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RESEARCH ARTICLE

Gender difference in trends in healthy life expectancy in 2005–2012 for adults aged 50 years and older in South Africa

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Abstract: Data characterizing older people's life expectancy by good or poor health is important for policy and fiscal planning. This study aims to examine trends and investigate gender differences in healthy life expectancy (HLE) for older people in South Africa for the period 2005–2012. Using data from three repeated cross-sectional surveys conducted in 2005, 2008, and 2012, we applied a self-rated health measure to estimating HLE. The Sullivan method was used in the calculations. We found that unhealthy life expectancy decreased over the period, while HLE and the proportion of life spent in good health increased more than total life expectancy in the same period. Gender disparities were evident: Women had higher life expectancy than men, yet they spent a greater proportion of their lifetime in poor health. We concluded that HLE of older people in South Africa has improved over the period under investigation.

Keywords: *gender difference; health expectancies; healthy life expectancy; older adults; self-rated health; South Africa; Sullivan method*

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1. Introduction

Populations are rapidly growing older across the globe. The proportion of people aged 60 years and over is growing at a faster rate than any other age group (United Nations, 2017). Coupled with this, the length of life has also increased dramatically in most parts of the world. Initially, this demographic transition was experienced in developed countries, but of late, it has become a global phenomenon experienced by less developed regions as well. In South Africa, life expectancy at birth in the period of 2002–2014 increased from 51.1 years to 59.1 years for males and from 55.7 years to 63.1 years for females (Statistics South Africa, 2014). However, between 2002 and 2005, life expectancy declined due to the HIV epidemic. Nevertheless, there has since been an upward trend partly due to the successful roll-out of antiretroviral treatment (ART) (Bor, Herbst, Newell *et al*., 2013; Mayosi and Benatar, 2014; Statistics South Africa, 2014). According to the United Nations, the proportion of South Africans aged 60 years and over increased from 6.7% in 2005 to 8.0% in 2017 and is projected to double to 15.9% in 2050 due to gains in improved longevity (United Nations, 2017). Against this background, one interesting question is whether the gains in longer life are being accompanied by healthy and productive lives or by periods of illness, frailty, and more dependency. In other words, is the number of years gained being matched by quality in terms of health and well-being?

To answer the question about trends in mortality and morbidity, there is a need to develop a population health measure that combines the two components together into

a single measure (Mathers and Robine, 1997). This means that conventional measures solely based on mortality, such as life expectancy, are not sufficient to summarize population health. Progress has been made over the past decades in developing new summary measures of population health which is called health expectancies (Jagger, Cox, Le Roy *et al*., 2006; Saito, Robine, and Crimmins, 2014). Health expectancies can be defined as the average number of years an individual at a given age can be expected to live in good health based on the prevailing age-specific mortality and morbidity status (Jagger, Cox, Le Roy *et al*., 2006). Health expectancies can be derived from various health measures that vary from objective ones, for example, disability, to subjective ones, such as self-rated health, and well-being. As such, different conclusions can be reached depending on the health measure used (Alves and Arruda, 2017; Christensen, Doblhammer, Rau *et al*., 2009; Doblhammer and Kytir, 2001; Zimmer, Hidajat, and Saito, 2015). Therefore, the first critical issue in health expectancy research is to define clearly the operational definition of health used (Saito, Robine, and Crimmins, 2014).

In this present study, a self-rated health measure was used to calculate healthy life expectancies (HLE). Self-rated health measures, albeit their subjectivity, have been widely accepted as reasonable measures of population health status (Doblhammer and Kytir, 2001). In fact, their use, initially in sociology (Suchman, Phillips, and Streib, 1958) and later in medical and epidemiological research (Kaplan and Camacho, 1983), dates back >50 years. Furthermore, self-rated health measures have been found to be a good predictor of mortality by longitudinal studies (Ardington and Gasealahwe, 2014; Feng, Zhu, Zheng *et al*., 2016; Idler and Benyamini, 1997; Mossey and Shapiro, 1982) and a good predictor of health care expenditures (De Salvo *et al*., 2009). There are some perceptions, though, that self-rated health measures are too subjective (Jagger, Gillies, Cambois *et al*., 2010), and questions have been raised about their reliability in developing areas where people have low awareness of health (Sabatini, 2014). This is due to "health illusions," a scenario whereby people "normalize" health deficits due to their low health expectations (Sen, 2002), which is likely the case in low-income settings. As a result, people may rate their health as good even if they are in a poor disease condition and without basic health-care facilities. Another view is that older adults can underrate the level of their disability and health challenges because they may subconsciously rate themselves better compared to their elderly peers (Jagger, Gillies, Cambois *et al*., 2010). On the other hand, Jylha's theoretical framework for self-rated health (Jylhä, 2009) suggests that a cognitive process is involved in an individual's rating of their own health status. According to this theory, the cognitive process is essentially subjective and is influenced by one's contextual environment (Jylhä, 2009). Therefore, despite its limitations, self-rated health is a useful global health indicator that can summarize all specific domains into a single health measure (Crimmins, 2004). The applicability of self-rated health in low-income settings has been established (Burström, 2012), and its construct validity has been confirmed through its association with socioeconomic status (Subramanian, Subramanyam, Selvaraj *et al*., 2009). Such a simple and single measure becomes even more efficient in resource-limited settings, where it can substitute for detailed composite measures that are more expensive.

Among researchers and policymakers mainly from European countries and the United States, the major interest has developed over the past years in using health expectancies to monitor population health over time (Jagger, Cox, Le Roy *et al*., 2006). Policymakers in these countries have shifted their focus to using health expectancy instead of life expectancy as a policy tool and primary measure of population health and to monitor health outcomes (Robine, Romieu, and Cambois, 1999). Furthermore, the indicator is also used for assessing inequalities, planning health care and social services, and allocating resources (European Health Expectancy Monitoring Unit, 2007). Unfortunately, in Africa, including South Africa, there is not much awareness of the usefulness of health expectancies for monitoring processes and policymaking. That is, in spite of the rapid aging processes mentioned above, which call for immediate attention on the well-being of older people, all that we know is that people are living longer, but we do not know how healthy older people are in South Africa.

The gender paradox in health is widely well known, that is, women tend to have a longer life yet poorer health than men. The root causes of the gender paradox are generally attributed to differences in socioeconomic status, genetic and acquired risks, immune-system responses, hormones, disease patterns and prevention, and health-reporting behaviors (Crimmins and Saito, 2000; Oksuzyan, Juel, Vaupel, *et al*., 2008). Nevertheless, a number of studies in Western countries and in China have persistently showed that the improvement in self-rated health and HLE between older men and older women largely depends on classification of self-rated health (Doblhammer and Kytir, 2001; Zack, Moriaarty, Ford *et al*., 2004; Gu, Dupre, Warner *et al*., 2009). For example, in Austria, older men and older women witnessed similar improvements in very good, good, and fair self-rated health and HLE in the 1990s, whereas older women showed greater improvements if the healthy condition was defined by very good and good (Doblhammer and Kytir, 2001). A study from the United States demonstrated similar improvements in self-rated health among older men and older women when good health was categorized as excellent, very good, and good (Zack, Moriaarty, Ford *et al*., 2004). Using three categories of

self-rated health (good, fair, and not good), data from the United Kingdom showed that HLE among older men increased more than older women from 1981 to 2001 (UK National Statistics, 2006). In China, improvements in self-rated health based on two or three categories were comparable for men and women in the late 1980s (Saito, Qiao, and Jitapunkul, 2003) and the 1992–2002 (Gu, Dupre, Warner *et al*., 2009). No studies on gender difference have been conducted in South Africa so far, which implies a need to examine the difference in self-rated health and HLE.

This study intends to explore the health state of older people in South Africa using a national HIV household dataset collected by the Human Sciences Research Council of South Africa. To the best of our knowledge, this is the first study to estimate health expectancies for South Africa using repeated cross-sectional surveys. The objective of this paper is to examine trends and investigate gender differences in HLE for older people in South Africa for the period 2005–2012. The research questions posed by this study are: Has the recent increase in total life expectancy (TLE) observed in South Africa been accompanied by an increase or decrease in health status among older people? Is there any difference between women and men? In answering these two questions, and based on the data on the elderly population of South Africa, we will also be simultaneously testing the hypotheses of compression or expansion of morbidity.

2. Methods

2.1. Data sources

The study was based on 2005, 2008, and 2012 waves of the South African National HIV Incidence, Prevalence, Behaviour and Communication Survey (SABSSM) conducted in South Africa by the Human Sciences Research Council (HSRC). These are repeated cross-sectional surveys aiming at surveillance of HIV incidence and prevalence in South Africa. The individual response rates for each survey were 96.0% in 2005 (Shisana, Rehle, Simbayi *et al*., 2005), 89.5% in 2008 (Shisana, Rehle, Simbayi *et al*., 2009), and 89.1% in 2012 (Shisana, Rehle, Simbayi *et al*., 2014). All three surveys included persons residing in community dwellings and aged 2 years and above. Institutionalized individuals (i.e., those in educational institutions, military barracks, old-age homes, or hospitals) were not included in the three surveys, and hence as a result they were also excluded from this study. The surveys included a multistage cluster sample stratified by province and settlement geography (genotype) with the predominant population group in each area used. In our analysis, the design characteristics of the three surveys were adjusted using the weighted prevalence rates. Further details about the sampling procedures were presented elsewhere for 2005 (Shisana, Rehle, Simbayi *et al*., 2005), 2008 (Shisana, Rehle, Simbayi *et al* 2009), and 2012 (Shisana, Rehle, Simbayi *et al*., 2014). A questionnaire was administered through face-to-face interviews conducted by trained fieldworkers. Sociodemographic and behavioral information were collected from consenting individuals. The surveys were approved by the HSRC Research Ethics Committee (REC). We restrict our analysis to older adults aged 50 years and older with a total valid sample of 14,344 respondents, consisting of 5333 men and 9011 women, 3795 from the 2005 wave, 2702 from the 2008 wave, and 7847 from the 2012 wave.

2.2. Analysis

HLE were calculated using the Sullivan method (Sullivan, 1971). This method utilizes the age-specific prevalence of different health states in a population at a certain point in time to calculate the person-years lived in the respective health states among life table stable population. The next step is to derive the total person-years lived by summing up the person-years lived from age x upward until the last age group in the life table. The total number of person-years lived is then divided by the number of survivors to obtain the HLE at a given age.

In the present study, the HLE is calculated based on a self-rated health measure obtained from the 2005, 2008, and 2012 waves of the SABSSM described above. In the three SABSSM waves, self-rated health was measured by self-assessed global health condition using a question *"In general, would you say that your health is excellent, good, fair or poor?"* The same wording of the question was used in the 2005, 2008, and 2012 surveys, which makes it feasible to evaluate trends in population health. Following the common practice in the field (Idler and Benyamini, 1997), a binary variable was created by categorizing; excellent and good as "good health" and fair and poor as "poor health." Multiplying the age-sex-specific prevalence of "good health" to the corresponding number of person-years lived with the given age range in the life table to obtain person-years in good health, and then accumulated them from a given age onward and divide by total survivors at a given age to obtain its HLE.

As previous research evidenced that the categorization of self-rated health may yield different outcomes for HLE (Doblhammer and Kytir, 2001; Gu, Dupre, Warner *et al*., 2009). A sensitivity analysis was performed by treating outcomes as excellent/good/fair as a group, which produced a comparable result. The estimates of life expectancy used in this study

were based on the mid-year sex-specific complete life tables that were interpolated and smoothed from the abridged life tables published by the United Nations (United Nations, 2017). We presented life tables in 10-year age intervals for each gender, beginning with age 50 and having an open interval for age 80 and above. The reason for collapsing the ages was to obtain more stable prevalence estimates. The United Nations life tables were available for the years - 2000–2005, 2005–2010, and 2010–2015. We used linear interpolation following a Lexis diagram approach to obtain life tables to correspond with the survey years (i.e., 2005, 2008, and 2012). Standard errors were calculated from the formulae suggested by the International Network on Health Expectancy (Jagger, Cox, and Le Roy, 2006). We calculated the age-sex-specific HLE and the proportion of HLE to TLE over the period 2005–2012 to establish if there was an absolute or relative expansion or compression of morbidity (European Health Expectancy Monitoring Unit, 2009) for the period.

3. Results

Table 1 summarizes the background characteristics of the sample aged 50 years and older who participated in the 2005, 2008, and 2012 national HIV household surveys. In all the surveys, the majority of the respondents was women and was in the 50–59 age category; most respondents rated their own health as "good" or "fair." Africans accounted for about 45–50% in the sample across years with a proportion of Africans mildly higher in women.

Table 2 shows that TLE was higher for women than men across all ages and time periods (2005, 2008, and 2012). For example, in 2012, a 50-year-old woman could expect to live 24.1 years, while a man of the same age could expect to live 19.1 years. Furthermore, in terms of absolute figures, women had higher expected lifetimes in good health across all ages and time periods. For example, the expected lifetime in good health for a 50-year-old woman was 15.0 years. The equivalent for a man of the same age was 13.1 years. However, women also had greater expected lifetimes in bad health across all ages. For example, in 2012, the expected lifetime in bad health at ages 50 and 80 for women was 9.1 and 3.5 years, respectively, while for men it was 6.0 and 2.1 years, respectively. As expected, both TLE and HLE decreased with age for both men and women in all the time periods.

Table 2 also shows the absolute difference in total, healthy, and unhealthy life expectancies between 2005, 2008, and 2012. The results show that TLE increased at all ages over the whole study period. This was accompanied by increases in HLE (good health) and remarkable declines in unhealthy life expectancy (poor health). This implies that older people in South Africa not only lived longer but also the absolute number of years lived in good health increased. Figure 1a clearly shows that the increases in HLE were greater than the increases in TLE across all ages with one exception for men at age 50. This is even more evident when looking at the figure for women [Figure 1b]. There was an absolute reduction in unhealthy years (years spent in bad health) for both men and women across all ages for the whole time period 2005–2012. However, for men, there appear to have been marginal gains in unhealthy years at age 50. The improvements in healthy years for the period 2005–2012 were statistically significant across all ages for women, while for men, the difference was significant at the oldest ages. However, for men of age 60, the change in HLE was significant for the period 2008–2012. The change in healthy years from 2005 to 2012 at age 80 was the same for both genders, i.e., a gain of 1.3 years.

Table 1. Descriptive characteristics of the sample aged 50 years and older by gender, 2005, 2008, and 2012 national HIV household surveys.

Variables	2005		2008		2012	
	Men (*n*=1291)	Women (*n*=2504)	Men (*n*=946)	Women (*n*=1756)	Men (*n*=3096)	Women (*n*=4751)
Self-rated health						
Excellent	9.06	6.71	17.44	12.81	15.60	11.26
Good	55.46	48.84	46.62	47.04	51.49	51.11
Fair	28.66	37.34	25.48	30.24	26.61	31.36
Poor	5.11	5.19	6.24	5.69	4.65	4.86
Age groups (in years)						
50–59	50.58	48.80	50.85	47.04	47.80	46.35
60–69	33.93	31.27	31.29	31.15	32.40	31.17
70–79	11.93	15.38	12.58	16.29	15.05	15.89
80+	3.56	4.55	5.29	5.52	4.65	6.52

Table 2. Total life expectancy, expected lifetime in self-rated good health and bad health for men and women in South Africa in 2005, 2008, and 2012.

Age	Life years	Men						Women					
		2005	2008	2012	Changes			2005	2008	2012	Changes		
					2005–2008	2008–2012	2005–2012				2005–2008	2008–2012	2005–2012
50	Total LE	18.4	18.4	19.1	−0.1	0.7	0.7	23.0	23.0	24.1	−0.1	1.2	1.1
	Unhealthy LE	5.9	6.1	6.0	0.2	−0.1	0.1	10.8	8.9	9.1	−1.8	0.2	−1.6*
	Healthy LE	12.6	12.3	13.1	−0.3	0.9	0.6	12.3	14.1	15.0	1.8*	1.0*	2.7*
60	Total LE	13.1	12.9	13.3	−0.2	0.5	0.3	17.5	17.3	17.9	−0.2	0.6	0.4
	Unhealthy LE	4.7	5.2	4.4	0.6	−0.9	−0.3	8.7	7.4	7.3	−1.3*	−0.1	−1.4*
	Healthy LE	8.4	7.6	9.0	−0.8	1.3*	0.6	8.8	9.9	10.6	1.1*	0.7	1.8*
70	Total LE	8.6	8.4	8.7	−0.3	0.3	0.1	11.9	11.6	11.9	−0.3	0.4	0.0
	Unhealthy LE	3.8	3.5	3.4	−0.3	−0.1	−0.4	6.5	6.1	5.2	−0.4	−0.9	−1.3*
	Healthy LE	4.9	4.9	5.3	0.0	0.4	0.4	5.4	5.5	6.8	0.0	1.3*	1.3*
80	Total LE	5.5	5.2	5.5	−0.3	0.2	−0.1	7.5	7.0	7.3	−0.4	0.2	−0.2
	Unhealthy LE	3.5	3.1	2.1	−0.4	−1.0*	−1.4*	5.0	4.0	3.5	−1.0	−0.5	−1.5*
	Healthy LE	2.0	2.1	3.4	0.1	1.2*	1.3*	2.4	3.0	3.7	0.6	0.8	1.3*

Level of significance for a two-tailed test. Test for statistical significance done for healthy LE and unhealthy LE. *Significantly different at 5% level from the previous time period. The sum of LE in health states might not add up to Total LE because of rounding, LE: Life expectancy

It is important to note that not only the absolute numbers of life expectancy and HLE increased over the period 2005–2012 for both men and women of all ages but also the proportions of life in good health did so. In 2005, an 80-year-old South African woman could expect to live about a third of her remaining lifetime in good health. By 2012, she could expect to live approximately half of her remaining lifetime in good health [Table 3]. On the other hand, a man of the same age could expect to live more than a third (36.8%) of his remaining lifetime in good health in 2005 and by 2012 approximately two-thirds (61.5%) [Table 3]. It is also evident that although women lived longer than men, they spent much of their lifetime in poor health. The standard errors of the proportions get larger with age due to the relatively smaller sample sizes at the oldest ages.

However, the changes in TLE and HLE over the period 2005–2008 and over the period 2008–2012 were different. Our results show that the TLE at all ages declined from 2005 to 2008 for both men and women with a reduction from 0.1 to 0.4 years and a greater reduction found at older ages, although such a decline is not statistically significant [Table 2]. Our results further show that male HLE at ages 50 and 60 declined in the period 2005–2008, while female HLE at these ages did not decline in the same period. The reduction in male HLE caused a decrease in the proportion of life in good health from 2005 to 2008 for age 50 by 1.4 percentage points (=66.8–68.2%) and age 60 by 4.9 percentage points (=59.3–64.2%). However, from 2008 to 2012, no reduction in TLE, HLE, and the proportion of life in good health was observed, and men at age 60 witnessed a more pronounced increase (by 1.3 years) in HLE, or 7.9% in 2012 than in 2008.

4. Discussion

Our focus in this study was to use a single global domain (self-rated health) from three waves of a nationally representative cross-sectional survey in South Africa from 2005 to 2012 to investigate changes in population health in relation to increases in TLE and to investigate the gender difference in such changes. Overall, the findings showed that the health of older people in South Africa improved over the period under investigation with a greater improvement in women. Our findings provide additional evidence to support the compression of morbidity (European Health Expectancy Monitoring Unit, 2009).

The improvement in HLE in South Africa over the period 2005–2012 that we observed in this study may be partially explained by contextual factors related to the hosting of the Federation of International Football Association (FIFA) World Cup in 2010. The success of hosting the 2010 World Cup brought a "feel good" sensation, happiness, national pride, and enhanced social cohesion across the country (Gibson, Walker, Thapa *et al*., 2014; Møller, 2014). We speculate that this could have translated into positive responses on self-rated health and, hence, a positive trend in HLE during the period

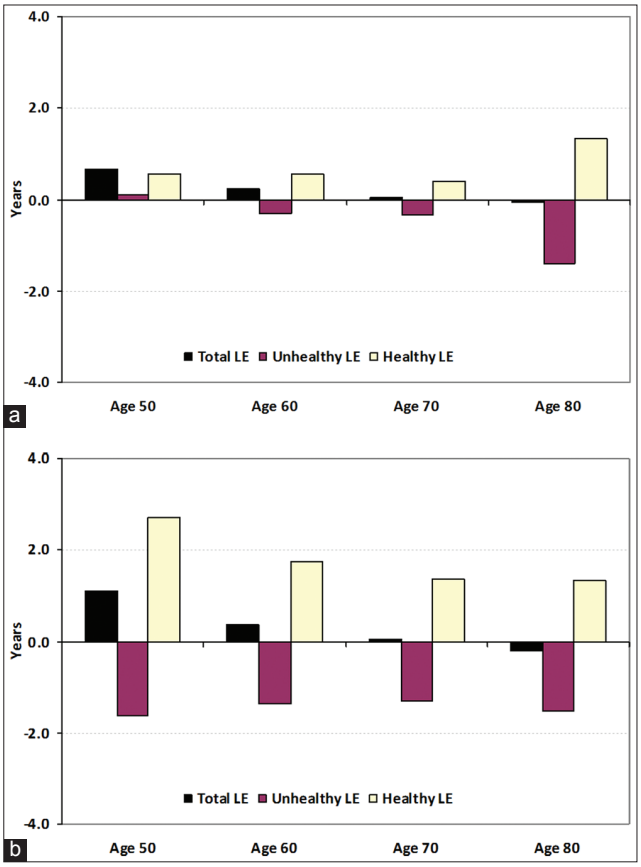

Figure 1. Changes in total life expectancy and life expectancy in good and bad health for (a) men and (b) women, South Africa, 2005–2012

Table 3. The proportion of expected lifetime in self-rated good health and bad health for men and women at ages 50, 60, 70, and 80 in South Africa in 2005, 2008, and 2012.

Age	Life years	Men			Women		
		2005	2008	2012	2005	2008	2012
50	Unhealthy LE	31.8	33.2	31.3	46.7	38.8	37.8
	Healthy LE	68.2	66.8	68.7	53.3	61.2	62.2
	SE for HLE/TLE	(2.1)	(2.2)	(1.4)	(1.6)	(1.9)	(1.3)
60	Unhealthy LE	35.8	40.7	32.8	49.6	42.7	40.9
	Healthy LE	64.2	59.3	67.2	50.4	57.3	59.1
	SE for HLE/TLE*	(3.3)	(3.3)	(1.9)	(2.1)	(2.6)	(1.7)
70	Unhealthy LE	43.6	41.9	39.2	54.5	52.9	43.4
	Healthy LE	56.4	58.1	60.8	45.5	47.1	56.6
	SE for HLE/TLE*	(5.3)	(5.2)	(3.2)	(3.2)	(4.5)	(2.7)
80	Unhealthy LE	63.2	59.3	38.5	67.7	57.6	48.6
	Healthy LE	36.8	40.7	61.5	32.3	42.4	51.4
	SE for HLE/TLE*	(10.0)	(9.3)	(7.1)	(6.3)	(7.3)	(5.5)

The sum of LE in health states might not add up to 100% because of rounding. *SE: Standard error for proportion Healthy LE/Total LE. LE: Life expectancy, HLE: Healthy life expectancy, TLE: Total life expectancy

2008–2012. Similar feel-good effects from hosting such a mega sports event were previously reported in France and Germany (Dutch National Committee for International Cooperation and Sustainable Development, 2008). A study from

Japan also observed the effect of contextual factors, i.e., the "Golden plan" during the period of 1986–2004 (Yong and Saito, 2009). During this period, several policy reforms were implemented which improved the health and well-being of older people in Japan. As a result, a positive trend in HLE was observed (Yong and Saito, 2009). Another possibility for improvement in HLE may be related to decrements in retirement age for men from age 65 down to age 60 in 2008–2010 as the receiving pension increases well-being (Schatz, Gomez-Olive, Ralston *et al*., 2012).

The finding that a greater improvement in HLE observed in women is accordance with a study from Austria (Doblhammer and Kytir, 2001). It is possibly due to better access to health and social services over the study period by women. The General Household Survey (Lehohla, 2013) showed that a higher proportion of women had better health-seeking behaviors compared to men, which included consulting a health worker when they were ill or injured. Another possible reason could be resilience in older women (Kinsel, 2005). There is evidence showing that older women are more resilient than their male counterparts in dealing with daily difficulties because women tend to have a better social supporting network than men (Depp and Jeste, 2006). Furthermore, as we reviewed above, self-rated health involves a process of self-perceptions and subjective judgments about various health domains (Feng, Zhu, Zheng *et al*., 2016; Jylhä, 2009); it is possible, during the study period, some health outcomes of women in South Africa improved greater than those of men. Unfortunately, this study did not analyze and isolate the independent effects of possible predictors of poor health. More research is clearly warranted to shed light on the root causes on the gender differential in the improvement of HLE.

One interesting finding of the present study is a decline in life expectancy for both women and men and a decline in HLE for men from 2005 to 2008, although these declines were not statistically significant. The declines in life expectancy and HLE in the period of 2005–2008 were probably linked to the financial crisis in South Africa. As the 2008 survey was conducted from May 2008 to March 2009 (Shisana, Rehle, Simbayi *et al*., 2009), it is thus possible that a sizeable portion of the sample provided the responses during the financial crisis in South Africa and across the global. There is evidence that the global financial crisis had a severe impact on South Africa, and consequently, the country's economy went into recession between 2008 and 2009 for the 1st time in 19 years (Rena and Msoni, 2014). During this period, the unemployment rate and poverty levels increased dramatically (Padayachee, 2010). We speculate that this could have a negative impact on HLE in South Africa, especially for men. Such a global and local economic crisis should also have reshaped people's daily life and behaviors and produced a negative impact on health-care access and health outcomes in South Africa, and such an impact might be more fatal to the older adults than the younger adults as the former needs more medical treatment and is more vulnerable. Fortunately, South African Government implemented a policy related to retirement age decrement from age 65 to age 60 for men in 2008–2010, which may partially offset the negative impact of financial crisis, especially for those aged 65 or younger.

Notwithstanding, although there were improvements over time in women, our results show that the proportion of women reporting "fair'/'poor" health [Table 1] was higher than men, and the proportion of life spent in poor health [Table 3] was higher for women than men in the study period. Studies are needed to investigate contextual determinants to which the health gaps between older men and women can be attributed in the South African setting, including gender roles. Health interventions need to be gender sensitive to address the health differences between the sexes.

One strength of this study is to use a nationally representative sample to investigate the trend of HLE among South Africans aged 50 or older for the 1st time. The consistencies in survey design, data collection methods, and same wording of questions across three waves in 2005, 2008, and 2012 make it possible to evaluate trends in the health of older people over the period. The study period is unique, not only covering the global financial crisis but, also covering the major events such as nation's pension reform and hosting the 2010 FIFA World Cup. All these events could largely influence people's assessment of their emotion, spirit, psychological well-being, and eventually self-rated health. We recommend studies that can disentangle this complexity tempo change of self-rated health in referring to contextual environments.

Several caveats are worthy of mentioning when interpreting the results. First, it is possible to have concluded otherwise had we used other measures, for example, disability. Such a measure is, however, not included in the SABSSM surveys' questionnaires used in this analysis. A study on HLE in Thailand found stagnation when using self-rated health and improvements in health status when using disability measures based on activities of daily living (ADLs) limitations (Karcharnubarn and Rees, 2009). It has been acknowledged that self-rated health and disability can actually follow different trends (Crimmins, 1996; Robine and Michel, 2004; Gu, Dupre, Warner *et al*., 2009; Spiers, Jagger, and Clarke, 1996). Furthermore, the cross-national and cross-cultural comparison of healthy expectancy based on self-rated health should be caution due to its subjectivity of self-rated health. Nevertheless, our results are in line with findings from the Rapid mortality surveillance (Dorrington, Bradshaw and Laubscher, 2014) which, based on mortality indicators over the

same period as this present study, also concluded that the country was progressing well toward the improvement of the population's health status.

Second, although we did not specifically analyze HIV and ART data, our results likely lend support to recent findings that people living with HIV are living longer and healthier lives than their past cohorts partly due to the successful roll-out of ART (Bor, Herbst, Newell *et al*., 2013; Shisana, Rehle, Simbayi *et al*., 2014). Nevertheless, more research on the separation of analysis of HIV and non-HIV populations is needed to validate our speculation.

Third, we only stratified the analyses by gender. This can be expanded to include other differentials such as education and race that have been also frequently studied in the existing literature (Feng, Zhu, Zheng *et al*., 2016; Gu, Dupre, Warner *et al*., 2009). The only drawback would be the unavailability of mortality data disaggregated by these variables, which would be required to apply the method used in this study. Related to this, due to the relatively small sample size of at oldest-old ages in the SABSSM surveys, we had an open interval at 80 years and above to have reliable estimates.

Fourth, the exclusion of institutionalized individuals from the SABSSM surveys can bias the prevalence of self-rated health and HLE estimates upward. It is important to include this segment of the elderly population, since they are likely to be different in terms of health from those residing in the community. Unfortunately, there are no comparable surveys that collect information on health among institutionalized elderly populations in South Africa. Fortunately, the effect of excluding the institutionalized population in the current study is negligible because the number of institutionalized older adults in South Africa is relatively small (Phillips and Noumbissi, 2004).

Fifth, as the sample size for single-age is not sufficiently large to calculate the prevalence of self-rated health, we used prevalence in 10-year age group to assume that the prevalence of self-rated health within the age group is the same for each of single year of age. Such a practice may introduce some bias than that based on the single-age rate if it would be available. However, the bias should not be substantial since such a practice is similar to the construction of abridged life tables.

Six, no covariate was included in the analysis. Given that self-rated health is closely linked to some major demographics and psychosocial factors (Feng, Zhu, Zheng *et al*., 2016), it is possible that the improvement in HLE in South Africa over the period of 2005–2012 may be attributable to differences in covariates even if disease condition, physical and cognitive functions, and reporting pattern had no change over time. Studies incorporating major covariates into modeling would shed light on investigating the possible root causes or underlying associates linked to the change of HLE.

Seven, we relied on the life tables produced by the United Nations as a basis to estimate the healthy expectancy. Although the data quality in South Africa is still a concern, as in most developing countries, we are confident that the United Nations life tables in the World Population Prospects are relatively robust given that these estimates are obtained from multiple sources under systematic examinations (United Nations, 2017).

5. Conclusions

Based on self-rated overall health in the South African National HIV Incidence, Prevalence, Behaviour and Communication Survey in 2005, 2008, and 2012, we concluded that the health condition of older adults in South Africa was improved over the period of 2005–2012. Gender differences were evident with women having a longer life expectancy, HLE, and unhealthy life expectancy, but lower proportions of life spent in healthy years. Our findings highlight the need for gender-sensitive health interventions among older adults. We also observed an increase in the proportion of HLE in 2012 for both men and women compared to those in 2005. This suggests some evidence of compression of morbidity in terms of self-rated health for South African older adults in the period of 2005–2012.

Authors' Contributions

W. Chirinda and Y. Saito designed the study, and W. Chirinda performed the analysis and drafted. W. Chirinda, Y. Saito, D. Gu and N. Zungu revised the manuscript and interpreted the results.

Ethics

Not applicable as the dataset used in this study is a publicly available source.

Conflicts of Interest

No conflict of interest was reported by the authors.

Disclaimer

Views expressed in the study are solely those of the authors and do not reflect those of the South African Medical Research Council, Nihon University, the United Nations, Human Sciences Research Council of Pretoria (South Africa), and the University of Pretoria.

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