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MORTALITY LEVEL AND TREND IN SOUTH AFRICA AND THEIR IMPLICATIONS

Mortality is a critical measure of population's health and public health systems. Infant mortality, for example, indicates quality of life, accessibility to primary healthcare and the overall health status of a country. Reduction in infant mortality shows improvement in the health status. No credible information about mortality in South Africa because the two previous censuses' data from Statistics South Africa (StatsSA) were not reliable, this study makes attempt to bridge the gap in the lack of knowledge. This study uses South African General Household Survey (SAGHS) data, to find the level and trend of mortality and their implications. Data for the years, 2012, 2013 and 2015, have been used. Demographic and statistical methods, including an evaluation of data quality using UN joint score, and construction of model life tables. The results indicated that the infant mortality rate (IMR) was 43 per 1000 in 2012, 36 per 1000 in 2013 and 21 per 1000 in 2015. This study further indicated that the general health status of South African population improved marginally from 2012 to 2015 because the life expectancy increased by 7 years for the males, and by 8 years for females, between those years. The study results that SAGHS data are reliable, mortality is decreasing with increasing life expectancy. The study recommends that more proactive measures need to be put in place to improve the health status of the population, especially the children because the IMR is still quite high and creates concerns.

Keywords: *Improvement, health status, life expectancy, infant mortality, general household survey, life cycle.*

Introduction. Mortality is an important component of demographic change and a critical measure of population's health and public health systems (McKerrow and Mulaudzi, 2010; Mathers and Boerma, 2010). The state of health of individuals and societies is the prime determinant of mortality level; however, variations in the types and severity of illness around the world indicate that the state of health is itself dependent on the level of socio-economic development. The level of mortality is a reflection and determinant of socio-economic status. Infant and child mortality rates are among the vital indicators widely used to assess the socio-economic wellbeing of a country's population. A reduction in child mortality significantly increases life expectancy and thus human capital, which is needed for development (Peter Byass *et al*., 2007).

South Africa does not have reliable information about the level of mortality and fertility because the two previous censuses, 2001 and 2011, data were not reliable. This study uses general household data from Statistics South Africa to determine the level of mortality and also to compare mortality differences in the 2012, 2013 and 2015 general household surveys.

Relevance of research. Mortality studies are very important in many ways. Particularly, the level of mortality provides evidence of health systems, health promotion and health status, including disease control. It shows how well the government takes the health matters of its citizens; how it manages diseases, prevents and protects its citizens from death; and also provides its citizens with vaccine or cure in case of epidemics. The current Covid-19 pandemic, for example, has shown how governments take the health and survival of their citizens diligently. The prevalence of mortality also shows how individual citizens take care of basic or primary healthcare practices; their attitude to diseases and public health issues.

Incidentally, there is no credible information about mortality in South Africa because the two previous censuses' data (2001 and 2011 census data) from Statistics South Africa (StatsSA) were not reliable. It is therefore important that we make attempts to know the health status of South Africans.

The purpose of the article. Since reliable information about mortality and for that matter, fertility, is not available in South Africa, this study makes attempt to bridge the gap in the lack of knowledge. It therefore uses South African General Household Survey (SAGHS) data, to find the level and trend of mortality and their implications. It aims also to find out whether reduction in mortality could come from the improvement in the health services.

The scientific novelty of the article. The results indicated that the infant mortality rate (IMR) was 43 per 1000 in 2012, 36 per 1000 in 2013 and 20 per 1000 in 2015. This study further proved that the general health status of South African population improved marginally from 2012 to 2015 because the life expectancy increased by about 7 years for the males, and by 8 years for the females, between 2012 and 2015.

Analysis of recent studies and publications. Mortality rates have been decreasing, especially childhood mortality rates, but because of the HIV-Aids pandemic the gains accrued from lower mortality is being eroded (Shisana et al., 2014; Dunkle et al., 2004). South Africa has the third highest burden of diseases in the world, after India and China, with an estimated incidence of 450 000 cases of active TB in 2013, an increase of 400 percent over the last 15 years (World Health Organization, 2014). TB remains the leading cause of death in South Africa, contributing to 12 percent of deaths in 2009 (StatsSA, 2014). It has been reported that the health of infants and children in South Africa is influenced by social and economic conditions under which they live and approximately up to 66 percent of children in the country live in poverty, with a monthly household income of less than R1200 (about US$80) per month (Whiting, 2013).

According to World Health Organization (WHO, 2011), education is vital for the prevention of most diseases including HIV/AIDS and this entails the full engagement of civil society. Many African countries have made a concerted effort to increase youth education rates, as education has been found, in many settings, to be a protective factor against illness, disease and mortality. Kyei (1995) found out in South Africa that the childhood mortality rate (under-five mortality) of black children whose mothers have higher education (Grade 12 and beyond) was less than a third of the rate of children whose mothers were without education. According to USAID, education has the potential to decrease malnutrition. Education promotes health; a child who is born to an educated mother is about 50 percent more likely to survive past the age of five because educated mothers are twice as likely to immunize their children, more likely to seek prenatal care and have assisted childbirth (USAID, 2009). The overall picture is that women with lower levels of education have higher death rates from all causes except, notably, breast cancer.

Research method. As detailed below, secondary data for the years, 2012, 2013 and 2015, have been used. Demographic and statistical methods, including an evaluation of data quality using UN joint score, and construction of model life tables.

I. Data sources.

The study covered the whole of South Africa. Secondary data obtained from Statistics South Africa (StatsSA) were used. The data were from the 2012, 2013 and 2015 general household surveys. The total study population was 51624670 in 2012, 52981991 in 2013 and 53769651 in 2015; males were 25259705 in 2012, 25823270 2013, and were 26878287 in 2015. The female population was 26364965 in 2012, 27158721 in 2013 and 26891364 in 2015.

There were 489871 deaths recorded in 2012 for all causes of death, 469459 in 2013 and 470899 in 2015; there were 256081 male deaths and 233790 female deaths in 2012; 245866 male deaths and 223593 female deaths in 2013. And there were 247960 male deaths and 222939 female deaths in 2015.

II. Statistical Analysis.

UN Joint Score. Firstly, an UN Joint score was calculated and subsequently life tables were constructed to determine the level of mortality.

The UN joint score method was used to check the quality of the age-sex data for both 2012 and 2013. The UN Joint score is defined mathematically as:

Joint score = A.R.M.S + A.R.F.S + 3 S.R.S; (ECA, 1989).

Where, ARMS and ARFS are respectively the male and female age ratio scores and SRS is the sex ratio score. A score of 20 means the data are very reliable, a score between 20 and 40, means the data may be used with some adjustments; a score between 40 and 60 means data are deficient and care and caution should be exercised in the use. If the score is beyond 60, the data are considered grossly erroneous (ECA, 1989, U.N., 2004).

The age ratios are defined as follows (ECA, 1989):

$$\text{UN method: } \frac{200P_X,\ X+4}{(P\,X-5,\ X-1+PX+5,\ X+9)} \quad (1)$$

Another important structural aspect of population, "sex ratios at deaths by age" were calculated. The sex ratio at death denotes the number of male deaths per 100 female deaths. A number less than 100 indicates relatively more female death occurrences; a number more than 100 indicates relatively more male death occurrences, whereas a ratio of 100 indicates an equal number of male and female deaths.

Finally, the study then used standard life table techniques to construct "model" life tables for 2012, 2013 and 2015; comparisons for the constructed life tables were done and used to examine the mortality changes in the population. The purpose of using life table techniques was to be able to measure actual life survival probabilities for all age groups by taking into account the mortality experiences of a population and also to measure the number of years expected to live.

Table 1. **Infant mortality & life expectancy at birth**

Year	Sex	Infant mortality, ${}_nQ_x$ / 1000	Life expectancy, e^o, years
2012	M	46	54
	F	40	59.7
	T (M+F)	43	57
2013	M	39	60
	F	34	64
	T (M+ F)	36	62
2015	M	22	61
	F	19.5	67
	T (M + F)	20.5	63.4

Source: Authors using the General Household Survey Data, 2012, 2013 & 2015.

Results

First the quality of the data is examined with a view to adjust where necessary.

Age-sex Accuracy index (Quality of the Data)

The UN Joint score obtained for 2012 was: = A.R.M.S + A.R.F.S + 3 S.R.S

Joint score = 3.06 + 3.73 +3(4.65)= 20.74

Table 2(a). **Life Table for the Male Population, 2015**

Age Group	MALE Population	Deaths	nMx	nQx	l(x)	nDx	nLx	T(x)	E(X)
0	5 991 33	13 048	0,021778	0,021543	100,000	2154,3	98491,9	6103514	61,04
1-4	2 396 532	4 238	0.001768	0,007047	97845,7	689,5	389537,8	6005022	61,37
5-9	2 786 238	1 827	0,000657	0,003279	97156,2	318,6	484984,5	5615484	57,80
10-14	2 577 497	1 765	0,000685	0,003419	96837,6	331,1	483360,3	5130500	52,98
15-19	2 565 342	4 164	0,001623	0,008082	96506,5	779,9	480582,5	4647139	48,15
20-24	2 658 198	8 584	0,003229	0,016016	95726,5	1533,2	474799,5	4166557	43,53
25-29	2 641 062	13 400	0,005074	0,025051	94193,3	2359,6	465067,5	3691757	39,19
30-34	2 097 659	16 740	0,007980	0,039121	91833,7	3592,6	450187	3226690	35,14
35-39	1 868 516	17 607	0,009423	0,046031	88241,1	4061,8	431051	2776503	31,46
40-44	1 589 938	18 081	0,011372	0,055289	84179,3	4654,2	409261	2345452	27,86
45-49	1 333 577	17 589	0,013189	0,063842	79525,1	5077,0	384933	1936191	24,35
50-54	1 095 142	19 309	0,017632	0,084436	74448,1	6286,1	356525,3	1551258	20,84
55-59	897 589	20 436	0,022768	0,107708	68162,0	7341,6	322456	1194733	17,53
60-64	689 567	21 271	0,030847	0,143192	60820,4	8708,9	282329,5	872276,6	14,34
65-69	488 824	19 436	0,039761	0,180829	52111,4	9423,3	236998,8	589947,1	11,32
70-74	311 836	16 282	0,052213	0,230923	42688,1	9857,7	188796,3	352948,3	8,27
75+	281 637	34 183	0,121373	0,465589	32830,4	15285,5	164152,0	164152,0	5,00

Source: Authors using the General Household Survey Data, 2015.

Table 2(b). **Life Table for the Female Population, 2015**

Age Group	FEMALE Population	Deaths	nMx	nQx	l(x)	nDx	nLx	T(x)	E(X)
0	588 137	11 451	0,019470	0,019282	100,000	1928,2	98650,3	6709291	67,09
1-4	2 352 548	3 659	0,001555	0,006200	98071,8	608,05	390661,3	6610641	67,431
5-9	2 359 517	1 373	0,000581	0,002905	97463,8	283,13	486611,3	6219980	63,82
10-14	2 750 987	1 409	0,000512	0,002558	97180,7	248,60	485282	5733368	59,00
15-19	2 560 971	2 904	0,001133	0,005654	96932,1	548,05	483290,3	5248086	54,14
20-24	2 559 030	5 854	0,002287	0,011373	96384,0	1096,18	479179,5	4764796	49,44
25-29	2 644 049	10 164	0,003844	0,019038	95287,8	1814,1	471903,8	4285616	44,98
30-34	2 591 192	12 784	0,004933	0,024368	93473,7	2277,8	461674	3813713	40,80
35-39	2 210 034	12 514	0,005662	0,027917	91195,9	2545,9	449614,5	3352039	36,76
40-44	1 906 405	12 359	0,006482	0,031897	88649,9	2827,7	436180,3	2902424	32,74
45-49	1 615 014	12 372	0,007660	0,037583	85822,2	3225,5	421047,3	2466244	28,74
50-54	1 405 003	13 391	0,009530	0,046546	82596,7	3844,5	403372,3	2045197	24,76
55-59	1 202 443	14 321	0,011909	0,057828	78752,2	4554,1	382375,8	1641824	20,85
60-64	1 045 353	15 628	0,014949	0,072057	74198,1	5346,5	357624,3	1259448	16,97
65-69	850 386	16 031	0,018851	0,090015	68851,6	6197,7	328763,8	901824,1	13,10
70-74	664 335	16 034	0,024135	0,113808	62653,9	7130,5	295443,3	573060,3	9,15
75+	639 468	60 691	0,094908	0,383538	55523,4	21295,3	277617	277617	5,00

Source: Authors using the General Household Survey Data, 2015.

Table 2(c). **Life Table for the Combined (M + F) Population, 2015**

Age Group	Combined Population	Deaths	nMx	nQx	l(x)	nDx	nLx	T(x)	E(X)
0	1 187 270	24 499	0,020635	0,020524	100,000	2042,40	98570,3	6339993	63,40
1-4	4 749 080	7 897	0,001663	0,006629	97957,6	649,36	390092,7	6241423	63,72
5-9	5 537 225	3 200	0,000578	0,002885	97 308	2042,40	485840	5851330	60,13
10-14	5 138 468	3 174	0,000618	0,003084	97 028	649,36	484390	5365490	55,30
15-19	5 124 373	7 068	0,001379	0,006873	96 728	280,73	481977,5	4881100	50,46
20-24	5 302 246	14 438	0,002723	0,013523	96 063	299,23	477067,5	4399123	45,79
25-29	5 232 254	23 564	0,004504	0,022267	94 764	664,81	468545	3922055	41,39
30-34	4 307 693	29 524	0,006854	0,033692	92 654	1299,07	455467,5	3453510	37,27
35-39	3 774 921	30 121	0,007979	0,039116	89 533	2110,12	438907,5	2998043	33,49
40-44	3 204 952	30 440	0,009498	0,046388	86 030	3121,71	420175	2559135	29,75
45-49	2 738 580	29 961	0,010940	0,053245	82 040	3502,16	399277,5	2138960	26,07
50-54	2 297 586	32 700	0,014232	0,068717	77 671	3990,78	375012,5	1739683	22,40
55-59	1 942 942	34 757	0,017889	0,085615	72 334	4368,20	346187,5	1364670	18,87
60-64	1 539 953	36 899	0,023961	0,113035	66 141	5337,35	312015	1018483	15,40
65-69	1 153 159	35 467	0,030756	0,142802	58 665	6192,88	272380	706467,5	12,04
70-74	805 114	32 316	0,040138	0,182388	50 287	7476,27	228507,5	434087,5	8,63
75+	921 105	94 874	0,103000	0,409543	41 116	8377,47	205580	205580	5,00

Source: Authors using the General Household Survey Data, 2015.

The UN joint score for South Africa 2013 from is 19.62. The results from the assessment show that the quality of the data for both 2012 and 2013 data is quite reliable because the joint scores are approximately 20.

The life expectancy at birth in 2012 for the male population was 54 years, and infant mortality rate was 46 per 1000. Thus, for every 1000 babies born 46 die before attaining the age of 1 and this figure is not high for a developing country. The life expectancy at birth for the female population in 2012 is 59.70 years and the infant mortality for the girls is 40 per 1000 live births. It is noted that, the death rates for boys are substantially higher than the rates for girls in every age group examined here.

The life expectancy at birth in 2013 was almost 60 years (59.8 years), and infant mortality rate was 39 per 1000 for males. Whilst the life expectancy at birth for the female population was 64 years (64.4 years), and infant mortality rate was 34 per 1000. Similarly, the life expectancy at birth in 2015 was 67 years and the infant mortality rate was 19 per 1000.

In summary, the mortality rates decreased from 2012 to 2013 and to 2015. The Table 1 shows that, in 2012 the infant mortality rate for boys was 46 per 1000 live birth and decreased by about 0.7 percentage-points in 2013 to 39 per 1000 and further decreased to 22 per 1000 live births in 2015. The infant mortality rate for boys decreased, and the life expectancy increased by about 6 years from 54 years in 2012 to 60 years in 2013 and further increased to 61 years in 2015. On the other hand, the infant mortality rate for girls was 40 per 1000 live birth in 2012 and decreased to 34 per 1000 in 2013 and to 19 per 1000 in 2015, a decrease of 2.1 percentage-points. Similarly, the life expectancy increased from 60 years through 64 to 67 years within the period 2012 and 2015.

For combined sexes, Tables 2a, 2b and 2c show that there was a decrease in infant mortality rate from 43 per 1000 in 2012 to 36 per 1000 in 2013 and to 21 in 2015. Furthermore, the life expectancy increased from 57 years in 2012 to 62 years in 2013 and to 63.4 years in 2015.

The results confirm that there has been a marked decrease in child mortality rates in South Africa, and thus this may be an indication of improved child health in the country. The decline in the childhood mortality rate may be due to increase in immunization rates, contribution of social grants in living standards, poverty alleviation and improvements in women's education, among others. Although these figures are encouraging, South Africa still has a high infant mortality rate, especially compared to other emerging markets and the developed world.

Some of the factors that may be keeping the infant mortality rate high in South Africa include the HIV pandemic, poverty and inadequate health-care for poor women during pregnancy and for their babies after birth, therefore more attention needs to be directed there.

Conclusion. The objectives of the study were to determine and compare mortality rates and the trends from the general household surveys. The study

also sought to determine and explore differences in life expectancy between the period 2012 and 2015, and the possible cause(s) and implications.

The study concludes that, the general health status of South African has improved significantly from 2012 to 2015 because the infant mortality rate has fallen during the period (2012-2015) and the average life expectancy at birth has risen during the same time. The improvement could be a reason of other factors including the current government commitments to dealing with HIV infections and poverty. Co-ordinated approaches by the government reveal some marked increasing and improving HIV services, as well as improving access to education and service delivery. These steps, possibly, have resulted in a decrease in death rates for all age groups and gender, and need to continue even further. The study results that SAGHS data are reliable, mortality is decreasing with increasing life expectancy. The study recommends that more proactive measures need to be put in place to improve the health status of the population, especially the children because the IMR is still quite high and creates concerns.

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РІВЕНЬ І ТЕНДЕНЦІЇ СМЕРТНОСТІ
В ПІВДЕННІЙ АФРИЦІ ТА ЇХ НАСЛІДКИ

Смертність є найважливішим показником стану здоров'я населення та систем охорони здоров'я. Наприклад, дитяча смертність указує на якість життя, доступність первинної медичної допомоги та загальний стан здоров'я країни. Зменшення дитячої смертності свідчить про покращення стану здоров'я. Недостатньо достовірною є інформація про смертність у Південній Африці, оскільки дані двох попередніх переписів статистики Південної Африки (*StatsSA)* не були надійними. Представлене дослідження є спробою подолання розриву через відсутність знань.

Дослідження застосовувало дані Південноафриканського загального опитування домогосподарств (*SAGHS)* для визначення рівня й тенденції смертності та їх наслідків. Аналізувались дані за 2012, 2013 та 2015 роки. В дослідженні використано демографічні та статистичні методи, які включили оцінку якості даних із застосуванням спільних балів ООН та побудову модельних таблиць життєвого циклу.

Результати показали, що рівень дитячої смертності (*IMR*) становив 43 на 1000 осіб у 2012 р., 36 на 1000 осіб у 2013 р. та 21 на 1000 осіб у 2015 р. Виявлено, що загальний стан здоров'я населення Південної Африки незначно покращився з 2012 по 2015 рр., оскільки середня тривалість життя чоловіків збільшилась тільки на 7 років, а для жінок — на 8 років. Результати дослідження свідчать, що дані *SAGHS* надійні: смертність зменшується зі збільшенням тривалості життя. Дослідження рекомендує застосовувати більш активні заходи для покращення стану здоров'я населення, особливо дітей, оскільки *IMR* все ще досить високий і викликає занепокоєння.

Ключові слова: поліпшення стану здоров'я, тривалість життя, дитяча смертність, загальне опитування домогосподарств, життєвий цикл.