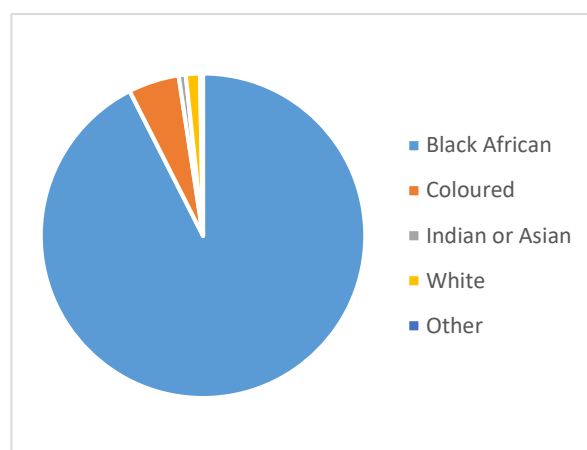
Figures 2 to 5 shows the distribution of deaths for under 5 children by selected variables.

- A higher proportion of deaths were for males (53%), compared to females (46%).

- 48% of the deaths were from urban areas, while 45% were from tribal or traditional / rural areas.

- Cause of deaths indicated that 80% of child deaths under the age five were due to natural causes. - This finding is aligned to the results from the 2010 mortality and causes of deaths data which indicates that the first leading cause of death for children aged below five years was Intestinal infectious diseases (14,6%), followed by respiratory and cardiovascular disorders specific to the perinatal period (10,6%). Influenza and Pneumonia were ranked third and was responsible for 9,2% of deaths (Stats SA, 2010).

3.3 Under Five Mortality rates

3.3.1 Trends in Under five mortality rate

Figure 6 displays national trends in under five mortality rate for the period 2006–2016 from various published sources. The results indicate a decline in U5MR over time. U5MR declined from 75 deaths per 1 000 live births in 2006 to 34 deaths per 1 000 in 2016. The Target for SDG for this indicator is 25 deaths per 1 000 live births by 2030.

Figure 6: Trends in Under five mortality rates by death year and source
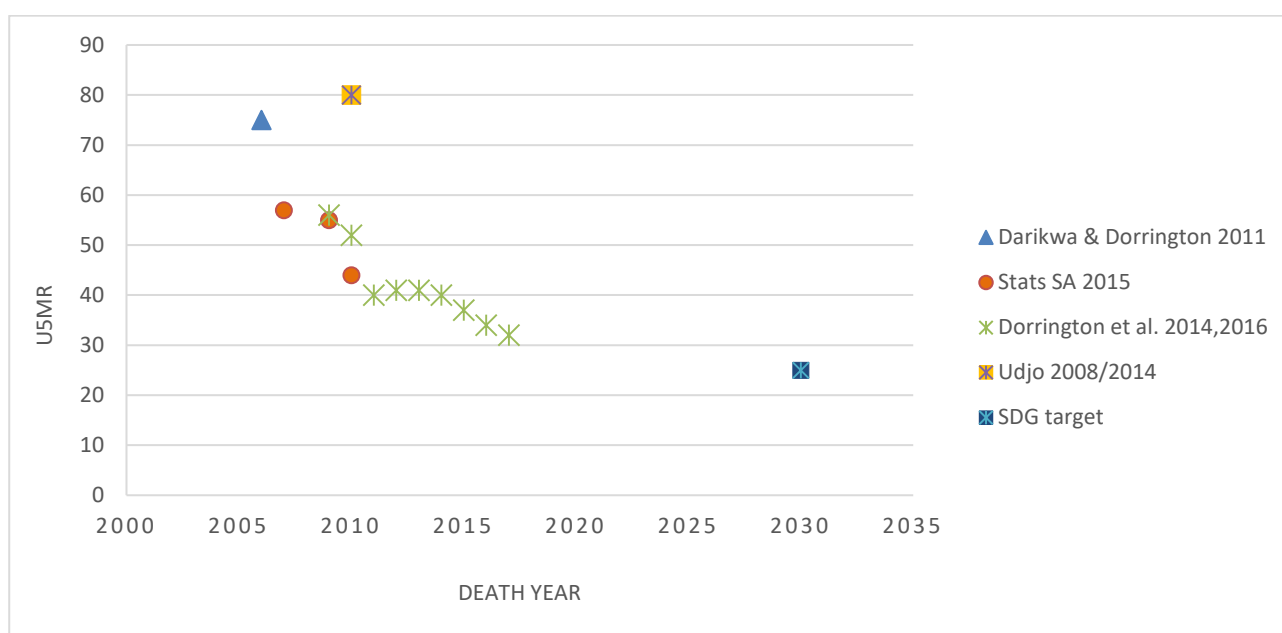
Source: Darikwa and Dorrington, 2011; Statistics South Africa, 2015; Udjo, 2014, Dorrington et al, 2014 & 2016.

3.3.2 Under 5 mortality rate by population group and sex of the child

The under 5 mortality rate by sex of the child showed no differences by sex. U5MR was observed to be 48 (males) and 48 (females).

As shown in Figure 7, the national U5MR indicates the diversity that exists in the country, with regards to under five mortality behaviour among its four main population groups. Black Africans (52,4) and Coloureds (30,2) reported the highest under five mortality rates, whilst Indians /Asians (21,8) and Whites (14,8) had the lowest under five mortality rate. However, it should be noted here that the sample size for the Indian/Asian population is small and thus estimates disaggregated by population group should be interpreted with caution.

Figure 7: Under five mortality rate by population group, Census 2011
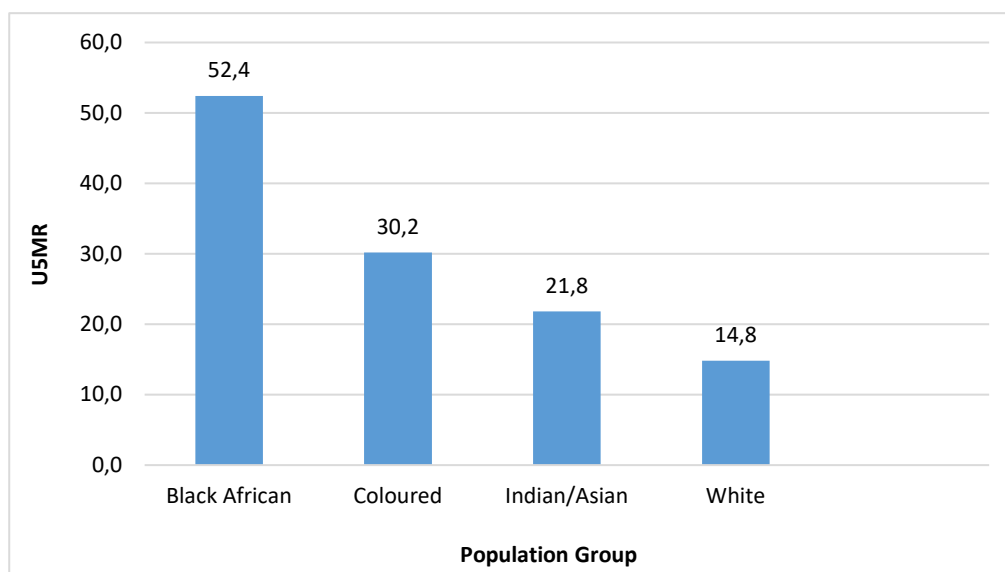
3.3.3 Under five mortality rate by Province

The map below indicates spatial differentials in under five mortality by province. The map below categorises provinces into 5 classes based on the severity of their under-five mortality rates. Amongst all the provinces, Western Cape, Gauteng and Limpopo provinces had the lowest Under five mortality rates of 24,5, 34,3 and 38,2 respectively, whilst Free State (68,4) and KwaZulu-Natal (62,6) have the highest under five mortality rates. The spatial differential somehow illustrates the significance of under-five mortality inequality among the provinces.

Map 1: Under five mortality rate by provinces, Census 2011
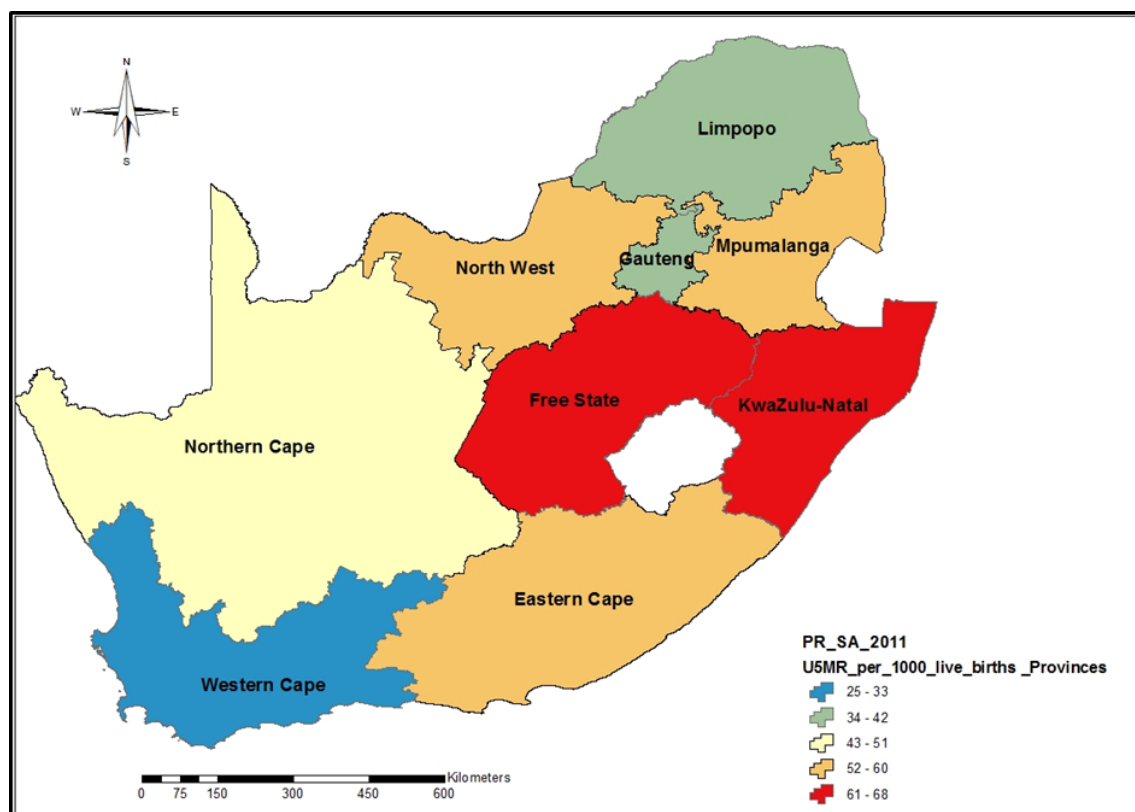
3.3.3.1 Comparison of the provincial under five mortality rates from other sources

In attempting to compare the provincial levels of U5MR, it should be noted that there are very few sources that have derived this indicator using household deaths to make it easier to compare with. Table 3 compares the provincial estimates in this study with estimates from the THEMBISA version 3.2 model developed by Johnson LF, et al. (2016). The model looks at progress towards the 2020 targets for HIV diagnosis and antiretroviral treatment in South Africa. In comparing against the THEMBISA model, the provincial estimates are reasonable and the patterns are consistent.

Table 3: Provincial estimates published from other sources

Provinces	Census 2011	THEMBISA Model 3.2
Western Cape	24,2	23,0
Eastern Cape	52,7	55,9
Northern Cape	48,3	36,8
Free State	68,3	59,6
KwaZulu-Natal	60,8	60,0
North West	59,6	41,5
Gauteng	29,8	35,7
Mpumalanga	52,4	56,2
Limpopo	36,7	37,3

3.4 Conclusion

Findings from this study reveal a fluctuating pattern in under five mortality rate a level of 75 deaths in 2006 to 34 deaths per 1 000 live births in 2016. This is largely due to the roll – out of ARV treatment and prevention of mother –to-child transmission of HIV (Dorrington, et al, 2016).

Spatial analysis indicates that Western Cape, Gauteng and Limpopo recorded low under five mortality rates. The findings are in line with modelled estimates by THEMBISA Model version 3.2 which showed the existence of spatial differentials in under five mortality rates that exists in the country. By population group, the results shows that Black African and Coloured had high under five mortality relative to Indian/Asian and White.

CHAPTER 4: DISCUSSION AND CONCLUSION

4.1 Discussion

The overall objective of this report was to produce sub-national under-five mortality rates using household deaths data from Census 2011. Child mortality in South Africa has declined substantially in the last decade after a reversal mainly due to HIV. In order to effectively address the problem and work towards further reductions of under-five mortality in the country, it is essential that efforts be focused more on lower levels of geography estimates as opposed to concentrating only on the level of mortality at national level.

Having derived the under-five mortality rates, the first important question has to be how the estimates are compared with those presented elsewhere. In this regard, the national level estimates can be compared with those produced from the Rapid Mortality Surveillance (RMS), UN Inter-agency Group for Mortality Estimation (UN-IGME), as well as other published studies from various scholars.

The provincial under-five mortality rates derived by Bangha and Simelane (2008) using the 2001 Census data may be compared roughly with estimates in this paper. However, neither the geographical unit nor time reference points are the same. Moreover, their provincial under-five mortality rates ranges from 19 in Western Cape to 66 in Eastern Cape. These estimates from 2001 appear to be lower than expected. This may be partly due to the fact that the 2001 Census data has some problems as noted by Dorrington, Moultrie and Timaeus (2004).

4.2 Conclusion

The study primarily aimed to derive estimates of U5MR for provinces of South Africa using the 2011 Census data. This is achieved through the use of a life table. Clear and significant spatial differentials in U5MR were observed in the country. Furthermore, the estimates obtained are reasonable and, those at national and provincial level are in agreement with results from other sources.

5. LIMITATIONS

1. All the analyses in this research are exclusively based on the Census 2011 data. A clear picture of under five mortality rates is envisaged from the upcoming Census 2021.

2. In estimating mortality for smaller geographical areas it is often difficult to construct more accurate estimates due to relatively small number of deaths relative to the denominator (births and deaths).

3. Completeness of deaths for children under age 5 below national level is largely also affected by circular migration.

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7. APPENDIX

Provinces and District	Number of deaths <5	Percent
Western Cape	**2 831**	**5,2**
City of Cape Town	1 703	3,1
West Coast	242	0,4
Cape Winelands	396	0,7
Overberg	118	0,2
Eden	303	0,6
Central Karoo	71	0,1
Eastern Cape	**7 760**	**14,2**
Buffalo City	453	0,8
Sarah Baartman	346	0,6
Amathole	1 007	1,8
Chris Hani	1 074	2,0
Joe Gqabi	494	0,9
O.R.Tambo	2 108	3,9
Alfred Nzo	1 700	3,1
Nelson Mandela Bay	577	1,1
Northern Cape	**1 239**	**2,3**
John Taolo Gaetsewe	407	0,7
Namakwa	81	0,1
Pixley ka Seme	190	0,3
Z F Mgcawu	205	0,4
Frances Baard	356	0,7
Free State	**4 015**	**7,4**
Xhariep	145	0,3
Lejweleputswa	1 006	1,8
Thabo Mofutsanyane	1 401	2,6
Fezile Dabi	598	1,1
Mangaung	865	1,6

	Number of deaths <5	
KwaZulu-Natal	**14 843**	**27,2**
Ugu	938	1,7
Umgungundlovu	1 152	2,1
Uthukela	1 288	2,4
Umzinyathi	1 155	2,1
Amajuba	782	1,4
Zululand	2 022	3,7
Umkhanyakude	1 044	1,9
Uthungulu	1 489	2,7
iLembe	874	1,6
Sisonke	978	1,8
eThekwini	3 122	5,7
North West	**4 774**	**8,7**
Bojanala	1 568	2,9
Ngaka Modiri Molema	1 285	2,4
Dr Ruth Segomotsi Mompati	921	1,7
Dr Kenneth Kaunda	1 001	1,8
Gauteng	**8 591**	**15,7**
Sedibeng	827	1,5
West Rand	668	1,2
Ekurhuleni	2 701	4,9
City of Johannesburg	2 702	5,0
City of Tshwane	1 693	3,1
Mpumalanga	**5 223**	**9,6**
Gert Sibande	1 902	3,5
Nkangala	1 311	2,4
Ehlanzeni	2 010	3,7
Limpopo	**5 306**	**9,7**
Mopani	1 153	2,1
Vhembe	964	1,8
Capricorn	1 257	2,3
Waterberg	789	1,4
Sekhukhune	1 143	2,1
Total	**54 580**	**100,0**