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The Gender Gap in Life Expectancy in South Africa from 2000 to 2015: The Role of Age- and Cause-Specific Mortality

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Abstract

In the last two decades, South Africa has experienced a marginal increase in life expectancy due to high mortality burden. It coincides with variations in age- and cause-specific mortality among females and males. The study aimed at quantifying the role of age- and cause-specific mortality to the gender gap in life expectancy in South Africa from 2000 to 2015. The study measured the trends in cause-specific mortality and contributions of each cause to life expectancy among South African males and females. Andreev's decomposition method was applied to decompose the contributions of age- and cause-specific mortality to the gender gap in life expectancy. The study revealed that recorded gender gap in life expectancy concentrated in the age group 15-34 was as a result of the differences in the contributions of the infectious diseases and external causes of mortality. In the elderly years, the gap in life expectancy among males and females were due to the variations in the contributions of mortality from circulatory and respiratory diseases. Given these, health policies and programs should target infectious diseases and external causes of death in the young adult years, the leading causes of mortality and circulatory and respiratory diseases, emerging major causes of mortality in the elderly years in South Africa

Keywords: Life expectancy; cause-specific; diseases; mortality; South Africa.

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1. Introduction

South Africa's increase in life expectancy is the second highest in sub-Sahara Africa [1]. Between 1980 and 1990, life expectancy in South Africa was approximately 59.5 years [2]. In 1999, life expectancy at birth for males in South Africa was 62 years while females was 68 years. However, in 2005, life expectancy at birth for females reduced by about 12 years and among males by 14 years [3]. Similarly, life expectancy at age 15 in 1990 decreased from 67.4 to 58.7 years in 2009. The reversal was influenced by the explosive spread of infectious diseases especially HIV/AIDS and Tuberculosis [4, 15]. Mortality from these diseases among males are twice as among women [16,18]. From 2010 to 2015, South Africa observed in life expectancy. The observed increment was about six years higher among women than among men [6, 11, 19,20]. Conversely, this achievement is somewhat challenged as mortality from respiratory, circulatory and endocrine diseases has been found to be increasing [7,21,23]. These chronic diseases are high during the adult and elderly years particularly in males as compared to females South Africa [5]. The rise in the incidence of silicosis, asthma and population of ex-smokers further increased the susceptibility of males' morbidity and mortality experiences from respiratory diseases [1,24,26]. Circulatory diseases cause about 10% of deaths in South Africa, a rate similar to other African countries. It is common among persons in the middle age adult and elderly years but has been recording a downward trend among persons aged 50 to 64 years [22]. Between two and eight times the global external causes of death occur in South Africa. Males unlike females within the ages 15 to 40 years are about four times at risk of mortality from external causes [6,27,29]. Moreover, endocrine diseases (ENM) are revaluing in South Africa as an effect of nutritional deficiencies [6,23,30,31]. The decrease in other causes of mortality such as maternal mortality counter the effects of chronic diseases on life expectancy [32].

Structural factors such as rapid urbanization, inadequate healthcare services, supply and access to medications such as antiretroviral therapy (ART) augment the risk of mortality and impacts life expectancy. Behavioral factors such as preference for sedentary life, poor eating habits, smoking and less physical activities increase the susceptibility of death from these causes. Certain socio-cultural practices also increase the risk of mortality from these causes [5,6,8,18,29,33,35]. Although studies on life expectancy and mortality patterns in South Africa put forward the argument for a converse–epidemiological transition, the pattern and contribution of the most recurring clusters of causes of death to life expectancy are still not well understood. Therefore, the study assessed the role of infectious, circulatory, endocrine and respiratory diseases and external causes in the gender gap in life expectancy in South Africa. The possible role of all other causes of death in the gap was also estimated. The changes in the age-sex pattern of deaths from all these diseases were quantified.

2. Materials and Methods

2.1 Data

The study employed data from the World Health Organization (WHO) Mortality Database, United Nations Population Division and the World Bank, Gender Statistics. The data from these repositories included causes of death per year, age and sex categories as well as the population size of South Africa. Information on the sex and age variations and mortality from certain infectious and parasitic diseases, diseases of the circulatory system and

diseases of the respiratory system, endocrine, nutritional and metabolic diseases, external causes morbidity and mortality from 2000 to 2015 were selected. However, these broad causes of mortality were in relation to the causes of death defined by the International Statistical Classification of Diseases, and Related Health Problems 10th revision (ICD 10) were used for the study [36,37].

2.2 Statistical Analyses

The study used two analytical approaches: an estimation of age- and cause-specific mortality rates for years under study, and a decomposition approach for contribution of these causes of mortality to life expectancy.

2.2.1 Standardized Death Rates and Trend Analysis

For each period, the recorded number of deaths were for five year age intervals. Ages above 84 years had smaller sample sizes; hence, the number of deaths at age 85 and above years were aggregated as age 85 and more to provide useful statistics. Except for ages 0 and age group 1-4, all other ages were five-year aggregated ages ranging from 5 to 85 and more years. Also, the number of deaths recorded by the unknown ages were redistributed among the various age groups to equate the number of cases in each age group to the total number of deaths per case. The output was used to estimate age- and cause-specific death rates among males and females($_{n}M_{x}$). The age-specific mortality rate for the major classes of causes of death and sex were standardized using the WHO standard population [38]. It eliminated the effect of age composition on the causes of death among the population [39], [40]. It also allowed for a detailed analysis of changes in the standardized death rates for these causes of mortality in South Africa [41].

2.2.2 Construction of Life Tables

Standard life table construction techniques were adapted to construct life tables. First, the age-specific mortality rates, estimated earlier, were summed and converted to the age-specific probability of dying ($_{n}q_{x}$):

$$\frac{n*_{n}M_{x}}{1+(n-_{n}a_{x})*_{n}M_{x}} \qquad (1)$$

However, the final age group (85 and more years) was allotted 1 as the estimated probability of dying. Second, the average number of person-years lived in the interval by those dying in the age interval ($_{n}a_{x}$) was deduced. However, the average number of person-years lived in the interval for ages 0 and 1-4 had different scales of estimation for males and for females. Third, the probability of surviving ($_{n}p_{x}$), number of deaths within the age interval ($_{n}d_{x}$), persons left alive in the age interval (l_{x}), person-years lived in the age group ($_{n}L_{x}$), number of person alive above a certain age ($_{n}T_{x}$) and the life expectancy at the age interval (e_{x}) were computed [42]. In all, 16 life tables were constructed for each sex and year (ie. 32).

2.2.3 Decomposition of Contribution of Causes of Death

Moreover, the contribution of each cause of death at a certain age to the differences in life expectancy for males and females were decomposed. Standard techniques for comparing life expectancies within the South African

population while analysing the age- and cause-specific contributions to the differences in the life expectancies were used [43,44]. The constructed life tables were inputs for decomposing cause-specific mortality contributions to life expectancy [4]. Specifically, the study adopted the decomposition method proposed by Andreev in 1982 (as cited by Andreev, Shkolnikov and Begun [45]; Bergeron-Boucher, Ebeling and Canudas-Romo [46]; Canudas-Romo [47]. Thus, the decomposition formula used for the study was:

$$(l^F)(e_x{}^{o(F)} - (e_x{}^{o(M)}) - (l^F)(e_{x+n}{}^{o(F)} - (e_{x+n}{}^{o(M)}), \qquad (2)$$

where l_x is a function in the standard life table, x is the initial age of the age interval n; $e_x{}^o$ is the temporary life expectancy for the age interval. Canudas-Romo, [47] postulated that such decomposition methods elucidate the gender and age differences in life expectancy at birth attributable to causes of death. Wunsch, Mouchart, and Duchène [48] added that the obtained quotient equals the differences between the values of the life expectancies at birth for the sexes. All analyses were performed in R Studio version1.1.456.

2.3 Ethical Consideration

No ethical approval from the author's institution was required since the study used a secondary data which was blind.

3. Results

3.1 Trend Analysis

Figure 1 shows the standardized death rates from infectious, circulatory, respiratory, endocrine diseases (ENM), external causes and all other causes of death among males and females in South Africa, 2000 to 2015. Generally, males experienced more deaths than females. While males recorded more deaths from infectious, circulatory and respiratory diseases and external causes (four times), females were exposed to more deaths from ENM. Mortality from infectious diseases increased from 2000 to 2005 but plateaued between 2006 and 2009. Mortality from respiratory diseases was highest in 2006. Mortality from circulatory diseases started increasing for both sexes in 2013. In 2013, deaths from external causes started increasing among males.

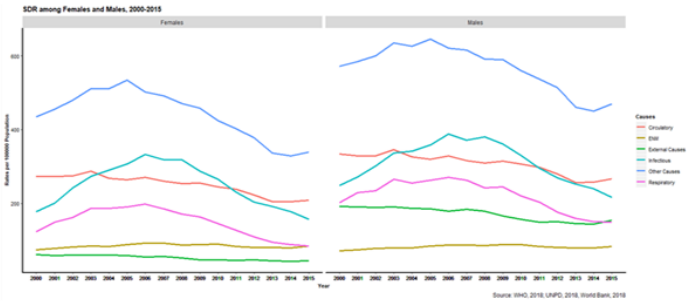

Figure 1: standardized death rates (SDR) from infectious, circulatory, respiratory, endocrine diseases, external causes and other causes of death among males and females in South Africa, 2000-2015

3.2 Decomposition Analysis (Within Time)

Figure 2 shows the contribution of each age-and cause-specific mortality to changes in life expectancy in South Africa, 2000-2015. The gap between the contributions to life expectancy for both sexes varied from 3.2 years in 2005 to 5.9 years in 2015. The gains in life expectancy were higher among females than males, especially at ages 35 and beyond. Males recorded lower contributions to life expectancy from external causes, circulatory, infectious, respiratory and other causes of death but not ENM diseases. In contrast, within the young adult ages (15 to 34 years), the gains in life expectancy favored males than females. While males lived longer because of decaying number of deaths from other causes, infectious, circulatory and respiratory diseases, females lived longer due to the decrease in deaths from external causes. The peak of male gains in life expectancy was at ages 20-29 years. Again, the decrease in the mortality from endocrine diseases within the ages 59 and 80 years, increase the gains in life expectancy of males. The contributions to life expectancy from respiratory diseases favored women in the middle and late working age groups (40-64 years) than among males in the same age group. External causes of death contributions to life expectancy started decaying in 2012. Also, from 2010, circulatory diseases contributed to the gains in female life expectancy of females than males.

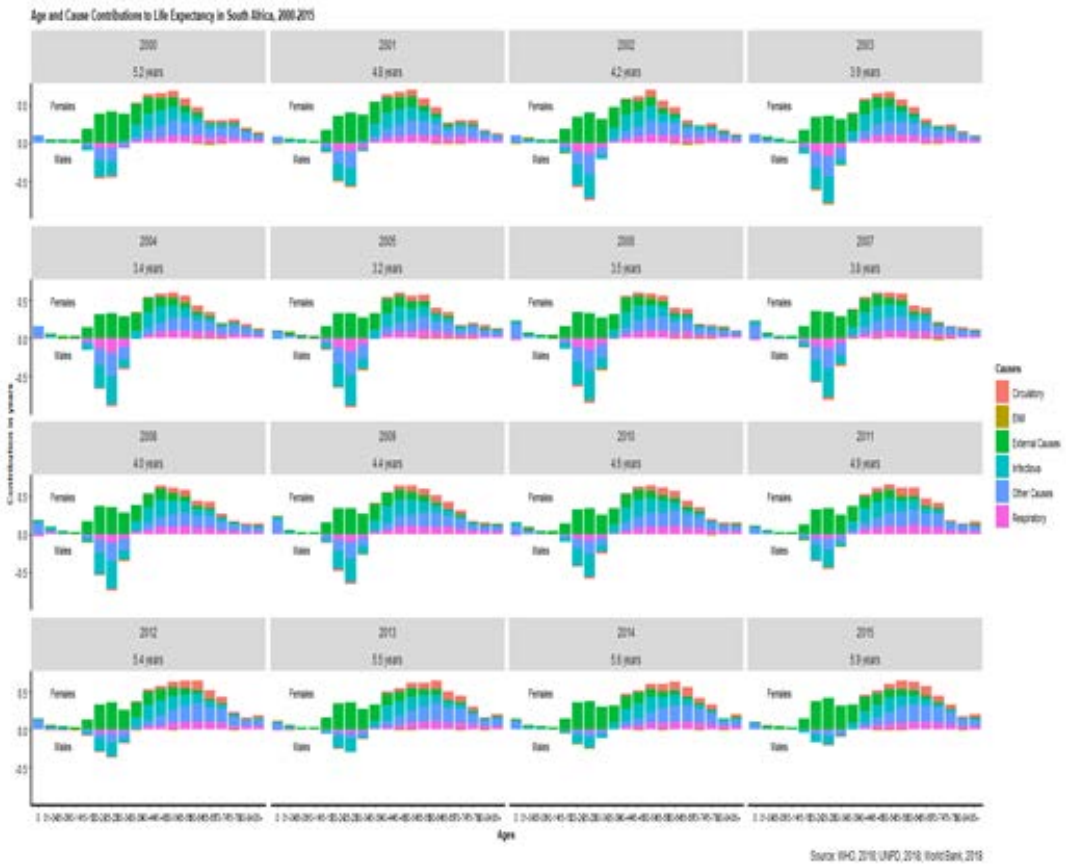

Figure 2: decomposition of the contribution of major classes of causes of death to life expectancy in South Africa, 2000-2015

3.3 Decomposition Analysis (Between Years)

To correctly understand the contributions to life expectancy over time, the study selected the initial and final years from the data to decompose the age- and cause-specific contribution to life expectancy. The results are presented in figure 3 which shows the contribution to life expectancy among females and males over time. Generally, males within the ages 25 to 49 years recorded the highest contribution to life expectancy from the causes of death. For females, 20 to 39 years recorded the highest life expectancy gains for the periods under study. However, in 2000, external causes contributed lower to the life expectancy among males at ages 15 and 54 years. In 2000, infectious diseases retarded the life expectancy of females within the ages of 20 to 34 years. By 2015, the reduction in life expectancy made by endocrine diseases were significantly higher among females (-0.07) than males (-0.06). The contribution made by the respiratory disease to life expectancy was considerably higher among females (0.88) than males (0.59).

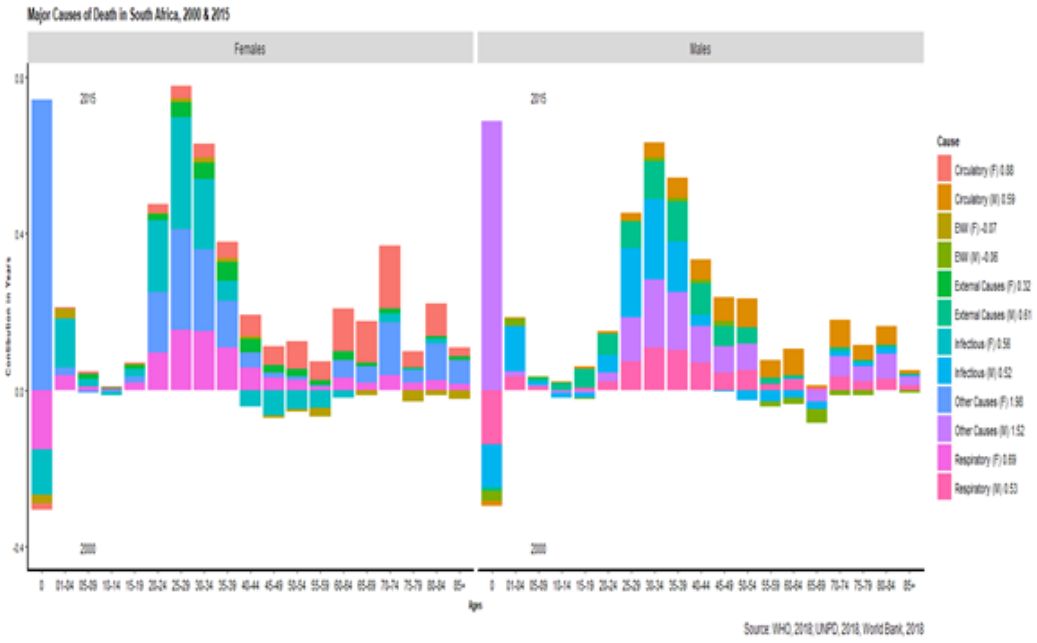

Figure 3: decomposition of the contribution of the major classes of causes of death to life expectancy for males (M) and females (F) in South Africa, 2000 and 2015

4. Discussion

The present study is the first study to decompose the contributions age- and cause-specific mortality of main clusters of causes of death to life expectancy from 2000 to 2015 among males and females in South Africa. It adds empirical evidence at a macro level to demographic, epidemiological and political discussions. Using data from three repositories, the study, on the one hand, dissected the patterns of infectious, circulatory, respiratory, endocrine diseases, external causes and all other causes of death standardized death rates for males and females and on the other hand, it decomposed the contribution of these major classes of causes of death to life expectancy in South Africa.

In the context of South Africa's mortality decline, mortality from all the causes of death under study is narrowing. This decline reveals the considerable furtherance of prevention and treatment services designed in South Africa for these mortality causing conditions. The observed pattern also suggest that plunges in mortality are a by-product of population-wide revamped management, treatment, and prevention of the onset of these causes of mortality in South Africa. Nevertheless, the marginal increase in mortality from certain chronic diseases might be due to unfavorable alternation in the proximate determinants of those diseases, behavior and healthcare effectiveness in particular [5,6].

From the study, it was observed that sex of a South African was an important determinant of mortality from certain causes in the country, as death among males was higher than among females. However, males had a significant decline in mortality from endocrine diseases than females. A finding contrary to Houle and his colleagues[18] postulation that deaths from all chronic diseases including endocrine diseases are higher among males than females in South Africa. Conversely, it confirms Agyepong and his colleagues [19] and Oni and his colleagues [20] postulations that endocrine diseases related deaths are higher among female than male South Africans. Moreover, the decrease in male mortality over time has not been the same as the decline in mortality among females. The decline in external causes of mortality among males was lower than among females. Not only does this finding corroborate the fact that external causes of death are endemic among males than females but also that the level of behavioral risk factors are marked among males than females [5,6,8, 29,33,35]. The study revealed the upsurge in mortality from infectious diseases from 2000 to 2005 [18,22,24]. The major reason of this rise was the decrease in the access to and supply of healthcare services [33]. The differences in the increase in the incidence of respiratory diseases such as silicosis, asthma and chronic obstructive pulmonary diseases can be associated with the rapid rise in mortality from respiratory diseases among males and females in South Africa in 2006 [1,24,26].

The shift in the role of age- and cause-specific mortality to the gender gap in life expectancy, especially in the young adult years where the contributions for males but not females decayed in the recent times unlike in the past was revealed in the study [4,36]. Thus, the gains in female in life expectancy were mainly attributable low levels of mortality from respiratory disease and external causes of death. Among males, the highest contributors to life expectancy were infectious and endocrine diseases. The low level of older age mortality from circulatory and respiratory diseases among females than males further augmented the gains in life expectancy among females. It affirms Houle and his colleagues [18] assertion that chronic diseases related deaths are higher among South African males than females. Moreover, it indicates South Africa's female advantage in life expectancy is an exemplary of what exist in developed countries [11,15,41]. The most significant increase in male life expectancy was recorded at ages 15-34 years. These were heavily dependent on infectious diseases and other causes of death. This finding affirms Houle and his colleagues [5]; Muula [33]; Naicker and his colleagues [34]; Teitelman and his colleagues [35] postulations that behavioral and socio-cultural factors manifesting as intergenerational sexual relationships, unprotected sexual intercourse and poor healthy life practices increased the risk of death from infectious diseases among females within the young adult years.

4.1 Limitations of the Study

The analyses of the study has several limitations. First, the study relied on multiple data sources for analyses. These might have caused over or under-estimation of the results of the study. However, it was assumed that these sources of data are indicative of population level statistic regarding the causes of death and population under study. Second, the analyses of the study did not consider the provincial differences in the causes of mortality in South Africa although the population-level effects of these causes of death have been analyzed. Thus, the study did not account for provincial differences in the contribution of these causes of mortality to life expectancy in South Africa. Importantly, it is vital that studies undertake more complex analyses of the provincial and population-level data over time to examine the potential impact of these causes of death on life expectancy, including if disaggregating data by sex, in South Africa.

5. Conclusion

In conclusion, infectious, circulatory, respiratory, endocrine diseases, external and other causes of morbidity and mortality have declined in South Africa. However, there are indications for stronger age-standardized death rates reductions in women than in men. The contributions to life expectancy allotted to these major classes of causes of death favored females than males. The results indicate the significant implications of the prevalence of mortality from infectious diseases and external causes in South Africa with a remarkable influence on the life expectancy of young South African adults. However, in the elderly years, circulatory and respiratory diseases increased women's susceptibility of death. If infectious diseases and external causes of death remain the leading causes of death in South Africa, males and females within the ages15-34 would expect to live in their young ages with the perceived vulnerability of infectious diseases and external causes of death.

6. Recommendations

Morbidity and mortality prevention, as well as health promotion and prolonging policies and programs, should target infectious diseases and external causes of death in the young adult years as these are the leading causes of mortality in those years. Besides, the policies and programs should target circulatory and respiratory diseases since these diseases emerged as the major clusters of causes of mortality in the elderly years in South Africa.

7. Author's Contribution

SSS conceived the study and performed the analysis. SSS drafted and edited the manuscript. The author proof-read the final manuscript and approved it.

8. Conflicts of Interest

The author declares that there is no conflict of interests regarding the paper

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