



# Sierra Leone Non-communicable Diseases and Injuries Poverty Commission: Findings and Recommendations

November 2020







## FOREWORD

In 1990, the life expectancy of our people of Sierra Leone sat at only 39 years. Today, even in the wake of a decade of civil war, the Ebola epidemic, and now the COVID-19 global pandemic, we have remained strong in our determination to rebuild our nation and protect and develop the health and wellness of our people.



Our National Action Plan for Health Security (NAPHS) 2018-2022 and Road Map for Universal Health Coverage in Sierra Leone gives us direction, equitably pointing us toward our Sustainable Development Goals. While meeting the call of significant and still-present infectious disease and socioeconomic challenges, we have responded to the growing need to prevent and control non-communicable diseases and injuries (NCDIs) in our country. Targeting early points of contact at decentralized levels in our health system, we are increasing awareness and early screening for chronic illness, disrupting the progression of disease so that we can avert costly treatment and loss of life. But still, our system still must be strengthened further. The burden of NCDIs remains too high, threatening the livelihood of our young people and further impoverishing those already vulnerable.

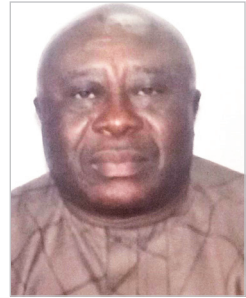
Building on a number of significant achievements in the NCD arena since the MoHS created NCD Strategic Health Policy in 2013, the establishment of the Sierra Leone NCDI Poverty Commission in April 2019 by the Directorate of Non-Communicable Diseases and Mental Health of the Sierra Leone Ministry of Health and Sanitation brings together needed multisectoral expertise and energy. Comprehensively analyzing national data with the support of epidemiological modeling and tracing the development and expansion of clinical services, staff, and medicines, the Commission gives us a clear sense of our NCDI progress. Strategizing on how NCDI conditions and costed interventions can be prioritized to meet the highest burdens of disease and disability in the most equitable, cost-effective manner, the Commission's recommendations offered here will aid as we continue to reach for Universal Health Coverage.

**Dr. Alpha T. Wurrie**  
**Minister of Health and Sanitation**  
**Republic of Sierra Leone**



## ACKNOWLEDGEMENTS

Sierra Leone's National Policy and five-year Strategic Plan (2013-2017) on Non-Communicable Diseases (NCDs), launched on September 6, 2013 by the Ministry of Health and Sanitation (MoHS), was developed in consultation with multi-sector stakeholders. Sierra Leone's appreciation of how NCD interventions must stretch beyond individual facilities and the health sector itself to effectively prevent and control NCDs is echoed in the novel documents. The Sierra Leone NCDI Poverty Commission upholds this call for multi-sectoral partnership and chose its members based on the importance of working across sectors to bring equitable prevention and control for NCDIs.



The Commission wishes to express its gratitude to the Honorable Minister of Health and Sanitation Dr. Alpha T. Wurie as well as leadership and partners within the Ministry of Health and Sanitation, including the Directorate of Non-communicable Diseases and Mental Health, the Health Education Division, the Director of Nutrition, and the Resident Solicitor. The Commission also wishes to acknowledge our multisector stakeholders outside of the health arena, including: the Ministry of Social Welfare, Gender, and Children's Affairs, the Ministry of Basic and Secondary Education, the Ministry of Finance, the Ministry of Youth Affairs, the Ministry of Agriculture and Food Security, the Ministry of Trade and Industry, the Sierra Leone Police, the Sierra Leone Road Safety Authority, National Drug Law Enforcement Agency, National Revenue Authority, and the Sierra Leone Standard Bureau. Beyond non-government agencies and partners, the Commission wishes to acknowledge the invaluable input from local and global partners including the World Health Organization, Health for all Coalition, the Kings Partnership, Voluntary Services Overseas, Disease Control Priorities, the Institute of Health Metrics and Evaluation, and partners Dr. Owizz and Dr. Haja Wurie. The Commission extends its gratitude to Harvard Medical School and Partners in Health for technical advice and funding to support the Commission and its work. Finally, the Commission extends deep appreciation to Sierra Leone's medical providers, clinicians, patients and families, for whom efforts to expand and strengthen NCDI services are needed most.

Rev. Canon Dr. Thomas T. Samba  
Chief Medical Officer  
Ministry of Health and Sanitation





# Sierra Leone NCDI Poverty Commission Members



Sierra Leone NCDI Poverty Commission meeting, Kono, February 2020.

## COMMISSION CO-CHAIRPERSONS

---

**Dr. Santigie Sesay**

*Ministry of Health and Sanitation, Directorate of Noncommunicable Diseases and Mental Health*

**Dr. Marta Lado**

*Partners In Health*

**Walter Carew**

*Sierra Leone Mental Health Coalition*

**Ballay Conteh**

*Ministry of Health and Sanitation*

**Maybelle Gamanga**

*Ministry of Basic and Senior Secondary Education*

## COMMISSION COORDINATOR

---

**Michael Alex Conteh**

*Ministry of Health and Sanitation, Directorate of Noncommunicable Diseases and Mental Health*

**Alhassan Jalloh**

*Sierra Leone Alcohol Alliance*

**Dr. Mohamed Jalloh**

*Sierra Leone Police*

## COMMISSIONERS

---

**Amara Bangura**

*Ministry of Planning and Economic Development*

**Dr. Chiyembekezo Kachimanga**

*Partners In Health*

**Magona M. H. J. Barry**

*Ministry of Trade and Industry*

**Abdul Kabba Kamara**

*Ministry of Youth Affairs*



**Mutiva Kappia**

*Ministry of Health and Sanitation, Directorate of Food and Nutrition*

**Ibrahim Kargbo**

*National Drug Law Enforcement Agency*

**Mamoud Kargbo**

*Handicap International*

**Dr. Janet Kayieta**

*World Health Organization*

**Ismaila Kebbie**

*Ministry of Health and Sanitation, National Rehabilitation Programme*

**Dr. Abu B.T. Koroma**

*Ministry of Health and Sanitation*

**Hawanatu K. Koroma**

*Ministry of Social Welfare, Gender, and Children's Affairs*

**Ibrahim Sorie Koroma**

*Ministry of Health and Sanitation, Health Education Division*

**Ljubica Ledenski**

*Emergency Hospital, Medical Coordinator*

**John Makanga**

*Ministry of Health and Sanitation, Solicitor*

**Alie H. D. Mansaray**

*Ministry of Agriculture and Forestry*

**Minkail I. Njai**

*Ministry of Health and Sanitation, CMO Office*

**Paul Quee**

*National Revenue Authority*

**Mohamed Sannoh**

*Sierra Leone Cancer Society*

**Kadiatu Savage**

*Ministry of Health and Sanitation, Mental Health Coordinator*

**Reynold Senesi**

*Ministry of Health and Sanitation, Directorate of Noncommunicable Diseases and Mental Health*

**James Stevens**

*Sierra Leone Road Safety Authority*

**Edna Thomas**

*Seventh Day Adventist Church*

**Sulaiman Turay**

*Sierra Leone Standard Bureau*

**Dr. Haja Ramatulai Wurrie-Kamara**

*College of Medicine and Allied Health Sciences (CoMAHS), University of Sierra Leone*

**COMMISSION ADVISORS**

---

**Gene Bukhman**

*Harvard Medical School, Department of Global Health and Social Medicine, Program in Global NCDs and Social Change; Partners In Health, NCD Synergies Project*

**Dr. Neil Gupta**

*Harvard Medical School, Department of Global Health and Social Medicine, Program in Global NCDs and Social Change; Partners In Health, NCD Synergies Project*

**RESEARCH SUPPORT**

---

**Matthew Coates**

*Harvard Medical School, Department of Global Health and Social Medicine, Program in Global NCDs and Social Change*

**Arielle Eagan**

*Harvard Medical School, Department of Global Health and Social Medicine, Program in Global NCDs and Social Change*

**Andrew Marx**

*Harvard Medical School, Department of Global Health and Social Medicine, Program in Global NCDs and Social Change*



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## ACRONYMS & ABBREVIATIONS

<b>CHW</b>	Community Health Worker
<b>COPD</b>	Chronic Obstructive Pulmonary Disorder
<b>CVD</b>	Cardiovascular Disease
<b>DALY</b>	Disability Adjusted Life Years
<b>FCHI</b>	Free Care Health Initiative
<b>GBD</b>	Global Burden of Disease
<b>IHD</b>	Ischemic Heart Disease
<b>IHME</b>	Institute of Health Metrics & Evaluation
<b>IPV</b>	Intimate Partner Violence
<b>LMIC</b>	Low & Middle-Income Countries
<b>MoHS</b>	Ministry of Health and Sanitation
<b>NAPHS</b>	National Action Plan for Health Security
<b>NCD</b>	Non-Communicable Disease
<b>NCDI</b>	Non-Communicable Diseases & Injuries
<b>NGO</b>	Non-Governmental Organization
<b>PBF</b>	Performance Based Financing
<b>PTSD</b>	Post-Traumatic Stress Disorder
<b>PVD</b>	Peripheral vascular disease
<b>RHD</b>	Rheumatic Heart Disease
<b>SDG</b>	Sustainable Development Goals
<b>TBI</b>	Traumatic Brain Injury
<b>THE</b>	Total Health Expenditure
<b>UHC</b>	Universal Health Coverage
<b>WHO</b>	World Health Organisation



## EXECUTIVE SUMMARY

Over the past decade, Sierra Leone has faced significant competing burdens of civil war, poverty, and infectious epidemics, including both Ebola and COVID-19. In the context of improving reproductive, maternal, newborn, and child health as well as control of infectious diseases, noncommunicable diseases and injuries (NCDIs) have emerged as a significant source of morbidity and mortality throughout the country and have become a key focus of the Ministry of Health and Sanitation (MoHS). The National Action Plan for Health Security (NAPHS) 2018-2022 and The Road Map for Universal Health Coverage in Sierra Leone detailed a strong commitment to developing a comprehensive health system, including high-quality and accessible services for NCDIs.

The Sierra Leone NCDI Poverty Commission was established with the support of the *Lancet NCDI Poverty Commission* in April 2019 by the MoHS to analyze available data on NCDIs and provide evidence-based recommendations to strengthen NCDI services in the country. The Sierra Leone NCDI Poverty Commission, comprised of a broad group of local multi-sectoral stakeholders, conducted a series of meetings and workshops to direct and guide its analysis. This report contains the major findings and recommendations of this Commission.

The Commission found that over the past decade, the burden of NCDIs in Sierra Leone has risen from 23% of all disability-adjusted life-years (DALYs) in 1990 to 34% of all DALYs in 2017. Deaths are increasingly due to NCDIs as well, with 33.7% of deaths in Sierra Leone in 2017 due to NCDs and 5.9% to injuries. Approximately two-thirds of this burden was due to NCDs outside of the predominant global NCD monitoring framework, which predominantly focuses on NCD conditions with behavioral risk factors. Contrary to popular beliefs regarding NCDIs, 56.5% of NCD DALYs and 78.4% of injury DALYs in Sierra Leone occur in those under the age of 40.

Although the Essential Package of Health Services 2015-2020 details robust plans to develop, strengthen, and decentralize NCDs, mental health, and injury/emergency services at secondary and primary health system level, the Commission found that most NCDI services are still lacking. The proportion of facilities reporting delivery of services is very low for conditions such as cardiovascular diseases (17%) and diabetes (9%), and services and personnel for NCDIs remain concentrated at the urban, tertiary level, constraining capacity and availability of services in more rural, decentralized levels.

Recognizing the significant need to further expand, develop, and decentralize NCDI services in the country, the Commission conducted a prioritization and costing exercise. After carefully reviewing findings on the NCDI burden of disease in the country and considering weighted metrics of burden, severity, disability, and equity, the Commission proposed an expanded set of 43 priority



NCDI conditions. Selected conditions included common NCDIs caused by traditional risk factors as well as severe, chronic NCDIs that affect younger and vulnerable populations, such as sickle cell, diabetes type 1, epilepsy, and trauma-included injuries. Guided by these selected NCDI conditions, the Commission then analyzed and recommended 38 cost-effective preventative, curative, palliative, and cross-cutting interventions that could be implemented to address the priority NCDs.

The Commission estimated that to introduce and implement the prioritized health sector NCDI interventions for a reasonable portion of the population in Sierra Leone, the annual cost would be \$87,996,382 USD, or \$11.50 USD per capita. This investment would equal approximately 17% of the current health expenditure in Sierra Leone. Together with robust multi-sectoral prevention-focused interventions, this expansion and delivery of health-sector interventions for NCDIs could potentially avert a substantial portion of death and disability due to NCDIs in the country and make significant strides to achieving full UHC.



# 1. Background and objectives of Sierra Leone NCDI Poverty Commission

## 1.1 INTRODUCTION TO NCDIS AND UHC IN SIERRA LEONE

Over the past decade, first marked by its 2010 Free Health Care Initiative, Sierra Leone has shown its commitment to equitable care at national level. Since then, the country has developed its Basic Package for Essential Health Services 2015-2020, the National Action Plan for Health Security (NAPHS) 2018-2022, and the Road Map for Universal Health Coverage. The country recognizes that a strong health system and society, at large, is needed to attain the Sustainable Development Goals and UHC. A key aim of Sierra Leone's UHC is to ensure early points of contact with the health system so that provision of comprehensive and quality care is both efficient and affordable.

As infectious diseases have been increasingly controlled in low- and middle-income countries (LMICs) and populations are living longer, non-communicable diseases and injuries (NCDIs) have become a significant source of morbidity and mortality. In Sierra Leone, NCDIs have increasingly become a priority in the health sector. To achieve UHC, MoHS appreciates that care must come both in reaction to emergencies and infectious disease outbreaks as well as in an effort to prevent and control complex, chronic NCDs and injuries. Building this interconnected foundation and increasingly expanding its focus to develop, strengthen, and decentralize health system interventions for NCDIs, Sierra Leone is gaining traction on its targets of UHC.

*“Our National Action Plan for Health Security and The Road Map for Universal Health Coverage in Sierra Leone that we will launch today are consistent with one of our key national priorities – healthcare. To our mind, quality healthcare is foundational to productivity and overall well-being. As a nation, we cannot afford the cost of not investing in healthcare and universal health coverage. It is a down payment on a fairer, safer and more prosperous future for our people and our country.”*

– His Excellency Brig. Rtd. Julius Maada Wonie Bio,  
President of the Republic of Sierra Leone, Freetown,  
12 September 2019



## Key Accomplishments and Current Program Initiatives for the MoHS Directorate of NCDs and Mental Health

### Key Accomplishments:

- Strategic planning: Establishment of a Noncommunicable Diseases and Injury Commission, Framework Convention on Tobacco Control (FCTC) Taskforce, and Mental Health Steering Committee
- Policies and treatment guidelines: National Policy and Strategic Plan on NCDs (2019-2023), National Mental Health Policy and Strategic Plan 2019-2023, National NCD Treatment Guidelines, and National Physical Rehabilitation Medicine Policy 2012
- Deployment of District Mental Health Nurse in 14 districts
- Trainings: District-level and clinician-level mhGAP training
- Campaigns: Reducing High Salt Consumption Campaign (Western urban and rural districts), Observed World Diabetes Day
- Cross-sectoral achievements: Alcohol Control Project and the Tobacco Control-WHO FCTC 2030, mHealth secretariat in partnership with International Telecommunication Union (ITU)
- Improved infrastructure: Sierra Leone Psychiatric Teaching Hospital

### Programmatic Initiatives:

- Strategic planning initiatives: Planned for the establishment of an NCD committee or task forces in the Districts, run by a District Focal Person
- Policy initiatives: Planned to launch the new NCD Policy and Strategic Plan, validate the NCD training and treatment guidelines, reviewed the 1902 Lunacy Act, the MH bill & Tobacco Control bills are being reviewed for onward submission to Parliament for enactment, strengthening legislation and policy framework to enable systemic action at all levels to protect public health
- NCD risk factor initiatives: Fully implemented and enforced WHO FCTC time-bound measures, Plan to conduct the Risk factor Survey (STEPS)
- Proposed Decentralization of NCD care: Plan to roll out the WHO PEN for the integration of basic NCDs into the PHC delivery system; started in 2 districts (Kono & Bombali)
- Enhance NCD awareness, early detection, and treatment:
  - *Advocacy* – The Ministry of Health and Sanitation in partnership with local Telecommunication Companies will raise awareness on NCDs and the risk factors through mobile messaging
  - *Diagnostics* – To establish cost-effective diagnostic services at different levels



- **Treatment** – Advocate for NCD drugs to be included in the list of Essential Medicines. Ensure uninterrupted availability to ensure adherence and continuation of care
- **CVD and diabetes-related care:**
  - District hospitals: to introduce medical treatment of acute heart attack
  - Clinics: to initiate screening and drug availability for primary & secondary prevention of CVD
  - Community outreach: to create diabetes prevention programs and community rehabilitation services
- **Cancer-related care:**
  - District hospitals: to initiate hormonal therapy, chemotherapy, and surgery for breast cancer
  - Clinics: to roll out cervical cancer screening/treatment
  - Community outreach: to promote HPV and childhood Hepatitis B vaccination.
- **Rehabilitative care:**
  - District hospitals: to roll out rehabilitation for NCD and other conditions that lead to disability and provide assistive technology
  - Clinics: to identify and refer patients who need rehabilitative services, follow up of patients
  - Community outreach: to promote awareness and education
- **Data strengthening:** to advocate for strengthening the monthly reporting of NCDs morbidity and mortality in public and private NGOs and healthcare facilities and integrate NCD data into the national HMIS, Revitalize the National Cancer Registry
- **Quality of training and care:** Leverage technical support from training institutions and research organizations

*Box 1. Key Accomplishments and Current Program Initiatives for the Sierra Leone Ministry of Health and Sanitation Directorate of Non-Communicable Diseases (NCDs) and Mental Health [Source: Sierra Leone MoHS, 2020]*

### 1.3 BACKGROUND AND OBJECTIVES OF THE SIERRA LEONE NCDI POVERTY COMMISSION AND GLOBAL LANCET NCDI POVERTY COMMISSION

In 2015, the global Lancet Commission on Reframing NCDs and Injuries for the Poorest Billion (“The Lancet NCDI Poverty Commission”) was launched



through a partnership with the Harvard Medical School Program on NCDs and Social Change and Partners In Health NCD Synergies Project. Complementing the global infectious disease agenda, the global Commission had four main objectives:

- 1. Assess the nature of the NCDI burden amongst the poorest billion people in the world**
- 2. Work with a group of countries to develop actionable pro-poor pathways for expansion of NCDI interventions**
- 3. Assure that sustainable financing is not a bottleneck to NCDI prevention and treatment among the world's poorest**
- 4. Expand the NCD movement and the global health agenda to urgently address NCDIs among the poorest billion**

To advise the global Commission and bring national-level leadership and stakeholders into the advocacy discussion of broadening the global non-communicable disease agenda, the Commission invited countries facing significant dual burdens of NCDIs and extreme poverty to create national commissions. With the funding and technical support of the global Commission, a number of countries have launched national commissions, including Nepal, Kenya, Mozambique, Ethiopia, Afghanistan, Malawi, and Liberia.

In response to the growing burden of NCDI conditions affecting the Sierra Leone population, the Directorate of Non-Communicable Diseases (NCD) and Mental Health in the Sierra Leone Ministry of Health and Sanitation (MoHS) established the Sierra Leone Noncommunicable Diseases and Injuries (NCDI) Poverty Commission in April 2019. The Commission aimed to examine a broad range of chronic NCDI conditions, including mental health, disability associated with injuries, pain and palliative care.

Appreciating the cross-sector partnerships needed to understand and control NCDI conditions, the MoHS NCD Directorate strategically positioned the Sierra Leone NCDI Poverty Commission to serve as a Multi-Sector Steering Committee for the MoHS. To achieve the objectives of the Commission, the Ministry of Health and Sanitation nominated cross-sector partners to serve as Commissioners and supporting experts. These included the World Health Organization (WHO) Sierra Leone Country Office, the Ministry of Health and Sanitation (Directorate of Noncommunicable Diseases and Mental Health, Directorate of Nutrition, Health Education Division, Resident Solicitor), cross-sector Ministries (Ministry of Social Welfare Gender and Children's Affairs, Ministry of Basic and Secondary Education, Ministry of Finance, Ministry of Agriculture and Food





Security, Ministry of Trade and Industry, Ministry of Youth Affairs), government partners (Sierra Leone Road Safety Authority, National Drug Law Enforcement Agency, Sierra Leone Police, National Revenue Authority, Standards Bureau), community-based partners (Partners in Health, King's Sierra Leone Partnership, Voluntary Services Overseas, Health for All Coalition), and select clinician experts in the NCDI field.

## The Sierra Leone NCDI Poverty Commission Objectives

- 1. Serve as a Multi-Sector Steering Committee for the MoHS NCD and Mental Health Directorate**
- 2. Establish NCDI burden of disease, particularly by socioeconomic risk factors, using existing data sources**
- 3. Document existing NCDI policies as well as availability and coverage of NCDI services**
- 4. Propose an expanded set of priority NCDI conditions, emphasizing local burden, severity, & equity**
- 5. Recommend cost-effective interventions to address priority NCDIs and estimate their cost and impact**

*Box 2. The Sierra Leone NCDI Poverty Commission Objectives [Source: Sierra Leone NCDI Poverty Commission, 2019]*

The Commission met over a series of six consultative meetings over a year and a half period, with financial and technical support from Partners in Health (PIH), Harvard Medical School Department of Global Health and Social Medicine, and the *Lancet* Commission on Reframing NCDs & Injuries for the Poorest Billion. Using existing data sources, the Sierra Leone NCDI Poverty Commission established the burden of NCDIs in the country and proposed a prioritized, cost-effective package of NCDI interventions for national NCDI care expansion. Findings and Recommendations of the Commission are provided in this report, which provides an expanded NCDI agenda to support Sierra Leone in its overarching aim to achieve UHC.

Using this report as a platform, the Commission aims to provide policy makers, clinicians, and cross-sector partners with increased understanding of the burden of NCDI conditions in Sierra Leone and a tangible path towards increasing accessible, cost-effective NCDI prevention, diagnostics, treatment, and care throughout the health system.



## 2. Burden of NCDs in Sierra Leone

### 2.1 THE BURDEN OF NCDs IN SIERRA LEONE: SUMMARY OF A LOCAL LITERATURE REVIEW

To understand the burden of NCDs in Sierra Leone, the Commission conducted a PubMed review of literature on NCDs in Sierra Leone published between January 1, 2000 and March 4, 2020. Of the 255 total publications identified, 108 provided primary population level data regarding NCDI condition in Sierra Leone. Of these, the highest volume of publications found was in injuries, followed by mental disorders, and then digestive disorders.

#### 2.1.1 NCD CONDITIONS WITH BEHAVIORAL AND CARDIO-METABOLIC RISK FACTORS

There were 36 publications on NCDs in Sierra Leone over the past two decades with a focus on conditions with behavioral and cardio-metabolic risk factors. Concerning cardiovascular disease, the majority of publications focused on hypertension. In a 2001-2003 cross-sectional, population-based study of adults in Sierra Leone, the prevalence rate of hypertension was found to be over 40% (Awad, 2014). A later study in an urban hospital clinic found a lower prevalence of 25.2% in patients over 15 years, with an age-adjusted prevalence of 19.6% (Meedhan et al, 2011). One study further explored hypertension, naming it as a possible stress-induced physical outcome of the trauma that perpetrators and victims experienced during the war (Henry, 2006). The sole diabetes publication found, focused on type 2 diabetes, specifically looking at prevalence in a government hospital between 2012 and 2014. This study reported an overall prevalence of type 2 diabetes of 6.2% with 0.8-3.9% prevalence among patients ages 18-39 years and increased prevalence as patients aged. Controlling for age and sex distribution of the national population, the authors reported a standardized type 2 diabetes prevalence of 7.0%, which was notably higher than the 2.4% the only previously published study of diabetes in Sierra Leone had found in 1997 (Sundufu et al, 2017). There were no identified publications in Sierra Leone focusing on chronic respiratory diseases.

#### 2.1.2 CANCERS

Concerning neoplasms, one study reported 3.3% population prevalence of breast cancer, with 93.8% of masses in women and a high percentage of these patients under age 30 (Ntirenganya et al, 2014). Another study investigated lung cancer mortality used WHO STEPS surveys, finding a mortality rate of 13.5 per 100,000 people; this was higher than the GLOBOCAN 2008 estimate of 5.8 per 100,000



(Winkler et al, 2013). Pain and psychosocial support in cancer care is not sufficiently supporting patients with cancer in the country. In a survey of health providers, respondents reported that 70-90% of their patients with cancer had severe pain at presentation, attributing this to a combination of physical and emotional pain, including a fear of dying (Soyannwo et al, 2001). Delays in seeking care caused many patients to present with advanced disease. One study found most patients in their study of children with Burkitt's lymphoma presented late, with 32% seeking care at stage II, 54% at stage III, and 13.8% at stage IV (San Roman et al, 2013).

### 2.1.3 OTHER NCD CONDITIONS

The majority (88%) of literature results reported on non "4x4" NCD conditions, such as digestive disorders, neurological disorders, musculoskeletal disorders, substance use, sense organs injuries, mental health problems, and other NCDs. The majority of publications on digestive disorders focused on chronic liver disease associated with hepatitis B virus. Though infant hepatitis B vaccination was introduced in Sierra Leone since 2007, birth dose vaccine has not been yet introduced and vaccination is not routinely available for at-risk adults or health care professionals. Prevalence of chronic hepatitis B in the population is estimated to range between 8.7% to 9.7% (Massaquoi et al, 2018; Ansumana et al, 2018). There is concern for higher hepatitis B prevalence in rural populations as well as those living in lower socio-economic classes (Yambasu et al, 2018; Wurie et al, 2005). Community health worker (CHW) knowledge of the virus is low and CHWs and health professionals are particularly susceptible to infection (Quin et al, 2018; Garcia et al, 2017).

Studies reported a high percentage of children in the population to have anemia (76.3%), with anemia statistically significantly higher in children with homozygous sickle cell genes (HbSS) (Wirth et al, 2016; Wirth et al, 2018). Presently, there is no national newborn screening program in Sierra Leone for sickle cell. One hospital-based study gave Emmel tests to 24.5% of pediatric patients with severe anemia, finding 24.3% to have sickle cell disease; yet, only 17% of patients with the disease returned home with prophylactic antibiotics (Italia et al, 2019).

A number of findings highlighted neurological symptoms as sequelae of infectious diseases, accident or trauma-induced injuries, amputations, or nephrotic syndrome. Ebola survivors reported a high degree of some disability (77.8%), with neurological sequelae including migraine headache, stroke, peripheral sensory neuropathy, peripheral nerve lesions, and limitations in cognition (Howlett et al, 2018; Jagadesh et al, 2018). Despite a significant (1%) prevalence of epilepsy in the population, there is a lack of community and school awareness of pediatric epilepsy in the country, worsened by false beliefs and social stigma



(Asare et al, 2005; Ali et al, 2014). Because of this, the condition leads to the child facing significant school absenteeism and social isolation.

Musculoskeletal disorders were highlighted in several studies. One study reported the national prevalence of musculoskeletal disorders to be 12.6% of adults, with 6% of such problems linked to non-traumatic etiology (Elliot et al, 2015). Two studies reported musculoskeletal symptoms for Ebola survivors, with 76-77.7% of survivors in a hospital-based study reporting arthralgia, 69.8% with fatigue, and 32.5% with back pain (Tiffany et al, 2016). Patient access to care remains a significant issue due to financial barriers; 63.9% of the population has musculoskeletal problems but is unable to receive needed medical care due to financial barriers (Stewart et al, 2015; Elliott et al, 2015).

Ocular symptoms were also prominent in Ebola survivors, with 60% of one study's participants reporting symptoms (Shantha et al, 2018). Ocular care is of particular need in EVD-affected countries and their health systems (Mattia et al, 2016).

#### 2.1.4 INJURIES

The largest proportion (40%) of results in the NCDI literature review found were on injuries, with the majority of these focusing on injuries due to war and conflict and a number due to interpersonal violence, road traffic accidents, burns and caustic ingestion, and animal contact. Some studies highlighted prevalence of specific trauma or accidents and their resulting injuries, while others focused on effective or proposed interventions to control and avert injuries. The high burden of injuries in Sierra Leone is compounded by a lack of access to care. In a comprehensive, retrospective countrywide survey at all health care facilities in 2012, more than 90% of the estimated operative need in Sierra Leone were unmet (Bolkan et al, 2015).

In a cross-sectional, randomized survey of internally displaced Sierra Leonean women in 2001, 13% were found to have experienced incidents of war-related human rights abuses in the last 10 years, including abductions, beatings, killings, sexual assaults and other abuses (Amowitz et al, 2002). Beyond these abuses, the civil war from 1991 to 2002 was also characterized by a specific form of physical abuse: limb amputations. Though national statistics on the number of people who suffered intentional amputation during the war is not known, an estimated 4,000 to 10,000 individuals, including women and children, suffered amputation of limbs, lips and ears (Park, 2007). Today, amputees continue to face difficulties with ongoing pain and sensation issues as well as access to needed prosthetic



and orthotic devices (Amowitz et al, 2002; Broughton, 2001; Lacoux et al, 2002; Chopra et al, 2003; Kargbo, 2002; Magnusson et al, 2014; Andregård et al, 2017).

Violence unrelated to war was also discussed in the literature, including the interpersonal violence (IPV), child maltreatment, and violence experienced by children with disabilities (Horn et al, 2016; Ardizzi et al, 2015; Njelesani et al; 2018).

Several studies reported injuries caused by accidents. In a population-based needs assessment, burns were reported to be very prevalent, with many occurring in children 0-4 years old (23/426, 5.4%) and 5-14 years old (37/887, 4.2%). Though one study reported that extremities were the most commonly burned body regions, five studies centered on caustic ingestion, which can cause severe injury to the esophagus and the stomach (Wong et al, 2014; Contini et al, 2009; 2007; 2009; 2009; 2011). In high-poverty settings, with crowded living conditions and less access to information on how to safely handle substances, caustic soda is anecdotally one of the most frequently ingested substances by children. Often resulting in serious injury, treatment for caustic ingestion often requires dilation and gastrostomy. Few facilities have such equipment required for these procedures, so children are often treated at home or by community-based traditional healers (Wong et al, 2014). Traditional healers can also accidentally cause burns as well due to the high temperature of herbal oils used during traditional care practices (Godwin et al, 2014). Delays in care are also significant; in one study, only 19.5% children with caustic ingestion arrived at the hospital within 72 hours; in another, children were referred sometimes weeks after ingestion.

Accidental traumatic injuries are highly prevalent in the population, with 12.4% of the population reporting at least one in the past year (Stewart et al, 2013). Falls are the most common cause (over 40%) of non-fatal injuries, ranging from fractures to spinal cord injuries. Road traffic accidents are the leading cause of injury-related injuries and deaths, causing 6% of such deaths (Gosselin et al, 2005; Stewart et al, 2013; Zafar et al, 2018). Fractures and spinal cord injuries are often untreated or care was delayed, with low long-term survival for those with spinal cord injuries after discharge (20.8%) (Stewart et al, 2016; Gosselin et al, 2005). Treatment and care for injuries face many challenges, including a lack of funding, healthcare personnel, imaging equipment, consumables and equipment for surgical and burn management, and barriers to facilities in rural settings (Davé et al, 2014; Wong et al, 2014). Venomous snake bites and the need for affordable, accessible antivenom were brought up in the literature, though no prevalence data on this burden was provided (Hamza et al, 2016; Wright et al, 2016).



### 2.1.5 MENTAL AND SUBSTANCE USE DISORDERS

A high proportion of studies in the literature review (29%) focused on mental health disorders. 22 focused on the impact of conflict on the population. One study reported 44% of females and 7% of males in a sample of child soldiers had been victims of rape; 31% had killed or injured a stranger or loved one (Bentacourt et al, 2010). Multiple studies have found former child-soldiers to have elevated levels of intrusion, arousal and avoidance symptoms, as well as challenges with social disorder and perceived stigma (Fox et al, 2000; Gupta et al, 2008; Vinson et al, 2012; Bentacourt et al, 2014). Multiple studies found that internalizing coping, rooted in depression and anxiety, remained the biggest predictor of future mental health disorders in this population, while healthier coping styles mitigated such risk (Sharma et al, 2017; Bentacourt et al, 2015). Familial and community support and protective factors can help mitigate long-term mental health difficulties, reducing PTSD over time with informal supports.

Three publications highlighted the mental health impact of Ebola on survivors, including a number with residual anxiety and paranoia (Kamara et al, 2017; Ji et al, 2017). In the Ebola response, mental health was included in the emergency response, with a nurse-led mental health and psychosocial support service set up at the central public referral hospital.

Substance use disorder literature is very limited for Sierra Leone. Only four articles published in the literature specifically studied substance abuse disorders. Three of these publications focused on tobacco use, reporting 37.7% of men and 6% of women using tobacco (Screeramareddy et al, 2014). Despite a high burden of mental health disorders in Sierra Leone, a significant treatment gap (98.8%) remains for those in need of formal mental health services (Sankoh et al, 2018). This is in part due to the limited mental health care capacity at national level; there is only one psychiatrist in the country and only a small number of psychiatric nurses and psychosocial counselors are trained (Asare et al, 2005; Esan et al, 2014).

### 2.1.6 OTHER FINDINGS

In part due to this lack of access to formal services, traditional healers are sometimes sought for care for these conditions (Godwin et al, 2014). A large proportion of the population uses traditional healers. 56.9% of patients in one study sought herbal medicine for hypertension, while 36.8% of women in another study consulted traditional healers for breast masses (James et al, 2018; Ntirenganya et al, 2014). This reliance on traditional healers was reported as a concerning barrier to medical care, highlighting a possible reason for delays in seeking care (Ntirenganya et al, 2014). Medical awareness and knowledge may also be limited for those living in poverty; though one study found a high percentage of women in the capital had knowledge of breast cancer, no such research has been done in rural populations (Shepherd et al, 2006).



## 2.2 THE FACILITY BURDEN OF NCDIS IN SIERRA LEONE: FINDINGS FROM THE HEALTH MANAGEMENT INFORMATION SYSTEMS

With the new inclusion of selected NCD indicators in the Ministry of Health and Sanitation Health Management Information System (HMIS), data on NCD cases and deaths is increasingly being reported at hospital and primary care levels. The Commission reviewed data from 2018 on reported cases and deaths at these levels (Table 1). Importantly, these data represent a first attempt at capturing information on facility visits for important high-burden NCD, injury, and mental health conditions. However, compared to estimated population-based prevalence (see section on Modeled Estimates of NCDI Burden of Disease in Sierra Leone), the reported numbers of cases and deaths are likely far short of the true number of cases and deaths due to NCDs, injuries, and mental health disorders. This may be due to limited case finding of these conditions, poor utilization of public facility-based health services by the population, or limited awareness by health care providers for detection, diagnosis, and reporting. Likely, the low numbers reported are a combination of these factors, and this is a key area for improvement.

### Total Reported Cases and Deaths for Select Conditions

NCDI condition	Cases reported at primary level across all districts	Cases and deaths reported at hospitals at national level	
	Number of cases (#)	Number of cases (#)	Number of deaths (#)
Eye Conditions	2271 <sup>1</sup>	16393	0
Hypertension	28050	6530	105
Trauma	51126 <sup>2</sup>	3576	13
Anemia	129791	2309	9
Oral & Dental Conditions	2235	2270	1
Mental Disorder	326	1174	0
Diabetes (Type 1 or Type 2)	399	1049	19
Cardiovascular Disease	455 <sup>3</sup>	958	28
Tumor/Cancer	371	377	0
Burns	6747	328	1
Sting & Bites	1911	287	1
Adverse Drug Reaction	795	n/a	n/a
<b>Total</b>	<b>224477</b>	<b>35251</b>	<b>177</b>

1. Combination of HMIS primary care level “Wounds/trauma” and “Diabetic Retinopathy” categories
2. Categorized as HMIS primary care level “Eye trauma” category
3. Combination of HMIS primary care level “Cardiovascular Disease” and “Congenital Abnormality” categories

Table 1. Total Reported Cases and Deaths for Select Conditions at Primary and Hospital Level Across all Districts in 2018 [Source: MoHS-SL HMIS, 2018]



### 2.3 MODELED ESTIMATES OF NCDI BURDEN OF DISEASE IN SIERRA LEONE

To supplement local and national data sources, the Global Burden of Disease (GBD) Study 2017 was used to estimate and model the impact of NCDIs in Sierra Leone. In 2017, 28.2% of all Disability Adjusted Life Years (DALYs) in the country were due to NCDs and 5.8% were due to injuries. 33.7% of deaths from all causes were due to NCDs and 5.9% to injuries (Figure 1).

#### Share of DALYs and Deaths Caused by NDCIs

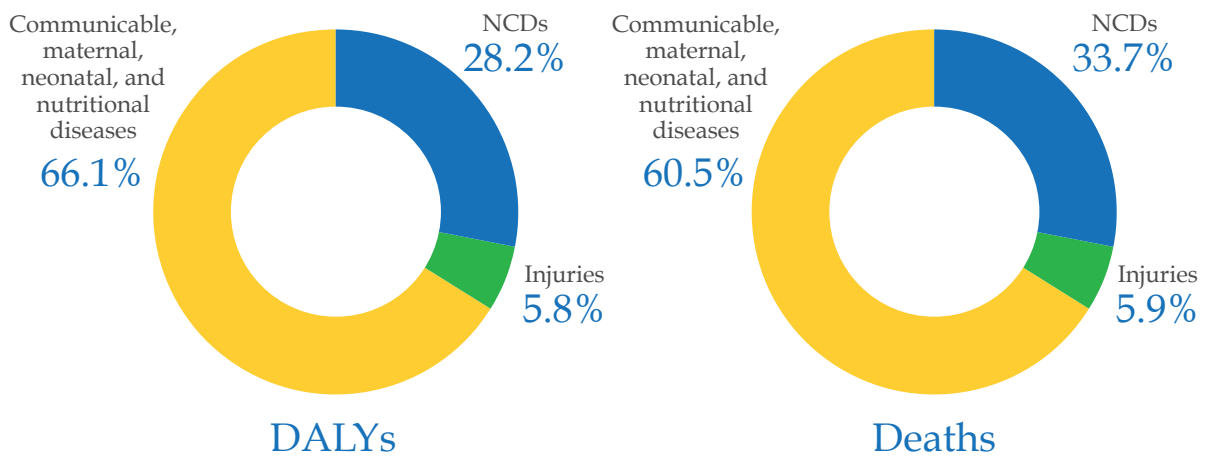


Figure 1. Current Proportion of DALYs and Deaths Attributed to NCDI in Sierra Leone in 2017 [Source: GBD, 2017]

Communicable diseases, maternal, neonatal and nutritional diseases are increasingly better controlled in Sierra Leone. Since 1990, the proportion of the disease burden due to NCDs and injuries combined has risen from 22.5% to 33.9% (Figure 2). This is likely due to several factors, including the increasing risk factors for many NCDIs, improving recognition, diagnosis, and reporting of many chronic diseases, and decline in several communicable, maternal, neonatal, and nutritional disorders, urbanization, poor adherence to safety precaution measures (transportation, construction, handling and abuse of substances etc.).

Similarly, the proportion of deaths due to NCDIs has increased in Sierra Leone. Deaths due to communicable diseases, maternal, neonatal and nutritional diseases have decreased from 71.2% to 60.4% while the proportion of deaths due to NCDs and injuries has risen significantly from 28.8% to 39.6%.





## Percentage of DALYs Attributed to NCDIs

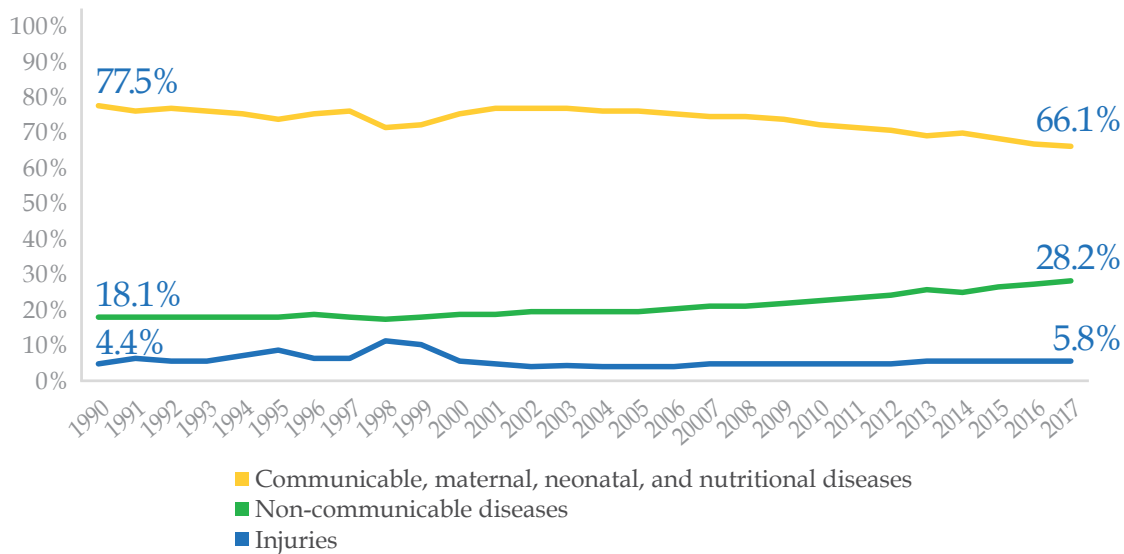


Figure 2. Increase in Percentage of DALYs Attributed to NCDIs in Sierra Leone from 1990-2017 [Source: GBD, 2017]

The current global action framework for NCDs calls attention to four NCDs (cardiovascular diseases, diabetes mellitus, cancer, and chronic respiratory diseases) with four modifiable risk factors (tobacco use, unhealthy diets, physical inactivity, and harmful alcohol use) (WHO, 2020). However, based on estimates from the GBD Study 2017, the Commission found that only 36.7% of the NCD DALYs were attributed to these four conditions (Figure 3). 63.3% of NCD DALYs in Sierra Leone were attributed to other conditions, such as neurological disorders (7.7%), digestive disorders (7.4%), musculoskeletal disorders (5.9%), skin and subcutaneous diseases (3.4%), kidney disease (2.9%), and other NCDs (23.6%). A number of particularly severe NCD conditions were also found to have particularly high burden, such as sickle cell disease (1.7%) and rheumatic heart disease (0.7%). A significant proportion of DALYs attributed to NCDs are caused by mental disorders (7.4%), including depressive disorders (2.6%), anxiety disorders (1.5%), conduct disorder (0.7%), bipolar (0.6%), and schizophrenia (0.5%). 1.7% of NCD DALYs are due to substance use disorders, with the highest burden due to drug use (1.1%), opioid use disorder (1.0%), and alcohol use disorder (0.6%).



## DALYs Attributed to 4x4 vs Non-4x4 NCD Conditions

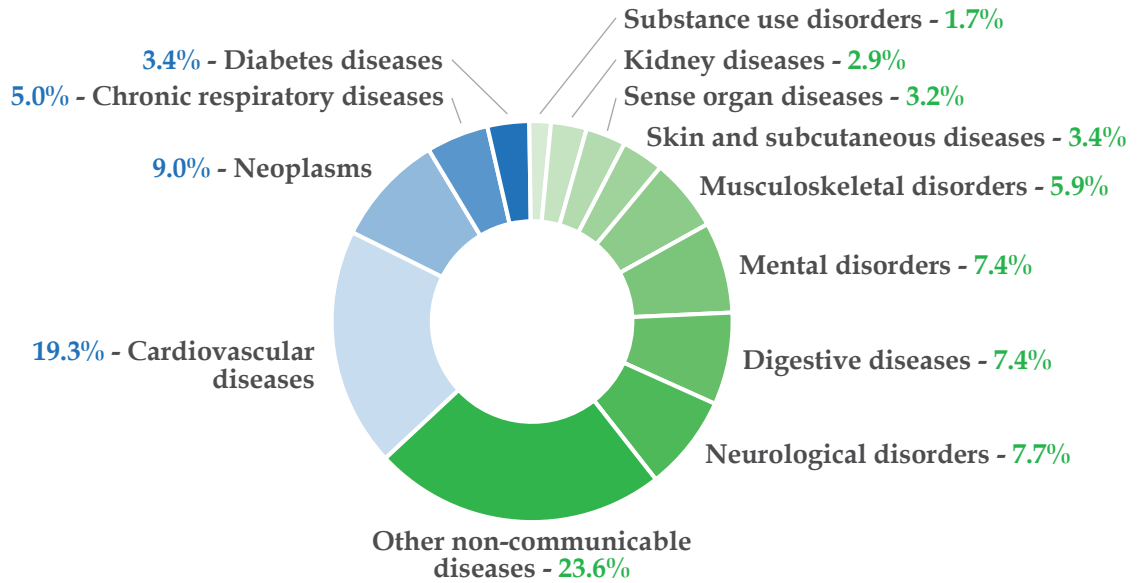


Figure 3. DALYs Attributed to 4x4 vs non-4x4 NCD Conditions in Sierra Leone in 2017 [Source: GBD, 2017]

Traditionally, NCDs have been thought to only affect older populations. However, the Commission found the burden of NCDs to be higher in people below age 40. 56.5% of NCD DALYs occurred in people below 40 years (Figure 4). For injuries, DALYs were even more prominent among younger ages, with 78.4% of DALYs attributed to injuries occurring in people under the age of 40.

## DALYs Attributed to NCDs and Injuries in People Under Age 40

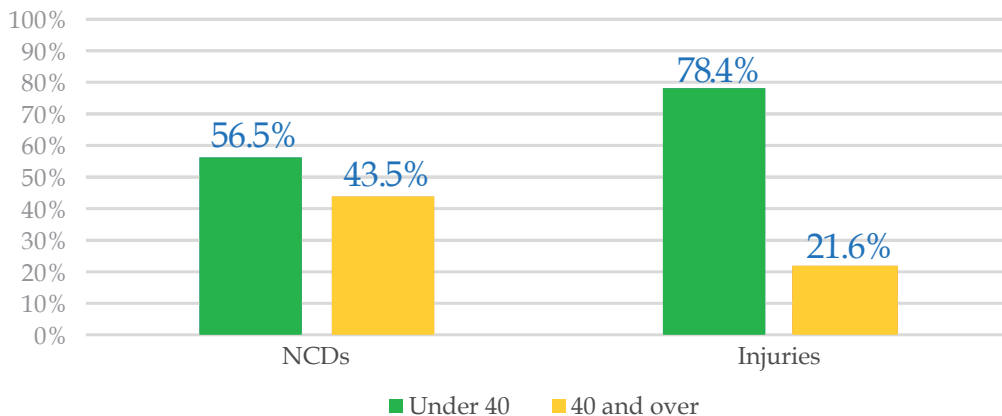


Figure 4. DALYs Attributed to NCDs and Injuries in People Under Age 40 in Sierra Leone in 2017 [Source: GBD, 2017]



### 3. Organization, availability, and investment of NCDI Services in the Sierra Leone Health Sector

#### 3.1 ORGANIZATION OF NCDI SERVICES

Sierra Leone’s health care system is divided into two tiers: primary health level and secondary level (see BPEHS 2015-2020, Figure 1). Beginning at the lowest, most decentralized level of services, primary health includes the community tier, two tiers of health posts, and the Community Health Centers (CHC). The secondary level is comprised of district and regional hospitals, where the most specialized care is found.

Sierra Leone’s current Basic Package of Essential Health Services 2015-2020 details the healthcare services presently mandated throughout the health system’s tiers at each level. Basic screening, counseling, and referral services for some NCDs, mental health disorders, and injuries are provided at the primary care level. More advanced diagnostic and treatment services are designated for the hospital level. The Commission analyzed the levels of delivery specifically for NCDs, mental health conditions, and injuries within the Essential Package of Health Services (Table 2).

#### Levels of Care Designated for Specific Services

Health Sector Tier	Service Delivery Area*			
	NCDs	Mental Health	Injury/Emergency Services	
Secondary Level	<b>Regional Hospital</b>	<ul style="list-style-type: none"> <li>• Screening for hypertension</li> <li>• Clinical management of hypertension</li> <li>• Screening for diabetes</li> <li>• Clinical management of diabetes</li> <li>• Referral back to CHC for chronic f/u</li> <li>• Pap smear for cervical cancer screening</li> <li>• Breast screening for breast cancer</li> <li>• Prostate cancer screening (digital rectal exam or prostate-specific antigen test)</li> </ul>	<ul style="list-style-type: none"> <li>• Diagnosis and treatment of commonly occurring mental illnesses and psychological disorders</li> <li>• Hospitalization of people with enduring mental illness</li> <li>• Alcohol/ Substance abuse prevention and treatment programs, including detoxification</li> <li>• Suicide prevention programs and treatment for attempted suicide</li> <li>• Child and adolescent mental health programs</li> <li>• Psychometric assessments</li> <li>• Child abuse services (detection, reporting, referral to social services)</li> <li>• Gender- and sexually based violence services (detection, treatment of injuries, referral to legal and social services)</li> <li>• Old-Age Psychiatry</li> <li>• Liaison services with families of patients before discharge, including stigma reduction services</li> </ul>	Management of: <ul style="list-style-type: none"> <li>• Sepsis</li> <li>• Anaphylaxis</li> <li>• Acute Coronary Syndrome and Acute Pulmonary Edema</li> <li>• Asthma</li> <li>• Poisoning</li> <li>• Seizure</li> <li>• Hypoglycemia</li> <li>• Hyperglycemia</li> <li>• Upper GI Bleed</li> <li>• Sickle Cell Crisis</li> <li>• Open or complex fracture</li> <li>• Traumatic limb injury</li> <li>• Gangrenous limb</li> <li>• Traumatic abdominal injury</li> <li>• Acute Abdomen</li> <li>• Obstructed hernia</li> <li>• Traumatic head injury</li> </ul>
	<b>District Hospital</b>	<ul style="list-style-type: none"> <li>• Same as Regional Hospital, minus prostate cancer screening</li> </ul>	<ul style="list-style-type: none"> <li>• Follow-up with discharged patients in their communities / homes</li> <li>• Occupational Therapy / rehabilitation for mentally ill patients</li> </ul>	Same as Regional Hospital, minus: <ul style="list-style-type: none"> <li>• Open or complex fracture</li> <li>• Traumatic limb injury</li> <li>• Gangrenous limb</li> <li>• Traumatic abdominal injury</li> <li>• Acute Abdomen</li> <li>• Obstructed hernia</li> <li>• Traumatic head injury</li> </ul>



## *Levels of Care Designated for Specific Services (cont.)*

Health Sector Tier	Service Delivery Area*			
	NCDs	Mental Health	Injury/Emergency Services	
Primary Level	<b>Community Health Center (CHC)</b>	<ul style="list-style-type: none"> <li>• Screening for hypertension and referral to hospital</li> <li>• Screening for diabetes and referral to hospital</li> <li>• Follow-up management for chronic conditions after return from treatment</li> <li>• Breast screening for cancer detection and referral to hospital</li> <li>• Health promotion and counseling on risk factors for major non-communicable diseases (diabetes, hypertension, and cancers [cervical, breast, prostate])</li> <li>• Behavior change for prevention of non-communicable diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Identification and referral of somatoform disorders</li> <li>• Identification and referral of alcohol and substance abuse disorders</li> <li>• Psychoeducation on mental illness</li> <li>• Community re-integration and re-habilitation</li> <li>• Stigma reduction programs</li> <li>• Identification of individuals with commonly occurring and/or enduring mental illness</li> <li>• Identification and referral of somatoform disorders</li> <li>• Identification and referral of alcohol and substance abuse disorders</li> <li>• Psychoeducation on mental illness</li> <li>• Community re-integration and re-habilitation</li> <li>• Stigma reduction programs</li> <li>• Alcohol/ Substance abuse prevention and treatment programs</li> <li>• Child and Adolescent mental health programs</li> <li>• School mental health programs</li> <li>• Child abuse services (detection, reporting, referral to social services)</li> <li>• Gender-based violence and domestic violence services (detection, medical care for victims, referral to legal and social services)</li> <li>• Psychosocial counseling</li> </ul>	<p>Initiate care and refer for management of:</p> <ul style="list-style-type: none"> <li>• Asthma</li> <li>• Hypertensive crisis</li> <li>• Soft tissue infection</li> <li>• Simple closed fracture</li> <li>• Hyperglycemia</li> <li>• Upper GI Bleed</li> <li>• Sickle Cell Crisis</li> <li>• Tetanus</li> <li>• Pneumothorax (trauma or spontaneous)</li> <li>• Testicular torsion</li> <li>• Major burns</li> </ul> <p>Refer for all other emergencies</p>
	<b>Community Health Post (CHP)</b>	<ul style="list-style-type: none"> <li>• Health promotion and counseling on risk factors for major non-communicable diseases (diabetes, hypertension, and cancers [cervical, breast, prostate])</li> <li>• Behavior change for prevention of non-communicable diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Same as CHC except:</li> <li>• Prescription of some psychotropic medications</li> <li>• Management of somatoform disorders through medication and counseling</li> </ul>	<p>Management of:</p> <ul style="list-style-type: none"> <li>• Soft tissue infection</li> <li>• Anaphylaxis</li> <li>• Wound infection</li> <li>• Hypoglycemia</li> </ul> <p>Initiate care and refer for management of:</p> <ul style="list-style-type: none"> <li>• Asthma</li> <li>• Hypertensive crisis</li> <li>• Sepsis</li> <li>• Seizure</li> <li>• Airway Management</li> <li>• External hemorrhage: first aid and refer to hospital</li> <li>• Shock: administer first aid, refer to hospital</li> <li>• Cardiorespiratory arrest: administer first aid, refer to hospital</li> <li>• Snake bite: first aid and refer to hospital</li> </ul> <p>Refer for all other emergencies</p>



Health Sector Tier	Service Delivery Area*			
	NCDs	Mental Health	Injury/Emergency Services	
Primary Level	Maternal and Child Health Post (MCHP)	Same as CHP	<ul style="list-style-type: none"> <li>• Identification of individuals with commonly occurring and/or enduring mental illness</li> <li>• Alcohol/ Substance abuse prevention and treatment programs</li> <li>• Child and Adolescent mental health programs</li> <li>• School mental health programs</li> <li>• Child abuse services (detection, reporting, referral to social services)</li> <li>• Gender-based violence and domestic violence services (detection, medical care for victims, referral to legal and social services)</li> <li>• Psychosocial counseling</li> </ul> Refer for: <ul style="list-style-type: none"> <li>• Diagnosis and treatment of commonly occurring mental illnesses and psychological disorders</li> <li>• Hospitalization of people with enduring mental illness</li> </ul>	<ul style="list-style-type: none"> <li>• Same as CHP except management of soft tissue infection and initiate care and refer for management for asthma and hypertensive crisis</li> <li>• Refer for all other emergencies</li> </ul>
	Community	Same as CHP	<i>CHWs are trained on WHO Mental Health Gap Action Programme (mhGAP) and can provide follow-up and referrals for members of their communities with identified mental health conditions. The Mental Health program is exploring the development of a Community Mental Health Aide cadre. CHWs or future CMHAs can also provide advocacy and awareness-raising in their communities about mental health conditions.</i>	<i>Community health workers are not currently trained in first aid or emergency management. Refer to nearest PHU or secondary care for all apparent emergencies.</i>

\*Oral and Eye Health service delivery areas excluded

Table 2. Levels of Care Designated for Specific Services for NCDs, Mental Health, and Injuries in the 2015-2020 Basic Package of Essential Health Services at Secondary and Primary Care Levels [Source: Sierra Leone Basic Package of Essential Health Services 2015-2020]



### 3.2 NCDI SERVICE READINESS: FINDINGS FROM THE SERVICE AVAILABILITY AND READINESS ASSESSMENT

The Commission analyzed the availability of NCDI services and essential commodities based on findings from the Service Availability and Readiness Assessment (SARA) 2017. Medications and diagnostics for NCDIs had very limited availability across all health facilities despite being included in the Essential Health Services Package. Figure 5 shows that most NCDI medications were available at less than 5% of facilities surveyed at that time.

#### Essential Medicine Availability for NCDIs

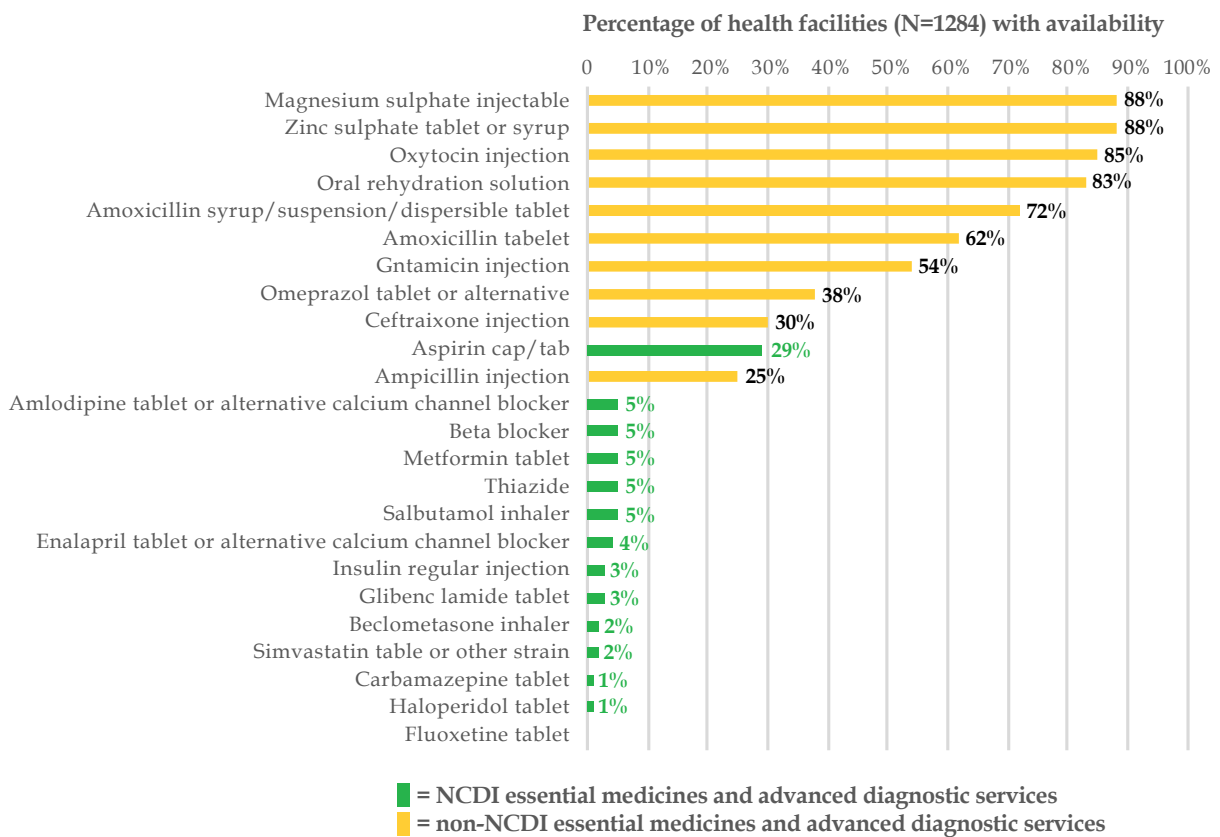


Figure 5. Essential Medicine Availability for NCDIs at Health Facilities in Sierra Leone in 2017 [Source: SARA 2017]

As Figure 6 shows, advanced diagnostics services for NCDI were also very low, ranging from 23% availability for urine protein to 5% for hemoglobin. Overall, both medications and diagnostics for NCDIs appeared to be substantially lower than for MNCH and infectious disease conditions, such as malaria and HIV.



## Advanced Diagnostic Service Availability for NCDIs

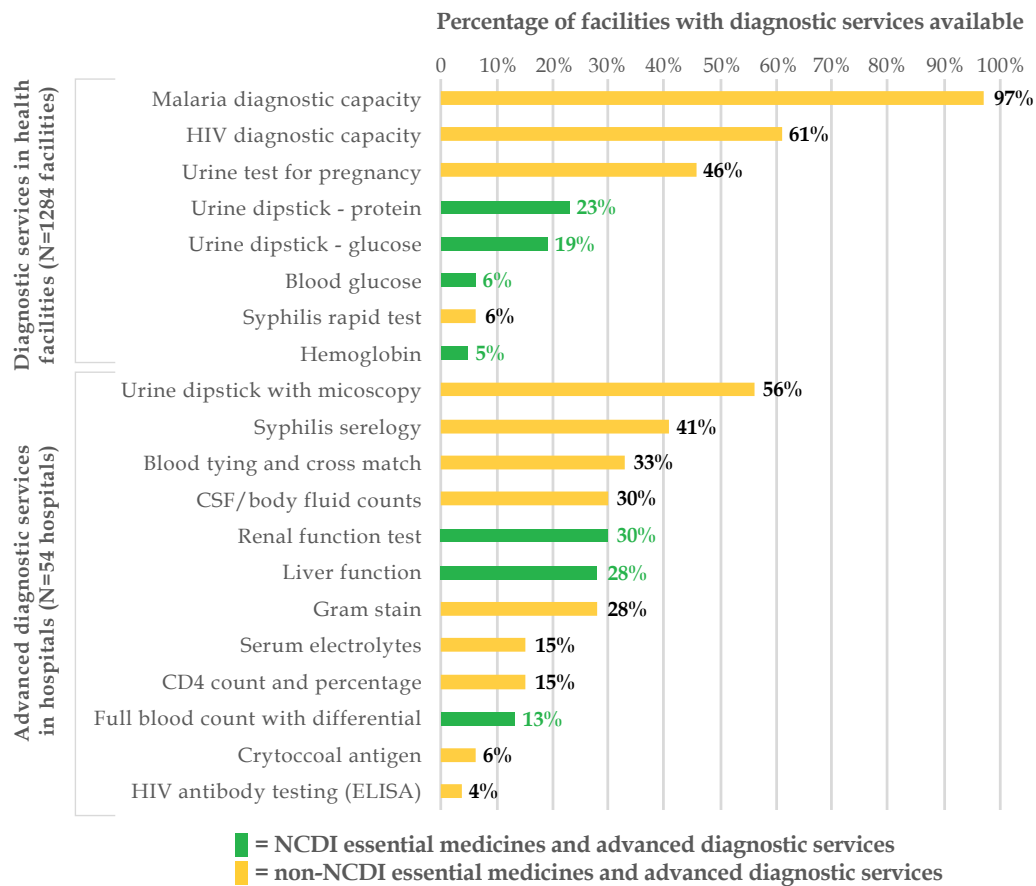


Figure 6. Advanced Diagnostic Service Availability for NCDIs at Health Facilities in Sierra Leone in 2017 [Source: SARA 2017]

Although NCDI services are included in the Basic Package of Essential Health Services, the availability of key services remains limited according to the SARA 2017 results. At that time, only 11% of total health facilities in the country reported offering diabetes services and 20% cardiovascular disease services (Figure 7). The majority of these facilities were at the hospital level, with 79% offering diabetes and 75% offering cardiovascular disease services. Most of these hospitals were private and located in urban settings, and public facilities or ones located in rural areas had much lower availability; this trend was seen at all level of facilities.



## Availability of Services for Diabetes and CVD

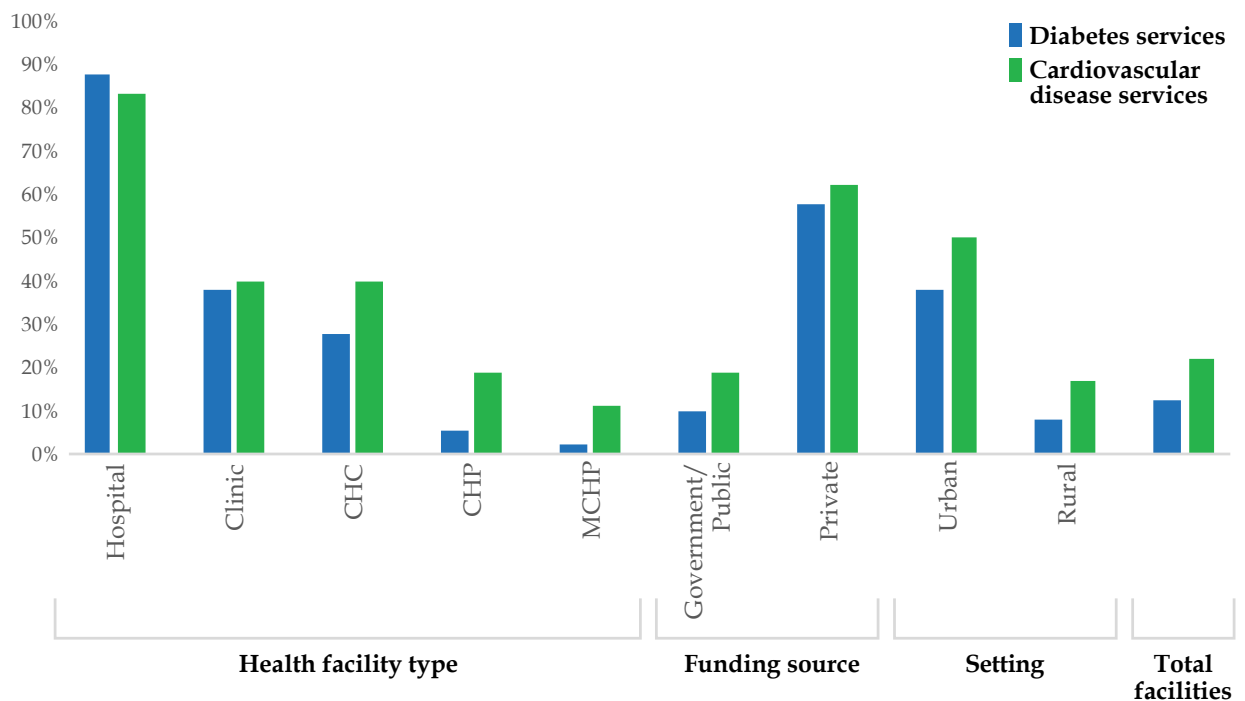


Figure 7. Availability of Services for Diabetes and Cardiovascular Diseases in Sierra Leone in 2017 [Source: SARA 2017]

### 3.3 CURRENT NCDI INVESTMENTS AND EXPENDITURE

According to the MoHS Annual Health Sector Performance Report in 2016, Sierra Leone’s Human Development Index (HDI) rank was 181<sup>st</sup> out of 187. As of 2018, GDP per capita in Sierra Leone was reported as \$533.99 per person (World Bank, 2020). The WHO Global Health Expenditure database and World Bank report as of 2017 a total current health expenditure (CHE) per capita of \$66.40 in Sierra Leone, which has been steadily declining since a peak of \$139.76 USD per capita in 2014. General government health expenditure (GGHE) in 2017 was \$9.12 USD, representing 13.7% of the CHE. Domestic private health expenditure comprised 67.6% of CHE (of which out-of-pocket expenditures comprised 50.4% of CHE) and external health expenditures comprised 18.6% of CHE. The Commission was not able to source available data directly regarding investments, payment structures, or the economic burden specifically of NCDI services.





## 4. Priority setting for an Expanded NCDI Agenda in Sierra Leone

### 4.1 SELECTION OF EXPANDED NCDI CONDITIONS IN SIERRA LEONE

A working group of the Commission conducted a structured priority setting exercise to determine which NCDI conditions should be prioritized within the context of Sierra Leone to expand on existing frameworks in order to achieve UHC. Using modeled estimates from GBD, 174 conditions were analyzed according to the following four metrics: 1) Comparison of DALY rate in Sierra Leone to high-income countries (“equity” metric); 2) Years of life lost per death (“severity” metric); 3) Years of life of disability per case (“disability” metric); and 4) Total DALYs (“burden” metric).

The total of 174 NCDI conditions were reviewed. Each condition was assigned a quartile across each metric, ranging from 1 as the lowest and 4 as the highest, and composite scores were calculated from averages of the four metric quartile scores. Conditions, ranked by composite score, were then presented to the Commission working group for expert review.

Considering the four metrics of burden, severity, disability, equity, the working group ranked NCDI conditions as high, medium, or low priority. Thirty conditions were unanimously ranked “high” and an additional 13 were selected after consultation within the group. These 43 NCDI conditions, which cause significant burden in the Sierra Leonean population, are shown below in Table 3. This list of conditions includes many common disease conditions caused by traditional NCD risk factors affecting older populations, but it also includes many severe NCDIs affecting younger and vulnerable populations, such as epilepsy, diabetes type 1, sickle cell, childhood and female malignancies, chronic liver diseases, and injuries due to violence and trauma.

### Priority NCDI Conditions

Condition Category	Prioritized NCDI Condition
Cancer	Acute lymphoid leukemia
	Breast cancer
	Cervical cancer
	Liver cancer due to alcohol use
	Liver cancer due to hepatitis B
	Liver cancer due to hepatitis C
	Non-Hodgkin lymphoma
	Prostate cancer



## *Priority NCDI Conditions (cont.)*

Condition Category	Prioritized NCDI Condition
Cardiovascular-cardiometabolic	Hypertensive heart disease
	Ischemic heart disease
	Ischemic stroke
Chronic pain	Low back pain
	Migraine
	Neck pain
Cirrhosis	Cirrhosis and other chronic liver diseases due to hepatitis B
Congenital	Congenital musculoskeletal and limb anomalies
Diabetes	Diabetes mellitus type 1
	Diabetes mellitus type 2
Digestive diseases	Appendicitis
	Gastritis and duodenitis
	Peptic ulcer disease
Epilepsy	Epilepsy
Eye diseases	Cataract
	Glaucoma
	Near vision loss
	Refraction disorders
Hematology	Sickle cell disorders
Injuries	Fire, heat, and hot substances
	Motorcyclist road injuries
	Motor vehicle road injuries
	Sexual violence
	Pedestrian road injuries
	Physical violence by sharp object
	Venomous animal contact
Kidney disease	Chronic kidney disease due to hypertension
Mental health	Major depressive disorder
Respiratory	Asthma
	Chronic obstructive pulmonary disease
Sense organ diseases	Age-related and other hearing loss
Urinary diseases and male infertility	Benign prostatic hyperplasia
	Female infertility
	Male infertility
	Urinary tract infections

*Table 3. Priority NCDI Conditions selected by the Sierra Leone NCDI Poverty Commission [Source: Sierra Leone NCDI Poverty Commission, 2020]*



## 4.2 PRIORITIZATION OF NCDI HEALTH SECTOR INTERVENTIONS

To address these priority NCDI conditions, the Commission working group next reviewed and prioritized preventative, curative, palliative, and cross-cutting health sector NCDI interventions. Evidence-based information on cost-effective interventions in the health sector for the selected NCDI conditions was obtained from the third edition of Disease Control and Priorities group (DCP3) (Jamison, 2018; University of Washington, 2020). The DCP3 has recently recommended an evidence-based package of health-sector interventions for Essential Universal Health Coverage (EUHC) in low-middle and low-income countries. This recommended package includes 65 interventions targeted for NCDIs. The DCP3 group provided expert committee rankings for three key intervention metrics based on available global data. These metrics were cost-effectiveness, financial risk protection, and prioritization for the worst off (equity). Interventions for cost-effectiveness and equity were ranked from 0 to 4, and those for financial risk protection from 0 through 6, with 0 representing the lowest value in each metric. The DCP3 group also provided an average direct unit cost for implementation per beneficiary in low-income countries. The Commission estimated the total number of individuals in Sierra Leone requiring each intervention annually based on disease prevalence and incidence estimated from GBD 2017. The total cost to reach all beneficiaries annually was calculated for each intervention.

The Commission assigned a baseline coverage level, according to available literature and from expert knowledge from commissioners. The commissioners also assigned a target coverage level to be achieved for each intervention by the year 2030. Based on prior programmatic scale-up experience, a 30% absolute coverage increase was determined to be a reasonable incremental coverage increase by 2030. The total cost of implementing the selected interventions was estimated by multiplying the direct unit cost (adjusted for Sierra Leone health sector costs) by the estimated Sierra Leonean population in need. Direct costs included those for personnel, equipment, laboratory and diagnostic services, drugs and other consumables. A 50% indirect cost was added to the direct cost to account for facility level expenses, such as, rent, maintenance and utilities. An additional 17% indirect cost was also added for non-facility-level costs like those for supply chain and health information systems. The incremental cost for each intervention was then estimated by multiplying the total of the above costs by the coverage increment.



With this information, the working group evaluated if each intervention is feasible, desired, and should be prioritized in Sierra Leone. A total of 38 interventions, ranging across NCDI conditions and level of health system, were prioritized and recommended for implementation. The selected interventions for addressing prioritized NCDI conditions and their costs are presented in Table 4. A number of these interventions already exist in Sierra Leone but could be further decentralized in the health sector, and some would be new if introduced.

The Commission found that to implement the recommended 38 health sector NCDI interventions at 100% coverage in Sierra Leone, the total per capita cost would be \$38.34 USD annually. In order to achieve a 30% incremental increase as a first stage of implementation and scale up, the total cost would be \$87,996,382.00 USD, or \$11.50 USD per capita. This total cost includes interventions to strengthen NCDI services, which would cost annually \$61,273,165 USD (\$8.01 USD per capita). Interventions to address mental health conditions are estimated to cost an additional \$7,869,952 USD (\$1.03 per capita) annually and interventions to develop surgical services are estimated to cost \$18,853,265 USD (\$2.46 USD per capita) annually. Based on 2017 reports of total current health expenditure of USD \$66.40, the annual additional cost of achieving the 30% increased increment in the prioritized interventions would represent approximately 17.3% of total current health expenditures.

# Recommended Health Sector Interventions for NCDI Conditions

Condition	Intervention name (Source: DCP3 EUHC NCDI)	Burden: Estimated pop. in need annually	Cost-Effectiveness (0-4)	Financial Risk Protection (0-6)	Equity (0-3)	Unit cost*	Total Cost for Coverage Increment	Level of Health System
Asthma/ COPD	Low-dose inhaled corticosteroids and bronchodilators for asthma and for selected patients with COPD	299,509	1	3	1	\$ 35.85	\$ 5,653,168.00	Health Center
Asthma/ COPD; CV/ ischemia	Tobacco cessation counseling, and use of nicotine replacement therapy in certain circumstances	1,151,980	4	2	1	\$ 9.41	\$ 5,706,986.00	Health Center
Asthma/ COPD; CV/ ischemia; Alcoholic cirrhosis	Mass media messages concerning use of tobacco and alcohol	7,829,749	4	1	1	\$ 0.01	\$ 26,901.00	Population
Cancer - Breast	Treat early stage breast cancer with appropriate multimodal approaches, including generic chemotherapy, with curative intent, for cases that are referred from health centers and first-level hospitals following detection using clinical examination	552	4	4	1	\$ 169.03	\$ 49,157.00	Referral and Specialty Hospitals
Cancer - Cervical	Opportunistic screening for cervical cancer using visual inspection or HPV DNA testing and treatment of precancerous lesions with cryotherapy	181,990	3	3	1	\$ 2.83	\$ 271,484.00	Health Center
Cancer - Cervical	School-based HPV vaccination for girls	96,784	3	3	1	\$ 6.48	\$ 330,012.00	Community
Cancer - Cervical	Treatment of early-stage cervical cancer	908	0	4	1	\$ 25.20	\$ 12,053.00	First-level Hospital
Cancer - Leukemias	Treat selected early-stage childhood cancers with curative intent in pediatric cancer units/hospitals	183	2	5	2	\$ 349.05	\$ 33,631.00	Referral and Specialty Hospitals
Cancer; Palliative Care	Palliative care and pain control services*	7,829,749	4	4	1	\$ 0.97	\$ 4,000,410.00	Health Center
Chronic Kidney Disease	Treatment of hypertension in kidney disease, with use of ACEi or ARBs in albuminuric kidney disease	510,314	2	2	1	\$ 33.25	\$ 8,934,686.00	Health Center
CV/ ischemia	Combination therapy for persons with multiple risk factors to prevent CVD (primary prevention)	107,645	2	2	1	\$ 27.15	\$ 1,538,724.00	Health Center
CV/ ischemia	Long term management of IHD, stroke, and PVD with aspirin, beta blockers, ACEi, and statins (as indicated), for secondary prevention	143,685	2	2	1	\$ 45.61	\$ 3,450,629.00	Health Center

## Recommended Health Sector Interventions for NCDI Conditions (cont.)

Condition	Intervention name (Source: DCP3 EUHC NCDI)	Burden: Estimated pop. in need annually	Cost-Effectiveness (0-4)	Financial Risk Protection (0-6)	Equity (0-3)	Unit cost*	Total Cost for Coverage Increment	Level of Health System
CV/ ischemia	Management for acute critical limb ischemia with unfractionated heparin and revascularization if available, with amputation as a last resort	48,450				\$ 471.11	\$ 12,017,465.00	Referral and Specialty Hospitals
CV/ ischemia	Mass media messages concerning healthy eating or physical activity	7,829,749	4	1	1	\$ 0.01	\$ 26,901.00	Population
CV/ ischemia	Opportunistic screening for hypertension for all adults, with treatment decisions guided by absolute CVD risk	1,076,451	1	1	1	\$ 1.05	\$ 594,057.00	Health Center
CV/ ischemia	Screening and management of hypertensive disorders in pregnancy	32,289	1	3	3	\$ 0.77	\$ 13,051.00	Health Center
CV/ ischemia	Use of aspirin in case of suspected myocardial infarction	13,402	4	2	1	\$ 0.02	\$ 134.00	Health Center
CV/ ischemia	Use of unfractionated heparin, aspirin, and generic thrombolytics in acute coronary events	3,722	2	4	1	\$ 376.59	\$ 738,076.00	First-level Hospitals
CV/ ischemia; RHD	Medical management of acute heart failure	17,111	4	5	3	\$ 540.73	\$ 4,871,426.00	First-level Hospital
CV/ ischemia; RHD	Medical management of chronic heart failure with diuretics, beta-blockers, ace-inhibitors, and mineralocorticoid antagonists	22,222	4	4	3	\$ 203.89	\$ 2,385,517.00	Health Center
Diabetes	Diabetes self-management education	249,821	-	-	-	\$ 3.67	\$ 483,233.00	Community
Diabetes	Prevention of long-term complications of diabetes through blood pressure, lipid, and glucose management as well as consistent foot care	249,821	4	2	1	\$ 59.80	\$ 7,865,475.00	Health Center
Diabetes	Screening for diabetes in all high-risk adults	717,634	4	2	1	\$ 1.02	\$ 385,525.00	Health Center
Diabetes	Screening for diabetes in pregnant women	269,076	1	3	3	\$ 6.59	\$ 934,129.00	Health Center
Epilepsy	Management of epilepsy using generic anti-epileptics	39,396	4	4	3	\$ 16.19	\$ 335,868.00	Health Center
Oral Health	Oral health promotion in schools	927,698	0	1	1	\$ 0.35	\$ 172,987.00	Community
RHD	Treatment of acute pharyngitis in children to prevent rheumatic fever	2,026,695	4	2	1	\$ 0.10	\$ 105,816.00	Community
Sickle Cell	In settings where sickle cell disease is a public health concern, universal newborn screening followed by standard prophylaxis against bacterial infections and malaria*	269,076	4	2	3	\$ 2.37	\$ 335,664.00	
<b>NCD subtotal incremental cost</b>							<b>\$ 61,273,165.00</b>	

Condition	Intervention name (Source: DCP3 EUHC NCDI)	Burden: Estimated pop. in need annually	Cost-Effectiveness (0-4)	Financial Risk Protection (0-6)	Equity (0-3)	Unit cost*	Total Cost for Coverage Increment	Level of Health System
Depression	Mass media messages concerning sexual and reproductive health; and mental health for adolescents†	7,829,749	4	2	1	\$ 0.82	\$ 3,387,208.00	Population
Bipolar disorder	Management of bipolar disorder using generic mood-stabilizing medications and psychosocial treatment‡	42,380	2	4	2	\$ 108.57	\$ 2,422,429.00	Health Center
Psychotic disorders	Management of schizophrenia using generic anti-psychotic medications and psychosocial treatment‡	9,654	2	4	2	\$ 58.49	\$ 297,290.00	Health Center
<b>Mental health subtotal incremental cost</b>							<b>\$ 7,869,952.00</b>	
Injuries	Elective surgical repair of common orthopedic injuries (e.g., meniscal and ligamentous tears) in individuals with severe functional limitation	16,826	-	-	-	\$ 64.80	\$ 574,021.00	Referral and Specialty Hospitals
Injuries; Surgery	Basic first-level hospital surgical services*	7,829,749	-	-	-	\$ 2.66	\$ 10,950,026.00	First-level Hospital
Injuries; Surgery	Basic outpatient surgical services*	7,829,749	-	-	-	\$ 0.27	\$ 1,109,603.00	Health Center
Injuries; Surgery	Basic rehabilitation services*	7,829,749	-	-	-	\$ 1.41	\$ 5,810,814.00	First-level Hospital
Injuries; Surgery	Expanded first-level hospital surgical services*	7,829,749	-	-	-	\$ 0.04	\$ 146,000.00	Referral and Specialty Hospitals
Injuries; Surgery	Specialized surgical services*	7,829,749	-	-	-	\$ 0.06	\$ 262,801.00	Referral and Specialty Hospitals
<b>Surgical subtotal incremental cost</b>							<b>\$ 18,853,265.00</b>	
<b>Grand cost (USD \$)</b>							<b>\$ 87,996,382.00</b>	
<b>Grand cost per capita (USD \$)</b>							<b>\$ 11.50</b>	

\*Included in a disease-based service package defined by DCP3

†The Commission recommends additional diagnostic measures not currently included in this costing model.

‡Commission notes that pre-service training for mental health disorders may also be required and is not costed here.

Table 4. Health Sector Interventions Recommended for NCDI Conditions Prioritized by the Sierra Leone NCDI Poverty Commission [Source: DCP3, 2018; Sierra Leone NCDI Poverty Commission, 2020]



### 4.3 INTEGRATION OF RECOMMENDED HEALTH SECTOR NCDI INTERVENTIONS IN EXISTING HEALTH SERVICES

The 38 interventions selected and recommended by the Commission can be integrated into Sierra Leone's tiers of existing health services in order to strengthen, rather than challenge, the current system. Figure 8 details the levels of the health system in which each intervention could be placed in order to strengthen and decentralize prevention, diagnosis, treatment, and care of NCDIs.

At community and population levels, the Commission prioritized mass media and campaigns to provide information, education, and communication around priority NCDI conditions were prioritized, including interventions for sexual and reproductive health, mental health, healthy eating and physical activity, and tobacco and alcohol use. At primary care level and throughout the health system's tiers, decentralized preventative interventions were included, such as HPV vaccinations, treatment of acute pharyngitis in children to prevent rheumatic fever, and screening services for diabetes, hypertension, and sickle cell disorders in appropriate settings. Expanded access to pharmacological interventions including chemotherapy for childhood cancer, systemic steroid and bronchodilator use for acute asthma, anti-epileptics for epilepsy, and aspirin, beta-blockers, ACE-inhibitors, and statins for chronic heart failure were also prioritized. Specialized interventions such as surgical care, pathological oncology services, and psychiatric care were also prioritized. The selected NCDI interventions included several cross-cutting "packages" of care, such as basic and expanded first-level hospital and outpatient surgical service and increased availability of basic rehabilitation services and palliative care and pain control services.





## Integration of Recommended Health Sector NCDI Interventions in Existing Health Services

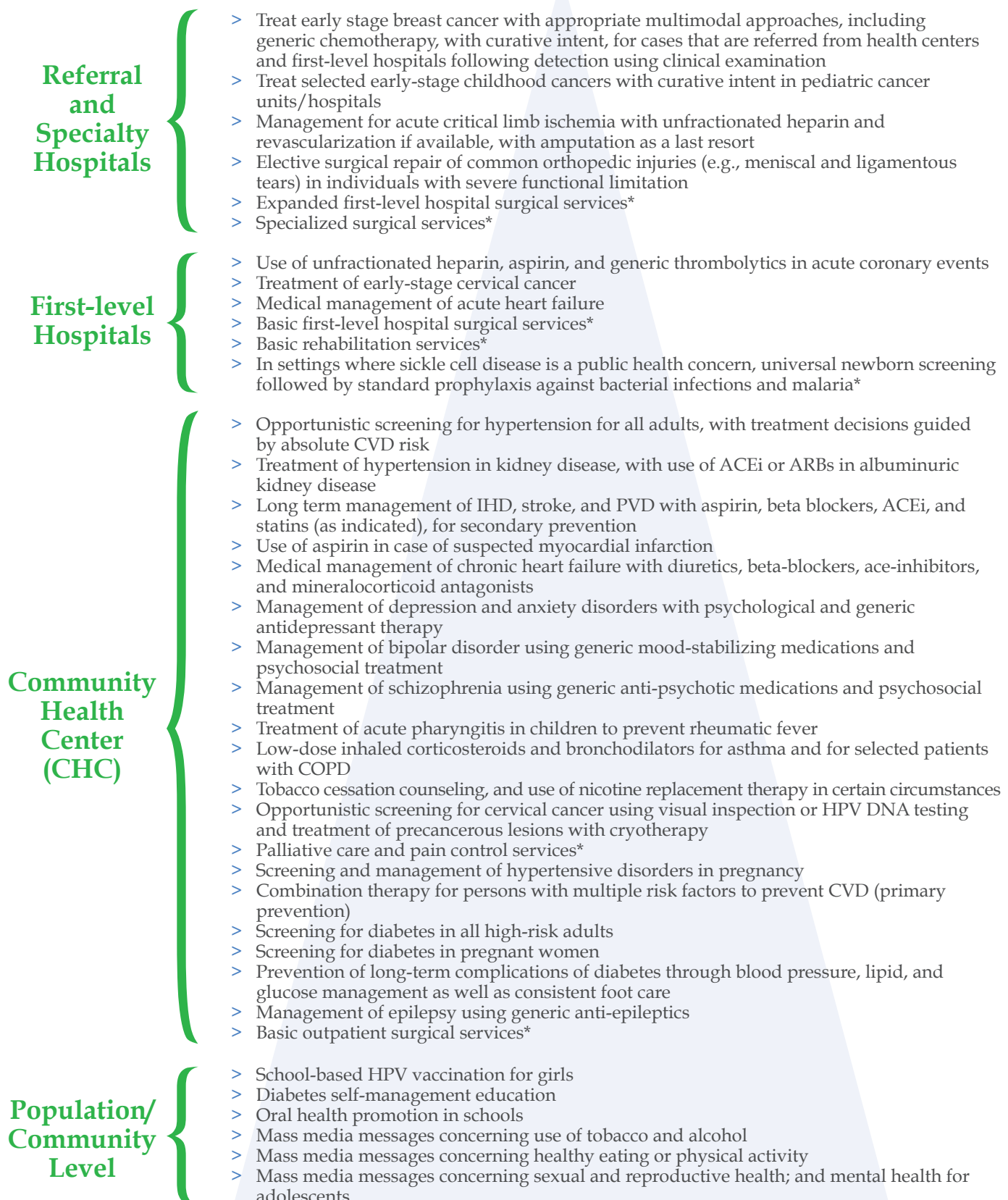


Figure 8. Integration of Recommended Health Sector NCDI Interventions in Existing Health Services [Source: Sierra Leone NCDI Poverty Commission, 2020]



#### 4.4 ROLE OF INTERSECTORAL INTERVENTIONS FOR NCDIS IN SIERRA LEONE

This Commission focused on recommendations for cost effective interventions that can be introduced or implemented in the health sector with support from the MOHS NCD and Mental Health Directorate. However, this Commission also recognizes several interventions that require implementation by additional directorates in the MOHS or by other line ministries. Table 5 provides several examples of such interventions.

#### Recommended Intersectoral Interventions for NCDs

<i>Disease/ Health Target</i>	<b>Intersectoral Intervention</b>
<i>Adolescent</i>	Adolescent-friendly health services: provision of condoms to prevent STIs; provision of reversible contraception; treatment of injury in general and abuse in particular; screening and treatment for STIs
<i>Assault/Violence</i>	Education campaigns for the prevention of gender-based violence
	Parent training, including nurse home visitation for child maltreatment, for high-risk families
	Post gender-based violence care including, counseling, provision of emergency contraception, and rape-response referral (medical and judicial)
<i>Asthma/COPD</i>	Mass media for awareness on hand washing and household air pollution health effects
<i>Congenital</i>	Provide iron and folic acid supplementation to pregnant women, as well as food/caloric supplementation to pregnant women in food insecure households
<i>Vision</i>	Vision prescreening by teachers; vision tests and provision of ready-made glasses on-site by eye specialists
<i>Injuries</i>	Sexual violence
	Poisoning by carbon monoxide

Table 5. Intersectoral Interventions for NCDs Recommended by the Sierra Leone NCDI Poverty Commission [Source: Sierra Leone NCDI Poverty Commission, 2020]



## 5. Key Findings and Recommendations

### 5.1 SUMMARY OF KEY FINDINGS

- **NCDIs make up a large share of the burden of disease in Sierra Leone, and it is increasing.** In 2017, 33.9% of all DALYs and 39.5% of all deaths were accounted for by NCDI and injuries, and the relative burden of NCDs and Injuries has significantly risen in the past two decades.
- **NCDIs impact people at young ages.** 56.5% of NCD DALYs and 78.4% of injury DALYs in Sierra Leone occur before age 40.
- **The burden of NCDs is very diverse.** Only 36.7% of NCD DALYs are attributed to the four conditions included in global NCD monitoring frameworks (cardiovascular disease, diabetes, cancer, and chronic respiratory disease). In Sierra Leone, a significant proportion of DALYs attributed to NCDs are caused by mental disorders (7.4%), and particularly severe NCD conditions, such as sickle cell and rheumatic heart disease, were found to have high burden.
- **The NCD burden is attributed to a multitude of risks.** Though there are behavioral interventions that a person can do to maintain health, behavioral or metabolic risk factors, such as alcohol, smoking, obesity, and hypertension, are not the only risk factors of NCDIs. Based on literature review, other systematic risk factors related to poverty, the environment, and chronic infections contributed to NCDIs in Sierra Leone.
- **Services for basic NCDIs remain limited.** Availability of medications, equipment, staffing, and guidelines that are required for NCDI delivery (and specified by the Essential Package of Health Services) is extremely limited. The proportion of facilities reporting delivery of services is very low for conditions such as cardiovascular diseases (17%) and diabetes (9%). Services and personnel for NCDIs remain concentrated at the urban and tertiary level, constraining capacity and availability of services in more rural and decentralized levels.
- **More local data on NCDIs is needed.** Local data regarding the burden and implications of NCDIs are limited. Although NCDIs have been introduced and integrated into the HMIS, data collection must be strengthened to appropriately capture the burden of disease being seen at facility level throughout the country.
- **Investment in NCDIs is limited.** Funding and resources for NCDIs are a significant constraint faced at national, facility, and patient level. Currently government investment in health care is low and out-of-pocket payments are high. More data is needed regarding the costs and economic burden of NCDIs in Sierra Leone. It is vital to ensure that the most vulnerable are able to access affordable care without incurring catastrophic expenditures.



## 5.2 RECOMMENDATIONS

- **The national agenda for NCDIs must be expanded to achieve UHC.** After the review of data of the overall burden of disease, equity profile of disease conditions, severity and disability of illness, the Commission selected 43 NCDI disease conditions for which health sector interventions should be introduced or intensified. These conditions build on the existing Sierra Leone strategic planning, and include asthma, chronic obstructive pulmonary disease, hypertensive heart disease and ischemic stroke, sickle cell, diabetes (type 1 and 2), breast cancer, non-Hodgkin lymphoma, cervical cancer, major depressive disorder, schizophrenia, substance abuse disorders, epilepsy, chronic kidney disease, and a number of injury-causing conditions including motor vehicle road injuries and sexual violence.
- **There are proven health interventions that can address these NCDIs that can be integrated into Sierra Leone's tiers of existing health services.** From an evidence-based package of interventions recommended for Universal Health Care, this Commission selected 38 potential interventions to be introduced or intensified within the health sector to target these priority NCDI conditions. These interventions were selected on the criteria of potential health impact, cost-effectiveness, financial risk protection, and priority to the “worst-off”, including those that could avert more severe or premature complications. These NCD interventions should be integrated throughout the health sector, including primary health delivery.
- **More investment in health, and NCDIs in particular, is needed.** The health sector interventions recommended by this Commission would require \$87,966,382 USD annually (\$11.50 per capita) to achieve a reasonable and meaningful level of coverage. This equates to 17.3% of current health expenditures. Such investment would likely result in significant reduction in premature death and disability in Sierra Leone.
- **Continued multisectoral action is required.** Evidenced by this Commission, Sierra Leone is committed to create sustainable multisectoral collaborative action for the prevention and mitigation of NCDIs. For an organized and systematic response to have the impact needed, high-level commitment from key stakeholders in all sectors is required in addition to sustained access to funding and resources.



## References

- Ali DB, Tomek M, Lisk DR. (2014). The effects of epilepsy on child education in Sierra Leone. *Epilepsy Behav*, 37:236-40. doi: 10.1016/j.yebeh.2014.07.007. Epub 2014 Aug 9.
- Amowitz LL, Reis C, Lyons KH, Vann B, Mansaray B, Akinsulure-Smith AM, Taylor L, Iacopino V. (2002). Prevalence of war-related sexual violence and other human rights abuses among internally displaced persons in Sierra Leone. *JAMA*, 287(4):513-21. doi: 10.1001/jama.287.4.513.
- Andregård E, Magnusson L. (2017). Experiences of attitudes in Sierra Leone from the perspective of people with poliomyelitis and amputations using orthotics and prosthetics. *Disabil Rehabil*, 39(26):2619-2625. doi: 10.1080/09638288.2016.1236409.
- Ansumana R, Dariano DF, Jacobsen KH, Leski TA, Lamin JM, Lahai J, Bangura U, Bockarie AS, Taitt CR, Yasuda C, Bockarie MJ, Stenger DA. (2018). Sero-prevalence of hepatitis B surface antigen (HBsAg) in Bo, Sierra Leone, 2012-2013. *BMC Res Notes*, 11(1):113. doi: 10.1186/s13104-018-3218-8.
- Ardizzi M, Martini F, Umiltvi MA, Evangelista V, Ravera R, Gallese V. (2015). Impact of Childhood Maltreatment on the Recognition of Facial Expressions of Emotions. *PLoS One*, 10(10):e0141732. doi: 10.1371/journal.pone.0141732.
- Asare J, Jones L. (2005). Tackling mental health in Sierra Leone. *BMJ*, 331(7519):720. doi: 10.1136/bmj.331.7519.720-b.
- Awad M, Ruzza A, Mirocha J, Setareh-Shenas S, Pixton JR, Soliman C, Czer LS. (2014). Prevalence of hypertension in the Gambia and Sierra Leone, western Africa: a cross-sectional study. *Cardiovasc J Afr*, 25(6):269-78. doi: 10.5830/CVJA-2014-058.
- Betancourt TS, Agnew-Blais J, Gilman SE, Williams DR, Ellis BH. (2010). Past horrors, present struggles: the role of stigma in the association between war experiences and psychosocial adjustment among former child soldiers in Sierra Leone. *Soc Sci Med*, 70(1):17-26. doi: 10.1016/j.socscimed.2009.09.038.
- Betancourt TS, Gilman SE, Brennan RT, Zahn I, VanderWeele TJ. (2015). Identifying Priorities for Mental Health Interventions in War-Affected Youth: A Longitudinal Study. *Pediatrics*, 136(2):e344-50. doi: 10.1542/peds.2014-1521.
- Betancourt TS, McBain R, Newnham EA, Akinsulure-Smith AM, Brennan RT, Weisz JR, Hansen NB. (2014). A behavioral intervention for war-affected youth in Sierra Leone: a randomized controlled trial. *J Am Acad Child Adolesc Psychiatry*, 53(12):1288-97. doi: 10.1016/j.jaac.2014.09.011.
- Bolkan HA, Von Schreeb J, Samai MM, et al. (2015). Met and unmet needs for surgery in Sierra Leone: A comprehensive, retrospective, countrywide survey from all health care facilities performing operations in 2012. Bolkan HA, Von Schreeb J, Samai MM, et al. Met and unmet needs for surgery in Sierra Leone: A comprehensive, retrospective, countrywide survey from all health care facilities performing operations in 2012. *Surgery*, 157(6):992-1001. doi:10.1016/j.surg.2014.12.028
- Broughton M. (2001). Controlling phantom limb pain in Sierra Leone. *Lancet*, 21;357(9264):1273. doi: 10.1016/s0140-6736(00)04465-2.
- Chopra CW, O'Boynick PL, Ahluwalia HK, Witt PD. (2003). Need for public and medical awareness of pediatric craniofacial trauma in Sierra Leone. *Plast Reconstr Surg*, 111(1):515-8. doi: 10.1097/00006534-200301000-00122.
- Contini S, Garatti M, Swarray-Deen A, Depetris N, Cecchini S, Scarpignato C. (2009). Corrosive oesophageal strictures in children: outcomes after timely or delayed dilatation. *Dig Liver Dis*, 41(4):263-8. doi: 10.1016/j.dld.2008.07.319.



- Contini S, Scarpignato C, Rossi A, Strada G. (2009). Oesophageal corrosive injuries in children: a forgotten social and health challenge in developing countries. *Bull World Health Organ*, 87(12):950-4. doi: 10.2471/BLT.08.058065.
- Contini S, Swarray-Deen A, Scarpignato C. (2011). Features and management of esophageal corrosive lesions in children in Sierra Leone: lessons learned from 175 consecutive patients. *J Pediatr Surg*, 46(9):1739-45. doi: 10.1016/j.jpedsurg.2011.03.017.
- Contini S, Swarray-Deen A, Scarpignato C. (2009). Caustic ingestion in children: is endoscopy always indicated? A perspective from a Sierra Leone experience. *Gastrointest Endosc*, 69(6):1191-2; author reply 1192-3. doi: 10.1016/j.gie.2008.09.026.
- Contini S, Tesfaye M, Picone P, Pacchione D, Kupperts B, Zambianchi C, Scarpignato C. (2007). Corrosive esophageal injuries in children. A short-lived experience in Sierra Leone. *Int J Pediatr Otorhinolaryngol*, 71(10):1597-604. doi: 10.1016/j.ijporl.2007.07.007.
- Davé DR, Nagarjan N, Canner JK, Kushner AL, Stewart BT; SOSAS4 Research Group. (2018). Rethinking burns for low & middle-income countries: Differing patterns of burn epidemiology, care seeking behavior, and outcomes across four countries. *Burns*, 44(5):1228-1234. doi: 10.1016/j.burns.2018.01.015.
- Elliott IS, Groen RS, Kamara TB, Ertl A, Cassidy LD, Kushner AL, Gosselin RA. (2015). The burden of musculoskeletal disease in Sierra Leone. *Clin Orthop Relat Res*, 473(1):380-9. doi: 10.1007/s11999-014-4017-8.
- Esan O, Abdumalik J, Eaton J, Kola L, Fadahunsi W, Gureje O. (2014). Mental health care in Anglophone West Africa. *Psychiatr Serv*, 65(9):1084-7. doi: 10.1176/appi.ps.201300300.
- Fox SH, Tang SS. (2000). The Sierra Leonean refugee experience: traumatic events and psychiatric sequelae. *J Nerv Ment Dis*, 188(8):490-5. doi: 10.1097/00005053-200008000-00003.
- Garcia-Tardan N, Gresnigt TM, Fofanah AB, Grobusch MP. (2017). Hepatitis B and C in Tonkolili Province, Sierra Leone. *Lancet*, 390(10101):1485. doi: 10.1016/S0140-6736(17)32390-5.
- Godwin Y, Bell DR, Rannan-Eliya SV. (2014). Traditional and modern medicine: morbidity of paediatric forearm fractures in Sierra Leone. *J Hand Surg Eur*, 39(7):783-4. doi: 10.1177/1753193412460172.
- Gosselin RA, Coppotelli C. (2005). A follow-up study of patients with spinal cord injury in Sierra Leone. *Int Orthop*, 29(5):330-2. doi: 10.1007/s00264-005-0665-3.
- Government of Sierra Leone. (2019). Sierra Leone National Action Plan for Health Security (2018-2022). Retrieved from: <https://www.afro.who.int/publications/sierra-leone-national-action-plan-health-security-2018-2022>
- Gupta L, Zimmer C. (2008). Psychosocial intervention for war-affected children in Sierra Leone. *Br J Psychiatry*, 192(3):212-6. doi: 10.1192/bjp.bp.107.038182.
- Hamza M, Idris MA, Maiyaki MB, Lamorde M, Chippaux JP, Warrell DA, Kuznik A, Habib AG. (2016). Cost-Effectiveness of Antivenoms for Snakebite Envenoming in 16 Countries in West Africa. *PLoS Negl Trop Dis*, 10(3):e0004568. doi: 10.1371/journal.pntd.0004568.
- HEART. (2006). Sierra Leone's Free Health Care Initiative: Financing implications. Retrieved from <https://www.heart-resources.org/wp-content/uploads/2016/10/Sierra-Leone-Free-Health-Care-Initiative-Financing-Implications.pdf>



- Henry D. (2006). Violence and the body: somatic expressions of trauma and vulnerability during war. *Med Anthropol Q*, 20(3):379-98. doi: 10.1525/maq.2006.20.3.379.
- Horn R, Puffer ES, Roesch E, Lehmann H. (2016). 'I don't need an eye for an eye': Women's responses to intimate partner violence in Sierra Leone and Liberia. *Glob Public Health*, 11(1-2):108-21. doi: 10.1080/17441692.2015.1032320.
- Howlett PJ, Walder AR, Lisk DR, Fitzgerald F, Sevalie S, Lado M, N'jai A, Brown CS, Sahr F, Sesay F, Read JM, Steptoe PJ, Beare NAV, Dwivedi R, Solbrig M, Deen GF, Solomon T, Semple MG, Scott JT. (2018). Case Series of Severe Neurologic Sequelae of Ebola Virus Disease during Epidemic, Sierra Leone. *Emerg Infect Dis*, 24(8):1412-1421. doi: 10.3201/eid2408.171367.
- Institute for Health Metrics and Evaluation (IHME). (2020). GBD Compare. Seattle, WA: IHME, University of Washington, 2017. Retrieved from <http://ghdx.healthdata.org/gbd-results-tool>.
- Italia MB, Kirolos S. (2019). Sickle cell disease in anaemic children in a Sierra Leonean district hospital: a case series. *Oxf Med Case Reports*, (7):omz061. doi: 10.1093/omcr/omz061.
- Jagadesh S, Sevalie S, Fatoma R, Sesay F, Sahr F, Faragher B, Semple MG, Fletcher TE, Weigel R, Scott JT. (2018). Disability Among Ebola Survivors and Their Close Contacts in Sierra Leone: A Retrospective Case-Controlled Cohort Study. Version 2. *Clin Infect Dis*, 66(1):131-133. doi: 10.1093/cid/cix705.
- James PB, Kamara H, Bah AJ, Steel A, Wardle J. (2018). Herbal medicine use among hypertensive patients attending public and private health facilities in Freetown Sierra Leone. *Complement Ther Clin Pract*, 31:7-15. doi: 10.1016/j.ctcp.2018.01.001.
- Jamison DT. (2018). Disease Control Priorities, 3rd edition: improving health and reducing poverty. *Lancet*, 391(10125):e11-4.
- Ji D, Ji YJ, Duan XZ, Li WG, Sun ZQ, Song XA, Meng YH, Tang HM, Chu F, Niu XX, Chen GF, Li J, Duan HJ. (2017). Prevalence of psychological symptoms among Ebola survivors and healthcare workers during the 2014-2015 Ebola outbreak in Sierra Leone: a cross-sectional study. *Oncotarget*, 8(8):12784-12791. doi: 10.18632/oncotarget.14498.
- Kamara S, Walder A, Duncan J, Kabbedijk A, Hughes P, Muana A. (2017). Mental health care during the Ebola virus disease outbreak in Sierra Leone. *Bull World Health Organ*, 95(12):842-847. doi: 10.2471/BLT.16.190470.
- Kargbo KL. (2002). Limbs of hope. Restoring amputees in Sierra Leone. *J Christ Nurs*, 19(1):22-4. doi: 10.1097/01.cnj.0000262144.20136.f3.
- Lacoux PA, Crombie IK, Macrae WA. (2002). Pain in traumatic upper limb amputees in Sierra Leone. *Pain*, 99(1-2):309-12. doi: 10.1016/s0304-3959(02)00154-9.
- Magnusson L, Ramstrand N, Fransson EI, Ahlstrvom G. (2014). Mobility and satisfaction with lower-limb prostheses and orthoses among users in Sierra Leone: a cross-sectional study. *J Rehabil Med*, 46(5):438-46. doi: 10.2340/16501977-1780.
- Massaquoi TA, Burke RM, Yang G, Lakoh S, Sevalie S, Li B, Jia H, Huang L, Deen GF, Beynon F, Sahr F. (2018). Cross sectional study of chronic hepatitis B prevalence among healthcare workers in an urban setting, Sierra Leone. *PLoS One*, 13(8):e0201820. doi: 10.1371/journal.pone.0201820.



- Mattia JG, Vandy MJ, Chang JC, Platt DE, Dierberg K, Bausch DG, Brooks T, Conteh S, Crozier I, Fowler RA, Kamara AP, Kang C, Mahadevan S, Mansaray Y, Marcell L, McKay G, O'Dempsey T, Parris V, Pinto R, Rangel A, Salam AP, Shantha J, Wolfman V, Yeh S, Chan AK, Mishra S. (2016). Early clinical sequelae of Ebola virus disease in Sierra Leone: a cross-sectional study. *Lancet Infect Dis*, 16(3):331-8. doi: 10.1016/S1473-3099(15)00489-2.
- Meehan KA, Bankoski AJ, Tejan E, Ansumana R, Bangura U, Stenger DA, Jacobsen KH. (2011). Hypertension in Bo, Sierra Leone. *Ethn Dis*, 21(2):237-42.
- Njelesani J, Hashemi G, Cameron C, Cameron D, Richard D, Parnes P. (2018). From the day they are born: a qualitative study exploring violence against children with disabilities in West Africa. *BMC Public Health*, 18(1):153. doi: 10.1186/s12889-018-5057-x.
- Ntirenganya F, Petroze RT, Kamara TB, Groen RS, Kushner AL, Kyamanywa P, Calland JF, Kingham TP. (2014). Prevalence of breast masses and barriers to care: results from a population-based survey in Rwanda and Sierra Leone. *J Surg Oncol*, 110(8):903-6. doi: 10.1002/jso.23726.
- Park, A. (2007). Making sense of amputations in Sierra Leone. *Journal of Social Justice*, 19:579-587.
- Price RR. (2013). Investigating the causes of trauma: critical initial steps to designing sustainable interventions in Sierra Leone: Comment on "Traumatic injuries in developing countries". *JAMA Surg*, 148(5):469-70. doi: 10.1001/jamasurg.2013.1348.
- Qin YL, Li B, Zhou YS, Zhang X, Li L, Song B, Liu P, Yuan Y, Zhao ZP, Jiao J, Li J, Sun Y, Sevalie S, Kanu JE, Song YJ, Jiang JF, Sahr F, Jiang TJ; Chinese Military Medical Experts Group in Sierra Leone. (2018). Prevalence and associated knowledge of hepatitis B infection among healthcare workers in Freetown, Sierra Leone. *BMC Infect Dis*, 18(1):315. doi: 10.1186/s12879-018-3235-1.
- San Roman M, Aguilo F, Clapes M, Sheku M, Dawoh P, Mora J, Cruz O. (2013). Burkitt's lymphoma treatment in a rural hospital in Sierra Leone. *Trans R Soc Trop Med Hyg*, 107(10):653-9. doi: 10.1093/trstmh/trt069.
- Sankoh O, Sevalie S, Weston M. (2018). Mental health in Africa. *Lancet Glob Health*, 6(9):e954-e955. doi: 10.1016/S2214-109X(18)30303-6.
- Sreeramareddy, C.T., Pradhan, P.M. & Sin, S. (2014). Prevalence, distribution, and social determinants of tobacco use in 30 sub-Saharan African countries. *BMC Med*, 12(243). <https://doi.org/10.1186/s12916-014-0243-x>
- Shantha JG, Mattia JG, Goba A, Barnes KG, Ebrahim FK, Kraft CS, Hayek BR, Hartnett JN, Shaffer JG, Schieffelin JS, Sandi JD, Momoh M, Jalloh S, Grant DS, Dierberg K, Chang J, Mishra S, Chan AK, Fowler R, O'Dempsey T, Kaluma E, Hendricks T, Reiners R, Reiners M, Gess LA, O'Neill K, Kamara S, Wurie A, Mansaray M, Acharya NR, Liu WJ, Bavari S, Palacios G, Teshome M, Crozier I, Farmer PE, Uyeki TM, Bausch DG, Garry RF, Vandy MJ, Yeh S. (2018). Ebola Virus Persistence in Ocular Tissues and Fluids (EVICT) Study: Reverse Transcription-Polymerase Chain Reaction and Cataract Surgery Outcomes of Ebola Survivors in Sierra Leone. *EBioMedicine*, 30:217-224. doi: 10.1016/j.ebiom.2018.03.020.
- Sharma M, Fine SL, Brennan RT, Betancourt TS. (2017). Coping and mental health outcomes among Sierra Leonean war-affected youth: Results from a longitudinal study. *Dev Psychopathol*, 29(1):11-23. doi: 10.1017/S0954579416001073.
- Shepherd JH, McNerney PA. (2006). Knowledge of breast cancer in women in Sierra Leone. *Curationis*, 29(3):70-7. doi: 10.4102/curationis.v29i3.1105.
- Soyannwo A, Amanor-Boadu SD. (2001). Management of cancer pain--a survey of current practice in West Africa. *Niger Postgrad Med J*, 8(4):175-8.





- Stewart BT, Groen RS, Kamara TB, Kwon S, Kingham TP, Kushner AL. (2015). Rectal bleeding and endoscopy need in Sierra Leone: results of a nationwide, community-based survey. Stewart BT, Groen RS, Kamara TB, Kwon S, Kingham TP, Kushner AL. Rectal bleeding and endoscopy need in Sierra Leone: results of a nationwide, community-based survey. *Lancet*, 385 Suppl 2:S4. doi:10.1016/S0140-6736(15)60799-1
- Stewart BT, Kushner AL, Kamara TB, Shrestha S, Gupta S, Groen RS, Nwomeh B, Gosselin RA, Spiegel D. (2016). Backlog and burden of fractures in Sierra Leone and Nepal: Results from nationwide cluster randomized, population-based surveys. *Int J Surg*, 33:49-54. doi: 10.1016/j.ijvs.2016.07.009.
- Stewart KA, Groen RS, Kamara TB, Farahzad MM, Samai M, Cassidy LD, Kushner AL, Wren SM. (2013). Traumatic injuries in developing countries: report from a nationwide cross-sectional survey of Sierra Leone. *JAMA Surg*, 148(5):463-9. doi: 10.1001/jamasurg.2013.1341.
- Sundufu AJ, Bockarie CN, Jacobsen KH. (2017). The prevalence of type 2 diabetes in urban Bo, Sierra Leone, and in the 16 countries of the West Africa region. *Diabetes Metab Res Rev*, 33(7). doi: 10.1002/dmrr.2904.
- Tiffany A, Vetter P, Mattia J, Dayer JA, Bartsch M, Kasztura M, Sterk E, Tijerino AM, Kaiser L, Ciglenecki I. (2016). Ebola Virus Disease Complications as Experienced by Survivors in Sierra Leone. *Clin Infect Dis*, 62(11):1360-1366. doi: 10.1093/cid/ciw158. Epub 2016 Mar 21.
- University of Washington. (2020). Disease Control Priorities. Accessed from <http://dcp-3.org/>
- Vinson GA, Chang Z. (2012). PTSD symptom structure among West African war trauma survivors living in African refugee camps: a factor-analytic investigation. *J Trauma Stress*, 25(2):226-31. doi: 10.1002/jts.21681.
- Watkins, D.A., O.F. Norheim, P. Jha, and D.T. Jamison. (2017). "Reducing Mortality within Universal Health Coverage: The DCP3 Model." DCP3 Working Paper Series. Working Paper #21.
- Winkler V, Ott JJ, Cowan M, Becher H. (2013). Smoking prevalence and its impacts on lung cancer mortality in Sub-Saharan Africa: an epidemiological study. *Prev Med*, 57(5):634-40. doi: 10.1016/j.ypmed.2013.08.022.
- Wirth JP, Ansumana R, Woodruff BA, Koroma AS, Hodges MH. (2018). Association between sickle cell and  $\alpha$ -thalassemia genes and hemoglobin concentration and anemia in children and non-pregnant women in Sierra Leone: ancillary analysis of data from Sierra Leone's 2013 National Micronutrient Survey. *BMC Res Notes*, 11(1):43. doi: 10.1186/s13104-018-3143-x.
- Wirth JP, Rohner F, Woodruff BA, Chiwile F, Yankson H, Koroma AS, Russel F, Sesay F, Dominguez E, Petry N, Shahab-Ferdows S, de Onis M, Hodges MH. (2016). Anemia, Micronutrient Deficiencies, and Malaria in Children and Women in Sierra Leone Prior to the Ebola Outbreak - Findings of a Cross-Sectional Study. *PLoS One*, 11(5):e0155031. doi: 10.1371/journal.pone.0155031.
- Wong EG, Groen RS, Kamara TB, Stewart KA, Cassidy LD, Samai M, Kushner AL, Wren SM. (2014). Burns in Sierra Leone: a population-based assessment. *Burns*, 40(8):1748-53. doi: 10.1016/j.burns.2014.03.007.
- World Health Organization. (2020). Four noncommunicable diseases, four shared risk factors. Retrieved from <https://www.who.int/ncdnet/about/4diseases/en/>
- World Health Organization. (2013). Ministry of Health Launches National NCDs Policy and Strategic Plan 2013-2017. Retrieved from <https://www.afro.who.int/news/ministry-health-launches-national-ncds-policy-and-strategic-plan-2013-2017>



- World Health Organization. (2019). Sierra Leone launches a comprehensive five-year National Action Plan for Health Security in compliance with International Health Regulations. Retrieved from <https://www.afro.who.int/news/sierra-leone-launches-comprehensive-five-year-national-action-plan-health-security-compliance>
- The World Bank Group. (2020). Sierra Leone. Retrieved from <https://data.worldbank.org/country/sierra-leone>
- Wurie IM, Wurie AT, Gevao SM. (2005). Sero-prevalence of hepatitis B virus among middle to high socio-economic antenatal population in Sierra Leone. *West Afr J Med*, 24(1):18-20. doi: 10.4314/wajm.v24i1.28156.
- Yambasu EE, Reid A, Owiti P, Manzi M, Murray MJS, Edwin AK. (2018). Hidden dangers-prevalence of blood borne pathogens, hepatitis B, C, HIV and syphilis, among blood donors in Sierra Leone in 2016: opportunities for improvement: a retrospective, cross-sectional study. *Pan Afr Med J*, 30:44. doi: 10.11604/pamj.2018.30.44.14663.
- Zafar SN, Canner JK, Nagarajan N, Kushner AL; SOSAS4 Research Group. (2018). Road traffic injuries: Cross-sectional cluster randomized countrywide population data from 4 low-income countries. *Int J Surg*, 52:237-242. doi: 10.1016/j.ijssu.2018.02.034.



