Combating Noncommunicable Diseases in Kenya
An Investment Case

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Executive Summary

BACKGROUND

In Kenya, the growing prevalence of noncommunicable diseases (NCDs) is a major public health concern and a hindrance to long term economic growth. NCDs reduce human capital and increasingly divert societal resources to less productive uses. High costs to manage the growing caseload of NCDs afflict Kenyan families, businesses, and the government. In addition, NCDs lower economic productivity by shortening life spans and causing illness during an individual's prime working years. If more aggressive action is not taken, the NCD burden threatens Kenya's quest to advance Universal Health Coverage (UHC), a central pillar of the health reform agenda that includes prevention and care for NCDs. To fulfill its commitments to advance health through UHC and to build human capital—as demonstrated through the Government’s stated commitment to the World Bank's Human Capital Project—Kenya must address the rising NCD burden.

OBJECTIVES

Scant published studies have quantified the health and economic burden of NCDs in Kenya. Moreover, within the Kenyan context, few studies have examined the costs and/or benefits of scaling up health interventions that target multiple NCDs and NCD risk factors. To make informed decisions about which interventions to implement to reduce the burden of NCDs, policy makers require credible measures of the expected benefits and costs from investing in NCD prevention and treatment interventions.

Given these needs, the purpose of this study was to do the following:

1. Assess the current economic burden of NCDs in Kenya;
2. Quantify the short- and medium-term economic benefits and costs of scaling up treatment interventions to address NCDs in Kenya; and
3. Provide evidence and strengthen advocacy and resource mobilization efforts that can accelerate investments in human capital development by demonstrating how NCDs impact productivity and the capacity of individuals to achieve their full potential.
METHODS

The investment case assesses the economic burden created by seven of the 15 diseases and conditions described by the Kenya Non-Communicable Diseases and Injuries Poverty Commission: diabetes, cardiovascular disease (CVD), cervical cancer, breast cancer, motor vehicle injuries, chronic obstructive pulmonary disease (COPD), and sickle cell disease. These conditions are responsible for the majority of NCD-related deaths in Kenya. The investment case measures economic burden using a cost-of-illness approach. The burden is comprised of direct and indirect costs. Direct costs reflect the cost to the government or private sector to provide treatment for a given disease or condition, while indirect costs reflect the value of lost economic productivity due to premature mortality, absenteeism (missed days of work), and presenteeism (working at reduced capacity while at work) caused by a disease or condition.

Second, the investment case examines the extent to which the economic burden can be reduced by scaling up interventions that are designed to treat four of seven diseases and conditions described above: CVD, COPD, breast cancer, and cervical cancer. The analysis uses the UN interagency OneHealth Tool (OHT) to assess the costs and health benefits of providing selected NCD care to the population—for example, number of lives saved, and healthy life years gained. In a return-on-investment (ROI) analysis, health benefits are monetized using the human capital approach, and the costs and benefits of the interventions are compared to assess the ROI of each intervention.

RESULTS AND RECOMMENDATIONS

Seven NCDs and conditions caused KSh 230 billion (a billion is 1,000 million) in economic losses in 2016, the equivalent of 3.4 percent of Kenya’s gross domestic product (GDP). Ninety-three percent of the burden is comprised of indirect productivity losses while the remainder is attributable to direct medical costs. If the coverage levels of interventions to treat these conditions remain low, NCDs will continue to cause major economic losses, resulting in average annual losses of KSh 607 billion in 2030.

By acting now, the Government of Kenya can reduce future health and economic losses due to NCDs. From 2016 to 2030, scaling up screening and treatment for four major NCDs (CVD, COPD, and breast cancer and cervical cancer) would do the following:

- Avert nearly 110,000 incremental deaths, of which nearly 89,000 would have been caused by cardiovascular disease. In addition, 811,000 healthy life years would be restored to the Kenyan population, 67 percent of which are generated by interventions addressing chronic obstructive pulmonary disorder.
- Provide economic benefits (KSh 175 billion) that outweigh the costs (KSh 142 billion). The CVD interventions account for 86 percent of the total economic benefits while representing 43 percent of the costs. The CVD interventions (ROI 2.48) are the only package of interventions found to have an ROI greater than one over the analyzed period from 2016 to 2030. Cervical cancer interventions have the next highest ROI (0.73), followed by the breast cancer (0.57), and COPD (0.09) interventions.
The investment case shows that there is an evidence-based opportunity to reduce the health and economic burden of NCDs, and demonstrates that Kenya can facilitate its efforts to implement UHC and make a generational investment in human capital by addressing the NCD burden in the country. Given these findings, it is recommended that the Government of Kenya take the following steps:

1. **Invest in scaling up interventions for NCDs, drawing on economic and efficiency analyses to inform the prioritization of the allocation of scarce resources.** The investment case analysis shows that the package of CVD interventions is economically efficient and offers a return on investment (ROI) over the next 15 years, while investments in the cancer and COPD packages have ROIs lower than one. Given that CVD presents the highest burden of any condition analyzed in the investment case, and that the CVD interventions generate clear health and economic benefits, Kenya could prioritize scaling up the CVD interventions analyzed in this investment case. This could begin with expanding access to preventative services to address CVD risk factors, such as hypertension and hyperlipidemia. Despite offering lower economic returns, other conditions should not be neglected given the huge economic burden that all the NCDs impose on the country. Health is a human right; investing in scaling up interventions that address all NCDs creates an opportunity for all people to pursue their full potential.

2. **Increase NCD resource allocation by the Government of Kenya, and other national and international partners.** By investing KSh 142 million in NCD treatment now, Kenya would save KSh 175 billion in economic losses from poor health over 15 years. Kenya should analyze how to mobilize the resources required to fund this investment and may consider win-win strategies—such as increasing (or implementing) taxes on tobacco, alcohol, and sugar-sweetened beverages—that synergistically achieve health aims while also generating revenue.

3. **Prioritize and sustain efforts on prevention and health promotion.** Although the investment case primarily focused on clinical interventions, the results point to the importance of tackling NCD risk factors and investing in health promotion—basically interventions that prevent, halt, or delay the progression of disease. NCDs share modifiable risk factors (tobacco smoking, unhealthy diet, physical inactivity, and harmful consumption of alcohol), which, when tackled, can prevent, halt, or delay the progression of disease. Interventions to screen for and quickly manage metabolic risk factors, such as high blood pressure, high cholesterol, high fasting blood glucose, and obesity, will also delay the progression of disease, reducing the long-term costs of treatment. Investing in health promotion and primary prevention is thus a strategic approach to minimizing the costs of NCDs. Though further research on the benefits of such interventions in Kenya in relation to their costs is much needed, the World Health Organization (WHO) has identified a set of intervention “best buys” that could provide useful guidance. There is also considerable scope for the design and implementation of policies and programs aimed at behavior change, particularly among youth and adolescents.

4. **Continue investment in NCD control through Universal Health Coverage (UHC), delivering on the Big Four agenda.** By providing accessible, responsive, and inclusive health services that engage all population groups, and
especially those who are the most vulnerable, no one is left behind. Moreover, inclusion of NCD prevention services can reduce future catastrophic health expenditures, protecting individuals from poverty. Both the quantity and quality of health services should be considered. Investments in NCD control should be well coordinated with all health system stakeholders to create synergies in the delivery of care and ensure that health service delivery is not fragmented programmatically (noncommunicable versus communicable disease care). UHC services should also prioritize preventative interventions to maximize health service delivery benefits.

5. **Plan additional economic analysis of interventions addressing NCDs.** As indicated earlier, population level interventions have been proven to offer a high return for investment. Further prioritization and economic analysis of these interventions, therefore, is needed, especially given their high potential impact. In addition, the investment case did not analyze interventions addressing two diseases (diabetes and sickle cell disease) and one condition (road traffic injuries) that were included in the cost-of-illness analysis. Analysis of additional diseases and conditions would provide a more comprehensive picture of options for prioritizing and controlling NCDs and injuries. Finally, updating the current analysis of cancer and COPD interventions with additional information may produce different results. The ROI analysis did not place a monetary value on the decreases in disease morbidity that result from clinical interventions. Including this component in future analyses would provide more equal weighting to interventions such as those for COPD, which have a larger impact on disease morbidity than mortality.
Abbreviations

AMI  acute myocardial infarction
COI  cost of illness
COPD chronic obstructive pulmonary disease
CVD cardiovascular disease
GBD Global Burden of Disease
GDP gross domestic product
HC  human capital
HCP Human Capital Project
ICC interagency coordinating committee
IHD ischemic heart disease
IHME Institute for Health Metrics and Evaluation
KSh Kenyan shilling
KEPH Kenya Essential Package for Health
KNBS Kenya National Bureau of Statistics
LMIC low- and middle-income country
MI myocardial infarction
NCD noncommunicable disease
NCDI noncommunicable diseases and injuries
NTSA National Transport Safety Authority
OHT OneHealth Tool
PV present values
ROI return on investment
RTI road traffic injuries
SDG Sustainable Development Goal
THE total health expenditure
UHC universal health coverage
VIA visual inspection with acetic acid
WHO World Health Organization
BACKGROUND

The global burden of noncommunicable diseases (NCDs) or chronic diseases—primarily, cardiovascular diseases (or heart diseases), diabetes, cancers, and chronic lung diseases—has increased sharply over the past two decades, with low-and-middle-income countries (LMICs) most heavily impacted by this shift. In Kenya, NCDs caused 111,000 deaths in 2017, nearly 62 percent of which occurred in individuals under age 70 (GBD 2017 Causes of Death Collaborators 2018). The increasing prevalence of NCDs—resulting in a double burden of infectious and chronic diseases—constitutes a major public health concern. NCDs account for more than 50 percent of total hospital admissions and over 55 percent of hospital deaths in Kenya (Ministry of Health, Government of Kenya 2015a). By 2030, it is projected that deaths due to communicable diseases will decrease by 48 percent, while deaths due to NCDs will rise by 55 percent (Ministry of Health, Government of Kenya 2015b).

NCDs create high economic costs that are borne at the individual, household, community, and national levels. Large expenditures to treat ill health impose a direct burden, which can impoverish individuals and households (Chuma and Maina 2012). But the economic burden of NCDs also stems from indirect sources. Poor health reduces productivity by permanently or temporarily removing individuals from formal or informal labor markets. When individuals die prematurely, the labor output that they would have produced in their remaining years is lost. In addition, individuals with NCDs are less likely to participate in the workforce, and more likely to miss days of work (absenteeism) or to work at a reduced capacity while at work (presenteeism) (Wang et al. 2004). Between 2011 and 2030, it is estimated that NCDs will cause more than US$21 trillion in lost economic output in LMICs (Bloom et al. 2011).

Despite the substantial health and economic burden of NCDs, both domestic and external financing to scale up interventions to address these conditions remain limited. In Kenya, although total expenditure for NCDs increased by 20 percent between 2012 and 2016, the proportion of NCD expenditure as a share of total health expenditure declined over the period from 6.2 percent in
OMBATING NONCOMMUNICABLE DISEASES IN KENYA

2012/13 to 5.7 percent in 2015/16 (table 1.1) (Ministry of Health, Government of Kenya 2017b). Given that less than two percent of global donor funding on health is allocated to NCD prevention and control, and growth in donor funding is relatively stagnant, responsibility then falls to the Government of Kenya to finance interventions to address the NCD epidemic (Global Burden of Disease Health Financing Collaborator Network 2017).

Health has a central place in the Kenya government’s national development goals and NCDs are central to Kenya’s quest to achieve Universal Health Coverage (UHC) by 2022. The rising prevalence of NCDs requires increased resources to satisfy the fundamental principles of UHC, which are (1) equitable access to care; (2) the provision of high quality care; and (3) financial protection. Treatment for NCDs already accounts for a large share of screening and medicines provided through UHC in Kenya (Ministry of Health, Government of Kenya 2018). Prevention and early control of NCDs will ensure that people have access to effective treatment without experiencing financial hardship.

Kenya is a pioneer in the World Bank’s global Human Capital Project (HCP). The HCP supports countries to improve health and education as a means of promoting equity and economic growth. Improvements in health can materially impact national prosperity. Good health has been linked to increases in the economic output of workers, increased rates of savings among individuals, and foreign investment in business and infrastructure (Jamison et al. 2015; Yamey et al. 2017). In 2017, Kenya ranked 94 out of 154 countries in terms of human capital (HC) and had a HC index higher than the average for its region and income group (World Bank 2018). Kenya must continue to invest in the health of the nation in order to realize the full potential of its HC, and to achieve the long term economic growth envisioned in the national Vision 2030 agenda.

Tackling NCDs is vital to achieve the 2030 Sustainable Development Goals (SDG). SDG Target 3.4 seeks to reduce premature deaths from NCDs by one-third. Given the interrelation between NCDs, poverty, and its multisectoral dimensions, this SDG target is directly linked with eight other SDGs (1, 2, 4, 5, 8, 10, 11, 12), making it central to the broader development agenda. According to the NCD Countdown, Kenya is losing ground in the goal to reduce NCD mortality by 2030 (NCD Countdown 2030 Collaborators 2018). Achieving SDG 3.4 will require concerted effort to tackle NCDs within the broader framework of health service delivery (Bertram et al. 2018).

### STUDY OBJECTIVES

This study provides new evidence by assessing the short- and medium-term economic benefits and costs of scaling up treatment interventions to address NCDs in Kenya. Developing an “investment case” for NCDs brings visibility to a

| FISCAL YEAR | TOTAL HEALTH EXPENDITURE (THE) | NCD EXPENDITURES AS % OF THE |
|-------------|--------------------------------|------------------------------|
| 2012/13     | KSh 271.9 b                    | 6.2% (KSh 16.9 b)            |
| 2015/16     | KSh 346.7 b                    | 5.7% (KSh 19.8 b)            |

Source: Kenya National Health Accounts FY2015/2016.
Note: b = billion; KSh = Kenyan shilling; NCD = noncommunicable disease.
growing epidemic and can guide policy makers toward actionable steps that can be taken to reduce the NCD burden. Importantly, the investment case can be used to advocate for greater allocation of resources from the National Treasury. In addition, the NCD investment case can be used to do the following:

1. **Accelerate progress on UHC.** Understanding the costs as well as the ROI of selected NCD interventions will inform the design of the package of affordable health services for chronic conditions as UHC is expanded to all Kenyans; support more effective integration of cost-effective interventions into routine health service delivery; and improve tracking and monitoring of achievements in health outcomes related to NCDs—all of which support pathways to UHC.

2. **Accelerate investments in HC Development.** In order to accelerate HC development, Kenya will need to invest national resources to tackle the key barriers to health and education. This requires a strong evidence base to demonstrate the interlinkages between health improvements and individual productivity. This investment case contributes to the evidence base by demonstrating how NCDs—a primary driver of premature mortality in adults—impact productivity and the capacity of individuals to achieve their full potential.

3. **Strengthen advocacy and resource mobilization efforts.** The investment case provides an opportunity to refocus and revitalize the fight against NCDs in Kenya. In LMICs, a lack of political commitment to and resource allocation for NCDs remain a challenge, in part because the diseases continue to be viewed as a “problem of affluent countries.” This investment case is an advocacy tool that can highlight the benefits of cost-effective interventions, and act to mobilize resources, both domestically and externally, to address critical gaps in NCD prevention and control.

**MAKING THE CASE**

The remainder of this report is divided into four sections. Chapter 2 provides a summary of NCD prevention and control efforts in Kenya, including recent surveys, and policy response. Chapter 3 describes the methodology for the NCD investment case. Chapter 4 presents the findings of the investment case. Chapter 5 discusses the implications of the findings and recommendations.

**NOTE**

1. SDG 1: End poverty; SDG 2: Zero hunger; SDG 4: Quality Education; SDG 5: Gender Equality; SDG 8: Decent Work and Economic Growth; SDG 10: Reduced Inequities; SDG 11: Sustainable Cities and Communities; SDG 12: Responsible Consumption and Production.
DISEASE AND RISK FACTOR BURDEN IN THE COUNTRY

Epidemiological burden of noncommunicable diseases

In Kenya, over one-third of all deaths are attributable to noncommunicable diseases (NCDs) (IHME 2017). Reliable cause of death data is limited in Kenya. However, the Institute for Health Metrics and Evaluation (IHME) estimates that in 2017 around 60,000 deaths were caused by the seven NCDs and injuries included in this investment case, with cardiovascular disease (CVD) accounting for the highest share of these NCD deaths (59 percent), followed by chronic respiratory diseases (14 percent), diabetes (12 percent), road traffic injuries (9 percent), breast cancer (3 percent), cervical cancer (3 percent), and sickle cell disease (<1 percent) (IHME 2017).

Kenya faces a double burden of communicable and noncommunicable diseases. Figure 2.1 shows that the percentage of deaths attributable to NCDs increased from 1997 to 2017, while communicable disease deaths declined (IHME 2017).

Burden of NCD risk factors

The prevalence of NCD risk factors is also high. In 2015, Kenya conducted its first nationally representative survey on NCD risk factors, using the World Health Organization (WHO) Stepwise Approach to NCD Risk Factor Surveillance (STEPS). The survey assessed the prevalence of tobacco smoking, physical inactivity, harmful consumption of alcohol, unhealthy diets, overweight and obesity, hyperglycemia (raised blood sugar), hyperlipidemia (raised cholesterol), and hypertension (raised blood pressure). These risk factors account for two-thirds of NCD incidence globally. Box 2.1 shows the prevalence of these risk factors in Kenya. Importantly, the vast majority of survey respondents had never been measured for blood pressure, blood glucose, or cholesterol, a concerning finding because of the linkage between these metabolic risk factors and CVD. There appears to be high awareness of some risk factors such as salt, but less awareness of screening for cancer or raised blood pressure. In addition, delays in diagnosis and treatment lead to disease complications and high rates of hospitalization.
Selected findings of 2015 Kenya STEPwise survey for noncommunicable disease risk factors

Metabolic risk factors
- Blood pressure
  - 56 percent of Kenyans have never been screened for raised blood pressure.
  - 23.8 percent of Kenyans have high blood pressure.
  - Among those who had been previously diagnosed with hypertension, only 22.3 percent were currently on medication prescribed by a health worker.
- Blood glucose
  - 87.8 percent of Kenyans have never been measured for raised blood sugar.
  - Among those diagnosed with elevated blood sugar, less than half (40.1 percent) are currently taking medication.
- Cholesterol
  - Most Kenyans (97.7 percent) have never been measured for cholesterol levels.
  - Only 13.3 percent of Kenyans who reported that they have been diagnosed with elevated cholesterol levels are on medication.

Behavioral risk factors
- Tobacco use
  - 13 percent of Kenyans currently consume tobacco products, with a higher prevalence of use among men (23 percent) compared to among women (4.1 percent).
  - 24 percent and 20.9 percent of Kenyans are exposed to secondhand smoke at home and work, respectively.
- Alcohol consumption
  - 19.3 percent of Kenyans currently consume alcohol, and 13 percent of those who consume alcohol do so on a daily basis.
  - Consumption of unrecorded alcohol (alcoholic drinks that are homebrewed, excluding changaa, busaa or muratina or any alcohol not intended for drinking) was reported by 35.5 percent of adults.
- Fruit and vegetable consumption
  - Kenyans report an average daily consumption of two servings (2.1) of

continued
Situation Analysis

POLICY RESPONSE TO NCD PREVENTION AND CONTROL IN KENYA

Kenya’s Big Four Agenda—championed by President Uhuru Kenyatta in his 2017 inaugural speech—prioritizes the attainment of Universal Health Coverage (UHC) by 2022. The link between achieving UHC and addressing NCDs was summarized by the Cabinet Secretary for Health, Dr. Sicily Kariuki, during a March 2018 speech: “Unless we do more and make concerted efforts towards preventing and affordably treating NCDs, the attainment of UHC is unlikely to be feasible.” The UHC package includes NCD screening and treatment as part of increasing access to essential health care for all Kenyans, with care delivered through community health volunteers and primary health centers. These services include full coverage of essential medicines and supplies for NCD diagnosis.

The National NCD Strategy 2015–20 provides a framework upon which both the national and county governments can draw to develop action plans for the prevention and control of NCDs. Some disease-specific policies include the National Cancer Control Strategy 2017–22, the Kenya National Guidelines for Cardiovascular diseases management 2018, and the National and Clinical Guidelines for Management of Diabetes Mellitus among others (Ministry of Health, Government of Kenya 2017a). Appendix C details the situation of NCDs within the Kenyan health policy context.

The investment case is aligned with Kenya’s National Strategy for the Prevention and Control of Non-Communicable Diseases 2015–20 by focusing on the conditions—CVD, diabetes, cancer, respiratory diseases, and injuries—causing high health burdens in the country. The provision of NCD services—especially clinical screening and treatment—analyzed in the investment case fall within the UHC package of care and Kenya has prepared multiple disease strategies to guide the provision of that care.

NOTES

1. Appendix A contains additional institutional context on NCDs in Kenya.
2. The other pillars of the Big Four Agenda are affordable housing, enhancing manufacturing, and food security and nutrition.
3 Investment Case Methods

The investment case analyzes seven of the 15 diseases and conditions described as presenting a “high” disease burden by the Kenya Non-Communicable Diseases and Injuries Poverty Commission (Kenya NCDI Poverty Commission 2018). These seven were selected based on some or all of the following criteria: (1) the disease or condition was designated by the Kenya Ministry of Health as a priority for intervention over the next five years; (2) proven cost-effective interventions are available to address the disease or condition; (3) scaling up interventions to address the disease or condition is highly feasible; (4) addressing the disease or condition was advised by policy makers in the ministry’s NCD department or key opinion leaders; and (5) data was available to facilitate analysis of the disease and condition.

First, a cost-of-illness (COI) approach is used to measure the economic burden of all seven of those NCDs in Kenya over the period 2016–30. Second, a return on investment (ROI) analysis is conducted for four of those diseases: cardiovascular disease (CVD), chronic obstructive pulmonary disease (COPD), and breast cancer and cervical cancer. This more limited set of diseases and conditions comprised those available for analysis in the UN interagency OneHealth Tool (OHT), a software-based health modeling tool that assesses the costs and health benefits of interventions. This chapter describes the methodology underlying those two analyses. Costs and benefits are presented in real 2016 Kenyan shillings, and future costs and monetized benefits are discounted at a rate of 6.5 percent annually (Addicott, Fenichel, and Kotchen 2020).

**CURRENT ECONOMIC BURDEN OF SEVEN NCDs**

Projections of incidence, prevalence, and mortality from seven diseases and conditions are calculated to estimate the health burden of each from 2016 to 2030. For breast cancer, cervical cancer, COPD, CVD, and diabetes, estimates are obtained from the OHT under the assumption that current coverage rates of interventions to address each disease do not change over the period of the analysis. Projections of sickle cell disease are made assuming that the rate of
2.5 cases per 100,000 population holds steady as the population increases over the time horizon of the analysis. In each year for which deaths due to sickle cell are projected, 17 percent of deaths are assumed to be adults, based on a study from Tanzania (Makani et al. 2011). Future road traffic injuries are estimated using Institute for Health Metrics and Evaluation Global Burden of Disease (GBD) data to project mortality from road accidents, where the number of fatalities for 2016 was 3,978 and was projected to increase to 5,146 in 2020, 5,591 in 2025 and 6,036 in 2030. The number of individuals with minor and serious injuries was estimated using reports from National Transport and Safety Authority (NTSA). More information on the model and calculations used to make projections is provided in appendix F.

A COI approach is employed to determine the economic burden due to NCDs. COI assesses the direct and indirect costs related to a disease. Direct costs reflect the cost to the government or private sector to provide treatment; indirect costs reflect the value of lost productivity due to the disease, including costs due to premature mortality, absenteeism, and presenteeism. Direct and indirect costs are calculated independently of each other, and then summed to calculate the total cost of NCDs to an economy. The COI is also reported as a share of gross domestic product (GDP). More information on the sources underlying inputs to the COI analysis may be found in appendix B.

**CALCULATING THE DIRECT COSTS OF NCDs**

The investment case calculates the cost to provide screening, diagnosis, and treatment of ill health caused by seven diseases or injuries as shown in box 3.1.

The investment case uses the UN interagency OneHealth Tool (OHT)—which was developed by technical committees of the United Nations Interagency Taskforce on NCDs—academic literature, and expert opinion to estimate the resources required to provide screening, diagnosis, or treatment for patients. Five types of resources and their costs are assessed: (a) medicines and supplies; (b) compensation for health professionals; (c) overhead costs of outpatient visits and inpatient stays, such as utility costs, administrative and other nonhealth staff; (d) programmatic costs; and (e) patient transport costs. “Estimating mortality and morbidity of sickle cell disease and road traffic injuries” section of the appendix F provides information on the sources from which each type of cost data was derived, and also summarizes the per-person treatment costs of each clinical intervention.

Total direct costs are calculated by multiplying the number of persons to be treated in each year for a given disease by the per-person cost of treatment. The number of people treated for each condition was obtained by multiplying the population in need of the service by the coverage of each intervention, as calculated by OHT. The baseline coverages varied from intervention to intervention, although it was about 30 percent for most of the interventions. The baseline targets were obtained mainly from the Kenya NCDI Poverty Commission 2018 report and the Kenya Stepwise 2015 report. Endline target was 80 percent for all interventions; this target was obtained from the NCDI report. This endline coverage was considered plausible given the low coverages of interventions at the baseline.
CALCULATING THE INDIRECT COSTS OF NCDs

Within the investment case, indirect costs reflect the monetary value of lost productivity when people who, due to NCDs, exit the labor market early due to premature death, miss days of work due to ill health (absenteeism), or are less productive while at work due to ill health (presenteeism).

The indirect costs of premature mortality are estimated using the human capital (HC) approach, based on which each year of productive life saved is valued as the potential output a worker would have produced (proxied as GDP per worker) had (s)he continued working under complete health. The productivity loss is computed as follows:

**Noncommunicable disease clinical interventions costed**

**Breast cancer**
- Screening: breast cancer screening and diagnosis by way of a clinical breast examination.
- Treatment: cancer treatment for stages I–IV.

**Cervical cancer**
- Screening: Visual inspection with acetic acid (VIA), pap smear, biopsy and histopathology.
- Treatment: cryotherapy, and cervical cancer treatment for stages I–IV.

**COPD**
- Treatment: Inhaled salbutamol, low-dose oral theophylline, Ipratropium inhaler, exacerbation treatment with antibiotics, exacerbation treatment with oral prednisolone, exacerbation treatment with oxygen.

**CVD**
- Secondary prevention: Screening for risk of CVD; treatment for those with very high cholesterol but low absolute risk of CVD (< 20 percent); treatment for those with high blood pressure but low absolute risk of CVD (< 20 percent); treatment for those with absolute risk of CVD 20–30 percent, treatment for those with high absolute risk of CVD (> 30 percent).
- CVD control: treatment of new cases of acute myocardial infarction (AMI) with aspirin; treatment of cases with established ischemic heart disease (IHD), and; treatment for those with established cerebrovascular disease and post stroke.

**Diabetes**
- Screening: Screening for risk of diabetes.
- Diabetes control: Standard glycemic control (oral only), standard glycemic control (insulin).
- Treatment to prevent complications from diabetes: Neuropathy screening and preventative foot care; retinopathy screening and photocoagulation; treatment for those with very high cholesterol but low absolute risk of diabetes (< 20 percent); treatment for those with high blood pressure but low absolute risk of diabetes (< 20 percent); treatment for those with absolute risk of diabetes 20–30 percent, and; treatment for those with high absolute risk of diabetes (>30 percent).

**Road traffic injuries**
- Treatment: Treatment of minor, moderate and severe injuries.

**Sickle cell disease**
- Management: Management of sickle cell condition in adults, and management of sickle cell condition in children.

Note: COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease.
Productivity loss from premature mortality = Number of NCD deaths, x GDP per worker, x labor force participation rate x employment rate x the expected number of years of working life lost

Where,
- $i$ represents the year in the analysis.
- **GDP per worker** is KSh 489,641 in 2017 and grows at a projected rate of six percent annually.
- **Labor force participation rate** is 67.3 percent and remains static throughout the analysis.
- **Employment rate** is 89 percent and remains static throughout the analysis.
- **Expected number of years of working life lost** due to each disease is reported in box 3.2.

### Indirect productivity losses: Assumptions and sources

#### Breast and cervical cancers
- On average, each cancer death is assumed to result in the loss of 10 years working life, based on data from the Nairobi Cancer Registry, which shows that the average age of those who die from cancer is about 50 years. Assuming retirement at age 60, 10 years of working life are lost.
- Cancer causes individuals to lose 12.5 percent of working days due to absenteeism and 8.5 percent to presenteeism (Goetzel et al. 2004).

#### COPD
- The number of averted deaths was given by OHT, where the average age of death resulted in 11 years of working life lost.
- COPD causes individuals to lose 6.1 percent of working days to absenteeism and 17.2 percent to presenteeism (Goetzel et al. 2004).

#### CVD
- The number of averted deaths was given by OHT, where the average age of death resulted in 15 years of working life lost.
- CVD causes individuals to lose 2.8 percent of working days due to absenteeism and 6.8 percent to presenteeism (Goetzel et al. 2004).

#### Diabetes
- The number of averted deaths was given by OHT.
- Diabetes causes individuals to lose 5.7 percent (Namibia study) of working days due to absenteeism (Guariguata et al. 2012) and 11.2 percent to presenteeism (Goetzel et al. 2004).

#### Road traffic injuries
- World Bank estimates of mortality from road traffic injuries.
- On average, 150 days of work are lost due to serious accidents and 7 days for minor injuries (Mofadal and Kanitpong 2016).

#### Sickle cell disease
- Mortality of 0.65 per 100,000 is assumed using IHME GBD data. No data is available on the average age at death for the adults. The investment case assumes a loss of 10 years of working life.
- It is assumed 17 percent of those with sickle cell disease are adults (Makani et al. 2011) and that adults lost about 17 percent of working days annually due to the condition. No estimates of presenteeism are included in the analysis.

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Note: COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease; IHME GBD = Institute for Health Metrics and Evaluation Global Burden of Disease; OHT = OneHealth Tool.
The value of lost future years of life is converted into a present value, using a cumulative discount factor applied over the expected number of years of life lost. The discount factor is derived from a 6.5 percent discount rate specific to Kenya that is calculated by (Addicott, Fenichel, and Kotchen 2020), who factored in Kenya’s age-specific mortality rates and life expectancies to estimate the long-term social discount rate in Kenya.

The indirect cost of reductions in productivity because of absenteeism or presenteeism due to ill health are calculated as follows:

\[
\text{Productivity loss from absenteeism or presenteeism} = \text{Percent productive time lost per year} \times \text{disease prevalence (# of people)} \times \text{GDP per worker} \times \text{labor force participation rate} \times \text{employment rate}.
\]

Where,

- \(i\) represents the year in the analysis.
- GDP per worker is KSh 489,641 in 2017 and grows at a projected rate of six percent annually.
- Labor force participation rate is 67.3 percent and remains static throughout the analysis.
- Employment rate is 89 percent and remains static throughout the analysis.
- Percent productive time lost per year due to a given disease is derived from academic literature, as reported in box 3.2.

Future losses are discounted at a rate of 6.5 percent. The total productivity loss is the sum of productivity losses from mortality, absenteeism, and presenteeism.

**RETURN-ON-INVESTMENT ANALYSIS**

The return-on-investment analysis examines the extent to which the health and economic burden of NCDs can be reduced through the scale up of interventions that target and treat four out of seven of the diseases and conditions: breast cancer, cervical cancer, COPD, and CVD. Policy measures designed to reduce NCD risk factor prevalence were not included in the analysis as they were deemed to be outside the mandate of the Kenya Ministry of Health. In particular, Kenya’s National Cancer Control Strategy 2017–22 has spurred scaling up of cancer screening and down-staging of cancer treatment. National Cancer Screening Guidelines were implemented in 2018 that highlight mass screening of cervical, breast, and colorectal cancer and emphasizes individual training for prostate cancer. The ministry of health has added a component for early detection including endoscopy for patients at high risk. Oral cancer has also been included in these guidelines. None of these recent advances towards cancer prevention and early treatment is incorporated into the results of the current study. These changes suggest that a follow-up economic analysis of cancer prevention and care might be warranted.

**Step 1: Select the interventions and specific NCDs for the investment case**

The investment case focuses on clinical interventions designed to prevent or treat breast cancer, cervical cancer, COPD, and CVD. The interventions included
in the ROI analysis—those which target breast cancer, cervical cancer, COPD, and CVD—are described in “ROI analysis: Description of clinical interventions” section of appendix F.

**Step 2: Assess the costs of scaling up coverage of clinical interventions**

The analysis examines two scenarios using the OHT: a “business as usual” scenario in which current coverage rates of interventions stay the same from 2016 to 2030, and a “scale up” scenario in which coverages are scaled to reach more people in need of treatment.

“ROI analysis: Baseline and target coverages of interventions” section of appendix F lists the coverage rates of interventions in the analysis, from 2016 to 2030, and appendix C shows the extent to which the scale up in coverage reduces the treatment gap for each disease. The number of people reached in the baseline scenario is compared to the number of people reached in the scaled-up scenario to ascertain the additional number of people that the health system will treat. The additional number of people treated is multiplied by the unit cost of each treatment to obtain the total cost of providing treatment.

**Step 3: Estimate the health gains**

To assess the benefits of scaling up health interventions, the investment case uses the NCD impact module of the OHT to assess the impact of scaling up interventions on population health. The module applies effect sizes for each intervention to the people who receive treatment. The effect sizes are derived from academic literature (see appendix F, “ROI analysis: Intervention impact” section). OHT models the impact of the interventions, including on the number of lives saved and healthy years gained.

**Step 4: Monetize the health gains**

The number of lives saved as a result of scaling the interventions was monetized in order to assess labor productivity gains that result from avoidance of premature deaths.

For this purpose, the human capital (HC) approach used earlier was modified:

\[
\text{Productivity gains from avoided premature mortality} = \text{Number of NCD deaths avoided} \times GDP \text{ per worker} \times \text{labor force participation rate} \times \text{employment rate} \times \text{the expected number of years of working life gained}
\]

Estimates of gains from avoided absenteeism and presenteeism were not included in the analysis.

**Step 5: Return on investment**

The ROI is a measure of the economic value of an investment. An investment is considered efficient if the financial gain from the investment exceeds its cost. The ROI is defined as the ratio between the monetarized benefits and the costs, both expressed in discounted present values (PV).
Return on investment = \frac{PV (Total productivity benefits)}{PV (Total implementation costs)}

A return on investment greater than one indicates that the PV of the project’s benefits outweighs the PV of its costs. For the Kenyan investment case, the return on investment for NCD interventions was evaluated both in the short term (2016–22) and in the medium term (2016–30).

**STUDY LIMITATIONS**

Limitations of the study are as follows:

- This study does not include an evaluation of the costs and benefits of addressing behavioral risk factors (notably, tobacco smoking, unhealthy diets, physical inactivity, and harmful consumption of alcohol). Unlike other NCD investment cases, this study focused primarily on treatment—interventions within the purview of the health sector. Within this context, the inclusion of preventative interventions was limited to instances where those interventions formed part of the standard protocol, as defined in the One Health Tool, for facility-based primary prevention and treatment. Preventative measures can stop disease from emerging and have been shown to be highly cost-effective. Their inclusion would likely raise the ROI from NCD interventions.

- Uncertainty in model parameters. This investment case is based on assumptions regarding the model parameters which are subject to uncertainty and may affect the results. For example, the effectiveness and costs of the interventions considered may change as new technologies are continuously developed. Similarly, societal changes in lifestyle and in the environment can affect the prevalence and incidence of the selected NCD conditions. To test the sensitivity of the model parameters to these assumptions, a series of sensitivity analyses were performed where inputs were changed.

- Labor market assumptions. To value the economic output that is lost as a result of ill health, the investment case uses the HC approach. The HC approach assumes that when an individual drops out of the labor force their contributions are not replaced by another productive individual. High unemployment rates in Kenya (11 percent) may challenge this assumption, given that a slack labor force means that new workers are potentially available to substitute for, or replace individuals who cannot work because they are sick or have died. If coworkers can cover the tasks of a sick individual, or if firms can hire individuals to fill the roles of people who drop out of the workforce due to ill health, then in theory economic losses can be lessened (Lensberg et al. 2013). However, in the real world, it is not always possible to replace workers—it can be costly and worker absences can sometimes have an outsized effect by impacting the economic output of multiple other employees given that many worker projects occur in a team setting (Lensberg et al. 2013). Finally, the friction cost approach assumes that the individual who replaces a sick employee was completely unproductive in their previous role in the formal or informal labor market, or within their household (Neumann et al. 2017). Given these considerations, the investment case follows the Panel on Cost-Effectiveness in Health and Medicine’s recommendation to use the HC approach (Neumann et al. 2017).
• The ROI analysis includes only four out of seven high burden NCD conditions. Due to limited data availability on the impact of all the selected interventions on health outcomes, the ROI was estimated for four conditions only—breast cancer, cervical cancer, CVD, COPD. However, estimations of the economic burden are included for all seven conditions (including sickle cell disease, diabetes, and road traffic injuries).

NOTES

1. The choice of 2016, as base year, was based on the Kenya NCDI Poverty Commission report, which this NCD investment case relies on for the coverage rates for the selected interventions.
2. The base year used in the Kenya NCDI Poverty Commission’s report is 2016. The base year is not included in the calculation of the ROI, and as such all investment case results are presented in 2017 currency units.
This section presents a summary of the findings of the investment case. Results are shown for the current and projected economic burden of noncommunicable diseases (NCDs) and the returns from scaling up health interventions to target Chronic Obstructive Pulmonary Disease (COPD), cardiovascular disease (CVD), breast cancer, and cervical cancer.

**ECONOMIC BURDEN OF NCDs IN KENYA**

The seven NCDs and conditions analyzed for this investment case—breast cancer, cervical cancer, COPD, CVD, diabetes, sickle cell disease, and road traffic injuries—impose a high burden on Kenya’s economic well-being. In 2016, NCDs led to KSh 230 billion (a billion is 1,000 million) in economic losses due to medical expenditures and indirect productivity losses, equivalent to 3.4 percent of GDP.

Given projected trends in the prevalence of NCDs, coupled with the increase in the national population, the NCD economic burden will increase annually through 2030. The results showed that with present coverage of the interventions, the economic burden of these NCDs will increase from KSh 230 billion in 2016 to KSh 607 billion in 2030. Figure 4.1 gives a breakdown of the cumulative economic losses caused by each disease or condition over the time horizon of the analysis. CVD causes the highest economic losses, KSh 3,008 billion, or around 52 percent of the losses generated by the seven NCDs and conditions that were analyzed. Diabetes presents the next highest economic burden (KSh 930 billion, 16 percent), followed by COPD (KSh 807 billion, 13.9 percent), and road traffic accident injuries (KSh 668 billion, 11.5 percent).

Direct economic losses due to health care expenditures account for KSh 430 billion, representing 7.4 percent of the total NCD burden. Government is estimated to have covered KSh 147.3 billion of those health care expenditures, KSh 132.7 billion was covered by households and individuals in out-of-pocket expenses, and the remainder by donors and other sources. The indirect costs of NCDs—defined as the sum of the productivity loss due to premature deaths, absenteeism and presenteeism—constitute the largest share of total losses (93 percent). Figure 4.2 shows losses by source.
This section presents the impact of scaling up clinical interventions that address breast cancer, cervical cancer, COPD, and CVD. Single interventions and policy measures that target a particular disease or risk factor are bundled together as “packages” within the analysis. For instance, each of the interventions addressing breast cancer—awareness, screening by clinical breast exam and mammography, and treatment of stage I–IV cancer—are analyzed together and named the “breast cancer package.”
The costs of implementing the policy measures and interventions, and the resulting health and economic benefits are discussed below. Appendix E presents results from a sensitivity analysis.

**HEALTH BENEFITS OF THE INTERVENTIONS**

In order to assess the health benefits from scaling up NCD interventions, this study examined the number of lives saved by a package of interventions, and the number of healthy life years gained.

Scaling up interventions to treat the four conditions would save nearly 110,000 lives over the period 2016–30, or about 7,860 deaths per year as shown in table 4.1. The CVD package provides the largest health impact, saving nearly 89,000 lives. These lives saved are mediated through avoided CVD events, controlled through better management of risk factors like high blood pressure and high cholesterol.

Together the packages of interventions restore nearly 811,000 healthy life years to the population, which results from the interventions’ ability to improve quality of life. Implementing the COPD package would result in the highest number of healthy life years gained (540,588), followed by CVD (236,988), cervical cancer (20,560), and breast cancer (12,720).

**COSTS AND ECONOMIC BENEFITS FROM SCALING UP THE INTERVENTION PACKAGES**

By investing KSh 142 billion from 2016 to 2030 to scale up all of the clinical interventions targeting breast cancer, cervical cancer, COPD, and CVD, Kenya can generate KSh 175 billion in savings or about KSh 12.5 billion per year on average. Every Kenyan shilling invested is expected to generate 1.23 shillings in return.

As presented in table 4.2, the CVD package of interventions drives the return on investment—it is the only package with a return on investment (ROI) greater than one—generating 86 percent of the total productivity benefits, while representing only 43 percent of the costs of all of the packages. In the longer term, scaling up interventions for CVD is not only efficient, but the country gets back almost twice the cost of its interventions in productivity gains.

**TABLE 4.1 Health benefits from scaling up noncommunicable disease interventions**

| PACKAGE      | NUMBER OF LIVES SAVED | HEALTHY LIFE YEARS GAINED |
|--------------|-----------------------|---------------------------|
|              | SHORT TERM (2016–22)   | LONG TERM (2016–30)       | SHORT TERM (2016–22) | LONG TERM (2016–30) |
| CVD          | 15,578                | 88,676                    | 22,221               | 236,988             |
| Breast cancer| 893                   | 5,245                     | 1,300                | 12,720              |
| Cervical cancer| 1,229                | 7,840                     | 2,018                | 20,560              |
| COPD         | 1,378                 | 8,140                     | 88,031               | 540,588             |
| **Total**    | **19,078**            | **109,901**               | **113,570**          | **810,856**         |

*Source: World Bank.*

*Note: COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease; KSh = Kenyan shilling.*
The ROIs for the cancer interventions are lower than 1. This means in the 15-year period used in this investment case analysis, the return to the government from implementing cancer screening and treatment does not pay itself back. This is unsurprising for two reasons. First, cancer manifests over a long time period and often is not detected until many years after a carcinogenic exposure or otherwise later in life. The investments in prevention and early diagnosis will provide long term returns and can be expected to break even over a longer time period. While the returns to the cancer packages take longer to manifest, they represent significant opportunities to advance Kenyans’ right to health by working to prevent cancer altogether or to preclude advancement to late stages that can devastate individuals, especially women, and families.

Second, cancer interventions are more costly than those for other diseases and the prevalence is low enough in the population that fewer cases are prevented compared to CVD or COPD during this time period. It is worth noting that NCD prevention interventions often show much higher ROI than treatment interventions due to lower cost of prevention. By design, those prevention interventions are not a part of this investment case. However, as mentioned above, Kenya is implementing its new National Cancer Control Strategy, including scaling up HPV screening, testing and vaccination as well as breast cancer screening. This implies that ROI for the stated cancer interventions will continue to improve.

Finally, the COPD interventions offer large morbidity benefits, restoring over 540,000 healthy life years to the population. However, the ROI analysis only valued the ability of interventions to prevent premature mortality. The COPD interventions did not save a sufficient number of lives to provide an economic argument for action in this analysis, but a different analysis that takes into account the ability of COPD interventions to improve individuals’ functioning may conclude differently.

Appendix E presents results from a sensitivity analysis that varied coverage rates of interventions, and discount rates.
1. To calculate the share of health care expenditure savings for public, nonprofit, and private entities, the investment case assumes that savings accrue to each entity in equal proportion to its contribution to total health expenditure, as obtained from the WHO health expenditures database—from which government is shown to cover 34.3 percent of total health expenditures, households cover 30.9 percent through out-of-pocket expenditures, donors cover 23.4 percent, with the remainder attributable to other sources.

2. Personal communication with Dr. Mary Nyangasi, head of the cancer control program in the Kenya Ministry of Health NCD department, October 2019.
This noncommunicable disease (NCD) Investment Case shows that NCDs cause significant health and economic harms. In 2017, over 111,000 Kenyans lost their lives due to NCD-related causes, 51 percent of which were attributable to the seven conditions considered in the investment case. Annually, these seven NCD conditions cost Kenya’s economy approximately KSh 230 billion or 3 percent of gross domestic product (GDP). Economic losses due to these NCD conditions are projected to increase to KSh 607 billion annually by the year 2030 if Kenya does not take action.

However, the burden of NCDs can be reduced. Scaling up coverage of clinical interventions that target breast cancer, cervical cancer, COPD, and CVD would do the following:

• Save Kenyan lives and restore healthy life years. Kenya would avert nearly 110,000 deaths over the period 2016 to 2030 from scaling up interventions for breast cancer, cervical cancer, COPD and CVD. About 89,000 (81 percent) of the lives saved occur because individuals avoid deaths caused by CVD, emphasizing the need for Kenya to invest in measures to control the onset and management of CVD events, especially by managing risk factors like high blood pressure, high cholesterol, and obesity.

• Generate KSh 175 billion in economic benefits. These economic benefits derive from reducing premature mortality, which ensures that individuals remain alive and healthy enough to continue to contribute their skill and ability to the economy.

By reducing the NCD burden, Kenya can increase economic productivity and human capital development as envisioned in Vision 2030. This finding is important when viewed within the lens of missed opportunities for wealth creation and human capital formation. At the household level, the catastrophic expenditures associated with NCD treatment result in high out of pocket payments, which create opportunity costs in areas like education, further eroding efforts to accelerate investments in human capital formation.

While the investment case primarily focused on health facility-based interventions to treat already existing cases of disease or risk factors, primary prevention efforts should be considered to prevent disease from occurring in the
first place. Policy measures—increasing tobacco taxes, restricting the availability of alcohol by limiting the locations and hours of sale, legislating that food products display labels to warn about high salt, sugar, and fat content—have an essential role to play in NCD prevention. The World Health Organization has identified highly cost-effective interventions to reduce demand for tobacco and alcohol and improve diets and physical activity levels. There is considerable scope for the design and implementation of policies and programs aimed at behavior change, particularly among youth and adolescents.

This investment case provides evidence that can guide policy decisions related to NCDs. We therefore propose the following key actions that the government can take to tackle NCDs:

1. **Invest in scaling up interventions for NCDs, drawing on economic and efficiency analyses to inform the prioritization of the allocation of scarce resources.** The investment case analysis shows that the package of CVD interventions is economically efficient and offers a return on investment (ROI) over the next 15 years, while investments in the cancer and COPD packages have ROIs lower than one. Given that CVD presents the highest burden of any condition analyzed in the investment case, and that the CVD interventions generate clear health and economic benefits, Kenya could prioritize scaling up the CVD interventions analyzed in this investment case. This could begin with expanding access to preventative services to address CVD risk factors, such as hypertension and hyperlipidemia. Despite offering lower economic returns, other conditions should not be neglected given the huge economic burden that all the NCDs impose on the country. Health is a human right; investing in scaling up interventions that address all NCDs creates an opportunity for all people to pursue their full potential.

2. **Increase NCD resource allocation by the Government of Kenya, and other national and international partners.** By investing KSh 142 million in NCD treatment now, Kenya would save KSh 175 billion in economic losses from poor health over 15 years. Kenya should analyze how to mobilize the resources required to fund this investment and may consider win-win strategies—such as increasing (or implementing) taxes on tobacco, alcohol, and sugar-sweetened beverages—that synergistically achieve health aims while also generating revenue.

3. **Prioritize and sustain efforts on prevention and health promotion.** Although the investment case primarily focused on clinical interventions, the results point to the importance of tackling NCD risk factors and investing in health promotion—basically interventions that prevent, halt, or delay the progression of disease. NCDs share modifiable risk factors (tobacco smoking, unhealthy diet, physical inactivity, and harmful consumption of alcohol), which, when tackled, can prevent, halt, or delay the progression of disease. Interventions to screen for and quickly manage metabolic risk factors, such as high blood pressure, high cholesterol, high fasting blood glucose, and obesity, will also delay the progression of disease, reducing the long-term costs of treatment. Investing in health promotion and primary prevention is thus a strategic approach to minimizing the costs of NCDs. Though further research on the benefits of such interventions in Kenya in relation to their costs is much needed, the World Health Organization (WHO) has identified a set of intervention “best buys” that could provide useful guidance. There is also
considerable scope for the design and implementation of policies and programs aimed at behavior change, particularly among youth and adolescents.

4. **Continue investment in NCD control through Universal Health Coverage (UHC), delivering on the Big Four agenda.** By providing accessible, responsive, and inclusive health services that engage all population groups, and especially those who are the most vulnerable, no one is left behind. Moreover, inclusion of NCD prevention services can reduce future catastrophic health expenditures, protecting individuals from poverty. Both the quantity and quality of health services should be considered. Investments in NCD control should be well coordinated with all health system stakeholders to create synergies in the delivery of care and ensure that health service delivery is not fragmented programmatically (noncommunicable versus communicable disease care). UHC services should also prioritize preventative interventions to maximize health service delivery benefits.

5. **Plan additional economic analysis of interventions addressing NCDs.** As indicated earlier, population level interventions have been proven to offer a high return for investment. Further prioritization and economic analysis of these interventions is needed, especially given their high potential impact. In addition, the investment case did not analyze interventions addressing two diseases (diabetes and sickle cell disease) and one condition (road traffic injuries) that were included in the cost-of-illness analysis. Analysis of additional diseases and conditions would provide a more comprehensive picture of options for prioritizing and controlling NCDs and injuries. Finally, updating the current analysis of cancer and COPD interventions with additional information may produce different results. The ROI analysis did not place a monetary value on the decreases in disease morbidity that result from clinical interventions. Including this component in future analyses would provide more equal weighting to interventions such as those for COPD, which have a larger impact on disease morbidity than mortality.
Enabling factors for successes in noncommunicable disease (NCD) control in Kenya include the formation of a dedicated NCD department in the ministry of health, increased number of stakeholders and increasing research on NCDs. An NCD interagency coordinating committee (ICC) was formed to address the multisectoral response to NCDs. Strong support from Parliament and the President for the Universal Health Care agenda has provided additional impetus for prevention and control of NCDs.

Kenya faces an important challenge in effectively translating national ambitions into practice. The Kenya Constitution 2010 devolved health services to the 47 counties giving them a greater role in planning, allocating resources and implementing programs tailored to their needs. This had increased the demand of health services with resultant challenges in the dissemination and enforcement of policies to the lower level facilities, coordination of health services and ensuring constant supply of NCD medicines and diagnostics. The delivery of preventative services, such as screening and chronic care models and data capture, remain limited as the health system continues to emphasize treatment for communicable diseases. Late detection of cases and limited options combined with high costs for treatment of NCDs is common. For example, 70 percent of cancer patients presenting at health facilities are in advanced stages of illness, stages III and IV with high probability of death. The high cost of treatment for advanced cases also limits health seeking behavior in the population. As a result, there remains a persistent gap between need and actual delivery of NCD care. The treatment gaps—the percentage not receiving treatment—for selected NCDs are chronic obstructive pulmonary disease (87 percent); diabetes (69 percent); cervical cancer (64 percent); cardiovascular disease (60 percent); and breast cancer (57 percent).

The Kenya Service Availability and Readiness Assessment Mapping report 2013 showed that NCD tracer commodities were among the least available products (Ministry of Health, Government of Kenya 2014). Only 25 percent of primary health care facilities and 32 percent of hospitals had NCD tracer commodities available. Availability of key medications and readiness of NCD services was limited despite their inclusion in the Kenya Essential Package for Health (KEPH). In 2013, only 4.9 percent of facilities were providing all KEPH services required to halt and reverse the rising burden of NCDs, with dispensaries and public facilities having the highest proportion of facilities providing all of their expected services. NCD screening and rehabilitation were the least available service.

The Kenya Non-Communicable Diseases and Injuries Poverty Commission’s 2018 report found that services for basic NCDs and injuries are lacking, particularly in poorer regions and in the public sector. Coverage of basic NCD
and injuries, such as diagnosis and treatment of hypertension and diabetes or cancer screening is low and is inversely related to wealth. This report showed that access to screening for both hypertension and diabetes was associated with wealth quintile, with progressively higher proportions never previously screened with increasing poverty level. This was also seen when comparing urban and rural areas with a higher proportion of individuals never previously screened in rural areas for both hypertension (60.7 percent vs. 48.1 percent) and diabetes (89.6 percent vs. 84.8 percent). Of those patients found to have hypertension, access to treatment was associated with wealth quintile, with poorer populations less likely to be on treatment.

Other challenges associated with NCD prevention and control in Kenya include (1) limited funding to NCDs in the health sector with poor prioritization of NCD prevention and control in government agenda setting—planning and budgeting at both national and county level; (2) low levels of awareness of NCDs and their risk factors in the population; (3) lack of an NCD prevention and control infrastructure at the county level to coordinate planning, programming, monitoring and evaluation; (4) limited resources for public health initiatives to raise awareness of and promote healthy lifestyles in the prevention and control of priority NCDs; (5) unavailability of quality data due to poor capture and reporting of NCD-related indicators in the District Health Information System and limited population level data on NCD-related morbidity and mortality trends; (6) low levels of awareness of NCD prevention and control strategies among health policy makers, planners, and health care providers; and (7) poor coordination mechanisms to handle NCDs efforts by the various sectors outside health.
APPENDIX B

Data Sources

| VARIABLE | MEASUREMENT | SOURCES |
|----------|-------------|---------|
| Total in need population | Total number of people with a given NCD condition in a given year. | OneHealth Tool and IHME Global Burden of Disease (GBD) |
| Coverage target | The percentage of population that is provided with a given service in each year per NCD disease or condition. | Kenya NCDI Poverty Commission |
| Cases treated | Actual numbers based on population in need and coverage targets. | OneHealth Tool and IHME GBD |
| Salaries and allowances | Total average annual salary and allowances per cadre in the public health sector in 2016. | Kenya Ministry of Health |
| Prices of drugs, reagents and supplies | Prices in KSh for these inputs in 2016. | OneHealth Tool and Kenya Medical Supplies Authority |
| Patient transport cost | Average transport cost in KSh incurred by patients when seeking NCD service. | Literature |
| Overhead cost | Cost of utilities, administration and other staff (excluding doctors, nurses, pharmaceutical technologists, laboratory technologist and technicians, radiographers/X-ray technicians). | Dynamic Costing Model (Kenya) |
| Contact time | Time it takes, in minutes, a doctor or a nurse or any other staff involved in screening, diagnoses and treatment to serve one patient during an outpatient visit or an inpatient day. | Expert opinion, literature and OneHealth tool |
| GDP at market prices | Annual value in KSh for each year from 2016 to 2030. | Kenya National Bureau of Statistics (KNBS) and the National Treasury for projections |
| Labor force participation rate | Rate for men = 72.4 percent, 62.4 percent for women, and an average of 67.3 percent. Rates were maintained constant from 2016 to 2030. | International Labour Organization |
| Employment rate | Rate for men = 91 percent, rate for women = 87 percent, average rate for both = 89 percent | World Bank |
| Mortality | Number of deaths per disease or condition for each year. | World Bank estimation for sickle cell and road injuries using literature and OneHealth Tool for other conditions. IHME Global Burden of Disease also used. |
| Absenteeism | Measured as fraction of working time lost as a result of being sick and the resulting disability associated with the disease/condition. | Literature |
| Presenteeism | Measured as percentage of output per worker lost to relatively lower productivity attributed to the disease or condition. | Literature |
| Output per worker | Average gross domestic product per worker. | KNBS, Economic Survey 2017, National Treasury. |
| Coverage target | The percentage of population that is provided with services in each year per disease or condition. | Kenya NCDI Poverty Commission |
| Cases treated | Actual numbers based on population in need and coverage targets. | OneHealth Tool and GBD |

Source: World Bank.
Note: IHME = Institute for Health Metrics and Evaluation; KSh = Kenyan shilling; NCD = noncommunicable disease; NCDI = Non-Communicable Diseases and Injuries.
APPENDIX C

Treatment Gaps in the Different Conditions
| TABLE C.1  Treatment gaps in status quo and scale up scenarios |
|-------------------------------------------------------------|
| 2016  | 2017  | 2018  | 2019  | 2020  | 2021  | 2022  | 2023  | 2024  | 2025  | 2026  | 2027  | 2028  | 2029  |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| **Diabetes management**                                      |
| Population in need  | 751,861 | 772,415 | 793,668 | 815,493 | 837,868 | 860,786 | 884,247 | 908,259 | 932,834 | 957,984 | 983,725 | 1,010,076 | 1,037,050 | 1,064,653 |
| Status quo coverage  | 235,536 | 241,975 | 248,633 | 255,470 | 262,480 | 269,659 | 277,009 | 284,531 | 292,230 | 300,109 | 308,173 | 316,428 | 324,878 | 333,525 |
| Scale up coverage  | 235,536 | 270,084 | 306,399 | 344,501 | 384,445 | 426,285 | 470,083 | 515,901 | 563,807 | 613,870 | 666,164 | 720,766 | 777,754 | 837,200 |
| Gap with status quo  | 69% | 69% | 69% | 69% | 69% | 69% | 69% | 69% | 69% | 69% | 69% | 69% | 69% | 69% |
| Gap with scale up  | 69% | 65% | 61% | 58% | 54% | 50% | 47% | 43% | 40% | 36% | 32% | 29% | 25% | 21% |
| **COPD: Inhaled salbutamol**                                 |
| Population in need  | 525,836 | 544,700 | 559,338 | 579,518 | 595,127 | 616,573 | 633,196 | 655,981 | 673,686 | 697,895 | 716,747 | 742,451 | 762,490 | 789,738 |
| Status quo coverage  | 84,134 | 100,380 | 116,662 | 134,945 | 153,033 | 173,521 | 193,577 | 216,474 | 238,677 | 264,203 | 288,747 | 317,132 | 344,210 | 375,690 |
| Scale up coverage  | 84,134 | 87,152 | 89,494 | 92,723 | 95,220 | 98,652 | 101,311 | 104,957 | 107,790 | 111,663 | 114,679 | 118,792 | 121,998 | 126,358 |
| Gap with status quo  | 84% | 84% | 84% | 84% | 84% | 84% | 84% | 84% | 84% | 84% | 84% | 84% | 84% | 84% |
| Gap with scale up  | 84% | 82% | 79% | 77% | 74% | 72% | 69% | 67% | 65% | 62% | 60% | 57% | 55% | 52% |
| **CVD (all interventions in the investment case)**            |
| Population in need  | 2,473,154 | 2,570,818 | 2,676,065 | 2,788,093 | 2,906,250 | 3,029,872 | 3,158,979 | 3,292,934 | 3,431,270 | 3,573,448 | 3,718,964 | 3,867,730 | 4,018,780 | 4,170,801 |
| Status quo coverage  | 997,816 | 1,037,000 | 1,079,238 | 1,124,224 | 1,171,689 | 1,221,356 | 1,273,242 | 1,327,091 | 1,382,713 | 1,439,894 | 1,498,431 | 1,558,295 | 1,619,097 | 1,680,310 |
| Scale up coverage  | 997,816 | 1,109,366 | 1,229,951 | 1,359,831 | 1,499,236 | 1,648,317 | 1,807,546 | 1,977,006 | 2,156,810 | 2,346,973 | 2,547,471 | 2,758,519 | 2,979,669 | 3,210,100 |
| Gap with status quo  | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% |
| Gap with scale up  | 60% | 57% | 54% | 51% | 48% | 46% | 43% | 40% | 37% | 34% | 32% | 29% | 26% | 23% |
| **Sickle cell**                                              |
| Population in need  | 60,429 | 62,047 | 63,718 | 65,435 | 67,199 | 69,011 | 70,872 | 72,784 | 74,748 | 76,766 | 78,839 | 80,966 | 83,150 | 85,388 |
| Status quo coverage  | 6,043 | 6,205 | 6,372 | 6,543 | 6,720 | 6,901 | 7,087 | 7,278 | 7,475 | 7,677 | 7,884 | 8,097 | 8,315 | 8,539 |
| Gap with status quo  | 90% | 90% | 90% | 90% | 90% | 90% | 90% | 90% | 90% | 90% | 90% | 90% | 90% | 90% |

*continued*
### TABLE C.1, continued

| Condition       | Year | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|-----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Breast cancer— |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| status quo      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Stage I and II  |      | 2,042| 2,123| 2,208| 2,298| 2,391| 2,493| 2,596| 2,703| 2,816| 2,932| 3,054| 3,181| 3,311| 3,446|
| Stage III and IV|      | 2,740| 2,848| 2,979| 3,117| 3,252| 3,394| 3,535| 3,681| 3,832| 3,991| 4,157| 4,330| 4,511| 4,697|
| Total cases     |      | 4,782| 4,971| 5,187| 5,415| 5,643| 5,887| 6,131| 6,384| 6,648| 6,924| 7,212| 7,511| 7,822| 8,143|
| Breast cancer—  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| scale up        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Stage I and II  |      | 2,042| 2,267| 2,506| 2,760| 3,027| 3,315| 3,616| 3,935| 4,272| 4,628| 5,006| 5,405| 5,826| 6,270|
| Stage III and IV|      | 2,740| 2,762| 2,785| 2,793| 2,776| 2,744| 2,690| 2,620| 2,535| 2,437| 2,325| 2,198| 2,058| 1,903|
| Total cases     |      | 4,782| 5,029| 5,291| 5,553| 5,804| 6,059| 6,306| 6,555| 6,807| 7,065| 7,331| 7,603| 7,884| 8,174|
| Breast cancer   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Gap with        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| status quo      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| percentage      |      | 57%  | 57%  | 57%  | 58%  | 58%  | 58%  | 58%  | 58%  | 58%  | 58%  | 58%  | 58%  | 58%  | 58%  |
| Gap with        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| scale up        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| percentage      |      | 57%  | 55%  | 53%  | 50%  | 48%  | 45%  | 43%  | 40%  | 37%  | 34%  | 32%  | 29%  | 26%  | 23%  |
| Cervical cancer—|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| status quo      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Stage I and II  |      | 1,788| 1,889| 1,994| 2,104| 2,217| 2,335| 2,458| 2,585| 2,717| 2,854| 2,996| 3,144| 3,295| 3,450|
| Stage III and IV|      | 3,148| 3,325| 3,511| 3,703| 3,902| 4,109| 4,325| 4,548| 4,780| 5,021| 5,271| 5,529| 5,795| 6,068|
| Total cases     |      | 4,936| 5,214| 5,505| 5,807| 6,120| 6,445| 6,783| 7,133| 7,498| 7,876| 8,267| 8,673| 9,090| 9,518|
| Cervical cancer—|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| scale up        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Stage I and II  |      | 1,788| 2,055| 2,344| 2,656| 2,991| 3,351| 3,738| 4,153| 4,597| 5,071| 5,577| 6,117| 6,689| 7,294|
| Stage III and IV|      | 3,148| 3,121| 3,087| 3,047| 2,998| 2,943| 2,879| 2,807| 2,726| 2,636| 2,536| 2,427| 2,305| 2,171|
| Total cases     |      | 4,936| 5,175| 5,431| 5,702| 5,989| 6,294| 6,617| 6,960| 7,323| 7,707| 8,114| 8,544| 8,994| 9,465|
| Breast cancer   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Gap with        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| status quo      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| percentage      |      | 64%  | 64%  | 64%  | 64%  | 64%  | 64%  | 64%  | 64%  | 64%  | 64%  | 64%  | 64%  | 64%  | 64%  |
| Gap with        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| scale up        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| percentage      |      | 64%  | 60%  | 57%  | 53%  | 50%  | 47%  | 44%  | 40%  | 37%  | 34%  | 31%  | 28%  | 26%  | 23%  |

Source: World Bank.
Note: COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease.
APPENDIX D

Details of Economic Burden by Condition

### TABLE D.1 Summary economic burden, by disease or injury

Kenyan shillings, billions

| Year | Breast Cancer | Cervical Cancer | Sickle Cell | Diabetes | COPD | CVD | Traffic Accident Injuries | Total  |
|------|---------------|-----------------|-------------|----------|------|-----|---------------------------|--------|
| 2016 | 6.7           | 6.8             | 0.7         | 38.2     | 33.2 | 116.3 | 28.5                      | 230.4  |
| 2017 | 7.0           | 7.3             | 0.7         | 40.3     | 34.9 | 123.8 | 30.7                      | 244.9  |
| 2018 | 7.4           | 7.9             | 0.8         | 42.9     | 36.8 | 132.4 | 32.4                      | 260.6  |
| 2019 | 8.0           | 8.7             | 0.8         | 45.7     | 39.1 | 142.1 | 34.2                      | 278.6  |
| 2020 | 8.6           | 9.5             | 0.9         | 48.9     | 41.7 | 153.1 | 36.3                      | 298.9  |
| 2021 | 9.3           | 10.4            | 0.9         | 52.2     | 44.5 | 164.8 | 38.5                      | 320.7  |
| 2022 | 10.0          | 11.3            | 1.0         | 55.8     | 47.6 | 177.3 | 40.8                      | 343.9  |
| 2023 | 10.7          | 12.3            | 1.1         | 59.6     | 50.9 | 190.6 | 43.2                      | 368.4  |
| 2024 | 11.5          | 13.4            | 1.1         | 63.6     | 54.5 | 204.8 | 45.8                      | 394.7  |
| 2025 | 12.3          | 14.5            | 1.2         | 67.9     | 58.5 | 220.4 | 48.5                      | 423.3  |
| 2026 | 13.1          | 15.7            | 1.3         | 72.5     | 62.8 | 237.3 | 51.4                      | 454.1  |
| 2027 | 14.0          | 17.0            | 1.4         | 77.4     | 67.5 | 255.4 | 54.4                      | 487.1  |
| 2028 | 14.9          | 18.4            | 1.4         | 82.6     | 72.6 | 275.0 | 57.6                      | 522.5  |
| 2029 | 15.9          | 19.8            | 1.5         | 88.2     | 78.1 | 296.1 | 61.0                      | 560.6  |
| 2030 | 22.1          | 21.4            | 1.6         | 94.2     | 84.0 | 318.8 | 64.6                      | 606.7  |
| Total | 171.5       | 194.5          | 16.5        | 929.9    | 806.7 | 3,008.3 | 668.0                   | 5,795.3 |

Source: World Bank calculations.
Note: COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease.

### TABLE D.2 Economic burden of noncommunicable diseases and injuries, by cost type

Kenyan shillings, billions

| Type          | Health Care Costs | Productivity Cost of Premature Deaths | Productivity Cost of Absenteeism | Productivity Cost of Presenteeism | Total  |
|---------------|-------------------|--------------------------------------|----------------------------------|-----------------------------------|--------|
| COPD          | 37.9              | 314.0                                | 142.1                            | 312.7                             | 806.7  |
| CVD           | 123.6             | 2,502.1                              | 111.6                            | 271.1                             | 3,008.3|
| Breast        | 44.1              | 123.8                                | 2.1                              | 1.5                               | 171.5  |
| Cervical      | 64.9              | 126.2                                | 2.0                              | 1.3                               | 194.5  |
| Diabetes      | 111.8             | 600.0                                | 72.4                             | 145.7                             | 929.9  |
| Sickle        | 1.5               | 3.1                                  | 11.9                             | —                                 | 16.5   |
| Injuries      | 46.1              | 587.5                                | 34.4                             | —                                 | 668.0  |
| Total         | 429.9             | 4,256.7                              | 376.5                            | 732.2                             | 5,795.3|

Source: World Bank calculations.
Note: Breast = breast cancer; Cervical = cervical cancer; COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease; Sickle = sickle cell disease; — = not available.
APPENDIX E

Sensitivity Analysis

A sensitivity analysis is performed to assess if the results of the economic burden and the return on investment (ROI) would change significantly when underlying assumptions are varied. The sensitivity analysis is carried at two levels: first, by varying the end line target coverage rates from 80 percent to 70 percent and to 90 percent, and second, by changing the discount rate from 6.5 percent to 5 percent and to 8 percent. In all the scenarios constant or real values of the costs and productivity were used, with 2016 as the base year. Tables E.1 and E.2 show the sensitivity of the ROI with respect to the change in the end line coverage at 70 percent and 90 percent, respectively, while maintaining the discount rate at 6.5 percent.

The results in table E.1 show that the ROI is not sensitive to change in intervention coverage. Reducing coverage from 80 percent to 70 percent in 2030

| TABLE E.1 Estimated return on investment for scaling up interventions |
| --- | --- |
| SHORT-TERM IMPACT (2016-22) | LONG-TERM IMPACT (2016-30) |
| TOTAL COST (KSh, MILLIONS) | TOTAL PRODUCTIVITY BENEFITS (KSh, MILLIONS) | ROI | TOTAL COST (KSh, MILLIONS) | TOTAL PRODUCTIVITY BENEFITS (KSh, MILLIONS) | ROI |
| CVD | 11,265 | 22,707 | 2.02 | 48,994 | 123,984 | 2.53 |
| Breast | 2,739 | 1,454 | 0.53 | 13,382 | 7,239 | 0.54 |
| Cervical | 2,241 | 1,521 | 0.68 | 9,554 | 8,314 | 0.87 |
| COPD | 9,533 | 668 | 0.070 | 41,314 | 3,653 | 0.088 |
| Total | 25,777 | 26,350 | 1.02 | 113,244 | 143,191 | 1.26 |

Source: World Bank.
Note: Breast = breast cancer; Cervical = cervical cancer; COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease; KSh = Kenyan shilling; ROI = return on investment.

| TABLE E.2 Estimated return on investment for scaling up interventions |
| --- | --- |
| SHORT-TERM IMPACT (2016-22) | LONG-TERM IMPACT (2016-30) |
| TOTAL COST (KSh, MILLIONS) | TOTAL PRODUCTIVITY BENEFITS (KSh, MILLIONS) | ROI | TOTAL COST (KSh, MILLIONS) | TOTAL PRODUCTIVITY BENEFITS (KSh, MILLIONS) | ROI |
| CVD | 16,897 | 30,652 | 1.81 | 73,490 | 160,696 | 2.19 |
| Breast | 3,579 | 2,186 | 0.61 | 17,191 | 11,250 | 0.65 |
| Cervical | 6,073 | 2,558 | 0.42 | 29,830 | 14,317 | 0.48 |
| COPD | 13,858 | 889 | 0.064 | 60,077 | 4,841 | 0.081 |
| Total | 40,408 | 36,285 | 0.90 | 180,589 | 191,104 | 1.06 |

Source: World Bank.
Note: Breast = breast cancer; Cervical = cervical cancer; COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease; KSh = Kenyan shilling; ROI = return on investment.
leads to modest reduction in ROI for cardiovascular disease (CVD), cervical cancer, chronic obstructive pulmonary disease (COPD). On the other hand, as shown in table E.2, the ROI remained stable even with increased coverage from 80 percent to 90 percent by 2030. For instance, the ROI on CVD reduces from 2.48 to 2.19 in the longer term. The ROI on breast cancer, cervical cancer and COPD follows the same pattern.

The sensitivity results for ROI with a discount rate of five percent as opposed to the 6.5 percent that was used in the scale up scenario are presented in table E.3.

Table E.3 shows that by decreasing the rate of discounting future costs and benefits, the effect is to increase the ROI for all interventions. This notwithstanding, the results show that the benefits continued to exceed cost for CVD, but for breast cancer, cervical cancer and COPD are below one, where costs outweighed productivity benefits. Overall, these results show that change of the discount rate did not significantly affect the ROI.

| TABLE E.3 Estimated return on investment for scaling up interventions |
|-----------------------|----------------------|----------------------|----------------------|----------------------|
| 80 percent coverage in 2030 and 5 percent discount rate |
| SHORT-TERM IMPACT (2016–2022) | TOTAL COST (KSh, MILLIONS) | TOTAL PRODUCTIVITY BENEFITS (KSh, MILLIONS) | ROI | TOTAL COST (KSh, MILLIONS) | TOTAL PRODUCTIVITY BENEFITS (KSh, MILLIONS) | ROI |
| CVD | 14,965 | 33,567 | 2.24 | 70,006 | 191,916 | 2.74 |
| Breast | 3,533 | 2,091 | 0.59 | 18,471 | 11,444 | 0.62 |
| Cervical | 3,084 | 2,348 | 0.76 | 14,193 | 14,050 | 0.99 |
| COPD | 12,763 | 1,009 | 0.079 | 59,509 | 5,956 | 0.100 |
| Total | 34,346 | 39,015 | 1.14 | 162,180 | 223,366 | 1.38 |

Source: World Bank.
Note: Breast = breast cancer; Cervical = cervical cancer; COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease; KSh = Kenyan shilling; ROI = return on investment.
COI ANALYSIS: PROJECTING THE HEALTH BURDEN

Projections of prevalence of—and mortality from—seven diseases and conditions are calculated to estimate the health burden of each from 2016 to 2030.

For breast cancer and cervical cancer, cardiovascular disease (CVD), chronic obstructive pulmonary disorder (COPD), and diabetes estimates are obtained from the OneHealth Tool (OHT), under the assumption that current coverage rates of interventions to address each disease do not change over the period of the analysis. For road traffic injuries (RTI) and sickle cell disease, estimates are calculated manually in Excel using information obtained from published literature.

OneHealth Tool: Projecting mortality and morbidity of five diseases

The OHT contains PopMod, a collection of multistate dynamic population lifetables that project the extent to which the population experiences health events and the likelihood of death, considering competing risk among diseases, and existing prevention, treatment, and control efforts. PopMod is described elsewhere (Lauer et al. 2003).

Within the OHT, PopMod is linked to platforms built for breast cancer, cervical cancer, CVD, COPD, and diabetes. Each contains health states specific to the disease. For example, figure F.1 shows health states for CVD; figure F.2 shows health states for COPD; and figure F.3 shows health states for diabetes. Using prevalence data from the 2010 Global Burden of Disease (GBD) study (Lozano et al. 2012), PopMod divides the population among disease health states, and places the remaining population in the “disease free” state. Over time, individuals may experience events that transition them from one health state to another (for example, a previously disease-free healthy person may have a stroke). Baseline rates of transition between health states, and the likelihood of survival or death are sourced from the 2010 GBD study. The OHT reports prevalence rates of each disease, and the number of deaths that occur in a given year.

Estimating mortality and morbidity of sickle cell disease and road traffic injuries

Sickle cell disease

Projections of sickle cell disease are made assuming that the rate of 2.5 cases per 100,000 population holds steady as the population increases over the time horizon.
of the analysis. In each year for which deaths due to sickle cell are projected, 17 percent of deaths are assumed to be adults, based on a study from Tanzania (Makani et al. 2011). Population projections are obtained using the OHT.

**Road traffic injuries**
Data from Kenya National Safety Authority (NTSA)—on both serious and minor injuries in 2016 and 2017—was used to compute a ratio of about 38 RTI per 100,000 people. This ratio was applied to growing population rates over the time horizon of the analysis. The resulting number was then divided into serious and minor injuries using data from NTSA.
Mortality from RTI was originally estimated using data from the Institute for Health Metrics and Evaluation’s GBD study, where a regression analysis was employed to analyze data from 1995 to 2016. The resulting coefficients of intercept and time trend variable was applied to project mortality from 2016 to 2030. These projections were compared to estimates from a systematic review conducted by Adeloye et al. (2016), which found that RTIs cause about 9.3 deaths per 100,000 people in Africa. This rate was similar to that found in the regression analysis. Hence, the rate of 9.3 deaths per 100,000 population was used, applying the rate to OHT population projections through 2030.

**COST-OF-ILLNESS ANALYSIS: CALCULATING DIRECT AND INDIRECT COSTS**

**Direct costs of screening, diagnosis, and treatment**

The investment case uses the UN interagency OHT, academic literature, and expert opinion to estimate the resources required to screen, diagnose, or treat patients.

Data on individual cost components is drawn from various sources. Salaries of health personnel are given by the Kenya Ministry of Health. Prices of medications, reagents, and supplies are given by the Kenya Medical Supplies Authority and default data embedded in the OHT. Overhead costs—inclusive of utilities, administration and other nonhealth staff—are given by a dynamic costing model developed for Kenya. The amount of time each doctor, nurse, or other type of staff member spends with a patient to perform a given task or treatment is estimated from expert opinion, academic literature, and resource estimates embedded in the OHT.

Drawing from these estimates of resources and costs, tables F.1 and F.2 show the calculated per person treatment cost of each intervention.
TABLE F.1  Per person cost of screening, diagnosis, and treatment of noncommunicable diseases
Kenyan shillings

| BREAST CANCER | DRUGS, SUPPLIES, REAGENTS | LABOR | OVERHEAD | PATIENT TRANSPORT | TOTAL UNIT COST |
|---------------|---------------------------|-------|----------|-------------------|-----------------|
| Diagnosis: screened with clinical breast exam | 53,231 | 21,432 | 1,786 | 1,000 | 77,449 |
| Diagnosis: screened with mammogram | 50,962 | 14,288 | 1,786 | 1,000 | 68,036 |
| Breast cancer treatment: stage I | 115,900 | 11,182 | 82,168 | 32,000 | 241,250 |
| Breast cancer treatment: stage II | 149,788 | 20,351 | 82,168 | 32,000 | 284,307 |
| Breast cancer treatment: stage III | 162,950 | 20,351 | 119,680 | 39,000 | 341,981 |
| Breast cancer treatment: stage IV | 108,875 | 12,487 | 92,886 | 24,000 | 238,248 |

| CERVICAL CANCER | DRUGS, SUPPLIES, REAGENTS | LABOR | OVERHEAD | PATIENT TRANSPORT | TOTAL UNIT COST |
|----------------|---------------------------|-------|----------|-------------------|-----------------|
| Visual inspection with acetic acid (VIA) | 259 | 185 | 272 | 200 | 916 |
| Papanicolaou test (pap smear) | 245 | 637 | 378 | 200 | 1,460 |
| Biopsy and histopathology | 1,859 | 649 | 2,589 | 1,000 | 6,097 |
| Cryotherapy | 6,248 | 611 | 262 | 300 | 7,421 |
| Cervical cancer treatment: stage I | 155,574 | 18,851 | 82,168 | 32,000 | 288,593 |
| Cervical cancer treatment: stage II | 174,476 | 19,610 | 82,168 | 32,000 | 308,254 |
| Cervical cancer treatment: stage III | 178,635 | 19,610 | 119,680 | 39,000 | 356,925 |
| Cervical cancer treatment: stage IV | 113,335 | 12,487 | 92,886 | 24,000 | 242,707 |

| CVD AND DIABETES | DRUGS, SUPPLIES, REAGENTS | LABOR | OVERHEAD | PATIENT TRANSPORT | TOTAL UNIT COST |
|------------------|---------------------------|-------|----------|-------------------|-----------------|
| Screening for risk of CVD/diabetes | 209 | 222 | 272 | 200 | 903 |
| Treatment for those with very high cholesterol but low absolute risk of CVD/diabetes (< 20 percent) | 1,472 | 1,004 | 1,088 | 800 | 4,364 |
| Treatment for those with high blood pressure but low absolute risk of CVD/diabetes (< 20 percent) | 899 | 1,004 | 1,088 | 800 | 3,791 |
| Treatment for those with absolute risk of CVD/diabetes 20–30 percent | 2,357 | 1,056 | 1,221 | 1,347 | 5,981 |
| Treatment for those with high absolute risk of CVD/diabetes (>30 percent) | 2,376 | 1,079 | 1,164 | 1,284 | 5,903 |
| Treatment of new cases of acute myocardial infarction (AMI) with aspirin | 3,731 | 6,268 | 5,448 | 8,000 | 23,447 |
| Treatment of cases with established ischemic heart disease (IHD) | 3,828 | 1,550 | 5,045 | 4,000 | 14,423 |
| Treatment for those with established cerebrovascular disease and post stroke | 3,828 | 3,067 | 5,993 | 7,000 | 19,888 |
| Standard glycemic control (oral only) | 5,262 | 1,805 | 1,090 | 800 | 8,957 |
| Standard glycemic control (insulin) | 39,075 | 1,805 | 1,090 | 800 | 42,770 |
| Intensive glycemic control (weighted cost) | 21,931 | 1,805 | 1,090 | 800 | 25,626 |
| Retinopathy screening and photocoagulation | 90 | 90 |
| Neuropathy screening and preventive foot care | 1,519 | 1,519 |
### TABLE F.1, continued

| COPD                                     | DRUGS, SUPPLIES, REAGENTS | LABOR | OVERHEAD | PATIENT TRANSPORT | TOTAL UNIT COST |
|------------------------------------------|----------------------------|-------|----------|-------------------|-----------------|
| Inhaled salbutamol                       | 1,563                      | 209   | 272      | 800               | 2,844           |
| Low-dose oral theophylline               | 1,831                      | 209   | 272      | 800               | 3,112           |
| Ipratropium inhaler                      | 2,778                      | 209   | 272      | 800               | 4,059           |
| Exacerbation treatment with antibiotics  | 38                         | 209   | 272      | 800               | 1,319           |
| Exacerbation treatment with oral prednisolone | 318                      | 209   | 272      | 800               | 1,599           |
| Exacerbation treatment with oxygen       | 3,749                      | 3,634 | 4,903    | 1,000             | 13,286          |

### SICKLE CELL DISEASE

| DRUGS AND SUPPLIES | LABOR | OVERHEAD | PATIENT TRANSPORT | TOTAL UNIT COST |
|--------------------|-------|----------|-------------------|-----------------|
| Outpatient         | 6,220 | 835      | 1,088             | 8,943           |
| Inpatient          | 8,315 | 10,658   | 14,298            | 35,770          |

Source: World Bank.

Note: COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease.

### TABLE F.2 Per person cost of treatment for road traffic injuries, by severity

**Kenyan shillings**

| COST CATEGORY | COST ITEM                                                                 | AVERAGE COST |
|---------------|---------------------------------------------------------------------------|--------------|
| MINOR         | Admission fees (average admission period = 3 days)                        | 1,000 per day, hence 3,000 |
|               | Consultation fee                                                          | 1,000        |
|               | Surgical care                                                             | 5,000        |
|               | Analgesics                                                                | 300          |
|               | Antibiotics                                                               | 500          |
|               | Wound care                                                                | 1,000        |
|               | Radiological investigations/imaging                                        | 2,000        |
|               | Total                                                                      | 12,800       |
| MODERATE      | Admission fees (average admission period = 10 days)                       | 1,000        |
|               | Initial consultation fee                                                  | 1,000        |
|               | Surgical care                                                             | 1,000        |
|               | Analgesics                                                                | 1,000        |
|               | Antibiotics                                                               | 1,000        |
|               | Radiological investigations/imaging                                        | 5,000        |
|               | Wound care                                                                | 5,000        |
|               | Implants                                                                   | 45,000       |
|               | Rehabilitation                                                             | 10,000       |
|               | Total                                                                      | 69,000       |
| SEVERE        | Admission fees (average admission period = 14 days)                       | 1,000        |
|               | Initial consultation fee                                                  | 1,000        |

*continued*
TABLE F.2, continued

| COST CATEGORY | COST ITEM | AVERAGE COST |
|----------------|-----------|--------------|
| Surgical care  | 20,000    |              |
| Analgesics     | 2,000     |              |
| Antibiotics    | 3,000     |              |
| Radiological investigations/imaging | 20,000   |              |
| Advanced care (ICU, HDU etc.). On average patients may need intensive care for 3–5 days | 5,000 daily, 25,000 |              |
| Implants       | 45,000    |              |
| Rehabilitation | 20,000    |              |
| Wound care     | 10,000    |              |
| Total          | 147,000   |              |

Source: World Bank.
Note: HDU = high dependency unit; ICU = intensive care unit.

ROI ANALYSIS: DESCRIPTION OF CLINICAL INTERVENTIONS

TABLE F.3 Clinical interventions, by condition

CARDIOVASCULAR DISEASE

CVD SECONDARY PREVENTION

Treatment for individuals with high CVD risk (≥ 20 percent) To lower the risk of stroke or acute myocardial infarction (MI), individuals with elevated metabolic risk factors for CVD receive pharmacological treatment—consisting of diuretics, ACE inhibitors, calcium channel blockers, statins, and lifestyle advice, alone or in combination.

Treatment for individuals with high blood pressure (≥ 140 mmHg), but low absolute CVD risk <20 percent

Treatment for individuals with high cholesterol (≥ 6 mmol/L), but low absolute CVD risk <20 percent

CVD CONTROL

Treat new cases of acute myocardial infarction Treatment for acute MI consists of immediate provision of aspirin.

Provide multidrug therapy to treat those with established ischemic heart disease and stroke

Treatments for cases of established stroke and IHD consist of multidrug therapy, including treatment with aspirin, beta blockers, thiazide, calcium channel blockers and ACE inhibitors.

CANCERS

BREAST

Screening: Clinical breast exam or mammography, with timely diagnosis Breast cancer interventions focus on early diagnosis through scale up of annual clinical breast examinations or biannual mammography screenings (in women age 40–70), which shifts the stage in which women are identified to have cancer, improving survival rates. Once diagnosed, women receive stage-specific treatment (inclusive of surgery and/or systemic therapy, and hormone therapy).

Treatment of breast cancer stages I–IV

CERVICAL

Screening: Visual inspection with acetic acid (VIA), Pap test, or HPV DNA test, with timely diagnosis Cervical cancer interventions focus on early diagnosis and treatment. Preventative efforts include screening of women age 30–49 (triennial for VIA and PAP tests, quinquennial for HPV tests) to identify cases of pre cancer. Treatment of pre cancer is conducted using cryotherapy or loop electrosurgical excision procedures. Women with cancer receive stage-specific treatment (inclusive of surgery and/or systemic therapy, and hormone therapy).

Treatment of cervical intraepithelial neoplasia using cryotherapy or loop electrosurgical excision procedure

Treatment of cervical cancer stages I–IV

continued
TABLE F.3, continued

CHRONIC OBSTRUCTIVE PULMONARY DISEASE

FUNCTIONAL IMPROVEMENT

Symptom relief using bronchodilators | To provide symptom relief and improve functioning, individuals with COPD receive pharmacological treatment consisting of short- or long-acting bronchodilators, including ipratropium, salbutamol, or theophylline.

ACUTE EXACERBATIONS

Treatment of COPD exacerbations with antibiotics, prednisolone, or oxygen therapy | Acute exacerbations are treated according to cause and severity. Antibiotics treat lung inflammations triggered by viral infections. Prednisolone is prescribed to reduce inflammation. Oxygen therapy is administered in cases of hypoxia or to provide symptom relief.

Source: World Bank.
Note: ACE = angiotensin-converting enzyme; HPV = human papillomavirus.

ROI ANALYSIS: BASELINE AND TARGET COVERAGES OF INTERVENTIONS

TABLE F.4 Baseline and target coverages

|                       | Percent | CURRENT COVERAGE IN KENYA (2016) | 2022 (SHORT TERM) | 2030 (MEDIUM TERM) |
|-----------------------|---------|----------------------------------|-------------------|-------------------|
| **CERVICAL CANCER**   |         |                                  |                   |                   |
| HPV DNA test          | 1       | 3                                | 5                 |
| VIA                   | 1       | 4                                | 7                 |
| Pap smear             | 5       | 10                               | 17                |
| Biopsy and histopathology | 13.5   | 15                               | 18                |
| Cervical cancer treatment: stage I | 50  | 63                               | 80                |
| Cervical cancer treatment: stage II | 55 | 66                               | 80                |
| Cervical cancer treatment: stage III | 75 | 81                               | 90                |
| Cervical cancer treatment: stage IV | 100 | 100                              | 100               |
| **BREAST CANCER**     |         |                                  |                   |                   |
| Screening: clinical breast examination | 23 | 47                               | 80                |
| Screening: mammography | 2 | 2.9                             | 4                 |
| Breast cancer treatment: stage I | 50 | 63                               | 80                |
| Breast cancer treatment: stage II | 55 | 66                               | 80                |
| Breast cancer treatment: stage III | 80  | 81                               | 90                |
| Breast cancer treatment: stage IV | 100 | 100                              | 100               |
| **CARDIOVASCULAR DISEASE** | |                                  |                   |                   |
| Screening for risk of CVD/diabetes | 30 | 51                               | 80                |
| Treatment for high cholesterol but low absolute risk of CVD/diabetes (<20 percent) | 30 | 51 | 80 |
| Treatment for high blood pressure but low absolute risk of CVD/diabetes (<20 percent) | 30 | 51 | 80 |
TABLE F.4, continued

| Current Coverage in Kenya (2016) | Target Coverage (Scale Up) |
|---------------------------------|-----------------------------|
|                                 | 2022 (Short Term) | 2030 (Medium Term) |

Treatment for high absolute risk of CVD/diabetes (>30 percent) 30 51 80
Treatment of new cases of acute MI with aspirin 30 51 80
Treatment of cases with established ischaemic heart disease 30 51 100
Treatment for those with established cerebrovascular disease and post stroke 30 51 100

CHRONIC OBSTRUCTIVE PULMONARY DISORDER

| Treatment                                | CURRENT COVERAGE IN KENYA (2016) | TARGET COVERAGE (SCALE UP) |
|------------------------------------------|----------------------------------|-----------------------------|
| Inhaled salbutamol                       | 15                               | 43 80                       |
| Low-dose oral theophylline               | 15                               | 43 80                       |
| Ipratropium inhaler                      | 15                               | 43 80                       |
| Treatment of acute exacerbation with antibiotics | 15 | 43 80 |
| Treatment of acute exacerbation with oral prednisolone | 15 | 43 80 |
| Treatment of acute exacerbation with oxygen | 15 | 43 80 |

Source: World Bank.
Note: Coverages represent the percent of the population in need that receives the intervention. The population in need varies by intervention. For instance, the population in need of a pap smear is women age 30–49, while the population in need of a biopsy is the women who test positive for precancer or cancer. CVD = cardiovascular disease; HPV = human papillomavirus; MI = myocardial infarction; VIA = visual inspection with acetic acid.

ROI ANALYSIS: INTERVENTION IMPACT

Effect sizes of interventions

Table F.4 lists the effect sizes of the interventions that are included in the analysis. The effect sizes are embedded in the OHT and are derived from academic literature.

The majority of the effect sizes represent changes in the rates that individuals move from one health state to another. The OHT applies these effect sizes to the populations that are reached by interventions, impacting transition rates of individuals between health states (see “COI analysis: Projecting the health burden” section). However, the remaining effect sizes—for interventions that target high CVD risk, high cholesterol, high blood pressure, and treatment for stroke or IHD survivors—act to reduce metabolic risk factors. For these interventions, the impact is mediated by a risk equation first published in a study by Ortegón et al. (2012) and detailed within the OHT NCD Module User guide. In this method, the change in the rates of transition from one CVD health state to another are:

modelled by stochastically simulating populations specific for age and sex with the observed baseline values of ischemic heart disease (IHD) and stroke incidence and the observed distribution of risk factors (systolic blood pressure, serum cholesterol, body mass index, and prevalence of long-term smokers). Incidence risk is apportioned between individuals using estimates of the relative risk of modelled risk factors on cardiovascular events. Population level incidence of IHD and stroke is recalculated after applying the impact of the interventions on the individual risk factor values for those receiving the intervention. (Ortegón et al. 2012, 3–4)
### TABLE F.5 Effect sizes of clinical interventions that target breast cancer and cervical cancer

| INTERVENTION                                                                 | EFFECT SIZE                                                                 | SOURCE                                                                                       |
|------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| **BREAST CANCER**                                                            |                                                                             |                                                                                             |
| Biannual mammography screening (women age 50–69)                              | Sensitivity 0.76, Specificity 0.93                                          | IARC 2016                                                                                    |
| Treatment of breast cancer stages I–IV                                       | Percent reduction in mortality, by stage (I—95.7 percent, II—78.3 percent, III—59.6 percent, IV 46 percent) | Davies et al. 2013; Groot et al. 2006; Perez et al. 2014; Zelle et al. 2012                 |
| **CARDIOVASCULAR DISEASE**                                                    |                                                                             |                                                                                             |
| Treatment for individuals with high CVD risk (≥ 20 percent)                  | 1.05 mmol/L reduction in cholesterol                                        | Law, Morris, and Wald 2009; Taylor et al. 2013                                               |
|                                                                              | 5.9 mmHg reduction in systolic blood pressure                               |                                                                             |
| Treatment for individuals with high blood pressure (≥ 140 mmHg), but low absolute CVD risk (< 20 percent) | 5.9 mmHg reduction in systolic blood pressure                               | Law, Morris, and Wald 2009                                                                 |
| Treatment for individuals with high cholesterol (≥ 6.0 mmol/L), but low absolute CVD risk (< 20 percent) | 1.05 mmol/L reduction in cholesterol                                        | Taylor et al. 2013                                                                           |
| Treat new cases of acute myocardial infarction with aspirin                  | 15 percent reduction in CVD mortality                                       | ATT 2002                                                                                    |
| Provide multidrug therapy to treat those with established ischemic heart disease and stroke | 1.05 mmol/L reduction in cholesterol                                        | Law, Morris, and Wald 2009; Taylor et al. 2013                                               |
|                                                                              | 5.9 mmHg reduction in systolic blood pressure                               |                                                                             |
| **CERVICAL CANCER**                                                          |                                                                             |                                                                                             |
| Triannual screening through visual inspection with acetic acid (VIA) test (women age 30–49), with timely diagnosis | Sensitivity 0.62, Specificity 0.95                                          | Goldie et al. 2001; IARC 2005                                                               |
| Screening through the Pap test (women age 30–49), with timely diagnosis      | Sensitivity 0.62, Specificity 0.95                                          | Goldie et al. 2001; IARC 2005                                                               |
| Screening through the HPV DNA test (women age 30–49), with timely diagnosis  | Sensitivity 0.88, Specificity 0.75                                          | Goldie et al. 2001; IARC 2005; WHO 2014                                                     |
| Treatment of cervical cancer stages I–IV                                     | Percent reduction in mortality, by stage (I—77.5 percent, II—68.4 percent, III—65 percent, IV 75 percent) | Chuang et al. 2016; Goldie et al. 2003; NCCN 2017                                           |
| **CHRONIC OBSTRUCTIVE PULMONARY DISORDER**                                   |                                                                             |                                                                                             |
| Symptom relief with inhaled salbutamol                                       | 15 percent improvement in functioning (quality of life improvement)         | Sestini et al. 2002                                                                          |
| Low-dose oral theophylline                                                   | 11 percent improvement in functioning (quality of life improvement)         | OHT                                                                                         |
| Ipratropium inhaler                                                         | 17 percent improvement in functioning (quality of life improvement)         | OHT                                                                                         |
| Exacerbation treatment with antibiotics                                       | 76 percent reduction in case fatality rate                                  | Rico-Mendez et al. 2005; Sin and Man 2006; Vollenweider et al. 2012                         |
| Exacerbation treatment with oral prednisolone                               | 34 percent reduction in case fatality rate                                  | Rico-Mendez et al. 2005; Sin and Man 2006; Vollenweider et al. 2012                         |
| Exacerbation treatment with oxygen                                           | 50 percent reduction in case fatality rate                                  | Rico-Mendez et al. 2005; Sin and Man 2006; Vollenweider et al. 2012                         |

Source: World Bank.

Note: CVD = cardiovascular disease; HPV = human papillomavirus; OHT = OneHealth Tool.
Additional information on impact modelling

- The modelling and assumptions behind the clinical interventions that address breast cancer and cervical cancer are detailed in Gopalappa et al. (2018).
- The modelling and assumptions behind the clinical interventions that address COPD are detailed in Stanciole et al. (2012).
- The modelling and assumptions behind clinical interventions that address CVD are detailed in Ortegón et al. (2012).
- See the OHT NCD Module User guide: https://avenirhealth.org/Download/Spectrum/Manuals/SpectrumManualE.pdf
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ECO-AUDIT

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Noncommunicable diseases such as cancer, diabetes, chronic lung diseases, and heart diseases are the leading cause of death and disability. In Kenya, the growing prevalence of these diseases is a major public health concern and a hindrance to long-term economic growth. This is because these conditions reduce human capital and divert societal resources. The high cost of managing the growing caseload of noncommunicable diseases (NCDs) also afflicts Kenyan families, businesses, and the government, and increasingly leads to impoverishment.

Developing an appropriate policy response to the threat of NCDs requires a clear understanding of the economic impacts as well as the benefits of potential interventions, both from a health and an economic perspective. Such information allows policy makers to evaluate the trade-offs between different investment decisions, with the goal of ensuring that any interventions maximize the rewards to individuals and to society at large.

Combating Noncommunicable Diseases in Kenya is one of a few published studies on the economic burden of NCDs in Kenya. It focuses on a limited set of conditions, aligned with the burden of NCDs in Kenya, and demonstrates both the long-term costs of these diseases and the strong health and economic benefits of scaling up interventions. It contributes to a growing body of analysis on NCDs in Kenya—and in Africa—and provides much-needed evidence to facilitate advocacy and foster dialogue to confront this serious challenge.