2022 Liberia Population and Housing Census

Thematic Report on
Mortality

June 2024

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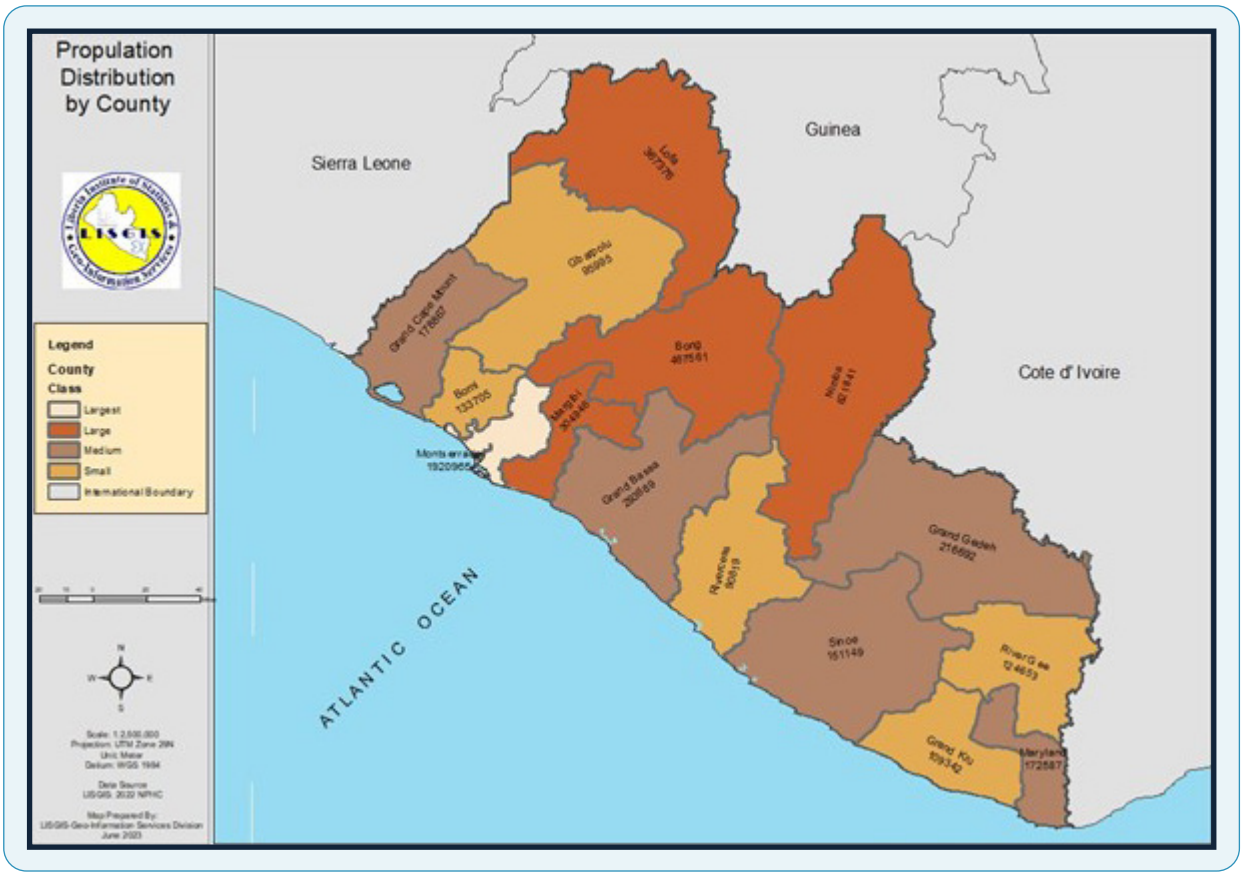
Administrative map of Liberia



Foreword

The 2022 National Population and Housing Census is the fifth and first digital census with the full deployment of ICT techniques and followed the UN Recommended Principles for the 2020 round of censuses. The basis for the conduct of the census is Article 39 of the 1986 Constitution of the Republic of Liberia. On October 10, 2022, the Government of Liberia initiated "an Act Authorizing the Executive Branch of Government to conduct the 2022 Liberia Population and Housing Census".

Hence, following the successful implementation of the 2022 Liberia Population and Housing Census, the Liberia Institute of Statistics & Geo-Information Services (LISGIS) produced 14 thematic reports. These reports summarized the country's demographic, social, and economic sectors. The publication of the thematic reports is consistent with the United Nations (UN) International Standards of releasing National Census results and thematic reports.

The 14 thematic reports form a primary source of socio-economic and demographic data at various levels and provide relevant information to foster national development, good governance, and resource distribution. The results presented in this thematic report will form a solid basis for the successes and challenges in the implementation of the Sustainable Development Goals (SDGs) as well as support the implementation of the development of the Africa Union Agenda 2063: The Africa We Want; Transforming Our World and other national and international programs.

I am pleased that the thematic reports helped to guide our national development plan. I would like to appreciate the support received from development partners and individuals during the entire process of writing the thematic report.

On behalf of the Census Commission and Board of Directors of LISGIS, I thank the Government of Liberia and our development partners for providing the required resources for conducting the census. Thanks also go to the national and international experts who worked very hard to complete these thematic reports.

Special appreciation for the success of the census goes to Hon. Samuel D. Tweah, Jr., former Chairman of the Census Commission, the Census Commission, the Steering Committee, the Census Secretariat, other national and international experts, census staff, and all respondents who provided the required information as well as all stakeholders for their commitment, motivation, and support to the National Population and Housing Census process.

I look forward to the continued support and guidance of development partners to engender sustainable development in our country.

Hon. Dehpue Y. Zuo
Deputy Minister for Economic Management
& Chairman of the Board
Ministry of Finance and Development Planning

Preface

The Liberia Institute of Statistics & Geo-Information Services (LISGIS) conducted the fifth and first fully digital census in November 2022. The 2022 National Population and Housing Census data was collected using Computer Assisted Personal Interviewing (CAPI) technology. Data were collected using tablets and later transmitted to LISGIS's server electronically.

The 14 thematic areas identified provide a comprehensive understanding of the population. These thematic areas are a) Population Distribution and Size b) Children, Adolescents, and Youth c) People with disabilities and older people d) Migration and Urbanization e) Labor force and Employment, f) Education, and Literacy g) Agricultural Population, h) Non-monetary poverty i) Housing conditions and facilities j) Mortality, k) Fertility, l) Marriages/Nuptiality, m) Gender Dimensions, and n) Population Projections. I would also like to thank the national and international experts for preparing the thematic reports.

Though the Government contributed immense resources to the 2022 National Census exercise, the requirements were enormous and beyond the capacity of the Government and LISGIS. It is with pleasure that we recognize and appreciate the support of the United Nations Population Fund (UNFPA), the Swedish Government, the World Bank, the United States Aid for International Development (USAID), the Irish Government, the Government of Ghana, Economic Community of West African States (ECOWAS) and the United Nations Children's Fund (UNICEF) and other partners whose timely and continuous interventions gave stimulus to the execution of the 2022 Liberia Population and Housing Census including the preparation of the reports.

Special gratitude goes to the general public for their cooperation and support. We are indebted to personnel and the management of LISGIS, national and international experts, supervisors, and enumerators for successfully conducting the 2022 National Population and Housing Census.

Richard F. Ngafuan
Director General
LISGIS

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Acronyms

ANC	Antenatal Care
ASDR	Age-Specific Death Rate
CAPI	Computer Assisted Personal Interviewing
CD	Children Dead
CDR	Crude Death Rate
CEB	Children Ever Born
CMBS	Code of Marketing Breast Milk Substitutes
CS	Children Surviving
DP	Development Partners
EPI	Expanded Programme on Immunization
FRH	Family and Reproductive Health
GDP	Gross Domestic Product
GNI	Gross National Income
HDI	Human Development Index
HDR	Human Development Report
HHFA	Harmonized Health Facility Assessment
HSS	Health Systems Strengthening
IMR	Infant Mortality Rate
IUSSP	International Union for the Scientific Study of Population
LDHS	Liberia Demographic and Health Survey
LPHC	Liberia Population and Housing Census
MMR	Maternal Mortality Rate
MoH	Ministry of Health
NCD	Non-Communicable Diseases
PAPD	Pro-Poor Agenda for Prosperity and Development
PCD	Prevention of Communicable Diseases
PMTCT	Prevention of Mother-To-Child Transmission
REACH	Renewed Efforts Against Child Hunger and Under-nutrition
SDG	Sustainable Development Goals
SRHR	Sexual Reproductive Health and Rights
UHC	Universal Health Coverage
UNICEF	United Nations Children's Fund
VNR	Voluntary National Report
WHO	World Health Organization

Factsheet

No	Indicator	Value	
		2008	2022
1	Reported household deaths	41,048	69,897
2	Reported deaths among women aged 15-49 years	6,631	5,801
3	Reported pregnancy-related deaths	1,332	538
4	Proportion of maternal deaths that are pregnancy-related	-	9.3
5	Neonatal Deaths	-	35.6
6	Infant Mortality Rate	78	63.7
7	Under-Five Mortality Rate	112	92.6
8	Child Mortality Rate	41	32.1
9	Mortality - male children (5-14 years)	-	25.6
10	Mortality - female children (5-14 years)	-	19.3
11	Mortality - adolescent male (10-19 years)	-	28.2
12	Mortality - adolescent female (10-19 years)	-	18.9
13	Crude Death Rate	21	13.3
14	Crude Death Rate (Males)	-	14.9
15	Crude Death Rate (Females)	-	11.7
16	Urban Crude Death Rate	17.9	10.5
17	Rural Crude Death Rate	23.7	16.7
18	Life Expectancy (National)	52.7	58.0
19	Life Expectancy (Males)	51.6	55.6
20	Life Expectancy (Females)	53.9	61.2
21	Maternal Mortality Ratio (National)	890	854
22	Maternal Mortality Ratio (Urban)	686	694
23	Maternal Mortality Ratio (Rural)	1,057	1,024

Sources: 2008 Census, 2022 census

Executive summary

Importance of mortality analysis

The mortality analysis has been undertaken to inform policy, decision-making and planning for implementation of targeted interventions to ensure inclusivity in all facets of political, social and economic governance of the country. It helps to monitor and report key national, regional and international development initiatives like the Sustainable Development Goals (SDGs) of which goal 3 relates to mortality. This study also provides information to monitor the future growth trajectory of the population so that pre-emptive measures can be taken to maximize the country's demographic dividend.

Demographic and socioeconomic context

The mortality analysis has been carried out in the context of Liberia's demographic, social and economic circumstances. With a Gross National Income per capita of $630 in 2021(World Bank, 2022), 85 per cent of Liberian households are experiencing severe to moderate food insecurity, 23.9 per cent of the households are chronically hungry and 3 per cent of children under five years are acutely malnourished (United Nations Sustainable Development Cooperation Framework Progress Report on Liberia, 2021), childhood and maternal mortality have been high. In the 2019 Liberia Demographic and Health Survey (LDHS)[1] infant mortality increased from 54 per 1,000 live births in 2013 to 63 per 1,000 live births, under-five mortality remained constant at 94 per 1,000 live births, while maternal mortality declined from 1,072 deaths per 100,000 in 2013 to 913 deaths per 100,000 live births in 2020.

This report shows the 2022 status of these mortality indices using data from the 2022 Population and Housing Census (PHC). The report discusses the quality of mortality data in Liberia and identifies the methodological approaches for estimating key mortality indices in the country. It examines the levels, trends and age-sex patterns of infant, under-five and maternal mortality and derives population life tables by sex, locality of residence and county. Finally, it makes some policy recommendations for future general and targeted interventions aimed at reducing mortality.

Sources of data, data quality and assessment

The data used in the analysis are births in the last 12 months, household deaths 12 months preceding the census, parental survivorship data and data on children ever born, children surviving. The quality of mortality estimates depends on the quality of mortality data. The single year ages of mothers were assessed which revealed age misreporting, age misstatement and age heaping. An examination of the death data revealed response and omission errors, which tend to underestimate the level of mortality and distort trends in mortality. These were evaluated through sex ratios and average parities by age of mother. The quality of the data on children ever born, children surviving and proportion dead was assessed by examining the pattern of average parities reported by women in each age group. The data appeared to be fairly well reported.

Methods of analysis

The direct methods which use data on date of birth of children, their survival status and the dates of deaths or ages at deaths of deceased children and the Coale-Trussell version of the Brass indirect technique which uses data on children ever born and children surviving by age of mother to derive the proportion dead among children ever born were used for estimating childhood mortality indicators. The MORTPAK software developed by the United Nations and other software developed by the US Census Bureau were used to construct the mortality estimates and the life tables.

Levels, patterns and trends in mortality

The crude death rate (CDR) computed for Liberia was 13.3 per 1,000 population. The CDRs for males and females were 14.9 per 1,000 population and 11.7 per 1,000 population respectively. Comparable estimates from the 2008 PHC were 11.8 per 1,000 population

1 LISGIS. 2019. LDHS

for males and 10.7 per 1,000 population for females. The rates for urban and rural areas were 10.6 and 16.8 per 1,000 population respectively. A CDR of 20 deaths per 1,000 population for each of two counties, Grand Kru and Lofa was found to be the highest among the 15 counties. Montserrado had the lowest CDR of nine deaths per 1,000 population.

The age-specific death rates (ASDRs) were highest at ages 0-4 years declining to its lowest at ages 10-14 years and thereafter increased with age. From age group 1- 4 through to age group 45- 49, the rates for males were higher than those of females but beyond age group 45-49 the ASDRs for females were higher than those for males. The computed neonatal mortality was 36 deaths per 1,000 live births. Infant mortality had declined from 112 deaths per 1,000 live births in 2008 to 93 deaths per1,000 live births in 2022 while child and under-five mortality declined from 78 and 41 deaths per 1,000 live births to 64 and 32 deaths per 1,000 live births respectively in 2022.

The probability of adult females dying between age 15 and 60 was 0.252 while that of male adults was 0.342. In 2022, about 9 percent of all deaths to women aged 10-54 years were pregnancy-related. The highest number of pregnancy-related deaths occurred in the age group 20-24 where over 26 percent of all births was also concentrated. Maternal mortality ratios (MMRs) in Liberia have been inconsistent rising from 578 deaths per 100,000 live births in 2000 to 994 deaths per 100,000 live births in 2007. It fell to 890 in 2008 then rose sharply to 1,072 deaths per 100,000 live births in 2013. It declined to 742 deaths per 100,000 live births in 2019/2020 but increased to 854 deaths per 100,000 live births in 2022. Maternal mortality ratio was lower in urban areas (694 deaths per 100,000 live births) compared to a rural ratio of 1,024 deaths per 100,000 live births in 2022. There were maternal mortality differentials across the counties with Grand Gedeh (694 deaths), Margibi (746 deaths) and Montserrado (531 deaths) experiencing ratios below the national average of 854 deaths per 100,000 live births in 2022. Montserrado had the lowest maternal mortality ratio of 531 deaths per 100,000 live births in 2022 while Grand Kru experienced the worst maternal mortality of 1,252 deaths per 100,000 live births. Grand Cape Mount and Maryland had their maternal mortality ratios decline markedly from 1,679 deaths per 100,000 live births and 1,934 deaths per 100,000 live births in 2008 to 1201 deaths per 100,000 live births and 997 deaths per 100,000 live births respectively in 2022. The differential mortality observed in locality and county of residence may be a reflection of disparities in the distribution of health facilities and other basic social amenities and essential services. The age-pattern of pregnancy-related maternal mortality showed a higher ratio (805) for age group 15-19, decreased to the lowest ratio of 673 in age group 20-24 and thereafter increased with age.

The Coale-Trussell indirect technique based on the average values of the South model for women in the age group 25-39 years yielded estimates of 47 infant deaths per 1,000 live births during the period February 2014–March, 2018. This compares favourably with the United Nations Projections for 2022 for Liberia of 48.3 infant deaths per 1,000 live births (United Nations, World Population Prospects, 1950-2023)[2]. Under-five mortality based on the Trussell's equations was 56 deaths per 1,000 live births. Infant and under-five mortality rates for males were higher than for females irrespective of place of residence.

Expectation of life at birth

The life expectancy for Liberians is 58.3 years, with male life expectancy of 55.3 years and female life expectancy of 61.1 years. Urban females have a higher life expectancy (59.1 years) than urban males (58.1). In rural areas, females also have a higher life expectancy of 55.6 years as against their male counterparts of 54 years.

Mortality differentials

An examination of the socioeconomic differentials in mortality revealed that infant and under-five mortality was higher in rural areas than in urban areas. Rural areas recorded infant and under-five mortality rates of 55 deaths per 1,000 live births and 67 deaths per 1,000 live births respectively as against urban experience of 39 deaths per 1,000 live births for infants and 47 deaths per 1,000 live births for under five. In terms of county of residence, the results showed that five years preceding the census, infant and under-five mortality ranged from 30 deaths and 35 deaths per 1,000 live births respectively in Grand Gedeh County to 70 deaths and 92 deaths per 1,000 live births respectively in Bomi County. The interplay of the disparities in the distribution of healthcare facilities, environmental as well as socioeconomic

2 https://www.macrotrends.net/countries/LBR/liberia/infant-mortality-rate

factors might have accounted for the differentials in mortality among the counties.

Children of widowed women experienced the highest infant and under-five mortality rates of 99 deaths per 1,000 live births and 144 deaths per 1,000 live births respectively while children of never married women experienced the lowest infant and under-five mortality rates of 43 deaths per 1,000 live births and 51 deaths per 1,000 live births respectively. Children of mothers with secondary or higher education had lower infant mortality (32 per 1,000 live births) and under-five mortality (37 per 1,000 live births) as against children of mothers with no education that had infant mortality experiences of 52 per 1,000 live births and under-five mortality of 64 per 1,000 live births.

Policy implications and recommendations

The findings show high infant, under-five and maternal mortality in Liberia and that calls for urgent policy action in the face of this population health crisis and threat to the achievement of the SDG goals. The Ministry of Health is to collaborate more with its partners, particularly the WHO, Liberia, to judiciously implement National Health Policy to reduce infant, under-five and maternal mortality.

In Liberia, most of the childhood illnesses and deaths are due to preventable and treatable causes such as malaria, acute respiratory tract infections and diarrhoea[3]. The adoption and implementation of the following policies to support mothers to breastfeed according to WHO recommended guidelines: 1) Policies and practices in health facilities including nutrition counselling, 2) Renewed Efforts Against Child Hunger and Under-nutrition (REACH) initiative, 3) Code of Marketing Breast Milk Substitute (CMBS) Bill are recommended.

Adult mortality was found to be high with male adult mortality slightly higher than female adult mortality. This category of the population is the working class who may be the breadwinners of their households. The higher death rate in male than female is also likely to create single mothers and loss of family income thus affecting basic necessities like food, shelter and healthcare. The Government of Liberia should develop and implement Social Safety Net for single mothers and develop and implement Behaviour Change Communication (BCC) Strategy on lifestyle to reduce lifestyle diseases. Furthermore, healthcare financing policy is recommended in place of out-of-pocket financing of healthcare services across multiple age groups including the adult working population to promote the uptake of preventive services.

In the area of life expectancy, females were found to have higher life expectancy at birth (61.1 years) than their male counterparts (55.6 years). Urban life expectancy is higher than in rural areas. These suggest that urban areas enjoy relatively better health facilities and other living conditions than their rural counterparts. The findings point to the need to build resilience and invest in human development, especially for rural communities, which are at greater risk of deterioration in their quality of life. Therefore, the Liberian Health Service should increase access to high-quality health services in rural communities to build resilience.

Differentials in childhood mortality are influenced by interconnected factors as marital status, mother's education, literacy and income. For example, children of mothers who are literate or have higher educational attainment or more wealth have lower mortality experiences. These women are better equipped with relevant knowledge about pregnancy and childcare, able to identify childhood diseases and take early action to seek healthcare for their children. The implication is that if citizens especially females are well educated, their activities in relation to pregnancy, childcare, prevention of childhood diseases and access to early treatment could greatly enhance child survival. Provision of education to all citizens especially females is recommended. The Government of Liberia should also develop and implement Livelihood Empowerment Against Poverty Programme (LEAP). Furthermore, the Ministry of Health, UNICEF and partners should identify the gaps in the Child Survival Strategy, review and provide adequate funding for its effective implementation.

Mortality indicators cannot be monitored without the availability of regular and high-quality data. Since census data is costly to collect and done only at decennial intervals, the Ministry of Health and its partners should restructure the civil registration and vital statistics (CRVS) system and provide annual budgetary allocation for the registration of vital events throughout the country.

3 Republic of Liberia. National Health Policy, 2022-2031.2022. Monrovia

1. Introduction

Mortality is a key indicator of a country's Human Development Index (HDI). High mortality indices would transform into a low HDI since mortality affects the human development resources of the country. The state of mortality in a country, therefore, provides evidence of the nature of human resources and enables policymakers to formulate evidenced-based policies to improve it. The Government of Liberia is a signatory to the United Nations Sustainable Development Goals (SDGs). Goal 3: Good Health and Well-Being captures the subject matter of interest, mortality. Specifically, goal 3 targets 1 and target 2 deal with maternal and childhood mortality respectively. Goal 3 target 8 provides for achieving universal health coverage as a means to prevent or reduce causes of mortality. Mortality analysis would, therefore, enable the Government of Liberia to monitor and report on the progress of SDG Goal 3 and compare its performance in relation to countries in the world particularly those in sub-Saharan Africa

1.1 Importance of mortality analysis

The study of mortality, its level, pattern and trends, helps to describe the population's state of health. It reveals differentials that exist within sub-groups of the population and informs government for targeted intervention. High mortality is usually prevalent in rural and deprived areas of a country and the study of mortality may reveal that these areas abound in poverty and as a result mothers are unable to provide good nutrition for their children. Again, it reveals differentials in the provision of health infrastructure, essential medicines and other basic social amenities among the different segments of the country. These provide evidence for policymakers to plan and implement priority interventions to address the issues.

The analysis would serve to bridge the data gap in mortality between the 2008 Census and the 2022 census. Even though the 2019/2020 LDHS provided data on mortality, they were collected from a sample of the population and therefore the analysis using data from the 2022 census would present a more comprehensive and better picture of the mortality experiences of the Liberian population than the LDHS.

Finally, as a component of population change, the study of mortality provides information to monitor the future growth trajectory of the population to enable policymakers and planners take pre-emptive measures to maximize the country's demographic dividend. Effective development planning, therefore, requires an understanding and knowledge of the mortality situation of the country.

There is no efficient vital registration system in Liberia. Data could be collected from a number of sources including administrative sources, surveys and censuses. While administrative source is the cheapest, it is not well developed. Surveys provide detailed information but are limited in terms of coverage. The only data source that provides a varied range of data and indicators for planning for the whole population is the population and housing census.

1.2 Background of 2022 Liberia Population and Housing Census

The 2022 Liberia Population and Housing Census (LPHC) is the fifth and first digital census conducted in Liberia. Earlier censuses were conducted in 1962, 1974, 1984 and 2008. The 2022 census adopted electronic tablets to collect the data through the Computer Assisted Personal Interviewing (CAPI) technique. Census enumeration commenced on 12th November and was completed on 20 December 2022. The census questionnaire solicited information about religion, marital status, ethnicity, migration, disability, education and literacy, economic activity including agriculture, occupation, industry, employment, fertility, mortality, housing and housing characteristics. It collected detailed data on the socioeconomic and demographic characteristics of the country's population and housing types and their characteristics in every town, village /and locality. Indicators of the housing condition include type of drinking water, sanitation, electricity and the distance from households to the nearest social infrastructure such as schools and health facilities. These pieces of information provide the needed data for evidenced-based planning, policy formulation, investment and intervention programs in education, health, housing and other social services at all levels of governance. The data would be used to support implementation, monitoring and reporting on national and international development initiatives such as the Pro-poor Agenda for Prosperity and Development (PAPD), the AU

Agenda 2,063 and the 2030 Agenda for Sustainable Development Goals with the aim of leaving no one behind in Liberia's development agenda.

1.3 Demographic, economic and social context

1.3.1 Demographic context

Liberia is a West African country with a total land area of 95,830 square kilometres (37,000 sq. miles). It is bordered by three countries and the Atlantic Ocean; Sierra Leone on the West, Cote D'Ivoire on the East, Guinea on the North and on the South by the Atlantic Ocean. As at 2022 the population of Liberia was 5,250,187 with male and female populations of 2,644,027 and 2,606,160 respectively. It has a youthful population with population aged 0-14 years accounting for about 34.0 per cent of the total population and 2.8 per cent aged 65 years and over. Approximately 55 per cent (54.5 per cent) of the population lives in the urban areas with 45.5 per cent in the rural areas. It has 15 administrative counties.

1.3.2 Economic context

Liberia is among the 10 poorest countries in Africa with a Gross National Income (GNI) per capita of $630 in 2021[4]. Its Gross Domestic Product (GDP) per capita declined to an all-time low of $115 during the civil wars in the mid-1990s. In the 2021 Human Development Report (HDR), Liberia was ranked 178 out of 191 countries and territories surveyed with an overall score of 0.481[5]. Malnutrition is a major contributory factor to increased vulnerability to diseases especially in children. In Liberia only 55 per cent of babies are exclusively breastfed for six months as against the national target of 70 per cent by 2025[6]. The United Nations Sustainable Development Cooperation Framework Progress Report 2021 on Liberia[7] noted that 85 per cent of Liberian households experienced severe to moderate food insecurity, 23.9 per cent of the households were chronically hungry and 3 per cent of children under five years were acutely malnourished.

1.3.3 Social context

Liberia has 935 health facilities (MoH, Human Resource Mapping, 2023). Seventy per cent of the population is within one hour of trekking or 5km to the nearest health facility, 65 per cent of the health facilities provide Prevention of Mother-to-Child Transmission (PMTCT) services which services are integrated into Antenatal Care Services. It has prioritized Sexual Reproductive Health and Rights (SRHR) over the last decade. These improvements notwithstanding, the country has limited access to high-quality healthcare, shortage of healthcare workers, inadequate health infrastructure and inadequate funding.

In January 2016, Liberia officially launched the Agenda for Sustainable Development and had since mainstreamed the SDGs into her development agenda. The current national development plan christened the PAPD, 2018-2023, captures health (including child and maternal health) in Pillar One (Power to the People) of the plan. However, Liberia's performance has not been encouraging as far as achieving the SDG goals including goal 3 that is on Good Health and Well-being. In sub-Saharan Africa, Liberia was ranked 158 out of 163 countries[8] assessed in 2022. Overall, while the regional average was 53.6 per cent, Liberia's average was 49.9 per cent.

In her second Voluntary National Review (VNR) Report in 2022, it had 11 priorities one of which is on health. Liberia has an elaborate ten-year National Health Policy and Strategic Plan (2022–2031) that is focused on universal health coverage (UHC) and health security. Key commitments made in this plan included equitable and Universal Access to Comprehensive Health Services, elimination of Preventable, Communicable & Non-Communicable Diseases (PCD and NCD) and elimination of preventable maternal and neonatal, morbidities and mortality. The health sector is also working to eliminate preventable maternal mortality and neonatal mortality through provision of skilled delivery of births by skilled health personnel, ensuring universal access to prenatal and postnatal care and family planning services, emergency obstetric and neonatal care, and management of pregnancy-related complications

4 World Bank (2022) Liberia Economic Update: Prospects for Inclusive and Sustainable Growth. Country Program Report.
5 https:/report.hdr.undp.org/
6 Walters D. Phan L, Mathisen R. The Cost of Not Breastfeeding in Liberia (https://doi.org/10.1093/heapol/czz050)
7 United Nations Sustainable Development Cooperation Framework Progress Report 2021 on Liberia
8 United Nations Sustainable Development Report 2022

and preventable complications arising from unsafe abortion. According to the 2021 Harmonized Health Facility Assessment (HHFA) Report[9], physical access to maternal and childhood health services increased over a three-year period (2018 to 2021). For instance 89 per cent of health facilities offer antenatal care (ANC) services, 86 per cent provide basic obstetric and newborn services and 77 per cent provide comprehensive obstetric care services.

According to UNICEF[10], globally 15,000 children die on average every day. Five million children under five died in 2021including 2.3 million newborns, along with 2.1 million children. The World Health Organization (WHO) also estimated that almost 800 women died each day in 2020 from preventable causes related to pregnancy and childbirth and that a maternal death occurred almost every two minutes. It noted that almost 95 per cent of all maternal deaths occurred in low and lower middle-income countries in 2020 and that sub-Saharan Africa alone accounted for around 70 per cent of maternal deaths (202, 000)[11]. In Liberia, according to the 2019/2020 Demographic and Health Survey, 913 women died of pregnancy-related causes for every 100,000 live births.

In 2021 in response to mitigating the impact of COVID-19 the United Nations, among other things, supported 4.1 million Liberians with essential health services, strengthened the capacity of 3,838 health workers to provide essential health services and provided 1,432 health facilities with essential health equipment and materials. As a result of the continuous improvement in the health services there has been a reduction in mortality since 2008. The 2008 LPHC[12] estimated infant, under-five and maternal mortality at 78 per 1,000 live births, 112 per 1,000 live births and 890 deaths per 100,000 live births respectively. The 2013 Liberia Demographic and Health Surveys (LDHS[13]) estimated infant mortality rate (IMR) at 54 per 1,000 live births, under-five mortality rate at 94 per 1,000 live births and maternal mortality at 1,072 deaths per 100,000 live births. Even though the results of the 2019 LDHS[14] showed an increase in infant mortality from 54 per 1,000 live births in 2013 to 63 per 1,000 live births, under-five mortality remained constant at 94 per 1,000 live births, while maternal mortality declined from 1,072 deaths per 100,000 in 2013 to 913 deaths per 100,000 live births in 2020.

The United Nations Country Results Report on Liberia, 2022[15] reported an IMR of 25 deaths /1,000 live births, child mortality of 63 deaths/1,000 live births and under-five mortality of 93 deaths/1000 live births for Liberia. The United Nations in collaboration with the Ministry of Health supported the Renewed Efforts Against Child Hunger and Under-nutrition (REACH) initiative with the aim of combating child hunger and under-nutrition. The United Nations also took steps to improve nutrition governance, regulatory and policy frameworks by developing and submitting the Code of Marketing Breast Milk Substitute (CMBS) Bill to the National Legislature for enactment into Law.

Liberians are faced with inaccessibility of healthcare services due to lack of financial resources and long distances to health facilities[16]. The Liberia Ministry of Health Ten-year National Health Policy and Strategic Plan 2022–2031[17] identified as challenges severe shortage of skilled and qualified human resources and inequitable distribution; limited health infrastructure; inadequate diagnostic capacity, frequent shortages of essential drugs and supplies; limited financial resources for reproductive health and a weak referral system. The elimination of these challenges would further improve health outcomes including reduction in mortality and hence increase in life expectancy.

9 2021 Harmonized Health Facility Assessment (HHFA) Report
10 United Nations IGME: Levels and Trends in Child Mortality: Report 2022
11 WHO: https://www.who.int/news-room/fact-sheets/detail/maternal-mortality
12 LISGIS. 2008. Liberia Population and Housing Census
13 LISGIS. 2013 LDHS
14 LISGIS. 2019. LDHS
15 The United Nations Country Results Report, Liberia, 2022
16 Ministry of Finance and development Planning. 2023. Addis Ababa Declaration on Population and Development AADPD+10. National Review Report. Monrovia, Liberia
17 Ministry of Health. 2022. A Ten-year National Health Policy and Strategic Plan (2022-2031). Monrovia. Liberia

1.4 Objectives

The general objective of the study is to provide an in-depth analysis of the mortality situation in Liberia using the 2022 census data. The specific objectives are to:

- assess the quality of mortality data collected by the 2022 LPHC;
- estimate the levels and trends in infant, child, and adult mortality;
- examine the socioeconomic differentials of infant and under-five mortality; and
- make recommendations for policy and programme interventions based on empirical evidence from the mortality analysis.

1.5 Organization of the report

The report is organized in five chapters. Chapter 1 focuses on introduction which gives a brief background to the study, the demographic and socioeconomic context within which the mortality analysis is being done, an overview of the 2022 PHC of Liberia, the objectives of the mortality analysis and the organization of the report. Chapter 2 assesses the quality of the data and highlights the methodology for the mortality analysis. In Chapter 3, the relevant mortality measures have been estimated using both direct and indirect mortality estimation techniques. The socioeconomic differentials in mortality have been examined in Chapter 4. Chapter 5 is devoted to policy implications, recommendations and conclusion.

2. Data evaluation and methodology

This chapter focuses on the sources of data, definition of the concepts used in the mortality analysis, evaluation of the mortality data collected from the 2022 Liberia PHC, the methodological issues and the methods used for the estimation of the relevant mortality indicators.

2.1 Sources of data

Mortality measurement uses information on the number of deaths and the population exposed to the risk of dying. The number of deaths is obtained from death registration records while the population exposed to the risk of dying is obtained from population census and sample surveys. However, in Liberia, registration of vital events especially deaths is incomplete and beset with errors of omission, non-response, age misreporting and age misstatements. Consequently, mortality measures generated from such data can be prone to distortions.

In the absence of good and exhaustive death registration records, Liberia has been relying on population and housing censuses and sample surveys for mortality data. The 2022 LPHC provided the information required for the estimation of the mortality indicators and determination of the levels, patterns, trends and differentials in mortality.

The data used for estimating mortality rates were obtained from the parental survivorship section (Questions P13-14), fertility section (Questions P31A-P40) and mortality section (Section 6) of the 2022 LPHC questionnaire. The specific questions were on Children ever born and surviving (Questions P31A-P35), births in the last 12 months (that is current fertility) (questions P36-P40) and deaths in the household in the last 12 months preceding the census (Section 6: questions DO1-DO5c and parental survivorship (questions P13-14).

2.2 Definition of concepts

In this section, the key concepts that have been used in the monograph are defined. They are crude death rate (CDR), infant death rate, age-specific death rate, childhood mortality (infant, child and under-five mortality), maternal mortality ratio and rate and life expectancy at birth.

CDR is the number of deaths per 1,000 population in a given year.

Infant Death Rate is the number of deaths to infants in a given year per total live births in that same year.

Age-Specific Death Rate is the number of deaths of people in a specified age group per 1,000 population of that age group.

Infant Mortality (1q0 or q1) is the probability of dying between birth and age one. This is expressed per 1,000 live births

Child Mortality (4q1 or q4) is the probability of dying between age one and five.

Under-five Mortality (5q0 or q5) is a combination of infant and child mortality and is defined as the probability of dying between birth and exact age five. The rate is expressed per 1,000 children.

Adult Mortality (45q15) is the probability that an individual alive at exact age 15 will die before exact age 60, given the mortality conditions of a given year or period. It is expressed as deaths per 1,000 persons reaching age 15.

Maternal Mortality Ratio is defined as the number of deaths due to pregnancy-related causes (puerperal causes) per 100,000 live births.

Maternal Mortality Rate relates the number of deaths due to pregnancy-related causes to the number of women of the childbearing age group (15-49 years). The death due to pregnancy-related causes must occur while pregnant, during delivery or within six weeks after the end of the pregnancy or childbirth.

Life Expectancy (e^o_0) is an estimate of the average number of additional years a person could expect to live if the age-specific death rates for a given year prevailed for the rest of a person's life.

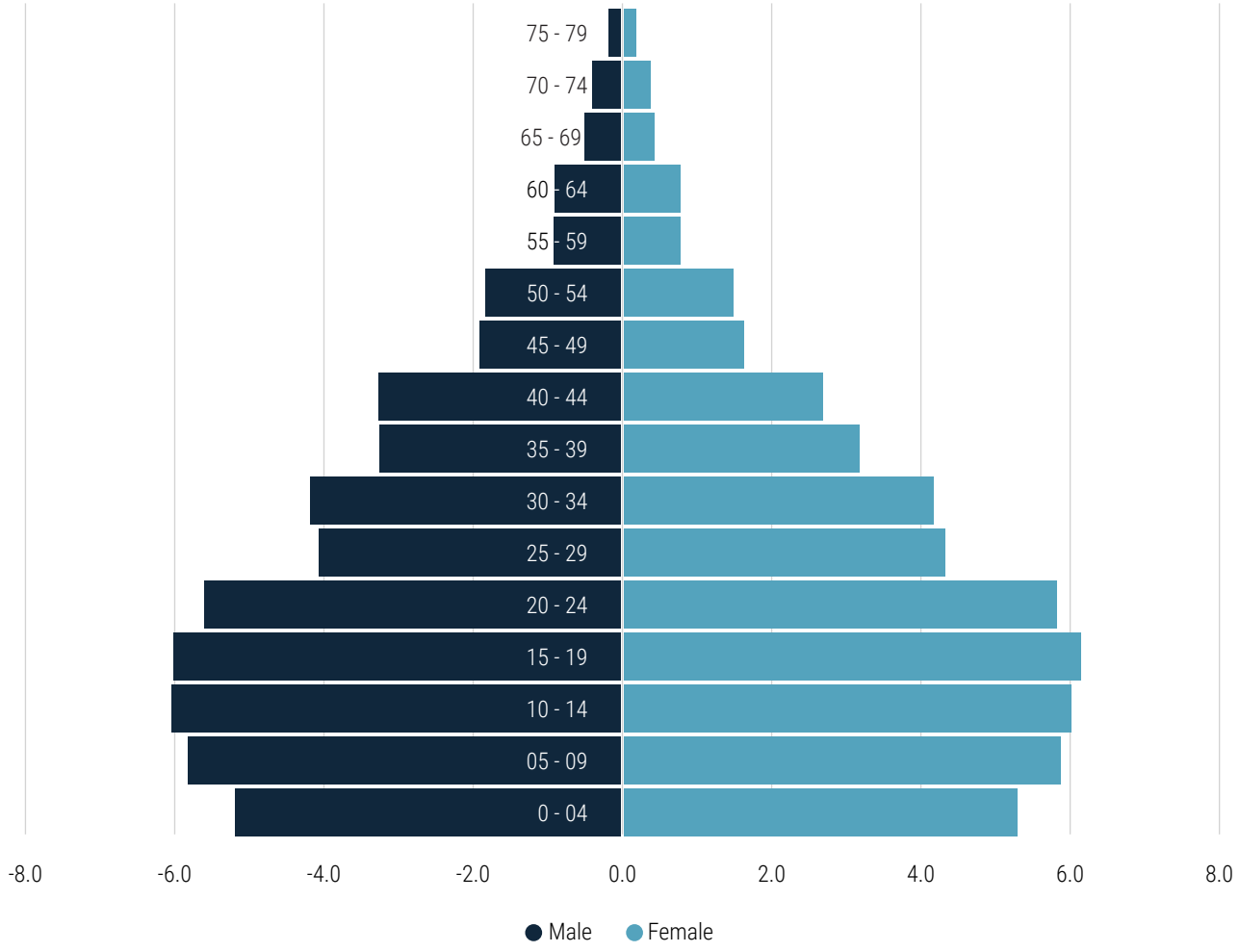
2.3 Data evaluation and quality assurance

The quality of data for estimation of mortality measures has been a major concern over the years. This is because the accuracy of the measures and the resultant levels and trends that are established depend on the accuracy of the mortality data collected. These data are collected from surveys and censuses and are prone to a number of errors particularly omission and response errors. The result, in most cases, is underestimation of the level of mortality, which eventually distorts the level of mortality of the country. The Liberia 2022 LPHC faced similar challenges and to identify the errors and reduce their impact on data quality an assessment was performed on the age and sex data and the children ever born and children surviving data.

2.3.1 Age-sex structure of the population

The age-sex structure of a population is a basic attribute for evaluating changes in a population. The changes are influenced by fertility, mortality and migration and these demographic changes are best illustrated by constructing a population pyramid. The population pyramid constructed for Liberia is presented in Figure 2.1 (Appendix Table 1). The wide base of the pyramid illustrates that Liberia has a relatively young population with about 34 per cent of the population below 15 years. Also, lots of children are born but a lot of them do not survive into adulthood.

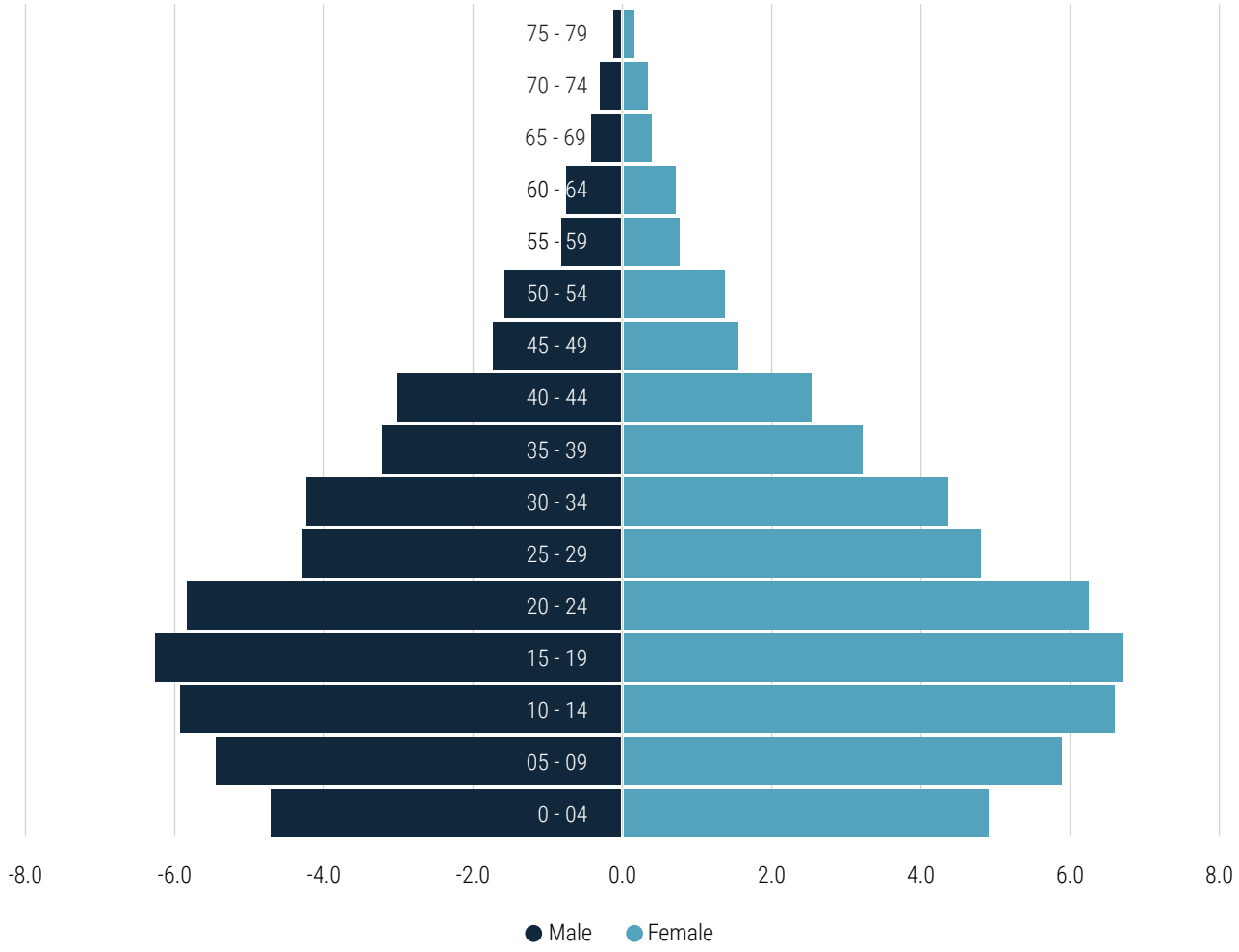
Figure 2.1: Population pyramid of Liberia



Source: LISGIS, Liberia 2022 Population and Housing Census

In the urban areas (Figure 2.2a), females were more represented from age 0 - 34 years while males were also more represented from age 35 - 69 years.

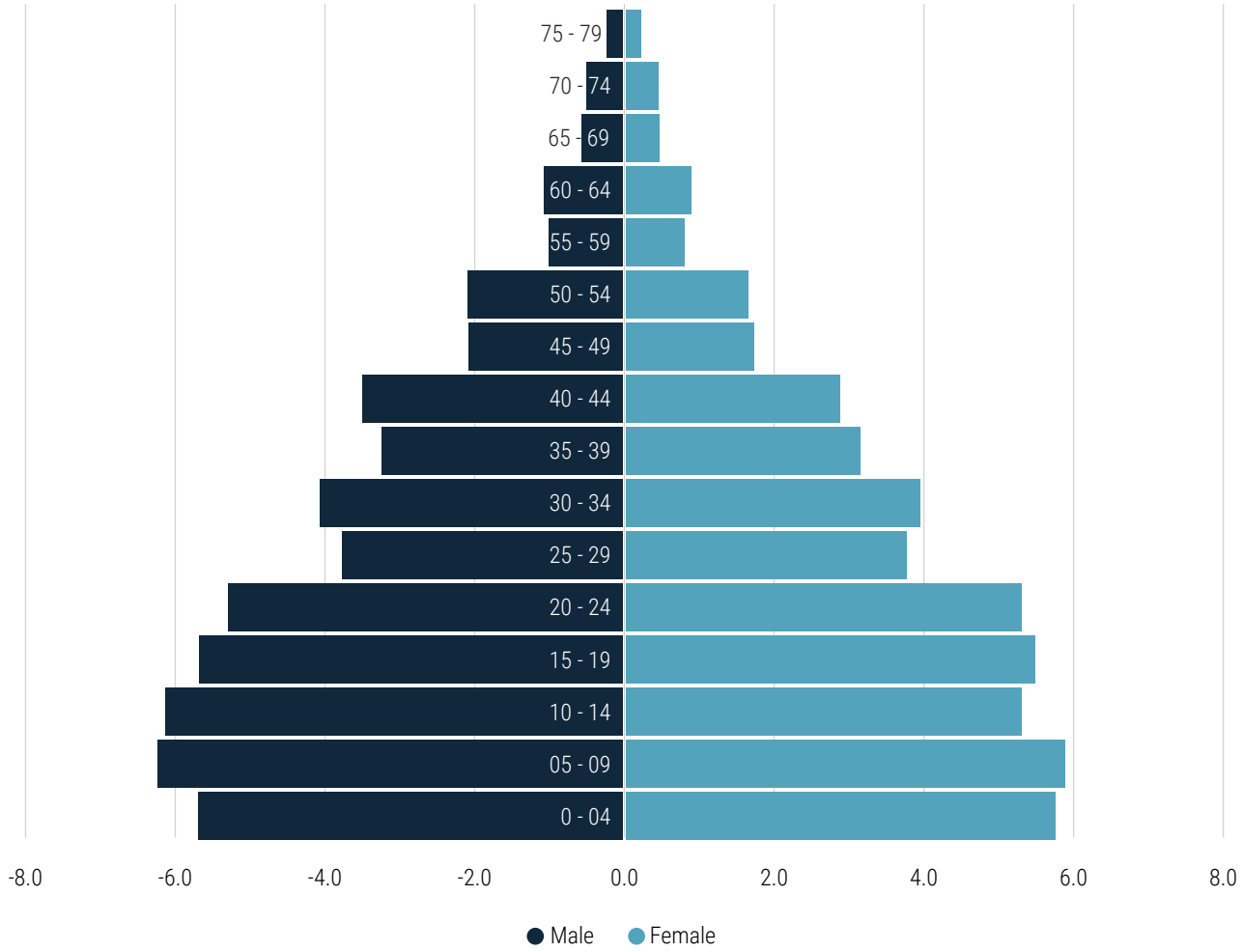
Figure 2.2a: Population pyramid of Liberia, urban



Source: LISGIS, Liberia 2022 Population and Housing Census

In rural place of residence (Figure 2.2b), females were more represented at ages 0-4 years while males were more represented at ages 5-19 years and 25-74 years. This shows that in those age groups the female and male population were better reported.

Figure 2.2b: Population pyramid of Liberia, rural



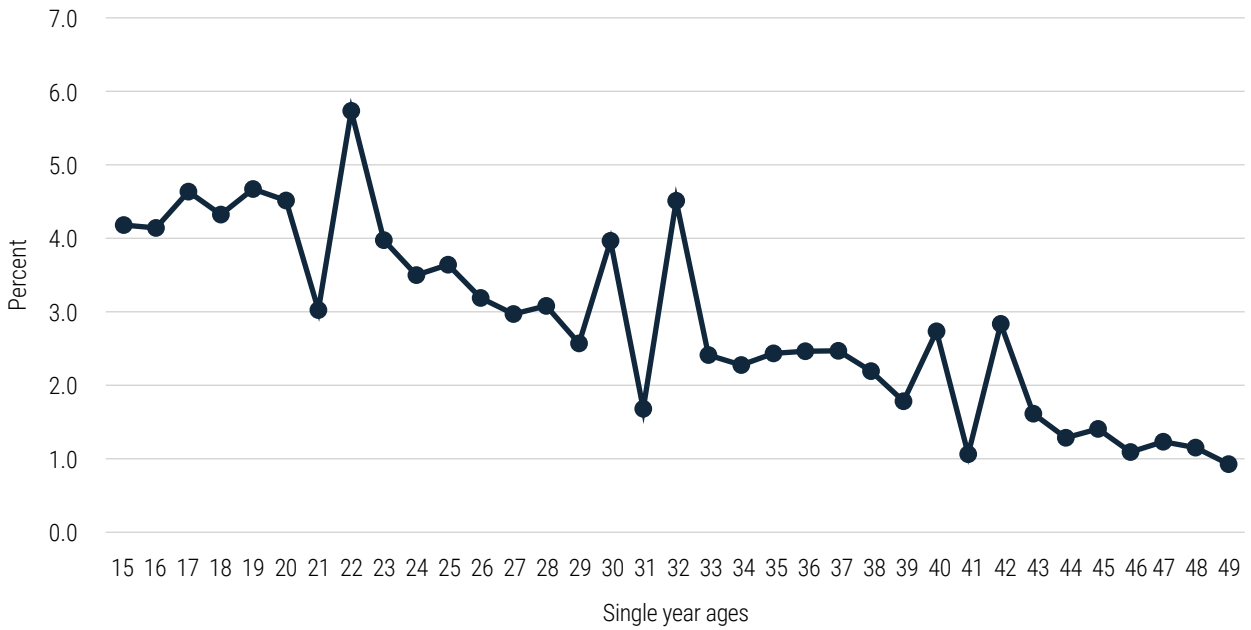
Source: LISGIS, Liberia 2022 Population and Housing Census

2.3.2 Age distribution of respondents

Single year ages

The single year age distribution of women (Appendix Table 2) in the reproductive age group 15-49 shows that there is age misreporting depicted by the spikes in the graph (Figure 2.3). An examination shows preference for ages 22, 30, 32, 40 and 42.

Figure 2.3: Single year age distribution of women 15-49 years



Source: LISGIS, Liberia 2022 Population and Housing Census

Grouped data

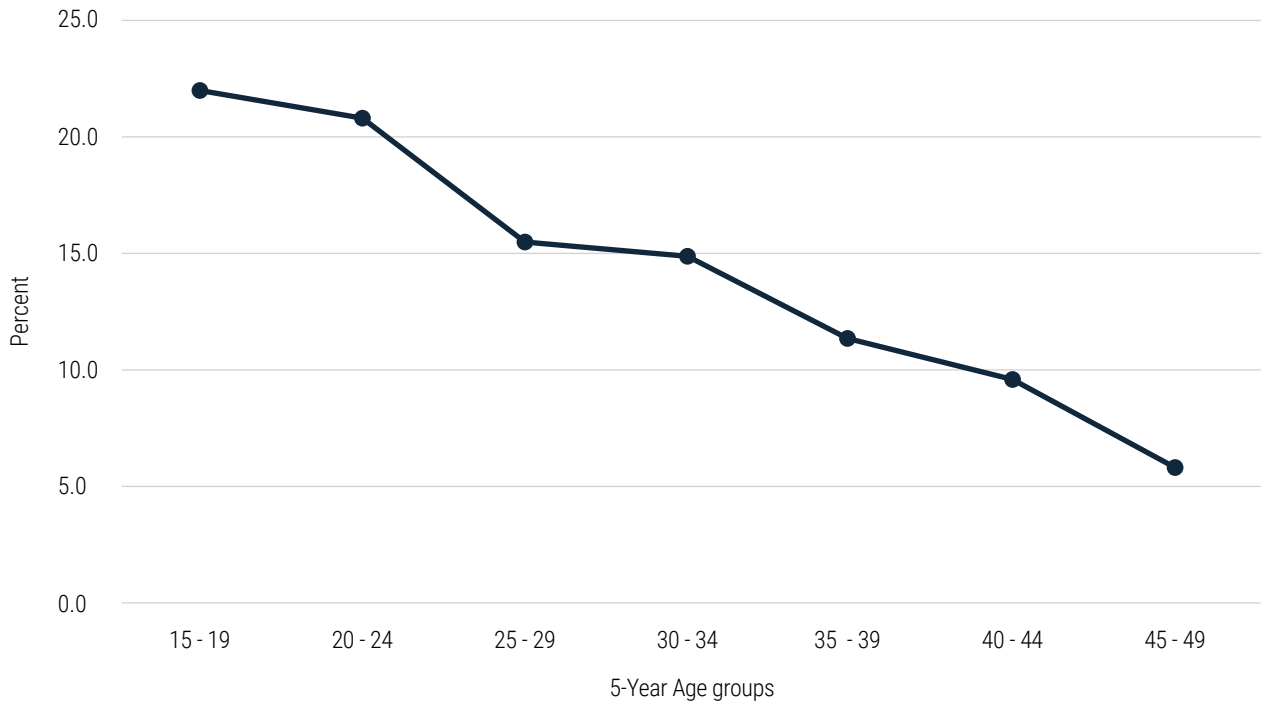
To make the data more robust for the estimation of the mortality indicators, the single year ages have been grouped into five-year ages (Table 2.3) to remove the outliers in the ages reported as shown in Figure 2.4. In populations of high fertility, it is expected that the absolute first difference will decrease with age because of increasing mortality. An examination of the absolute first difference in Table 2.1 showed no systematic pattern. This irregular pattern is an indication of distortions in the reported ages of respondents. However, a graphical presentation of the percentage distribution of the women into five-year age groups showed that grouping the data minimizes age heaping (Figure 2.4).

Table 2.1: Per cent distribution of mothers aged 15-49 by 5-year age groups

Age group	No of Women	Per cent	Absolute first difference
15 - 19	322,844	22.0	-
20 - 24	305,640	20.8	1
25 - 29	227,432	15.5	5
30 - 34	218,837	14.9	1
35 - 39	167,434	11.4	3
40 - 44	140,960	9.6	2
45 - 49	85,783	5.8	4
Total	1,468,930	100.0	

Source: LISGIS, Liberia 2022 Population and Housing Census

Figure 2.4: Five-year age distribution of women 15-49 years

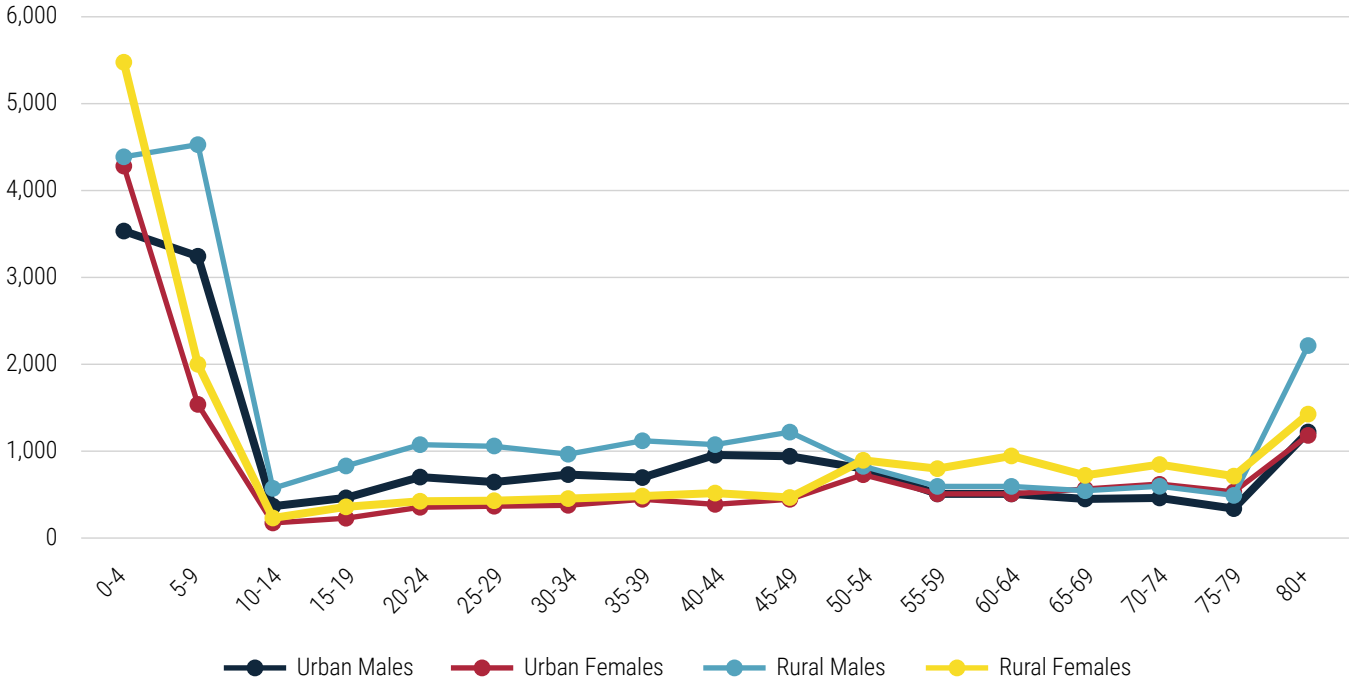


Source: LISGIS, Liberia 2022 Population and Housing Census

2.3.3 Age-sex distribution of deaths

As one of the components of population change, changes in mortality influence population growth and distribution if corresponding changes are not recorded in fertility and migration. It is therefore essential to examine the distribution of deaths to determine any disparities in age reporting of deaths. Figure 2.5 (Appendix Table 3) shows the age-sex distribution of deaths by residence. Male deaths were higher than female deaths from ages 5 to 54 years irrespective of place of residence. Under-five (0-4 years) reported deaths showed that more females died than males. This is unusual and may be due to under count of male deaths or over count of female deaths. Between age group 50-54 and 75-79 rural female deaths were better reported than their female counterparts in urban areas and also males and females in urban areas.

Figure 2.5: Age distribution of deaths by sex and residence

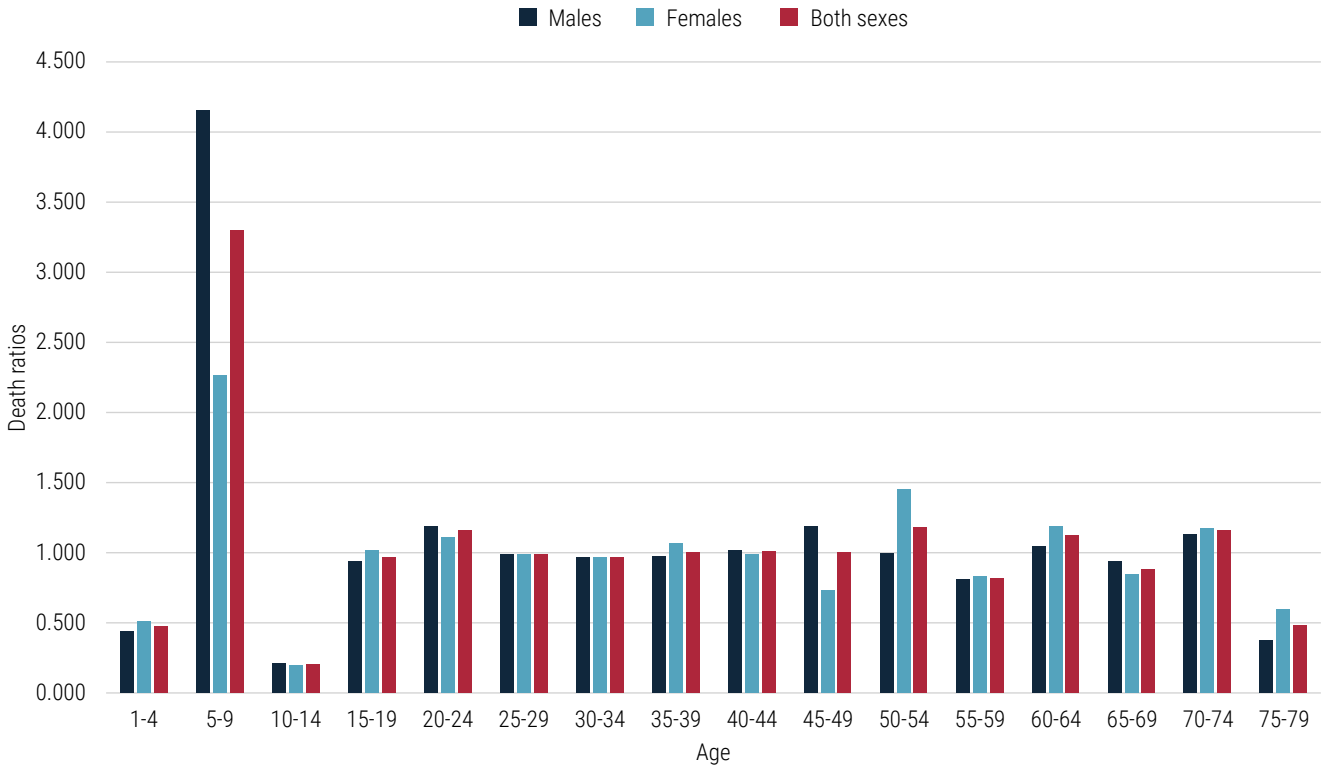


Source: LISGIS, Liberia 2022 Population and Housing Census

2.3.4 Ages at death

Ages at death should be fairly smoothly distributed by age. To assess this death ratios are calculated across successive age groups. They show the relationship of deaths at a particular age group relative to the next higher age group. For instance, the death ratio for age group 5-9 is calculated by multiplying 2 by the deaths at the next higher age group (10-14) and dividing by the combined deaths in age groups 5-9 and 15-19 (death ratio for 5-9 age group = 2) (deaths in age group 10-14)/(deaths in age groups 5-9 plus deaths in age group 15-19). The death ratios should not show much variation from one age group to another. The death ratios presented in Figure 2.6 (Appendix Table 4) show that apart from age group 5-9 years, the rest are fairly smoothly distributed across the age groups.

Figure 2.6: Death ratios by age and sex



Source: LISGIS, Liberia 2022 Population and Housing Census

2.3.5 Data on children ever born, children surviving and children dead

Data on children ever born (CEB), children surviving (CS) and children dead (CD) are good sources of information for evaluation of mortality data. The key indicators from these sources examined for misreporting of deaths are sex ratios, average parities and proportion of dead children.

Sex ratios

Sex ratios at birth should not deviate far from 100 to 106 males per 100 females. A sex ratio significantly higher than 100 shows under reporting of females while sex ratios significantly lower than 100 signifies under reporting of males. Again sex ratios at death for sub-Saharan Africa, typically, range between 102 and 140 for under-fives. The computed sex ratios for CEB, CS and CD are presented in Table 2.2. Although an examination of the sex ratios does not show marked discrepancies, they suggest under reporting of females for ages 15-24 years. The sex ratios for CD do not show irregularities to suggest under reporting of deaths to any of the sexes.

Table 2.2: Sex ratios of CEB, CS and CD by age of mother, 2022

Age of mother	CEB	CS	CD
15-19	1.12	1.11	1.31
20-24	1.10	1.09	1.27
25-29	1.08	1.08	1.26
30-34	1.08	1.07	1.30
35-39	1.08	1.06	1.28
40-44	1.08	1.07	1.32
45-49	1.08	1.05	1.32

Source: LISGIS, 2022 LPHC

Average parities

The pattern of average parities reported by women of each age group can also give an indication of the quality of the data on CEB. Average parities should increase with age up to the age group 45-49 if fertility has not increased for some time in the past. As indicated by Macinko et al., 2007 however, as a result of memory loss there is the tendency for older women to underestimate the number of children they have given birth to and/or omit some of the children who died especially those who died shortly after birth than those who survived. These omissions if they occur can distort the pattern of average parities. An examination of the average parities in Table 2.3 showed a consistent increase up to age group 45-49 suggesting that the 2022 data appear to be fairly well reported.

Table 2.3: Age group of mother, mean number of CEB, mean number of CS and mean number of CD

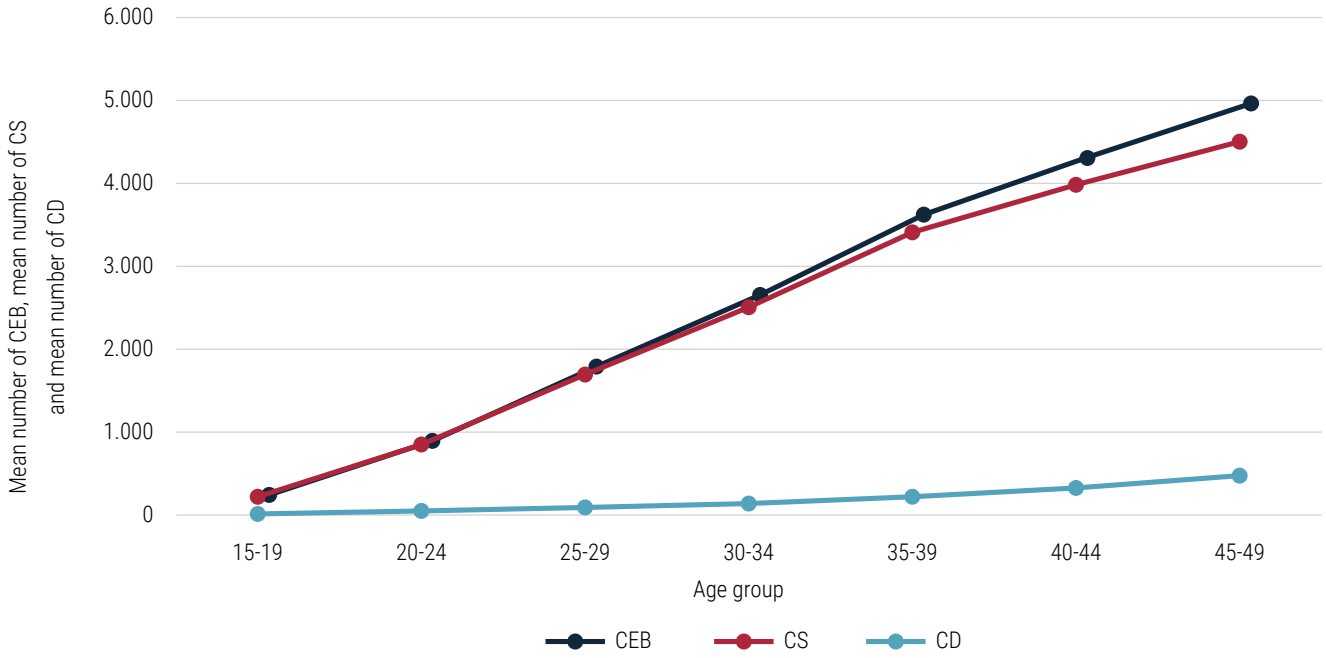
Age group of mother	Both sexes			Male			Female		
	CEB	CS	CD	CEB	CS	CD	CEB	CS	CD
15-19	0.242	0.228	0.014	0.128	0.120	0.008	0.114	0.108	0.006
20-24	0.904	0.858	0.046	0.473	0.448	0.026	0.431	0.410	0.020
25-29	1.794	1.705	0.089	0.934	0.884	0.050	0.861	0.821	0.040
30-34	2.654	2.513	0.141	1.379	1.299	0.080	1.276	1.214	0.062
35-39	3.631	3.412	0.219	1.881	1.758	0.123	1.750	1.654	0.096
40-44	4.307	3.981	0.326	2.241	2.056	0.185	2.066	1.925	0.141
45-49	4.976	4.503	0.473	2.580	2.312	0.269	2.395	2.191	0.204

Source: LISGIS, 2022 LPHC

Mean number of CEB

Generally, parity increases with age of the mother and the proportion of male children borne by each group of women should be close to females borne by the same group of women. Table 2.3 shows data on mean number of CEB, mean number of CS and mean number of CD. They follow the general pattern. Figure 2.7 shows a clearer picture where the mean number of CEB, mean number of CS and mean number of CD all increase with the age of the mother and the proportion of males is close to females in each age group suggesting that the data on CEB are of good quality.

Figure 2.7: Mean number of CEB, mean number of CS and mean number of CD by age of mother



Source: LISGIS, Liberia 2022 Population and Housing Census

Proportion of dead children

Unless child mortality or fertility has been increasing, the proportion of dead children should increase with age of mother. This is because the older the woman is the more exposed her children are to the risk of dying. This explains the higher child mortality from 10 to 15 years than earlier periods before the census. However, evidence from the CEB data shows that the proportion of CD were higher at ages 15-19 and 20-24, attained the lowest proportion at age 25-29 and thereafter increased with age of the mother. The pattern suggests over reporting of deaths at ages 15-24 years but thereafter the proportions do not give indication of increasing number of omissions of dead children with increasing age of the mother.

2.4 Methodological issues and method of analysis

2.4.1 Methodological issues

Mortality data must be interpreted with caution because of problems associated with its collection. Census data are associated with age heaping and age exaggeration. Many Liberians claimed to have an age that ends in zero and 2. Another challenge with census data is age exaggeration, whereby Liberians claimed to be older than they actually were, or the age at death of persons who have died was reported as older than was actually the case. These problems are common in developing countries like Liberia.

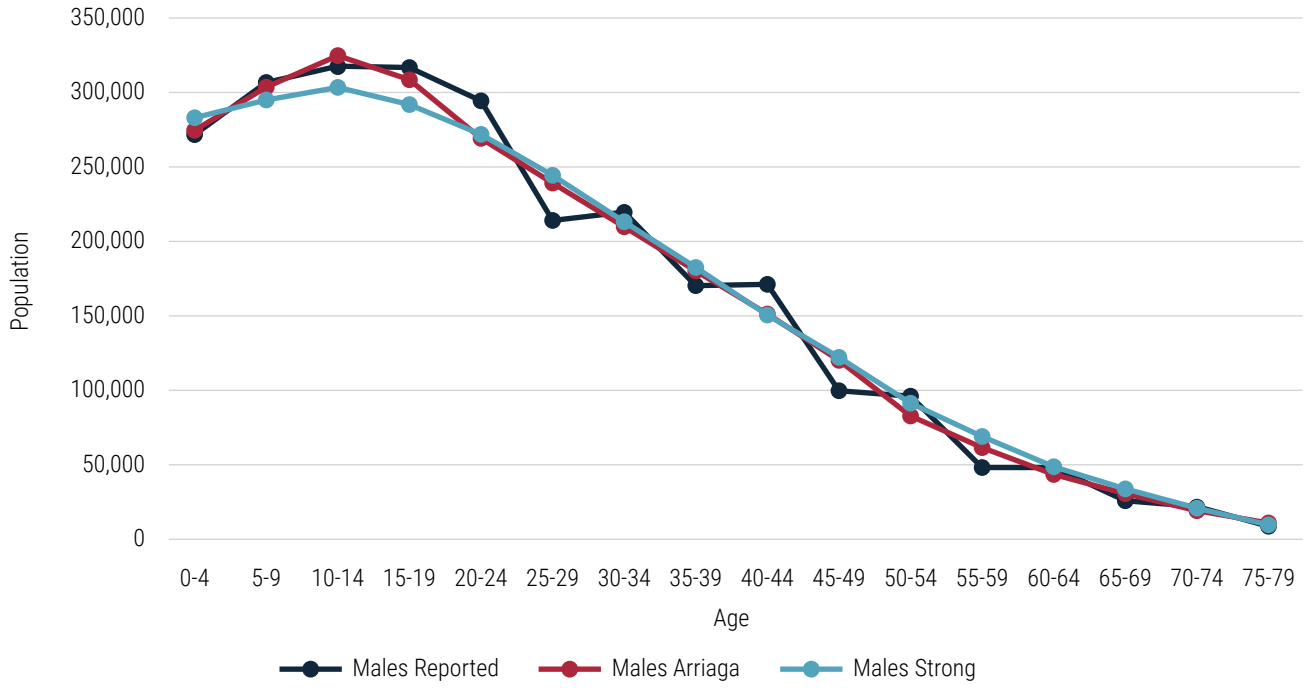
Another limitation of the mortality data is under reporting of deaths. This invariably is due to recall or memory lapse especially of older women. This is usually the case for children who died immediately after childbirth or who died in the early stages of a woman's reproductive life cycle. Age misreporting cannot be overlooked in census enumeration. The child mortality data were derived from birth history; meanwhile some of the mothers interviewed were not literate to provide accurate dates of birth of their children. The parental survivorship data collected from the census also suffers from under reporting or age misreporting especially where the parents died while the respondent was very young or was not living with them. The overall effect is that the age-sex data collected from the census may be distorted and therefore has been examined for adjustment, where necessary.

2.4.2 Adjustment of age and sex data

The technical team constituted by the LISGIS to undertake the demographic evaluation of the 2022 census recommended no adjustment to the census data. Notwithstanding, the reported age structure was examined for possible adjustment or smoothening to remove the observed distortions. The smoothening technique involved the application of formulas to the reported data to produce new results on the assumption that the new data would have been the outcome if distortions had not occurred. To preserve the enumerated totals, the smoothening technique applied to the age-sex data was the Carrier Farrag, K. King Newton, Arriaga, United Nations and Strong, using the PAS AGESMTH. The results of the Arriaga and Strong procedures are presented for males in Figure 2.8 and females in Figure 2.9 (Appendix Tables 5 and 6).

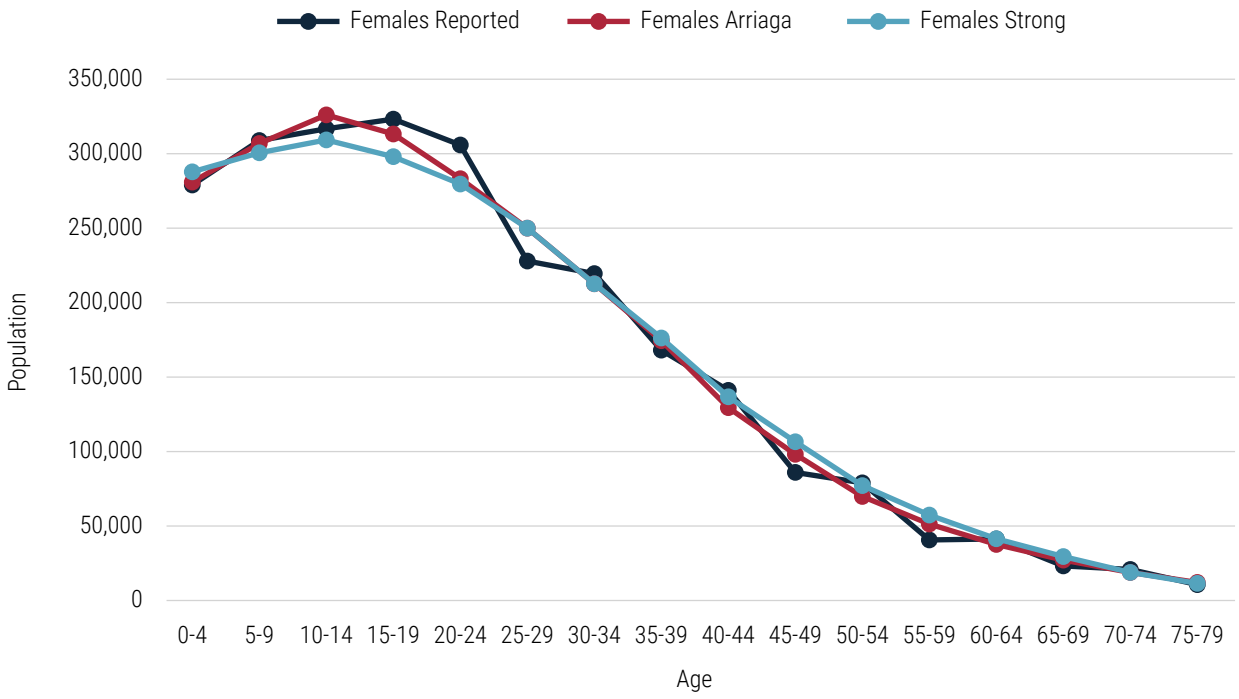
The reported and smoothed age distributions using the Arriaga and Strong procedures show similarities between the reported and smoothed even though there were deviations from age 5 to 24 for males and 14-24 for females. The females were better reported than males from age group 30-34 years. From these results, the age-sex data are fairly accurate and could be used for further analysis. The Brass General Growth Balance was also used to adjust the number of deaths. Other indirect mortality estimation software, for example the US Census Bureau, 1994 software, LTMXQXAD have in-built adjustment factors which was also employed to adjust the deaths data in the construction of the life tables.

Figure 2.8: Reported and smoothed population by age, males



Source: LISGIS, Liberia 2022 Population and Housing Census

Figure 2.9: Reported and smoothed population by age, females



Source: LISGIS, Liberia 2022 Population and Housing Census

2.4.3 Method of analysis

Two main procedures have been used for estimating childhood mortality indicators. These are direct and indirect procedures. The direct procedures have been used to estimate the childhood mortality rates, the crude death rates and the age-specific death rates. The relevant data obtained from the 2022 LPHC were used to estimate mortality for a period of 12 months preceding the census date (12 November, 2022). Where appropriate, the indices derived were compared with indicators obtained from previous censuses and Demographic and Health Surveys.

Indirect procedures have also been used. The specific indirect procedure used in this chapter is the Brass method, which uses data on CEB and CS by age of mother to derive the proportion dead among CEB. The International Union for the Scientific Study of Population (IUSSP) Excel Spread sheet[18], PAS and MORTPAK software were used to construct the mortality estimates and the life tables.

2.5 Limitations of the data

The 2022 Census missed the benefit of analysing cause-of-death data, which is very critical in planning effective health delivery because apart from isolating pregnancy-related death, all other causes of death were not asked. Collecting and analysing administrative records from health facilities may compensate for the loss of data.

18 http://demographicestimation.iussp.org/content/indirect-estimation-child-mortality

3. Levels, trends and patterns of mortality

In this chapter, the levels, trends and patterns of mortality in Liberia are discussed. All over the world considerable efforts have been made to improve child survival and therefore, reduce childhood mortality. This chapter adopted both direct and indirect mortality estimation procedures to derive the relevant mortality estimates.

3.1 Estimation of mortality from household death records

The crude death rates, age-specific death rates, infant and under-five mortality rates, adult mortality and maternal mortality ratio have been estimated. The proportion of CD of the CEB and the percentage share of total household deaths occurring 12 months preceding the census night by county, residence and sex have also been examined to serve as rough estimates of childhood mortality.

3.1.1 Crude death rate

The CDR is a good indicator of the general health status of a population. It is good for assessing the effectiveness of a country's health system whose status impacts on the health of the population and influences the number of deaths in the population. The CDR is computed by dividing the total deaths occurring in a given year by the mid-year population of the same year multiplied by 1,000.

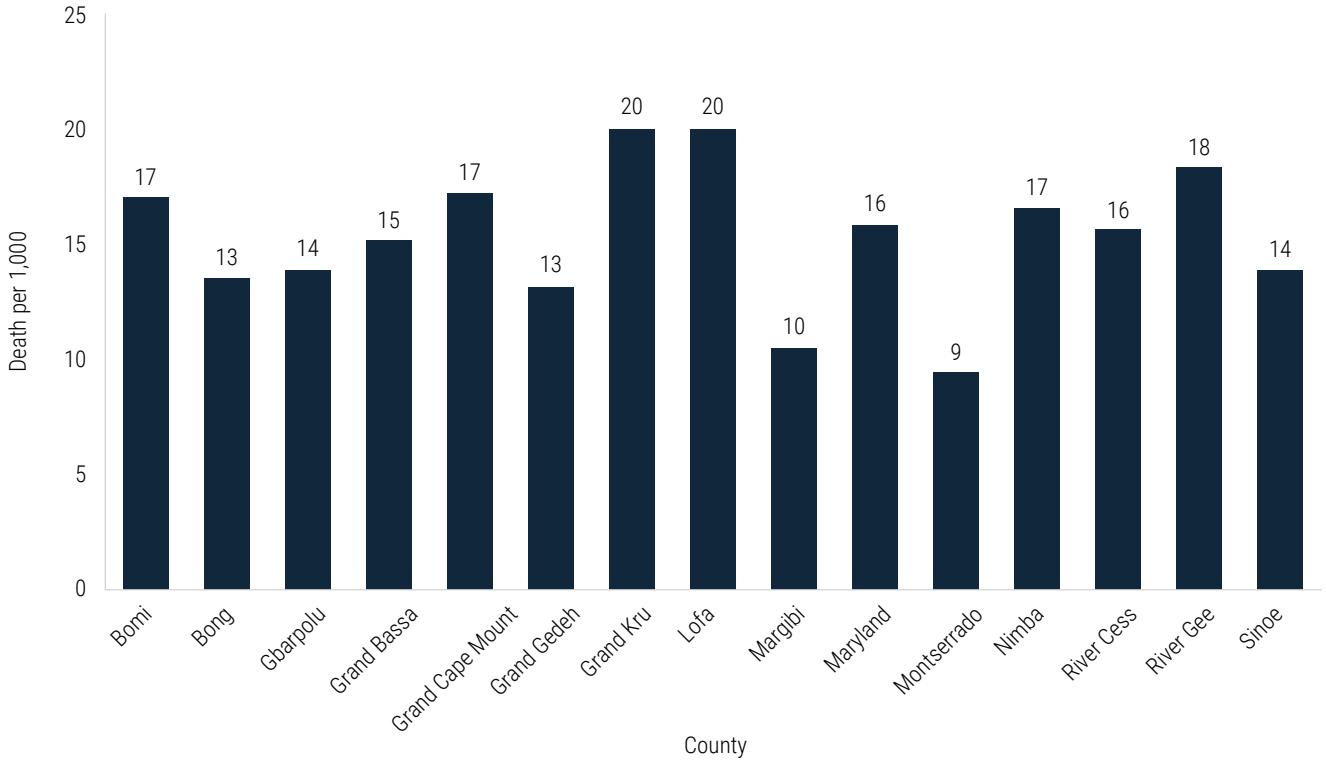
Crude death rate by sex and residence

The CDR computed for Liberia is 13.3 per 1,000 population in the year preceding the census. The CDR for males is 14.9 per 1,000 population while that for females is 11.7 per 1,000 population. The rates for urban and rural areas are 10.0 and 16.8 per 1,000 population.

Crude death rate by county

The crude death was highest (20 deaths per 1,000 population) for each of two counties, Grand Kru and Lofa (Figure 3.1). Montserrado had the lowest CDR of nine deaths per 1,000 population. Only four counties; Montserrado (9 deaths per 1,000 population), Margibi (10 deaths per 1,000 population), Bong (13 deaths per 1,000 population) and Grand Gedeh (13 deaths per 1,000 population) have CDRs lower than the national average of 13.3 deaths per 1,000 population.

Figure 3.1: CDR by county



Source: LISGIS, Liberia 2022 Population and Housing Census

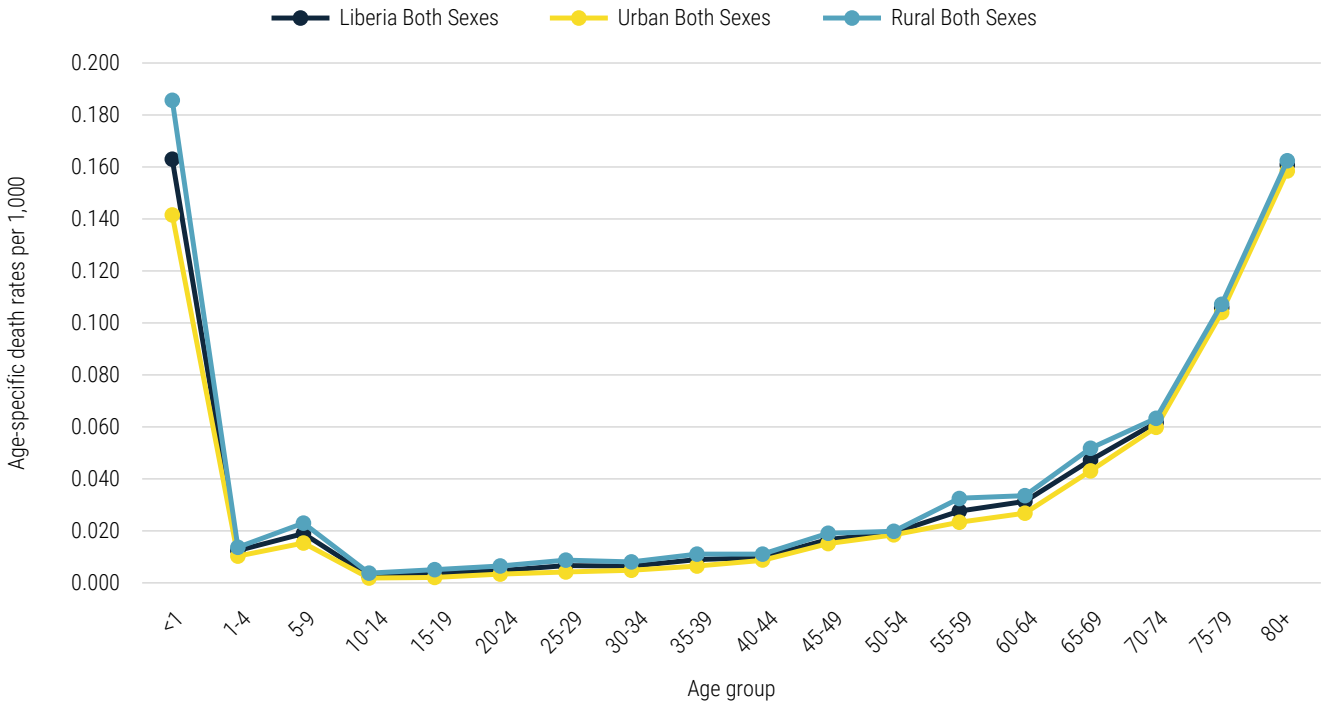
The CDR does not make allowance for the age structure but it is well documented that mortality rates are higher in infancy, falling to the lowest level at ages 10-14 years and increase with increasing age thereafter. It is therefore, not good for comparison across sub-populations. To eliminate the effect of age structure and make comparison across sub-populations on an equal basis, the CDR was standardized. A direct standardization procedure using the WHO World Standard Population was chosen. The procedure[19] involved multiplying the age-specific death rates in each age group by the standard population in the same age group. The results are summed up and divided by the total of the standard population to get the adjusted CDR. The computed adjusted CDR for the country is 19 per 1,000 population, 21.7 per 1,000 population for males and 16.5 per 1,000 population for females. In comparison, the 2008 LPHC yielded adjusted CDR of 22 per 1,000 population for males and 20 per 1,000 population for females.

3.1.2 Reported age-sex specific death rates

Age-sex specific death rates (ASDRs) have been computed for each age group to allow for comparison of mortality at different ages or the same age over time. ASDRs are calculated by dividing the deaths in a particular age group by the mid-year population of the same age group and multiplied by 1,000. The ASDRs computed for Liberia are presented in Figures 3.2a-3.2c (Appendix Table 7). Typical of the ASDRs, mortality was highest at the ages 0-4 years and declined to its lowest at ages 10-14 years and thereafter increased with age. This is in conformity with the typical mortality pattern over all age groups, which has a U-shape. There was, however, higher death rate at age group 5-9 over and above the death rate at age group 1-4 years. In Figure 3.2a the results also show that the rates for males are higher than those of females, an indication of relatively higher male mortality in the country.

19 See appendix 1

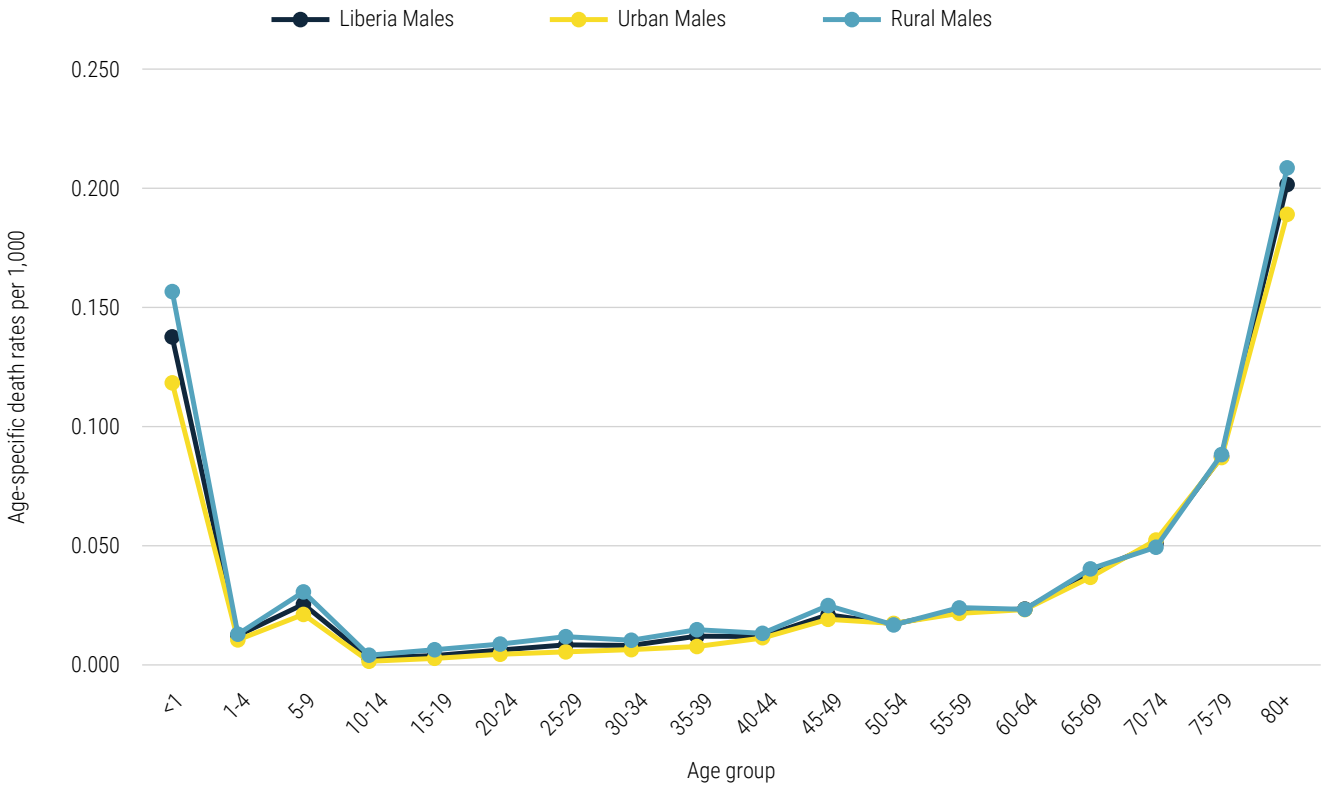
Figure 3.2a: Reported ASDRs per 1,000 mid-year population, Liberia, 2022



Source: LISGIS, Liberia 2022 Population and Housing Census

In Figure 3.2b, the reported ASDRs for rural males were above those of urban males from age 0 through to age group 45-49 years. Between ages 50-54 and 75-79, the rates for urban and rural males were almost equal.

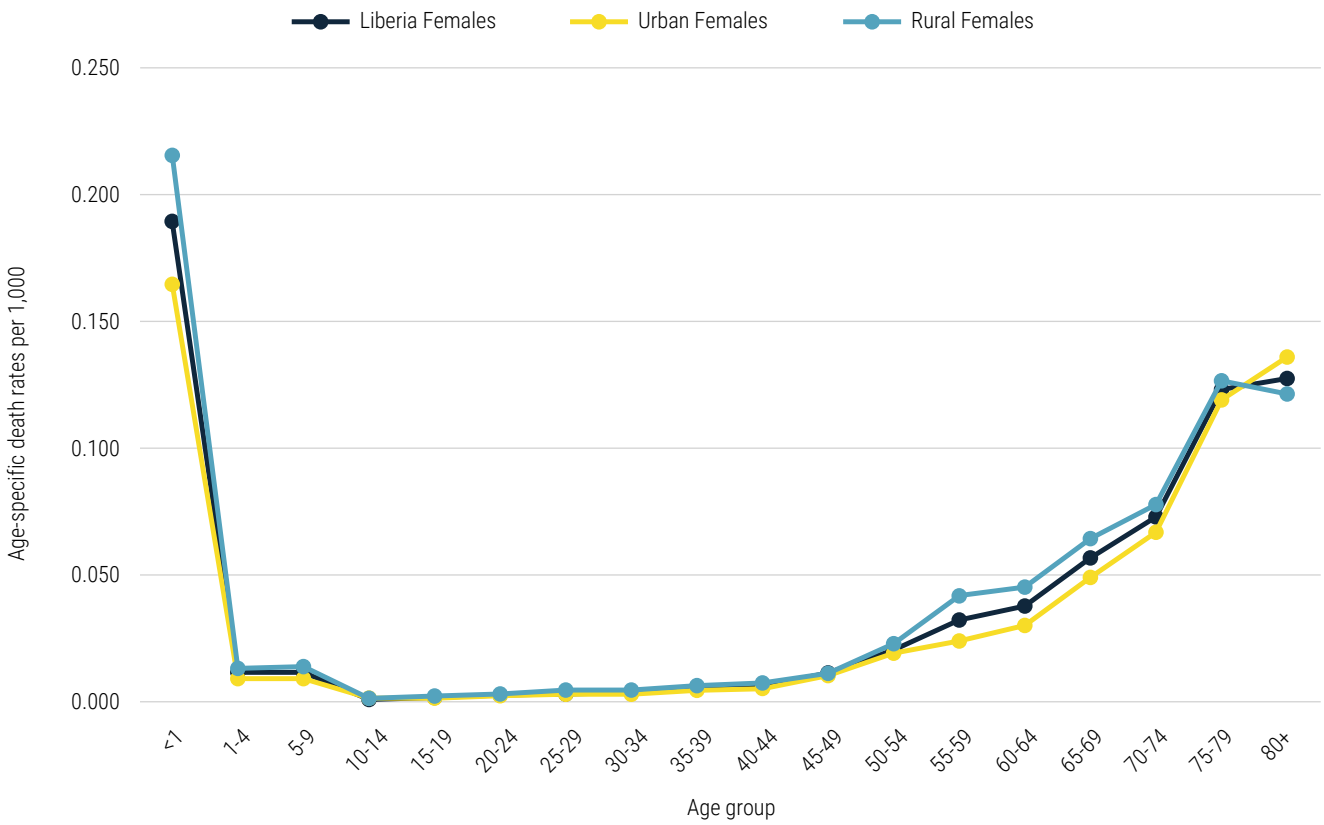
Figure 3.2b: Reported ASDRs per 1,000 mid-year population, Liberian males, 2022



Source: LISGIS, Liberia 2022 Population and Housing Census

In Figure 3.2c, the ASDRs were almost the same for both urban females and rural females from age group 10-14 through to 45-49. Higher ASDRs were recorded for rural females than urban females between ages 50 and 79 years.

Figure 3.2c: Reported ASDRs per 1,000 mid-year population, Liberian females, 2022



Source: LISGIS, Liberia 2022 Population and Housing Census

3.1.3 Childhood mortality

Information on childhood mortality shows the overall health of a country. It is relevant for demographic assessment of a country's population and quality of life. Infant and under-five mortality rates are important indicators of overall child health of a country and the country's social-economic development. They highlight the children at higher risk of death and direct the attention of relevant authorities to plan and implement targeted interventions to improve child survival. They also provide relevant information for governments and the health sector to make informed decisions on allocation of resources. Childhood mortality considered in this section are neonatal (0-28 days), infant (1-11 months) child and under-five (12-59 months) mortality.

The computed childhood mortality rates are shown in Table 3.1. Neonatal mortality is 36 deaths per 1,000 live births and infant mortality is 64 deaths per 1,000 live births. The data also shows that child mortality is 32 deaths per 1,000 live births while under-five mortality is 93 deaths per 1,000 live births.

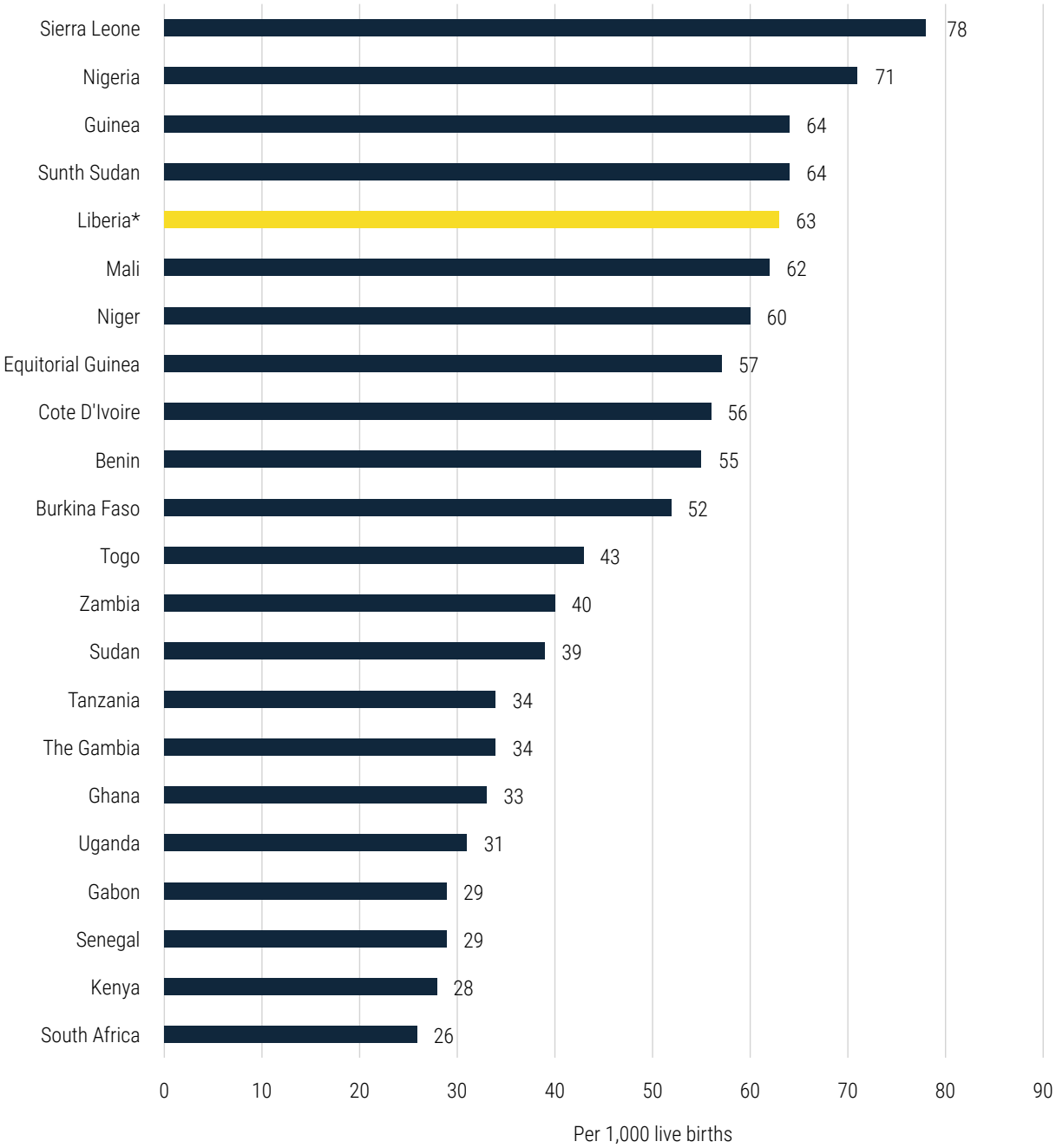
Table 3.1: Childhood mortality indices

Type of childhood mortality	Rate per 1,000 live births
	2022 LPHC
Neonatal mortality rate	35.6
IMR	63.7
Child mortality rate	32.1
Under-five mortality rate	92.6

Sources: 2022 LPHC

To determine the performance of Liberia in terms of minimizing childhood mortality, some 22 sub-Saharan African countries' childhood mortality experiences have been compared (Figure 3.3 and Appendix Table 8). Among the 22 sub-Saharan African countries, IMR for 2021 varies from 26 deaths per 1,000 live births in South Africa to 78 deaths per 1,000 live births in Sierra Leone. The estimate for Liberia derived from the 2022 PHC is 63 deaths per 1,000 live births. Of the 22 countries compared, Liberia has the fifth highest IMR. Compared with its immediate neighbours Sierra Leone, Guinea and Cote D'Ivoire, Liberia places second (63 deaths per 1,000 live births) after Cote D'Ivoire which has a relatively lower rate of 56 deaths per 1,000 live births.

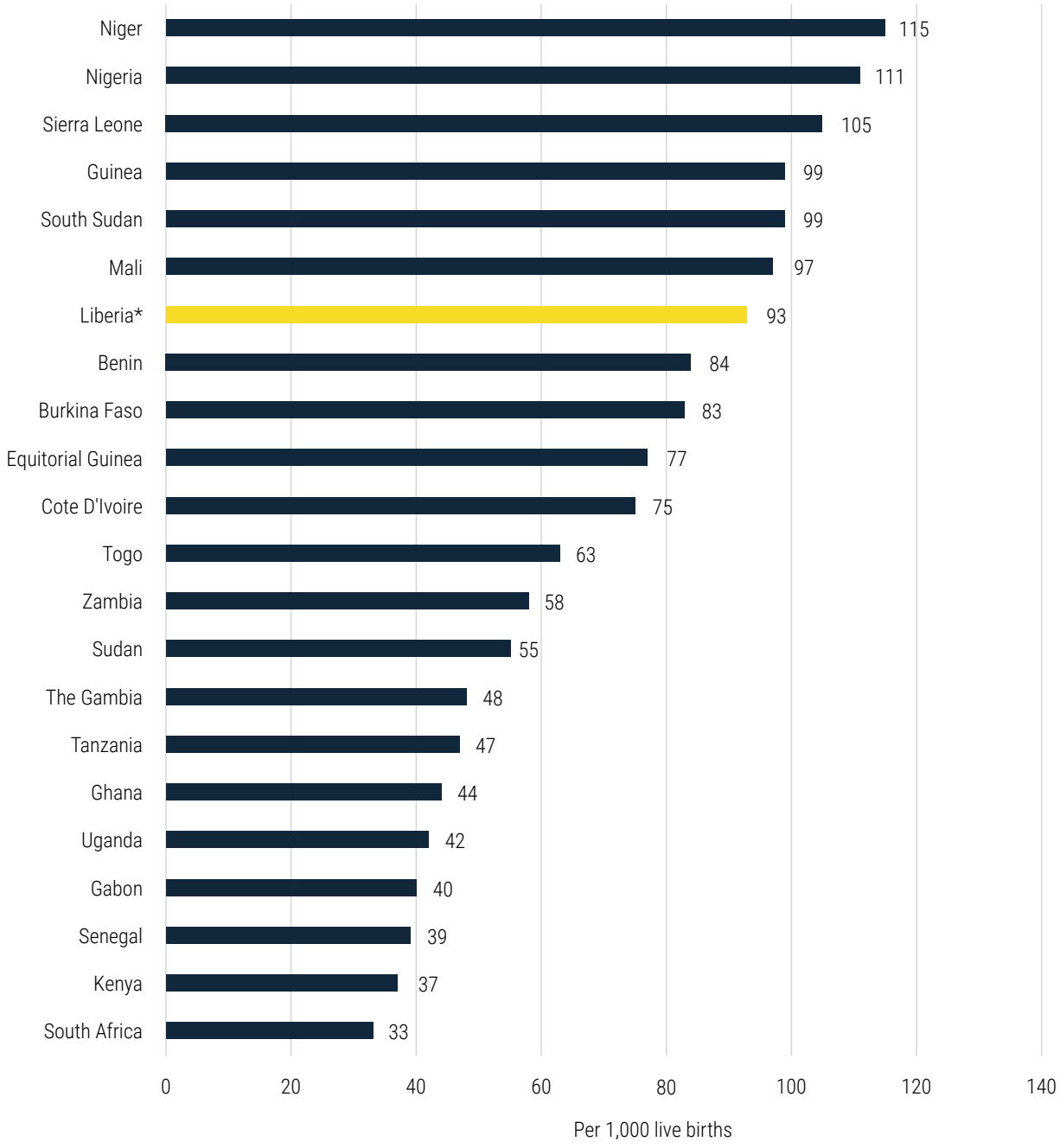
Figure 3.3: Infant mortality rates in selected sub-Saharan African countries



Source: United Nations Inter-agency Group for Child Mortality Estimation (estimates for 2021)
* Estimate from LPHC, 2022

Under-five mortality remains high in the sub-region, ranging from 33 deaths per 1,000 live births in South Africa to as high as 115 deaths per 1,000 live births in Niger (Figure 3.4 and Appendix Table 8). Of the 22 countries, Liberia places the seventh highest (93 per 1,000 live births) in under-five mortality rate. Compared with its immediate neighbours Sierra Leone, Guinea and Cote D'Ivoire, Liberia places second after Cote D'Ivoire. Sierra Leone with 105 deaths per 1,000 live births has the highest under-five mortality rate among countries bordering Liberia.

Figure 3.4: Under-five mortality rates in selected sub-Saharan African countries



Source: United Nations Inter-agency Group for Child Mortality Estimation (estimates for 2021)
* Estimate from LPHC, 2022

3.1.4 Adult mortality

This section examines adult mortality from data derived from the 2022 census using the orphanhood method. The method relies on two questions: Is …. mother alive? and Is ….father alive? which were asked in the census through questions P13 and P14 respectively. This method estimates the mortality of adult men and women indirectly based on reported proportions of respondents whose mother or father were still alive at the time of the census. The method relates the proportion of respondents with living mothers and fathers in two adjoining age groups to measures of life table survivorship by means of a system of weighting factors whose values depend on mean age at childbearing. By allowing for the mean age at which mothers give birth in the study population, the life table survivorship from age 25 to age 25+n (where n is linked to the age of the respondents) is estimated based on the age group of the respondents (l25+n/L25) from the proportion of respondents in each age group whose mother is alive. Similarly, by adjusting for the mean age at which men have children, the life table survivorship of adult men could be estimated from the proportions of respondents whose father are alive. The survivorship of men is, however, measured between a base age of 35 and 35+n since men tend to be older than women at the time of birth of their children.

The input data for the estimation of adult female mortality (maternal orphanhood) using the Brass method are: i). Number of respondents with mothers alive by age group, ii). Total number of respondents by age group and iii). Births in the last 12 months preceding the census by the reproductive age group 15-49. For the paternal orphanhood, the input data are: i). Number of respondents with father alive by age group, ii). Total number of respondents by age group and iii). Currently married men and women by age group 10-84+. The births data is used for the calculation of mean age at childbearing for women while the data on currently married men and women is used to compute the median age of either sex. The difference between the two is then added to the female mean age at childbearing to get an estimate of the male mean age at childbearing.

For female adult mortality, Table 3.2 presents all respondents (male and female) and the number of mothers alive by age group while Table 3.3 tabulates the births in the last year by age group of mother. Using these data on the maternal orphanhood status of respondents, the estimation of female adult mortality is computed. The demographic estimation software: http://demographicestimation.iussp.org/content/indirect-estimation-child-mortality; which has an application for estimating adult mortality from data on orphanhood, was used for the computation.

Table 3.2: Reported number of respondents and number of mothers alive by age group

Parental survivorship (Maternal)		
Age group	**Respondents**	**Number of mothers alive**
5-9	614,604	564,166
10-14	632,622	579,126
15-19	638,463	573,299
20-24	599,536	515,450
25-29	440,934	365,348
30-34	438,060	340,930
35	72,313	44

Source: LISGIS, Liberia 2022 Population and Housing Census

Table 3.3: Children born during the last 12 months preceding the census by age of mother at the time of the census, 2022

Age group	Births in the last year, B(i)	Mid-point age, (N)	B(i)*N
15-19	9,944	17	169,048
20-24	16,781	22	369,182
25-29	13,487	27	364,149
30-34	11,092	32	354,944
35-39	7,571	37	280,127
40-44	3,322	42	139,524
45-49	804	47	37,788
Totals	63,001		1,714,762

Source: LISGIS, Liberia 2022 Population and Housing Census

The resultant maternal orphanhood output of selected variables is presented in Table 3.4. The estimates obtained from the maternal orphanhood data refer to periods between 4 and 12 years prior to the census. Estimates based on reports of young respondents and thus corresponding to younger values of n (under 20) tend to be affected by misreporting of the orphanhood status and are usually not considered. Averaging the estimates for ages 25-35, the female adult probability of dying between age 15 and 60 years is 0.252 with a reference date between 2010 and 2013 or time period of 10 to 12 years prior to the census.

Table 3.4: Estimates of female adult mortality from proportions of respondents with surviving mother and time reference**

Age n	Proportion alive	Probability of dying 45q15	Reference date	Time Period*
10	0.918	0.520	2019.2	3.7
15	0.915	0.363	2017.0	5.9
20	0.898	0.298	2015.0	7.9
25	0.860	0.285	2013.1	9.7
30	0.829	0.246	2011.6	11.2
35	0.778	0.225	2010.4	12.4

Source: LISGIS, Liberia 2022 Population and Housing Census
* Number of years prior to the census to which estimates of probability of dying refer
** Refer to appendix 10 for full table

For male adult mortality estimation, Tables 3.5 and 3.6 provide the input data into the IUSSP spread sheet for estimation of adult male mortality from data on orphanhood.

Table 3.5: Reported number of respondents and number of fathers alive by age group

	Parental survivorship (Paternal)	
Age group	Respondents	No of fathers alive
5-9	614,604	553,893
10-14	632,622	562,305
15-19	638,463	544,840
20-24	599,536	477,930
25-29	440,934	324,026
30-34	438,060	286,242
35	337,732	44

Source: LISGIS, Liberia 2022 Population and Housing Census

Table 3.6: Currently married population by age and sex

Age group	Married men	Married women
10-14	316,719	315,903
15-19	315,619	322,844
20-24	293,896	305,640
25-29	213,502	227,432
30-34	219,223	218,837
35-39	170,298	167,434
40-44	170,868	140,960
45-49	100,206	85,783
50-54	95,866	78,708
55-59	48,307	40,942
60-64	47,888	41,159
65-70	26,288	22,497
70-74	21,094	20,341
75-80	9,611	9,888
80+	17,216	20,662
Total	2,066,601	2,019,030

Source: LISGIS, Liberia 2022 Population and Housing Census

The paternal orphanhood output of selected variables is presented in Table 3.7. The estimates obtained from the paternal orphanhood data refer to periods between 5 and 13 years prior to the census. The male adult probability of dying between age 15 and 60 years is 0.342. The reference date to which the estimate refers is 2010 to 2012 or time period of 11 to 13 years prior to the census.

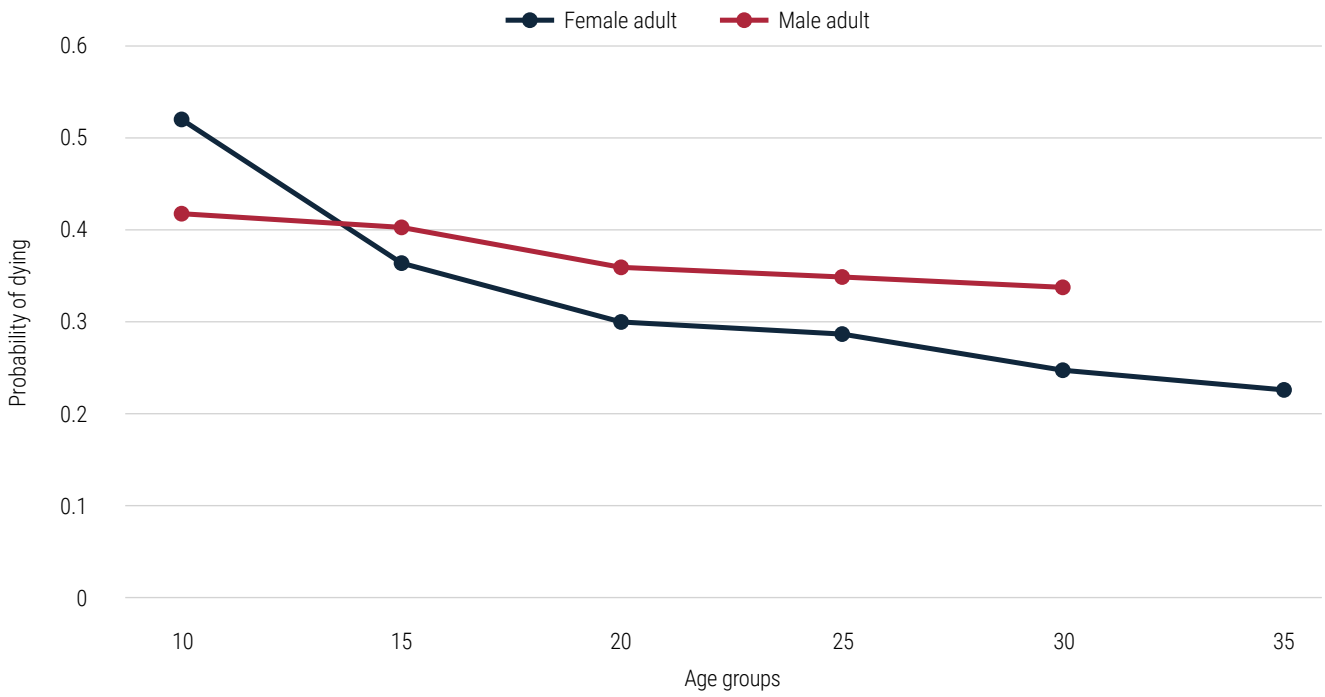
Table 3.7: Estimates of male adult mortality from proportions of respondents with surviving father and time reference

Age n	Proportion alive	Probability of dying 45q15	Reference date	Time Period
10	0.901	0.417	2017.7	5.16
15	0.889	0.403	2015.6	7.30
20	0.853	0.358	2013.6	9.30
25	0.797	0.348	2011.7	11.13
30	0.735	0.337	2010.1	12.73

Source: LISGIS, Liberia 2022 Population and Housing Census
*Refer to appendix 11 for full table

Figure 3.5 compares the mortality experiences of male and female adults. Mortality decreases with age for both male and female adults. Below age 15, female mortality is higher than male mortality but beyond age 15 male adult mortality is higher than female adult mortality at each age. These differences are partly due to gender differences in health behaviours such as smoking, alcohol and drug use and occupational risks which tend to be more common in men and have growing consequences with increasing age. Female adult mortality declines faster than male adult mortality at all ages.

Figure 3.5: Comparison of male and female adult mortality estimates by age



Source: LISGIS, Liberia 2022 Population and Housing Census

Comparison of adult mortality estimate from the 2008 census mortality report with the estimate from the 2022 census data is limited only to proportions of mothers and fathers alive. This is because the 2008 PHC mortality report did not estimate the probability of dying for male and female adults. It only reported on the proportion of mothers and fathers alive. A review of the proportion of mothers and fathers alive

in both the 2008 census mortality report and the 2022 census for ages 10, 15 and 20 only show marginal differences (Table 3.8).

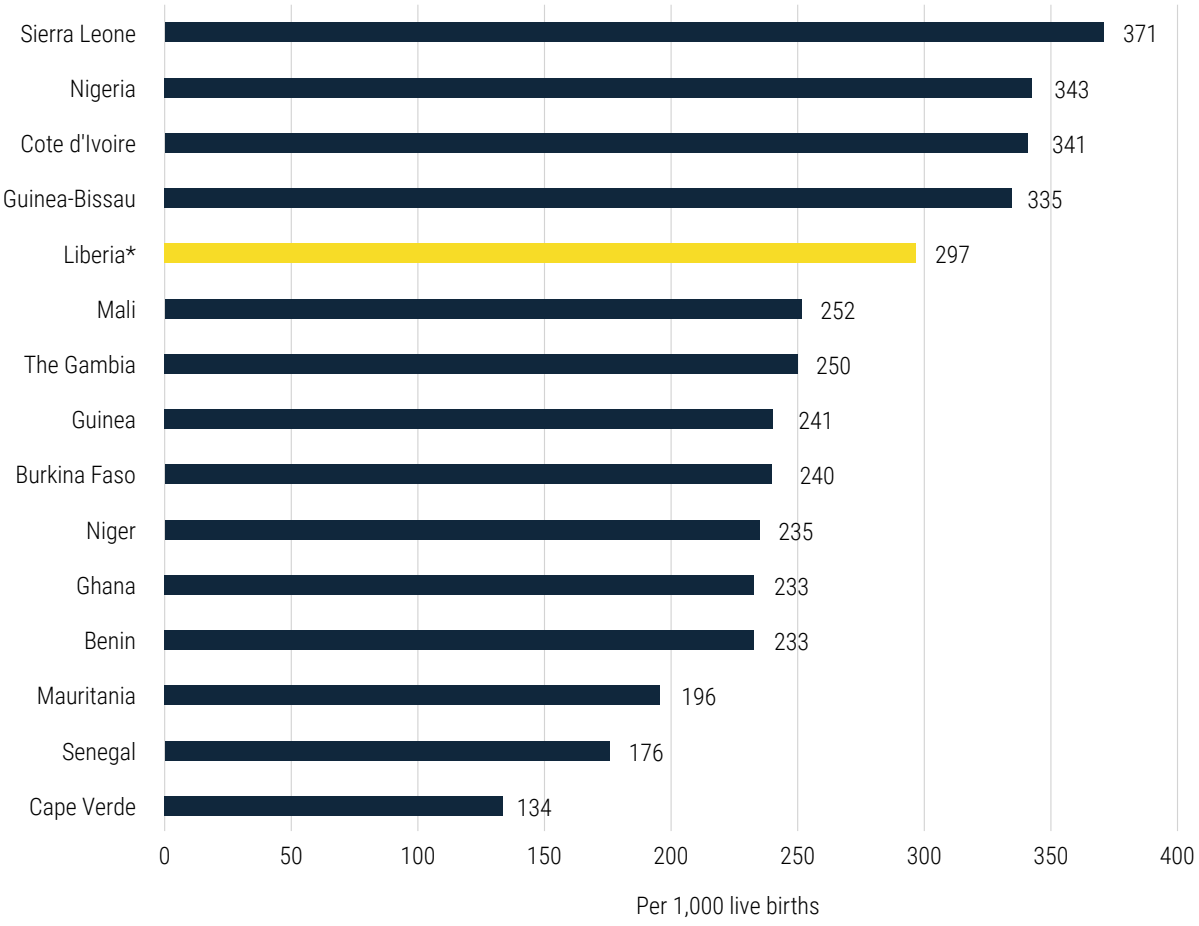
Table 3.8: Comparison of proportion of mothers alive and fathers alive in 2008 and 2022

	Proportion of mothers alive		Proportion of fathers alive	
Age n	2008	2022	2008	2022
10	0.935	0.918	0.917	0.901
15	0.918	0.915	0.857	0.889
20	0.878	0.898	0.781	0.853

Sources: LISGIS, Liberia 2022 Population and Housing Census and 2008 Census

Adult mortality remains high in West Africa ranging from 134 deaths in Cabo Verde to 371 deaths in Sierra Leone in 2019 (Figure 3.6, Appendix Table 11). The adult mortality rate for Liberia estimated from the 2022 LPHC is 297 deaths per 1,000 persons reaching age 15. Of the 15 West African countries, Liberia (297 deaths) ranks the eleventh highest in adult mortality rate.

Figure 3.6: Comparison of adult mortality in West African countries, 2019



Sources: United Nations, Department of Economic and social Affairs, Population Division (2019). World Mortality 2019: Highlights (ST/ESA/SER.A/432)
* Estimate from LPHC, 2022

3.1.5 Maternal mortality

According to WHO, maternal mortality is death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. Maternal mortality ratio (MMR) has been estimated using questions DO5A to DO5C of the 2022 census. MMR is the number of maternal deaths divided by the number of live births multiplied by 100,000. MMRs have been computed for both national and the counties.

Maternal mortality ratio for Liberia

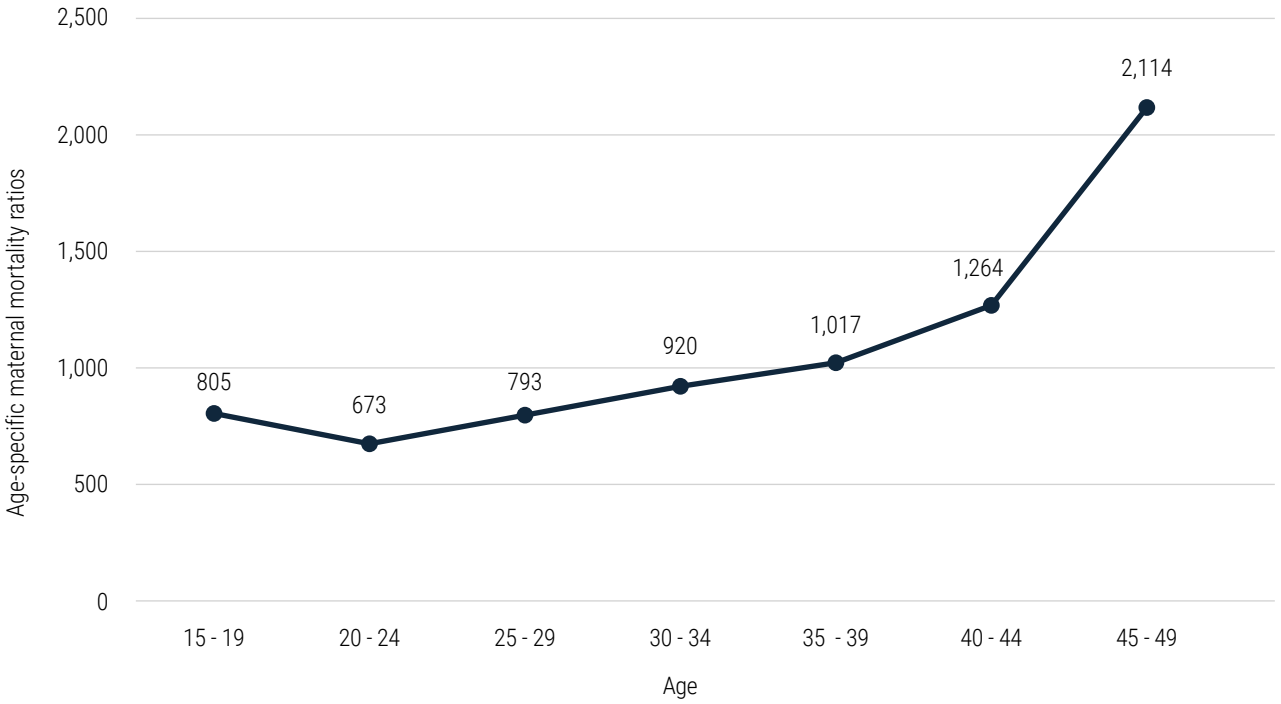
The census provided a rich source of information for estimating maternal mortality. Section six of the census questionnaire is devoted to deaths in the household. Apart from questions on age and sex of death of a member of a household in the 12 months preceding the census, the section also asked specific questions in relation to deaths to females and sought to find out if death to a female was during pregnancy, child birth or within six weeks after end of pregnancy. Table 3.9 presents the general female deaths and pregnancy-related deaths by age. In 2022, about 8 per cent of all deaths to women aged 10-54 years were pregnancy-related. The highest number of pregnancy-related deaths occurred in the age group 20-24 where over 26 per cent of all births also concentrated. The computed MMRs expressed per 100,000 live births are shown in Table 3.9. The MMR for Liberia is 854 deaths per 100,000 live births. It depicts a higher ratio for females 15-19 years than those of age groups 20-24 and 25-29. As noted earlier, women 15-19 are more susceptible to pregnancy-related causes of death than women in older ages because of some factors including undeveloped physiological make-up of young mothers that make them vulnerable to complications in childbirth. MMR increased with age from age group 20-24 years (Figure 3.7).

Table 3.9: General female deaths, pregnancy-related deaths and MMRs by age, 2022

Age group	No. of women	Total number of births	Total female deaths	Total pregnancy-related deaths	Percentage of pregnancy-related deaths	MMRs
15-19	322,844	9,944	601	80	13.3	805
20-24	305,640	16,781	774	113	14.6	673
25-29	227,432	13,487	797	107	13.4	793
30-34	218,837	11,092	838	102	12.2	920
35-39	167,434	7,571	939	77	8.2	1,017
40-44	140,960	3,322	923	42	4.6	1,264
45-49	85,783	804	929	17	1.8	2,114
Total	1,468.93	63,001	5,801	538	9.3	854

Source: LISGIS, Liberia 2022 Population and Housing Census

Figure 3.7: Reported age pattern of maternal mortality, 2022



Source: LISGIS, Liberia 2022 Population and Housing Census

Maternal mortality by locality of residence

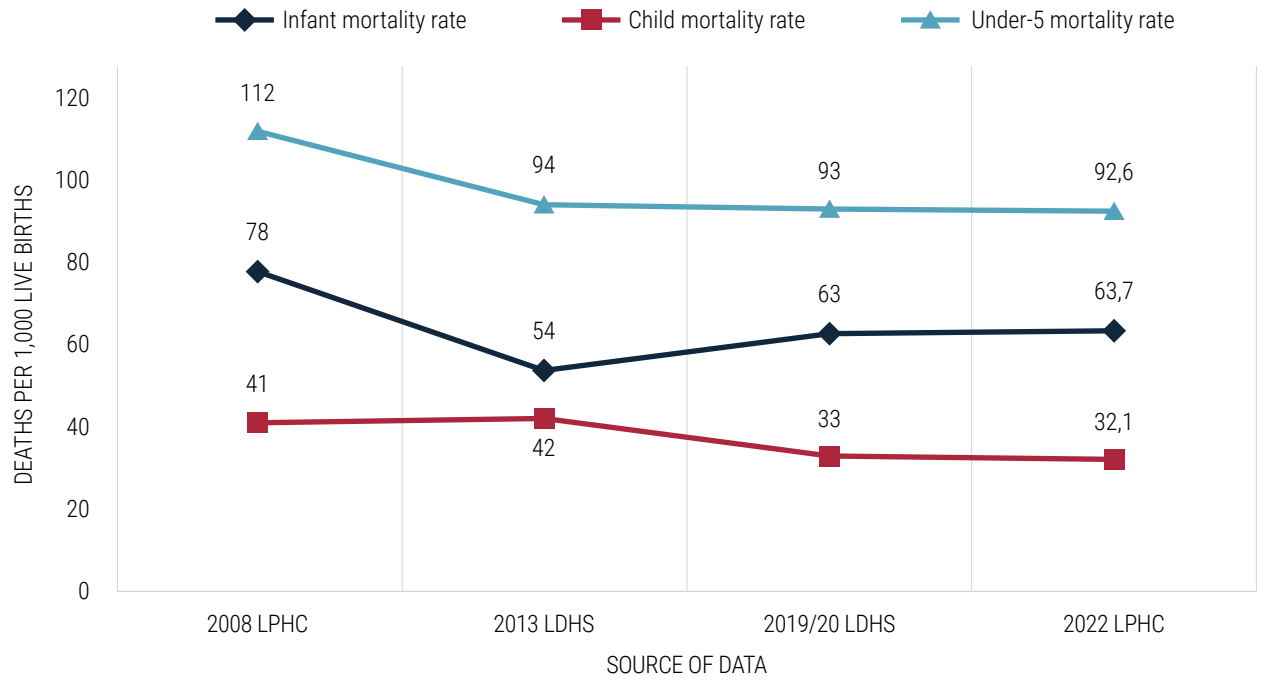
MMRs were computed for urban and rural areas. The ratio for urban in 2022 is 694 deaths per 100,000 live births as against 686 deaths per 100,000 live births in 2008 indicating an increase in maternal mortality in urban areas over the 14 year period. For rural areas, the ratio is 1,024 deaths per 100,000 live births in 2022 compared to 1,057 deaths per 100,000 live births in 2008, a reduction in maternal mortality in the rural areas over the same period.

3.1.6 Trends in childhood and maternal mortality

Trends in childhood mortality

Overall, there has been marked improvement in childhood mortality rates since 2008 (Figure 3.8). Infant and under-five mortality rates declined sharply from 78 per 1,000 live births and 112 deaths per 1,000 live births respectively in 2008 to 54 deaths per 1,000 live births and 94 deaths per 1,000 live births respectively in 2013. Child mortality, however, increased marginally from 41 deaths per 1,000 live births in 2008 to 42 deaths per 1,000 live births in 2013 but declined in 2019/2020 to 33 deaths per 1,000 live births. Infant mortality rose from 54 deaths per 1,000 live births in 2013 to 63 deaths per 1,000 live births in 2019/2020. Under-five mortality had decreased consistently since 2008, though the decrease had been marginal from 2013 to 2022. All the three childhood mortality rates had been relatively stable since 2019/2020.

Figure 3.8: Trends in childhood mortality rates

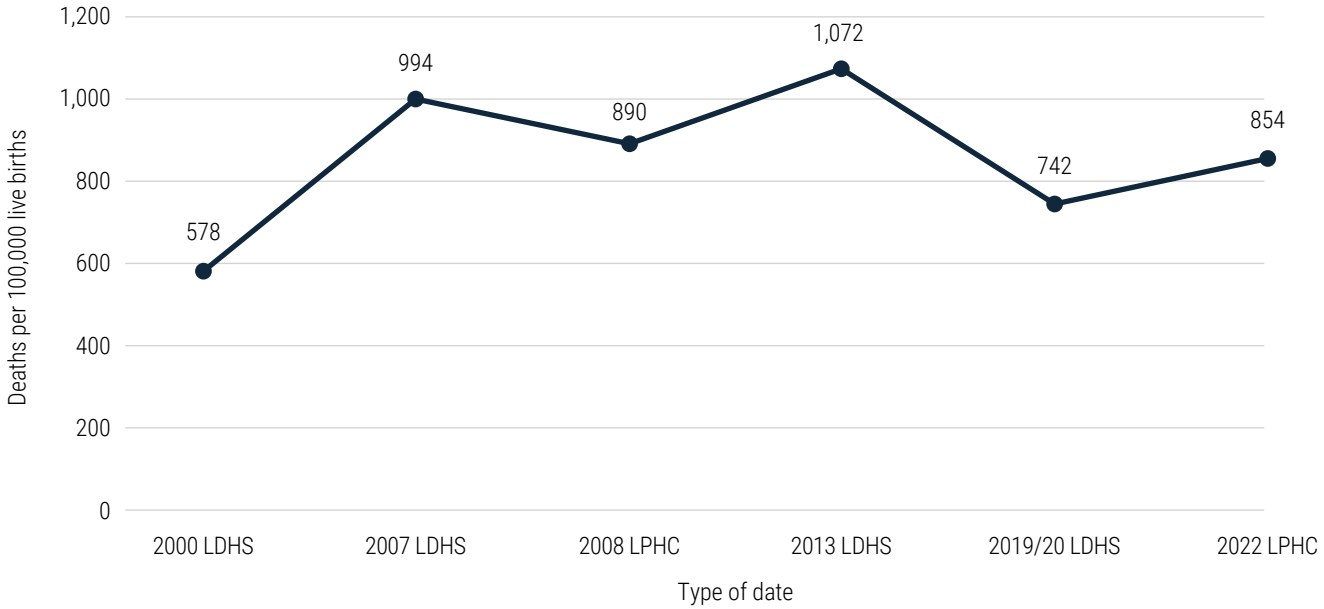


Sources: LISGIS, Liberia 2008, 2022 Population and Housing Census and LDHSs, 2013 and 2019/20

Trends in maternal mortality

The MMR estimated from the censuses and Demographic and Health Surveys from 2000 to 2022 are presented in Figure 3.9. The figures are significantly higher than the World Bank 2020 estimate of 652 maternal deaths per 100,000 live births. The MMR had not shown any consistency between the period 2000 and 2022. It was lowest in 2000 (578 deaths per 100,000 live births) and highest in 2013 (1,072 deaths per 100,000 live births). Over the nine-year period (from 2013 to 2022), maternal mortality declined from 1,072 deaths per 100,000 live births to 854 deaths per 100,000 live births. Compared to the 2019/20 LDHS, however, MMR has increased from 742 maternal deaths per 100,000 live births to 854 maternal deaths per 100,000 live births.

Figure 3.9: Trends in maternal mortality ratios, 2000-2022

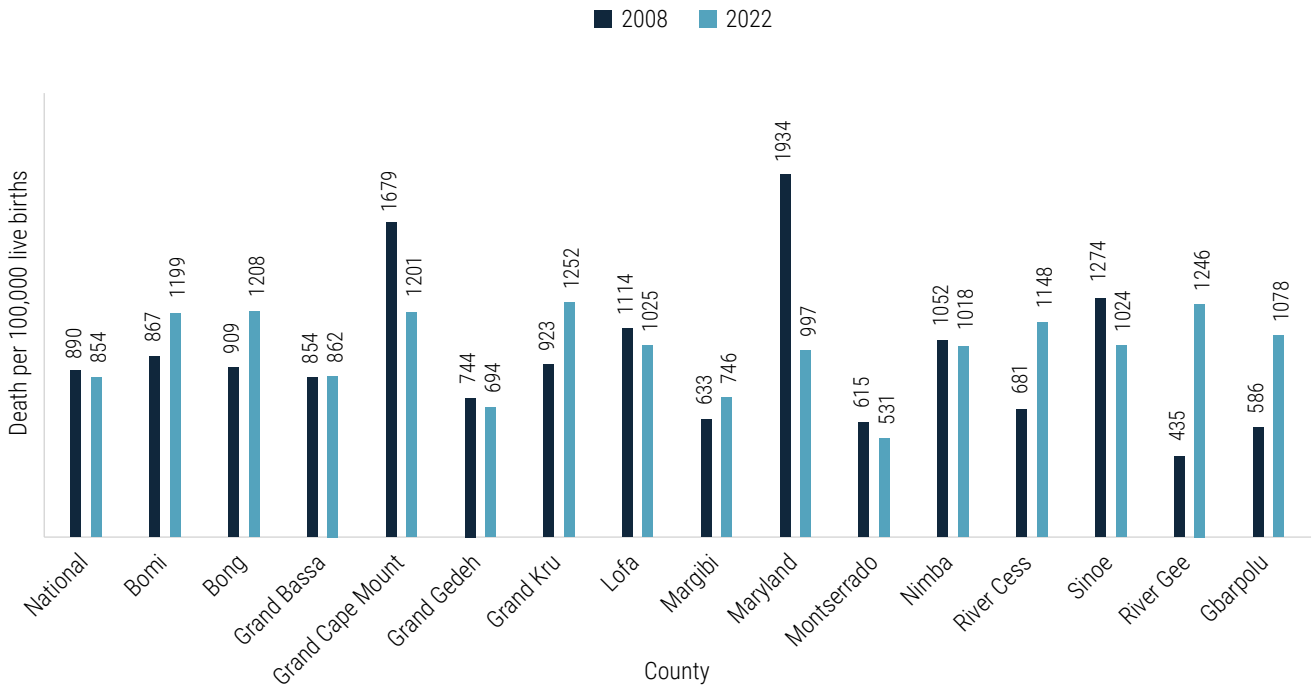


Sources: LISGIS, Liberia 2008, 2022 Population and Housing Census and LDHSs, 2000, 2007, 2013 and 2019/20

Maternal mortality by county

The MMRs for the counties are presented in Figure 3.10 (Appendix Table 12). Of the 15 counties, only seven counties had improvements in their MMRs. Three counties, Grand Gedeh, Margibi and Montserrado had MMRs below the national ratio of 854 deaths per 100,000 live births in 2022. Montserrado had the lowest MMR of 531 deaths per 100,000 live births in 2022. The two counties that had marked improvement in their MMRs were Grand Cape Mount and Maryland. Their MMRs declined markedly from 1,679 deaths per 100,000 live births and 1,934 deaths per 100,000 live births in 2008 to 1,201 deaths per 100,000 live births and 997 deaths per 100,000 live births in 2022 respectively. Findings from the 2022 LPHC show that three counties River Cess, River Gee and Gbarpolu slackened from 681deaths per 100,000 live births, 435 deaths per 100,000 live births and 586 deaths per 100,000 live births in 2008 to as high as 1,148 deaths per 100,000 live births, 1,246 deaths per 100,000 live births and 1,078 deaths per 100,000 live births respectively in 2022.

Figure 3.10: Maternal mortality by county, 2008 and 2022

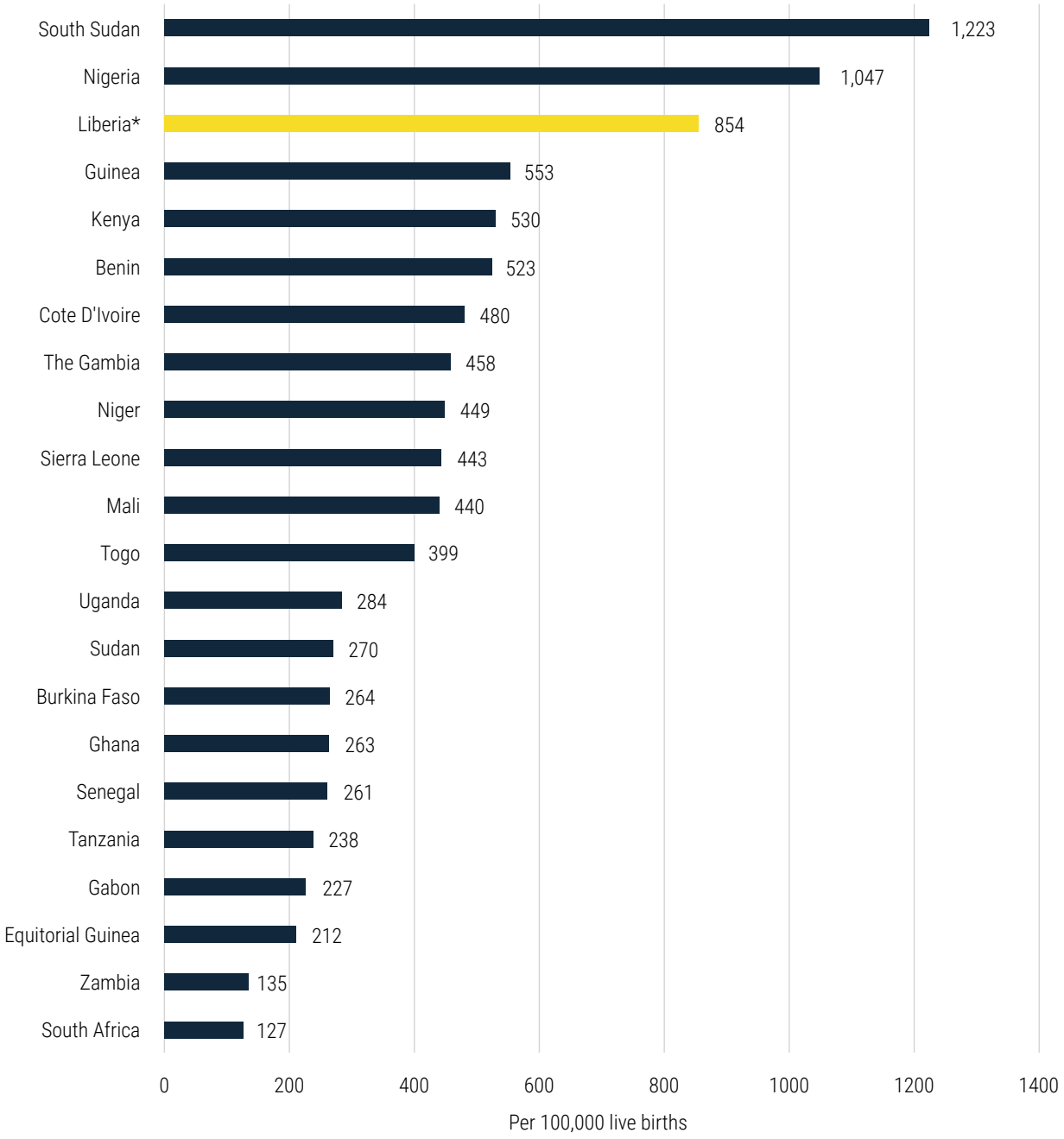


Sources: LISGIS, Liberia 2008 and 2022 Population and Housing Censuses

Comparison of maternal mortality in selected sub-Saharan African countries

Maternal mortality remains high in sub-Saharan African countries. Of the 22 countries listed in Figure 3.11(appendix Table 8), maternal mortality ranges from a high of 127 deaths per 100,000 live births in South Africa to a highest of 1,223 deaths per 100,000 in South Sudan. Of the 22 countries, Liberia (854 deaths per 100,000 live births) is the twentieth worst country in terms of MMR. South Sudan and Nigeria have an MMR of more than 1,000 per 100,000 live births. None of the countries is close to attaining the maternal mortality SDG target of 70 per 100,000 live births.

Figure 3.11: MMRs in selected sub-Saharan African countries, 2020

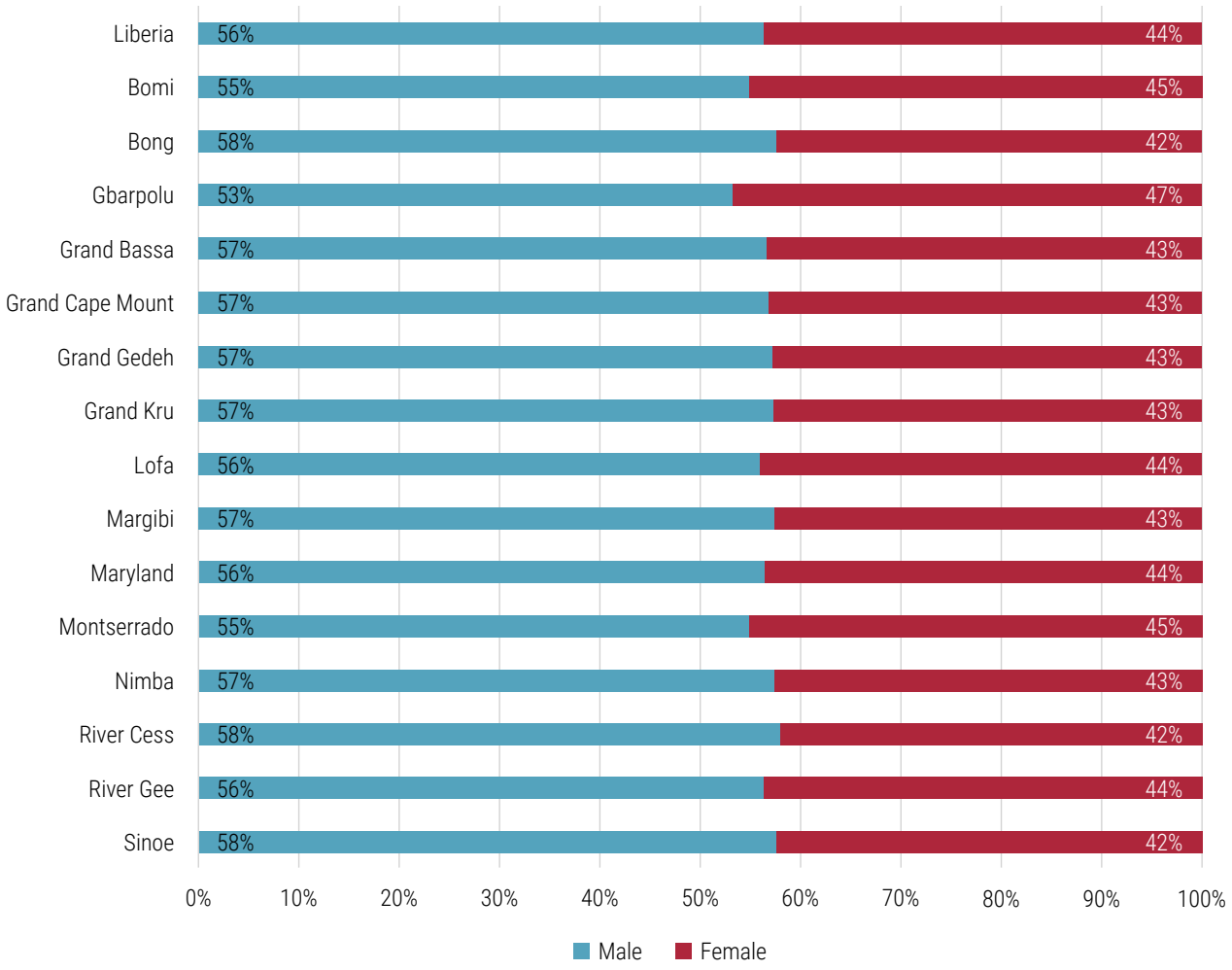


Sources: LISGIS, 2022 LPHC; WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. Trends in Maternal Mortality 2000-2020. Geneva, WHO, 2023

3.1.7 Share of household deaths by county, residence and sex

Figure 3.12 (Appendix Table 13) shows the percentage share of total household deaths occurring 12 months preceding the census night by county and sex. For the total country, males constituted 56 per cent of the household deaths while they form 50.4 per cent of the total population. In each of the counties over 50 per cent of household deaths were males. Sinoe, River Cess and Bong Counties recorded the highest (58 per cent) household deaths.

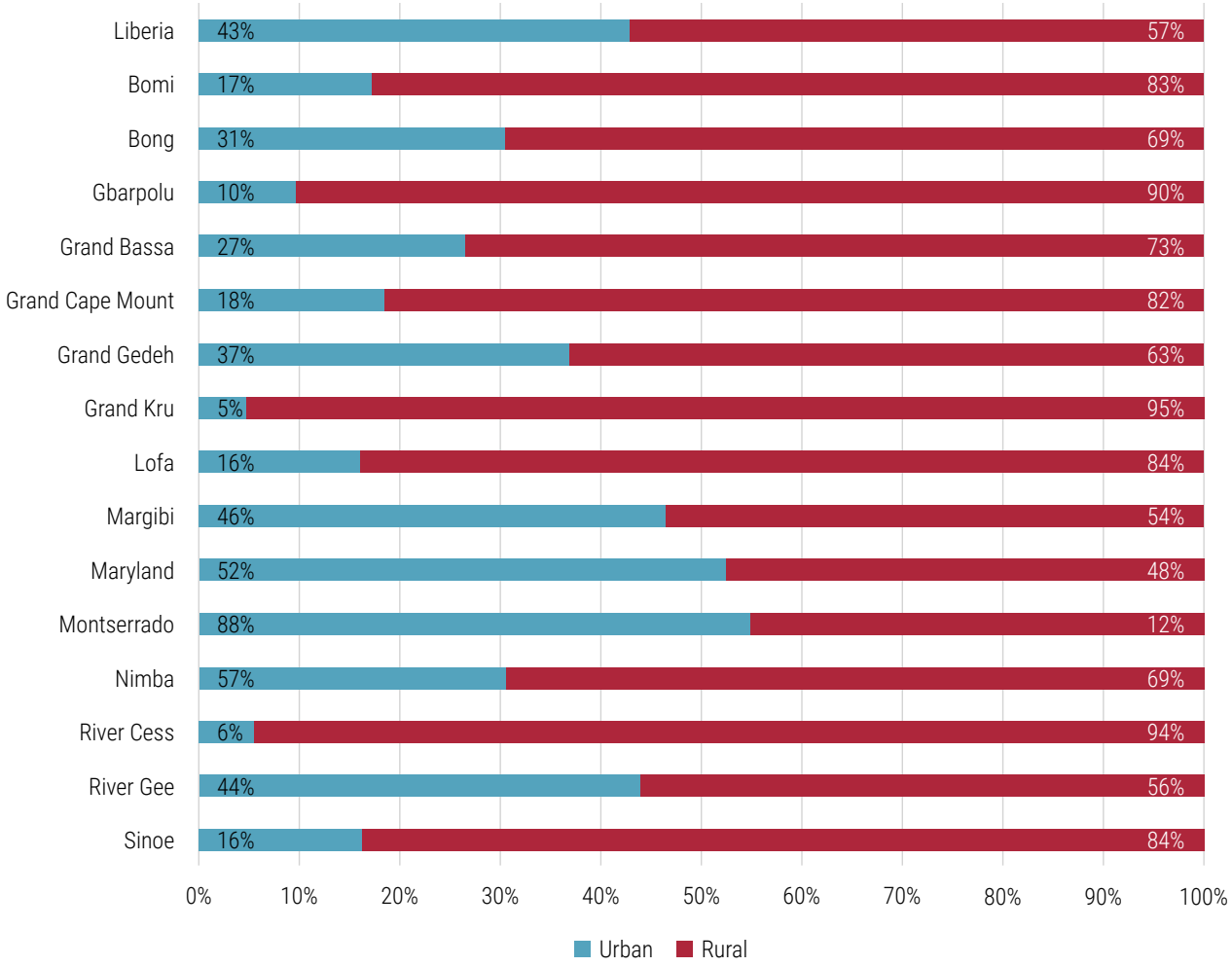
Figure 3.12: Share of total household deaths occurring 12 months preceding the census night by county and sex



Source: LISGIS, Liberia 2022 Population and Housing Census

In terms of total country, about 57 per cent of household deaths occur in the rural areas as against 43 per cent in the urban areas (Figure 3.13, Appendix Table 14). In urban and rural areas of the counties, only two counties, Maryland and Montserrado have a greater share of household deaths occurring in urban areas. While urban areas of Maryland County had 52 per cent of the county's share of household deaths, as high as 88 per cent of all household deaths in Montserrado County occurred in the urban areas. Of the total household deaths occurring in each of the counties, seven counties had less than 20 per cent each occurring in their urban areas. These counties are Gbarpolu (10 per cent), Sinoe (16 per cent), River Cess (6 per cent), Lofa (16 per cent), Grand Kru (5 per cent), Grand Cape Mount (18 per cent) and Bomi (17 per cent).

Figure 3.13: Share of total household deaths occurring 12 months preceding the census night by locality



Source: LISGIS, Liberia 2022 Population and Housing Census

3.1.8 Proportion dead of CEB

Proportions of CD by place of residence and age of mother

Table 3.10 presents the proportions of CD of the CEB to mothers 15-49 years by total country, urban/rural and county. These are rough estimates of child mortality. The proportion of CD was generally higher in age group 15-19 in almost all the geographical areas falling to the lowest in age group 25-29 and thereafter rose. The county with the highest proportion of CD is Bomi (108/1,000 live births) while Grand Gedeh is the county that recorded the lowest proportion of CD (38/1,000 live births).

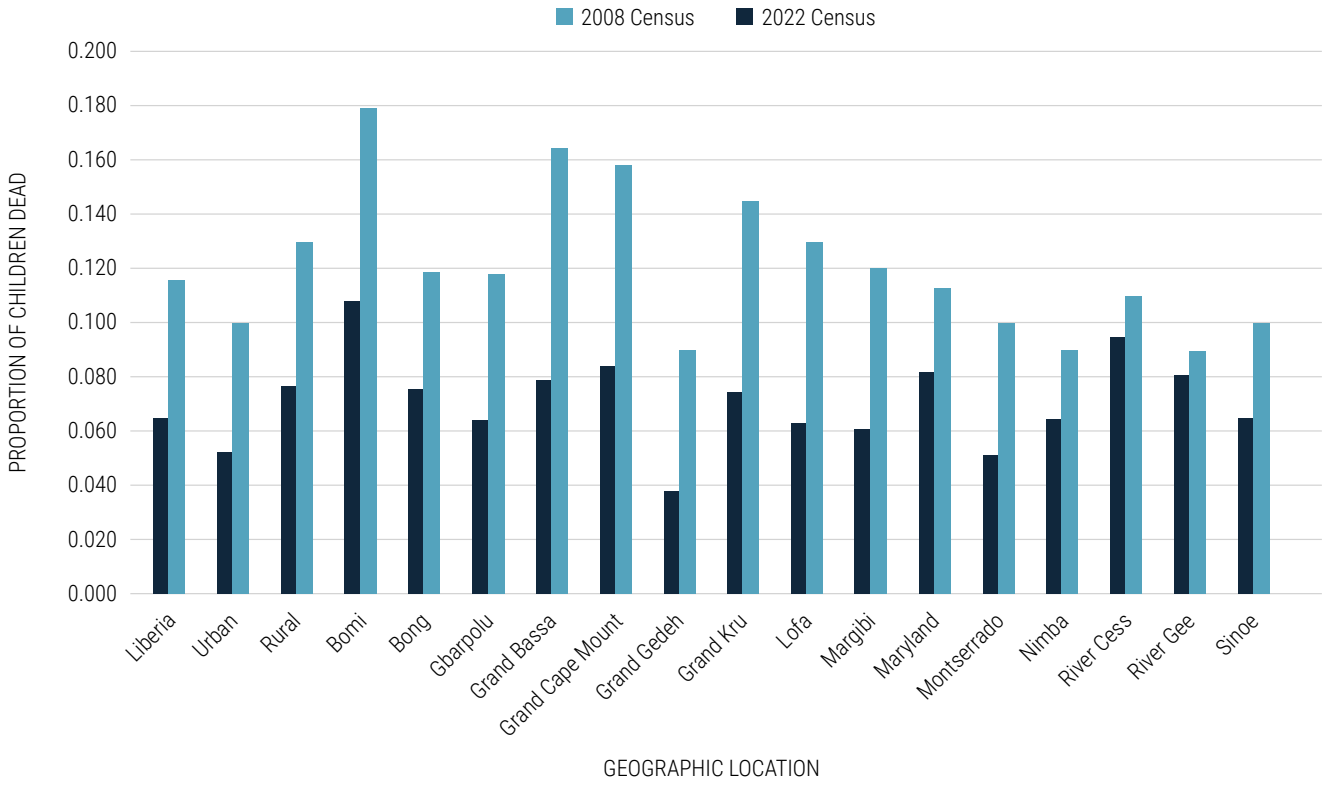
Table 3.10: Proportion of CD of CEB by age, place of residence and county

		Age of mother						
Location	**Total**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**
Liberia	0.065	0.059	0.051	0.050	0.053	0.060	0.076	0.095
Urban	0.052	0.077	0.047	0.041	0.042	0.043	0.049	0.060
Rural	0.077	0.066	0.060	0.059	0.063	0.071	0.090	0.112
Bomi	0.108	0.119	0.100	0.085	0.084	0.105	0.125	0.144
Bong	0.076	0.080	0.063	0.060	0.065	0.068	0.087	0.106
Gbarpolu	0.064	0.056	0.052	0.044	0.052	0.058	0.072	0.104
Grand Bassa	0.079	0.071	0.062	0.066	0.066	0.074	0.089	0.115
Grand Cape Mt	0.084	0.038	0.065	0.070	0.074	0.087	0.108	0.121
Grand Gedeh	0.038	0.031	0.026	0.029	0.033	0.037	0.042	0.052
Grand Kru	0.074	0.032	0.049	0.048	0.065	0.070	0.091	0.111
Lofa	0.063	0.065	0.055	0.047	0.053	0.061	0.076	0.086
Margibi	0.061	0.051	0.053	0.049	0.049	0.052	0.073	0.088
Maryland	0.082	0.047	0.049	0.051	0.064	0.083	0.094	0.126
Montserrado	0.051	0.052	0.044	0.043	0.043	0.047	0.059	0.074
Nimba	0.064	0.051	0.039	0.044	0.052	0.060	0.076	0.102
River Cess	0.095	0.075	0.056	0.076	0.075	0.083	0.114	0.143
River Gee	0.081	0.057	0.062	0.055	0.063	0.075	0.094	0.116
Sinoe	0.065	0.050	0.051	0.052	0.051	0.063	0.073	0.093

Source: LISGIS, 2022 LPHC

The proportion of CD recorded in 2022 in all the geographical locations of Liberia was lower than those recorded in these same locations in 2008 (Figure 3.14, Appendix Table 15). This gives an indication that there had been an improvement in childhood mortality.

Figure 3.14: Proportion of CD by place of residence and county, 2008 and 2022

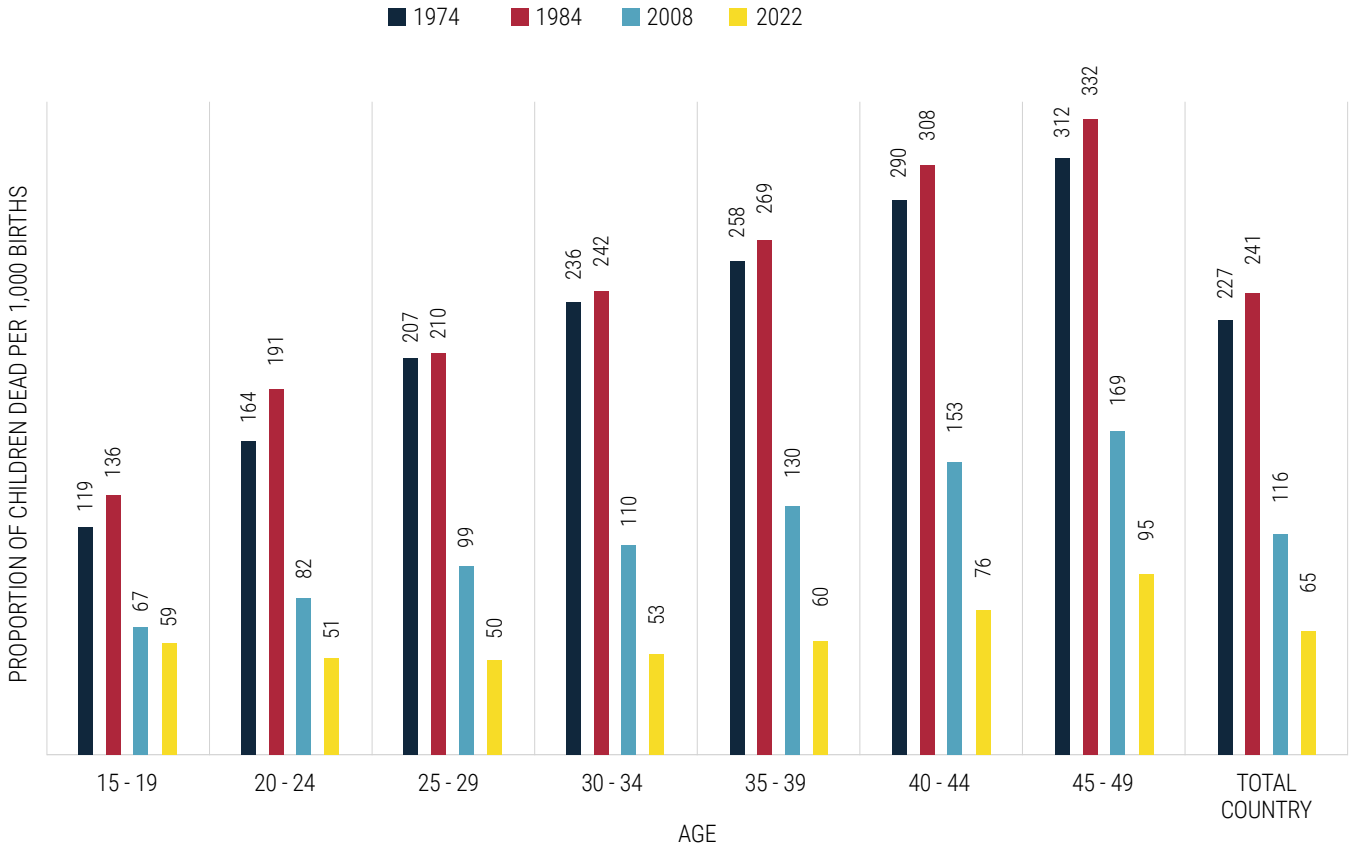


Source: LISGIS, 2008 and 2022 LPHCs

Patterns and trends in proportion of CD

Figure 3.15 shows the pattern and trends in the proportion of CD from 1974 to 2022. In Liberia as a whole, the proportion of CD had decreased by about 27 per cent from 241 deaths per 1,000 births in 1984 to 65 deaths per 1,000 births in 2022. The general pattern is that the proportion of CD increases with age. However, in 2022 the proportion of dead decreased from age 15-19 through to age 30-34 before increasing with age. The proportion of CD was highest in 1984. Since then the proportion of CD had fallen for all age groups, with 15-19 recording the highest percentage decrease of about 43 per cent.

Figure 3.15: Reported child mortality experiences in Liberia by age of mother, 1974-2022



Sources: LISGIS. 1974, 1984, 2008 and 2022 LPHCs

3.2 Indirect estimation of mortality

The census solicited responses from women 10-54 years on children they have ever given birth to and how many children have been born alive. These questions allowed for the estimation of childhood mortality through indirect procedures. The specific indirect procedure used was the Trussell variant of the Brass method[20] which uses data on CEB and CS by age of mother 15-19, 20-24, 25-29, etc., to derive the proportion dead among CEB. The information on proportion of CD of the CEB can yield reasonable estimates of childhood mortality and trends. The proportions dead were converted to probabilities of dying *q1*, *q2*, *q3*, *q5* and *q10* using a set of multipliers (Ki) computed from the average parities of women in the age group 15-19, 20-24 and 25-29 and a given set of co-efficient. The basic form of the equation is given as:

$q(x) = K(i) \times D(i)$

where, *K(i)* is the multiplier, which adjusts for non-mortality factors affecting the value *D(i)*,

D(i) = denote proportion dead among CEB among women in successive five-year age groups, where *i=1* represents 15-19, *i=2* denotes 20-24, etc.

K(i) is derived from the following estimation equation:

$K(i) = a(1+ b(i) \times P(1)/P(2) + c(i) \times P(2)/P(3),$

Where, *P(i)* is the parity or average number of CEB reported by women in age group *i*

The time locations of the estimated probabilities are also obtained using a similar procedure:

$t(i) = a(i) + b(i) \times P(1)/ P(2) + c(i) \times P(2)/ P(3).$

The relationship between the proportions of CD and the *q(x)* function is determined by the association

20 United Nations. United Nations Manual X. Indirect Techniques for Demographic Estimation. Pp73-81

between the duration of exposure to the risk of dying and the mother's age and timing of childbearing. The UNFPA-IUSSP Excel spread sheet[21], PAS, and MORTPAK software possess the relevant attributes to incorporate the above formulas to produce the mortality estimates and construct life tables.

3.2.1 Assumptions

The method assumes that the risk of a child dying is a function only of the child's age and no other factors such as mother's age or birth order of the child. However, in reality children of young mothers, especially those giving birth for the first time, experience higher mortality than older women because of their undeveloped physiology and inadequate care and attention to their newborn babies compared to older women. Therefore, mortality estimated based on reports of women aged 15-19 are generally disregarded. They are also disregarded because the number of children born and dead to this group of women is small. Therefore, using children from younger women would lead to overestimation of overall mortality levels. Again mortality indices based on reports of women aged 20-24 years might also be overestimated, since a proportion of their children would have been born when they (mothers) were aged 15-19 years. On the other hand, older women are more prone to omissions and other errors than younger women and as a result may underestimate the number of CEB particularly dead children. Therefore, estimates derived from women aged 40 years and above are also affected by omission errors. Given the upward and downward biases that usually distort the estimates based on reports of the younger women and the older women (age 40 and above years) respectively, data from the two extremes tend to be regarded as inaccurate and were therefore, excluded from the calculation of the mortality estimates.

3.2.2 Reliable estimates

Based on the assumptions in section 3.2.1, the only estimate that offers reliability for childhood mortality estimates is under-five mortality (q(5)). Irrespective of the model to which the Brass method is applied, the errors that will affect the resulting q(5) (under-five mortality) estimates are more likely to be smaller in absolute and relative terms than those that would affect q(1) (infant mortality) and q (4) (child mortality). In other words, q (5) is more stable than q(1) and q (4). Under-five mortality (q (5)) is therefore, considered a robust indicator of childhood mortality when it is estimated by the Brass method.

3.2.3 Indirect estimates of infant and under-five mortality

The estimation of childhood mortality using the Coale-Trussell techniques requires knowledge of the pattern of mortality that best fits the data being analysed. As a consequence of lack of adequate data to determine the pattern, model life tables are used. The choice of appropriate and suitable model life table is essential for two reasons. First, the age pattern of mortality influences the probability of dying before exact age x (xq0). It may, therefore, affect the indirect estimation of infant mortality to be computed. Second, the use of multipliers for converting the proportion of CD into probabilities of dying in the Coale-Trussell technique demands knowledge of the mortality pattern to guide the selection of appropriate multipliers. Many types of model life tables have been developed including the United Nations sets, the Brass Model Logit Life Table System and the Princeton Regional Model Life Tables or the Coale-Demeny Model Life Tables. The Coale-Demeny Model Life Table has four families, the North, South, East and West. The South family was chosen for the estimation of the childhood mortality because Liberia's mortality is characterized by high under-five mortality, high mortality over age 65 and low adult mortality. The mortality estimation based on the Trussell's version of the Coale and Demeny model life table for infant and under-five mortality for both sexes is presented in Tables 3.10 and 3.11 respectively. The estimates were derived using the QFIVE application in the MORTPAK software.

Based on the estimates, the infant mortality for both sexes was derived by averaging the values of the South model for women in the age group 25-39 years. This produced an estimate of 47 infant deaths per 1,000 live births for the reference period February 2014–March 2018 (Table 3.11). The indirect estimate of 47 infant deaths per 1,000 live births compares favourably with the United Nations Projections for 2022 for Liberia of 48.3 infant deaths per 1,000 live births (United Nations, World Population Prospects, 1950-2023)[22].

21 http://demographicestimation.iussp.org/content/indirect-estimation-child-mortality
22 https://www.macrotrends.net/countries/LBR/liberia/infant-mortality-rate

Table 3.11: Indirect estimates of IMR (1q0) by applying the Trussell's equations

	Average number of								
Age of mother	Children ever born	Children surviving	Proportion dead	Age	Reference date	West	North	East	South
15-19	0.242	0.228	0.058	1	2021.3	0.047	0.044	0.050	0.042
20-24	0.904	0.858	0.051	2	2020.0	0.045	0.040	0.047	0.045
25-29	1.794	1.705	0.050	3	2018.3	0.042	0.037	0.045	0.044
30-34	2.654	2.513	0.053	5	2016.3	0.043	0.038	0.046	0.046
35-39	3.631	3.412	0.060	10	2014.2	0.045	0.040	0.050	0.051
40-44	4.307	3.981	0.076	15	2011.8	0.051	0.045	0.058	0.059
45-49	4.976	4.503	0.095	20	2008.8	0.057	0.049	0.066	0.067

Source: Computed from LISGIS, Liberia 2022 Population and Housing Census

The indirect estimate of under-five mortality rate based on the Trussell's equations is 56 deaths per 1,000 live births (Table 3.12).

Table 3.12: Indirect estimates of under-five mortality rate (5q0) by applying the Trussell's equations

	Average number of								
Age of mother	Children ever born	Children surviving	Proportion dead	Age	Reference date	West	North	East	South
15-19	0.242	0.228	0.058	1	2021.3	0.061	0.064	0.059	0.050
20-24	0.904	0.858	0.051	2	2020.0	0.057	0.057	0.056	0.053
25-29	1.794	1.705	0.050	3	2018.3	0.053	0.052	0.052	0.052
30-34	2.654	2.513	0.053	5	2016.3	0.054	0.053	0.054	0.055
35-39	3.631	3.412	0.060	10	2014.2	0.058	0.057	0.059	0.062
40-44	4.307	3.981	0.076	15	2011.8	0.067	0.065	0.070	0.073
45-49	4.976	4.503	0.095	20	2008.8	0.076	0.072	0.081	0.086

Source: Computed from LISGIS, Liberia 2022 Population and Housing Census

3.3 Construction of empirical model life tables

3.3.1 Empirical model life tables

A life table is simply a convenient way of analysing ASDRs. The ASDRs are the only raw data input. These are calculated from the mid-year age distribution of the population and deaths. In constructing the life table, the first column calculated is the qx which gives the probability of dying between exact age x and x+1. The qxs column is calculated from the ASDRs (denoted by Mxs) through the application of some adjustment factors. The rest of the columns are then generated directly or indirectly from the qx column. The software used for the construction of the life tables included the MORTPAK, the LTPOPDTH, the Growth Balance Equation plus LTPOPDTH and the LTMXQXAD (US Census Bureau, 1994).

Using these applications, five sets of life tables were constructed from observed ASDRs and population by age based on the data collected in the 2022 census. Depending on the procedure, the ASDRs or

the number of deaths were adjusted and used to construct the life tables. The life expectancies from the different life tables are shown in Table 3.13 and the procedures and data input are briefly described in appendix B.

Table 3.13: Estimates of life expectancy

	Life expectancy at birth	
Estimates based on:	Male	Female
Procedure 1	45.7	48.3
Procedure 2	45.9	49.2
Procedure 3	44.1	49.2
Procedure 4	55.6	61.2
Procedure 5	65.7	69.2

Sources: Derived estimates based on the 2022 Census
Procedure 1. Reported ASDRs (MORTPAK)
Procedure 2. Reported ASDRs and population by age (LTPOPDTH)
Procedure 3. Brass General Growth Balance Equation method to adjust the reported number of deaths (LTPOPDTH)
Procedure 4: Reported ASDRs and adjusted mx values (LTMXQXAD)
Procedure 5: Reported ASDRs and adjusted mx values (MORTPAK)

The estimates for procedure 4 (LTMXQXAD) were adjudged to represent the life expectancy of Liberia considering their life expectancy in 2008 (males 51.6 and females 53.9). On the basis of this, life tables have been generated for Liberian males, females, both sexes, urban males, urban females, urban both sexes, rural males, rural females and rural both sexes. The life tables for Liberian males, females and both sexes have been presented in Tables 3.14 to 3.16. (The rest are in appendix Tables 16-21).

Table 3.14: Empirical model life table for Liberia, both sexes

Age x	nMx	nqx	lx	Ndx	nLx	5Px	Tx	ex
0	0.054	0.051	100,000	5,129	94,871	0.936	5,801,286	58.0
1-4	0.009	0.034	94,871	3,262	372,960	0.972	5,706,416	60.1
5-9	0.003	0.015	91,609	1,351	454,668	0.988	5,333,455	58.2
10-14	0.002	0.010	90,258	892	449,060	0.987	4,878,787	54.1
15-19	0.003	0.015	89,366	1,375	443,391	0.981	4,429,727	49.6
20-24	0.004	0.022	87,991	1908	435,183	0.977	3,986,336	45.3
25-29	0.005	0.023	86,082	2010	425,387	0.976	3,551,154	41.3
30-34	0.005	0.025	84,073	2,121	415,061	0.973	3,125,766	37.2
35-39	0.006	0.029	81,952	2,377	403,817	0.967	2,710,705	33.1
40-44	0.008	0.037	79,575	2,946	390,511	0.958	2,306,888	29.0
45-49	0.010	0.047	76,629	3,570	374,221	0.942	1,916,378	25.0
50-54	0.014	0.069	73,059	5,038	352,702	0.920	1,542,157	21.1
55-59	0.019	0.092	68,021	6,277	324,416	0.883	1,189,455	17.5
60-64	0.031	0.143	61,745	8,849	286,603	0.819	865,039	14.0

Age x	nMx	nqx	lx	Ndx	nLx	5Px	Tx	ex
65-69	0.051	0.226	52,896	11,932	234,650	0.718	578,436	10.9
70-74	0.086	0.354	40,964	14,493	168,586	0.570	343,786	8.4
75-79	0.151	0.547	26,470	14,490	96,128	0.451	175,200	6.6
80+	0.152	1.000	11,981	11,981	79,072		79,072	6.6

Source: Computed from LISGIS, Liberia 2022 Population and Housing Census

Table 3.15: Empirical model life table for Liberia, Males

Age x	nMx	nqx	lx	Ndx	nLx	5Px	Tx	ex
0	0.106	0.096	100,000	9,552	90,448	0.885	5,559,440	55.6
1-4	0.014	0.055	90,448	4,935	351,923	0.959	5,468,992	60.5
5-9	0.003	0.015	85,513	1,305	424,304	0.987	5,117,069	59.8
10-14	0.002	0.010	84,208	883	418,835	0.986	4,692,765	55.7
15-19	0.004	0.018	83,326	1,494	412,894	0.978	4,273,930	51.3
20-24	0.005	0.026	81,832	2,134	403,826	0.976	3,861,036	47.2
25-29	0.004	0.021	79,698	1,707	394,225	0.978	3,457,210	43.4
30-34	0.005	0.023	77,992	1,765	385,545	0.976	3,062,985	39.3
35-39	0.005	0.026	76,226	1967	376,214	0.971	2,677,440	35.1
40-44	0.006	0.032	74,259	2,361	365,393	0.964	2,301,226	31.0
45-49	0.008	0.039	71,898	2,830	352,416	0.951	1,935,833	26.9
50-54	0.012	0.059	69,068	4,070	335,165	0.932	1,583,417	22.9
55-59	0.016	0.079	64,998	5,108	312,219	0.901	1,248,252	19.2
60-64	0.026	0.121	59,890	7,247	281,332	0.849	936,033	15.6
65-69	0.041	0.186	52,643	9,776	238,775	0.770	654,701	12.4
70-74	0.066	0.284	42,867	12,156	183,945	0.654	415,927	9.7
75-79	0.110	0.432	30,711	13,273	120,375	0.481	231,982	7.6
80+	0.156	1.000	17,439	17,439	111,607		111,607	6.4

Source: Computed from LISGIS, Liberia 2022 Population and Housing Census

Table 3.16: Empirical model life table for Liberia, Females

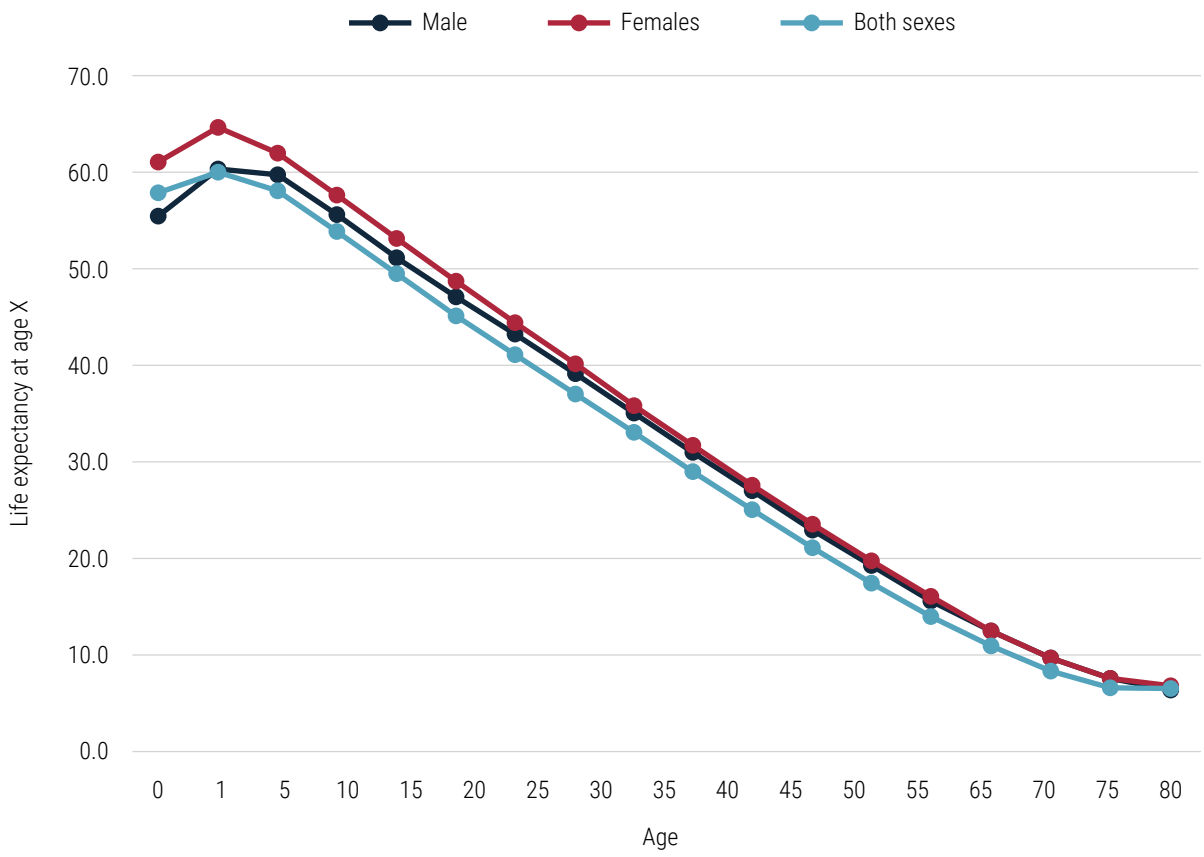
Age x	nMx	nqx	lx	ndx	nLx	5Px	Tx	ex
0	0.074	0.069	100,000	6,921	93,079	0.923	6,117,307	61.2
1-4	0.006	0.022	93,079	2035	368,247	0.981	6,024,227	64.7
5-9	0.002	0.011	91,044	1,040	452,622	0.990	5,655,980	62.1
10-14	0.002	0.008	90,005	720	448,224	0.991	5,203,358	57.8
15-19	0.002	0.011	89,285	979	443,977	0.987	4,755,134	53.3
20-24	0.003	0.015	88,306	1,299	438,281	0.984	4,311,157	48.8
25-29	0.003	0.017	87,007	1,482	431,327	0.982	3,872,876	44.5
30-34	0.004	0.019	85,524	1,623	423,564	0.979	3,441,549	40.2
35-39	0.004	0.022	83,901	1,851	414,879	0.974	3,017,985	36.0
40-44	0.006	0.029	82,050	2,419	404,204	0.967	2,603,106	31.7
45-49	0.007	0.036	79,631	2,880	390,957	0.957	2,198,902	27.6
50-54	0.010	0.051	76,751	3,922	373,952	0.940	1,807,946	23.6
55-59	0.014	0.069	72,829	5,002	351,643	0.912	1,433,993	19.7
60-64	0.023	0.108	67,828	7,318	320,844	0.860	1,082,351	16.0
65-69	0.038	0.175	60,510	10,606	276,034	0.776	761,507	12.6
70-74	0.066	0.284	49,904	14,161	214,117	0.648	485,473	9.7
75-79	0.115	0.447	35,743	15,961	138,814	0.488	271,356	7.6
80+	0.149	1.000	19,782	19,782	132,542		132,542	6.7

Source: Computed from LISGIS, Liberia 2022 Population and Housing Census

3.3.2 Estimation of life expectancy

Life expectancy is the average number of additional years a person aged x in a given year expects to live if the current age-specific deaths rates remain the same throughout the lifetime of the person. The most commonly used is life expectancy at birth (e00). It is a summary measure of the mortality experiences of a country's population. It is an important indicator of a country's health status. Unlike infant and child mortality, which focus on mortality at a young age, life expectancy estimates mortality along the entire life course. High life expectancy indicates increasing longevity and vice versa. The indicator differs considerably by age, sex and geographic location. Therefore, life expectancy has been computed for males, females, both sexes, urban males, urban females, rural males and rural females. Each category's expectation of life is presented in the e00 column of the particular category's life table (see Tables 3.14-3.16 and appendix Tables 16-21). The life expectancies for Liberian sexes, males, and females, are presented in Tables 3.14-3.16 and Figure 3.16 (Appendix Table 22). Overall, the life expectancy at birth for Liberians (both sexes) is 58 years, with male and female life expectancies of 55.6 years and 61.2 years respectively. The life expectancies show sex differences in the pattern of mortality by age. The expectation of life is highest at age one for both sexes rather than zero indicating that life before age one is very critical. Thereafter, life expectancy declines as a result of ageing. For instance, at age 10, life expectancy is 54.1years while it reduces to 29 years at age 40.

Figure 3.16: Life expectancy by age and sex



Source: LISGIS, Liberia 2022 Population and Housing Census

Table 3.17 presents the summary indicators of life expectancy at birth. Life expectancy is higher for urban females (59.1 years) than urban males (56.4 years). Rural females have higher life expectancy of 55.8 years as against their rural males of 54.2 years (see appendix for details).

Table 3.17: Summary indicators of life expectancy at birth

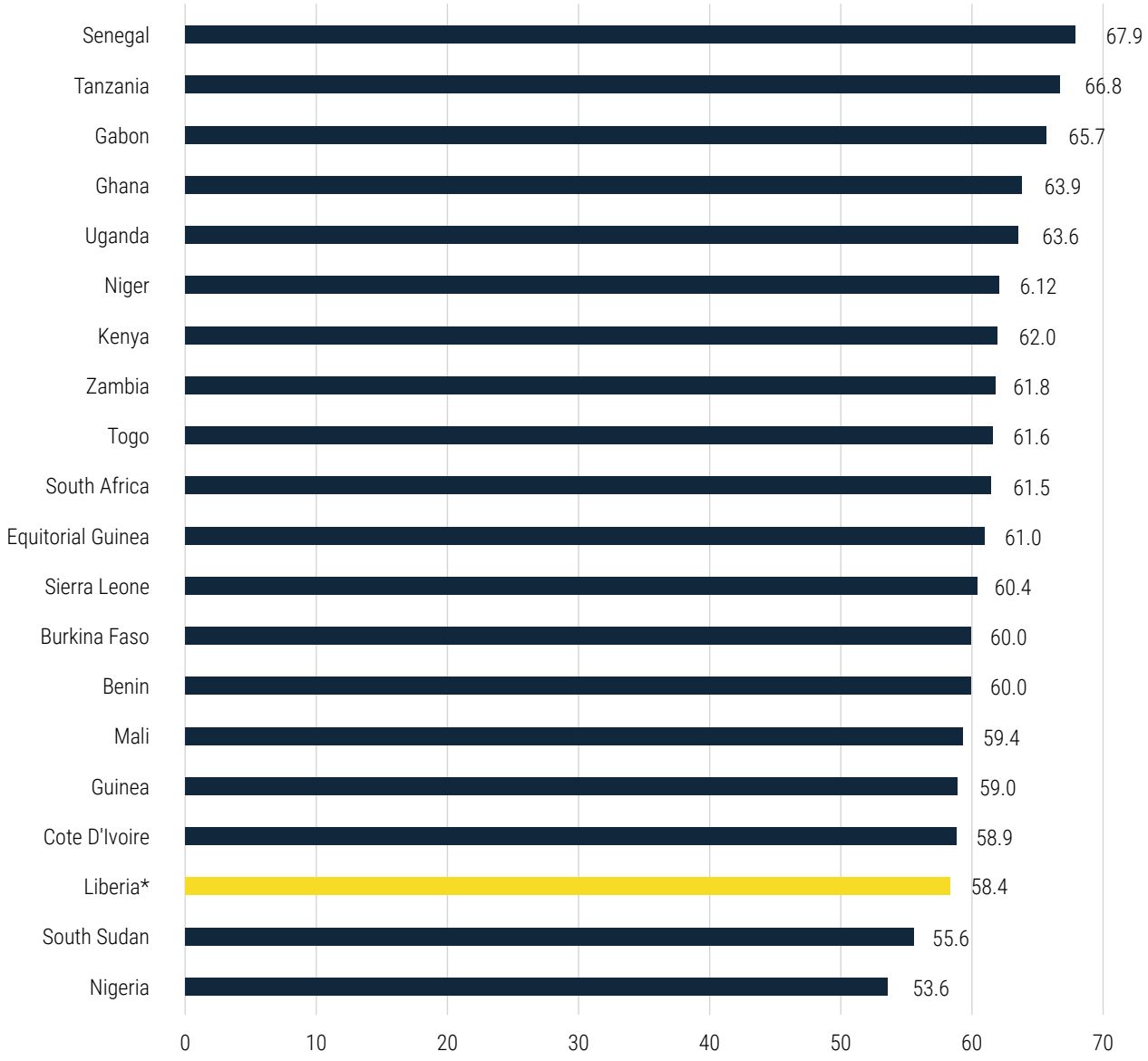
Category	Life expectancy at birth
National	
Both sexes	58.0
Males	55.6
Females	61.2
Locality of residence	
Urban males	56.4
Urban females	59.1
Rural males	54.2
Rural females	55.8

Source: LISGIS, Liberia 2022 Population and Housing Census

Comparison of life expectancy at birth of Liberia with selected sub-Saharan African Countries

Life expectancy at birth is relatively low in sub-Saharan Africa as shown in Figure 3.17 (Appendix Table 23). Of the 22 countries listed, Senegal has the highest of 67.9 years while Nigeria has the lowest of 53.6 years. Liberia is the third lowest out of the 22 countries with life expectancy of 58.4 years

Figure 3.17: Life expectancy at birth in selected sub-Saharan African countries



Sources: World Population Prospects, 2022 and Liberia 2022 Population and Housing Census

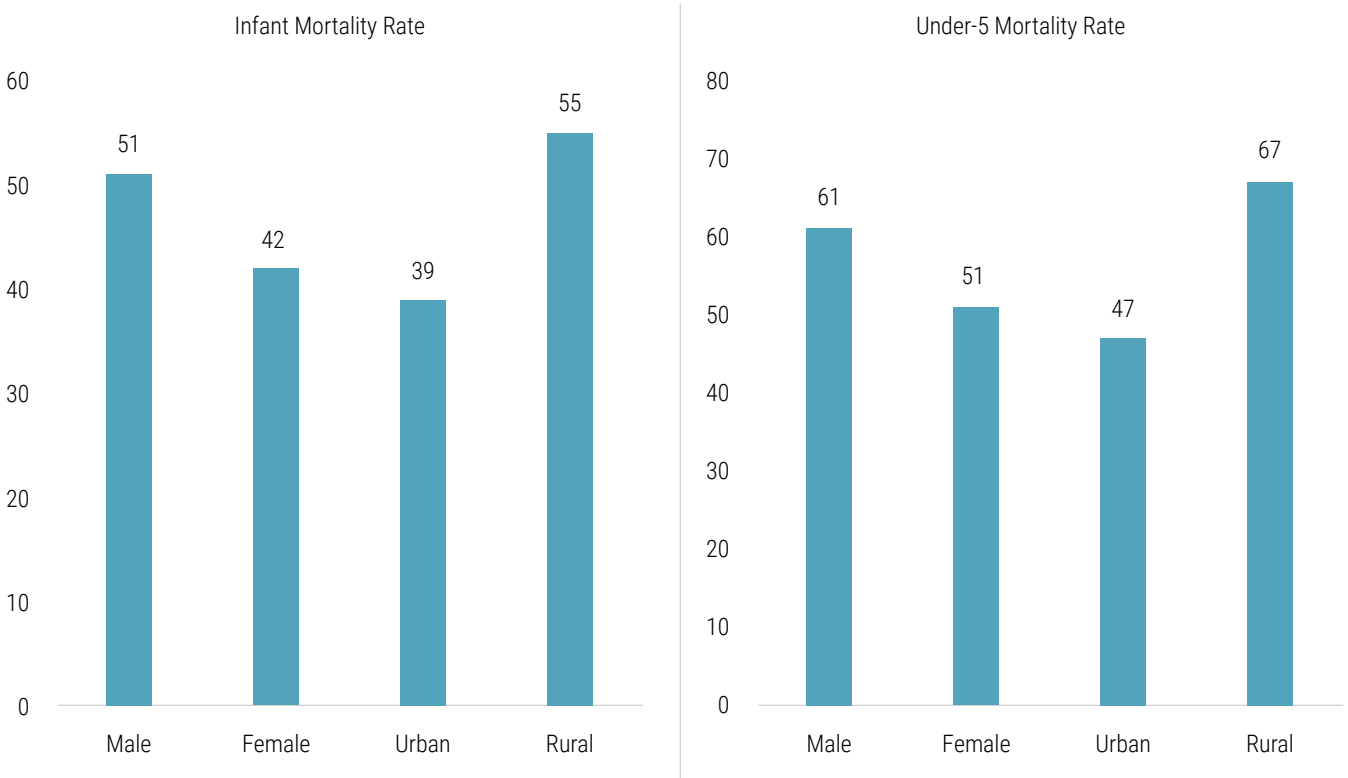
4. Demographic and socioeconomic differentials in mortality

In this chapter, infant and under-five mortality differentials are examined by key demographic and socioeconomic factors. It has been established that a number of demographic and socioeconomic factors exert influence on mortality (Shryock and Siegel, 2004). Specific factors documented to have influence on mortality and which have been examined in this chapter are sex, locality of residence, region (county), marital status, mother's level of education, literacy of mother and mother's level of wealth. These factors have been used as independent variables on infant and under-five mortality. The key demographic and socioeconomic factors influencing mortality are presented in Appendix Table 25.

4.1 Sex

Figure 4.1 (appendix Table 25) shows that infant and under-five mortality is higher for males than for females. Male infant and under-five mortality rates of 51 per 1,000 live births and 61 per 1,000 live births respectively were higher than 42 infant deaths per 1,000 live births and 51 under-five deaths per 1,000 live births for their female counterparts. As expected, the mortality differentials are explained by sex differences in genetic and biological make-up, with male infants/boys being biologically weaker and more prone to diseases and premature death. Males are more likely to be born prematurely and to suffer from respiratory conditions in the perinatal period than females.

Figure 4.1: Sex and locality differentials in mortality



Source: LISGIS, Liberia 2022 Population and Housing Census

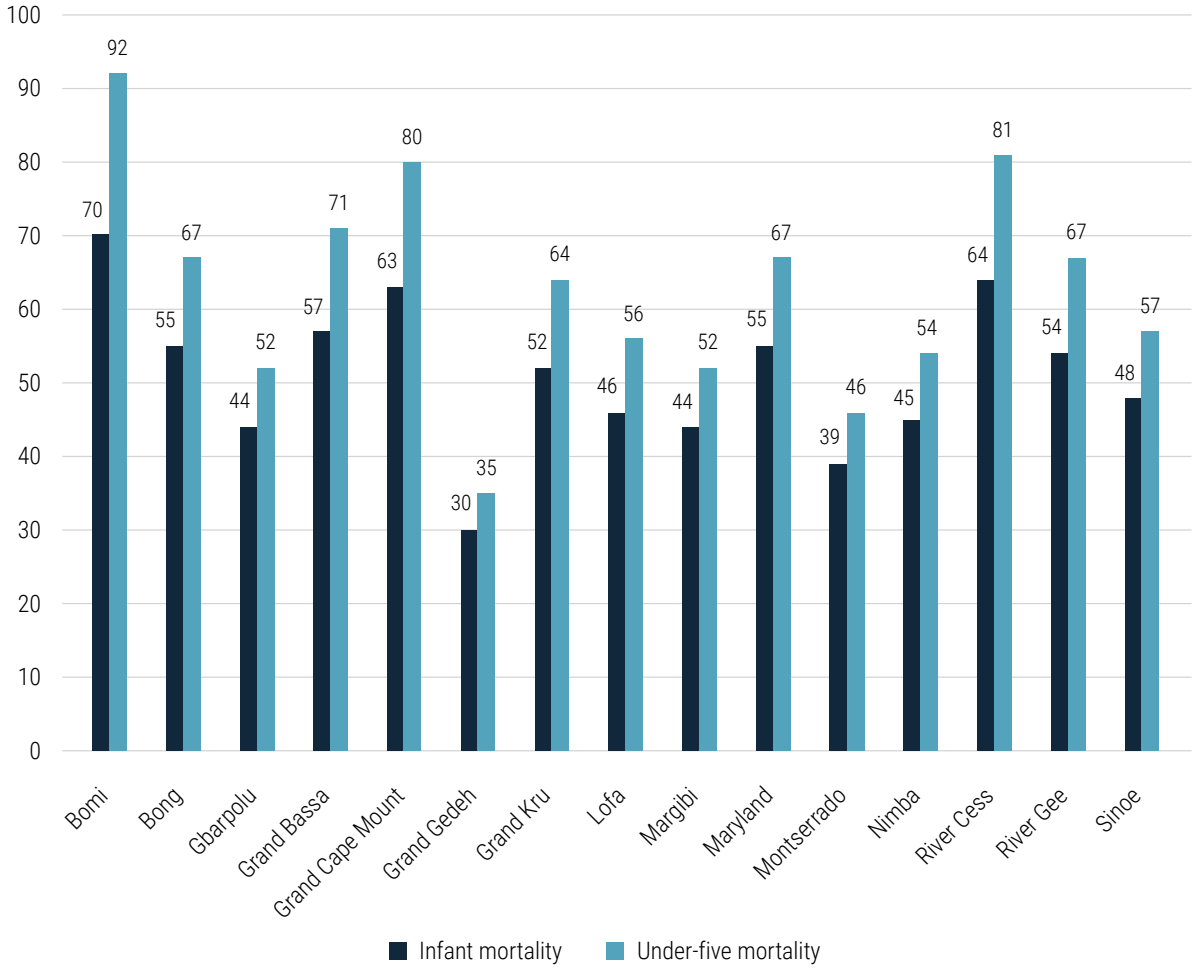
4.2 Locality of residence

Locality of residence is considered as an important influential factor in mortality analysis. Residing in an urban area or a rural area is associated with certain conditions including socio-cultural which influence the living conditions of the people, the behavioural pattern of the people, the availability of basic social amenities and services including access to essential health services. In developing countries like Liberia, the provision of this critical infrastructure is skewed in favour of urban centres and therefore children in these centres are more likely to enjoy better social services than their counterparts in rural areas. As a result the survival chances of children living in urban areas are more likely to be higher than those in rural areas. Figure 4.1 shows that both infant and under-five mortality are higher in rural than urban areas. While rural areas experienced infant and under-five mortality rates of 55 deaths per 1,000 live births and 67 deaths per 1,000 live births respectively, urban areas experienced 39 deaths per 1,000 live births and 47 deaths per 1,000 live births of infant and under-five mortality respectively. The urban/rural differential is expected and it could be a reflection of the poor living conditions existing in rural areas as well as the lack of access to health facilities. According to the 2021 United Nations Country Results Report on Liberia (March 2022), rural poverty accounted for 71.6 per cent while urban poverty was 31.5 per cent. There is therefore, the likelihood that mothers in rural areas were unable to provide nutritious diets for their children compared to their counterparts in urban areas. The implication is that besides other socio-cultural characteristics, which could have adverse impact on child survival, the rural population is less likely to meet its basic needs than the urban population.

4.3 County of residence

Like place of residence, county of residence of mother could also influence the mortality experience of her children. This is because county of residence is influenced by environmental and socio-cultural factors, which could affect the survival chances of children under the age of five. As shown in Figure 4.2, five years preceding the census, infant mortality ranged from 30 deaths per 1,000 live births in Grand Gedeh County to 70 deaths per 1,000 live births in Bomi County. During the same period, under-five mortality ranged from 35 deaths per 1,000 live births in Grand Gedeh County to 92 deaths per 1,000 live births in Bomi County. Grand Gedeh County experienced the lowest infant and under-five mortality while Bomi County experienced the highest infant and under-five mortality among the 15 counties. Apart from Bomi County, Grand Cape Mount and River Cess Counties experienced relatively higher infant and under-five mortality rates. These three counties each experienced infant mortality of above 60 deaths per 1,000 live births and under-five mortality of at least 80 deaths per 1,000 live births.

Figure 4.2: County differentials in mortality



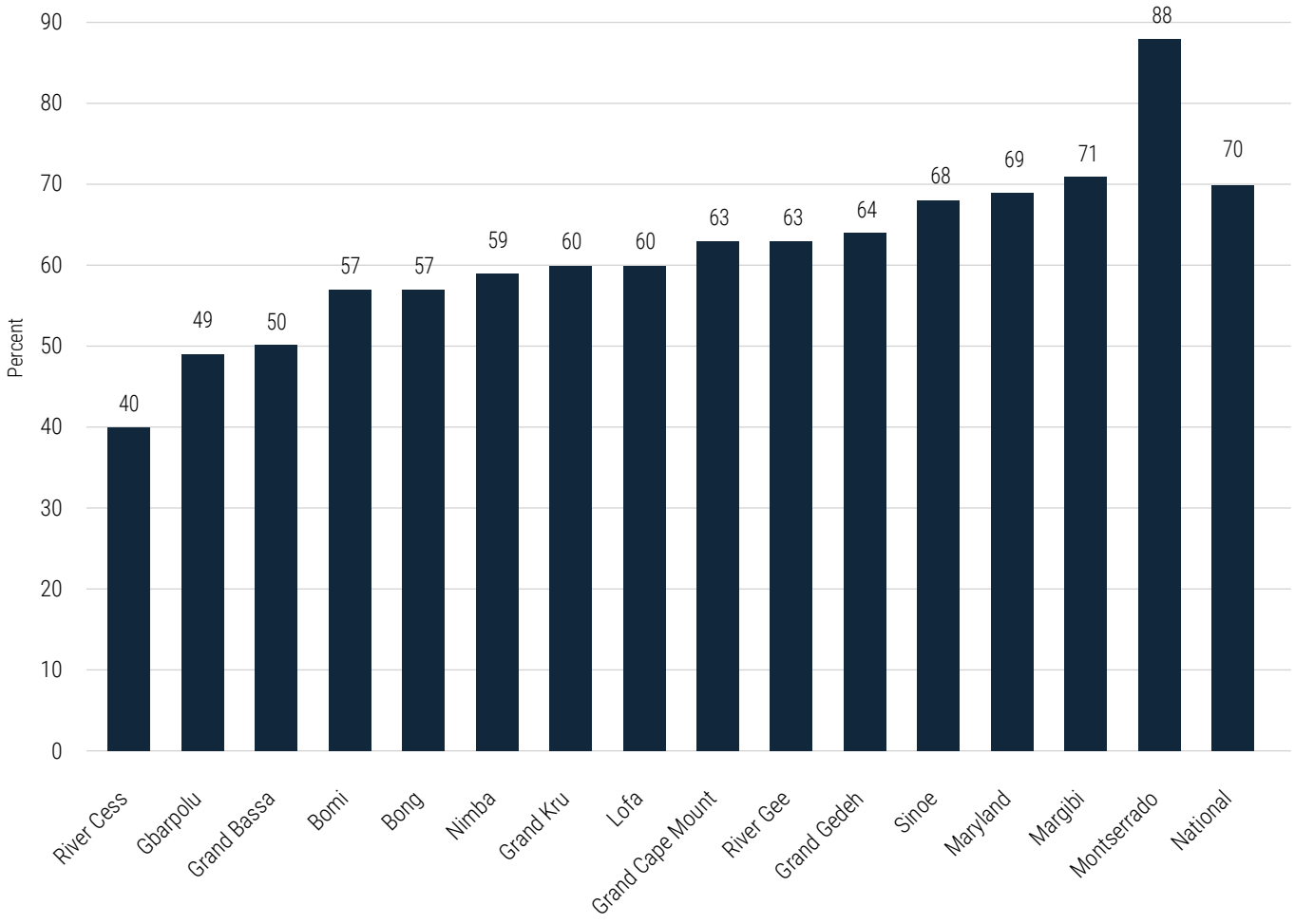
Source: LISGIS, Liberia 2022 Population and Housing Census

The differentials in mortality among the counties may be attributed, among other things, to the interplay of some factors. These may include disparities in the distribution of and access to healthcare facilities, basic social amenities and services, environmental as well as socioeconomic factors. For instance, as shown in Figure 4.3 (appendix Table 24), while about 57.0 per cent of the population in Bomi County could access healthcare within one hour of walking, about two-thirds (64.0 per cent) of the population in Grand Gedeh could access healthcare within one hour of walking. Even though, Sinoe, Maryland, Margibi and Montserrado Counties have a relatively higher percentage of their population accessing healthcare within one hour of walking, their infant and under-five mortality rates were higher than Grand Gedeh County. This explains why only one factor cannot explain the mortality differentials among the counties. Factors like potable drinking water systems, good transportation system and proper nutrition, among others could influence mortality differentials among counties. However, it is surprising that Montserrado County, which is better, endowed with basic infrastructural facilities and amenities than Grand Gedeh County could still experience higher mortality than Grand Gedeh County. It could be a case of mothers in Montserrado County not taking advantage of the infrastructure and amenities provided them to take proper care of their children to increase their survival chances.

In seeking more explanation to the mortality differentials in counties, an assessment of the advantages or opportunities and disadvantages or deprivation of the counties was done. The results are presented in Appendix Table 26. It shows that Bomi County's advantage of proximity to the national capital and the existence of an iron ore company which provides employment to the inhabitants do not impact on the people in the county. As a result

as high as 52.0 per cent of its households occupy one room and 58.0 per cent of households use bush for their human waste disposal. In the case of Bong County, about 48.0 per cent of households use bush for human waste disposal while about 33.0 per cent of households use unimproved sources of water for drinking. Good sanitation plays a major role in the survival chances of children especially infants so the poor human waste disposal and use of unimproved sources of water for drinking has serious consequences for under-five children. This may explain why infant and under-five mortality are high in Bomi County (70 and 92 for infant and under five respectively) and Bong County (55 and 67 for infant and under five respectively). On the other hand, Grand Gedeh has two health facilities with 16 health professionals and 11 Laboratory Technicians. It is noted for widespread illegal mining activities and wildlife hunting for commercial purpose. These activities may provide financial resources to the households to enable them take proper care of their under-five children and hence the relatively low infant and under-five mortality of 30 and 35 per 1,000 live births respectively. Montserrado County has the most advantages being the national capital with a lot of socioeconomic activities that provide jobs to inhabitants, health facilities, good roads, good housing and improved sources of water for drinking and only seven per cent of households using bush for human waste disposal. However, it is difficult to explain why its infant (39 per 1,000 live births) and under-five mortality (46 per 1,000 live births) experiences are higher than Grand Gedeh County. The advantages/opportunities and disadvantages/deprivation tabulated against each of the counties (Appendix Table 26) may provide a clue as to the existence of the differential mortality experiences of the counties.

Figure 4.3: Access to healthcare within one hour of walking

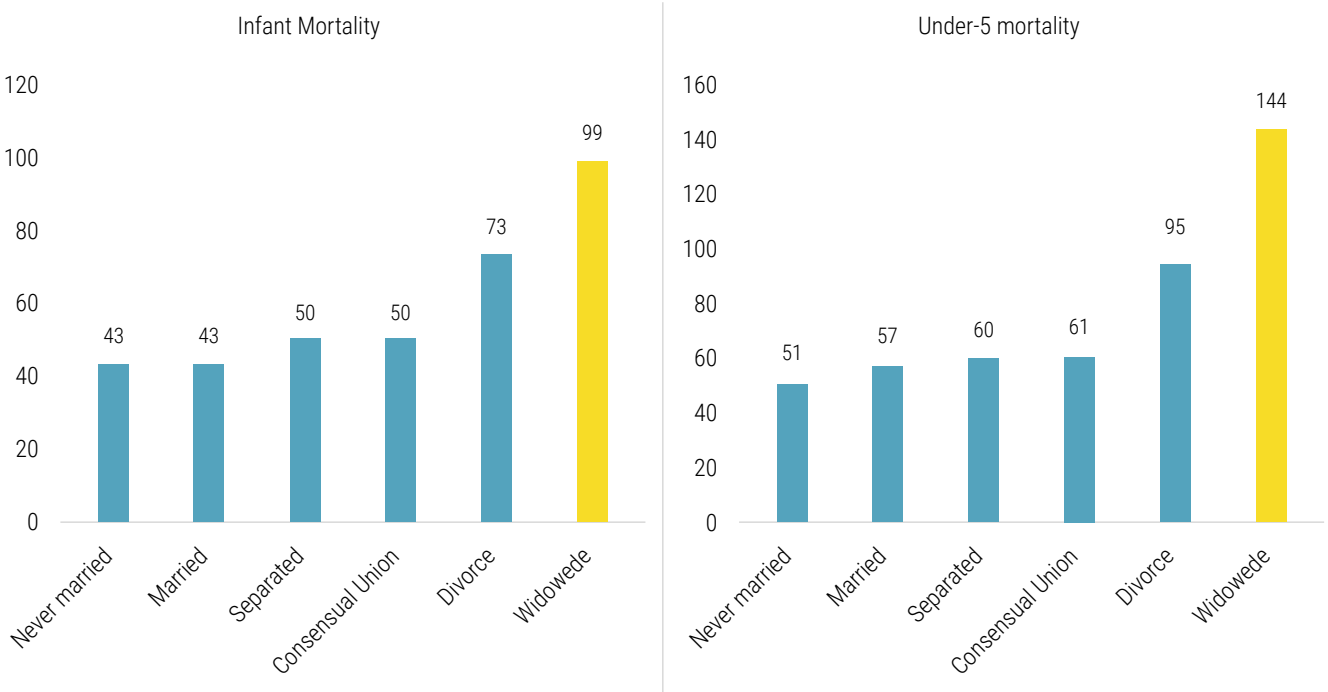


Source: Computed from 2022 LPHC

4.4 Marital status

Question number P06 in the census questionnaire was on marital status and it was asked of all persons aged 12 years and older. This information has been categorized into never married, married (monogamous and polygamous), separated, divorced, widowed and consensual union and their respective mortality presented in Figure 4.4. Children aged below five years of widowed women experienced the highest infant and under-five mortality rates of 99 deaths per 1,000 live births and 144 deaths per 1,000 live births respectively. This is followed by children of divorced women with mortality experiences of 73 per 1,000 live births for infant and under-five of 95 per 1,000 live births. Children of never married women experienced the lowest infant and under-five mortality rates of 43 deaths per 1,000 live births and 51 deaths per 1,000 live births respectively. The higher infant and under-five mortality of children of widowed and divorced women could be due to financial constraints and lack of better care for the children. Age may also be a factor as widowed and divorced women may be older and have been having children over a long period contributing to longer exposure to the risks of dying. Overall, the expectation was that children of married women in the country would experience the lowest childhood mortality possibly because of the combined effort of the spouses in terms of financial resources and better care for their children as compared with that of single mothers but this is not the case. The under-five mortality for children of married mothers was higher (57 per 1,000 live births) compared to those of mothers who had never been married (51 per 1,000 live births). This could be due to longer exposure of married mothers to the risks of dying. There is also the possibility that the never married women had support from the fathers of their children in addition to getting family support. They could, therefore, provide better care in terms of better nutrition and healthcare for their children.

Figure 4.4: Infant and Under-five mortality and mother's marital status



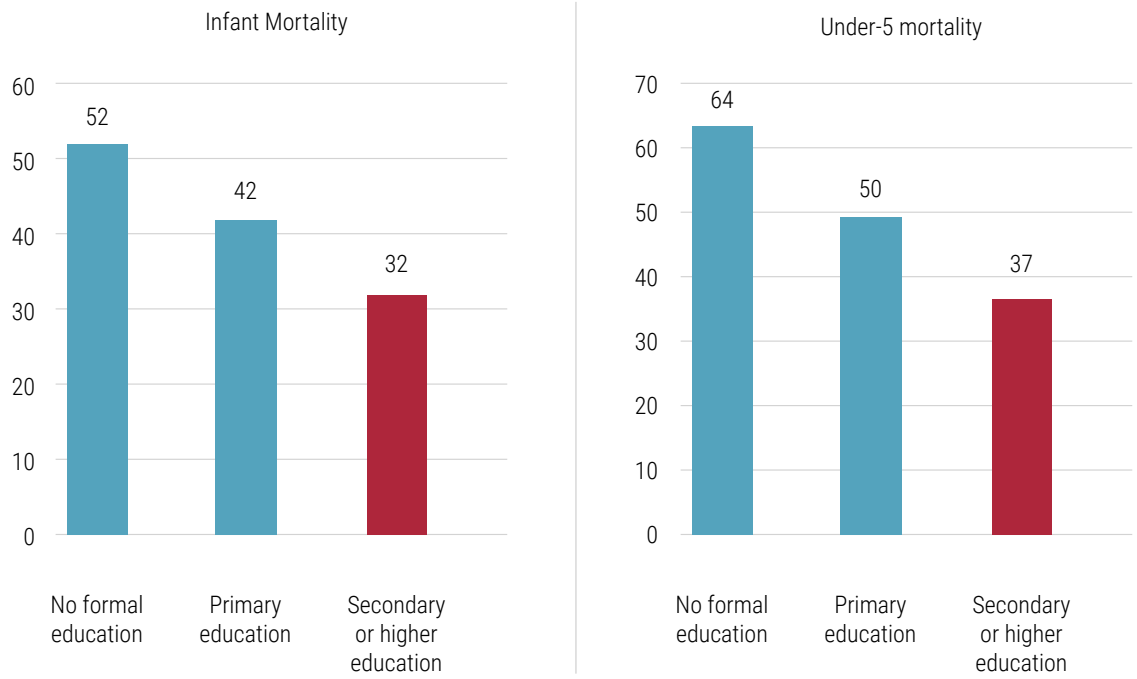
Source: Computed from LISGIS, Liberia 2022 Population and Housing Census

4.5 Mothers' level of education

Education is generally seen as a determinant of a household's wealth and purchasing power and consequently access to better nutrition and healthcare. This is because education opens doors to gaining access to better paid jobs and hence, better income. Education also enables mothers to gain knowledge about proper childcare, better nutrition and early treatment from childhood diseases for

their children than mothers with low or no formal education. The mothers' educational attainment has been classified into "no formal education", "primary" and "secondary and higher". The results of the infant and under-five mortality rates by the level of mothers' education are presented in Figure 4.5. As expected, there is marked decline in both infant and under-five mortality with increasing levels of mother's educational attainment. Children of mothers with secondary or higher education experienced lowest infant mortality (32 deaths per 1,000 live births) and under-five mortality (37 deaths per 1,000 live births) compared to children of mothers with no formal education (52 for infants and 64 for under five).

Figure 4.5: Infant and Under-five mortality and mother's level of education

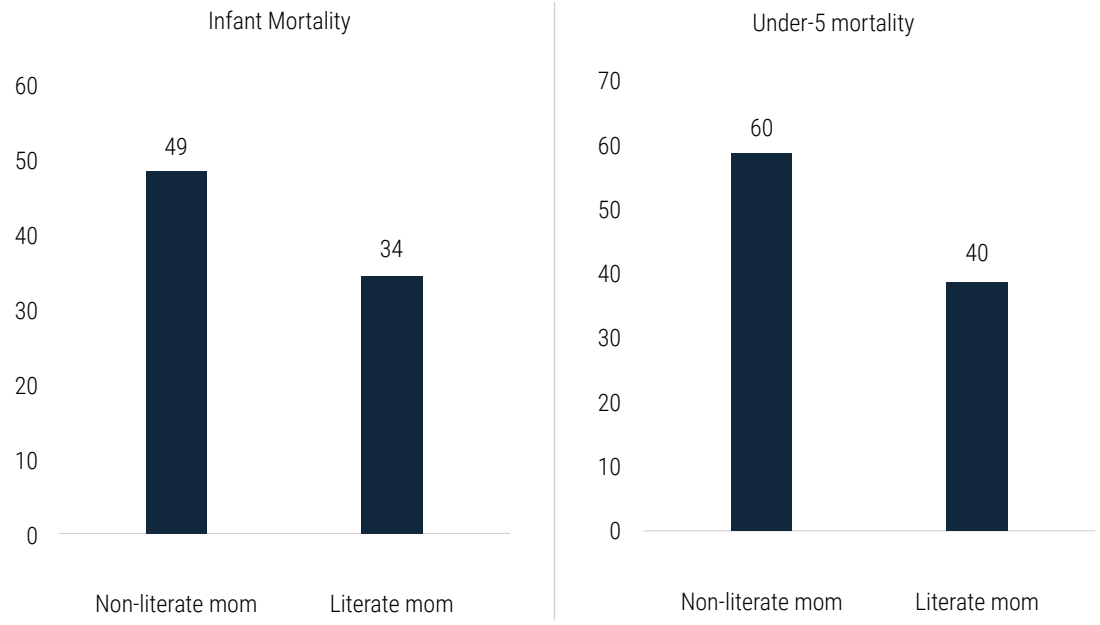


Source: Computed from LISGIS, Liberia 2022 Population and Housing Census

4.6 Mother's literacy

Mothers have been categorized into non-literate mothers and literate mothers and the results of the analysis is presented in Figure 4.6. The findings show that while infant and under-five mortality of literate mothers was lower (34 and 40 respectively), those of children of non-literate mothers were higher (49 and 60 per 1,000 live births respectively). This is expected because mothers who are able to read and write are better able to understand information about their pregnancy and are better equipped to detect warning signs of pregnancy complications to seek medical attention earlier than mothers who cannot read and write.

Figure 4.6: Infant and Under-five mortality and mother's literacy

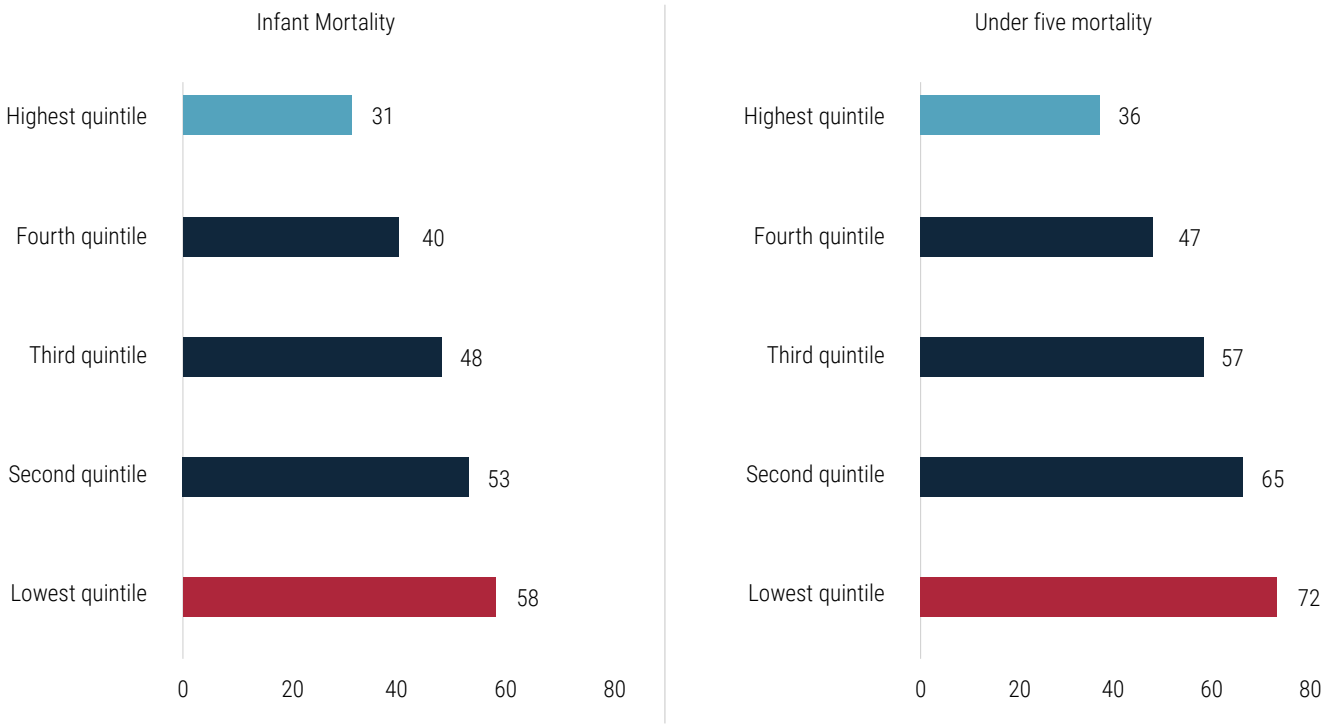


Source: LISGIS, Liberia 2022 Population and Housing Census

4.7 Mother's level of wealth

Data from the 2022 census (Figure 4.7) show that mother's level of wealth has influence on childhood mortality and that as mother's level of wealth increases, childhood mortality decreases. The results show that children of mothers within the highest wealth quintile had lower mortality experiences (IMRs of 31 per 1,000 live births and under-five mortality rates of 35 per 1,000 live births) as against children of mothers in the lowest wealth quintile (infant mortality rate of 58 and under-five mortality rate of 72 per 1,000 live births). Wealth may influence childhood mortality in a number of ways. Mothers who have relatively more wealth could afford proper hygiene and better healthcare for their infants. They could also provide better nutrition to their children. The combined effect is that mothers with higher levels of wealth are able to reduce the incidence of childhood diseases on the children, increase their survival chances and hence reduce their mortality.

Figure 4.7: Infant and Under-five mortality and mother's level of wealth



Source: LISGIS, Liberia 2022 Population and Housing Census

5. Policy implications

5.1 Policy implications

This chapter presents the policy implications of the mortality analysis and findings. The implications involve how the evidence in this report suggests the need for policy formulation or changes in existing policy or the judicious implementation of the provisions or specific provision of existing policy.

The findings show high infant, under-five and maternal mortality in Liberia with infant mortality being 64 deaths per 1,000 live births, under-five mortality of 93 deaths per 1,000 live births and maternal mortality of 854 per 100,000 live births. This calls for urgent policy action in the face of this population health crisis and threat to the achievement of the SDG goals for which the Liberian Government has an obligation to work towards achieving. The global target for under-five mortality is 25 per 1,000 live births and at least 70 per 100,000 live births for maternal mortality by 2030. The policy action and strategy to address this challenge have been proffered in the Liberia National Health Policy, 2022-2031 with end targets for maternal and under-five mortality of 220 and 25 respectively. With seven years to 2030, the target date for the SDGs, extra ordinary measures would be required to make substantial progress towards achieving the SDG Goal 3. The recommendation, therefore, is for the Ministry of Health to collaborate more with its partners, particularly the WHO, Liberia, to judiciously implement the National Health Policy to reduce infant, under-five and maternal mortality. The Ministry of Health should deepen implementation of the AADPD commitment number 37 which states as "Eliminate preventable maternal mortality and neonatal mortality through ensuring that births are attended by skilled health personnel, and that there is universal access to prenatal and postnatal care and family planning, emergency obstetric and neonatal care, and management of pregnancy-related complications and preventable complications arising from unsafe abortion in order to protect the health and safeguard the lives of women, adolescent girls and neonates" (Country Report AADPD,2023[23]). The WHO, Liberia, in collaboration with the MoH, should commit to the implementation of the WHO Thirteenth General Programme of Work (GPW13) 2018-2025 particularly the UHC Cluster which comprises Health Systems Strengthening (HSS), Family and Reproductive Health (FRH), and Expanded Programme on Immunization (EPI) programmes at national and sub-national levels. It should also pay attention to reorienting health systems towards primary healthcare as the foundation of UHC[24]. The Government should also intensify education on health insurance or a public health system to encourage more people to enrol on to it to achieve the set target of 125 per 1,000 population by 2031.

Infant and under-five mortality rates are valuable indicators of health status. Aside from death in the early part of life, which is mainly due to biological factors, infant and child deaths are influenced by environmental factors like childhood diseases, nutrition, childcare practices and environmental sanitation. Infant mortality is associated with diarrhoea and pneumonia – the two leading causes of childhood death worldwide. In Liberia, most of the childhood illnesses and deaths are due to preventable and treatable causes such as malaria, acute respiratory tract infections and diarrhoea[25]. Diarrhoea and other preventable childhood diseases result from poor feeding habits, which result in malnutrition especially when breastfeeding practices are not adhered to or not provided at all. In Liberia, only 55 per cent of babies are exclusively breastfed for six months[26]. To meet the national breastfeeding target of 70 per cent by 2025 there should be improved policies and programmes to encourage exclusive breastfeeding.

In Liberia, each year, optimal breastfeeding practices have the potential to save 1,159 children's lives and

23 National Population Commission. 2023. Country Report AADPD@10@ICPD@30. Monrovia
24 WHO. 2022. Rebuilding Liberia's Health System. Annual Report. Monrovia
25 Republic of Liberia. National Health Policy, 2022-2031.2022. Monrovia
26 Walters D, Phan L, Mathisen R. The cost of Not Breastfeeding: Global Results from a New Tool. Health Policy and Planning 2019. Availability from https://doi.org/10.1093/heapol/czz050

save over $200,000 in health system treatment costs related to inadequate breastfeeding.[27] To realize the health and economic benefits of breastfeeding, policymakers and implementers should adopt and implement the following policies to support mothers to breastfeed according to WHO recommended guidelines: 1) Policies and Practices in Health Facilities including nutrition counselling, 2) Renewed Efforts Against Child Hunger and Under-nutrition (REACH) initiative, 3) CMBS Bill sent to the National Legislature for enactment into Law, and 4) Social and Behaviour Change Communication through multiple channels tailored to the local context including community health workers and volunteers.

This report demonstrates that mortality rates are higher in rural than urban areas and even higher in some geographical areas (the counties). For instance, the CDR for rural (16.7) is about 23.0 per cent higher than that of urban areas (10.5). These differentials may be due to disparities in the distribution of essential services like health infrastructural facilities, services and essential medicines, other essential social services and accessibility and higher efficiency of these services in urban areas than in rural areas or in Montserrado County than in other counties. This imbalance would need to be addressed through the provision of health infrastructure, essential health services and medicines to reduce both the differentials in mortality and the level of mortality. The Government's Five-Year Development Plan: The PAPD makes provisions in Pillar One of the plan to expand access to essential health services. However, the provision of health infrastructure alone does not ensure utilization, accessibility is also important. Evidence from the 2022 census show that only 39.5 per cent of the Liberian population can access a health facility in less than 20 minutes of walking, 20.5 per cent between 20 and 39 minutes, 10.3 per cent 40-59 minutes and almost a third (29.7 per cent) can access a health facility in one hour or more. There is the urgent need to provide all year-round motor able roads and efficient transportation systems, be it public or private throughout the country so as to facility transportation of the population to the health facilities in times of need.

Adult mortality was found to be high with male adult mortality slightly higher than female adult mortality. This category of the population is the working class who may be the breadwinners of their households. The higher death rate in male than female is also likely to create single mothers and loss of family income thus affecting basic necessities like food, shelter and healthcare. The Government of Liberia should develop and implement Social Safety Net for single mothers and develop and implement Behaviour Change Communication (BCC) Strategy on lifestyle to reduce lifestyle diseases. Furthermore, healthcare financing policy is recommended in place of out-of-pocket financing of healthcare services across multiple age groups including the adult working population to promote the uptake of preventive services. This recommendation reinforces the eight strategic targets of "reducing out-of-pocket payment for healthcare" provided for in the National Health Policy, 2022-2031. The Government of Liberia should also develop and implement Social Safety Net for single mothers and develop and implement BCC Strategy on lifestyle to reduce lifestyle diseases.

In the area of life expectancy, females were found to have higher life expectancy at birth (61.1 years) than their male counterparts (55.6 years). Urban life expectancy is higher than in rural areas. Both females and males have lower expectation of life in the rural areas than in urban areas. The difference between female and male expectation of life in the rural areas is lower (1.6 years) than in urban areas (2.7 years). While these suggest that urban areas enjoy relatively better health facilities and other living conditions than their rural counterparts, it also suggests that females take better advantage of the availability health facilities than their male counterparts. The findings point to the need to build resilience and invest in human development, especially for rural communities, which are at greater risk of deterioration in the quality of life. Therefore, the Liberian Health Service should increase access to high-quality health services in rural communities to build resilience.

The study shows that childhood mortality is influenced by marital status, mother's education, literacy and income. These factors are interconnected and their availability or absence may cause variations in the mortality experiences of mothers and their children under five years of age. The differentials in mortality by these socioeconomic factors thus exist in Liberia and call for urgent need to address them. There should be a social intervention policy, like the Livelihood Empowerment Against Poverty Programme (LEAP) being implemented in Ghana, targeted at women who are divorced and widowed because they have no partners and therefore, no financial or other support to take proper care of their children. The mortality experiences of their children

27 Walters D, Phan L, Mathisen R. The cost of Not Breastfeeding: Global Results from a New Tool. Health Policy and Planning 2019. Availability from https://doi.org/10.1093/heapol/czz050

(infant 73 and under five of 95 for divorced women and 99 and 144 respectively for widowed women) are over 100.00 per cent those of married women (44 for infants and 57 for under five). The LEAP or similar policy would provide monthly stipend to these women to enable them take proper care of their children.

Findings from the study show that children of mothers who could read or write or do both and mothers with higher educational attainment have lower mortality experiences. These women are better equipped with relevant knowledge about pregnancy and childcare. They are also better able to identify childhood diseases and take early action to seek healthcare for their children. The implication is that if citizens especially females are well educated, their activities in relation to pregnancy, childcare, prevention of childhood diseases and access to early treatment could greatly enhance child survival. These findings present a clear opportunity for policymakers to reduce infant and maternal deaths through the provision of education to all citizens especially females. The PAPD has provisioned for increased access to basic education, adult learning and skills development opportunities, and to basic health. It is required of implementers, the Ministry of Education and its partners and affiliates to embrace this provision, work together and diligently implement them to help reduce the menace of childhood and maternal mortality. Furthermore, the MoH, UNICEF and partners should identify the gaps in the Child Survival Strategy, review and provide adequate funding for its effective implementation.

The findings revealed the relationship between wealth and childhood mortality establishing that children of women with higher levels of wealth have lower probability of dying than the children of women with low or no wealth (Table 4.1). The key source of wealth is income and income is generated through the engagement of some economic activities. The provision of job opportunities for all citizens capable of undertaking some economic activity would be favourable in the fight against the elimination or reduction of childhood mortality. While recommending the implementation of Pillar 2 of PAPD (the Economy and Jobs), special mention is made of development outcome 2: "Increased agricultural production and productivity and improved forest utilization through competitive value chains and market". The activities that bring about this development outcome are so fundamental that any citizen who desires to undertake some economic activity for a living could find consolation. The Ministries of Agriculture and Finance in collaboration with their partners are encouraged to make resources availability for the implementation of the provision of Pillar 2 of the PAPD. The Government of Liberia should also develop and implement LEAP to support the vulnerable women with monthly stipend to be able to cater for their basic needs.

The variations in mortality observed among the counties may have been influenced by disparities in the distribution of and access to basic social amenities including health facilities, educational infrastructure and water and sanitation services. This situation if continued to exist would make some counties more attractive to live in than others. This could trigger internal migration from less-endowed counties to well-endowed counties bringing in its trail congestion, unemployment, housing shortages, poor sanitation and social vices. Therefore, the skewed distribution of basic social amenities must engage the attention of policymakers. The Government of Liberia, working through the relevant institutions, should make conscious and consistent effort to provide these services to ensure equitable access and use of the facilities. To this end the responsible institutions should programme these essential services in their medium term plans and budget appropriately for them. The Ministry of Finance should, on its part, annually make adequate budgetary allocations for the provision of these essential services. This recommendation ties in with the development outcome number 4 (Increased access to basic education, adult learning and skills development opportunities, and to basic health) under Pillar One of the Five-Year National Development Plan: The PAPD.

From the study, it is evident that mortality indicators cannot be monitored without the availability of regular and high-quality data. Without data, it would be difficult for policymakers to gauge population health since mortality provides such measures. Since census data is costly to collect and done only at decennial intervals, regular and sustained availability of data collected at relatively lower cost for continuous monitoring of mortality indicators is recommended. To this end, the Ministry of Health should invest more in the civil registration and vital statistics (CRVS) system. It should budget appropriately for its restructuring and allocate adequate resources, on an annual basis, for the registration of vital events throughout the country.

5.2 Conclusion

High mortality is a drain on the population of Liberia. The issues presented in this report pose a threat to population health and human resources. Mortality differentials were evident in population sub-groups and geographical areas. The probable causes were thought to have resulted basically from variations in the distribution of socioeconomic and developmental resources, key among them being health facilities, water and sanitation services, electricity, better housing, high-quality education and job opportunities. These require action by policymakers to correct the imbalance both in mortality differentials and spatial inequities to ensure healthy living and long life expectancy for the population. The policy implications highlighted in this report and the recommendations proffered for consideration by policymakers and implementers provide direction to reduce the high mortality in Liberia.

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Appendices

Table 1: Population by age, sex and residence

	Urban			Rural			Total		
Age group	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
Under 1	19021	19071	38092	17913	17691	35604	36934	36762	73696
01 - 04	116528	121457	237985	118270	120001	238271	234798	241458	476256
05 - 09	156486	168221	324707	149208	140689	289897	305694	308910	614604
10 - 14	170398	188906	359304	146321	126997	273318	316719	315903	632622
15 - 19	179802	191710	371512	135817	131134	266951	315619	322844	638463
20 - 24	167518	178560	346078	126378	127080	253458	293896	305640	599536
25 - 29	123228	137178	260406	90274	90254	180528	213502	227432	440934
30 - 34	121871	124568	246439	97352	94269	191621	219223	218837	438060
35 - 39	92611	92085	184696	77687	75349	153036	170298	167434	337732
40 - 44	87120	72198	159318	83748	68762	152510	170868	140960	311828
45 - 49	50353	44256	94609	49853	41527	91380	100206	85783	185989
50 - 54	45919	39088	85007	49947	39620	89567	95866	78708	174574
55 - 59	23968	21799	45767	24339	19143	43482	48307	40942	89249
60 - 64	22220	20020	42240	25668	21139	46807	47888	41159	89047
65 - 69	12633	11248	23881	13655	11249	24904	26288	22497	48785
70 - 74	8930	9366	18296	12164	10975	23139	21094	20341	41435
75 - 79	3967	4400	8367	5644	5488	11132	9611	9888	19499
80+	6615	8835	15450	10601	11827	22428	17216	20662	37878
Total	**1409188**	**1452966**	**2862154**	**1234839**	**1153194**	**2388033**	**2644027**	**2606160**	**5250187**

Table 2: Single year age distribution of women 15-49 years

Age	Frequency	Percent	Age	Frequency	Percent	Age	Frequency	Percent
15	61454	4.2	27	43757	3.0	39	26338	1.8
16	60911	4.1	28	45289	3.1	40	40272	2.7
17	68187	4.6	29	37858	2.6	41	15891	1.1
18	63601	4.3	30	58339	4.0	42	41799	2.8
19	68691	4.7	31	24944	1.7	43	24014	1.6
20	66389	4.5	32	66378	4.5	44	18984	1.3
21	44632	3.0	33	35593	2.4	45	20618	1.4
22	84417	5.7	34	33583	2.3	46	16137	1.1
23	58600	4.0	35	35923	2.4	47	18206	1.2
24	51602	3.5	36	36258	2.5	48	17096	1.2
25	53481	3.6	37	36556	2.5	49	13726	0.9
26	47047	3.2	38	32359	2.2			

Table 3: 5-Year age-sex distribution of deaths by residence

	Urban			Rural			Total		
Age group	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
< 1	2262	3155	5417	2855	3878	6733	5117	7033	12150
1-4	1274	1120	2394	1533	1598	3131	2807	2718	5525
5-9	3243	1545	4788	4537	2000	6537	7780	3545	11325
10-14	358	173	531	579	236	815	937	409	1346
15-19	458	238	696	815	363	1178	1273	601	1874
20-24	695	361	1056	1081	413	1494	1776	774	2550
25-29	655	370	1025	1059	427	1486	1714	797	2511
30-34	741	384	1125	969	454	1423	1710	838	2548
35-39	696	448	1144	1130	491	1621	1826	939	2765
40-44	957	395	1352	1076	528	1604	2033	923	2956
45-49	947	460	1407	1228	469	1697	2175	929	3104
50-54	804	733	1537	824	890	1714	1628	1623	3251
55-59	517	513	1030	587	796	1383	1104	1309	2413
60-64	514	589	1103	592	946	1538	1106	1535	2641
65-69	460	548	1008	554	728	1282	1014	1276	2290
70-74	461	617	1078	596	848	1444	1057	1465	2522
75-79	342	522	864	504	702	1206	846	1224	2070
80+	1231	1185	2416	2212	1428	3640	3443	2613	6056
Total	**16615**	**13356**	**29971**	**22731**	**17195**	**39926**	**39346**	**30551**	**69897**

Table 4: Death ratios

Age	Both sexes	Male	Female
01-04	0.346	0.330	0.366
05-09	0.472	0.491	0.448
10-14	0.742	0.767	0.709
15-19	0.962	0.924	1.016
20-24	1.164	1.207	1.107
25-29	0.985	0.982	0.989
30-34	0.966	0.966	0.965
35-39	1.005	0.957	1.066
40-44	1.007	1.022	0.988
45-49	1.000	1.021	0.971
50-54	1.179	1.143	1.234
55-59	0.819	0.878	0.738
60-64	1.124	1.044	1.248
65-69	0.887	0.938	0.820
70-74	1.158	1.137	1.186
75-79	0.195	0.199	0.190

Table 5: Reported and smoothed population by age, males

Age-sex	Reported	Farrag	Newton	Arriaga	Nations	Strong
MALE						
Total, 0-79	2626811			2626811		2626811
Total, 10-69	2018680	2018680	2018680	2018680	2020774	2018680
0-4	271732			274355		282548
5-9	305694			303071		294878
10-14	316719	321278	320546	324293	317926	303191.9
15-19	315619	311060	311792	308045	317466	291428.0
20-24	293896	269045	268875	268728	282469	271126.0
25-29	213502	238353	238523	238670	231349	244318.0
30-34	219223	209991	209531	209543	203917	212302.2
35-39	170298	179530	179990	179978	184352	181879.0
40-44	170868	152290	150871	151047	154725	150545.0
45-49	100206	118784	120203	120027	115649	121733.0
50-54	95866	83663	84393	83207	83372	91385.8
55-59	48307	60510	59780	60966	58225	68967.0
60-64	47888	44170	44180	43627	41269	48433.2
65-69	26288	30006	29996	30549	30056	33371
70-74	21094			19681		20596
75-79	9611			11024		10109
80+	17216					

Table 6: Reported and smoothed population by age, females

Age-sex	Reported	Farrag	Newton	Arriaga	Nations	Strong
FEMALE						
Total, 0-79	2585498			2585498		2585498
Total, 10-69	1968139	1968139	1968139	1968139	1971167	1968139
0-4	278220			280559		287197
5-9	308910			306571		299933
10-14	315903	323229	322752	326029	318887	308656
15-19	322844	315518	315995	312718	323642	297314
20-24	305640	283271	282316	283173	295173	279247
25-29	227432	249801	250756	249899	242622	249253
30-34	218837	213695	212281	212546	207577	211588
35-39	167434	172576	173990	173725	175020	175685
40-44	140960	129862	130035	128943	132808	136319
45-49	85783	96881	96708	97800	95508	106152
50-54	78708	69246	70018	68953	69491	76779
55-59	40942	50404	49632	50697	48788	57092
60-64	41159	37248	37417	36947	35394	41006
65-69	22497	26408	26239	26709	26259	29049
70-74	20341			18353		19093
75-79	9888			11876		11136
80+	20662					

Table 7: Reported age-specific death rates by sex and residence

	Liberia			Urban			Rural		
Age group	Both Sexes	Males	Females	Both Sexes	Males	Females	Both Sexes	Males	Females
< 1	0.163	0.137	0.189	0.141	0.118	0.165	0.186	0.156	0.215
1-4	0.012	0.012	0.011	0.010	0.011	0.009	0.013	0.013	0.013
5-9	0.019	0.026	0.012	0.015	0.021	0.009	0.023	0.030	0.014
10-14	0.002	0.003	0.001	0.001	0.002	0.001	0.003	0.004	0.002
15-19	0.003	0.004	0.002	0.002	0.003	0.001	0.004	0.006	0.003
20-24	0.004	0.006	0.003	0.003	0.004	0.002	0.006	0.009	0.003
25-29	0.006	0.008	0.004	0.004	0.005	0.003	0.008	0.012	0.005
30-34	0.006	0.008	0.004	0.005	0.006	0.003	0.008	0.010	0.005
35-39	0.008	0.011	0.006	0.006	0.008	0.005	0.011	0.015	0.007
40-44	0.010	0.012	0.007	0.009	0.011	0.006	0.011	0.013	0.008
45-49	0.017	0.022	0.011	0.015	0.019	0.011	0.019	0.025	0.011
50-54	0.019	0.017	0.021	0.018	0.018	0.019	0.019	0.017	0.023
55-59	0.027	0.023	0.032	0.023	0.022	0.024	0.032	0.024	0.042
60-64	0.030	0.023	0.038	0.027	0.024	0.030	0.033	0.023	0.045
65-69	0.047	0.039	0.057	0.043	0.037	0.049	0.051	0.041	0.064
70-74	0.062	0.051	0.073	0.060	0.052	0.067	0.063	0.049	0.078
75-79	0.106	0.088	0.123	0.104	0.087	0.119	0.107	0.088	0.127
80+	0.161	0.201	0.127	0.158	0.189	0.136	0.163	0.209	0.121

Table 8: Childhood and maternal mortality in selected sub-Saharan African countries

Country	U5MR (2021)	IMR (2021)	MMR (2020)
Niger	115	60	449
Nigeria	111	71	1047
Sierra Leone	105	78	443
Guinea	99	64	553
South Sudan	99	62	440
Mali	97	55	523
Benin	84	52	264
Burkina Faso	83	57	212
Equatorial Guinea	77	57	652
Liberia	76	34	238
Cote D'Ivoire	75	43	399
Togo	63	34	458
Zambia	58	33	263
Sudan	55	29	227
The Gambia	48	28	530
Tanzania	47	29	261
Ghana	44	40	135
Uganda	42	39	270
Gabon	40	56	480
Senegal	39	64	1223
Kenya	37	31	284
South Africa	33	26	127

Table 9: Adult female mortality from orphanhood data

Age group	Total respondents	Mother alive	Proportion alive	Mean age at child bearing	Age n	l(25+n/l(25)	Standard ls(25+n)	Level α	Probability of dying 45q15	Reference date
5- 9	614604	564166	0.9179	27.22	10	0.8975	0.8137	1.0911	0.5200	2019.2
10-14	632622	579126	0.9154	27.22	15	0.9069	0.7991	0.5018	0.3630	2017.0
15-19	638463	573299	0.8979	27.22	20	0.8950	0.7806	0.2993	0.2980	2015.0
20-24	599536	515450	0.8597	27.22	25	0.8614	0.7570	0.2590	0.2852	2013.1
25-29	440934	365348	0.8286	27.22	30	0.8365	0.7241	0.1349	0.2465	2011.6
30-34	438060	340930	0.7783	27.22	35	0.7937	0.6786	0.0625	0.2249	2010.4
35-39	35923	31	0.0009	27.22	40	-0.0286	0.6128			1967.8

Table 10: Adult male mortality from orphanhood data

Age group	Total respondents	Father alive	Proportion alive	Mean age at childbearing	Age n	l(25+n/l(25)	Standard ls(25+n)	Level α	Probability of dying 45q15	Reference date
5 – 9	614604	553893	0.9012	28.29	10	0.8410	0.7570	0.6778	0.4169	2017.7
10-14	632622	562305	0.8888	28.29	15	0.8479	0.7570	0.6296	0.4026	2015.6
15-19	638463	544840	0.8534	28.29	20	0.7994	0.7241	0.4878	0.3585	2013.6
20-24	599536	477930	0.7972	28.29	25	0.7210	0.6786	0.4540	0.3477	2011.7
25-29	440934	324026	0.7349	28.29	30	0.6209	0.6128	0.4209	0.3371	2010.1
30-34	438060	286242	0.6534	28.29	35	0.0178	0.5203			1983.9
35-39	35923	31	0.0009	27.22	40	-0.0286	0.6128			1967.8

Table 11: Adult mortality in West African countries

Country	Probability of dying between ages 15 and 60
Cabo Verde	134
Senegal	176
Mauritania	196
Benin	233
Ghana	233
Niger	235
Burkina Faso	240
Guinea	241
The Gambia	250
Mali	252
Liberia*	297
Guinea-Bissau	335
Cote d'Ivoire	341
Nigeria	343
Sierra Leone	371

Table 12: Maternal mortality ratios by county, 2008 and 2022

County	2008	2022
National	890	854
Bomi	967	1199
Bong	909	1208
Gbarpolu	586	1078
Grand Bassa	854	862
Grand Cape Mount	1679	1201
Grand Gedeh	744	694
Grand Kru	923	1252
Lofa	1114	1025
Margibi	633	746
Maryland	1934	997
Montserrado	615	531
Nimba	1052	1018
River Cess	681	1148
River Gee	435	1246
Sinoe	1274	1024

Table 13: Household deaths occurring 12 months preceding the census night by county and sex

County	Male	Female
Liberia	56%	44%
Bomi	55%	45%
Bong	58%	42%
Gbarpolu	53%	47%
Grand Bassa	57%	43%
Grand Cape Mount	57%	43%
Grand Gedeh	57%	43%
Grand Kru	57%	43%
Lofa	56%	44%
Margibi	57%	43%
Maryland	56%	44%
Montserrado	55%	45%
Nimba	57%	43%
River Cess	58%	42%
River Gee	56%	44%
Sinoe	58%	42%

Table 14: Household deaths occurring 12 months preceding the census night by residence

County	Urban	Rural
Liberia	43%	57%
Bomi	17%	83%
Bong	31%	69%
Gbarpolu	10%	90%
Grand Bassa	27%	73%
Grand Cape Mount	18%	82%
Grand Gedeh	37%	63%
Grand Kru	5%	95%
Lofa	16%	84%
Margibi	46%	54%
Maryland	52%	48%
Montserrado	88%	12%
Nimba	31%	69%
River Cess	6%	94%
River Gee	44%	56%
Sinoe	16%	84%

Table 15: Proportion of child dead by place of residence and county, 2008 and 2022

County	2008	2022
National	0.065	0.116
Urban	0.052	0.100
Rural	0.077	0.130
Bomi	0.108	0.179
Bong	0.076	0.119
Gbarpolu	0.064	0.118
Grand Bassa	0.079	0.164
Grand Cape Mount	0.084	0.158
Grand Gedeh	0.038	0.090
Grand Kru	0.074	0.145
Lofa	0.063	0.130
Margibi	0.061	0.120
Maryland	0.082	0.113
Montserrado	0.051	0.100
Nimba	0.064	0.090
River Cess	0.095	0.110
River Gee	0.081	0.090
Sinoe	0.065	0.100

Table 16: Empirical model life table for urban males

Age x	nMx	nqx	lx	ndx	nLx	5Px	Tx	Ex
0	0.073	0.068	100000	6777	93223	0.916	5638061	56.4
1-4	0.011	0.044	93223	4113	364667	0.967	5544837	59.5
5-9	0.003	0.013	89110	1148	442681	0.989	5180170	58.1
10-14	0.002	0.009	87962	770	437886	0.988	4737490	53.9
15-19	0.003	0.016	87192	1402	432457	0.980	4299604	49.3
20-24	0.005	0.023	85791	2015	423916	0.976	3867147	45.1
25-29	0.005	0.024	83776	2012	413848	0.975	3443232	41.1
30-34	0.005	0.025	81763	2074	403633	0.973	3029384	37.1
35-39	0.006	0.029	79690	2304	392688	0.968	2625751	32.9
40-44	0.007	0.036	77386	2766	380012	0.959	2233062	28.9
45-49	0.010	0.047	74619	3478	364401	0.941	1853050	24.8
50-54	0.015	0.071	71141	5071	343028	0.917	1488649	20.9
55-59	0.020	0.096	66070	6314	314565	0.879	1145621	17.3
60-64	0.032	0.149	59756	8895	276542	0.814	831055	13.9
65-69	0.052	0.230	50861	11718	225010	0.716	554513	10.9
70-74	0.086	0.354	39143	13840	161115	0.572	329503	8.4
75-79	0.149	0.543	25303	13750	92140	0.453	168388	6.7
80+	0.152	1.000	11553	11553	76248		76248.48	6.6

Table 17: Empirical model life table for urban females

Age x	nMx	nqx	lx	ndx	nLx	5Px	Tx	Ex
0	0.072	0.067	100000	6681	93319	0.922	5911142	59.1
1-4	0.008	0.030	93319	2777	367722	0.977	5817823	62.3
5-9	0.002	0.011	90542	956	450321	0.991	5450101	60.2
10-14	0.002	0.008	89586	713	446150	0.990	4999780	55.8
15-19	0.002	0.012	88873	1026	441801	0.986	4553630	51.2
20-24	0.003	0.016	87847	1400	435735	0.983	4111829	46.8
25-29	0.004	0.018	86447	1593	428252	0.981	3676095	42.5
30-34	0.004	0.020	84854	1729	419946	0.978	3247843	38.3
35-39	0.005	0.024	83125	1973	410691	0.972	2827897	34.0
40-44	0.007	0.033	81152	2658	399114	0.963	2417206	29.8
45-49	0.008	0.041	78494	3208	384450	0.949	2018092	25.7
50-54	0.013	0.061	75286	4588	364961	0.929	1633642	21.7
55-59	0.017	0.082	70698	5813	338959	0.895	1268681	17.9
60-64	0.028	0.131	64886	8468	303259	0.831	929721	14.3
65-69	0.048	0.214	56418	12085	251877	0.726	626463	11.1
70-74	0.085	0.350	44333	15533	182830	0.568	374586	8.4
75-79	0.155	0.558	28799	16059	103849	0.458	191756	6.7
80+	0.145	1.000	12740	12740	87907		87907	6.9

Table 18: Empirical model life table for rural males

Age x	nMx	nqx	lx	ndx	nLx	5Px	Tx	Ex
0	0.073	0.068	100000	6820	93180	0.919	5418672	54.2
1-4	0.009	0.034	93180	3183	366355	0.939	5325492	57.2
5-9	0.017	0.083	89997	7441	431384	0.934	4959137	55.1
10-14	0.010	0.048	82556	3944	402922	0.964	4527753	54.8
15-19	0.005	0.024	78613	1850	388438	0.981	4124830	52.5
20-24	0.003	0.015	76763	1129	380991	0.981	3736392	48.7
25-29	0.005	0.024	75633	1800	373667	0.971	3355401	44.4
30-34	0.007	0.035	73833	2547	362798	0.965	2981734	40.4
35-39	0.007	0.036	71286	2532	350099	0.963	2618936	36.7
40-44	0.008	0.038	68754	2631	337191	0.959	2268837	33.0
45-49	0.009	0.043	66123	2833	323531	0.952	1931646	29.2
50-54	0.011	0.053	63289	3330	308123	0.940	1608116	25.4
55-59	0.014	0.067	59960	4018	289755	0.918	1299992	21.7
60-64	0.021	0.098	55942	5500	265961	0.886	1010237	18.1
65-69	0.028	0.131	50442	6587	235743	0.838	744276	14.8
70-74	0.044	0.199	43855	8711	197498	0.755	508533	11.6
75-79	0.071	0.302	35144	10619	149172	0.520	311035	8.9
80+	0.152	1.000	24525	24525	161863		161863	6.6

Table 19: Empirical model life table for rural females

Age x	nMx	nqx	lx	ndx	nLx	5Px	Tx	Ex
0	0.086	0.079	100000	7919	92081	0.905	5578969	55.8
1-4	0.011	0.044	92081	4009	360305	0.964	5486889	59.6
5-9	0.004	0.019	88072	1681	436157	0.984	5126584	58.2
10-14	0.002	0.012	86391	1061	429303	0.986	4690427	54.3
15-19	0.003	0.016	85330	1336	423310	0.982	4261124	49.9
20-24	0.004	0.020	83994	1695	415731	0.978	3837815	45.7
25-29	0.005	0.023	82298	1925	406679	0.975	3422084	41.6
30-34	0.005	0.026	80373	2117	396573	0.972	3015405	37.5
35-39	0.006	0.031	78256	2388	385310	0.965	2618832	33.5
40-44	0.008	0.039	75868	2946	371976	0.957	2233522	29.4
45-49	0.009	0.046	72922	3378	356167	0.945	1861546	25.5
50-54	0.013	0.065	69545	4525	336410	0.924	1505379	21.6
55-59	0.018	0.087	65019	5679	310901	0.890	1168969	18.0
60-64	0.029	0.135	59341	7984	276745	0.828	858068	14.5
65-69	0.048	0.214	51357	11002	229280	0.730	581323	11.3
70-74	0.082	0.340	40355	13727	167457	0.587	352043	8.7
75-79	0.142	0.523	26628	13938	98294	0.467	184587	6.9
80+	0.147	1.000	12690	12690	86292		86292	6.8

Table 20: Empirical model life table for urban, both sexes

Age x	nMx	nqx	lx	ndx	nLx	5Px	Tx	Ex
0	0.058	0.054	100000	5441	94559	0.933	5781045	57.8
1-4	0.008	0.032	94559	3037	372162	0.974	5686486	60.1
5-9	0.003	0.013	91522	1157	454718	0.989	5314325	58.1
10-14	0.002	0.009	90365	812	449797	0.988	4859606	53.8
15-19	0.003	0.015	89554	1340	444419	0.982	4409809	49.2
20-24	0.004	0.021	88214	1887	436352	0.978	3965390	45.0
25-29	0.005	0.023	86327	1980	426685	0.976	3529037	40.9
30-34	0.005	0.025	84347	2082	416529	0.973	3102353	36.8
35-39	0.006	0.028	82265	2335	405486	0.967	2685824	32.6
40-44	0.007	0.037	79930	2942	392293	0.958	2280337	28.5
45-49	0.010	0.047	76988	3624	375880	0.941	1888044	24.5
50-54	0.015	0.071	73364	5224	353762	0.917	1512164	20.6
55-59	0.020	0.096	68140	6522	324397	0.878	1158402	17.0
60-64	0.033	0.150	61618	9262	284936	0.809	834005	13.5
65-69	0.054	0.239	52356	12500	230530	0.701	549069	10.5
70-74	0.093	0.377	39856	15035	161692	0.541	318539	8.0
75-79	0.167	0.589	24821	14628	87535	0.442	156847	6.3
80+	0.147	1.000	10193	10193	69312		69312	6.8

Table 21: Empirical model life table for rural, both sexes

Age x	nMx	nqx	lx	ndx	nLx	5Px	Tx	ex
0	0.061	0.057	100000	5732	94268	0.928	5503981	55.0
1-4	0.010	0.039	94268	3702	369668	0.951	5409713	57.4
5-9	0.010	0.051	90566	4582	441374	0.959	5040045	55.7
10-14	0.006	0.030	85984	2577	423475	0.975	4598671	53.5
15-19	0.004	0.020	83406	1703	412775	0.980	4175196	50.1
20-24	0.004	0.019	81704	1543	404662	0.978	3762421	46.0
25-29	0.005	0.025	80161	2012	395777	0.972	3357759	41.9
30-34	0.006	0.032	78150	2495	384510	0.967	2961982	37.9
35-39	0.007	0.035	75655	2638	371679	0.962	2577472	34.1
40-44	0.008	0.041	73017	2998	357589	0.956	2205793	30.2
45-49	0.010	0.048	70019	3336	341752	0.945	1848204	26.4
50-54	0.013	0.063	66682	4223	322854	0.927	1506452	22.6
55-59	0.017	0.083	62459	5202	299293	0.896	1183597	18.9
60-64	0.027	0.126	57258	7212	268258	0.845	884304	15.4
65-69	0.042	0.188	50046	9419	226681	0.764	616046	12.3
70-74	0.069	0.295	40627	11972	173205	0.640	389365	9.6
75-79	0.117	0.452	28655	12946	110910	0.487	216160	7.5
80+	0.149	1.000	15709	15709	105250		105250	6.7

Table 22: Life expectancy by age and sex

Age x	Male	Female	Both sexes
0	55.6	61.2	58.0
1	60.5	64.7	60.1
5	59.8	62.1	58.2
10	55.7	57.8	54.1
15	51.3	53.3	49.6
20	47.2	48.8	45.3
25	43.4	44.5	41.3
30	39.3	40.2	37.2
35	35.1	36.0	33.1
40	31.0	31.7	29.0
45	26.9	27.6	25.0
50	22.9	23.6	21.1
55	19.2	19.7	17.5
60	15.6	16.0	14.0
65	12.4	12.6	10.9
70	9.7	9.7	8.4
75	7.6	7.6	6.6
80	6.4	6.7	6.6

Table 23: Life expectancy of selected sub-Saharan African countries

Country	Life Expectancy
Nigeria	53.6
South Sudan	55.6
Liberia*	58.4
Cote D'Ivoire	58.9
Guinea	59.0
Mali	59.4
Benin	60.0
Burkina Faso	60.0
Sierra Leone	60.4
Equatorial Guinea	61.0
South Africa	61.5
Togo	61.6
Zambia	61.8
Kenya	62.0
Niger	62.1
Uganda	63.6
Ghana	63.9
Gabon	65.7
Tanzania	66.8
Senegal	67.9

Table 24: Access to health care within one hour of walking

County	Population with access to health care within one hour of walking
River Cess	40%
Gbarpolu	49%
Grand Bassa	50%
Bomi	57%
Bong	57%
Nimba	59%
Grand Kru	60%
Lofa	60%
Grand Cape Mt	63%
River Gee	63%
Grand Gedeh	64%
Sinoe	68%
Maryland	69%
Margibi	71%
Montserrado	88%
National	**70%**

Table 25: Infant and Under-five mortality by socio-economic characteristics

Socio-economic characteristics	Infant mortality (Both sexes)	Under-five mortality (Both sexes)	Reference period
Sex			
Male	51	61	2014.2-2018.2
Female	42	51	2014.2-2018.3
Locality			
Urban	39	47	2014.3-2018.5
Rural	55	67	2014.2-2018.0
County			
Bomi	70	92	2013.1-2017.7
Bong	55	67	2014.2-2017.9
Gbarpolu	44	52	2013.7-2018.0
Grand Bassa	57	71	2014.0-2018.1
Grand Cape Mount	63	80	2014.3-2017.4
Grand Gedeh	30	35	2014.6-2018.4
Grand Kru	52	64	2014.8-2018.5
Lofa	46	56	2014.4-2018.2
Margibi	44	52	2014.2-2018.2
Maryland	55	67	2014.6-2018.7
Montserrado	39	46	2014.3-2018.5
Nimba	45	54	2014.1-2018.3
River Cess	64	81	2014.6-2018.2
River Gee	54	67	2014.4-2018.4
Sinoe	48	57	2014.5-2018.1
Marital status			
Never married	43	51	2014.4-2018.4
Married (mono and polygamous)	43	57	2014.2-2016.4
Separated	50	61	2014.6-2016.5
Divorced	73	95	2014.5-2015.3
Widowed	99	144	2013.0-2014.0
Consensual Union	50	60	2014.7-2017.2

Mother's level of education			
No formal education	52	64	2013.5-2018.4
Primary education	42	50	2014.0-2018.7
Secondary or higher education	32	37	2015.0-2018.6
Literacy			
Non-literate mothers	49	60	2014.2-2018.2
Literate mothers	34	40	2014.3-2018.6
Wealth Quintile			
Lowest quintile	58	72	2014.5-2017.9
Second quintile	53	65	2014.2-2018.1
Third quintile	48	57	2014.1-2018.3
Fourth quintile	40	47	2014.1-2018.5
Highest quintile	31	36	2014.8-2018.9

Table 26: Respective advantages and disadvantages of counties that enhance survival chances of children or predispose them to morbidity/mortality

County	Advantages/opportunities	Disadvantages/deprivation
Bomi	Proximity to the nation's capital makes referral easier. Has an Iron Ore mining company and Mano Palm company that provide job opportunities for the population.	42.7% of the population lacks access to health services. The county has only two Laboratory Technicians that provide Laboratory services to 133,705 people. Little over half (52%) of Bomi health facilities do not have midwives. 52% of households occupy one room and 58 % of households use bush for human waste disposal.
Bong	Has three hospitals with an Iron Ore mining company that provide employment opportunities for the population.	42.8% of the population has no physical access to health services (2022 Census). 47.9% of households use bush for human waste disposal and about 33% of households use unimproved water source for drinking.
Gbarpolu	Has a lot of gold and diamond deposits, with widespread illegal mining activities that create income for the population. Hunting and logging activities are common also. The construction of a modern hospital, the Emirate Hospital will address some of the health challenges of the population.	Gbarpolu is very remote with only 16 health facilities serving 95,995 people. Kungbor District has just a single health facility with five professional health workers and Belle District has only two health facilities with six professional health workers (MoH HIS-2023). Population with access to healthcare is 49.4% (2022 Census) and there are only two Laboratory Technicians in the entire county. 57% of households use bush for human waste disposal and 41% of households use unimproved water source for drinking.
Grand Bassa	Has a sea port, a big fishing community, and the second largest rubber company in Liberia (Liberia Agriculture Company), that employ thousands of citizens. The biggest Iron Ore Mining Company (Arcelor Mittal Steel) has their sub-station in Bassa and ship iron ores out of Liberia from Grand Bassa seaport. Arcelor Mittal provides thousands of jobs for the population.	49.6% of the population has access to health care (2022 Census). There are only 8 Laboratory Technicians and 30 midwives serving 293,689 people (MOH Health workforce mapping exercise, 2023). Camp Wood District has just a single health facility and District #2 has only two health facilities (MOH HIS, 2023). 54% of health facilities do not have any midwife. About 36% of households occupy one room, about 59% of households use bush for human waste disposal and 55% of households use unimproved water source for drinking.

Grand Cape Mount	Grand Cape Mount has huge deposits of diamonds and gold with a gold mining company (Bea Mountain-Turkish and South African Mining company).	Grand Cape Mount has only six Laboratory Technicians serving 178,867 people. Over two-thirds (37.1%) of the population lack access to health care. Majority (66%) of the health facilities lack midwives to provide antenatal, delivery and postnatal health services for pregnant women. About 40% of households use bush for human waste disposal.
Grand Gedeh	Grand Gedeh has widespread illegal mining activities and the county is noted for wildlife hunting for commercial purpose.	Grand Gedeh County has only 11 Laboratory Technicians that provide Laboratory services to 216,692 people. Konobo District has two health facilities with 16 professional health workers. Over one-third (36.7%) of the population lacks access to health services. Grand Gedeh is inaccessible during the raining season.
Grand Kru	Grand Kru is naturally beautiful, with vast savannah land and beaches. There are numerous illegal mining activities taking place in the county that provide income for the inhabitants.	The county has only seven Laboratory Technicians that provide services to 109,342 people. About 40.3% of the county's population lack access to health care services. Grand Kru is one of the remotest counties in Liberia with limited or no basic social services such as banks, electricity, safe pipe-borne water, etc. The county is cut off from many parts of the country during the raining season. About 48% of households use bush for human waste disposal and 47 % of households use unimproved sources of water for drinking.
Lofa	Shares borders with Sierra Leone and the Republic of Guinea. Lofa County's location promotes trade and commerce. The majority of the population are farmers, involved with Cocoa and Coffee production. The county was once the bread basket of Liberia.	About 39.5% of the population lack access to health services. The county has only six Laboratory technicians serving 367,376 people. About 40% of households use bush for human waste disposal and 31% of households use unimproved sources of water for drinking.
Margibi	There is a rubber plantation that provides jobs and it has a high migrant population after Montserrado.	About 29% of the population lack access to health services. Nearly a quarter (23%) of Margibi's health facilities (61 health facilities) do not have midwives. About 27% of households use unimproved water sources for drinking.
Maryland	Has few concessions (Cavalla Rubber Company, Golden Veroleum Palm Company, etc) that provide economic activities and income for the population.	About 29% (2022 Census) of the population lack access to health services. The county is cut off from the rest of Liberia during the raining season. About 36% of households occupy one room and 22% of households use bush for human waste disposal.

Montserrado	The county has almost 53% of the country's 1,064 health facilities. Contain the national capital, has a lot of socio-economic opportunities. For example, job opportunities, social infrastructure, seat for Development Partner Agencies, relatively good roads, housing and sanitation, highest migrant population, etc.	About 80% of its 562 health facilities are owned by private providers. Coordination of health services is a challenge due to multiple actors. 12.4% of the population has no access to health services (particularly those in rural Montserrado). About 44 % of households occupy one room, 28 % of households use unimproved sources of water for drinking and only 7% of households use bush for human waste disposal.
Nimba	Nimba County is one of the endowed counties in Liberia. The biggest Iron Ore mount is situated in Nimba. The mining company (Arcelor Mittal) provides thousands of jobs for the population. It has the second biggest economy in Liberia.	The iron ore extraction has virtually no impact on the households because about 32,000 households are in the poorest wealth quintile. About 40% of the population lack access to health services.
River Cess	Fishing, logging and illegal mining are the major sources of income in River Cess County.	Has the lowest (40.4%) access to health services. River Cess is one of the least developed counties in Liberia next to Gbarpolu. The county also has poor road network and is cut-off from many parts of the country during the raining season. About 44% of its households occupy one room, as high as 76% of households use bush for human waste disposal and 63% of households use unimproved water sources for drinking.
River Gee	Has a hospital, two health centres and many clinics that provide health services. Illegal mining provides income for the population.	About 27% of the population lack access to health services. It is very difficult to retain health care professional due to the county's remoteness. River Gee is cut off from Monrovia and most part of the country during the raining season due to bad road conditions.
Sinoe	Sinoe has a seaport that is used for the shipment of timber, palm and goods. There are companies (logging companies and Golden Veroleum Palm Company), and many illegal mining sites that create job opportunities and income for the population.	Bad roads condition cut off the county from Monrovia during the raining season. This impact prices of basic commodities and economic activities. Sinoe has just a single Laboratory Technician (MOH Health Workforce Mapping, 2023) and 22.2% of the population has no access to healthcare services (2022 Census). About 57% of households use bush for human waste disposal and 45% of households use unimproved sources of water for drinking.

Appendix B

Description of method and data input for the generation of the life tables

The first set (Procedure 1) was built from the observed ASDRs (mx) using the MORTPAK software.

The second set (Procedure 2) was fitted with deaths by age and population by age, using LTPODTH software (US Bureau of Census, 1994). The procedure produces a life table based on the mx values smoothed by a moving average of the logarithms of the death rates.

For the third procedure, the reported number of deaths by sex was adjusted for completeness by the Brass balance growth equation method and the adjusted total number of deaths by sex was then redistributed by age by the observed proportions in each age group. The LTPODTH software was employed to generate the life table.

In the fourth procedure, the indirect method was used to compute for under-five mortality to compute for probability of dying using the Coale and Demeny Life Tables, North model. The resultant probabilities of dying were fitted into the LTMXQXAD Software (US Bureau of Census).

The fifth procedure was like the fourth procedure except that the resultant probabilities of dying were fitted into the MORTPAK software.