

Maternal health heterogeneity: Comparative evidence on reproductive age life expectancy and maternal morbidities in sub-Saharan Africa

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Abstract

Background

Remarkable progress has been made in reducing maternal mortality over the past three decades. However, the remaining burden is uneven -- sub-Saharan Africa (SSA) alone accounted for roughly two thirds of maternal deaths in 2017. The number of years women spend with maternal morbidities, and how much each maternal complication contributes to unhealthy remaining years in reproductive ages is unknown.

Objective

The study estimates the number of life years that women of reproductive ages spend in poor health due to indirect maternal health morbidities.

Methods

We use Demographic and Health Survey data from 23 SSA countries to estimate age-specific mortality prevalence in reproductive age women, and construct life tables to estimate the survival function and reproductive age life expectancy (RALE) with and without HIV and anemia using the Sullivan method.

Results

We show that despite a reduction in maternal mortality ratio (MMR), there is still high prevalence of HIV and anemia among SSA women. There is also heterogeneity in disease prevalence across SSA regions with a higher prevalence of anemia in East, Central and West Africa and a high HIV prevalence in Southern Africa. These conditions compromise women's health and reduce their healthy living by an average of 14.3 years [14.3-14.4], where 11.6 years [11.6-11.7] are spent on anemia, 1.7 years [1.7-1.8] on HIV and 1.1 years [1.1-1.2] on comorbidities. SSA women of reproductive ages spend approximately 42% of RALE life years with maternal morbidities (14.3 years [14.3-14.4]).

Conclusion

The study shows that despite a reduction in MMR over the years, there is still a high prevalence of HIV and anemia among SSA women between 2010 and 2018. If successful management of women and children's health as well as sustainable development goal (SDG) 3 are to be achieved, morbidity prevention and management measures among women will need to be enhanced during the entire reproductive ages.

Key Words: Maternal morbidities, life expectancy, reproductive age, sub-Saharan Africa

Introduction

About 295,000 maternal deaths were observed in 2017 (1). While remarkable progress has been made in reducing maternal mortality over the past three decades, marked regional disparities persist. Ninety four percent of all maternal deaths occur in Lower and Middle Income Countries (LMICs), and sub-Saharan Africa (SSA) alone accounted for roughly two thirds of these deaths in 2017, with a maternal mortality ratio (MMR) of 462 compared to 11 per 100,000 live births in high-income countries (HICs) (2). Despite this reduction, maternal morbidity (defined as any health condition attributed to and/or complicating pregnancy and childbirth which has a negative impact on women's wellbeing and/or functioning) is still high (3). Being a rare event, maternal deaths account for a small fraction of the overall burden of poor maternal health and is not a comprehensive measure to monitor progress in improving maternal health outcomes (2–5). WHO recommends including morbidity in the monitoring of maternal health as the years that women spend with illness and suffering compromise their healthy life years (4). Maternal morbidity results in detrimental effects on women's health which may disrupt the achievement of sustainable development goal (SDG) target 3.1 (of reducing the global maternal mortality ratio to less than 70 per 100,000 live births) (5) and yet has been neglected in the reproductive health agenda (3).

Global evidence shows that for every maternal death, 30-40 women end up having maternal morbidities that undermine their normal functioning, including physical, mental or sexual health issues that also lead to other socioeconomic repercussions (3,6). Despite not knowing the overall estimates of maternal morbidity, 27 million annual morbid episodes were estimated to have occurred in 2015 from the five main direct obstetric causes of maternal mortality (7). SSA has high rates of reproductive age morbidity, including haemorrhage, eclampsia, abortions, and prolonged labour, as well as indirect morbidities including HIV, malaria, and anemia (2,6) as well as the novel COVID-19 pandemic (8). When a pregnant woman has indirect maternal morbidities such as HIV, malaria and anemia, they are also more likely to suffer from direct causes of mortality such as sepsis. Studies have shown that pregnant and postpartum women who are HIV positive have around eight times the risk of mortality compared to HIV negative women (9,10). HIV infected women have over five times higher risk of direct maternal mortality, and are more likely to die from underlying causes than HIV negative women (11). A study in Mozambique showed that malaria, HIV and, anemia were found in more than 40% of maternal deaths due to abortion, ectopic pregnancy and sepsis (12). Further, the risk of still births is doubled among HIV infected women and foetal anemia is increased among infants born to HIV positive women (13). Studies have shown that hemorrhage is the leading cause of maternal mortality (14) and anemia is one of the leading global causes of hemorrhage and disability (15) and therefore should be treated as one of the most serious global public health problems.

While women in LMICs have higher life expectancy than males, they spend most of their life with diseases due to reproductive age maternal morbidities (16). Evidence shows that infants born to women with obstetric complications are 3.7 times more likely to die than those without complications (17). Over the life course, women are at higher risk of developing long term chronic diseases later in life because of maternal morbidities. Most morbidities are usually not reversible and result in permanent disabilities (18). Economically, women spend 11% more than men in similar age groups on reproductive age morbidity treatment expenditures and 24% have difficulty in resuming household work (19) while socially, some women are neglected by their husbands due to reproductive age morbidities such as fistula (20). The high intimate partner violence levels among pregnant women may also exacerbate maternal morbidities (21).

Unlike mortality, the demographic impact of morbidity in pregnancy and in the postpartum period has rarely been examined, and yet many women face morbidities in almost every pregnancy and child birth (3). Of increasing concern is the fact that most SSA women have high unmet needs for family planning in almost all ages, which might lead to a higher reproductive age morbidity risk, especially in younger and older ages (22–25). If long term solutions to women’s poor health are to be found, proper management of maternal morbidities should be enhanced as women’s experiences of morbidities and the entire childbirth process – with challenges and delays in accessing and receiving appropriate care – are key in managing maternal and child health and preventing premature mortality.

In SSA, studies of maternal health impact have estimated the life years lost for reproductive age women as a result of maternal mortality (26–29) and healthy life expectancy for the entire population (30). However, little is known about how long reproductive age women spend with maternal morbidities, which may have an impact on their lifestyle and reproductive health choices as well as affect their infants’ health (19). There is limited research measuring the demographic impact of maternal morbidities on the health of women. Since the reproductive age period is limited to 15-50 years, eliminating morbidities would allow women to have successful pregnancies and healthy children and support them to live longer and healthier lives even beyond the reproductive ages.

This study estimates the number of life years that women of reproductive ages spend in poor health due to maternal morbidities. This is the first study in SSA, to the best of our knowledge, to quantify the estimated life years women of reproductive ages live with maternal morbidities during their reproductive life, and measure how much each morbidity compromises their reproductive age life expectancy.

Data and Methods

We used Demographic and Health Surveys (DHS) data for SSA countries that measured both HIV and anemia prevalence between 2010 and 2018 to determine the prevalence of maternal morbidities (HIV and anemia) among women of reproductive ages (15-50) in 23 countries (31) (See appendix 1 for countries included, survey years and sample sizes). We used HIV and anemia prevalence to estimate number of years lived by reproductive women with the two diseases (9,12). Some SSA countries were excluded from the analysis as they only had one disease (either HIV or anemia) for women while others only measured infant and not maternal anemia. The DHS is a representative, cross-sectional survey with information on a country's demographic and health status and usually occurs every five years. It has standard questions which are asked to women and men on various demographic, household, and health information in LMICs. This makes it comparable in many common indicators across countries. Mortality and disease prevalence data are available by 5 year age groups for ages 15-50 (31).

Analysis

DHS age-specific death rates were used to construct country-specific life tables and estimate the survival function and reproductive age life expectancy (RALE) (32). RALE refers to the average number of years expected to be lived by a woman aged 15 during her reproductive age period (15-50), based on observed age-specific death rates and calculated as: $RALE(t) = \frac{T(15,t)-T(50,t)}{\ell(15,t)}$, where $T(x, t)$ and $\ell(15, t)$ correspond to the life table measures for the person-years above age x and the number of survivors at age 15 at time t , respectively. In summary, RALE is a life expectancy where the life table starts at age 15 and is completed at age 50. Since the reproductive age range is 15 to 50, the total number of years for RALE are 35 years if no woman dies. In addition, healthy and unhealthy RALE were calculated using the prevalence rates of HIV and anemia of women in reproductive ages (the respective International Classification of Diseases revision 10th revision codes are HIV B20-B24 and anemia D60-D64) (33).

In this study, reproductive age morbidities (HIV and anemia) are defined as morbidities which women have experienced as a result of indirect causes during their reproductive age period. These were the only morbidities captured in the DHS across SSA between 2010 and 2018. However, HIV and anemia have been associated with most indirect maternal deaths, including those from direct causes as they predispose a woman to direct causes of maternal deaths, such as postpartum haemorrhage leading to death (11,12,34,35). It is common to find HIV and anemia as the contributing causes of death among women who die from direct maternal mortality causes (21). For example, a study in Malawi showed

that HIV-infected women face higher rates of mortality from direct maternal causes (9). The prevalence of HIV and anemia are used here to calculate the average number of years a woman will spend with HIV and anemia in their reproductive age life expectancy. This prevalence of morbidity can be interpreted as the number of reproductive years with HIV and anemia which women aged 15-50 would experience if current age specific rates of mortality and morbidity prevailed throughout the reproductive age period. Thus, the higher the prevalence of diseases, the higher its effect on RALE. In the results section, we present three causes of morbidity: HIV and anemia separated, as well as the cases where combined comorbidity of HIV and anemia was present.

The Sullivan method is usually used for separating life expectancy into disabled and disability-free life years (36,37). We use the Sullivan method to calculate the reproductive years spent with and without HIV and anemia. It uses the life table person-years combined with the age specific prevalence of a disease to derive age specific unhealthy person-years from a particular disease. After that, unhealthy total person-years between ages 15 and 50 and unhealthy reproductive age life expectancy are derived (37).

The resultant reproductive age life expectancy (RALE) is then the addition of healthy life expectancy (HLE), and unhealthy life years due to HIV (UHIV), anemia (UA), and HIV and anemia combined (UHA):

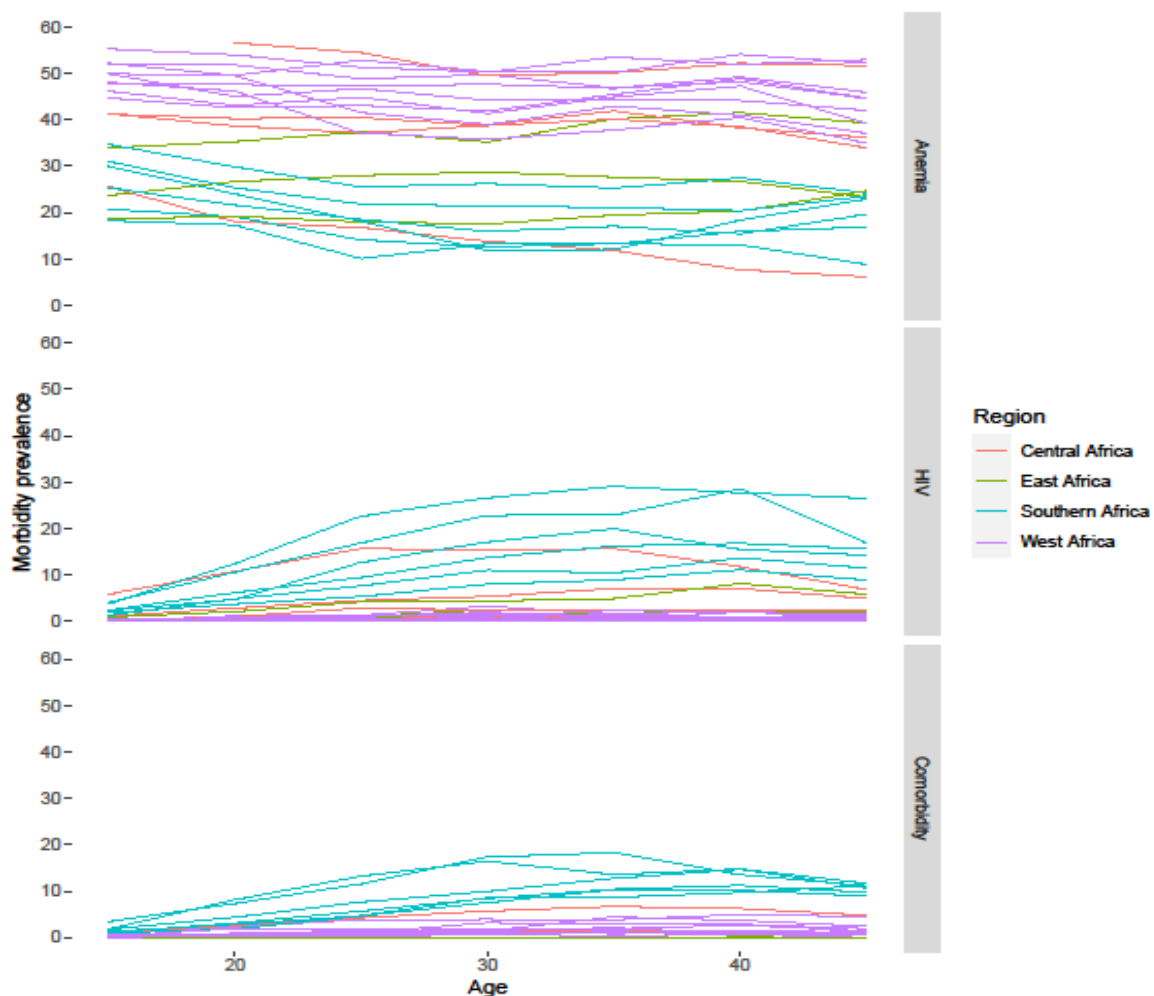
$$RALE(t) = HLE(t) + UHIV(t) + UA(t) + UHA(t).$$

We calculate RALE with and without morbidities for each country in SSA, as well as an aggregate for the entire region (as the average of the age-specific death rates and assuming that the obtained information between 2010 and 2018 did not differ much from year to year). Confidence intervals of 95% for all healthy and unhealthy life expectancies were calculated by bootstrapping (38). All calculations were conducted in the R statistical programming language (39).

Results

Morbidity burden is high among the SSA countries. Anemia is generally higher in almost all countries followed by HIV and the comorbidity of the two morbidities (Figure 1, detail values in appendix 2). There is also heterogeneity in disease prevalence across SSA regions. There is generally a higher prevalence of anemia in East, Central and West Africa (having the highest prevalence) and a very low HIV prevalence as compared to Southern Africa that has high HIV as well as anemia and comorbidity. Anemia prevalence is high at both younger and older reproductive ages compared to HIV which is higher in mid and older reproductive ages. There is a higher comorbidity in countries that have high HIV prevalence than those with anemia and the age pattern is similar with that of HIV.

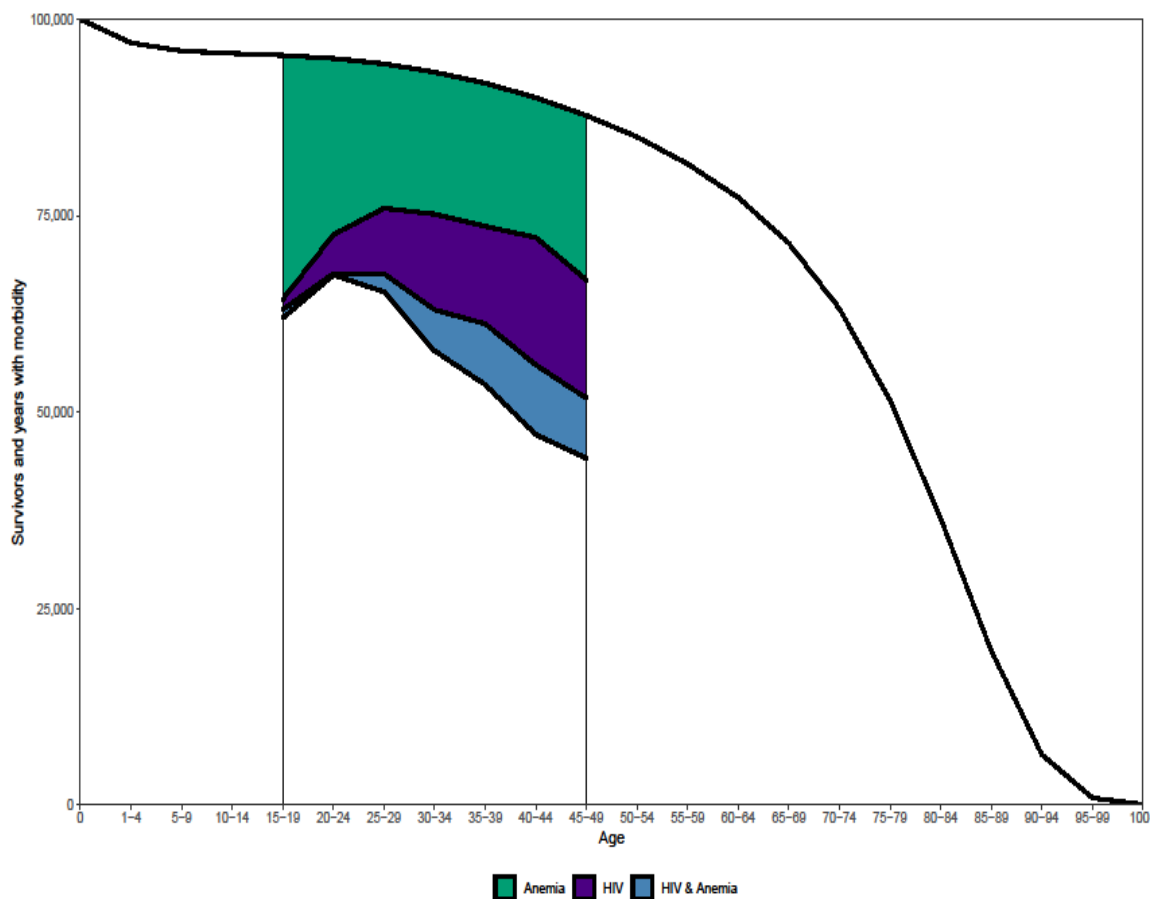
Figure 1: Age-pattern of morbidity prevalence among SSA reproductive age women, 2010-2018



Source: authors' calculations based on DHS data

Figure 2 shows the life table survival function of Zambian women from age 0 to 100 and depicts morbidity of women in reproductive ages (15-50) in 2018 (40). The overall survival for females aged 0-100 is represented by the outer curve. The area under the curve between ages 15 and 50 shows the RALE for Zambian women of 34.3 years at 95% [CI 34.3-34.4] and it is divided by its healthy and unhealthy life years by each disease and comorbidity. Zambian women have a high number of morbidities due to anemia (8.1 years [8.0-8.2]), HIV (3.0 years [3.0-3.1]), as well as comorbidities of the two diseases (2.4 years [2.4-2.5]). This is equivalent to a total of 39.4% of years of RALE lived unhealthy (anemia 23.6%, HIV 8.7%, and comorbidity 7.0%).

Figure 2: Survival function and years with and without HIV and Anemia for Zambian Women, 2018.



Source: authors' calculations based on DHS data and UN World Population Prospects

Figure 3 shows the unhealthy life years spent with HIV and Anemia for SSA Countries, 2010-2018. Generally, there is a higher anemia prevalence than HIV for all countries except Lesotho which has a

higher HIV and the women who had both anemia and HIV comorbidity were less than those who had HIV. More countries have a higher HIV prevalence than the comorbidity of HIV and anemia except for Burkina Faso, Ivory Coast, Gabon, Gambia, Ghana, Mali, Senegal, Sierra Leone, and Togo which are mainly in West Africa where there is lower HIV prevalence than most parts of SSA.

The healthy and unhealthy RALE of SSA women between ages 15-50 and the years that they spend in reproductive ages with each disease are shown in Table 1. For the entire SSA, on average women will spend 14.3 years [14.3-14.4] unhealthy of their RALE with morbidities, equivalent to 42.2% of total RALE: 11.6 years [11.6-11.7] with anemia (34.3%), 1.7 unhealthy years [1.7-1.8] due to HIV (4.9%), and 1.1 unhealthy years [1.1-1.2] due to the combination of HIV and anemia (3.1%). Most of the countries in SSA have similar RALE except Gambia, Ghana, Guinea and Lesotho that have lower RALE. Rwanda has the highest RALE at age 15 (34.7 years [34.7-34.8]) while Guinea has the lowest (29.4 years [29.0-30.0]). This means that on average, a Rwandese and Guinea woman are expected to live 34.7 [34.7-34.8] and 29.4 [29.0-30.0] years in their reproductive life, respectively. Similarly, Rwanda has the lowest number of years of women with morbidities (8.3 years [8.3-8.4]) as compared to Gambia which has highest (21.4 years [21.4-21.5]). Similarly, South Africa (11.8%) and Lesotho (11.2%) have the highest comorbidities as well as the highest HIV rates in SSA (Appendix 2).

Figure 3: Unhealthy Years Spent with HIV and Anemia for SSA Countries, 2010-2018.



Source: authors' calculations based on DHS data

Table 1: Healthy and Unhealthy Reproductive Age Life Expectancy (RALE) by Morbidity for SSA Countries, 2010-2018.

Country	Year	RALE	95% CI	Unhealthy life years				Healthy Life years
				HIV	Anemia	HIV & Anemia	Total Unhealthy	
Burundi	2016-17	34.4	34.4-34.5	0.4	12.9	0.2	13.5	20.9
Burkina Faso	2010	34.3	34.3-34.4	0.2	16.3	0.3	16.8	17.5
Cameroon	2018	34.2	34.2-34.3	1.6	13.3	0.0	14.9	19.3
Ivory Coast	2011-12	34.1	34.0-34.2	0.6	16.6	1.2	18.4	15.7
Chad	2014-15	34.2	34.2-34.3	4.0	4.9	0.0	8.9	25.3
DRC	2013-14	34.0	34.0-34.1	0.3	13.3	0.3	13.9	20.1
Ethiopia	2016	34.4	34.4-34.5	0.5	9.1	0.3	9.9	24.5
Gabon	2012	34.3	34.3-34.4	0.7	18.4	1.5	20.6	13.7
Gambia	2013	33.9	33.7-34.0	0.3	20.4	0.7	21.4	12.5
Ghana	2014	33.5	33.4-33.6	0.4	13.4	0.5	14.3	19.2
Guinea	2018	29.4	29.0-29.7	0.3	12.9	0.3	13.5	15.9
Lesotho	2014	33.8	33.7-33.9	7.1	4.9	3.8	15.8	18.0
Malawi	2015-16	34.2	34.2-34.3	2.3	9.5	2.2	14.0	20.2
Mali	2012-13	34.5	34.5-34.6	0.2	17.7	0.3	18.2	16.3
Namibia	2013	34.3	34.2-34.4	4.2	5.2	2.2	11.6	22.7
Niger	2012	34.2	34.1-34.3	0.1	15.2	0.1	15.4	18.8
Rwanda	2014-15	34.7	34.6-34.7	1.5	6.8	0.0	8.30	26.4
Senegal	2017-18	34.2	34.1-34.3	0.1	18.1	0.2	18.4	15.8
Sierra Leone	2019	34.2	34.1-34.3	0.3	15.5	0.4	16.2	18.0
South Africa	2016	34.2	34.1-34.3	6.0	6.7	4.0	16.7	17.5
Togo	2013-14	34.2	34.2-34.3	0.4	14.9	0.6	15.9	18.3
Zambia	2018	34.3	34.3-34.3	3.0	8.1	2.4	13.5	20.8
Zimbabwe	2015	34.1	34.1-34.2	3.9	6.5	3.0	13.4	20.7
SSA	2010-2018	34.0	34.0-34.1	1.7 (4.9%)	11.6 (34.3%)	1.1 (3.1%)	14.3 (42.2%)	19.6 (57.8%)

Source: authors' calculations based on DHS data

Discussion and Conclusion

To our knowledge, this is the first study to examine reproductive age life expectancy and partition it into healthy and unhealthy life years for anemia and HIV in SSA between 2010 and 2018. Results show that a 15-year-old woman in SSA is expected to live 34.0 more years [33.0-34.1] in her reproductive life. However, an extensive proportion of women's reproductive age life expectancy is spent with morbidities (over one third of their reproductive years). On average, the total number of years spent with reproductive health morbidities for women in SSA is 14.3 years [14.3-14.4]. Of these, 11.6 years [11.6-11.7] with anaemia, 1.7 years [1.7-1.8] will be spent with HIV, and 1.1 years [1.1-1.2] with both anemia and HIV. These diseases affect women's daily life functions and compromise their reproductive health life and that of their infants (19). This study also shows a high comorbidity of anemia and HIV for countries that have high HIV rates in Southern Africa such as South Africa and Lesotho. Southern Africa is also experiencing higher mortality rates among women of reproductive ages as compared to the other regions.

Previous studies have demonstrated the effect of maternal mortality on life expectancy but have not shown the impact of morbidity on RALE (26,29). This study goes further partitioning reproductive age life expectancy into its healthy and unhealthy years as a result of HIV and anemia (23). While for reproductive health policy makers, a decline in the maternal mortality ratio is a major milestone, unfortunately less attention has focused on how morbidities affect women's health after survival. Most of the women who survive remain with effects from the morbidities that they suffered from in their reproductive life years especially if the morbidities were severe, some of which have long term consequences and also affect their infants' health (10–12,18–20,22,41–43). Given the negative health outcomes associated with morbidities (44), efforts should be made towards morbidity reduction. In addition, indirect factors such as female education and autonomy, have shown to increase women's access to skilled birth attendants and family planning care as educated and autonomous women access health services easily (3) which will help promote healthy RALE of women. Further, autonomous and educated women are more likely to make informed choices which can affect choice of contraceptives to be used, when to have pregnancy and how often, choice of nutrition and use of condoms in case of HIV prevention.

The findings that women spend extensive periods of their reproductive years with morbidities should be a cause of concern. Studies have shown that despite women having longer life expectancy, they spend most of their lives with morbidities (44). COVID-19 has added to this burden of maternal morbidities being faced by women from 2019 onwards. Global maternal and fetal outcomes have worsened during the COVID-19 pandemic, with an increase in maternal depression, still births and ruptured ectopic pregnancies as well as maternal deaths. These outcomes are likely to be worse in

developing regions (SSA inclusive) with already high burden of morbidity prevalence rates (8). Maternal mortality has shown to reduce SSA RALE by one year despite being a rare event (26,29). Morbidities which have a higher prevalence have a likelihood of compromising women's health lives even more and further reduce RALE if not well managed. Furthermore, these diseases also affect infants causing ripple effects for the future generation's health and growth (41,45). Women are known to run and take care of homes even though their level of autonomy is low in many countries (46). Being affected by these morbidities means that they will not operate optimally and their contribution to household duties and running of the home, workforce and society will be compromised.

Programme specific approaches to reduce morbidity such as adequate focused antenatal care, contraceptive use, including condom use for HIV prevention and good nutrition for anemia can help promote healthy life for women in reproductive ages. Looking at the current global efforts in reducing maternal mortality, there is further need to focus on disease prevention among women of reproductive ages so as to promote healthy RALE and consequently increase survival of healthy babies. Maternal mortality is a very important indicator of women's health but only shows a single consequence of poor maternal health. Morbidity prevention will yield multiple benefits as it will prevent other morbidity consequences, such as postpartum depression as well as reduce maternal deaths (44) and save costs on money used for management of diseases. Health status of reproductive age women to a larger extent determines child health and probability of survival (47–49).

The present study has limitations. By using the Sullivan method, it is assumed that women with and without morbidities (based on cross sectional morbidity prevalence) have the same age specific mortality rates. As such, our results correspond to an underestimate of the mortality seen by women experiencing comorbidities. Further, we do not have information on the prevalence of direct maternal morbidities such as haemorrhage in the DHS which leads to an underestimation of the total effect of reproductive health morbidities on RALE. However, our comparative results of the morbidity burden (anemia and HIV) among women in SSA between 2010 and 2018 provide an important estimate of morbidity prevalence among reproductive age women in SSA and informs programming and policy across the region.

The demographic implications of eliminating these morbidities and their causes raises the importance of having quality data which will allow for comprehensive understanding of the causes of all morbidities at exact starting ages and the implications thereof. This should apply for all maternal direct and indirect causes, especially for SSA which has a high morbidity prevalence burden. Many of these morbidities are preventable (27) or can be managed with low cost measures (50–53). This study demonstrates the excess disease burden on the healthy lives of mothers due to maternal morbidities.

The measures used could be used to track maternal morbidity and mortality progress among reproductive age women in SSA and will be valuable descriptively for scholars of global health and analytically relevant for research on inequality, mortality trends, morbidity, and population dynamics. If successful management of women and children's health as well as sustainable development goal number 3 is to be achieved, morbidity prevention and management measures among women will need to be enhanced from pregnancy to the postpartum period.

Ethical Statement

This study involved secondary data analysis of public sources, which did not have any individual identifiers. As such, ethical approval for human subject research from the Institutional Review Board of the respective institutions was exempted.

Author Contributions

Vladimir Canudas-Romo conceived the study and together with Audrey Kalindi and Brian Houle planned its implementation. Audrey Kalindi did the analysis with guidance from Brian Houle and Vladimir Canudas-Romo. Audrey Kalindi wrote the first and subsequent drafts with guidance and advice from Brian Houle and Vladimir Canudas-Romo.

Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Conflict of interest

The authors declare that they have no conflicting interests.

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Appendix 1: Country, year of DHS and sample size

Country	Year of DHS	Sample size
Burundi	2016/17	17269
Burkina Faso	2010	14424
Cameroon	2018	13527
Ivory Coast	2011/12	9686
DRC	2013/14	18171
Chad	2014/15	17719
Ethiopia	2016	15683
Gabon	2012	9755
Gambia	2013	6217
Ghana	2014	9396
Guinea	2018	8000
Lesotho	2014	6621
Malawi	2015/16	24562
Mali	2012/13	10105
Namibia	2013	9849
Niger	2012	10750
Rwanda	2014/15	13497
Senegal	2017/18	16787
Sierra Leone	2019	15574
South Africa	2016	8514
Togo	2013/14	9549
Zambia	2018/19	13595
Zimbabwe	2015	9955

Appendix 2: Percentage of morbidity prevalence among SSA reproductive age women, 2010-2018.

Age	No disease	HIV	Anemia	Comorbidity
Burkina Faso				
15-19	52.33	0.06	47.61	0.00
19-24	51.96	0.19	47.60	0.25
25-29	51.48	0.69	47.29	0.55
30-34	50.08	0.70	47.65	1.56
35-39	51.52	0.91	46.77	0.81
40-44	48.54	0.93	49.20	1.33
45-49	52.40	0.62	45.89	1.09
Burundi				
15-19	65.93	0.05	33.92	0.10
19-24	64.02	0.37	35.30	0.31
25-29	61.34	0.96	37.35	0.34
30-34	63.07	1.02	35.23	0.68
35-39	56.90	1.79	40.15	1.16
40-44	55.98	2.1	41.52	0.39
45-49	57.39	2.61	39.30	0.70
Chad				
15-19	68.51	5.88	25.61	0.00
19-24	71.17	10.78	18.05	0.00
25-29	67.54	15.69	16.77	0.00
30-34	70.82	15.36	13.82	0.00
35-39	72.44	15.69	11.87	0.00
40-44	80.53	11.76	7.71	0.00
45-49	86.96	6.86	6.18	0.00
Ivory Coast				
15-19	47.35	0.00	51.91	0.74
19-24	44.7	1.20	51.80	2.30
25-29	45.97	1.32	48.86	3.85
30-34	43.13	3.28	49.69	3.91
35-39	47.81	1.52	46.86	3.81
40-44	44.56	2.33	48.19	4.92
45-49	48.49	2.41	44.58	4.52
Cameroon				
15-19	57.58	1.12	41.30	0.00
19-24	58.46	2.86	38.68	0.00
25-29	58.31	4.51	37.18	0.00
30-34	55.81	5.39	38.8	0.00
35-39	51.04	7.08	41.88	0.00
40-44	54.64	7.07	38.29	0.00
45-49	58.88	4.94	36.18	0.00
Democratic Republic of Congo				
15-19	58.30	0.10	41.19	0.41
19-24	58.79	0.39	40.26	0.56

25-29	58.22	0.69	40.46	0.63
30-34	59.18	0.79	38.77	1.26
35-39	57.36	1.13	40.09	1.42
40-44	59.54	0.9.0	38.53	1.03
45-49	63.91	1.30	33.91	0.87
Ethiopia				
15-19	75.87	0.28	23.72	0.13
19-24	72.73	0.45	26.66	0.15
25-29	70.28	1.02	28.01	0.68
30-34	67.61	2.50	28.74	1.15
35-39	68.90	2.38	27.65	1.08
40-44	69.93	2.33	26.74	1
45-49	73.75	1.96	23.31	0.98
Gabon				
15-19	38.65	0.17	60.18	1.00
19-24	39.80	1.00	56.60	2.60
25-29	38.35	2.91	54.49	4.25
30-34	42.39	2.42	49.5	5.69
35-39	40.65	2.52	50.15	6.68
40-44	39.03	2.59	52.16	6.22
45-49	41.25	2.29	51.67	4.79
Gambia				
15-19	40.33	0.00	59.19	0.38
19-24	36.15	0.22	63.42	0.22
25-29	33.82	0.53	64.07	1.59
30-34	37.16	0.61	60.86	1.38
35-39	34.11	1.68	59.79	4.42
40-44	34.38	0.85	61.08	3.69
45-49	42.91	1.62	53.04	2.43
Ghana				
15-19	51.49	0.34	48.05	0.11
19-24	52.07	0.88	46.17	0.88
25-29	60.21	1.19	37.15	1.45
30-34	61.35	1.05	35.79	1.80
35-39	57.95	2.36	37.80	1.89
40-44	54.82	2.08	40.45	2.65
45-49	62.65	0.95	34.99	1.42
Guinea				
15-19	52.70	0.56	46.17	0.56
19-24	55.78	0.36	43.13	0.72
25-29	53.11	1.20	44.81	0.87
30-34	56.45	1.15	41.40	1.00
35-39	52.48	1.49	44.87	1.16
40-44	51.22	0.45	47.22	1.11
45-49	58.73	1.23	39.22	0.82
Lesotho				
15-19	73.70	3.81	20.71	1.78
19-24	60.41	12.40	19.08	8.11

25-29	50.00	22.68	14.13	13.20
30-34	44.35	26.61	12.64	16.41
35-39	44.04	29.09	13.30	13.57
40-44	44.52	27.74	13.01	14.73
45-49	53.01	26.51	8.84	11.65
Malawi				
15-19	62.14	1.87	34.72	1.27
19-24	63.55	3.75	29.87	2.83
25-29	64.46	5.36	25.53	4.65
30-34	58.24	8.02	26.24	7.50
35-39	55.43	8.96	25.31	10.3
40-44	51.27	11.11	27.46	10.16
45-49	57.93	8.94	24.19	8.94
Mali				
15-19	49.34	0.22	49.89	0.55
19-24	49.09	0.43	49.62	0.86
25-29	46.04	0.68	52.79	0.49
30-34	47.99	0.73	50.43	0.85
35-39	48.12	0.33	50.24	1.31
40-44	44.89	0.42	54.07	0.63
45-49	45.72	0.59	52.21	1.47
Namibia				
15-19	78.42	2.36	18.28	0.94
19-24	76.11	4.70	17.33	1.86
25-29	72.47	12.71	10.14	4.69
30-34	61.08	17.1	13.26	8.55
35-39	58.12	19.93	13.28	8.67
40-44	58.84	15.5	15.98	9.69
45-49	57.71	14.29	16.86	11.14
Niger				
15-19	55.31	0.00	44.69	0.00
19-24	57.05	0.23	42.62	0.11
25-29	56.53	0.2	43.07	0.2
30-34	56.68	0.69	41.94	0.69
35-39	54.11	0.16	45.43	0.31
40-44	50.23	0.23	48.84	0.69
45-49	55.04	0.29	44.67	0.00
Rwanda				
15-19	80.43	0.94	18.63	0.00
19-24	78.70	2.11	19.19	0.00
25-29	77.78	4.22	18.00	0.00
30-34	78.05	4.39	17.56	0.00
35-39	75.61	4.92	19.47	0.00
40-44	71.50	8.14	20.36	0.00
45-49	69.45	5.87	24.68	0.00
Senegal				
15-19	44.69	0.00	55.26	0.05
19-24	45.62	0.2	53.98	0.20

25-29	48.15	0.08	51.32	0.45
30-34	48.81	0.16	50.29	0.74
35-39	45.22	0.23	53.51	1.04
40-44	46.18	0.28	51.98	1.56
45-49	45.66	0.40	52.93	1.01
Sierra Leone				
15-19	49.47	0.40	49.93	0.20
19-24	52.36	0.65	45.03	1.95
25-29	50.34	1.21	46.72	1.72
30-34	52.53	1.80	44.22	1.46
35-39	52.69	0.96	44.24	2.11
40-44	54.60	0.48	44.13	0.79
45-49	56.37	0.80	42.04	0.80
South Africa				
15-19	62.55	4.04	30.00	3.40
19-24	58.06	10.60	24.06	7.28
25-29	53.42	16.88	18.16	11.54
30-34	47.99	22.86	11.81	17.34
35-39	46.75	22.91	12.07	18.27
40-44	39.58	28.47	18.40	13.54
45-49	49.10	16.85	22.94	11.11
Togo				
15-19	47.39	0.11	52.16	0.33
19-24	49.11	0.48	49.58	0.83
25-29	56.45	0.99	41.56	0.99
30-34	55.76	2.02	39.05	3.17
35-39	53.68	0.46	42.94	2.91
40-44	54.16	2.03	40.97	2.84
45-49	59.52	1.45	37.11	1.93
Zambia				
15-19	66.57	1.31	31.05	1.07
19-24	66.73	4.85	25.35	3.07
25-29	64.75	7.68	21.88	5.69
30-34	59.18	11.04	21.4	8.39
35-39	58.07	10.45	21.1	10.39
40-44	54.72	13.66	20.41	11.22
45-49	55.25	11.5	23.55	9.71
Zimbabwe				
15-19	70.45	2.43	25.35	1.77
19-24	67.83	6.19	21.63	4.35
25-29	64.37	9.47	18.54	7.62
30-34	60.35	13.75	15.97	9.93
35-39	53.97	16.24	17.07	12.73
40-44	53.07	16.82	15.45	14.66
45-49	54.01	15.65	19.66	10.69

Appendix 3: Methodology

The uncertainty in life table measures was estimated with a simulation approach by generating 1000 draws from the distribution of sex-age-year specific death numbers for each population. The uncertainty of death numbers was characterised using binomial distribution. With each draw of the death number, a simulated life table was created. We derived 95% uncertainty intervals from the 2.5 and 97.5 percentiles of the resulting 1000 estimates of life expectancy and lifespan disparity (38).