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Quantifying the loss of healthy life expectancy due to population ageing: health benefit estimation from a global perspective

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ABSTRACT

Study objective Investing in health to improve healthy life expectancy (HLE) is fundamental to create a demographic dividend. However, how dramatic population ageing affects HLE remains unknown. This study aims to quantify and project the major diseases and injuries attributed to changes in population size and age structure that contributed to substantial losses in HLE.

Methods Using data from 188 countries in the Global Burden of Disease Study 2021 and World Population Prospects 2024, we assessed the correlation between HLE and total dependency ratios. Furthermore, we decomposed the mortality and disability burden attributable to changes in population size as well as age structure for 22 disease and injury categories and then quantified the loss of HLE due to the attributable burden. Additionally, we projected the loss of HLE due to priority diseases in 2030, while considering the impact of population ageing.

Results From 2010 to 2019, globally, the mortality and disability burden attributable to age structure caused 0.40 years and 0.71 years of HLE loss, while for population size, these two estimates were 1.18 years and 1.00 years. By 2030, the mortality and disability burden attributable to age structure may lead to 0.76 years and 0.89 years of HLE loss, while for population size, these two predictions will be 1.21 years and 1.17 years.

Discussion Population size growth is a consistent and crucial contributor to HLE losses. Reaping the second demographic dividend requires eliminating the double burden of premature death caused by infectious and chronic diseases, whereas gaining the sustainable third demographic dividend requires investments in healthy and successful ageing.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ A dramatic change in population size and age structure is transforming the demographic dividend of countries around the world, with the latter being inextricably linked to the sustainable development of society.

⇒ Health investment targeting healthy life expectancy (HLE) may be one of the most crucial elements to creating a demographic dividend. Yet, the global evidence on how dramatic population changes shall affect HLE remains unknown.

WHAT THIS STUDY ADDS

⇒ From 2010 to 2019, globally, the mortality and disability burden attributable to age structure caused 0.40 years and 0.71 years of HLE loss, while for population size, these two estimates were 1.18 years and 1.00 years.

⇒ By 2030, the mortality and disability burden attributable to age structure may lead to 0.76 years and 0.89 years of HLE loss, while for population size, these two predictions will be 1.21 years and 1.17 years.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Reaping the second demographic dividend requires eliminating the double burden of premature death caused by infectious and chronic diseases, whereas gaining the sustainable third demographic dividend requires investments in healthy and successful ageing.

⇒ This study may be useful for deriving consistent macropolicy interventions in regions with similar demographic dividend windows and socioeconomic contexts and provides a valuable research paradigm for different countries and regions to further explore subregional heterogeneity.

INTRODUCTION

The great wave of population ageing is sweeping the globe.[1] The main factors driving the ageing process are the decline in crude mortality and total fertility rates, the increase in life expectancy at birth and the growth in the population aged 65 years and over.[2] Population ageing has many social and policy implications, such as pressure for lower labour force participation and savings rates and increased pension and healthcare spending.[3] In addition, the burden of non-communicable diseases (NCDs) is increasing among middle-aged and older people, with a marked shift towards a greater proportion of years lived with disability as life expectancy increases.[4] These effects are transforming the demographic dividend of countries around the world that are undergoing population ageing. The first demographic dividend refers to the transition from high to low child mortality and fertility rates, with large numbers of surviving children growing up to work, increasing the size of the working-age population relative to the dependent population and thus generating socioeconomic growth.[5] The next stage is capital accumulation as a result of population ageing, which will continue to produce economic outcomes in the form of rising national wealth, known as the second demographic dividend.[5 6] The third demographic dividend activates the potential benefits of the elderly population not captured by the second demographic dividend, which is the additional and sustainable societal benefits brought by the generative social capital of the elderly population, which requires the realisation of successful ageing of societies.[7] Investing in health can lay the basis for a demographic dividend at different stages, and increasing the share of healthy life expectancy (HLE) in life expectancy is a crucial first step in proactively responding to complex demographic changes.[8] However, how demographic changes contribute to the loss of HLE is unclear.

Measuring and predicting the loss of HLE due to population changes is an important foundation for achieving the demographic dividend. HLE is a clear and consistent measure of population health outcomes that is reflected in the health policy objectives of countries worldwide. One of the distinctive advantages of HLE is that it can inform the authorities and relevant stakeholders of planning and implementing socioeconomic policies and strategies beneficial to population health.[9 10] Though previous studies have examined the loss of HLE due to disease, injury and health-related risk factors, population changes as an important social determinant have not received sufficient attention.[11–13] Indeed, the disease burden attributable to population changes can be decomposed and estimated from overall health, which offers an effective and crucial way of quantifying the loss of HLE due to population changes.[14 15]

Therefore, this study aims to fill these important gaps by investigating the demographic effects that may contribute to the loss of HLE. We measured the loss of HLE due to changes in population size and age structure in 188 countries and territories from 2010 to 2019 and projected estimates till 2030.

METHODS

Data sources

We extracted cause-specific death numbers and years lived with disability (YLD) rates for 2010–2019 from the Global Burden of Disease Study (GBD 2021) for global, Sociodemographic Index (SDI) regions, WHO regions and 188 countries and territories. We analysed burden estimates of diseases and injuries including all causes, level 1 causes and level 2 causes in the GBD cause hierarchy. The 2020–2021 GBD results were not directly employed in this study, as the GBD estimates in this period are typically influenced by the global impact of the COVID-19 pandemic and would result in a considerable amount of uncertainty hampering our analysis of future demographic dividend.[4] Detailed descriptions of GBD can be found elsewhere.[4 16] We have also obtained the corresponding national and regional population projections for 2030 from World Population Prospects (WPP 2024). The WPP formulated detailed assumptions about the future paths of fertility, mortality and international migration and used the probabilistic projection methods and the different deterministic scenarios to generate multiple sets of population projections for each country or region of the world.[17] This study complies with the Guidelines for Accurate and Transparent Health Estimates Reporting Statement.[18]

Analysis strategy

First, we decomposed the changes in cause-specific death numbers and YLD rates between 2010 and 2019 into the contribution of population size, age structure and all other reasons.[19] The death numbers and YLD rates due to population size and age structure represent disease burdens attributable to population changes. Then, we constructed the abbreviated life table and the cause-eliminated life table and used Sullivan's method to calculate HLE before and after elimination of the disease burden due to population changes.[20] The absolute difference between cause-eliminated HLE and HLE represents the loss of overall HLE due to population changes. Third, to identify the main causes, we decomposed the differences between cause-eliminated HLE and HLE into cause-specific contributions, including a comprehensive range of diseases and injuries.[21] A positive or negative contribution represents an increase or decrease in the loss of HLE due to a particular disease that can be attributed to population changes. Finally, based on the historical trends of death numbers and YLD rates from 2010 to 2019, we constructed the Bayesian age-period-cohort model to predict death numbers and YLD rates in 2030, respectively, and calculated HLE and cause-eliminated HLE combined with the existing population projection data.[22] The analysis process for the loss of HLE due to population changes in 2019–2030 is similar to those conducted in 2010–2019. Details of the methodology are provided in the online supplemental appendix text S1, S2 and S3. In addition, we calculated the total dependency ratio for each country and region as a proxy indicator of the demographic dividend.[23] The total dependency ratio relates the number of children (0–14 years old) and older persons (65 years or over) to the working-age population (15–64 years old). The linear regression models were used to assess the correlation between the total dependency ratio and HLE of cause deletion, adjusting for SDI as a potential confounding variable. Based on the total dependency ratio and the HLE, we have classified each country and region into four types for 2019 and 2030: high dependency ratio-high HLE (H-H type), high dependency ratio-low HLE (H-L type), low dependency ratio-high HLE (L-H type) and low dependency ratio-low HLE (L-L type). The classification criteria are provided in the online supplemental appendix table S1.

Patient and public involvement statement

It was not appropriate or possible to involve patients or the public in the design, conduct, reporting or dissemination plans of our research.

RESULTS

Relationship between total dependency ratio and HLE in 2019

Figure 1 shows that the lower the total dependency ratio, the higher the HLE. Linear regression analysis shows that after adjustment for the SDI, the total dependency ratio increased by 0.10, the HLE decreased by 0.98 years (p<0.001), the HLE without age structure effect decreased by 1.39 years (p<0.001) and the HLE without population size effect decreased by 0.77 years (p=0.006). (Online supplemental appendix table S2) The total dependency ratio is the sum of the old-age dependency ratio and the child dependency ratio. With the increase in SDI level, the old-age dependency ratio and child dependency ratio exhibited an upward and downward trend, respectively. (Online supplemental figure S1) The relationship among the old-age dependency ratio, the child dependency ratio and the HLE is provided in online supplemental figure S2 and S3, as well as online supplemental tables S3 and S4.

Loss of HLE in 2019 due to age structure and population size

Figure 2 shows that population size leads to a higher loss of HLE, with the mortality effect leading to a loss of more

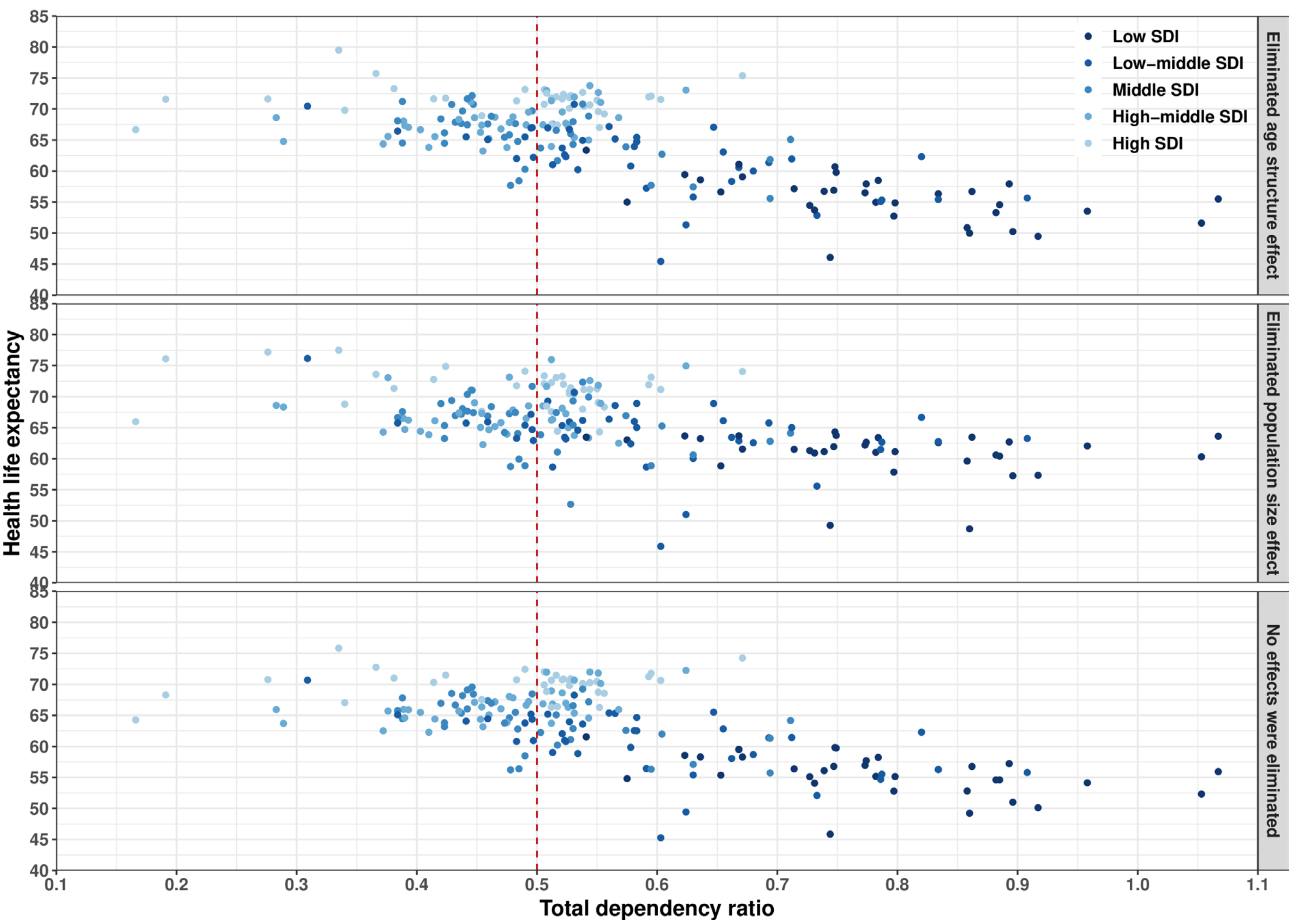

Figure 1 Relationship between total dependency ratio and healthy life expectancy in 2019. Dot represents a country or region. The red dashed line represents the cutoff value of the total dependency ratio in this study, with a total dependency ratio higher than 0.5 indicating a high level and a low level otherwise. SDI, Sociodemographic Index.

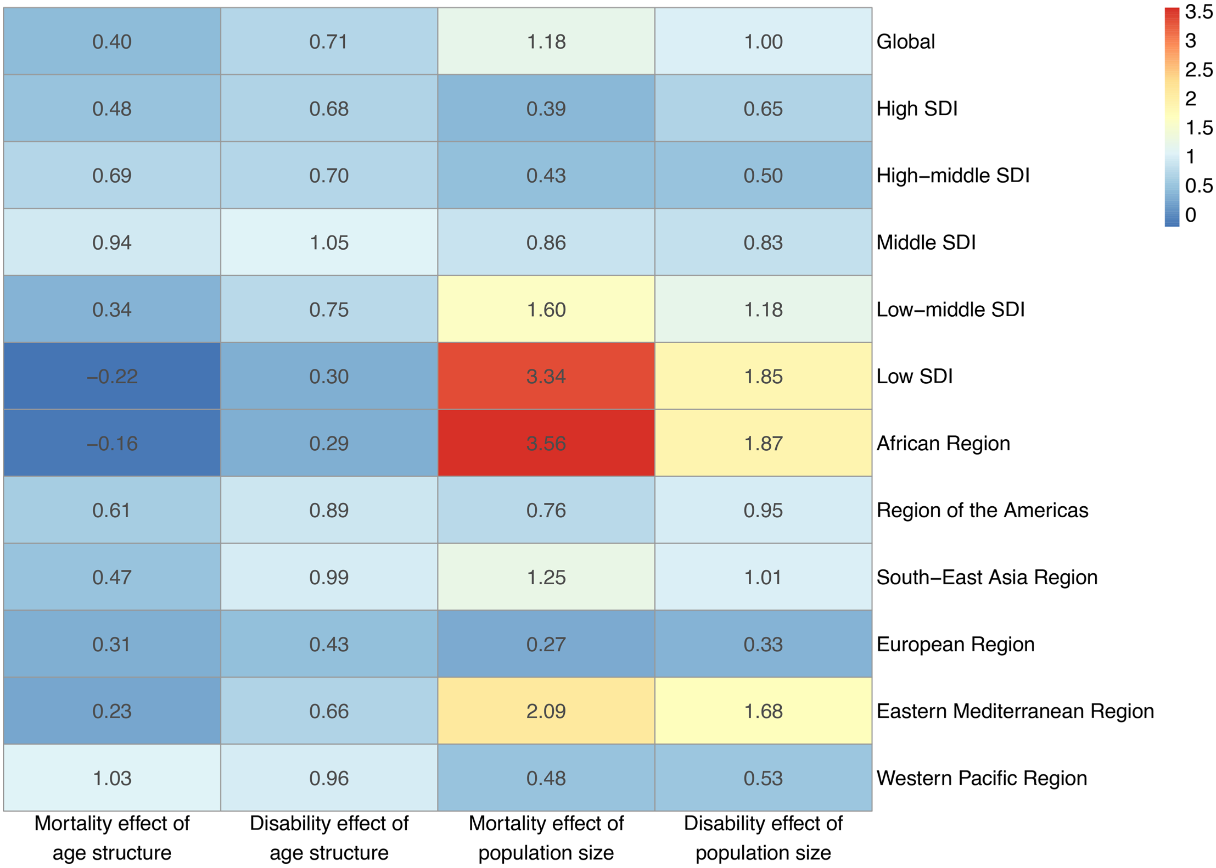

Figure 2 Loss of healthy life expectancy in 2019 due to age structure and population size. The positive number indicates the loss of healthy life expectancy caused by poor levels of mortality or disability attributable to population changes. The negative number indicates increases in healthy life expectancy caused by improved levels of mortality or disability attributable to population changes. SDI, Sociodemographic Index.

than 3 years of HLE in the low SDI region and the African region and 2 years of HLE in the Eastern Mediterranean region. The disability effect also leads to a loss of more than 1 year of HLE in the low SDI and low-middle SDI region, as well as the African region, the Eastern Mediterranean region and the South-East Asia region. The age structure leads to a substantial loss of HLE, with a mortality effect leading to a loss of 0.40 years of HLE globally. The disability effect also leads to a loss of 0.71 years of HLE globally and a loss of more than 1 year of HLE in the middle SDI region. The distribution for men and both sexes is similar, while women in the low SDI region and the African region have a loss of more than 2 years of HLE due to the disability effect of population size. The disability effect of age structure also leads to a loss of more than 1 year of HLE for women in the South-East Asia region and the Western Pacific region, as well as the middle SDI region (online supplement appendix figure S4 and S5). Detailed results by country and sex are provided in online supplemental data 1.

Top five causes of HLE loss due to age structure and population size in 2019

Figure 3 shows that in addition to the low SDI region and the high SDI region (disability effect of musculoskeletal diseases due to age structure and population size, respectively), the mortality effect of cardiovascular diseases is the leading cause of HLE loss globally. Among the effects attributed to age structure, the disability effect of musculoskeletal diseases is the second cause outside the Western Pacific region (disability effect of sense organ diseases). The mortality effect attributed to the population size of respiratory infections and tuberculosis represents the second leading cause in the low SDI region and the African region. In other regions, the mortality effects for neoplasms and cardiovascular diseases, as well as the disability effect for musculoskeletal disorders, are included.

Relationship between changes in the total dependency ratio and increases in HLE from 2019 to 2030

Figure 4 shows that the HLE has increased in most countries, with the total dependency ratio increasing in the high SDI region, but decreasing significantly in the low SDI region. By 2030, the distribution of the total dependency ratio and HLE will be similar to that in 2019, and the changes in HLE with the total dependency ratio will decrease compared with 2019 (online supplemental appendix figure S6). The linear regression analysis shows that after adjustment for the SDI, the total dependency ratio increases by 0.10, the HLE decreases by 0.77 years (p=0.008), the HLE without age structure effect

Regions	Dependency Ratios	Five leading causes for attributable loss of healthy life expectancy 1	2	3	4	5
Age structure						
Global	0.531	Cardiovascular diseases (0.28)	Musculoskeletal disorders (0.16)	Sense organ diseases (0.12)	Neoplasms (0.10)	Diabetes and kidney diseases (0.08)
High SDI	0.518	Cardiovascular diseases (0.18)	Musculoskeletal disorders (0.16)	Neoplasms (0.13)	Sense organ diseases (0.09)	Cardiovascular diseases (0.08)
High-middle SDI	0.431	Cardiovascular diseases (0.42)	Musculoskeletal disorders (0.17)	Neoplasms (0.16)	Sense organ diseases (0.14)	Cardiovascular diseases (0.10)
Middle SDI	0.464	Cardiovascular diseases (0.50)	Musculoskeletal disorders (0.21)	Sense organ diseases (0.20)	Neoplasms (0.16)	Chronic respiratory diseases (0.13)
Low-middle SDI	0.561	Cardiovascular diseases (0.28)	Musculoskeletal disorders (0.17)	Sense organ diseases (0.16)	Chronic respiratory diseases (0.13)	Mental disorders (0.09)
Low SDI	0.826	Cardiovascular diseases (0.07)	Musculoskeletal disorders (0.07)	Sense organ diseases (0.06)	Mental disorders (0.05)	Other non-communicable diseases (0.04)
African Region	0.810	Cardiovascular diseases (0.07)	Musculoskeletal disorders (0.06)	Mental disorders (0.05)	Sense organ diseases (0.04)	Other non-communicable diseases (0.04)
Region of the Americas	0.512	Cardiovascular diseases (0.26)	Musculoskeletal disorders (0.23)	Neoplasms (0.16)	Sense organ diseases (0.12)	Diabetes and kidney diseases (0.12)
South-East Asia Region	0.497	Cardiovascular diseases (0.33)	Sense organ diseases (0.23)	Musculoskeletal disorders (0.22)	Chronic respiratory diseases (0.17)	Diabetes and kidney diseases (0.11)
European Region	0.519	Cardiovascular diseases (0.20)	Musculoskeletal disorders (0.09)	Neoplasms (0.08)	Sense organ diseases (0.07)	Cardiovascular diseases (0.05)
Eastern Mediterranean Region	0.604	Cardiovascular diseases (0.26)	Musculoskeletal disorders (0.15)	Sense organ diseases (0.09)	Mental disorders (0.09)	Diabetes and kidney diseases (0.08)
Western Pacific Region	0.428	Cardiovascular diseases (0.52)	Neoplasms (0.23)	Musculoskeletal disorders (0.22)	Sense organ diseases (0.20)	Cardiovascular diseases (0.16)
Population size						
Global	0.531	Cardiovascular diseases (0.36)	Neoplasms (0.20)	Musculoskeletal disorders (0.16)	Mental disorders (0.12)	Sense organ diseases (0.09)
High SDI	0.518	Musculoskeletal disorders (0.15)	Cardiovascular diseases (0.12)	Neoplasms (0.12)	Mental disorders (0.09)	Other non-communicable diseases (0.05)
High-middle SDI	0.431	Cardiovascular diseases (0.20)	Neoplasms (0.10)	Musculoskeletal disorders (0.09)	Mental disorders (0.07)	Other non-communicable diseases (0.05)
Middle SDI	0.464	Cardiovascular diseases (0.29)	Neoplasms (0.13)	Musculoskeletal disorders (0.13)	Mental disorders (0.09)	Sense organ diseases (0.08)
Low-middle SDI	0.561	Cardiovascular diseases (0.40)	Neoplasms (0.16)	Musculoskeletal disorders (0.16)	Chronic respiratory diseases (0.15)	Mental disorders (0.13)
Low SDI	0.826	Cardiovascular diseases (0.77)	Respiratory infections and tuberculosis (0.41)	Neoplasms (0.30)	Enteric infections (0.28)	Mental disorders (0.24)
African Region	0.810	Cardiovascular diseases (0.77)	Respiratory infections and tuberculosis (0.48)	HIV/AIDS and sexually transmitted infections (0.45)	Neoplasms (0.33)	Mental disorders (0.25)
Region of the Americas	0.512	Cardiovascular diseases (0.20)	Musculoskeletal disorders (0.19)	Neoplasms (0.16)	Mental disorders (0.12)	Sense organ diseases (0.07)
South-East Asia Region	0.497	Cardiovascular diseases (0.34)	Musculoskeletal disorders (0.15)	Chronic respiratory diseases (0.13)	Neoplasms (0.12)	Mental disorders (0.11)
European Region	0.519	Cardiovascular diseases (0.10)	Neoplasms (0.06)	Musculoskeletal disorders (0.05)	Mental disorders (0.04)	Other non-communicable diseases (0.03)
Eastern Mediterranean Region	0.604	Cardiovascular diseases (0.80)	Neoplasms (0.25)	Musculoskeletal disorders (0.23)	Mental disorders (0.22)	Other non-communicable diseases (0.16)
Western Pacific Region	0.428	Cardiovascular diseases (0.15)	Neoplasms (0.09)	Musculoskeletal disorders (0.08)	Mental disorders (0.05)	Sense organ diseases (0.05)

Figure 3 Top five causes of healthy life expectancy loss due to age structure and population size in 2019. The number in parenthesis indicates the loss of healthy life expectancy attributable to population changes. SDI, Sociodemographic Index.

decreases by 1.26 years ($p<0.001$) and the HLE without population size effect increases by 0.30 years ($p=0.306$) (online supplemental appendix table S5).

Loss of HLE due to age structure and population size in 2030

By 2030, the mortality and disability burden attributable to age structure is projected to cause 0.76 years and 0.89 years of HLE loss globally, respectively. For population size, these estimates are predicted to be 1.21 years and 1.17 years. Figure 5 shows that out of 188 countries, the loss of HLE due to all-cause mortality and disability attributable to age structure is greater than 1 year in 56 and 41 countries, respectively, and the loss of HLE due to all-cause mortality and disability attributable to population size is greater than 1 year in 92 and 104 countries, respectively. NCDs are the leading cause, with their burden of disease due to population changes causing a much greater loss of HLE than communicable diseases and injuries. The global loss of HLE due to the mortality and disability effects of NCDs attributable to age structure was 0.77 years and 0.82 years, respectively, and the loss of HLE due to the mortality and disability effects of NCDs attributable to population size was 0.95 years and 1.00 years, respectively. (online supplemental appendix figure S7)

Between 2019 and 2030, the combined type of total dependency rate and HLE of 63 countries will have a transition. In terms of unhealthy, 19 countries will transition to H-L type or L-L type, with the leading cause of the transition from H-H type or L-H type mainly due to the mortality or disability effect of NCDs attributable to population size (0.74–3.14 years). The leading cause of the transition from H-L type or L-L type is mainly the mortality effects of NCDs attributable to population size or age structure (0.54–3.88 years). The ideal types are L-H type and H-H type, with five H-H type and four L-L type countries transitioning to L-H type and 28 countries transitioning from various types to H-H type. Detailed results by country are provided in online supplemental data 2 and 3.

DISCUSSION

Population changes are the foundation of the demographic dividend.[24] Since the 20th century, many countries have achieved rapid economic growth by taking advantage of the demographic dividend window created by the demographic transition.[25–27] While the stages of the demographic dividend show different trajectories of population changes, investing appropriately at each stage of life to enable people to live healthier and longer is an ambitious goal for public health in the 21st century.[28] This study uses HLE to measure how long people live in good health and decomposes the loss of HLE due to population size and age structure. These findings can help guide global health policymakers to implement consistent macropolicy interventions in regions with similar demographic dividend windows and health contexts. This study also provides a valuable research paradigm for different countries and regions to further explore subregional heterogeneity.

Growth in population size is consistently the principal driver leading to HLE losses

Changes in the size and age structure of the population and the main features of the demographic transition.

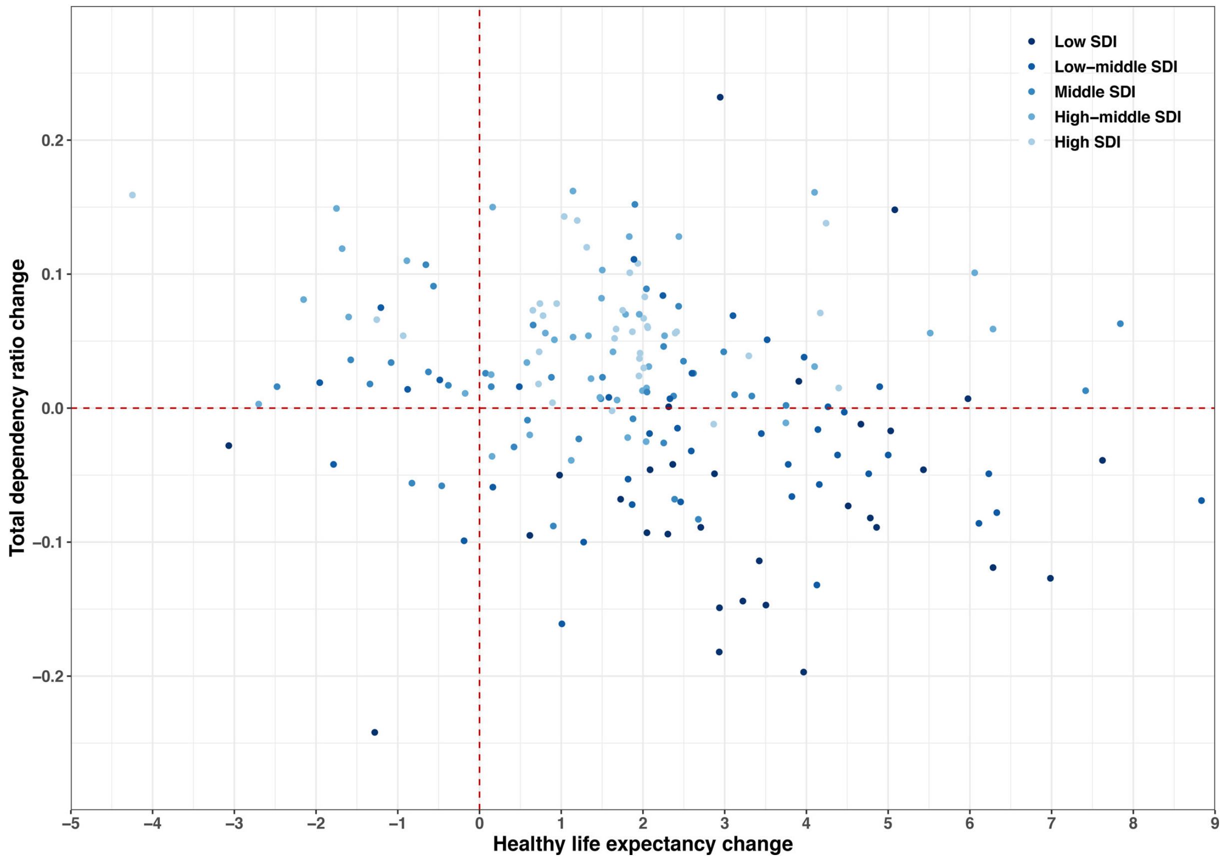

Figure 4 Relationship between changes in the total dependency ratio and increases in healthy life expectancy from 2019 to 2030. Dot represents a country or region. The red dashed lines divide the figure into four quadrants, representing that healthy life expectancy has increased while the total dependency ratios are at a high (first quadrant) or low (fourth quadrant) level, and healthy life expectancy has reduced while the total dependency ratios are at a high (second quadrant) or low (third quadrant) level. SDI, Sociodemographic Index.

Our results show that although the dependency ratio is a direct expression of age structure, it also appears to be correlated with the health effects of population size. Results from previous studies support our finding that the population size is the main driver of the loss in HLE from 2010 to 2019, which may be related to the excess burden of disease attributable to it.[14] The GBD report indicates that the absolute number of disease burden has not decreased substantially over the past three decades, given the growth and ageing of the world's population.[29] We observed extremely high HLE losses caused by premature death, which could be largely attributed to population size. The high HLE losses attributed to population size were particularly prevalent in the low SDI region and the African region. The main health consequence of the age structure that differs from population size is the prominence of age-related disability. The proportion of healthy years lost due to disability is high in the total loss of HLE attributable to changes in the age structure. In addition, we predicted that the global loss of HLE due to age structure would not exceed the impact of population size in 2030. To reap the full benefits of the demographic dividend, it is necessary to prevent premature deaths among young people and to achieve healthy ageing, which in turn requires costly healthcare expenditures to effectively tackle the growing burden of disease.[30] Programmes and services need to be reoriented to address the enormous burden of several priority diseases simultaneously, efficiently and effectively. Our results place the priority diseases responsible for the loss of HLE in each country and region at the top of the matrix for all-cause health risks. These findings offer insight into the potential influence of targeted healthcare expenditure on priority diseases on the creation of a demographic dividend.

Reap a second demographic dividend by eliminating the double burden of premature mortality from infectious and chronic diseases

The results of the study in the typical area provide a visual indication of the direction for future action. We found that chronic and infectious diseases constitute the double burden of premature death that the African region has to face before it enters the demographic dividend window. Chronic diseases are mainly cardiovascular diseases and neoplasms, while infectious diseases are mainly respiratory infections and tuberculosis as well as HIV/AIDS and sexually transmitted infections. The dependency ratio in Africa is much higher than in the rest of the world, at 81.0% in 2019. After peaking in the 1960s in the rest of the world, the dependency ratio bottomed out in the first decade of

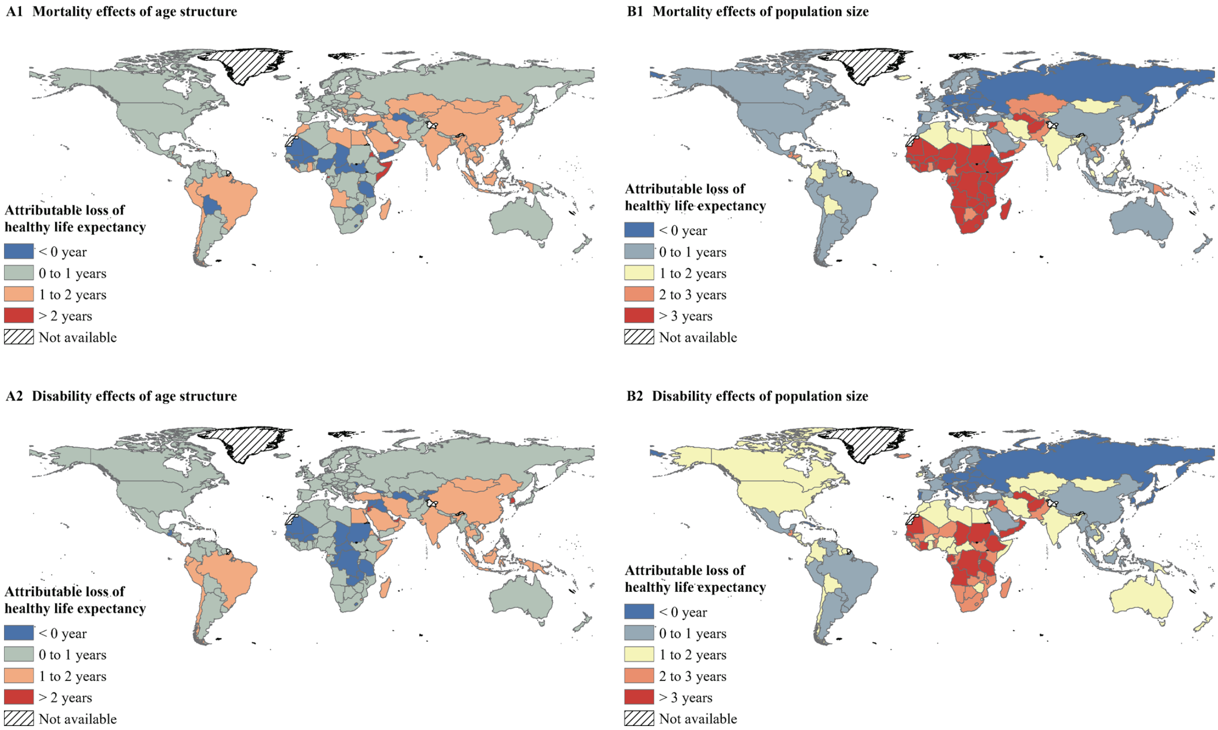

Figure 5 Loss of healthy life expectancy due to age structure and population size in 2030. Section A presents the loss of healthy life expectancy caused by changes in the level of mortality (A1) or disability (A2) attributable to the age structure. Section B presents the loss of healthy life expectancy caused by changes in the level of mortality (B1) or disability (B2) attributable to the population size. The number greater than 0 indicates the loss of healthy life expectancy caused by poor levels of mortality or disability attributable to population changes. The number less than 0 indicates increases in healthy life expectancy caused by improved levels of mortality or disability attributable to population changes.

the 21st century with the rapid decline in fertility and has since started to rise slowly and gradually entered the ageing phase. In sub-Saharan Africa, however, the decline in the dependency ratio has been much slower and more gradual than that in other parts of the world.[31] This suggests that while the rest of the world has generally entered an ageing society, sub-Saharan Africa will be the only region in the world to refrain from an era of ageing, where it holds a typical low dependency ratio and a large working-age population.[32] However, Africa's opportunities offered by the demographic dividend window will be hampered by the high number of premature deaths among young people from chronic and infectious diseases. Realising the demographic dividend requires creating the right conditions in areas such as health, sanitation, fertility, education and economic policy, which do not appear to be in place for most African countries at present.[33] To avoid Africa's demographic dividend from turning into a demographic debt, the authorities must continue to consolidate hard-won development gains and increase investment in the health and social protection of young people, focusing on the long-term economic impact of demographic factors.[34]

Investment in healthy and successful ageing may create opportunities to gain a sustainable third demographic dividend

Most HLE losses in the Western Pacific region, where the dependency ratio was the lowest, could be ascribed to changes in the age structure. Age-related premature deaths are mainly due to cardiovascular diseases and neoplasms, while disability is mainly due to musculoskeletal diseases and sense organ diseases. While the Western Pacific region is enjoying a demographic dividend, people aged 65 years and over are the fastest-growing age group.[35] According to the WHO report, more than half of the countries in the Western Pacific region are ageing in 2020 and are expected to be aged societies by 2030.[36] Enabling healthy older people to actively participate and contribute to society is the only way to turn the challenges of an ageing population into opportunities.[37] While the ageing of the working-age population may reduce total factor productivity growth, policies such as universal health coverage, personalised digital coaching and lifelong learning can effectively mitigate this negative impact.[38–40] It is necessary to recognise that policies need to follow the trajectory of the demographic transition to actively respond to the ageing wave and make the demographic dividend sustainable.

Linkages among demographic dividend, socio-economic development and public health

The rising total dependency ratio is indicative of an escalating dependency burden within the labour force, a state of affairs that is inimical to the establishment of demographic dividends that are conducive to socioeconomic growth. Our results indicated that the increase in the total dependency ratio was accompanied by a decrease in SDI levels and HLE. The underlying reason for this phenomenon may be that the burden of disease attributable to population changes increases the demand for healthcare, allowing increasing labour mobility to the healthcare sector.[41] This may have reduced the labour productivity of the society and thus hindered socioeconomic growth. Further exploration was undertaken into the relative effects of the old-age dependency ratio and the child dependency ratio on HLE. At lower SDI levels, the child dependency ratio is generally higher, suggesting the potential for future increases in the working-age population and the creation of demographic dividends.[42] However, suboptimal socioeconomic development is often associated with healthcare inequality, emphasising the fundamental requirement to safeguard child welfare at lower SDI levels.[43 44] Higher SDI levels are associated with a higher old-age dependency ratio, which is linked to low birth rates and population ageing. While the old-age dependency ratio may promote socioeconomic growth by increasing the social saving rate and social investment, it is contingent on achieving healthy and successful ageing.[8 45] This study revealed the loss of HLE due to population change across various socioeconomic levels and demographic dividend stages and attributed them to specific diseases and injuries. These findings provide a useful reference for identifying priority causes of loss of HLE and for the adoption of immediate collaborative management and comprehensive intervention for multiple major burdens of disease, to safeguard the well-being of key populations and create the demographic dividend.

Strengths and limitations

The main advantage is that we comprehensively quantified how changes in population size and age structure would affect HLE. To the best of our knowledge, no prior research has identified the main target diseases that urgently demand more socioeconomic investments to grasp the demographic dividend from a global perspective. This study also projects possible scenarios for the demographic dividend and population health in 2030, which may inform the development of unified global strategies and actions for the creation of a demographic dividend. Some limitations should also be noted. First, the global impact of the COVID-19 pandemic has not been included in our analysis. Nevertheless, our modelling estimates may still be robust since recent publications[46–48] have demonstrated clear evidence of a rebound in life expectancy in the postpandemic era. Second, as GBD results from the model-based integration of heterogeneous data sources, the potential bias of these estimates should be considered.

CONCLUSION

Overall, this study reveals that population size growth shall be a consistent and crucial contributor to HLE losses. More importantly, the findings yielded by our state-of-the-art modelling strategies show that reaping the second demographic dividend requires eliminating the double burden of premature death regarding infectious and chronic diseases. For gaining the sustainable third demographic dividend, the general population may urgently require comprehensive socioeconomic investments during the process of healthy and successful ageing development. Our study, covering the full spectrum of diseases and injuries at both the global and country levels, will facilitate policy decisions on prioritising health issues and using the potential opportunity of the demographic dividend for more sustainable development in a healthy society.

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