Defining the Ethiopian Essential Health Service Package

Process, methods and cost-effectiveness evidence for the prioritisation of health interventions

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Scientific environment

The PhD candidate was a researcher with the Bergen Centre for Ethics and Priority Setting (BCEPS) in the Department of Global Public Health and Primary Care at the Faculty of Medicine, University of Bergen. Professor Ole F. Norheim, as the main supervisor, and Drs Alemayehu Hailu and Solomon Tessema Memirie, as co-supervisors, provided guidance throughout the PhD period. This research was funded by the Bill & Melinda Gates Foundation through the Disease Control Priorities – Ethiopia project in collaboration with Ethiopia's Ministry of Health. Professor Ole F. Norheim (UiB, BCEPS) and Dr. Stéphane Verguet (Harvard T.H. Chan School of Public Health) are Principal Investigators of Disease Control Priorities – Ethiopia project.

Dedication

I dedicate this academic work and express my respect in honour of my father, Teshome Eregata, and my mother, Tsige Tefera, for your enormous pure love and care in those beautiful days**.** You encouraged and showed me the light of education in my early days of schooling.

I am also grateful to my late elder brother, Girma Teshome, whom we have lost to myocardial infarction.

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Acknowledgements

Summary

Background: All countries have signed up to the United Nations (UN) Sustainable Development Goals (SDGs), including Target 3.8 on achieving universal health coverage (UHC). UHC is realised when everyone has access to quality essential health services with financial risk protection. Countries should, therefore, measure and track their progress towards UHC over time and take appropriate action. Defining an essential health service package (EHSP) is the first and crucial step towards UHC progress. In defining an EHSP, counties identify the type and mix of health services that respond to their populations' needs. However, there are gaps in evidence regarding Ethiopia's current UHC status, and it had been more than 15 years since the EHSP was defined in Ethiopia. Furthermore, there is relatively little national cost-effectiveness evidence available to redefine the EHSP in Ethiopia. Therefore, this study aimed to estimate Ethiopia's UHC service coverage status, generate relevant cost-effectiveness evidence and synthesise and describe the methods, process and key features of the revised Ethiopian EHSP.

Methods: This thesis consists of three studies. In Paper I, 16 individual tracer indicators that measure a health system's performance in various domains were selected to measure UHC service coverage in Ethiopia. We grouped the tracer indicators into four major programme areas (i.e., reproductive maternal neonatal child health [RMNCH], infectious disease, noncommunicable disease [NCD] and capacity and access), and we constructed an overall UHC service coverage index using geometric means. We also estimated the subnational level of UHC service coverage. In this paper, various surveys and routinely collected administrative data were used. In Paper II, we employed a standardised WHO-CHOICE generalised cost-effectiveness analysis (GCEA) methodology. Average cost-effectiveness ratios (ACERs) for 159 health interventions were calculated. The health benefits of interventions were determined using healthy life years (HLYs) gained. The economic costs of interventions were estimated from the health system perspective. We used the OneHealth tool for data analysis. In the third paper (Paper III), we synthesised and described the methods, process and critical features of the 2019 EHSP. A total of 35

consultative workshops were convened with experts and the public to define the revision's scope, develop a list of health interventions, agree on the prioritisation criteria, gather evidence and compare health interventions. Seven prioritisation criteria were employed: disease burden, cost effectiveness, equity, financial risk protection, budget impact, public acceptability and political acceptability.

Results: The overall UHC service coverage for Ethiopia in 2015 was 34.3%, ranging from the highest (52.2%) in Addis Ababa to the lowest (10%) in Afar. The programme area coverage varied from about 53% for infectious diseases to 20% for capacity and access (Paper I).

In Paper II, we found ACERs ranging from less than US$1 per HLY gained for family planning intervention to about US$48,000 for colorectal cancer treatment at stage 4. About 75% of all interventions evaluated had ACERs of less than US$1,000 per HLY gained. The majority (95%) of RMNCH and infectious disease interventions had an ACER of less than US$1,000 per HLY while around half of interventions (44%) targeting NCDs had an ACER of less than US$1,000 per HLY.

In Paper III (EHSP revision process), 1,749 interventions were identified in the first phase. These interventions were regrouped and reorganised, and 1,442 interventions were identified as possible candidates for the EHSP. In the second phase, we removed interventions that did not match the burden of disease or were not relevant in the Ethiopian setting, and, therefore, the number of EHSP intervention was reduced to 1,018. We then evaluated and ranked the interventions by the other six criteria. In the final EHSP, 594 (58%) interventions were classified as high priority, 213 (21%) as medium priority and 211 (21%) as low priority. The current policy is to provide 56% of interventions free of charge and to ensure 38% on cost-sharing and 6% on cost-recovery arrangements.

Conclusions: In conclusion, the baseline (2015) UHC service coverage index for Ethiopia was low. Furthermore, several potential cost-effective interventions were available that could substantially reduce Ethiopia's disease burden if scaled up. The revision of Ethiopia's

EHSP followed a comprehensive, participatory, inclusive and evidence-based process, and the EHSP interventions were linked to appropriate health care delivery platforms and financing mechanisms.

Keywords: Universal health coverage, cost-effectiveness analysis, priority setting, Ethiopia, essential health services package, equity, financial risk protection

List of Original Papers

This thesis is based on the following three papers, referred to in the text by their Roman numerals.

Paper I

Eregata GT, Hailu A, Memirie ST, Norheim OF. Measuring progress towards universal health coverage: National and subnational analysis in Ethiopia. BMJ Global Health. 2019; 4(6). doi:10.1136/bmjgh-2019-001843

Paper II

Eregata GT, Hailu A, Stenberg K, Johansson KA, Norheim OF, Bertram MY. Generalized cost-effectiveness analysis of 159 health interventions for the revision of the Ethiopian essential health service package. Cost Eff Resour Alloc. 2021; 19(2). doi.org/10.1186/s12962-020-00255-3

Paper III

Eregata GT, Hailu A, Geletu ZA, Memirie ST, Johansson KA, Stenberg K, Bertram MY, Aman A, Norheim OF. Revision of the Ethiopian essential health service package: An explication of the process and methods used. Health Systems & Reform. 2020; 6(1). doi: 10.1080/23288604.2020.1829313

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Abbreviations

A4R	Accountability for reasonableness
ACER	Average cost-effectiveness ratio
AD	Average age at death
BCC	Behavioural change communication
CBHI	Community-based health insurance
CEA	Cost-effectiveness analysis
CHE	Catastrophic health expenditures
CMNND	Communicable, maternal, neonatal and nutrition disorders
DALY	Disability-adjusted life year
DCP	Disease control priority
EC	Executive committee
ECEA	Extended cost-effectiveness analysis
EDHS	Ethiopian Demographic and Health Survey
EDP	Evidence-based deliberative process
EDP	Evidence-informed deliberative processes
EHSP	Essential health service package
EPHI	Ethiopian Public Health Institute
EPSA	Ethiopian Pharmaceutical Supply Agency
ETB	Ethiopian birr
EUHC	Essential universal health packages
FRP	Financial risk protection
GBD	Global burden of disease
GCEA	Generalised cost-effectiveness analysis
GDP	Gross domestic product
GTP	Growth and Transformation Plan
HAAD	Health-adjusted age of death
HBP	Health benefit package
HEP	Health Extension Programme
HIV	Human immunosuppressive viruses
HLY	Healthy life year
HMIS	Health management information system
HRH	Human Resources for Health
HRIS	Human resource information system
HSDP	Health sector development plan
HTA	Health technology assessment
ICER	Incremental cost-effectiveness ratio
ID	Infectious disease
IHME	Institute for Health Metrics and Evaluation
IRH	International health regulation
JCCC	Joint Core Coordinating Committee
JCF	Joint Consultative Forum
JSC	Joint Steering Committee
LMICs	Low- and middle-income countries
MCDA	Multi-criteria decision analysis

MDG	Millennium Development Goal
MIS	Malaria Indicator Survey
MOH	Ministry of Health
NCD	Noncommunicable disease
NGO	Non-governmental organisation
NHA	National Health Account
NTD	Neglected tropical disease
OHT	OneHealth tool
OOP	Out-of-pocket payment
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PHC	Primary health care
RHB	Regional health bureau
RMNCH	Reproductive, maternal, newborn and child health
SARA	Service Availability and Readiness Assessment survey
SDG	Sustainable Development Goals
SHI	Social health insurance
TB	Tuberculous
TGE	Transitional Government of Ethiopia
THE	Total health expenditure
TWG	Technical working group
UHC	Universal health coverage
UN	United Nations
WASH	Water, sanitation and hygiene
WB	World Bank
WHO	World Health Organization
WHR	World Health Report

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Chapter 1. Introduction

1.1 Background

Several organised attempts have been made to promote the health of people globally. In 1948, the World Health Organization (WHO) in its constitution defined health in a very broad sense as 'a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity' (1). This definition is crucial as it introduced a social model of health as a new paradigm (2). In 1978, 30 years later, Member States of the United Nations (UN), convened in Alma-Ata, reaffirmed this definition of health and endorsed a primary health care (PHC) strategy to achieve 'health for all by the year 2000' (3). PHC is defined as 'essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford' (3).

The PHC strategy brought important principles into perspective, such as health as a human rights issue, the multi-sectoral concept of health, community ownership and active participation in policymaking (3, 4). Furthermore, PHC emphasises bringing health care close to where people live and work (2). However, PHC was not fully implemented because of poor leadership at the country level, lack of coordination at the global level, a shortage of health workforce, inadequate funding, a large urban-rural gap and the emergence of new infectious diseases (IDs) (4, 5).

In 2000, the UN convened countries, donors and the development community around eight goals to be achieved by 2015: the Millennium Development Goals (MDGs). Three of the goals pertained directly to health, and most of the other goals were related to health (6). Although many MDGs were not achieved, a tremendous improvement was recorded in reducing maternal and child mortality as well as in reducing the malaria, TB and HIV burden (7). The MDGs' health goals were criticised for being disease-specific, unsustainable and lacking a system-strengthening component (8). Furthermore, almost half

the world's population cannot access essential health services, and about 100 million people are forced into extreme poverty annually because of medical expenses (9). The proportion of people facing catastrophic financial hardship due to out-of-pocket spending on health care (i.e., spending more than 10% of their total income for health care) increased from 2.7% in 2000 to 3% in 2010 (9). This contributed to developing a more comprehensive goal by the UN: the Sustainable Development Goals (SDGs). In 2015, all countries signed on to the SDGs. The third goal on health is to 'ensure healthy lives and promote wellbeing for all at all ages'. To achieve this goal, universal health coverage (UHC) emerged as an overarching target (Target 3.8).

This chapter, therefore, concentrates on the theoretical and empirical evidence around UHC—what actions can be selected to progress towards UHC at the country level and how to quantify progress towards UHC service coverage—with a particular focus on defining an essential health service package (EHSP) in the low- and middle-income countries (LMICs) context. I conclude this chapter by providing the rationale for the studies included in this thesis.

1.2 What is UHC?

There is a growing consensus on the importance of UHC globally. Both WHO and the World Bank (WB) have placed UHC at the top of their health sector agenda for the past 15 years. For instance, Margaret Chan, former WHO Director-General, called UHC 'the single most powerful concept that public health has to offer'. There is also strong enthusiasm and political commitment for UHC in most of the Member States. Nonetheless, there was no explicit understanding of the definition, conceptual framework and scope of UHC for many years, and thus its meaning evolved through several readings by various systems.

The most frequently cited interpretations of UHC are those provided by WHO in its 2008 and 2010 World Health Reports (WHRs), which state that UHC is achieved when 'all people and communities can use the promotive, preventive, curative, rehabilitative and

palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does not expose the user to financial hardship' (8, 10). This definition entails that UHC can be viewed from three interconnected dimensions: population coverage, service coverage and financial security (Figure 1). The service coverage dimension examines which health interventions should be provided first. The population coverage dimension explores what proportion are covered. The financial coverage dimension explores the proportion of cost-sharing (8, 10).
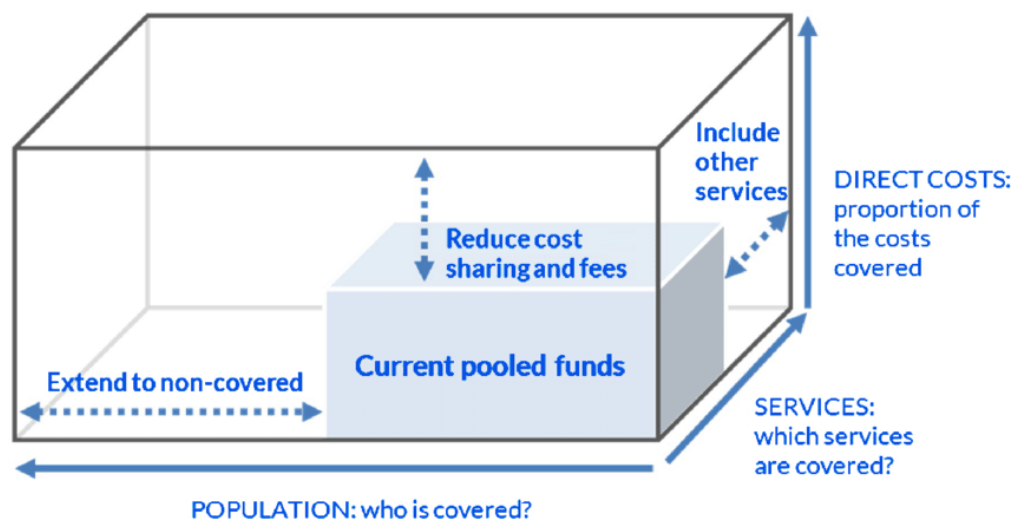
Figure 1. The three dimensions of UHC (Source: World Health Report 2008 and 2010) (8, 10).

1.3 What can be done to progress towards UHC?

In the 2010 WHR, WHO posed three fundamental questions: How should countries finance UHC plans? How should countries limit the financial risk of their people due to medical

reasons? How should countries encourage the optimum use of available resources for health? Following that report, various proposals have been put forward on UHC. In 2014, the WHO Consultative Group on Equity and Universal Health Coverage, in its final report entitled 'Making Fair Choices on the Path to Universal Health Coverage', published a new priority-setting framework and recommended a three-layer solution to progress towards UHC at the country level (11). According to WHO, categorising health services into various priority groups should be the first step to identify high-priority interventions explicitly. As no country can afford to deliver the whole list of health services, prioritising health service is an inevitable, critical and essential step (11). I further expand on this point in the next subsection.

Expanding coverage for those high-priority interventions to everyone is a second step. This can be achieved by eliminating out-of-pocket payments (OOPs) through increasing mandatory prepayment mechanisms (i.e., insurance). The third step based on WHO's recommendation is to bring disadvantaged groups into consideration (i.e., economically poor, rural populations, etc.) and to expand their coverage (11).

1.4 Identifying priority services for UHC

The rapid expansion of advanced health technology has been seen worldwide, resulting in improvements in human wellbeing. This fast expansion of health care technology is also associated with an increased cost of health service delivery while available resources are always limited (12, 13). Therefore, no country in the world can afford to provide all services to the whole population in a sustainable manner. Identifying priority services that can be realistically delivered is one of the vital steps on the path towards UHC at the country level.

There are two key priority-setting approaches. The first approach is a priority setting using health technology assessment (HTA) platforms. HTA refers to 'a systematic evaluation of properties, effects, and impacts of health technology'(14). HTA can identify priority

services by comparing interventions in terms of their health, societal and economic impacts. HTA is the predominant mechanism of priority setting in most high-income countries (14). The National Institute for Health and Care Excellence in the UK is the outstanding HTA platform example. Recently, there is also growing demand for establishing HTA bodies in many LMICs. The Health Intervention and Technology Assessment Programme in Thailand is an excellent model of this. However, priority setting using the HTA approach is often conducted for a single health technology at a time. Therefore, it is costly, time consuming and not practical for evaluating an extensive list of health interventions for UHC-type reform.

The second priority-setting approach defines an essential health *benefits* package or EHSP.[1] This approach is more appropriate for UHC-type reform that involves evaluating large sets of health interventions in the health sector. EHSP revision enables evaluating large sets of health interventions in a relatively shorter time than the HTA process. The EHSP revision process is conducted periodically (i.e., often in five- or 10-year intervals) while HTA is a one-by-one continuous evaluation process. Therefore, the EHSP process is a predominantly preferred approach in many LMICs.

1.4.1 Priority-setting frameworks for designing an EHSP

Priority setting is a complicated exercise that requires theoretical and empirical analysis of the health system from political, economic, social and environmental perspectives. Various important frameworks have been developed and proposed for different contexts to navigate this complexity, but there is yet no single widely accepted framework (15-18). This subsection briefly describes three of the more prominent frameworks applicable to low- and middle-income settings from the perspective of the EHSP revision process.

In the 1993 World Development Report, Jamison et al. provide the disease control priority (DCP) framework for selecting and ranking health services based on a combination of

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[1] Ethiopia chose the second priority-setting approach (defining an EHSP). A detailed description of the Ethiopian EHSP revision approach is included in Chapters 2–6.

disease burden and economic evaluation (cost effectiveness). According to Jamison et al., all health problems should be ranked based on the disease burden they place on the population (i.e., total disability-adjusted life year [DALY] losses), and the corresponding available interventions for each problem should be ranked based on cost effectiveness (i.e., DALY averted per dollar spent). Priority should then be given to those health problems for which cost-effective interventions are available that can minimise DALY loss. Jamison et al. further argue that, if a particular health problem causes many DALY losses, it should be a priority for research on the development of cost-effective interventions. Therefore, DCP formally introduced economic evaluation as an essential tool for prioritising health intervention and disease control programmes in LMICs (19, 20).

DCP-1 and DCP-2 have been criticised for showing less concern for the distribution of the health benefits from the interventions across the socioeconomic gradient (21). However, in the third edition (DCP-3), this framework has quickly evolved, and it includes other vital dimensions using an extended cost-effectiveness analysis (ECEA) approach. ECEA is an expansion of standard cost-effectiveness analysis (CEA) that enables evaluating financial risk protection (FRP), equity impact, death averted and poverty cases averted by the interventions in addition to costs and health benefits. Furthermore, DCP-3 brought together more than 500 scholars and proposed 21 essential universal health packages (EUHCs) appropriate to LMICs that contain 218 promotive, preventive, curative, rehabilitative and palliative interventions. These packages also include intersectoral and health-system level interventions. DCP-3 proposed a subset of 108 interventions as a 'highest priority package' that needs particular attention to be implemented as a first step towards UHC for rapid population health improvement (19, 22).

Glassman et al., in a seminal paper, provide another priority-setting framework, which argues that all interventions should be compared, ranked and selected based on their 'value for money' from a broader societal perspective (23). The central element in this framework is 'value', which may vary from society to society and from time to time. On this

framework, Glassman et al. provide 10 core steps for revision of an EHSP that fit nicely in the classical policy cycle of planning (Steps 1–7), implementation (Steps 8–9) and evaluation (Step 10) (Figure 2) (23). According to this framework, defining the priority-setting exercise goal is the first and most crucial step in the EHSP revision process. This step helps to ensure that coherence in the whole process can be maintained. Defining an appropriate goal is fundamental for installing accountability mechanisms as it helps determine whether the EHSP responds to what it initially intended to achieve (23).

According to Glassman et al., defining methods and prioritisation criteria for appraisal, choosing the package outline and selecting areas for further analysis are essential steps. Other crucial steps in EHSP design include collecting evidence, understanding appraisal and budget impact assessment, deliberating on evidence, making recommendations and taking decisions, translating decisions into resource allocation and use and implementing and managing the EHSP. Reviewing and learning should be integral parts of the design process as they pave the way for improvement in the next round of revision with a new goal. Furthermore, the context (i.e., political institutions, health systems, markets, rights, technology, the economy) in which the EHBP design is conducted is a crucial element to be considered (Figure 2) (24).

Figure 2. Core elements of defining an EHSP (Source: Modified from Glassman et al. (23)).

In 2014, the WHO Consultative Group on Equity and Universal Health Coverage provided another priority-setting framework stating that UHC-oriented EHSPs at the country level should evolve through continuing dialogue with all stakeholders using quantitative and qualitative criteria (11). The Consultative Group proposed that priority should be given to those interventions that are very cost effective and whose implementation would result in higher FRP and reduced inequity. This framework provides major priority-setting criteria (cost effectiveness, priority to the worse off and FRP) and discusses the relevance of additional criteria (e.g., severity of the disease, past health loss, economic productivity) (11).

1.4.2 Priority-setting criteria

In defining an EHSP, the gap between what is affordable and what is ideal is challenging. Reconciling aspirational policy targets with existing available resources is one of the central goals in revising the EHSP in many countries. The challenge is enormous in a low-resource setting with minimal financial and technical capacities. Therefore, hard decisions using multiple criteria, each representing different values, must be made.

Various criteria have been used in diverse settings to compare and rank health interventions and technologies differently. Some of the criteria are associated with the interventions' characteristics (e.g., cost effectiveness, effectiveness). In contrast, some others are associated with the health problem/disease (e.g., disease burden, severity, FRP) and the characteristics of the targeted beneficiaries (e.g., income, age, sex, residence). Systematic reviews identify that CEA is the most frequently used criterion in diverse settings, followed by severity, equity, FRP and budget impact (25, 26). I briefly describe the more common criteria (i.e., cost effectiveness, severity, equity, FRP, budget impact). Furthermore, public and political acceptability are usually considered in priority-setting exercises—implicitly or explicitly (27, 28).

Cost effectiveness
Economic resources are finite while population health demands are enormous. Therefore, cost is the primary input to the decision-making process in any health care system. Because of budget constraints and continued increases in costs in many countries, cost effectiveness has become an essential guiding principle in priority setting. Many leading health economists and ethicists agree that the cost-effectiveness criterion should be a centrepiece of priority-setting analysis as the opportunity costs of ignoring this criterion, in terms of health benefits forgone, could potentially be huge (29, 30). Hence, a comparison of the costs of including additional health interventions with their health benefits is key to decision-making. CEA is a type of economic evaluation that compares two or more health interventions based on both cost and health benefit (31).

CEA has two fundamental approaches: marginal/incremental CEA, which uses an incremental cost-effectiveness ratio (ICER), and generalised CEA (GCEA), which uses an ACER to compare the added value of the intervention with its associated cost (Figure 3). The ICER reports the ratio of the change in the cost to the change in health benefit.

$$ICER = \frac{[Cost\ A\ -\ Cost\ B]}{[Effectivness\ A - Effectivness\ B]}$$

where ICER is incremental cost effectiveness for Intervention A compared with Intervention B and where Cost A, Cost B, Effectiveness A and Effectiveness B represent costs and effectiveness for interventions A and B, respectively.

Incremental CEA compares the cost effectiveness of adding new interventions against the current best practice (32). ICER is the most widely used measure in the economic evaluation literature, and it is an appropriate measure for HTA settings where the aim is to evaluate a single or a few closely related interventions compared with the current best available alternative (33). However, the incremental approach assumes that the current practice is organised in the most efficient way possible. Therefore, it does not account for existing inefficiencies in the health system, and it is difficult to examine whether the current mix of interventions represents an efficient use of resources (32, 34).

GCEA is one form of CEA that compares interventions with a 'doing-nothing' scenario (32). The ACER captures the average cost per health benefit (i.e., ACERA = COST A / Effect A) (35, 36). GCEA was proposed and developed by WHO's CHOosing Interventions that are Cost Effective (CHOICE) programme (34, 37). This approach assesses whether the current mix of interventions is efficient and whether a proposed new technology or intervention is appropriate. For EHSP revision and other sector-wide CEAs of wide ranges of interventions from multiple programme areas, GCEA is a preferred approach (34).
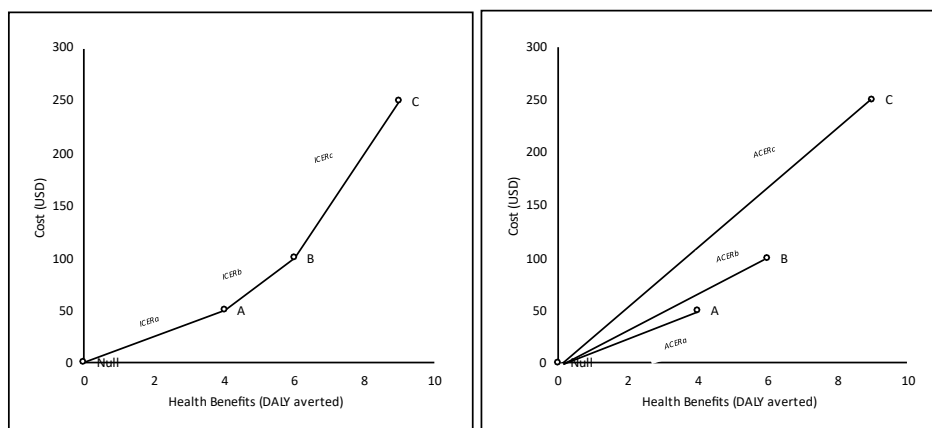
Figure 3. ICERs in the incremental analysis (A) and ACERs in the GCEA (B) (Source: WHO; hypothetical example modified by the author).

Severity

Concern about health problems or conditions that cause severe illness to an individual or a society at large is an important matter to consider in resource allocation decisions (38, 39). Therefore, severity criteria are applied in many priority-setting processes, in both high- and low-income settings, to compare both interventions and diseases (40-42). For example, in Norway, 'severity of disease' has been used in priority setting since 1987 (43-45). Severity criteria have also been applied in priority setting in many LMICs (41, 42, 46).

Severity can be measured using burden of disease data employing an 'average age at death' (AD) parameter. It is also desirable to include morbidity in many cases, and this measure is called 'health-adjusted age of death' (HAAD).[2] Practically, we assign additional weights

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[2] To compute HAAD, data on cause-specific incidence, prevalence, average disability and mortality as well as all-cause mortality and average population disability can be taken from the Global Burden of Disease Study. To calculate condition-specific HAAD, a cohort of individuals is created for each health condition such that the age pattern reflects the condition-specific incidence. This cohort is then exposed to with-condition mortality risk for a certain length of time depending on the condition, after which they are exposed to the general population mortality risk. For some conditions, the elevated mortality risk is lifelong. Using standard life table methods, the deaths can be counted by age. The years lived are then adjusted based on the population average disability in years lived without the condition and on the background disability and condition-specific disability for years lived with the condition.

according to who are worst off in terms of lifetime health (AD or HAAD). Conditions and corresponding interventions can be graded, for example, on a scale of 1 to 4 based on HAAD cut-offs of fewer than 30 years (worst) and greater than 60 years (best) (47, 48).

Equity

Prioritising health interventions based solely on cost effectiveness may not always be aligned with the public view of fair health services distribution. In deciding whether to include a specific intervention in the health service package, policymakers should carefully consider the interventions' equity impact. People living in poverty and with severe diseases are more likely to have poor health than others, which can be captured by a concern for the worse-off, or equity impact (49). Also, health services should be available to every person with the same need regardless of socioeconomic status, age, gender or location (i.e., urban/rural or across different regions of a country) (50, 51).

Equity criteria arise from a government's policy commitment and local social values to make a reasonable and just distribution and a pro-poor health system. The equity criterion can be applied to give higher priority to health gains from interventions targeting diseases, conditions and risk factors that mainly affect the worse off, although the definition of 'worse off' varies from country to country (11, 42, 52). The equity impact of interventions can be quantitatively measured using a concentration curve and concentration index (52-54).

Financial risk protection

There is a broad consensus that the FRP criterion should be incorporated in priority-setting decisions (11, 55). FRP is defined as households' ability to obtain health services without financial hardship. Financial risk can best be measured using catastrophic health expenditures (CHEs). A CHE is defined as total spending per household for a medical

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HAAD, then, can be measured in years of the average health-adjusted age at which individuals with a particular disease or injury die.

reason that is greater than 10% of the total income or 40% of non-food expenditure. Large OOP medical payments due to illness can cause financial hardship. Health services that cause large OOP expenditures to patients and households should be given high FRP weights and be considered high-priority interventions (11, 56).

Budget impact

A budget-impact criterion helps to compare whether or not any high-impact and cost-effective interventions are affordability at large scale implementation (57, 58). For instance, an Intervention A may be attractive in terms of CEA with an ACER of US$50 per DALY. If the implementation of Intervention A (e.g., influenza vaccination) in Ethiopia cost US$1 per person per year, US$55 million per year is needed if the intervention is to be delivered to 50% (approximately 55 million) of the population. A hypothetical Intervention B (e.g., HPV vaccine) that is relatively less cost effective compared with Intervention A, with an ACER of US$100 per DALY averted, may cost US$10, so US$5 million is needed if the intervention is to be delivered to all 13-year-old girls (approximately 500,000 population). Therefore, budget impact criteria facilitate the comparison of interventions beyond cost-effectiveness criteria in terms of affordability compared with the available budget. The available budget determines the final set of services to be provided (58).

1.4.3 Deliberation and decision process

Priority setting is a value-based and political process that tries to harmonise the divergent values, needs and interests of people, individuals, groups and patients (59). Therefore, priority setting in the design of an EHSP should be democratic, open and participatory (involving wide ranges of stakeholders) (60, 61). In benefit package design, one of the early and exemplary processes of open public deliberation is the case of the Oregon Health Plan (62). In the Oregon Health Plan, the state invited people to prioritise the medical conditions covered by the heath benefit package in an open, deliberative process (63).

Amongst both researchers and policymakers, there is a growing consensus on the value of deliberation and public participation in priority setting (15, 64, 65). Daniels and Sabin

proposed a widely known framework, accountability for reasonableness (A4R), to make the deliberation process legitimate and fair (66). According to A4R, the following four conditions should be fulfilled to conduct legitimate and fair prioritisation processes: relevance, publicity, appeals/revision and enforcement. *Relevance* entails that all relevant stakeholders should have the chance to participate in the process. Differing views, opinions and preferences should be respected. The debates should be based on clear arguments, and all involved stakeholders should be given a chance to have a voice. *Publicity* entails that priority-setting decisions and the justifications behind them should be transparent and made publicly available. The publicity can be done using media or any other means of communication, circulating and posting the meeting agenda and draft reports. *Appeals* and *revision* entail that all stakeholders should be given a chance to make an appeal against decisions, suggest revisions and receive a response. Appeals ensure that people affected by the decision have a voice, are adequately heard and are guaranteed a revision procedure. *Enforcement* entails that the first three conditions are appropriately obeyed. This condition is crucial, and a legally mandated institution should be in place to implement, monitor and ensure that the deliberative process that meets the standards of the four conditions is continuously applied (66).

Combining the more qualitative A4R process and the more quantitative multi-criteria decision analysis (MCDA), Baltussen et al. recently proposed a new deliberation framework called evidence-informed deliberative processes (EDP) (67). The EDP framework's key feature is the early involvement of relevant stakeholders to identify, reflect and learn about relevant values' meanings and importance. According to EDP, the stakeholders' involvement ranges from identifying prioritisation criteria to technical dialogue and decisions for inclusion or exclusion of interventions from the benefits package. This can contribute to the legitimacy of final decisions by elected government officials (67). Although both A4R and EDP are developed and explored in various HTA settings, the four conditions of A4R and EDP are also highly applicable in the EHSP revision process (67).

1.5 Measuring progress towards UHC

The crucial steps in rapidly progressing towards UHC include measuring the baseline status, understanding gaps, taking remedial action along the way, and monitoring improvements at the national and subnational levels (68, 69). In this regard, several country-level and multi-country studies have been conducted to measure the national UHC status in diverse countries (70-85). In the past five years, at the global level, WHO, the WB and the Institute for Health Metrics and Evaluation (IHME) have made a proposition to formulate a comparable UHC monitoring tool/framework using various data sources and methodologies (86-88).

In the first global UHC tracking report, published in 2017, WHO and the WB jointly introduced a new UHC monitoring framework (89). According to this framework, the FRP element can be measured using both the incidence of impoverishment and the incidence financial catastrophe. The service coverage element can be measured using 16 selected tracer indicators. The tracer indicators are grouped into four major categories: reproductive, maternal, newborn and child health (RMNCH); IDs; noncommunicable disease (NCD); and service capacity and access (86). A geometric mean of each tracer indicator can be first aggregated for each major group, and then the overall UHC index can be computed by taking a geometric of the coverage across the four major groups. According to these metrics, the two interdependent UHC sections (i.e., FRP and service coverage) should be measured and presented separately. In this report, WHO/WB provide the 2015 UHC service coverage status of all UN member countries using only 14 of the tracer indicators (because of data limitations) (86). The proposed UHC target in 2030 is achieving 80% service coverage and 100% FRP; the service coverage baseline ranges from 22% in Somalia to already higher than 80% in most OECD countries (86).

Wagstaff and Neelsen propose another UHC monitoring framework, which uses a single index by combining the two aspects of UHC into one (i.e., FRP and service coverage) (88). In this model, a weighted geometric average of service coverage and FRP is employed. The

UHC service coverage index is built using a weighted geometric average of another eight tracer indicators (cervical cancer screening, breast cancer screening, antenatal care, full immunisation, skilled birth attendance, treatment of acute respiratory infections, treatment of diarrhoea and inpatient admissions). The financial risk is measured as the incidence of CHE (i.e., those who encounter medical spending exceeding 10% of household income). The service coverage part is further divided into prevention and treatment categories. This tool also demonstrates how to compute the inequality-adjusted UHC index, considering the coverage difference across socioeconomic groups. Wagstaff and Neelsen illustrate the tool using empirical data from 111 LMICs, generating a single UHC index for each country that ranges from about 35% in Côte d'Ivoire to about 80% in Ukraine (88).

In 2020, the 2019 Global Burden of Diseases Collaborators on Universal Health Coverage introduced a new UHC monitoring tool utilising a weighted average of 23 tracer indicators. The 23 tracer indicators were chosen based on WHO's General Programme of Work (GPW13)[3] framework, with a design representing effective coverage of promotive, preventive and therapeutic services in all age groups. Unlike contact coverage indicators, effective coverage indicators capture quality and the services' outcomes (i.e., mortality averted, disease incidence/prevalence reduced, etc.). The group demonstrate the tool using global burden of disease (GBD) data from 1990 to 2019 and generate a UHC service coverage index for 204 countries and territories, ranging from about 22% in the Central African Republic to 96% in Japan (87).

In general, all three UHC monitoring frameworks consistently employ the incidence of impoverishment and financial catastrophe resulting from OOP health payments to measure FRP. However, the frameworks vary substantially regarding the measurement of service coverage. The variation is due to the number and types of service tracer indicators used, how the service types are categorised (inpatient vs. outpatient service or curative vs. preventive service) and how they are weighted. Additionally, some key health services

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[3] GPW13 is https://www.who.int/about/what-we-do/GPW13_WHO_Impact_Framework_Indicator_Metadata.pdf

aspects were excluded from the indicators on the grounds of simplicity, comparability and information availability in all three frameworks (90). Furthermore, both WHO/WB and Wagstaff and Neelsen captured contact coverage rather than effective coverage while the recent IHME measure employed effective coverage, which accounts for the quality of service delivered (86, 87).

1.6 Overview of the Ethiopian health system

Ethiopia is the second-most populous country in Africa, with an estimated population of about 110 million in 2020. Nearly 85% of the population live in rural areas and are dependent on subsistence agricultural. Despite fast economic growth in the past 15 years, with an average growth rate of 8% annually, Ethiopia is still one of the low-income countries, with a per capita income of US$953 in 2019. About one-fourth of the population live with an income that is below the poverty line (91). Ethiopia is a federal state organised into 10 semi-autonomous regions and two chartered cities (Addis Ababa, the capital, and Dire Dawa). The regions are divided into zones and districts (*woreda*). The woredas are further divided into villages (*kebeles*). Kebeles are the smallest administrative unit.

Section 1.6.1 briefly describes major milestones, policies and strategies in the Ethiopian health system in the past 100 years, prior to the health sector transformation plan (HSTP). Section 1.6.2 briefly describes the Ethiopian health system's status using the six health system building blocks.

1.6.1 Some historical perspective

Ethiopia is an ancient independent country with its own medical tradition for millennia. However, the people have been deeply interested in modern health services for centuries (92, 93). The establishment of the first hospital in Addis Ababa by the Russian Red Cross Society in 1909 (94), the ratification of the Public Health Proclamation in 1946, the

establishment of the Ministry of Health (MOH) in 1948[4] and the founding of Gonder Public Health College and Training Center (GPHC&TC) in 1954 can be mentioned as significant milestones in the progress of the Ethiopian health system from traditional medicine to a modern health system. The 1946 proclamation established legal grounds for institutionalising health departments at national, provincial, and sub-provincial (*Awraja*)[5] levels. The college trained health officers, community nurses and sanitarians to staff provincial health centres. This played a pivotal role in expanding health service and greatly increasing the number of health professionals (95-97).

In the 1960s, the first national health policy/strategy was formulated as part of the Second Five Year Plan (1963–1967). The central objective of this strategy was to meet the health needs of rural populations. It was targeted to expand health centres and health stations (with one health centre serving 50,000 people and supervising 10 health stations). Although this strategy contributed to some extent to an increased access to essential health services through expansion of health facilities (i.e., hospitals, health centres, health stations) and the integration of preventive and curative services, the main objectives were not fully realised because of a critical shortage of health workers, drugs, medical equipment and supplies; an inadequate supervision, communication and referral system; underutilisation of the capital budget; and an insufficient recurrent budget (96-99).

In the Third Five Year Plan (1968–1972), the focus was mainly on malaria elimination and on vertical programmes, such as TB, malaria and leprosy. However, the implementation was fundamentally problematic because it focused mainly on building and running hospitals in major cities. For instance, in 1974, there were 6,474 health personnel of all types, 650 health stations, 93 health centres and 84 hospitals (with 8,624 beds). About 43%

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[4] After independence from the Italian occupation, from 1941 to 1946, the public health service in Ethiopia was administered by the Department of Public Health within the Ministry of Interior.

[5] *Awraja* (Amharic: አውራጃ) is roughly translates to "county" or "sub-province" that contained a number of districts prior to 1996.

of the health budget was allocated to hospitals in three major cities (Addis Ababa, Harar and Asmara[6]) (96, 98, 99).

When the socialist *Derg* regime came to power in 1974, there was again an aspiration to establish a community-based PHC system. The Ethiopian government warmly welcomed the 1978 Alma-Ata Declaration on Primary Health Care and the 'Health for all by 2000' call (100). A prominent programme that reflected an inter-sectoral and community participation approach was the 'development through cooperation' (*Ediget be Hibiret zemetcha*) campaigns implemented between 1978 and 1985. In this programme, the government sent final-year high school and university students to remote areas to carry out development campaigns. Although the campaigns' scope was much more comprehensive, the students were actively involved in various health programmes, ranging from the construction of health facilities, communal solid waste disposal pits and latrines to traditional birth attendance and health education. The number of health stations tripled from 650 to 1,950. The number of health centres increased from 93 to 145 (96, 98, 99).

The 'development through cooperation' programme contributed to increased health awareness and utilisation of health services. It had little impact in terms of strengthening community health more broadly. The ideals of community participation, a vital feature of the PHC strategy, were undermined by the regime's authoritarian structure and the coercive nature of the government's interventions. Therefore, the implementation of PHC policies was mostly unsuccessful in Ethiopia, mainly because the specific elements of the PHC strategies were not clearly defined at the national level, and administrators of provinces' health departments and experts at health facilities had limited awareness of those elements as defined at the national level (98-100).

In 1984, the MOH launched an ambitious 10-year Perspective Health Plan (1984/85 to 1993/94) (101). In this plan, a six-tiered health system was introduced with a network of community health services (health posts) at the base, health stations (clinics) at the second

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[6] Asmara is no longer a part of Ethiopia after the secession of Eritrea from Ethiopia in 1993 by referendum.

level, health centres at the third level, rural hospitals at the fourth level, regional hospitals at the fifth level and central referral and teaching hospitals at the top (98-100).

The 10-year Perspective Health Plan was targeted to extend access to health services to 80% of the population, reduce the infant mortality rate from 155/1,000 to 95/1,000, reduce the crude mortality ratio from 247/1,000 to 95/1,000, improve life expectancy at birth from 42 years to 55 years and increase the number of health professionals.[7]

After the Derg regime was overthrown in May 1991, the Transitional Government of Ethiopia (TGE) was immediately established. The TGE ratified a new health policy in September 1993 that has 10 basic components, eight priority areas and 17 general strategies. This policy's fundamental motto is 'prevention is better than cure', and it highly emphasises the importance of health promotion and disease prevention. This policy's core principles are democratisation, decentralisation, collaboration and promoting the private sector's involvement in health service delivery. This policy is still the active health policy of Ethiopia.[8] To translate this policy into action, a 20-year health sector development plan (HSDP) was formulated in 1997.

The HSDP was in place from 1997 to 2015 and was implemented as four successive five-year plans (HSDP I–HSDP IV). While HSDP I, HSDP II and HSDP III were aligned with the overall government Plan for Accelerated and Sustained Development to End Poverty (PASDEP) at the national level and the MDGs at the global level, HSDP IV was aligned with the national Growth and Transformation Plan I (GTP I) at the national level (Figure 4). Notable achievements during the HSDP period include, but are not limited to, the accelerated expansion of health infrastructure, the institutionalisation of the health extension programme (2003), the defining of the EHSP (2005) and the accelerated

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[7] The plan was to increase all medical doctors from 721 to 2,000, specialists from 349 to 819, nurses from 1,960 to 5,498, sanitarians from 298 to 1,962, laboratory technicians from 425 to 1,209 and health assistants from 6,991 to 13,500.

[8] The revision of the health policy was initiated in 2015.

expansion of human resources for health (102-105). Figure 4 outlines significant developments and events in the Ethiopian health system as of 1993.
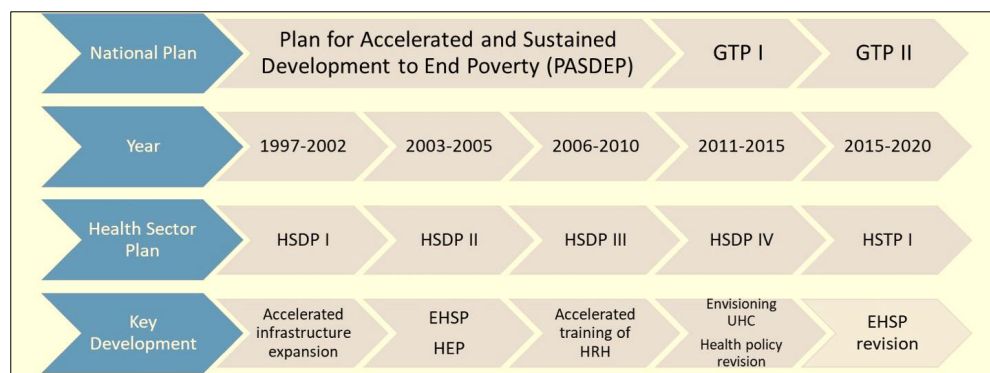
Figure 4. Overview of the Ethiopian health system (1993–2020) (Source: Compiled by the author). GTP = Growth and Transformation Plan; HSDP = health sector development plan; HEP = health extension programme; HRH = Human Resources for Health; UHC = universal health coverage; EHSP = essential health services package.

In summary, despite all the remarkable results in the country in the past 100 years, the people of Ethiopia are still suffering from a massive burden of diseases from communicable, maternal, neonatal and nutritional disorders (CMNND). The magnitude of NCDs and injuries is rising, and both the coverage of essential health services and health service utilisation are low (106). There is also high catastrophic out-of-pocket health spending for health in Ethiopia (107-109).

1.6.2 Overview of the Ethiopian health system during HSTP I

In the HSTP I period, Ethiopia has been expanding health service coverage to mental health, NCDs and injury beyond the communicable disease and maternal and child health programmes. The HSTP period is 2015–2020 (110).

Health status

Ethiopia has undertaken significant efforts in improving the health of its people. There has been a remarkable result registered in terms of reducing morbidity and mortality (111). Ethiopia's life expectancy improved from 38 in 1960 to 47.1 in 1990, 65 in 2015 and 66.2

in 2018 (112). Maternal mortality declined substantially from 676 per 100,000 live births in 2011 to 420 in 2016. Modern family planning methods utilisation increased from 6% in 2000 to 35% in 2016. Demand for family planning increased from 45% to 58% in the same period (113). Similarly, the morbidity and mortality of IDs, such as HIV/AIDS, TB and malaria, has markedly decreased in the past decades (113, 114). However, Ethiopia is one of the countries with a high disease burden, even compared with other low-income countries, with an age-standardised DALY loss of 47,099 per 100,000 population in 2017. CMNNDs represent the highest disease burden, accounting for 58% of the DALY loss. In the same year, while NCDs, such as cardiovascular diseases, diabetes and cancer, accounted for 34% of the total DALY loss, injuries accounted for about 8% of the total (115).

Health service delivery

Ethiopian health service delivery is organised in a three-tier health care system. In general, the primary level of care comprises a primary hospital (covering 60,000–100,000 people), health centres (covering 25,000–40,000 people) and their five satellite health posts (covering 3,000–5,000 people). The secondary level of care consists of a general hospital, covering a population of 1.0–1.5 million, while the tertiary level of care consists of a specialised hospital serving 3.5–5.0 million people. Each level of care is connected to the next level through a referral linkage mechanism (Figure 5).
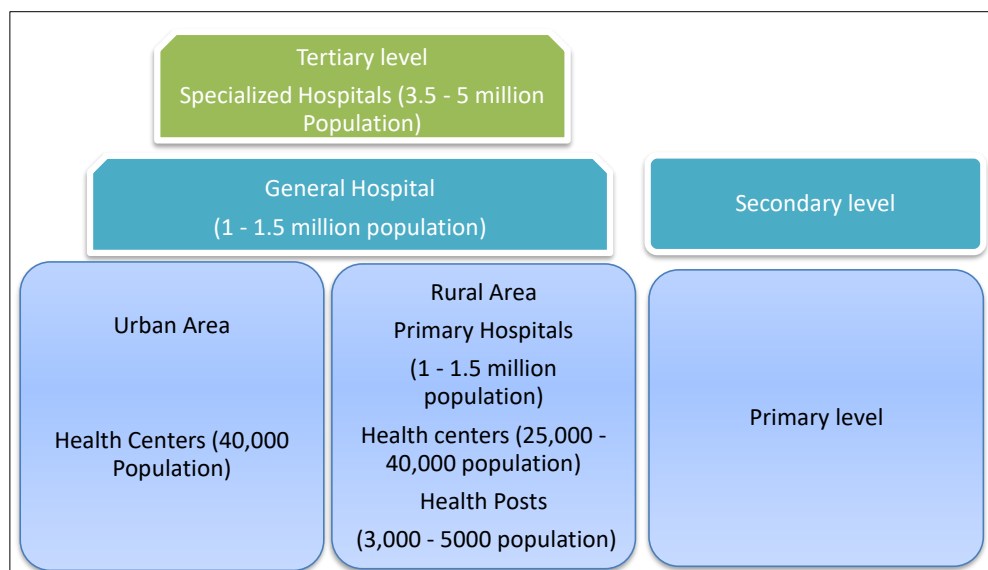
Figure 5. The Ethiopian three-tier health system (Source: HSTP 2015).

Health workforce

The availability of a sufficient health workforce with the right skill mix is critical to the achievement of UHC in any country. Despite the efforts made in the past 20 years to increase the number of low- and mid-level health professionals in Ethiopia, the country is known for having a very small health workforce by any standard. For instance, the health workforce density index, which is measured by the sum of skilled health professionals (health officers, medical doctors, nurses and midwives) per 10,000 population, is 0.96 while the figure is 2.2 for the rest of Africa, and the WHO recommendation is 4.45 if a country is to meet the SDG health targets (116-120).

Health information systems

Accurate, reliable and timely information is vital in effectively leading the health system with the right evidence. By the end of 2013, a health management information system (HMIS) had been implemented in 98% of public hospitals and 87% of health centres. Additionally, over 60% of facilities employed a full-time HMIS focal person, which

improved the completeness and timeliness of health reports (121). Subsequently, Ethiopia introduced a new district (woreda) -based planning process that utilises the facility-level data now available via the HMIS to plan future spending and management according to facility-specific needs (122).

Health financing

The government of Ethiopia has implemented several strategies, including the provision of high-impact interventions free of charge through an exemptions programme, subsidisation of more than 80% of the cost of care in government health facilities, implementation of community based health insurance (CBHI) schemes and full subsidisation of the very poor through fee waivers for both health services and CBHI premiums (123-125). Despite these efforts, direct household payment to facilities during service use remains unacceptably high. According to National Health Account 7, out-of-pocket spending on health amounted to 31% of total health expenditure (THE) in 2016/17, considerably higher than the global recommended target of 20% (107). A significant proportion of households (4.2%) face the effect of CHEs (108).

Ethiopia's THE was estimated at ETB72 billion (US$3.1 billion) in 2016/17, accounting for 4.2% of the country's gross domestic product (GDP). The THE has grown steadily since 1995/96. It grew by 45% from ETB49.6 billion in 2013/14 to ETB72.1 billion in 2016/17 (107). However, this growth was 15% in real terms after adjusting for inflation. Furthermore, the GDP share is lower than the expected average of 5% for low-income countries and below the global average of 9.2% (107).

The share of government contribution to THE was 32% in 2016/17, only slightly higher than the 30% contribution in 2013/14. The share of government health expenditure was 1.4% of GDP in 2016/17, lower than the low-income country average of 1.9% for the same year (107). PHC providers, including primary hospitals, health centres and health posts, received more than 61% of total government recurrent expenditure. Seventy percent of Ethiopia's government health spending goes to infectious/parasitic diseases, reproductive

health and nutritional deficiencies. The average health expenditure per capita is US$33 as compared to a regional average of US$38 (107).

Health system governance

The health governance system in Ethiopia is a mirror of the broader political system of the country. The MOH is mandated to formulate policies, strategies and standards in consultation with regional health bureaus (RHBs). The RHBs focus mostly on the implementation of programmes and projects and developing directives and manuals. Therefore, the MOH is responsible for developing the national health policy and defining the EHSP and health sector transformation plans. The Executive Committee (EC) at the MOH level is the highest decision-making body in the health sector at the federal level (105, 110).

The governance and decision-making roles are decentralised at various levels from national to RHBs and from regions to district health offices. For instance, the Joint Steering Committee (JSC) is a forum that brings together critical policymakers at the federal and regional level. The minister of health chairs the JSC meeting, and the participants include the state ministers of health, RHB heads, deputy RHB heads and the heads of departments/services of the MOH and the RHBs. The JSC meets every two months (105, 110).

Another national-level governance structure is the Joint Consultative Forum (JCF). The JCF is the highest governance body that decides, guides, oversees and facilitates the implementation of strategic plans in the health sector. It also serves as a dialogue and consultation forum on the overall policy direction, reform and institutional issues of the health sector between the government, development partners and other stakeholders. The MOH chairs the JCF. Its members include high-level representatives of the relevant federal government bodies, representatives of multilateral and bilateral development partners and non-governmental organisations (NGOs) that work on health and nutrition and representatives of the private sector and health professionals' associations. There is also the

Joint Core Coordinating Committee (JCCC), which is a technical arm of the JCF. The JCCC mainly support the JCF on technical issues, such as coordination, implementation, evidence generation and evaluation (105). Furthermore, the governance system comprises consultation forums that facilitate collaborative decision-making processes with stakeholders, such as all citizens, NGOs and development partners (105, 110).

1.7 Recent efforts to progress towards UHC in Ethiopia

There is strong political commitment and aspiration in the Ethiopian government to achieving UHC (110). In the past decades, several efforts to progress towards UHC in Ethiopia have been made. I will describe two prominent recent cases that indicate the commitment of the government to UHC. The first prominent progress towards UHC happened in 2015 when, considering the country's national goal to reach lower–middle-income status by 2025 and upper–middle-income status by 2035, the federal MOH conducted an 'envisioning exercise for the health sector' (126). The envisioning team analysed the experiences of various poorly and well-performing middle-income countries and produced a strategy to guide Ethiopia's progress towards UHC, entitled *Envisioning Ethiopia's path towards universal health coverage through strengthening primary health care* (126, 127). The strategies include defining the EHSP of the country, identifying priority health interventions, deciding on the payment mechanism (exempting or cost-sharing) for high-priority interventions and increasing domestic resource mobilisation, including the expansion of CBHI and social health insurance programmes (126, 127).

The other prominent action on the path towards UHC in Ethiopia was that the MOH clearly articulated the priorities on which the Ethiopian government wants to focus to facilitate progress towards UHC: (1) defining a cost-effective package of essential health benefits available to all; (2) developing investment plans for the physical and human infrastructure needed to deliver benefits; (3) developing a national health financing system; (4) developing integrated multi-sectoral planning and implementation of health and non-health interventions at the district level (128). Additionally, the establishment of the health

insurance agency and the formulation of new health care financing strategies to alleviate financing and service delivery challenges can be mentioned to indicate the Ethiopian government's commitment to progress towards UHC (129).

1.8 The rationale for the revision of the Ethiopian EHSP

Changes in health care demand, epidemiologic and demographic transitions and economic growth were the main justifications for revising the 2005 Ethiopian EHSP. The Ethiopian government has conducted successive reforms based on the country's formulation of health policy. First, the 20-year strategic plan named HSDP, implemented in four phases, was developed; each phase had a five-year implementation period. In the implementation of HSDP I, there was a gap at the grassroots level, and it was recommended to train community health workers; a health extension programme was launched by the year 2003. The Ethiopian Health Extension Programme (HEP) was an innovative programme that resulted in remarkable improvement in the rural population's health status by using a community-based approach delivered by health extension workers. Because of the HEP, the public's awareness of health and hygiene has substantially increased, contributing to increased health-seeking behaviour and health service demand (130).

Second, selecting high-impact interventions was mandatory, and the 2005 EHSP was defined. Since 2005, the country's epidemiologic and socioeconomic profile has substantially changed in many ways. Life expectancy has greatly increased. The incidence of NCDs and injuries has increased. For instance, the 2017 GBD study shows that NCDs and injuries account for 33% and 8% of the disease burden in Ethiopia, respectively[9]. However, the 2005 EHSP and the entire health sector were configured around managing communicable diseases, RMNCH and vaccine-preventable diseases, giving less emphasis to NCDs. Therefore, revising the health service package to address the whole range of health issues and all age groups was necessary.

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[9] http://www.healthdata.org/ethiopia

There has been remarkable economic growth in Ethiopia in the past 15 years. For example, over the past 10 years, the annual growth rate has been 10.9%. The GDP per capita has increased from US$163 in 2005 to US$953 in 2019 (91). This resulted in increased health care resources and the public's ability to pay for health services. Additionally, economic growth, especially initially, may lead to lifestyle changes that may increase NCDs. Therefore, a health care package that matches the economic capacity of the country is vital.

Additionally, Ethiopia, like all other UN member states, by signing on to the SDGs, has committed to achieving UHC by 2030. This reinforces the imperative that health services needing to be delivered 'universally' must be identified. Therefore, the need was highly critical for a new health benefits package that would fit the country's socioeconomic, epidemiologic and demographic situation; explicitly identify included interventions based on evidence; and accommodate the current global context (i.e., the SDGs).

Furthermore, in the past 15 years, several new health interventions were included in the Ethiopian health system without thorough examination of their merits. Rolling out new health interventions in a system without a clear understanding of their added value may lead not only to the inclusion of inappropriate interventions but also to excluding vital health interventions. Therefore, a consensus was reached to revise the EHSP in 2016, preparatory work was conducted in 2017 and the revision was conducted in 2018 and 2019.

1.9 Rationales of the studies

For the successful revision of an EHSP, a candid examination of the country's health status, a clear framework, evidence for priority setting and a strong political will to make necessary change were critical elements. However, when the work on this thesis started, the available evidence in these regards was minimal. Therefore, understanding Ethiopia's baseline UHC coverage was vital to devising an appropriate EHSP and later monitoring the package's implementation. Furthermore, only a few studies were available that measured Ethiopia's UHC service coverage status (86-88). A study by WHO found a 39% coverage for Ethiopia

(86). However, this WHO study did not provide a subnational service coverage status and employed only limited sets of indicators.

Regarding priority setting for UHC-type reform, except for a few theoretical guides that describe how to conduct benefits-package revision, no practical guidance was available that could inform policymakers in LMICs. Besides, most EHSP reports from other LMICs did not provide an adequate description of the methods employed, the process followed or the interventions incorporated, and that information is relevant for transparency and replicability purposes (131-146).

After identifying potentially relevant interventions, large sets of evidence were needed to compare the merits and demerits of each of the interventions based on selected criteria in the revision of the EHSP.[10] As CEA is seen to be a critical priority-setting criterion, cost-effectiveness evidence is a central element in comparing interventions. However, only some studies had been published on the cost-effectiveness evaluation of health interventions in Ethiopia (147), and the limited available evidence was mainly produced using incremental CEA (148-151). Therefore, we identified critical gaps in knowledge in three unique but interlinked areas: First, we estimated the baseline UHC service coverage for Ethiopia. Second, we generated cost-effectiveness evidence for large sets of interventions. Finally, we synthesised the methods and key findings of the Ethiopian EHSP revision process.

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[10] The evidence needed is described in detail in section 1.3.

Chapter 2. Objectives

2.1 General objective

This study aimed to estimate the UHC status of Ethiopia, generate relevant cost-effectiveness evidence and describe the process of defining an EHSP for the country.

2.2 Specific objectives

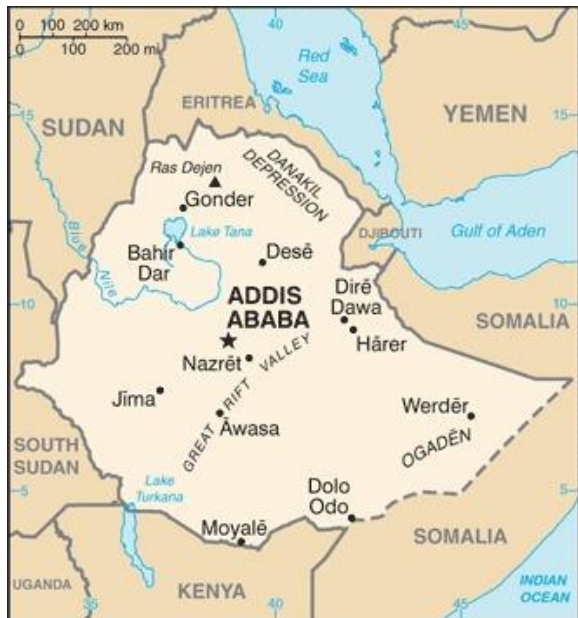1. To estimate the 2015 national and subnational UHC service status for Ethiopia (Paper I)
2. To generate average cost-effectiveness evidence (ACERs) for relevant health interventions using WHO's generalised cost-effectiveness approach to revise Ethiopia's EHSP (Paper II)
3. To describe the revision process, key methodology, stakeholders' and experts' involvement and the most important features of the new Ethiopian EHSP (Paper III)

Chapter 3. Methods

This thesis consists of three studies (Papers I–III). Each of the studies is linked to specific objectives presented in Chapter 2. This section first provides a general overview of the study site (Ethiopia) and the study period. I then present a summary of the study design, data and analytic approaches of Papers I and II. Furthermore, I briefly present the priority-setting methods of the Ethiopian EHSP, including the road map, team organisation, scope, identification of candidate interventions and evidence synthesis. A detailed description of the methodology is provided in each of the published articles (Annexe 1).

3.1 Study site and settings

The studies in this thesis were conducted in Ethiopia. To understand either the Ethiopian health system or its implications for UHC in the country, some information about its demographic, social, economic and political background is essential. Ethiopia is in located in the eastern part of Africa. Sudan and South Sudan bound Ethiopia to the west, Eritrea and Djibouti to the northeast, Somalia to the east and southeast and Kenya to the south. The country occupies an area of 1.1 million square kilometres. More than half the country's geographic area lies above 1,500 m above sea level; the highest altitude, at Ras Dashen, is

Ethiopia Map (Source: CIA world fact book)

4,620 m above sea level and the lowest altitude, at the Dallol Depression, is 130 m below

sea level (152). Ethiopia is a federal state organised into 10 regional states and two chartered cities, Addis Ababa (the capital) and Dire Dawa (another city in the eastern part).

Ethiopia is the second-most populous country in Africa after Nigeria, with about 110 million people (152). The population is characterised by rapid growth (2.6%), a young age structure and a high dependency ratio. In 2016, the total fertility rate (TFR) in Ethiopia was 4.6 births per woman (2.3 in urban areas and 5.2 in rural areas), and the crude birth rate was 32 per 1,000 population. The average household size was 4.6 (153).

Although the Ethiopian economy has been growing fast over the past two decades, the country is still one of the low-income countries in the world, with a GDP of US$953 per capita in 2019 (91). The country aspires to attain lower–middle-income country status by 2025 (154, 155). The economy in Ethiopia is predominantly dependent on agriculture, which accounts for 34% of GDP. Over two decades, although the total per capita spending on health increased eightfold (from US$4.00 in 1995 to US$33.20 in 2016/17), the country's THE remained low compared to that of other countries in Africa. The THE in 2016/17 was only US$3.1 billion, accounting for 4.2% of GDP (107). Furthermore, the recent Covid-19 pandemic has substantially affected the economy (156).

Ethiopia has substantially progressed towards achieving the MDGs, particularly in hunger, gender parity in primary education, child mortality, HIV/AIDS and malaria. Between 2000 and 2017, Ethiopia's Human Development Index value increased from 0.283 to 0.463,[11] an increase of 63.5% yet below the average of 0.504 (153). Improving access to health services has been one of the primary agendas during HSDP and HSTP. As a result, noticeable improvements have been achieved in various dimensions of access to health and health-related services (113).

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[11] http://hdr.undp.org/en/countries/profiles/ETH

3.2 Study period

The overall study period of this research was from April 2018 through November 2019. Inception meetings were held from May through August 2018 to develop a road map and launch the EHSP revision work. These inception meetings aimed to define the end goals, set the scope of the revised EHSP and establish a common understanding among all stakeholders for the revision process. As a result, a detailed EHSP preparation plan was presented at these inception meetings, and an agreement was reached with the stakeholders about the goals and scope of the EHSP. The final EHSP was launched on November 19, 2019 (Table 1).

Table 1. Timeline of the studies in this thesis.

Time	2018 Apr–Jun	2018 Jul–Sep	2018 Oct–Dec	2019 Jan–Mar	2019 Apr–Jun	2019 Jul–Sep	2019 Oct–Dec
Paper I	Data collected	Analysis and write-up					
Paper II				GCEA training	Cost data collected for GCEA	Analysis and write-up	
Paper III	Core team established	Technical working group organised; EHSP revision road map prepared and approved	Intervention-listing workshops held	Evaluation and evidence synthesis	Costing and fiscal space estimation		Final EHSP launched

3.3 Study design and data

There are three prominent designs employed to measure countries' progress towards UHC (86-88). The approach proposed by WHO/WB was employed in Paper I (86). Because this approach has been utilised in various countries recently, it is an excellent design for making a multi-country comparison. However, this approach measures only UHC contact coverage (not effective coverage). Various data sources were used in Paper I. The author used the HMIS, the 2016 Ethiopian Demographic and Health Survey (EDHS), the 2015 Malaria Indicator Survey (MIS), the NCD STEPS survey and the Service Availability and Readiness Assessment (SARA) survey (113, 157, 158).

There are two principle CEA approaches (i.e., incremental CEA and GCEA). In Paper II, we employed a GCEA approach to generate ACERs for 159 health intervention. The analysis was done from the health systems' perspective. The cost information was identified and measured systematically from various departments and agencies of the MOH. For example, the cost of drugs and supplies was obtained from the Ethiopian Pharmaceutical Supply Agency, and the cost of human resource was obtained from the Human Resources for Health (HRH) department. The international drug price database of Management Sciences for Health was also used for some of the costs of drugs and supplies.

Data on the effectiveness of the health benefits of the interventions were estimated by applying various integrated impact-models of the latest version of Spectrum software. We applied the DemProj module to estimate the projected population growth and basic demographic parameters. The FamPlan module estimated family planning interventions. The AIDS Impact module estimated the impact of HIV interventions, and the impact of TB interventions was estimated using the TB Impact module. The LiST module was used to estimate the benefit of nutrition, RMNCH and water, sanitation and hygiene (WASH) interventions, and the impact of NCD policy interventions and other NCD interventions was estimated using the NCD Impact module. We modified the input data from the WHO-CHOICE GCEA tool to the local context whenever necessary.

In the third paper (Paper III), which synthesises the methods, process and significant features of the revised Ethiopian EHSP, various study designs and data sources were used. In general, a sector-wide (comprehensive) analysis of health interventions using both qualitative and quantitative criteria for priority setting was employed. An EDP was also employed. I co-led and coordinated the whole of the revision process.

3.4 The EHSP revision process

Road map and organisation

The first step in defining Ethiopian's EHSP was organising a team and defining the revised package's scope. The revision team consisted of a core team and a technical working group

(TWG). The core team comprised a health systems specialist, epidemiologist and health economist while the TWG consisted of about 30 senior experts on various health system dimensions. The core team's responsibilities were to redefine EHSPs, including developing a prioritisation protocol, collecting data, synthesising evidence, engaging stakeholders and analysing costing and the fiscal space. In comparison, the responsibilities of the TWG were to support the core team in the development of the revision road map and the process of revising the package. Consequently, a road map of the revision process and the methods to be used was developed, presented to the policymakers and approved by the EC of the MOH (Figure 6).
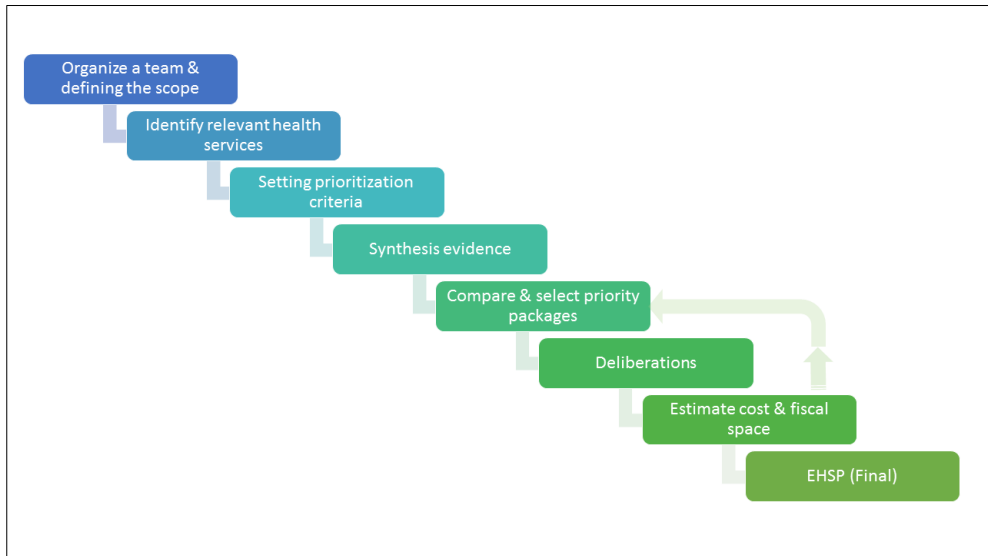
Figure 6. Road map for the revision of the Ethiopian EHSP.

Scope of EHSP

The national health policy and the country's SDG-UHC commitment were the bases for defining the revision's scope. The scope addresses four crucial elements of the EHSP. First, it was designed to address the Ethiopian population's health needs across the whole life course regardless of income, gender or residence (urban/rural). Second, it was designed to be delivered at all service levels (i.e., primary, secondary and tertiary). Third, the package

was designed to serve for five years (2020–2025). Fourth, it was to include promotive, preventive, curative and rehabilitative interventions.

Identification of relevant health interventions

To prepare a complete list of interventions, we searched the national health sector plan, strategies and national publications along with reviews of the WHO intervention compendium (forthcoming)[12] and the DCP-3.[13] Subsequently, we held a two-day workshop with eight subject matter experts from various programme areas, PHC practitioners, doctors and specialists, and they proposed all health services relevant to the Ethiopian context to identify additional interventions. In this step, we identified all health intervention components, including the promotive, preventive, curative and rehabilitative interventions relevant to Ethiopia.

Setting prioritisation criteria

Based on the data, dialogue and decision, we set our prioritisation criteria. Our approach was first to review the literature, national health policy documents and relevant strategic health sector documents. Additionally, we considered the criteria for the prioritisation of health services recommended by WHO's Consultative Group on Equity and Universal Health Coverage, including maximising the total health gains for a given investment, giving priority to health services that target or benefit the less fortunate and providing FRP, particularly to the poor (11). We held 10 consultative and deliberative meetings with global and local experts, public representatives and professional associations on the proposed criteria. Finally, seven prioritisation criteria were selected, namely the burden of disease, cost effectiveness, equity, FRP, budget impact, public acceptability and political acceptability.

For the evidence synthesis, we included a comprehensive list of interventions (1,749) that resulted from the intervention listing exercise. We cleaned the original (1,749) list of

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[12] https://www.who.int/universal-health-coverage/compendium
[13] http://dcp-3.org/

interventions to avoid duplication and got a list of 1,442 interventions. We invited various directorates of the MOH and subject matter experts to comment on the list of interventions. We further compared the interventions with the burden of disease and risk factors of the country. After we removed interventions unmatched by the burden of disease or not relevant in the Ethiopian setting, the number of interventions was reduced to 1,223. Finally, another regrouping and reorganising of health interventions yielded 1,018 interventions ready for evaluation and comparison based on the other criteria.

3.5 Analytic approaches

We used geometric means to estimate the national and subnational coverage of UHC for the country in Paper I. We analysed the service coverage for each programme area. We estimated the overall UHC service coverage for the country (national and subnational level). One-way sensitivity analysis was also done to determine how the overall UHC service coverage index would change because of a change in analysis approach or tracer indicators. For instance, we computed the UHC index using the arithmetic mean in place of geometric means to determine the analysis approach's effect on the overall UHC index. We also did a sensitivity analysis by reducing one indicator at a time, first removing the health service capacity and access variable and then removing the entire 'health service and capacity' component.

In Paper II, an intervention's ACER was computed as a ratio of the intervention's total cost to total healthy life years (HLYs) gained from the intervention. A 100-year time horizon was used. Both costs and health benefits were discounted at an annual rate of 3%. All ACERs were reported in 2019 US$ per HLY (37).

For Paper III, inputs from CEA, equity analysis, costing and budget impact analysis and fiscal space analysis were employed. A sector-wide CEA integrated ACERs for 144 intervention from Paper II, 382 interventions from the literature search and others using expert judgement for priority setting. CEA for sector-wide priority setting was limited in many other settings because of a lack of sufficient data.

The interventions were first ranked according to cost effectiveness and then adjusted if the interventions had a high equity score and FRP score. The scores for equity impact and FRP were assigned through the Delphi process with input from subject matter experts, professional associations and public representatives. The budget impact and the number of interventions a health system needs can depend on the number of individuals in need and the intervention coverage. We estimated the population in need using the total number of individuals affected by the condition and the proportion of those who needed the intervention. Finally, the core team undertaking the evaluation presented the full results to policymakers at the MOH to discuss whether to include or exclude specific interventions before final approval. The EC of the MOH, the highest level decision-making body in the sector, took the final decision (Figure 7).

Analytic & evidence synthesis for prioritization in the Ethiopian EHSP, 2019

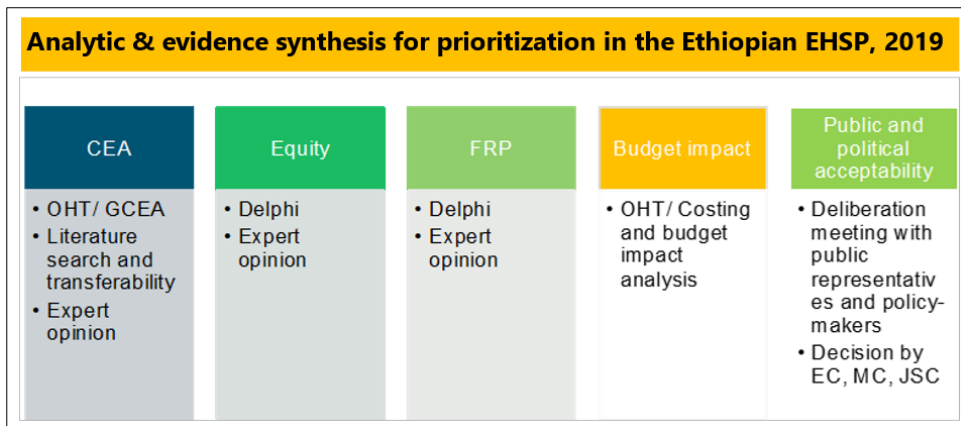| CEA	Equity	FRP	Budget impact	Public and political acceptability
• OHT/ GCEA • Literature search and transferability • Expert opinion	• Delphi • Expert opinion	• Delphi • Expert opinion	• OHT/ Costing and budget impact analysis	• Deliberation meeting with public representatives and policy-makers • Decision by EC, MC, JSC

Figure 7. Evidence synthesis for the revision of the Ethiopian EHSP.

No predefined cost-effectiveness thresholds were used in Paper II or Paper III. In Paper II, we ranked the interventions based on their ACERs. In Paper III, the ACERs were used as input to rank interventions while additional information on equity and FRP informed the final ranking.

STATA (Papers I, II and III), MS Excel (Papers I, II and III) and the OneHealth tool (OHT) (Paper II) were used for data management and analysis. Table 2 presents the major statistical techniques and data sources employed in this thesis.

Table 2. Summary of analytic approaches and data sources employed in this thesis.

Paper	Analytic approaches employed	Data sources
Paper I	Geometric mean, principal component analysis	HMIS, EDHS 2016, the 2015 MIS, NCD STEPS survey, HRIS, administrative records, SARA (113, 157, 158)
Paper II	GCEA, costing, intervention impact modelling	HRH, EPSA, international drug price database (MSH), various integrated impact models of the latest version of Spectrum software
Paper III	GCEA, literature review for CEA, Delphi process for equity and FRP, costing and fiscal space analysis for budget impact analysis	Results from Paper II, literature search, expert opinion

HMIS = Health Management Information System; EDHS = Ethiopian Demographic and Health Survey; MIS = Malaria Indicator Survey; NCD STEPS Survey = Noncommunicable Disease STEPwise approach to Surveillance; HRIS = Human Resource Information System; SARA = Service Availability and Readiness Assessment; EPSA = Ethiopian Pharmaceutical Supply Agency

3.6 Ethical considerations

This study complied with all basic recommended national and international research ethics standards (159). The principal investigators and all the research team strictly followed the research ethics standards in Ethiopia and Norway. This study was approved by the Institutional Review Board of the Ethiopian Public Health Institute (Ref: EPHI/6.13/607). Furthermore, we obtained an official letter of permission from the Ethiopian federal MOH. This study did not involve any individual-level data or sensitive patient information.

Chapter 4. Results

4.1 UHC service coverage for Ethiopia (Paper I)

We aimed to estimate the national and subnational UHC service coverage, which we used as a baseline to revise the EHSP of Ethiopia. Additionally, we aimed to determine the regional variation as well as the variations among programme areas.

The Ethiopian national UHC service coverage for 2015 was 34%, with substantial variation across regions and programme areas. For example, the overall coverage varied across regions, ranging from 52% in Addis Ababa to 10% in the Afar region. The coverage also varied across the programme areas, ranging from 20% for service capacity and access to 53% for ID (Figure 8). There was also variation within the programme areas. For example, in the RMNCH programme area, while the service coverage for the immunisation sub-programme was 53%, it was only 30% for the pregnancy care sub-programme. In the NCD programme area, the variation was wider, ranging from 3% for cervical screening to nearly 100% for the management of diabetes (Table 3).

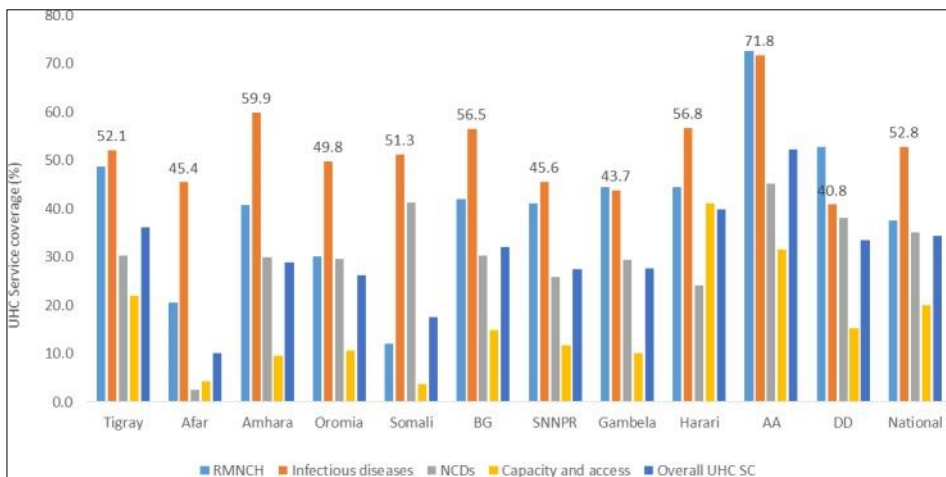Figure 8. UHC service coverage indicators by region and programme area, Ethiopia, 2015.

The sensitivity analysis indicated that the index was sensitive to the selected analysis method and the tracer indicators. When we used the arithmetic mean, the UHC index

increased to 48%. The UHC index was 41% when we removed the 'health service and capacity' element and 30% when we removed the 'health security' element.

Table 3: Regional and national summary of UHC service coverage, Ethiopia, 2015.

Tracer indicator	Tigray	Afar	Amhara	Oromia	Somali	BG	SNNPR	Gambela	Harari	AA	DD	National
RMNCH												
Family planning	35.2	11.6	46.9	28.1	1.4	28.4	39.6	34.9	29.3	50.1	29.1	35.3
Pregnancy care	57.9	18.4	29.5	20.9	15.4	34.7	33.1	45.1	42.3	92.9	61.2	29.8
Immunisation	81.4	20.1	63.8	39.9	36.3	76.2	59.0	54.8	58.7	95.7	84.9	53.2
Child treatment	34.1	41.3	31.4	35.0	26.8	41.6	36.7	45.0	53.8	62.5	51.2	35.3
UHC–RMNCH	48.8	20.5	40.8	30.1	12.0	42.0	41.0	44.4	44.5	72.6	52.7	37.5
Infectious diseases												
Tuberculosis treatment	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6
HIV treatment	59.9	37.5	62.8	49.1	82.3	67.8	38.9	23.8	77.2	67.8	62.1	55.0
Malaria prevention	40.4	50.6	43.4	41.0	37.7	40.3	35.5	42.3	71.0	N/A	15.6	39.7
Improved water and sanitation	51.2	37.7	79.0	51.1	37.4	62.5	52.5	61.0	31.8	91.7	48.2	59.9
UHC–ID	52.1	45.4	59.9	49.8	51.3	56.5	45.6	43.7	56.8	71.8	40.8	52.8
Noncommunicable diseases												
Treatment of CVD	70.8	58.5	55.6	61.6	69.0	62.0	48.4	66.3	62.6	40.7	75.2	58.2
Management of diabetes	100.0	100.0	93.6	100.0	74.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cervical cancer screening	1.2	0.0	1.6	1.4	8.0	1.5	1.0	2.0	0.8	11.0	3.7	2.9
Tobacco control	99.6	81.2	96.4	88.8	71.0	89.6	92.8	56.0	67.2	93.2	75.8	89.2
UHC–NCD	30.3	2.6	29.9	29.6	41.3	30.2	25.9	29.4	24.1	45.2	38.1	35.0
Service capacity and access												
Hospital access	26.1	4.5	9.4	13.4	2.3	15.3	10.9	23.7	81.8	35.7	44.3	13.1
Health worker density	8.0	0.4	1.6	1.7	0.4	5.9	2.8	1.4	19.7	15.0	1.6	3.1
Access to essential medicines	51.2	41.2	57.6	52.4	54.2	36.4	52.8	31.1	43.2	58.8	49.8	50.8
Health security	Na	Na	Na	Na	Na	Na	Na	Na	Na	Na	Na	78.0
UHC–SCA	22.0	4.2	9.5	10.6	3.7	14.9	11.7	10.1	41.1	31.6	15.2	20.0
Overall UHC index	36.1	10.0	28.9	26.2	17.5	32.1	27.5	27.5	39.8	52.2	33.4	34.3

[1] AA = Addis Ababa; BG = Benshangul Gumuze; DD = Dire Dawa; SNNPR = Southern Nations and National Region

4.2 Generating cost-effectiveness evidence (Paper II)

In Paper II, we aimed to generate the average cost-effectiveness evidence (ACERs) for relevant health interventions using the WHO generalised cost-effectiveness approach in the revision of Ethiopia's EHSP.

We produced ACERs for 159 EHSP interventions. We categorised the results by using US$100, US$500 and US$1,000. Based on this analysis, we found that 58 (37%) of the interventions had an ACER of less than US$100 per HLY, 104 (65%) had an ACER of less than US$500 per HLY and 119 (75%) had an ACER of less than US$1,000 per HLY gained. The majority of RMNCH and communicable disease interventions had an ACER of less than US$1,000 per HLY in this analysis (i.e., 97% of RMNCH, 100% of HIV, 100% of TB and 40% of malaria interventions) (Table 4) while 44% of NCD interventions had an ACER of less than US$1,000 per HLY.

The ACER for RMNCH interventions ranged from less than 1US$/HLY for family planning to US$1,591/HLY for zinc supplementation. The ACER of HIV/AIDS interventions ranged from US$13/HLY for anti-retroviral therapy for adult women to US$403/HLY for cotrimoxazole for children. The two most cost-effective malaria interventions among the four we evaluated in this study were insecticide-treated nets and indoor residual spraying, with ACERs of US$79/HLY and US$40/HLY, respectively. In contrast, the two least cost-effective interventions for malaria were intermittent preventive therapy for pregnant women and treatment of malaria for pregnant women with ACERs of US$1,310/HLY and US$1,469/HLY, respectively. In this study, we evaluated 10 TB interventions, and all the interventions were very cost effective, with ACERs ranging from US$129/HLY to US$163/HLY. The ACERs for NCD policy interventions ranged from US$26/HLY for reduction of salt intake by involving industries in reformulation to US$9,115/HLY for prevention of hazardous alcohol use using legal enforcement to restrict alcohol advertising.

Table 4. Summary of ACERs of the interventions by sub-programme (US$ per HLY).

Sub-programme	Mean	<US$ 1,000	Median	Min	Max
HIV/AIDS	106	100%	34	13	403
RMNCH	116	97%	37	0.4	1,591
WASH	122	100%	16	5	451
Tuberculosis	143	100%	139	129	163
Nutrition	262	100%	72	31	746
Cervical cancer	870	77%	111	34	6,534
Mental health	1,045	75%	185	31	7,610
Malaria	1,163	40%	1,310	40	2,915
NCD policy interventions	1,834	69%	437	26	9,115
Breast cancer	2,157	20%	1,535	366	6,104
Chronic respiratory diseases	2,307	50%	809	164	8,856
Colorectal cancer	3,920	18%	4,646	783	5,602
Overall	1,014	75%	151	0.4	9,115

4.3 Ethiopian revised EHSP (Paper III)

We aimed to synthesise and describe the revision process and key features (components, priorities, delivery level and payment mechanism) of the revised EHSP. The EHSP is a set of affordable promotive, preventive, curative and rehabilitative priority health interventions provided at all service delivery levels in an equitable, acceptable and sustainable manner on the path towards UHC.

4.3.1 Key features of the EHSP

Major programme areas and interventions

The pre-agreed and predefined prioritisation criteria were used to evaluate the final list of interventions (1,018). The analysis results were categorised in nine major programme areas as shown in the below table. RMNCH accounts for 33%, NCD for 21%, surgical and injury care for 18% and the rest of the percentage was for multi-sectoral nutrition interventions,

major communicable diseases, health education and behavioural change communication (BCC), emergency and critical care, neglected tropical diseases (NTDs) and hygiene and environmental health services (Table 5).

Table 5. Interventions by major programme area.

Major programme areas and sub-programme areas	N	%
RMNCH	333	32.7
NCD	218	21.4
Surgical and injury care	181	17.8
Multi-sectoral nutrition interventions	64	6.3
Major communicable diseases	62	6.1
Health education and BCC	57	5.6
Emergency and critical care	39	3.8
NTDs	35	3.4
Hygiene and environmental health services	29	2.8
Grand Total	**1,018**	**100.0**

Level of priority

The final list of EHSP interventions was categorised into high, medium and low priority interventions. Based on this, 549 (58%), 231 (21%) and 211 (21%) interventions were categorised as high, medium and low priority, respectively (Figure 9).
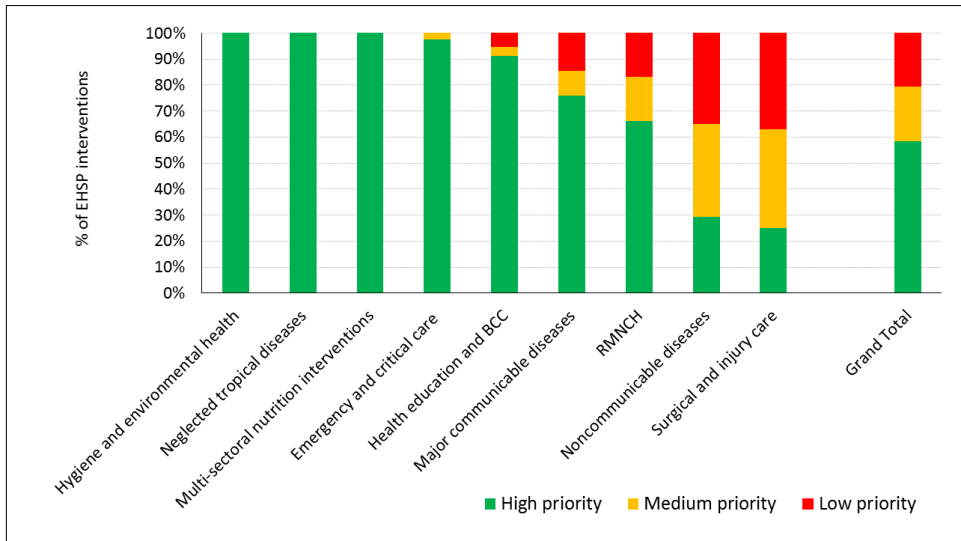
Figure 9. Interventions by level of priority.

Delivery platforms

We analysed the list of interventions categorised by the country's health care delivery level system. We categorised at a primary, secondary and tertiary level of delivery. From the total, about 60% of the interventions were categorised to be delivered at the PHC level, 20% were categorised at a secondary level of care and the rest were categorised at the tertiary level (Figure 10).
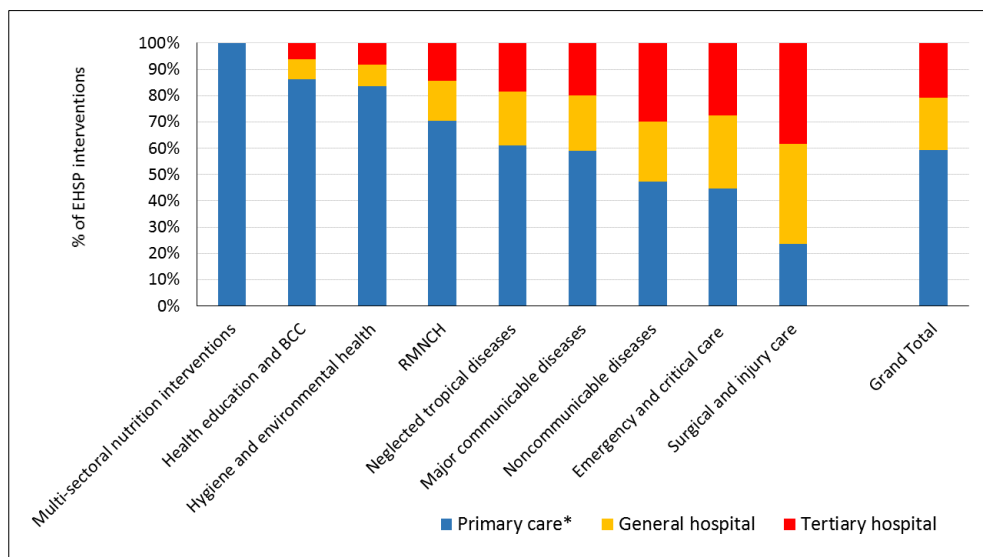
Figure 10: EHSP interventions by major programme area and delivery platform.
* Primary care includes community-based interventions, health posts, health centres and primary hospitals.

Payment mechanism

Of the entire list of interventions, 56% were categorised as exempted services while 38% and 6% were categorised as cost sharing and cost recovery, respectively (Figure 11).
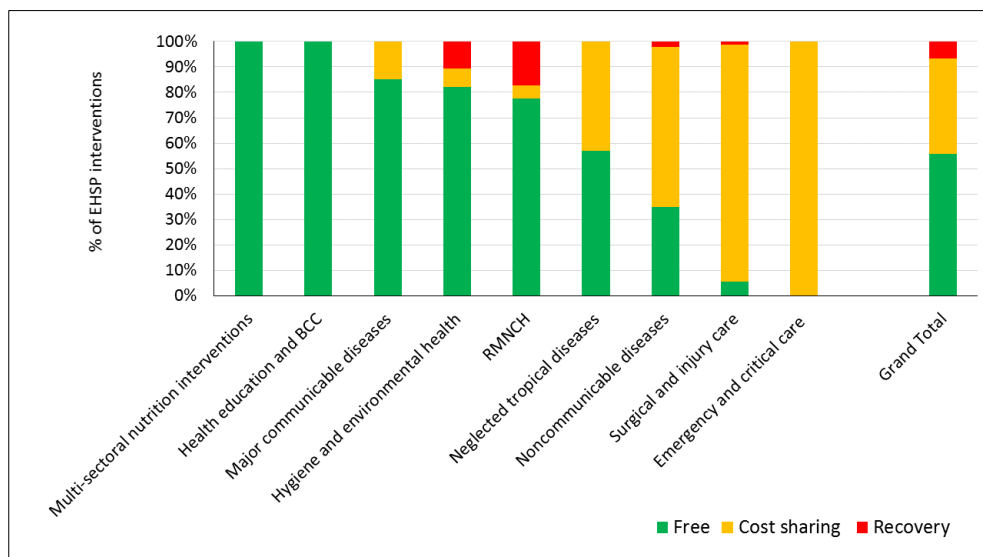
Figure 11. EHSP interventions by major programme area and payment mechanism.

Implementation strategies

Developing an implementation strategy is crucial in realising the effective implementation of a revised EHSP. An adequately designed implementation strategy is essential for instituting an appropriate planning, monitoring and evaluation system. The implementation strategy for the Ethiopian EHSP was developed by focusing on 10 critical strategic priorities aligned with the existing policy framework. The implementation strategy also proposed an institutional arrangement and various stakeholders' clearly outlined roles and responsibilities for the package's sound, efficient and sustainable implementation.

Monitoring and evaluation plan

Developing an appropriate monitoring and evaluation framework is vital in the implementation of an EHSP. Based on this, the MOH of Ethiopia had developed an EHSP monitoring and evaluation framework. The framework is based on the principles of one plan, one budget and one report. This helps the implementation to be very efficient and effective by avoiding the duplication of efforts by various actors/stakeholders. It also

considers the harmonisation of the existing health information system with population-based surveys.

Chapter 5. Discussion

In this chapter, I first briefly present the key findings of each paper. I then compare my findings with other, similar studies and experiences and present lessons drawn from the Ethiopian EHSP revision process. I then present and discuss the limitations of the revision process and each of the papers.

5.1 Discussion of main findings

The overarching goal of defining the EHSP was to facilitate the country's progress towards UHC by improving its efficiency, equitability and resilience. The studies in this thesis can contribute to this goal either by providing an understanding of the baseline service coverage for UHC monitoring (Paper I) or through evidence-based priority setting (Papers II and III) and enhanced health resource allocation in Ethiopia.

Low UHC service coverage in Ethiopia

Paper I specifically estimated UHC service coverage for Ethiopia for the year 2015. We found that the overall UHC service coverage was 34%, which is very low compared with the 80% target of the SDG by 2030.

The coverage is low compared with WHO estimates for Ethiopia (39%), the sub-Saharan Africa average (42%) and global coverage (64%) (76). It is also low compared with many other countries in sub-Saharan Africa (86) (e.g., Tanzania = 39%, Kenya = 57%). Another study, in Kenya, reported a service coverage of 42% in 2013. Additionally, we identified a substantial variation in service coverage across regions, ranging from 52.2% in the capital (Addis Ababa city administration) to 10% in the Afar region. Furthermore, UHC service coverage varies substantially across programme areas, ranging from 20% for health system capacity and access to 58% for ID. The latest NHA report also indicates that Ethiopia's resource expenditure follows a similar trend, with most of the financial resources allocated for ID and RMNCH and only 11.11% of the total heath expenditure allocated for NCD.

Cost-effectiveness evidence

In Paper II, we estimated ACERs for 159 unique interventions. Of the 159 interventions, we directly used 144 in the priority-setting exercise in the EHSP revision. The large majority (75%) of the interventions have ACERs of less than US$1,000. Furthermore, we identified substantial variation across programme areas, with most RMNCH interventions being very cost-effective while NCD and surgical interventions are mixed (i.e., 95% of RMNCH and ID interventions and 44% of NCD interventions have ACERs of less than US$1,000). Overall, our results are consistent with studies from other countries (e.g., Zimbabwe, Mexico) and other regional and global estimates (149, 160-170). Our findings are also the same as Ralaidovy et al.'s findings that three infectious disease interventions (i.e., HIV, TB and malaria) were cost effective, with cost-effectiveness ratios of less than US$100 per HLY saved for virtually all the interventions included (171). A study conducted in Argentina shows that the average cost effectiveness per DALY for various interventions was: (i) less salt in bread, US$151; (ii) mass media campaign, US$547; (iii) combination drug therapy provided to subjects with a 20%, 10% and 5% global CVD risk, US$3,599, US$4,113 and US$4,533, respectively; (iv) high blood pressure lowering therapy, US$7,716; (v) tobacco cessation with bupropion, US$33,563; and (iv) high-cholesterol–lowering therapy with statins, US$70,994 (172).

Our finding is also consistent with studies in Ethiopia by other researchers, for example, the study conducted by Memirie et al. in a CEA of the effectiveness of 13 maternal and neonatal health interventions. Our study for malaria interventions is aligned with the study conducted by Hailu et al. (161). For the insecticide-treated net, with an ICER of US$207 per DALY averted (160).

Evidence-based deliberative prioritisation

In Paper III, we documented and presented a detailed account of the Ethiopian EHSP revision process. A total of 35 consultative workshops were convened with experts and various public representatives. Various stakeholders were involved in defining the revision scope, developing a list of candidate health interventions, identifying prioritisation criteria, gathering evidence and comparing interventions. Seven prioritisation criteria were

employed for prioritisation (disease burden, cost effectiveness, equity, FRP, budget impact, public acceptability and political acceptability). Finally, a comprehensive list of interventions was identified (1,018 interventions), the interventions were categorised into priority groups (high, medium and low), the required resources were estimated, the interventions were linked with the existing service delivery platform and an appropriate payment mechanism was proposed based on the level of priority.

Using a priority setting process with multiple criteria was one of the fundamental strengths in the revision of Ethiopia's EHSP (Paper III). In contrast, in Zambia, Kenya and the Philippines, the EHSP revision included only cost effectiveness and disease burden to define essential services. In Liberia, disease burden, availability of interventions and feasibility were used. The Malawian EHSP was prioritised by cost effectiveness, equity, services and continuum of care. Other countries also applied a broader range of criteria. The criteria for selecting the list of health interventions for the Rwandan health benefits package included a high impact, safety, effectiveness, feasibility, sustainability and potential contribution in reducing the burden of disease. In Botswana, the EHSP was selected by considering the burden of disease, cost effectiveness and equity (urban/rural, pro-poor) while in Chile the prioritisation criteria were burden of disease, share of the population suffering from the disease, expected cost per beneficiary, supply capacity of the health system and the effectiveness of interventions. Cost effectiveness, affordability, FRP, scientific community opinion and cost effectiveness and budget impact were used as prioritisation criteria in Mexico and Iraq to formulate their EHSPs. In contrast, Bangladesh used the burden of disease, cost effectiveness and FRP as criteria (131-146).

Open and participatory process

Another essential feature of the Ethiopian EHSP is that an open and participatory process involving internal and external stakeholders was employed. Stakeholders from the health sector, through associations and public representatives, were invited and involved. This is similar to the Liberian and Malawian EHSP-defining processes in which open, participatory processes were employed involving people from local communities, districts and national

and international organisations in determining priority services. A consultative process was held with stakeholders to consider a more comprehensive political and ethical approach for the health system. Rwanda's MOH also led the country's process for defining the EHSP in collaboration with the health insurance agency and in consultation with the government cabinet. The result was published in an official MOH gazette available to the public and critical stakeholders. In contrast, the Philippines and Iraq revision processes were based mainly on data and quantitative exercises (132-134, 138).

5.2 Lessons learned from the Ethiopian EHSP revision

In principle, priority setting for designing a health benefits package should employ evidence-based, open, deliberative, participatory decision-making processes (11, 24, 66).. In practice, however, setting priorities in health service delivery is a challenging and complex exercise. In this regard, the revision of the Ethiopian EHSP was a systematic exercise to apply those critical principles within various technical and financial constraints. This process can be used as a practical example for other LMICs or for future revision in Ethiopia. Comparing the approach that we applied in the Ethiopian EHSP revision process vis-à-vis normative recommendations, I draw eight lessons for similar future work in Ethiopia or other LMICs.

Political commitment

Involving policymakers from all levels from the beginning is essential (24). There was exemplary political commitment and country ownership in Ethiopia that drove the revision of the EHSP. It was well embedded in the existing governance system and structure of the MOH. The MOH leadership from the top level to the medium and low levels were actively engaged.

Road map for the revision

The preparation of the road map for the revision of the EHSP was the most crucial step as it shaped the whole process (24). Starting by preparing the road map for the revision makes the process more transparent and robust. The road map included the scope, the objective

and expected outcomes, methodological details, a timeline, a governance structure, a communication plan and the roles and responsibilities of various stakeholders. All outstanding technical issues should be predefined in the methodology stage, such as how priority-setting criteria should be defined. How should relevant health interventions be identified? What approaches to evidence synthesis should be used?

Timeliness

The timeliness of the revision is an essential factor for the uptake of the EHSP. An EHSP should be prepared ahead of the national strategic plan (e.g., the HSTP in Ethiopia) to inform medium- or long-term plans (24). The revision of the Ethiopian EHSP was aligned with the national health sector transformation plan. A clear understanding of the time needed for the revision is fundamental. For example, the initial timeline proposed in the road map for the Ethiopian revision was six months. However, the whole process took about 18 months (i.e., from May 2018 to November 2019).

Open deliberation

An open deliberation process with stakeholder involvement is essential. In this process, we learned the essential lesson that robust deliberation with stakeholders is vital to the quantitative, data-driven analytic approach (24). However, a clear stakeholder engagement plan should govern who is invited to each deliberation process. What role can they play? Who makes the final decision? Also, all stakeholders should declare a conflict of interest before engaging in any dialogue as commercial interest can be challenging to a fair priority-setting process (173).

In Ethiopia, more than 35 workshops were held with various stakeholders. Two rounds of dialogue were conducted with external stakeholders, including public representatives, professional unions and disease-specific patient organisations. The first meeting discussed the prioritisation criteria and the second discussed the selection of interventions, the proposed payment mechanism, the service delivery platforms and the final validation of the

prioritised EHSP. Consultation directly with the public at the grassroots level remained limited, however.

Local values

Prioritisation criteria should be defined based on country context rather than by using generic criteria. Every country decides on national policy goals and the criteria for defining its essential health services (24). A legitimate, fair decision-making process begins with a transparent and inclusive identification of local values. All appropriate stakeholders should be included in the criteria-selection process. Policy goals and core values in many settings include health promotion and health improvement, equitable access to services, fair distribution of health outcomes, quality and FRP. Non-discrimination and solidarity are other core values.

Social values play an essential role in the selection of benefits. Social and political acceptability is also essential but must respect norms against legal or de facto discrimination against any given population or stakeholder group.

Comprehensive package

The Ethiopian EHSP was defined comprehensively. Some countries have defined the essential packages for PHC and tertiary health care separately. Some countries have separated the NCD and RMNCH packages. However, having a single comprehensive package that encompasses all levels of care and all types of disease/health condition is vital for various reasons, such as allocating the available resources for the health sector (174). Therefore, we recommend that other countries aim and work towards a more comprehensive package.

Linking with a financing mechanism

Estimating the required resources for implementing an EHSP is vital to examining its feasibility and affordability (11, 24). In this study, we estimated the financial resources required to implement the Ethiopian EHSP from 2020–2030, and we explored potential alternatives to increase the fiscal space for health in Ethiopia. Furthermore, in a sensitivity

analysis, we examined the possible impact of the Covid-19 pandemic on both the resources-needed and resources-available sides.

Linking with monitoring and evaluation

Linking with an implantation, monitoring and evaluation system and the 'Theory of Change' is necessary to enable taking corrective action during implementation and to document the lessons learnt in implementation (11, 24). The EHSP was launched in November 2019, and it has been active for about a year. The revised EHSP has been used in HSTP II, HRH, the optimisation of the health extension program (HEP) and in the primary care planning process.

Maintaining EHSP implementation during the Covid-19 pandemic

Like many other countries, Ethiopia has been substantially impacted by the Covid-19 pandemic. The Covid-19 pandemic impacts the delivery of essential health services by hindering the health system's capacity (175). In response to this, the MOH adjusted its strategy to include the continuity of essential health services as a vital component of the Covid-19 response. The ministry prepared an implementation guide that addresses how non–Covid-19 essential health services in Ethiopia can be delivered during the Covid-19 pandemic (176). The revised EHSP was used as a guiding document for prioritising priority health interventions in the context of Covid-19 (175). This guideline outlines the steps health facilities at all levels must take to ensure that the full range of essential health services continues, including safety protocols to prevent Covid-19 transmission. The MOH has continued to closely monitor the population's use of essential health services weekly, and, from March 2020, produced monthly monitoring reports with detailed data on trends in the utilisation of a range of maternal health, child health and communicable and NCD interventions. The results of these efforts have been promising.

5.3 Methodological discussion

Despite all efforts made to ensure reliability and rigour of the studies in this thesis, our analysis is liable to some limitations that affect the findings' internal and external validity.

Some of the limitations are specific to individual studies included in this thesis while some are generic to the overall priority-setting approach or economic evaluation method for defining the EHSP in Ethiopia. Therefore, in this part of the discussion, I critically examine the designs, the sampling and selection of indicators and the data collection and analytical techniques of the studies included in this thesis. Throughout, I evaluate the potential implications on validity, reliability and generalisability (32, 177-179).

5.3.1 Study designs

The choice of study design depends not only on the nature of the research questions under investigation but also on other practical issues (e.g., the urgency of the evidence needed, ethical issues, data availability, feasibility) (32, 177, 180). In Paper I, of the three prominent alternative approaches for measuring UHC service coverage status (86-88), we employed the framework proposed by WHO. This approach requires a retrospective review of service coverage information from various secondary sources (86). The main limitation of this approach compared with the approach proposed by the IHME is that it measures only UHC contact coverage (i.e., the quality of the service was not accounted for). Our approach used only 16 tracer indicators on RMNCH, NCD, ID, and service availability and access in measuring the UHC index while other essential areas such as mental health, NTDs and injury were not incorporated. Therefore, further methodological research is needed to refine the UHC service coverage index measurement tool. However, both the approach we employed and the IHME approach rely heavily on retrospective data. Based on global comparability and data availability, we used the WHO/WB approach, which is very relevant for policymakers.

In Paper II, we employed a GCEA approach to generate ACERs for 159 health intervention. The alternative economic evaluation approach was to use an incremental CEA. In general, criticism has been growing against CEA in priority-settings decisions (181). Also, methodological discrepancies across comprehensive economic evaluations and the inadequate generalisability and transferability of results to circumstances beyond the original study setting are challenges in the sector-wide analysis (182-184).

In Paper III, we employed a combination of designs. For example, more participatory observational methods were used to document and synthesise the revision process. Costing and fiscal space analysis approaches were used to estimate the resource need, predict expected available resources and estimate the affordability of the EHSP. To measure the equity and FRP implications of the interventions, the Delphi technique was used. These diverse methods may not capture all the relevant information, which may have affected the various health interventions' rankings. For example, data from the Delphi process may lack validity since it depends on expert judgement of few individuals, data from secondary sources might be outdated and may not be regularly updated, and cost data from small studies may not represent the situation in whole country (182-184). Much more work is therefore needed to develop these methods further.

5.3.2 Data availability and quality

Both the availability and the quality of data were crucial limitations for all three papers in this thesis: for the estimation of UHC service coverage, for the CEA and in defining the EHSP. In Paper I, various data sources were used, including the HMIS, the 2016 EDHS (113), the 2015 MIS (158) and the NCD STEPS survey (157). Additionally, inpatient admissions per capita, human resource distribution and health security information was collected from administrative records at the MOH and regional health offices. SARA data were also used for measuring access to essential medicines.

Data routinely collected for other purposes have various limitations. For example, as most of the secondary sources' information was not disaggregated by gender, socioeconomic status or other relevant parameters, we could not show the inequalities in the coverage across socioeconomic groups. Data on International Health Regulations (IHR) were not available from any source, and primary rapid assessment was conducted using expert judgement (interviews). Expert judgement is prone to bias.

In Paper II, various data sources from the MOH were used for estimating the interventions' effectiveness. The measurement of health benefits was also, to some extent, based on a

regional or international estimate of the impact of the interventions. The impact (effectiveness) of an intervention may be different in actual implementation in Ethiopia.

In Paper II, estimating the financial and economic cost of interventions was challenging because of the lack of primary sources of cost data at the country level for most inputs. We therefore modified the OHT data using different local or international data sources, such as HRH, EPSA and an international drug price database (MSH). Using data of diverse quality might affect the results.

5.3.3 Other limitations

Another limitation in the revision of the EHSP in Ethiopia may be the composition of the team conducting evaluation, appraisal and decision. Some researchers recommend that separate teams should conduct these activities. Similarly, in addition to my research role as a PhD candidate, I was co-leading the revision of the EHSP and heavily involved in the process. Therefore, Paper III, which aimed to synthesise and document the process, methods and critical features of the revised EHSP, may suffer somewhat from 'researcher bias' and should not be taken as a full evaluation study (185). Results should be interpreted with caution. Hence, it is essential that independent researchers further evaluate the revision process to assess the process and draw more lessons from it.

To mitigate the researcher's effect on the final result, however, we ensured that a technical working group was instituted early on and that this group would review the core team's work independently. Second, the process also involved diverse national and international experts for quality assurance, and the preliminary results of each activity were presented and debated externally before any decision was made.

Chapter 6. Conclusion and Recommendations

6.1 Conclusions

In this thesis, based on the findings of the first study, we conclude that the Ethiopian 2015 overall UHC service coverage was low compared with most other countries in the region. Furthermore, there was substantial variation in coverage between regions and across health service programmes.

Based on paper II, we conclude that the WHO-GCEA tool can be used to calculate country-specific CEA values for many health interventions under consideration for Ethiopia's EHSP, and several potentially cost-effective interventions are available that could substantially reduce Ethiopia's disease burden if scaled up.

Based on the third study, the Ethiopian EHSP has defined a set of affordable promotive, preventive, curative and rehabilitative priority health interventions that will be provided at all levels of service delivery in an equitable, acceptable and sustainable manner on the path towards UHC. In defining the Ethiopian EHSP, disease burden, cost effectiveness, equity, FRP, budget impact, public acceptability and political acceptability criteria were used. To compare and rank the interventions, the best available quantitative and qualitative evidence was employed. In the EHSP revision process, several rounds of consultations were held with public representatives, professional associations and subject-matter experts.

The revised Ethiopian EHSP includes 1,018 interventions organised into nine major programme areas and represents the most comprehensive revision process undertaken in a sub-Saharan African country. Having a detailed and comprehensive intervention list can help to ensure that essential interventions from all programme areas are included as part of UHC.

Furthermore, multi-criteria decision-analysis (MCDA) using the best available evidence (data), broad consultation with all stakeholders (dialogue) and an open, transparent and

democratic decision-making process (decision) are vital in defining an EHSP at the national level.

6.2 Recommendations and future perspectives

- To reach the UHC service coverage target, Ethiopia should rapidly scale up promotive, preventive and curative health services. Also, policymakers at the regional and federal levels should take corrective measures to narrow the gap in UHC service coverage between regions by redistributing the health workforce, increasing resource allocation to health and providing focused technical and financial support to low-performing regions.

- To strengthen and deepen its effort on UHC, the MOH needs to intensify its work in increasing the production and motivation of a high-quality health workforce.

- EHSP implementation at both the federal and regional levels should be strengthened. Linking priority interventions with existing service delivery, financing and payment mechanisms can help facilitate implementation.

- These measures require new and better financing mechanisms; therefore, wholistic health care financing reform should be undertaken to improve available resources for health in Ethiopia.

- More economic evaluation studies, especially on NCDs and multi-sectoral interventions, should be conducted to generate more evidence for priority setting.

- The foundation for the establishment of the HTA platform in Ethiopia should be started as soon as possible, including establishing a legal framework,

- Future priority-setting research should focus on designing advanced equity and FRP analysis and integrating these concerns with traditional CEA.

- Capacity building for the MOH staff on health economics and financing is essential.

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Paper I

BMJ Global Health

Measuring progress towards universal health coverage: national and subnational analysis in Ethiopia

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ABSTRACT

Introduction Aiming for universal health coverage (UHC) as a country-level goal requires that progress is measured and tracked over time. However, few national and subnational studies monitor UHC in low-income countries and there is none for Ethiopia. This study aimed to estimate the 2015 national and subnational UHC service coverage status for Ethiopia.

Methods The UHC service coverage index was constructed from the geometric means of component indicators: first, within each of four major categories and then across all components to obtain the final summary index. Also, we estimated the subnational level UHC service coverage. We used a variety of surveys data and routinely collected administrative data.

Results Nationally, the overall Ethiopian UHC service coverage for the year 2015 was 34.3%, ranging from 52.2% in the Addis Ababa city administration to 10% in the Afar region. The coverage for non-communicable diseases, reproductive, maternal, neonatal and child health and infectious diseases were 35%, 37.5% and 52.8%, respectively. The national UHC service capacity and access coverage was only 20% with large variations across regions, ranging from 3.7% in the Somali region to 41.1% in the Harari region.

Conclusion The 2015 overall UHC service coverage for Ethiopia was low compared with most of the other countries in the region. Also, there was a substantial variation among regions. Therefore, Ethiopia should rapidly scale up promotive, preventive and curative health services through increasing investment in primary healthcare if Ethiopia aims to reach the UHC service coverage goals. Also, policymakers at the regional and federal levels should take corrective measures to narrow the gap across regions, such as redistribution of the health workforce, increase resources allocated to health and provide focused technical and financial support to low-performing regions.

INTRODUCTION

Universal health coverage (UHC) is realised when everyone has access to quality essential healthcare services with financial risk protection.[1] The United Nations General Assembly, as part of the Sustainable Development Goal for health, calls on all countries to ensure

Key questions

What is already known?
► Measurement of service coverage is important for monitoring progress towards universal health coverage (UHC).
► The WHO and the World Bank has made country estimates of UHC service coverage, including Ethiopia.

What are the new findings?
► This paper estimates UHC service coverage for Ethiopia for the year 2015.
► The estimated subnational UHC service coverage varies substantially across regions and programme areas.

What do the new findings imply?
► Ethiopia should make an extra effort to achieve UHC service coverage goals in the next decade.
► Policymakers in Ethiopia should be cognisant of the subnational variation in UHC service coverage and should take corrective measures to narrow the gap across regions.

UHC by 2030.[2] Health services that should be provided include essential promotive, preventive, curative, rehabilitative and palliative health services.[1] However, each year, almost half of the world's population cannot access needed health services and about 100 million people are forced into extreme poverty because of health expenses. Globally, about 800 million people experience catastrophic financial hardship due to out-of-pocket healthcare spending (ie, spending more than 10% of their total income for healthcare).[3]

Ethiopia is one of the countries with a substantial disease burden from reproductive, maternal, neonatal and childhealth (RMNCH) and infectious diseases.[4] Recent evidence also shows that the magnitude of non-communicable disease (NCD) and injuries is rising in Ethiopia.[5] In addition, coverage of both basic health services and health service utilisation is low, and there

is a high geographical (urban-rural area and regional/subnational) inequality in service coverage.[6] Furthermore, catastrophic out-of-pocket spending is high.[7]

Cognisant of these challenges, the government of Ethiopia has developed key strategies to lead to UHC. These strategies include the following: first, defining the Essential Health Service Package of the country and identifying prioritised health interventions; second, exemption or cost-sharing of high-priority interventions; third, expansion of community-based health insurance programmes; fourth, integration of health services within other sectors from the national to the district level to address social determinants of health and fifth, establish emergency preparedness and response units at the level of both the national and Regional Health Bureaus (RHBs). Taken together, these strategies can improve the coverage of essential health services, reduce inequalities and provide financial risk protection.[8 9]

Despite a promise to provide all needed service to the whole population, UHC must be realised progressively, especially in resource-constrained countries. Responsibilities in the provision of UHC need to be redefined to a comprehensive set of essential health services that the government can guarantee to the entire population.[10] Therefore, with UHC as a global and country-level health policy goal, the need to measure and track its progress over time is imperative. WHO and World Bank (WB) have jointly identified two indicators for monitoring progress towards UHC: essential health service coverage (target number 3.8.1) and financial risk protection (target number 3.8.2). The 2030 UHC-Sustainable DevelopmentGoals (SDG) targets are intended to reach at least 80% for service coverage and 100% for financial risk protection.[11]

One challenge in the identification of UHC monitoring indicators is to decide how comprehensive the indicators should be to represent all essential health services in the system and control the number of indicators to enable comparability across countries that differ in terms of epidemiological and demographic characteristics. Boerma et al argue that country-level monitoring of UHC should address the epidemiological and demographic peculiarities in the country, while the intercountry comparison is more important for monitoring and comparing progress towards UHC.[12]

Hogan et al have proposed a metric for the monitoring of UHC: in particular, target 3.8.1. This seminal paper constructs a composite indicator to estimate UHC in a single number.[3] The indicator comprises four elements: reproductive, maternal, new-born and child health; infectious diseases; NCDs and service capacity and access. The authors argue that the application of this single indicator can be used to compare the progress of different countries and monitor a country's progress towards UHC.[3]

Although Wagstaff and colleagues were able to demonstrate the feasibility of an index-based approach to measuring, monitoring and comparing progress towards UHC,[13] only a few empirical studies attempt to estimate UHC status at the country level. Barasa, Nguhiu and McIntyre use Demographic and Health Survey (DHS) data to estimate Kenya's UHC progress using tracer indicators grouped as preventive and treatment interventions.[14] In Ethiopia, a case study regarding the identification of a UHC monitoring tool recommends that the UHC tracer indicators should be comprehensive, few in number and focused on impact, outcome and health systems dimension indicators. The case study also supports the inclusion of indicators that can capture NCDs.[15] Except for Hogan et al,[3] we have not found other empirical studies estimating the UHC status for Ethiopia, and none have attempted to demonstrate subnational variations in universal service coverage. In addition, the Ministry of Health does not use an explicitly defined UHC monitoring framework. Therefore, this study aimed to estimate the 2015 national and subnational UHC status for Ethiopia, which could serve as a baseline to monitor Ethiopia's progress towards UHC.

METHODS
The Ethiopian health system
Ethiopia is the second most populous country in Africa, with a total population of about 105 million in 2016.[16] Administratively, Ethiopia is divided into nine regional states (Tigray, Afar, Amhara, Oromia, BenshangulGumuze, Southern Nations, and National Region (SNNPR), Somali and Harari) and two chartered cities (Addis Ababa and Dire Dawa).

Healthcare delivery in Ethiopia is organised in a three-tier system.[8] The first, at the district level, is the primary healthcare unit (PHCU). The PHCU comprises one primary hospital, which can serve a population of about 60 000–100 000; four health centres (each serving a population of 15 000–25 000) and five health posts are attached to each health centre (each health post serving 3000–5000 people). The second level comprises general hospitals, each serving a population of 1–1.5 million, while the third level comprises specialised hospitals for a population of 3.5–5 million.

While the Federal Ministry of Health is responsible for the formulation and harmonisation of health programmes and strategies, the RHBs are mostly responsible for actual implementations. The budget flows to RHBs in two ways. From one side, the RHBs receive about 5%–10% of the total annual regional budget. This part of the budget is mainly spent on salaries for health professionals, procurement of medical supplies and procurement of drugs. The regions also use this part of the budget for construction and expansion of health centres and primary hospitals. The RHBs have a full mandate on this part of the budget. On the other side, RHBs receive an additional earmarked budget for specific programmes from external sources via the Federal Ministry of Health. In addition, the Ministry of Health also distributes un-earmarked funds from the SDG pool fund.

Service coverage indicators

In this study, we applied the approaches described by Hogan *et al* and the WHO/WB report on tracking progress towards UHC, with some modifications.[3 11] We used local data sources and checked that the indicators were also relevant for Ethiopia and that the data were available for all nine regions and the two city administrations. The selected indicators were well aligned with Ethiopia's priorities, set by the health sector transformation plan.[8] Sixteen indicators are from four major categories: RMNCH, infectious diseases, NCDs and service capacity and access. Tracer indicators in the area of RMNCH were as follows: family planning (FP) demand satisfied with a modern method among married women or in a union; pregnancy care (PC); immunisation for infants with three doses of pentavalent vaccine and care-seeking for children with suspected pneumonia. For infectious diseases, tracer indicators were tuberculosis treatment coverage (TB cases detected and cured); HIV treatment coverage; use of insecticide-treated bed nets among populations at risk of malaria and household access to at least basic sanitation services. For NCDs, we used the

following: prevalence of non-raised blood pressure (BP), mean fasting plasma glucose, cervical cancer screening and prevalence of tobacco non-smoking. To assess service capacity and access, we used hospital bed density, health worker density, access to essential medicines and the International Health Regulations core capacity index.

Data sources

We used a variety of data sources from Ethiopia (table 1), namely Ethiopia's Health Management Information System (HMIS),[17] Ethiopia's 2016 DHS (EDHS),[18] the 2015 Malaria Indicator Survey (MIS),[19] the NCD STEPwise approach to noncommunicable disease risk factor surveillance (STEPS) survey,[20] the 2016 Service Readiness and Availability (SARA) survey[21] and a Human Resource Information System (HRIS). Also, health security (HS) information was collected from administrative records at the Federal Ministry of Health and regional health offices. Since this indicator is only available at national level only, it is excluded from subnational analysis.

The Ethiopian 2016 DHS data were used to estimate UHC service coverage for RMNCH indicators. For

Table 1 Sources of data and indicator description for the UHC service coverage tracer indicators

Major indicators	Tracer indicator	Description	Data source
RMNCH	Family planning	Demand satisfied with modern methods among women 15–49 who are married or in a union	EDHS
	Pregnancy care	Average coverage of 4 or more antenatal visits and skilled birth attendants	EDHS
	Full child immunisation	One-year-old children who have received 3 doses of vaccine containing diphtheria, tetanus and pertussis	EDHS
	Child treatment	Care-seeking behaviour for children with suspected pneumonia	EDHS
Infectious diseases	Tuberculosis treatment	TB cases detected and cured	WHO
	HIV treatment	People living with HIV and receiving antiretrovirals (ART)	HMIS
	Malaria prevention	The population at risk sleeping under insecticide-treated bed nets	MIS
	Improved water and sanitation	Average coverage of households with access to improved water and sanitation	EDHS
NCDs	Prevention of CVD	Prevalence of no raised blood pressure	STEPS
	Management of DM	Prevalence of no raised blood glucose	STEPS
	Cervical cancer screening	Cervical cancer screening among women 30–49	STEPS
	Tobacco control	Adults age ≥15 years not smoking tobacco in the last 30 days	STEPS
Service capacity and access	Hospital access	In-patient admissions per capita	HMIS
	Health worker density	Health professionals per capita physicians, psychiatrists and surgeons	HRIS
	Access to essential medicines	The average proportion of the WHO-recommended core list of essential medicines present in health facilities	SARA
	Health security	International Health Regulations core capacity index	Primary

CVD, cardiovascular disease; DM, diabetes mellitus; EDHS, Ethiopia's Demographic and Health Survey; HMIS, Health Management Information System; HRIS, Human Resource Information System; MIS, Malaria Indicator Survey; NCDs, non-communicable diseases; RMNCH, reproductive, maternal, neonatal and child health; SARA, Service Readiness and Availability; TB, tuberculosis; UHC, universal health coverage.

measurement of the malaria prevention indicator, the 2015 Ethiopian MIS survey was used. The 2016 SARA survey was used to estimate the coverage of essential medicine. The SARA survey generates a set of core indicators on key inputs and outputs of the health scheme, which can be applied to assess progress in the health system, strengthening over time.[22] To estimate service coverage for the prevention of cardiovascular disease (CVD), management of diabetes mellitus (DM), cervical cancer screening and tobacco control, the NCD STEPS survey was applied. The Ethiopia STEPS are a nationally representative survey to gather comprehensive data on risk factors for NCDs, injuries and violence in Ethiopia. To estimate HIV treatment coverage, HMIS data, which is routinely collected from service provision at each facility, was used. The data source for health workforce (HWF) density are the HRIS of the Ministry of Health.

Data analysis

Estimation of the UHC service coverage index

The UHC coverage index was constructed from geometric means of the four major component indicators.[3] For the RMNCH category, the geometric mean of FP, PC, immunisation and child healthcare (CHC) were taken; for FP, contraceptive prevalence rate; for PC, a combination of prevalence of births attended by a skill birth attendant and prevalence of antenatal care coverage (ANC4+); for immunisation, DPT3 coverage and for CHC, treatment for childhood pneumonia in the last 2 weeks were used as follows:

$$RMNCH = (FP * PC * DPT3 * CHC)^{1/4}$$

For measurement of UHC service coverage in the infectious disease category, tuberculosis treatment (TB) was measured using the TB case detection rate and cure rate; antiretroviral treatment (ART) coverage was measured using people living with HIV who are currently on ART; water and sanitation (WASH) was measured using the average coverage of households with access to improved water and sanitation and Long-lasting insecticidal nets (LLIN) coverage was used.

$$Infectious = (TB * ART * WASH * ITN \ right)^{1/4}$$

LLIN coverage was not accounted for in Addis Ababa since the area is malaria-free.

NCD service coverage was calculated by a geometric mean of non-raised BP, fasting blood plasma glucose level (FPG), cervical cancer screening coverage and prevalence of non-tobacco users. We used the 2015 STEPS survey to compute the four tracer indicators in this category. The non-raised BP rate was measured by a prevalence of systolic BP<140 mm Hg or diastolic BP<90 mm Hg among adults aged 18 years and older. The FPG rate was measured by a prevalence of fasting plasma glucose of ≥7.0 mmol/L or those on medication for raised blood glucose among adults aged 18 years or older. The cervical cancer screening rate was measured by a proportion of women aged 30–49 years who reported ever having had a screening test for cervical cancer using any of the

methods (visual inspection with aceticaccede, pap smear and human papillomavirus test). For measurement of no tobacco use, the proportion of adults 15 years and older who have not smoked tobacco in the last 30 days of survey time was applied:

$$NCD = (BP * FPG * Cancer \ Screening * Tobacco \ right)^{1/4}$$

We used the prevalence of non-raised BP to estimate the service coverage for 'prevention of CVD' and the prevalence of non-raised blood glucose to estimate the service coverage for 'management of DM'. Since these two indicators are not measured in a proportion, we used the rescaling formulas recommended by WHO/WB:[3]

► Rescaled value for non-raised BP = (x − 50)/(100 − 50)*100, where x is the non-raised BP.
► Rescaled value for the management of non-FPG = (7.1 − y) / (7.1 − 5.1) *100, where y is the mean fasting plasma glucose.

For measurement of health service capacity and access (HSCA) coverage, hospital access (HP), HWF density, HS and data on the availability of essential medicine were used. For hospital access, we used annual in-patient admission or discharge per capita. For HWF density, we used the availability of health professionals: physicians, psychiatrists and surgeons per capita. For HS, we used the International Health Regulation core capacity index. Since this indicator is only available at the national level, it was excluded from the subnational analysis. For the measurement of essential medicines, we calculated the availability of the 14 WHO-recommended core list of essential medicines (ie, glibenclamide, beta-blocker, ACE inhibitor, simvastatin, amitriptyline, ciprofloxacin, co-trimoxazole, amoxicillin, ceftriaxone injection, diazepam tablet, diclofenac/ibuprofen, paracetamol and omeprazole) at health facilities:

$$HSCA = (Hospital \ access * HWF * Essential \ medicines \ HS \ right)^{1/4}$$

Therefore, the overall UHC service coverage was computed within each of the four categories and then across those category-specific means to obtain the final summary index.[3]

$$UEHSC = (RMNCH * Infectious * NCD \ Health \ Service \ Capacity \ right)^{1/4}$$

We computed the regional-level UHC service coverage status in the same way as the national index and compared their distributions to the national coverage and among regions. In this analysis, the geometric mean was applied instead of the arithmetic mean because the geometric mean is less sensitive to extreme values.[19]

We tested the sensitivity of the index to see how the indicators were combined into a summary measure by recomputing the index, using the arithmetic means in addition to the geometric means that was performed in the base case. We also assessed the sensitivity of the index by dropping one indicator at a time: first, deleting the HS

variable and then deleting the entire 'health service and capacity' component.

Patient and public involvement statement

The study was approved by the Institutional Review Board (IRB) of the Ethiopian Public Health Institute (Ref: EPHI/6.13/607). No patient level data were used in this study.

RESULTS

The Ethiopian overall UHC service coverage for the year 2015 was about 34.3% (table 2), ranging from 52.2% in Addis Ababa to 10% in Afar region (figure 1).

We also explored UHC service coverage variation across areas of service indicators (figure 2). The national RMNCH service coverage was 37.5%; in this category, PC (29.8%) was the lowest performing area, as traced by FP (35%) and child treatment (35.3%). However, immunisation coverage was relatively higher (53.2%) in this category.

The national UHC service coverage for the infectious disease category was 52.8%. In this category, the lowest coverage was for LLIN (39.7%), followed by HIV treatment (55%) and TB treatment (59.6%). The highest coverage in this category was for improved water and sanitation (59.9%).

The national UHC for the NCD category was 35%, while the national UHC service capacity and access coverage was only 20%, with the highest variation across regions ranging from 3.7% in Somali to 41.1% in Harari (figure 3).

The UHC index was very sensitive to the choice of summary method. If we had chosen to use the arithmetic mean instead of the geometric mean, the UHC index would be 47.7%. Similarly, the index is sensitive to the type of indicators selected. Deleting the 'health service and capacity' component resulted in a UHC index of 41.1%, while deleting the HS variable would have resulted in a UHC index of 30.3%.

DISCUSSION

In this study, we attempted to estimate UHC service coverage for Ethiopia using 16 tracer indicators classified into four major groups: RMNCH, infectious disease, NCD and service access and capacity. We identified low UHC service coverage, substantial regional variations and a difference in achievement across programme areas. These findings trigger two key policy-relevant questions: Will Ethiopia achieve the UHC-SDG target, given the current level? How can we narrow the subnational variations and the large differences by programme areas?

Low UHC service coverage

In this study, we identified that the 2015 overall UHC service coverage for Ethiopia (34.3%) was very low. This coverage level is substantially behind the SDG target of 80% by the year 2030 and also much lower compared with

most Eastern African countries.[2] For instance, the 2015 WHO/WB UHC service coverage estimate for Eastern African countries ranged from 39% in Tanzania to 57% in Kenya. A similar study by Barasa et al found a UHC service coverage for Kenya of about 42% in 2013.[14] The coverage for Ethiopia is also considerably lower compared with the global average service coverage (64%) and sub-Saharan Africa average (42%).[3]

This low service coverage can be partially explained by demand-side factors, such as high multidimensional poverty among a large majority of the Ethiopian households.[23 24] In Ethiopia, more than one-fourth of the entire population lives under the absolute poverty-line.[25 26] Also, the low literacy rate, together with poor modern healthcare-seeking behaviour, could contribute to low coverage.[27] From the supply side, minimal investment in Ethiopian health services could be the main reason for low UHC service coverage. For instance, although WHO recommends investing about US$112 per person annually (for low-income countries) to achieve the UHC-SDG target,[28] Ethiopia was only investing about US$28 per capita.[29] Therefore, it is reasonable to assume that the health infrastructure and human resources for health could have been better in Ethiopia if adequate resources had been mobilised in the health sector. However, achieving UHC requires the mobilisation of resources and equitable, transparent and efficient allocation and use of resources.[30]

Furthermore, our estimate (34.3%) is lower than an estimate by Hogan et al. (39%) and the WHO/WB report on tracking progress towards UHC for Ethiopia.[3 11] This can be explained by the difference in the number of tracer indicators included and data sources applied in the studies. While our study includes all 16 recommended tracer indicators from more reliable data sources, Hogan et al used only 14 of the tracer-indictors (ie, excluding cervical cancer screening and access to essential medicine).

Variation in achievement across programme area

As presented in detail in the WHO/WB joint technical report, the selection of the 16 tracer indicators is based on the definition of SDG 3.8.1, and all indicators are included with the intent to represent a given section of the health system.[11] Countries should show progress in all areas of the tracer indicators to achieve UHC. Therefore, the comparison of tracer indicators across programme areas is important in identifying the gaps. Our study demonstrates immense variation in service coverage across different components of the UHC progress indicators. The national coverage for infectious disease (52.8%) is higher than RMNCH (37.5%) and NCDs (35%). The service capacity and access coverage (20%) was the lowest. The difference between higher coverage for infectious disease and service capacity and access might somehow reflect disease-oriented 'priorities of the health system' in previous years in Ethiopia as well as globally.[31] This discrepancy was also reflected in the healthcare

Table 2 Regional and national summary of UHC service coverage, 2015 Ethiopia

Tracer indicators	Tigray	Afar	Amhara	Oromia	Somali	BG	SNNPR	Gambela	Harari	AA	DD	National
RMNCH												
Family planning	35.2	11.6	46.9	28.1	1.4	28.4	39.6	34.9	29.3	50.1	29.1	35.3
Pregnancy care	57.9	18.4	29.5	20.9	15.4	34.7	33.1	45.1	42.3	92.9	61.2	29.8
Immunisation	81.4	20.1	63.8	39.9	36.3	76.2	59.0	54.8	58.7	95.7	84.9	53.2
Child treatment	34.1	41.3	31.4	35.0	26.8	41.6	36.7	45.0	53.8	62.5	51.2	35.3
UHC_RMNCH	48.8	20.5	40.8	30.1	12.0	42.0	41.0	44.4	44.5	72.6	52.7	37.5
Infectious diseases												
Tuberculosis treatment	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6
HIV treatment	59.9	37.5	62.8	49.1	82.3	67.8	38.9	23.8	77.2	67.8	62.1	55.0
Malaria prevention	40.4	50.6	43.4	41.0	37.7	40.3	35.5	42.3	71.0	N/A	15.6	39.7
Improved water and sanitation	51.2	37.7	79.0	51.1	37.4	62.5	52.5	61.0	31.8	91.7	48.2	59.9
UHC_ID	52.1	45.4	59.9	49.8	51.3	56.5	45.6	43.7	56.8	71.8	40.8	52.8
Non-communicable diseases												
Treatment of CVD	70.8	58.5	55.6	61.6	69.0	62.0	48.4	66.3	62.6	40.7	75.2	58.2
Management of diabetes	100.0	100.0	93.6	100.0	74.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cervical cancer screening	1.2	0.0	1.6	1.4	8.0	1.5	1.0	2.0	0.8	11.0	3.7	2.9
Tobacco control	99.6	81.2	96.4	88.8	71.0	89.6	92.8	56.0	67.2	93.2	75.8	89.2
UHC_NCD	30.3	2.6	29.9	29.6	41.3	30.2	25.9	29.4	24.1	45.2	38.1	35.0
Service capacity and access												
Hospital access	26.1	4.5	9.4	13.4	2.3	15.3	10.9	23.7	81.8	35.7	44.3	13.1
Health worker density	8.0	0.4	1.6	1.7	0.4	5.9	2.8	1.4	19.7	15.0	1.6	3.1
Access to EM	51.2	41.2	57.6	52.4	54.2	36.4	52.8	31.1	43.2	58.8	49.8	50.8
Health security	Na	Na	Na	Na	Na	Na	Na	Na	Na	Na	Na	78.0
UHC_SCA	22.0	4.2	9.5	10.6	3.7	14.9	11.7	10.1	41.1	31.6	15.2	20.0
Overall UHC index	36.1	10.0	28.9	26.2	17.5	32.1	27.5	27.5	39.8	52.2	33.4	34.3

AA, Addis Ababa; BG, Benshangul Gumuze; CVD, cardiovascular disease; DD, Dire Dawa; NCDs, non-communicable diseases; RMNCH, reproductive, maternal, neonatal and child health; SCA, service capacity and access; SNNPR, Southern Nations, and National Region; UHC, universal health coverage.
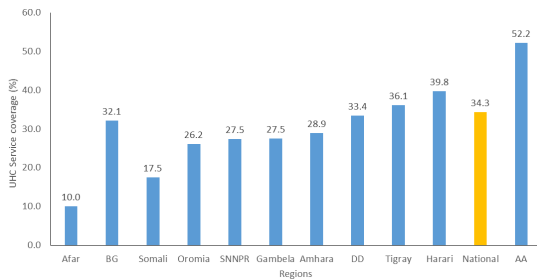
Figure 1 Overall UHC service coverage across regions. AA, Addis Ababa; BG, Benshangul Gumuze; DD, Dire Dawa; SNNPR, Southern Nations, and National Region; UHC, universal health coverage.
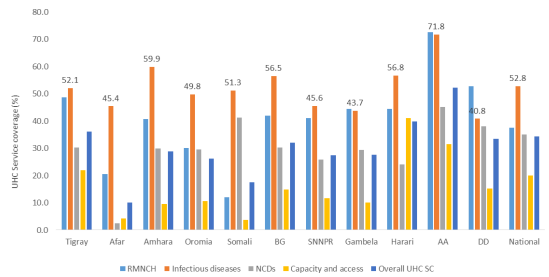

Figure 3 Regional variation of UHC SC tracer indicators. AA, Addis Ababa; BG, Benshangul Gumuze; DD, Dire Dawa; NCD, non-communicable diseases; RMNCH, reproductive, maternal, neonatal and child health; SNNPR, Southern Nations, and National Region; UHC, universal health coverage.

financing landscape that the larger share of the health resource in Ethiopia had been spent on major infectious diseases (ie, HIV, TB and malaria), followed by RMNCH services. The discrepancy can be partly ascribed to the influence of 'donor-driven prioritisation'. For example, cervical cancer screening coverage is very low (about 3%). Therefore, the reprioritisation of health services—based on local disease burden data—in a way that can provide equitable and sustainable service provision may be an important consideration for the Ministry of Health to improve the gap across the UHC programme area and increase the total health gained for a fixed amount of the available budget.[32]

In terms of service capacity and access, most of the UHC coverage indices are low. Access to essential medicine was 50.8%, and only 13% of the population had access to hospital admission service. Alarmingly, we identified that there is a very low health worker density (3.1%). Since Ethiopia has invested in low-skilled health extension workers at community level (with 1–2 years of health education), the human resource profile in Ethiopia indicates that there is a shortage in many of the highly skilled healthcare provider categories recommended by global standards, and there is a critical shortage of surgeons and psychiatrists. For instance, there are only about 35 psychiatrists and 190 surgeons

Figure 2 UHC service coverage across area of service indicators. NCD, non-communicable diseases; RMNCH, reproductive, maternal, neonatal and child health; UHC, universal health coverage.

in the country for a population of 105 million. A study in central Ethiopia also reports a similar finding using hospital-based data.[33] Therefore, the Ethiopian health system should clearly define a minimum set of important health services that are vital to the Ethiopian population and define the necessary workforce and health technologies, including essential medicine and physical infrastructure that matches the size and mix of the health needs of the whole population. Furthermore, the Ministry of Health should undertake a detailed analysis and close monitoring of the HWF density and distribution for all HWF categories both at national and subnational levels. Most importantly, these minimum inputs should be linked with adequate, sustainable financing mechanisms to ensure its continuity.

The relatively good coverage of tobacco control (89.2%), management of diabetes (100%) and CVD treatment (58.2%) can be due to the physically active lifestyle of the large majority of the Ethiopian population (ie, mostly rural residents and physically vigorous working conditions). However, the methodological limitations of how the indicators are constructed should be taken into account when interpreting these findings. In this study, tobacco control was defined as adults age ≥15 years not smoking tobacco in the last 30 days of the surveying period; management of diabetes is defined as the prevalence of non-raised blood glucose; and CVD treatment is defined as the prevalence of non-raised BP. Key components of the indicator are based on risk factors also influenced by factors other than service provision and access. To adjust for this limitation, we included coverage of cervical cancer screening. Without this indicator, the mean score for NCDs would have been much higher (and incorrect). Therefore, we recommend that these tracer indicators be replaced with indicators that directly measure the performance of the health system (if possible, effective coverage indicators). Similarly, a clear way of measuring the HS parameters should also be defined.

Subnational variation

Our study reveals that there was huge subnational variation across different areas, ranging from service coverage of about 10% in the Afar region to 52.2% in the capital. Essentially, the variability in the UHC SC index might be partially explained by variations in both supply-side factors (ie, availability of health personnel and infrastructure) and demand-side factors (ie, socioeconomic status and literacy rate). The service coverage in the emerging regions, such as Afar, Benshangul Gumuze, Somali region and Gambla, was far lower than the national average. The target stated in the Health Sector Transformation Plan is to bring coverage of the emerging regions to the national average.[8]

Therefore, policymakers and programme managers in Ethiopia should give more attention to the needs of emerging regions. For instance, an intensified, targeted and focused intervention can be launched, special technical support can be organised and the pastoralist programme can be strengthened. In addition, the Federal Ministry of Health, together with RHBs of the emerging regions, should design a joint strategic plan to help bring regions with low UHC coverage to reach the national average in a short time. These strategies might include allocating additional funds from the national treasury for health in emerging regions; training and deployment of new highly skilled health professional to pastoralist regions that will also need incentives to retain such workforces; expansion of health infrastructure; improvement of procurement and distribution of essential drugs, supplies and medical equipment and designing region-specific implementation plans that take the regional context into account. Regional governments should also increase the proportion of allocated resource to the health-sector from the regional budget.

Strength and limitations of the study

This study is the first of its kind in both fully constructing the UHC measurement index and measuring UHC service coverage at the national and subnational (regional) levels. However, the current study has some limitations related to either the selection of tracer indicator or the data sources, which require results to be interpreted with care. First, the identification of appropriate tracer indicators among several measures of service indicators is challenging for different reasons. In theory, the UHC encompasses several health service components. Second, the availability of appropriate data was a huge challenge and, therefore, some of the tracer indicators were proxy indicators, which only demonstrated the extent of the disease burden (eg, the prevalence of hypertension and FPG) rather than the actual service coverage.

Moreover, the coverage index does not adjust for quality. Findings from Service Provision Assessment (SPA) and SARA, as well as other studies, indicate that the quality of service provision is low and has substantial regional variation.[34 35] Although data were not available

to estimate effective coverage, as defined by Ng *et al*, it is not unreasonable to assume the effective coverage would be even lower than 34.3%.[36]

Regarding the data sources, we extensively applied survey data rather than routine administrative data. However, since survey data were not available to estimate service coverage of ART for HIV/AIDS, routine data from the health information management system was applied. Similarly, for tuberculosis, data from the WHO data repository were used. These routinely collected data might have limitation since these data were mainly collected by health professionals at health posts and health centres who have limited skill and a weak data quality monitoring system.[37 38]

Although wealth quintile data for some of the tracer indicators can be established from the survey data, disaggregated data by household socioeconomic status was lacking for some of the tracer indicators. Thus, we did not include inequality analysis across wealth quintiles.

CONCLUSION

The overall UHC service coverage for Ethiopia in 2015 was 34.3%. That outcome is much lower compared with other countries in the region and the SDG-UHC target by 2030. There are also substantial subnational variations in coverage indicators and, therefore, an intensified effort is needed to achieve the intended result within the next 10 years nationally, especially in the regions lagging behind the national average. In addition, policymakers should be aware of the regional variation in UHC service coverage indicators and take corrective measures to narrow the gap across regions. The Ministry of Health should also start benchmarking progress towards UHC at the subnational level. In addition, a catch-up plan for regions that are lagging should be designed, such as redistribution of the HWF, increased resource allocations to health and focused technical and financial supports. In sum, Ethiopia should scale up its coverage of promotive, preventive and curative health service through increasing its investment in primary healthcare.

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Data availability statement Data are available on reasonable request.

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Paper II

RESEARCH

Generalised cost-effectiveness analysis of 159 health interventions for the Ethiopian essential health service package

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Abstract

Background: Cost effectiveness was a criterion used to revise Ethiopia's essential health service package (EHSP) in 2019. However, there are few cost-effectiveness studies from Ethiopia or directly transferable evidence from other low-income countries to inform a comprehensive revision of the Ethiopian EHSP. Therefore, this paper reports average cost-effectiveness ratios (ACERs) of 159 health interventions used in the revision of Ethiopia's EHSP.

Methods: In this study, we estimate ACERs for 77 interventions on reproductive maternal neonatal and child health (RMNCH), infectious diseases and water sanitation and hygiene as well as for 82 interventions on non-communicable diseases. We used the standardised World Health Organization (WHO) CHOosing Interventions that are cost effective methodology (CHOICE) for generalised cost-effectiveness analysis. The health benefits of interventions were determined using a population state-transition model, which simulates the Ethiopian population, accounting for births, deaths and disease epidemiology. Healthy life years (HLYs) gained was employed as a measure of health benefits. We estimated the economic costs of interventions from the health system perspective, including programme overhead and training costs. We used the Spectrum generalised cost-effectiveness analysis tool for data analysis. We did not explicitly apply cost-effectiveness thresholds, but we used US$100 and $1000 as references to summarise and present the ACER results.

Results: We found ACERs ranging from less than US$1 per HLY gained (for family planning) to about US$48,000 per HLY gained (for treatment of stage 4 colorectal cancer). In general, 75% of the interventions evaluated had ACERs of less than US$1000 per HLY gained. The vast majority (95%) of RMNCH and infectious disease interventions had an ACER of less than US$1000 per HLY while almost half (44%) of non-communicable disease interventions had an ACER greater than US$1000 per HLY.

Conclusion: The present study shows that several potential cost-effective interventions are available that could substantially reduce Ethiopia's disease burden if scaled up. The use of the World Health Organization's generalised cost-effectiveness analysis tool allowed us to rapidly calculate country-specific cost-effectiveness analysis values for 159 health interventions under consideration for Ethiopia's EHSP.

Keywords: Cost effectiveness analysis, Health care rationing, Priority setting, Ethiopia, Essential health services

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Background

Priority setting allows consensus to be reached on which interventions to include in an essential health service package (EHSP), on which interventions to scale up first and on which intervention to scale

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down [1–3]. In this process, various approaches can be applied to compare interventions, of which cost effectiveness is the most widely used globally [4]. Cost-effectiveness analysis (CEA) plays a central role in decision making in many health technology assessment agencies in high-income countries [5], and there has recently been a growing interest in using cost effectiveness in defining national EHSPs in low- and middle-income countries [6].

In the Ethiopian EHSP revision, cost effectiveness was a criterion chosen to compare health interventions in terms of value for money [7], but there are only a few CEAs of health interventions from Ethiopia and other low-income countries. For instance, Hailu et al. examine the cost effectiveness of malaria prevention interventions [8], Memirie et al. examine that of maternal and neonatal interventions [9], Strand et al. evaluate that of neuropsychiatric services [10], and Tolla et al. examine that of cardiovascular disease prevention and treatment interventions [11].

Most of those studies applied an incremental cost-effectiveness approach that compares the cost effectiveness of adding new interventions against the current practice in the area [12]. This approach assumes that the current practice is organised in the most efficient way possible and thus does not account for existing inefficiencies in the health system. With incremental/marginal analysis, it is difficult to examine whether the current mix of interventions represents an efficient use of resources [12, 13]. Although these pieces of evidence are vital in informing the setting of priorities in decision making in specific sub-programme areas or for specific diseases, particularly when the existing package is assumed to allocate efficiently, they are less relevant in informing the sector-wide analysis of EHSP revisions [14, 15].

Therefore, the World Health Organization (WHO), in its CHOosing Interventions that are Cost Effective (CHOICE) programme, proposes a generalised CEA that compares all interventions with 'doing nothing' or a 'null scenario' [13]. This approach assesses whether the current mix of interventions is efficient and whether a proposed new technology or intervention is appropriate. It also provides decision makers with information on what they could achieve if they reallocated resources in the most efficient way. This approach provides broader generalisability of the CEA results and is considered an appropriate method for redefining an EHSP [13]. Therefore, this paper uses the WHO-CHOICE tool to calculate an ACER for the 159 relevant health interventions for use in the revision of Ethiopia's EHSP.

Methods

Study population and context

This study was conducted in Ethiopia in 2019 as part of the revision of the country's EHSP [7]. Ethiopia has a large disease burden, with average life expectancy of 65.5 [16, 17]. Communicable, maternal, neonatal, and nutritional disorders (CMNNDs) represent the greatest disease burden, accounting for 58% of disability-adjusted life year (DALY) loss in 2017. In the same year, the burden of NCDs, such as cardiovascular diseases, diabetes and cancer, accounted for 34% of the burden. About 8% of the DALYs were from emergencies and injuries [17]. Furthermore, Ethiopia is a low-income country, with a Gross Domestic Product (GDP) per capita of US$953 in 2019 [18] and a per capita health expenditure of about US$33 in 2016/17 [19]. Further reduction or slow increment of the health expenditure is expected in Ethiopia because of the impact of COVID-19 pandemic on the economic growth of the country and its global impact. Therefore, it is crucial to invest limited resources efficiently.

Interventions

A breakdown of interventions by the conditions they prevent or treat is provided in Table 1. A total of 1018 interventions were analysed for the EHSP. The current version of the WHO-CHOICE generalised cost-effectiveness analysis (GCEA) tool includes about 400 interventions [20], of which 159 were found to be relevant for the Ethiopian EHSP. We grouped the 159 interventions into 12 groups that matches with the sub-programme areas classification of intervention list in the EHSP. In general, and slightly over half of them fell under either reproductive, maternal, neonatal and child health (RMNCH) (28.3%), mental health (12.6%) or policies against NCDs (10.1%), such as physical inactivity, excessive alcohol use and tobacco, sugar and salt intake (Table 1).

Health effects of the interventions

We used the WHO-CHOICE GCEA tool to analyse the country-level health benefits of each intervention [21]. This model examines for each disease of interest (by incidence, remission and case fatality rates) how proportions of the population transit between health states in the presence or absence of an intervention. The Global Burden of Disease disability weights were used to evaluate the health state in the time spent in each health state, and the health effects generated by each intervention are presented as healthy life years (HLYs) gained [22].

We applied various integrated impact-modelling modules of the latest version of Spectrum software to model the health benefits of each intervention [22]

Table 1 Frequency and proportion of interventions evaluated by sub-programme area, 2019

Intervention by sub-programme area	N	%	Spectrum impact model used
RMNCH	44	28.3	LiST, FamPlan
Mental health	20	12.6	NCD impact
Policy interventions on NCDs	16	10.1	NCD impact
Cervical cancer	13	8.2	NCD impact
Respiratory disease	12	7.6	NCD impact
Colorectal cancer	11	6.9	NCD impact
Breast cancer	10	6.3	NCD impact
Tuberculosis	10	6.3	TIME Estimates and TIME impact
Nutrition	9	5.7	LiST
HIV/AIDS	5	3.1	AIM and GOALS
Malaria	5	2.5	LiST
Water hygiene and sanitation	4	2.5	LiST
Total	159	100	

The level of detail varies across the sub-programme areas

and applied the DemProj module to project population growth and other underlying demographic parameters (Table 1). This module uses World Population Prospects 2017 data from the United Nations Population Division. The FamPlan module was used to estimate the impact of family planning interventions. In this module, we used data from the 2016 Ethiopian Demographic Health Survey. We employed the AIDS Impact Module (AIM) (which was initially developed by UNAIDS to make national and regional HIV estimates every 2 years) to estimate the impact of interventions against HIV, and we employed the TIME Estimates and TIME impact Module to estimate the health impact of tuberculosis (TB) interventions. For RMNCH, nutrition and Water sanitation and hygiene (WASH) interventions, the Lives Saved Tool (LiST) module was employed, and we used the non-communicable disease impact module to calculate the impact of NCD policy interventions and other interventions against cancer and respiratory disease as well as mental health, neurological and substance use disorders [22].

The spectrum software includes default input for many countries based on data from various sources (i.e. systematic reviews, individual studies, national and regional reports, GBD etc.). We downloaded and used country-specific data for Ethiopia in the Spectrum software. The Country Data Package was prepopulated with the total population, population in need, target population, disease burden and effect size for each intervention. We carefully reviewed all the default input with programme area experts at the Ministry of Health, and appropriate changes were made when

deemed necessary. A more detailed explanation of each of the intervention input assumptions is provided elsewhere [22, 23].

Costs of interventions

The identification, measurement and valuation of the costs of all the interventions were conducted from the health system's perspective, accounting for the full cost of delivering an intervention, regardless of who currently pays for it. The ingredients costing approach was used, in which each input of delivering the intervention is identified and the quantity of each resource required by the intervention is multiplied by the unit price of each input (i.e., the unit price × quantity approach was applied) [12]. In the WHO-CHOICE GCEA tool, all the ingredients, based on expert recommendations, are provided as default values, and the country team reviewed the inputs and made changes when necessary. For example, all the drugs and supplies needed to provide each service were systematically identified, accounting for the cost of delivering the drugs and supplies from the point of production or purchase to the point of use (i.e., the cost of transportation, storage, shipment and customs clearance). Default prices for drugs and suppliers within the GCEA tool are taken from an international drug price database (MSH). We updated the prices of some drugs and supplies based on data from the Ethiopian Pharmaceutical Supply Agency and the Logistics Department of the Ministry of Health. To account for the cost of delivering drugs and supplies, an average mark-up of 6% of the price was generally taken. For drugs needing a cold supply chain,

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an additional 13% of the cost of the drug was taken as mark-up as the cold-chain system incurs an additional cost. For Long-lasting Insecticidal Nets (LLINs), a 26% mark-up was taken as LLINs are relatively bulky and their transportation, loading and unloading incur an additional cost [24].

Health personnel costs for providing the interventions were also included. The salary scale of the health workforce, such as the salaries and benefits of nurses, doctors and pharmacists, was based on the most up-to-date data from the Human Resource Department of the Ministry of Health of Ethiopia. Staff time use was calculated on the assumption that, on average, each person works 8 h per day over 230 working days per year. Inpatient cost per day and outpatient cost per visit were taken from the WHO-CHOICE model [25].

Programme costs were also included in this analysis [24]. Programme costs are the non-health care delivery costs associated with delivering an intervention programme that are incurred at a level other than the intervention's point of delivery. They include costs incurred at district, provincial or central levels and exclude costs incurred at facility or patient levels. They include the cost of administration and planning, media and communication, law enforcement, training, monitoring and evaluation. All costs were valued using 2019 US dollars (USDs). All cost input data originally collected in Ethiopian Birr (ETB) were first converted to USD using the average exchange rate for the year and were later converted to 2019 USD using the GDP deflator.

Cost-effectiveness analysis

To account for the impact of an intervention in the long term (steady state), we followed in this cost-effectiveness analysis model a hypothetical Ethiopian population cohort over a 100-year time horizon starting in 2019. The average cost effectiveness of the intervention was computed as a ratio of the total cost of the intervention to total health life years (HLYs) gained from the intervention [12, 26]. The interventions were ranked and compared based on their ACERs. Both costs and health outcomes were discounted at an annual rate of 3% [13].

Cost-effectiveness thresholds

A cost-effectiveness threshold (CET) is an explicit cut-off point for assessing the opportunity cost of interventions, with interventions having a cost-effectiveness ratio below the threshold being considered to offer good value for money [27]. There is a long-standing debate concerning the CET [18, 28, 29]. In the case of sector-wide analysis of health interventions using a GCEA, a CET is not required because the purpose of a GCEA is to compare the whole list of interventions against the comparator of doing nothing, and the ACERs of interventions should be compared with one another, even across programme areas, and not against a predefined CET [14, 15]. In this study, therefore, we did not apply a CET; instead, we report the ACERs in ascending order in bar graphs for each programme area. However, we use US$100 and US$1000 per HLY gained as references to summarise and present the ACER results.

Table 2 Summary of ACERs (USD per HLY) of the interventions by sub-programme areas

Sub-programme	Mean	SD	Median	p25	p75	Min	Max	% < $1000
HIV/AIDS	106	167	34	20	61	13	403	100
RMNCH	116	258	37	13	113	0.4	1591	97
WASH	122	219	16	9	234	5	451	100
Tuberculosis	143	12	139	137	147	129	163	100
Nutrition	262	312	72	37	580	31	746	100
Cervical cancer	870	1818	111	36	628	34	6534	77
Mental health	1045	1944	185	120	944	31	7610	75
Malaria	1163	1186	1310	79	1469	40	2915	40
NCD policy interventions	1834	2759	437	202	3053	26	9115	69
Breast cancer	2157	1895	1535	1032	2203	366	6104	20
Chronic respiratory diseases	2307	3344	809	368	1484	164	8856	50
Colorectal cancer	3920	1967	4646	2493	5436	783	5602	18
Overall	1014	1926	151	40	783	0.4	9115	75

SD: standard deviation; p25: 25th percentile; p75: 75th percentile; Min: minimum; Max: Maximum; % < $1000: proportions of interventions within that program area with ACERs lower than $1000 per HLY

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Results

In this study, we identified cost-effectiveness estimates for 159 interventions. An overview of the distribution of the ACERs is presented in Table 2. Of the total number of interventions evaluated in this study, 58 (37%) have an ACER of less than US$100 per HLY, 104 (65%) have an ACER of less than US$500 per HLY and 119 (75%) have an ACER of less than US$1000 per HLY gained.

Five interventions (basic palliative care for colorectal cancer, colorectal cancer treatment at stage 4, relapse prevention medication for alcohol use/dependence, inhaled short-acting beta-agonist for intermittent asthma and theophylline + high-dose inhaled beclometasone + short-acting beta-agonist for asthma) have an ACER above US$10,000 per HLY. Therefore, in the summary statistics provided in Table 2, we exclude these five interventions as they represent extreme values.

We estimated ACERs ranging from less than US$1 per HLY gained (for family planning) to about US$48,000 per HLY gained (for treatment of stage 4 colorectal cancer). A large majority (97%) of RMNCH and infectious disease interventions had an ACER of less than US$1000 per HLY, and a substantial proportion (44%) of NCD interventions had an ACER of greater than US$1000 per HLY (Table 2).

We present the full costs and effectiveness of all the interventions in supplement table (Additional file 1). Below, we present the key findings for major programme areas.

Cost effectiveness of RMNCH interventions

All RMNCH interventions except zinc supplementation (ACER = 1591 USD/HLY) and ectopic pregnancy case management (ACER = 685 USD/HLY) had an ACER of less than US$400 per HLY (Fig. 1). The three most cost-effective interventions in this category are preventing and managing unplanned pregnancy (ACER = 0.41 USD/HLY), provision of family planning services alone

Fig. 1 ACERs for RMNCH (Trimmed at US$350)

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(ACER = 0.42 USD/HLY) and provision of skilled assistance for normal delivery, including postpartum family planning (ACER = 0.47 USD/HLY). All immunisation interventions cost less than US$100 (e.g., the Hib vaccine costs 49 USD/HLY, routine EPI + additional vaccines cost 68 USD/HLY and pneumococcal vaccine costs 86 USD/HLY).

Cost effectiveness of HIV/AIDS, TB and malaria interventions

All the HIV/AIDS interventions had an ACER of less than US$100 per HLY gained except cotrimoxazole for children, which costs US$403 per HLY. Paediatric anti-retroviral therapy (ART) costs US$20 per HLY, Prevention of Mother to Child Transmission (PMTC) of HIV costs US$61 per HLY, ART for adult women costs US$13 per HLY and ART for adult men costs US$34 per HLY. In this study, we evaluated four antimalaria interventions. While the use of insecticide-treated materials costs US$79 per HLY and indoor

residual spraying costs US$40 per HLY, Intermittent Preventive Therapy (IPT) for pregnant women costs US$1310 per HLY and treatment of malaria for pregnant women costs US$1469 per HLY. The 10 TB interventions evaluated in this study have ACERs ranging from US$129 per HLY (for the detection and treatment of multidrug-resistance tuberculosis (MDR-TB) using a smear or culture) to US$163 per HLY (for the detection and treatment of TB using a combination of smear and Xpert) (Fig. 2).

Of the 13 WASH and nutrition interventions in this study, the three most cost-effective were use of a water connection in the home (ACER = US$5 per HLY), handwashing with soap (ACER = US$13 per HLY) and improved excreta disposal (latrine/toilet) (ACER = US$13 per HLY). Intermittent iron-folic acid supplementation for menstruating women where anaemia is a public health problem costs US$746 per HLY (Fig. 3).
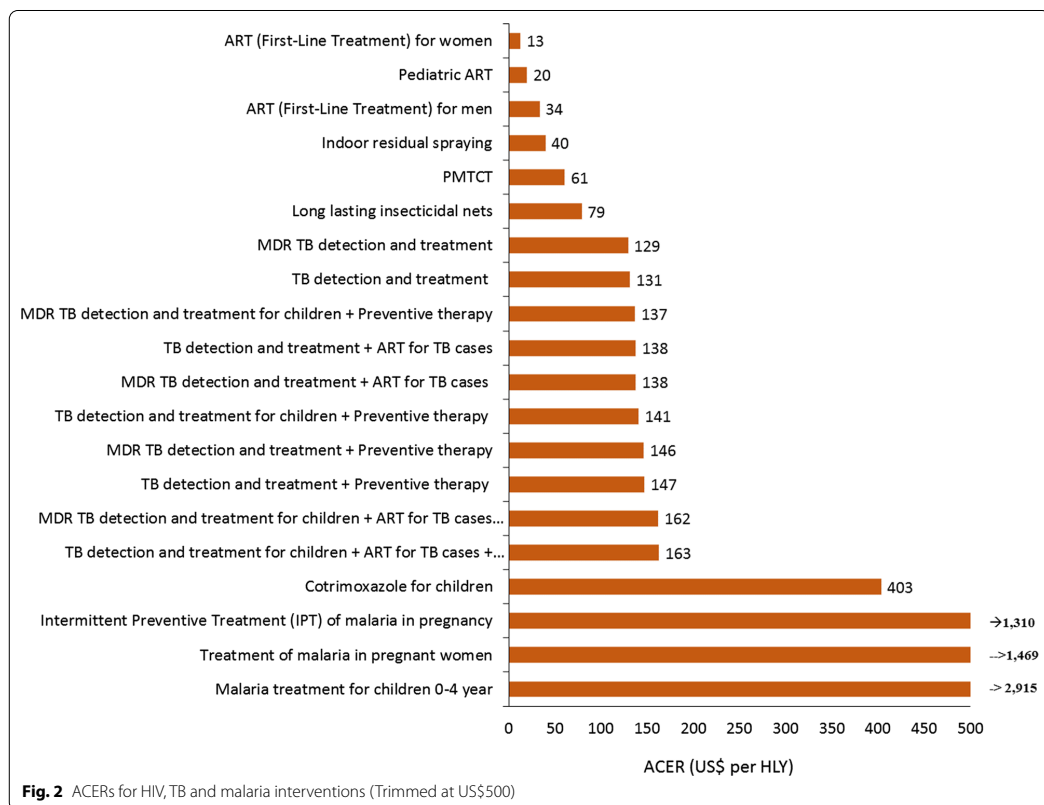
Fig. 2 ACERs for HIV, TB and malaria interventions (Trimmed at US$500)

Fig. 3 ACERs for nutrition and WASH interventions
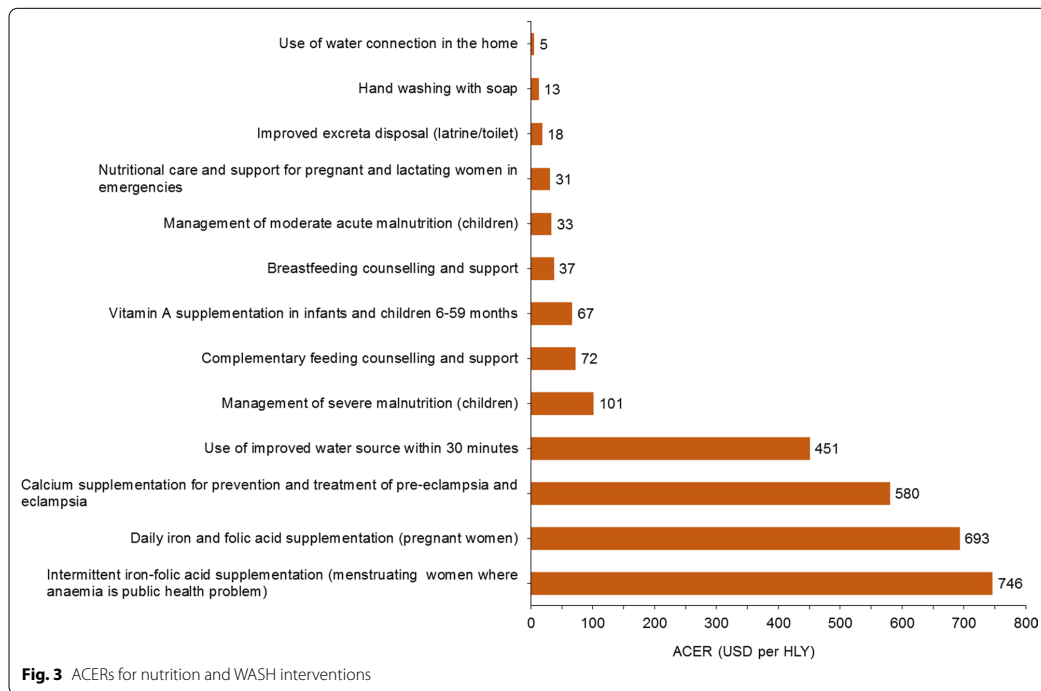
Cost effectiveness of NCD policy interventions

For the 16 policy interventions against NCDs evaluated in this study, the ACERs range from a high of US$9115 per HLY gained (for prevention of hazardous alcohol use using legal enforcement to restrict alcohol advertising) to a low of US$26 per HLY gained (for reduction of salt intake by harnessing/involving industries for reformulation). Most of the tobacco prevention interventions were very cost effective. For instance, the ACER for protecting people from tobacco smoke was US$232 per HLY while warning about the danger of tobacco using labels costs US$411 per HLY. The ACER for warning people about the danger of tobacco through mass media campaigns was US$515 per HLY gained, for enforcing bans on tobacco advertising US$105 per HLY gained and for enforcing youth access restrictions on tobacco US$1728 per HLY gained.

Intervention to enforce restrictions on the availability of retailed alcohol was US$4377 per HLY gained while screening and brief intervention for hazardous and harmful alcohol use was only US$579 per HLY gained. Most of the salt intake restriction interventions have the lowest cost-effectiveness ratios for Ethiopia. For instance, adopting standards in front-of-pack labelling costs US$42

per HLY. Providing education and communication costs US$333 per HLY, and pursuing salt reduction strategies in community-based eating spaces costs US$173 per HLY gained (Fig. 4).

Cost effectiveness of cancer interventions

All the early detection and screening interventions for cervical cancer cost less than US$100 per HLY. For example, a Papanicolaou test (Pap smear) costs US$34, visual inspection with acetic acid (VIA) costs US$35 and the HPV-DNA test costs US$60 per HLY gained. However, screening of breast cancer with clinical examination costs US$2203 per HLY and with mammography US$6104 per HLY. Similarly, colorectal cancer screening with sigmoidoscopy costs US$2493 and with colonoscopy US$5418 per HLY (Fig. 5).

Cost effectiveness of mental health interventions

In this study, we examined 20 mental health interventions. The provision of basic psychosocial treatment for mild depression is the most cost-effective intervention, with an ACER of US$31 per HLY, and basic psychosocial support for mild cases of anxiety disorder is the second most cost-effective (ACER = 67 USD/HLY). In the mental

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Fig. 4 ACERs for NCD policy interventions
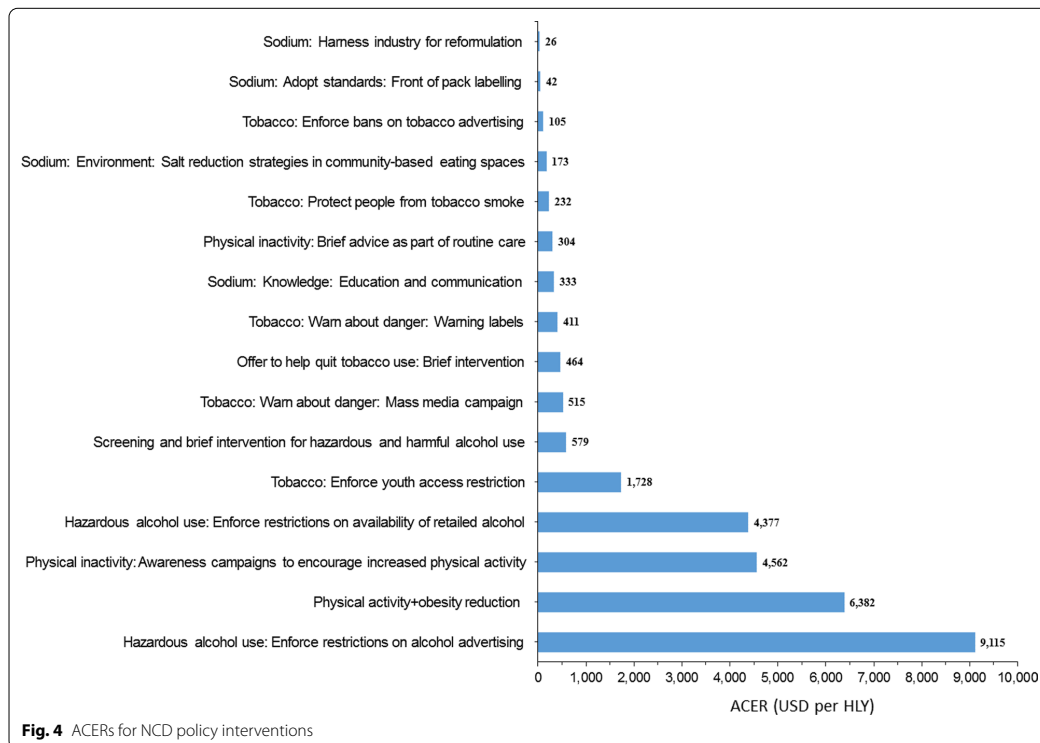
health intervention category, relapse prevention medication for alcohol use/dependence is the least cost-effective intervention, costing US$37,616 per HLY (Fig. 6).

Cost effectiveness of chronic respiratory disease interventions

We examined 12 interventions under the chronic respiratory disease category, and the provision of smoking cessation interventions to prevent chronic obstructive pulmonary disease (COPD) is the most cost effective (ACER = 164 USD/HLY). The provision of an inhaled, short-acting beta-agonist for intermittent asthma is the least cost-effective in this category, with an ACER of US$15,440 per HLY (Fig. 7).

Discussion

This analysis aimed to provide input for the revision of Ethiopia's EHSP, which used seven predefined and pre-agreed criteria, one being the cost effectiveness of interventions [7]. Our analysis encompasses a comprehensive range of health interventions, including preventive, promotive, curative and policy interventions. Of

the interventions analysed in this study, a large majority (75%) have ACERs of less than US$1000, and 36% have ACERs below US$100.

Cost-effectiveness analysis is an increasingly important prioritisation tool. The cost-effectiveness evidence for redefining Ethiopia's EHSP was generated in three ways: by contextualising CEA evidence from other studies using transferability criteria, by using expert opinion for multisectoral interventions and by using the WHO GCEA tool [7]. Using this tool, we provide cost-effectiveness evidence for 159 relevant health interventions for EHSP revision in Ethiopia. We believe that other low-income countries in Africa can also generate these pieces of evidence within a relatively short time and at an affordable cost compared with individual economic evaluation studies.

We provide cost-effectiveness evidence for 77 interventions on RMNCH and infectious disease (e.g., HIV, TB, nutrition, malaria and WASH) and for 82 interventions on NCDs. In general, a majority of the interventions have relatively low ACERs of less than US$1000 per HLY gained. However, when we disaggregate the finding
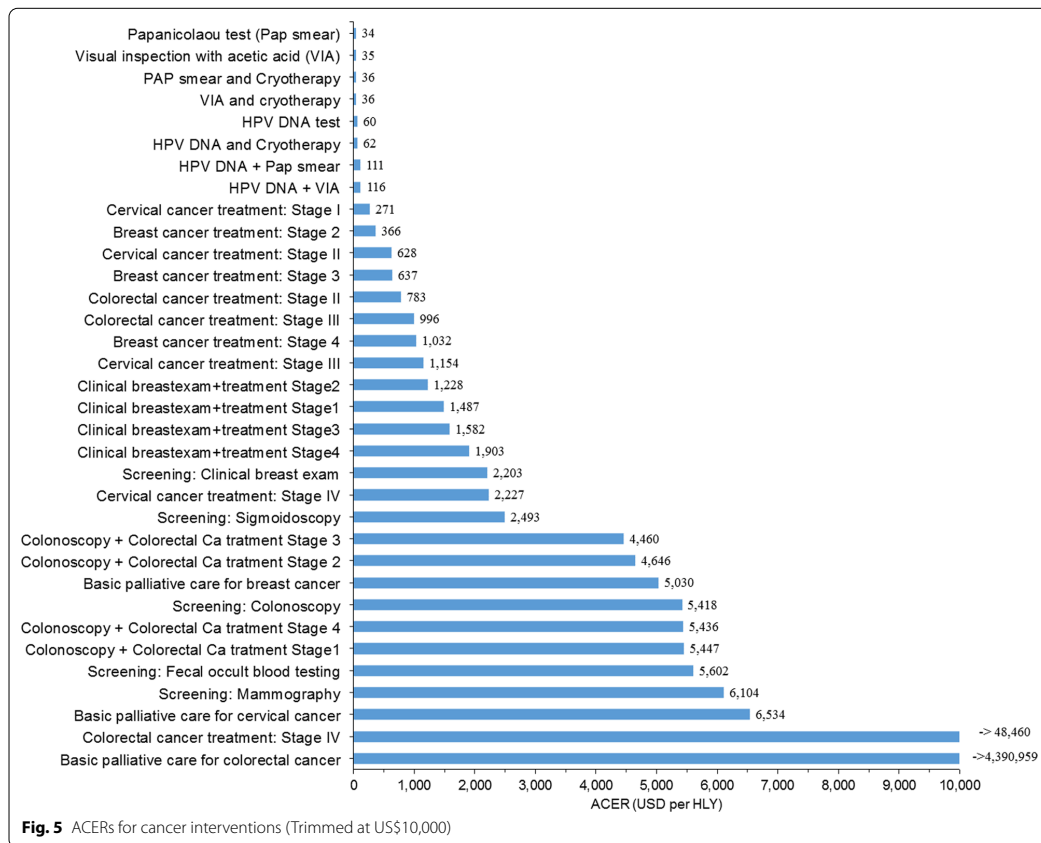
Fig. 5 ACERs for cancer interventions (Trimmed at US$10,000)

by programme area, the results are mixed. While a vast majority (95%) of RMNCH and infectious disease interventions have an ACER of less than US$1000 per HLY, a substantial proportion (44%) of NCD interventions have an ACER of higher than US$1000 per HLY. In general, findings from our study are consistent with findings of other country specific studies in Ethiopia, Zimbabwe, Mexico [8–10, 30–32], or other regional and global estimates [33–38]. However, head to head comparison of the ACERs and further examination of cost, effectiveness, and its driving factors remain a priority for additional research.

Family planning interventions, for example, are the most cost effective in this study, with ACERs of less than US$1 per HLY gained. This very low ACER may be partly explained by the fact that the model accounts for a reduction in unplanned pregnancies and an associated reduction in maternal mortality. Most of the interventions targeting infectious diseases were cost effective,

with an ACER of less than US$500 per HLY. For example, we evaluated four HIV/AIDS interventions, and they all, except the provision of cotrimoxazole for children, have an ACER of less than US$100 per HLY gained. The relatively low ACER in this study may partly reflect the decrement of the price of ART drugs as is shown in several recent studies [39, 40].

Addressing maternal, neonatal and child health issues is a top priority of the Ethiopian Ministry of Health (MoH) [7]. In our study, the majority of the interventions on RMNCH were very cost effective, with an ACER value of less than US$200 per HLY gained. This finding is in line with that of Memirie et al. in a CEA examining the cost effectiveness of 13 maternal and neonatal health (MNH) interventions in Ethiopia. Although not a GCEA and therefore not directly comparable, that study found that 12 of 13 MNH interventions had an

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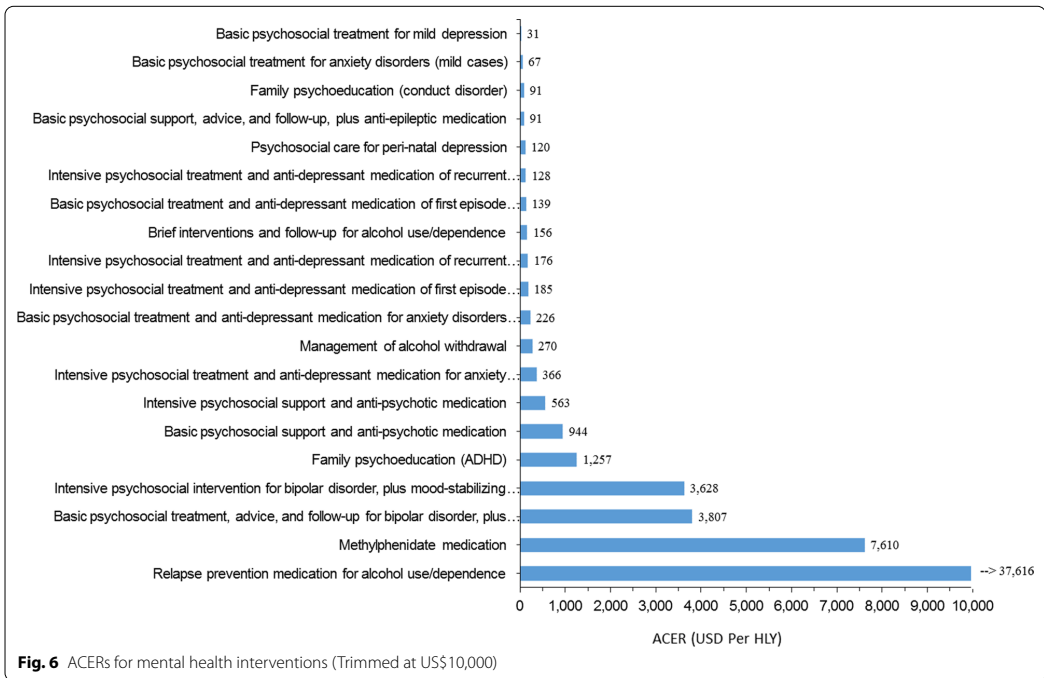
Fig. 6 ACERs for mental health interventions (Trimmed at US$10,000)
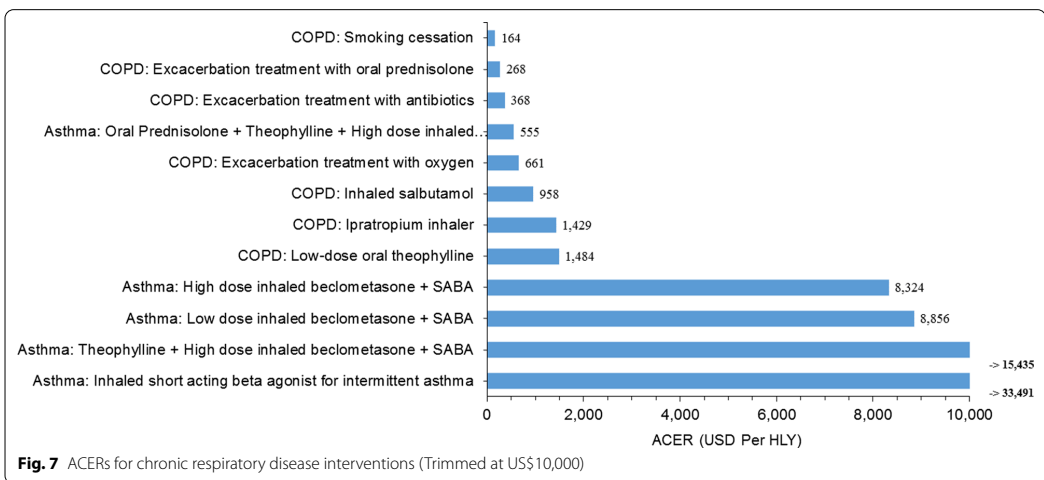
Fig. 7 ACERs for chronic respiratory disease interventions (Trimmed at US$10,000)

incremental cost-effectiveness ratio of less than US$400 per HLY [9].

Most of the preventive NCD policy interventions have a lower cost-effectiveness ratio than the treatment NCD interventions. A substantial proportion (44%) of NCD interventions have an ACER of greater than US$1000 per HLY. This relatively high ACER may reflect the fact that the treatment cost for chronic NCD is higher and the

treatment effectiveness lower than for the other interventions. This is particularly consistent with findings from a comprehensive, but relatively old study, examining 101 NCD interventions in Mexico. The study find similar variations among NCD policy interventions and NCD treatment interventions as we do [30].

Strengths and limitations

By applying the GCEA approach, it is possible to evaluate whether the current mix of interventions is efficient and whether proposed new interventions are appropriate. Therefore, GCEA is a more appropriate approach than a marginal analysis for conducting a sector-wide cost-effectiveness analysis of interventions [14, 15]. In this study, which included 159 interventions from diverse programme areas, we conducted a sector-wide cost-effectiveness analysis. Although this study covers a substantial number of crucial interventions, it did not attempt to analyse all interventions in the Ethiopian health sector. We believe, however, that our findings can be used as benchmarks for making better-informed expert judgements on other interventions that could not be analysed in such a standardised way.

WHO-CHOICE GCEA tool is important tool for sector-wide analysis of cost-effectiveness of wider range of interventions for priority setting. A primary advantage of the WHO-CHOICE GCEA tool is the ability to compare many interventions at the same time based on the same assumptions on cost, disease epidemiology and other key health system parameters (e.g., human resource, financing, and infrastructure). When health system plans and strategies are designed, we should evaluate and compare the costs and outcomes of combinations of interventions. However, a barrier to conducting economic evaluation studies is that they are time consuming and demand large amounts of local data and local technical expertise. We believe that this study demonstrates that the existing platform, with a large support team and substantial commitment, makes such an extensive and comprehensive evaluation possible.

Our work has other limitations. First, in this study, we used the health system perspective. In Ethiopia, one-third of the total health care cost is covered by the out-of-pocket expenditure of individuals [19], which can influence individuals' choices in accessing health care delivery. The choice of perspective should also be taken into consideration when interpreting the results. Second, in this GCEA study, we applied data from diverse sources to model the health impact of interventions and costs. Of course, modelling is inevitably an imperfect representation of reality, and, therefore, robust uncertainty analysis would to some extent alleviate this challenge. However,

because of the vast number of interventions included in this analysis, we did not include a sensitivity analysis. Therefore, as the software expands, future GCEA analysis of this kind should integrate a sensitivity analysis of at least some of the critical drivers of costs and health impacts.

A third limitation of this study is the use of DALYs for estimating disease burden and health benefit. Critics of DALY argue that the measure itself has limitations [41, 42]. Using DALYs tends to underrepresent or overestimate the value of interventions (such as palliative care and family planning) with outcomes that are not readily measured in this metric as well as interventions in nutrition for which the outcomes are improved cognition rather than improved health [43]. This is a real limitation that was taken seriously in the revision of Ethiopia's EHSP. For these interventions, we also relied on the expanded EHSP process with user involvement and expert judgements. Furthermore, criteria other than cost effectiveness, such as equity, financial risk protection, budget impact and public concern are also important for defining the EHSP [3]. A fourth limitation of this study is that the models used do not capture full health benefits. The most striking example is the LiST model which mainly considers mortality outcomes. Future analysis should also account for health benefits from RMNCH interventions that avert non-fatal conditions.

Additionally, there are gaps in the available evidence on the cost of interventions, which can be closed only by conducting substantially more research in developing countries. Therefore, we recommend a concerted effort to establish country-level cost databases. This could be combined with capacity building through the training of researchers to generate such evidence.

Conclusion

Through the process described above, we calculated country-specific CEA values which were required to inform the decisions around which interventions to provide under Ethiopia's essential health service package (EHSP). The present study shows that several potential cost-effective interventions are available in all program areas that could substantially reduce Ethiopia's disease burden if scaled up.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12962-020-00255-3.

Additional file 1. Cost, health effect and ACER for 159 health intervention, 2019.

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Publisher's Note

Paper III

Revision of the Ethiopian Essential Health Service Package: An Explication of the Process and Methods Used

Getachew Teshome Eregata , Alemayehu Hailu , Zelalem Adugna Geletu , Solomon Tessema Memirie , Kjell Arne Johansson , Karin Stenberg , Melanie Y. Bertram , Amir Aman & Ole Frithjof Norheim

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Revision of the Ethiopian Essential Health Service Package: An Explication of the Process and Methods Used

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ABSTRACT

To make progress toward universal health coverage, countries should define the type and mix of health services that respond to their populations' needs. Ethiopia revised its essential health services package (EHSP) in 2019. This paper describes the process, methodology and key features of the new EHSP. A total of 35 consultative workshops were convened with experts and the public to define the scope of the revision, develop a list of health interventions, agree on the prioritization criteria, gather evidence and compare health interventions. Seven prioritization criteria were employed: disease burden, cost effectiveness, equity, financial risk protection, budget impact, public acceptability and political acceptability. In the first phase, 1,749 interventions were identified, including existing and new interventions, which were regrouped and reorganized to identify 1,442 interventions as relevant. The second phase removed interventions that did not match the burden of disease or were not relevant in the Ethiopian setting, reducing the number of interventions to 1,018. These were evaluated further and ranked by the other criteria. Finally, 594 interventions were classified as high priority (58%), 213 as medium priorities (21%) and 211 as low priority interventions (21%). The current policy is to provide 570 interventions (56%) free of charge while guaranteeing the availability of the remaining services with cost-sharing (38%) and cost-recovery (6%) mechanisms in place. In conclusion, the revision of Ethiopia's EHSP followed a participatory, inclusive and evidence-based prioritization process. The interventions included in the EHSP were comprehensive and were assigned to health care delivery platforms and linked to financing mechanisms.

Introduction

In 2015, all United Nations Member States adopted the Sustainable Development Goals (SDGs) to guide policies and actions across all sectors that are important to development. SDG-3 is the health goal, and SDG target 3.8 specifically concerns achieving universal health coverage (UHC) for all segments of the population.[1] The World Health Organization (WHO) defines UHC as a condition in which "all people and communities can use the promotive, preventive, curative, rehabilitative and palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does not expose the user to financial hardship."[2] To make tangible progress toward UHC, countries should

clearly define the essential health services that they can deliver to their population within the available budget and without financial risk whilst also clearly defining how they plan to scale up coverage, reduce direct costs and expand the range of health interventions in the future.[3–7] An interventions is defined as "an act performed for, with or on behalf of a person or population whose purpose is to assess, improve, maintain, promote or modify health, functioning or health conditions."[8]

The selection of high-impact, priority interventions is important but has never been easy. Hard decisions must be made in situations with limited resources and high demands on health services. The decision should take into account the current

level of human and financial resources available, as well as practical constraints.[9,10] WHO and others, recommend systematic priority-setting that employs explicitly defined and agreed upon prioritization criteria, using evidence from all available sources and relying on participatory and democratic processes.[6,11-13] Explicit priority setting is more important than ever to agree on essential universal health services and reach consensus on how to finance them, whether through full public financing, cost-sharing or cost-recovery.[13]

The revision of the Ethiopian essential health services package (EHSP) can be seen as a key activity to accelerate the progressive realization of UHC for all Ethiopian citizens.[14,15] In 2018, a decision was made to revise the EHSP, which Ethiopia had first developed in 2005.[16] Since then, the disease burden profile of the country had changed due to a growing number of non-communicable diseases (NCDs) to which the package did not adequately respond.[17] Furthermore, the population's demand for health services had increased substantially, and several interventions had been introduced to the health system on an ad-hoc basis without formal evaluation.[18] Arguably, rolling out health interventions without a well-defined assessment of their costs and impact on health, equity, and financial risk could lead to the inclusion of ineffective interventions that replace services more crucial to UHC targets.

Recognizing the importance of clearly defined health intervention priorities to achieving UHC, the Ministry of Health (MoH) of Ethiopia revised the EHSP from May 2018 through November 2019.[19] This paper describes the revision process, the key methodology, the involvement of stakeholders and experts and the most important features of the new Ethiopian EHSP.

The paper is organized as follows: First, we describe the country context and the scope and objectives of the revised EHSP. Second, we describe the elements of the revision process (Figure 1), including its organization (the governance of the revision process), the identification of relevant health interventions, the selection of prioritization criteria, evidence synthesis, the comparing and ranking of interventions, the impact of costing and budget and the formulation and revision of the intervention list. Third, we describe the final revised EHSP. Finally, we compare and discuss the Ethiopian process and results with similar work in other countries.

Country Context

Ethiopia is the second-most populous nation in Africa, with a total population of about 108 million.[20] Approximately 83% of the population lives in rural areas, and their livelihood is mainly dependent on subsistent agriculture. Almost a quarter of the population lives below the poverty line, and the country's per capita income is only 953 USD.[21,22] Furthermore, per capita health expenditure in Ethiopia is very low at only 33 USD in 2016/2017.[23]
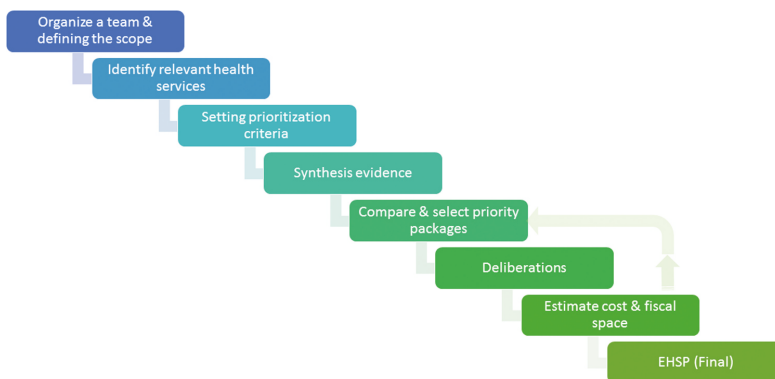

Figure 1. The roadmap for the revision process of Ethiopia's EHSP

Ethiopia is a federal state organized into nine semi-autonomous regions and two chartered cities (Addis Ababa, the capital, and Dire Dawa, a major city in eastern Ethiopia). The federal MoH is responsible for the formulation of health policies—including the definition of the EHSP—for the health sector. The regional health bureaus are the main implementers of the programs.[18]

Scope and Objectives of the Revised EHSP

The scope of the revised EHSP reflects the national health policy and its SDG-UHC commitments while taking into account the constraints of resource availability and economic growth. The EHSP has four basic features. First, it was designed to address the health needs of the Ethiopian population across the whole life course regardless of income, gender or residence (urban/rural). Second, it was designed to be delivered at all levels of service (i.e., primary, secondary and tertiary). Third, the package was designed to serve for five years (2020–2025) with regular revision every five year. Fourth, it includes promotive, preventive, curative and rehabilitative interventions.

The primary objective of the revised EHSP is to reduce the burden of disease in Ethiopia by making high priority interventions available and affordable. It also aims to protect people from catastrophic health expenditures, increase equitable access to health services, improve the efficiency of the health system and increase public participation and transparency in decision-making in the health sector.

Governance of the Revision Process

The MoH initiated the revision of the EHSP, and eight inception meetings were held from June–August 2018 to outline the EHSP revision plan, define the revision roadmap and determine the scope and objectives of the revised EHSP.[14] The existing MoH governance structure for decision-making was applied. All directorates at the MoH and representatives of all regional health bureaus were involved throughout the process to ensure inclusiveness and transparency. Additionally, national and international experts (WHO and Disease Control Priorities–Ethiopia) provided technical support throughout the process.

An EHSP core team, comprising a health economist, health systems specialist and epidemiologist, was organized by the minister to execute and coordinate the work. The core team's role was to facilitate the development of the entire package, including the development of a prioritization protocol, the collation of data, evidence synthesis, stakeholder engagement, and costing and fiscal space analysis. A technical working group (TWG) was established comprising 30 senior experts on various health system dimensions. The TWG supported the core team in the preparation of the revision roadmap, which helped to establish a common understanding among the stakeholders on the steps necessary to achieve an evidence-based revision of the package (Supplement I). As a result, a detailed plan of the revision process and the methods to be used were presented by the TWG to the MoH leadership and approved (Figure 1). The core team and TWG followed, with slight modifications, the steps of the health benefits package design recommended by Glassman et al.[24]

Identification of Relevant Health Interventions

The first step was to create a list of health interventions for consideration, including the promotive, preventive, curative and rehabilitative interventions relevant to Ethiopia. An exhaustive search of the Ethiopian health sector's plans, strategies and national publications was conducted along with reviews of the WHO intervention compendium (forthcoming) and the third edition of Disease Control Priorities (DCP3).[25] Subsequently, a two-day workshop was held to identify additional interventions. Eighty experts from various program areas, primary health care practitioners, doctors and specialists identified and proposed all health services relevant to the Ethiopian context. Furthermore, existing levels of coverage and availability of service were considered during the interventions listing process.

Stakeholder Engagement

The acceptability and legitimacy of the EHSP will depend not only on the type and quality of evidence used to define the package but also on the transparency and deliberativeness of the revision process.

Legitimacy and trust crucially depend on a deliberative process with stakeholder involvement.[26] Stakeholders were actively engaged in matters ranging from setting prioritization criteria and identifying health interventions to the prioritization and ranking of the interventions. The stakeholders included local experts, such as primary health care practitioners, doctors and specialists, as well as public representatives, including a women's association, a youth association and various professional associations. The latter included the Ethiopian Medical Association, Ethiopian Society of Obstetrics and Gynecologists, Ethiopian Surgical Association, Ethiopian Radiology Association, Ethiopian Public Health Association, Ethiopian Public Health Officer Association and Ethiopian Environmental Health Association as well as disease-specific interest groups, including the Diabetic Association, the Union of People Living with HIV, the Cardiac Disease Association, the Cancer Disease Association, the Kidney Disease Association, and the Association of People Affected by Leprosy (Supplement II). A total of 35 consultative workshops were convened with experts and the public to define the essential health service package.

Prioritization Criteria

The prioritization criteria were prepared by reviewing the literature, national health policy documents and relevant strategic health sector documents. Also considered were the criteria for the prioritization of health services recommended by WHO's Consultative Group on Equity and Universal Health Coverage, including maximizing the total health gains for a given investment, giving priority to health services that target or benefit the less fortunate and providing financial risk protection, particularly to the poor.[13] Broadly, such a prioritization approach is based on three elements: data, dialogue and decision.[27] Ten consultations and deliberative meetings were held on the proposed criteria with global and local experts, public representatives and professional associations.

After the deliberations, seven prioritization criteria were selected, namely the burden of disease, cost-effectiveness, equity, financial risk protection, budget impact, public acceptability and political acceptability. Disease burden was used to identify the relevant conditions and risk factors of

particular importance in the Ethiopian context. The cost-effectiveness criterion was used to quantitatively rank and compare health interventions according to the health gains that they would yield per dollar spent. The equity and financial risk protection criteria were used to further compare health interventions and to give higher values to health benefits for the less fortunate and to interventions that protect against catastrophic out-of-pocket health expenditures. In addition, the public and political acceptability of the interventions were taken into account through the qualitative deliberative process and a dialogue with policy makers.

Assessment and Synthesis of Evidence

Cost-effectiveness evidence was estimated using a mix of methods, including both new, context-specific analysis and a literature review. For 144 interventions, WHO's CHOosing Interventions that are Cost-Effective (CHOICE) methodology for generalized cost-effectiveness analysis (GCEA) was used to estimate average cost-effectiveness ratios (ACERs) using local input data. For 382 interventions, we used CEA evidence from the literature, such as the DCP3,[25] the Tufts CEA Registry,[28] and peer-reviewed articles after applying appropriate contextualization to the Ethiopian context using general transferability criteria based on the Consolidated Health Economic Evaluation Reporting Standards 10-point checklist.[29] The articles were searched using keywords constructed with a combination of the intervention's name, the study location (with priority given to studies done in Ethiopia or another low-income setting), and time (prioritizing recent studies). Two independent reviewers appraised the studies, and those deemed to meet a minimum standard of quality were accepted for inclusion in the evidence base. For the rest of the interventions (492), expert opinions were applied (Table 1). For the CEA, the health system perspective was taken, and only data that were transferable to the Ethiopian context were used. When cost information was originally from another setting, the currency difference was adjusted using the appropriate exchange rate and inflated to 2019 USD using the GDP deflator. Healthy life years (HLY) gained, Disability-Adjusted Life Years (DALYs) averted and Quality-Adjusted

Table 1. Summary of the sources of evidence for prioritization in the Ethiopian EHSP, 2019

Criterion	Evidence synthesis method
Disease burden	Global Burden of Diseases (GBD), 2017 study
CEA	GCEA study using WHO-CHOICE OneHealth Tool, literature search and transferability
Equity	Expert opinion using the Delphi method
FRP*	Expert opinion using the Delphi method
Budget impact	Costing and budget impact analysis Annual cost per capita
Public acceptability	Deliberative meetings with public representatives.
Political acceptability	Deliberative meetings with policy makers; decisions by EC, MC, and JSC

* Financial risk protection.

Life Year (QALYs) gained were the main health outcome measures. All costs and health outcomes were discounted at 3% per year.[30,31]

The interventions were first ranked according to cost effectiveness and then adjusted if the interventions had a high equity score and/or financial risk protection (FRP) score. The scores for equity impact and FRP were assigned through the Delphi process with input from subject matter experts, professional associations and public representatives. In the revision of the Ethiopian EHSP, the equity criterion was applied in a way that gives high priority for health interventions targeting diseases, conditions or risk factors which mainly affects the worse off. Based on a review of national policy and strategic documents in the Ethiopian health sector, the worse-off was defined as being children less than five years of age, pregnant mothers, the economically poor, and populations who live in very remote areas. The equity score and FRP score ranged from 1 (lowest) to 5 (highest), with 1 indicating no equity impact/no financial risk and 5 indicating that it would be inequitable not to include the intervention and that people would pay large sums out of pocket. Therefore, all the interventions were ranked in descending order based on their priority score, and the most cost-effective, equitable and financially protective health interventions were ranked accordingly and included in the EHSP as high-, medium- and low-priority interventions.[19]

Budget Impact

The gap between aspirational targets and available financial and physical resources is a rate-limiting factor in the implementation of EHSPs in many countries. The set of services to be made available was determined by the expected available budget. Therefore, conducting a costing exercise for the whole EHSP and, in particular, per health intervention was an important step.

The costing was done using the OneHealth Tool (OHT) for which the default setup includes 438 of the 1,018 interventions.[32] We manually estimated the costs of the remaining 580 interventions in the EHSP using an Excel spreadsheet.[33] The OHT's default data on the cost of drugs, supplies and the default population model for Ethiopia were updated with local country-level data.[25]

The budget impact and the number of interventions the health system needs and can provide depend on both the number of individuals in need and the intervention coverage. The population in need was estimated from the total number of individuals affected by the condition and the proportion of those who needed the appropriate intervention. We used estimates of prevalence and incidence data from national-level estimates and employed baseline UHC coverage data as published by Eregata et al., supplemented by expert judgments when necessary.[34]

Deliberation and Decisions on the Intervention List

The core team undertaking the evaluation presented the full results to the policy makers at MoH for review, for discussion of whether to include or exclude certain interventions and for approval. The final decision was taken by the executive committee (EC) of the MoH, which is the higher-level decision-making body in the sector.

Results

Interventions in the Final Revised EHSP

In the first comprehensive list, 1,749 interventions were included for consideration. This initial list was then further revised to avoid duplication and merged to 1,442 interventions. Various directorates of the MoH then commented on the intervention list. We further compared the interventions with the magnitude of the burden of disease or the risk factor they targeted. After removing interventions unmatched by the burden of disease or not relevant in the Ethiopian
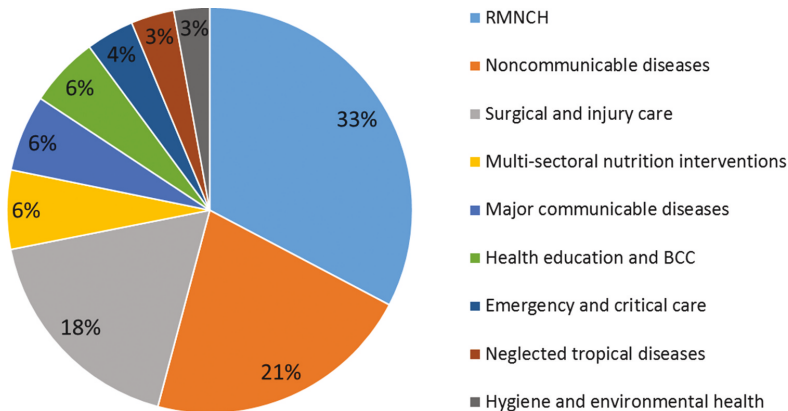
Figure 2. The proportion of interventions by major program area
Notes: BCC = behavioral change communication; NCD = non-communicable diseases; NTD = neglected tropical disease; RMNCH = reproductive maternal neonatal child health.

setting, the number of interventions was reduced to 1,223. Finally, another regrouping and reorganizing of health interventions yielded 1,018 interventions that were ready for evaluation and comparison based on the other criteria (Supplement III). The interventions by the major program are presented in Figure 2.

The interventions by the sub-program area are presented in Table 2.

Level of Priority

A decision was taken to make available all 1,018 interventions in the EHSP. Among them, 594 (58%) were categorized as a high priority, 213 (21%) as a medium priority and 211 (21%) as low priority interventions (Figure 3).

Delivery Platforms

About 60% of the interventions will be delivered through what, in Ethiopia, is defined as primary care (which includes community-based interventions, health posts, health centers and primary hospitals), about 20% at the secondary level of care and about 20% at the tertiary level (Figure 4). When we disaggregate the program areas, 70% of the RMNCH interventions will be delivered at the primary care level, while only 30% will be delivered at the secondary or tertiary level of care. For hygiene

and environmental health, 84% of the interventions will be delivered as primary care, and, for health education and promotion, the figure is 86%. On the other hand, 53% of the more advanced NCD and surgical interventions will be delivered in secondary and tertiary hospitals.

Payment Mechanism

The current policy is to provide 570 interventions (56%) free of charge while the remaining services will have a guaranteed availability but with cost-sharing (38%) and cost-recovery (6%) mechanisms in place (Figure 5). All the interventions under the program areas of multisectoral and health education will be provided free of charge while all the interventions under emergency and critical care will be provided with cost-sharing

Discussion

With a long-term goal of reaching UHC, Ethiopia revised the EHSP in 2019.[19] In light of the globally recommended approaches and principles for designing a good EHSP,[12,13,24,35-37] we discuss the process of revision, the key methodology, the involvement of stakeholders and experts and the key features of the new Ethiopian EHSP.

Table 2. Interventions by major program area and sub-program area

Major program areas and sub-program areas	N	%
RMNCH	**333**	**32.7**
Nutrition	130	12.8
Child health	88	8.6
Sexual and reproductive health	60	5.9
New-born health	34	3.3
Maternal health services	21	2.1
NCD	**218**	**21.4**
Cancer	68	6.7
Cardiovascular disease	28	2.8
Diabetes mellitus	6	0.6
MNSUD*: Childhood mental disorders	11	1.1
MNSUD: Substance use disorders	14	1.4
MNSUD: All	4	0.4
MNSUD: Mental disorders	20	2.0
MNSUD: Neurological disorders	4	0.4
NCDs: All	33	3.2
Non-communicable eye health problems	8	0.8
Renal diseases	8	0.8
Respiratory diseases	14	1.4
Surgical and injury care	**181**	**17.8**
Anesthesia	16	1.6
Surgical care	165	16.2
Multisectoral nutrition interventions	**64**	**6.3**
Multisectoral nutrition interventions	64	6.3
Major communicable diseases	**62**	**6.1**
HIV/AIDS	24	2.4
Tuberculosis	10	1.0
Malaria	13	1.3
Sexually transmitted infections	11	1.1
Leprosy	4	0.4
Health education and BCC	**57**	**5.6**
Health education and promotion	57	5.6
Emergency and critical care	**39**	**3.8**
Emergency and critical care: All	5	0.5
Pre-hospital emergency care	8	0.8
Basic emergency care	2	0.2
Advanced emergency care	24	2.4
NTDs	**35**	**3.4**
NTDs	35	3.4
Hygiene and environmental health services	**29**	**2.8**
Hygiene and environmental health	29	2.8
Grand Total	**1,018**	**100.0**

* MNSUD = Mental Neurological and Substance Use Disorder.

Participatory Process

As recommended by Norman Daniels in the accountability for reasonableness framework, an effort was made to ensure that the whole process of EHSP revision in Ethiopia was as open, fair, participatory and inclusive as possible.[35] The revision process took about 1.5 years (from May 2018 through November 2019). Most of the internal and external stakeholders were actively engaged from the inception to the finalization of the EHSP. Five rounds of workshops were conducted with policy makers at the regional and federal levels in the health sectors, including ministers, state ministers, director generals, directors, regional health bureau heads and deputy heads. As described in the Ethiopian health sector governance framework in the Health Sector Transformation Plan (HSTP), these groups are responsible for decision-making in the health sector, both technically and at the policy level.[18] Therefore, they discussed and defined the scope and goal of the revised EHSP, the selection criteria, the proposed payment mechanism, the level of health care delivery and the budget impact of the package. The final, prioritized list of interventions was approved by the same group.[19]

Two rounds of dialogue were conducted with external stakeholders, including public representatives, professional unions and disease-specific patient organizations. The first meeting discussed the prioritization criteria and the second discussed the selection of interventions, the proposed payment mechanism, the service delivery platforms and the final validation of the prioritized EHSP. Consultation directly with the public at the grassroots level remained limited, however.

Use of Multi-criteria Decision-making

Cost effectiveness has long been the most commonly applied prioritization criterion in defining health benefits package decision-making processes in many countries.[38,39] Recently, multi-criteria decision-making (MCDM) has become a widely accepted approach because UHC is not merely about maximizing health.[40] FRP, equity impact and budget impact are also important and must be considered. Public and political acceptability is likewise, important considerations. In this regard, the Ethiopian EHSP was revised through an MCDM process.[19]

Linking with Service Delivery and Financing Mechanisms

A well-designed EHSP should inform policy makers on how to better organize the health system in terms of payment mechanisms, delivery platforms, specific implementation plans and monitoring and evaluation methods.[18,24] In this regard, the interventions in the EHSP are aligned with clearly defined levels in the current service delivery platform. Because translating the intervention lists into real-world service provision requires linking with financing arrangements, the
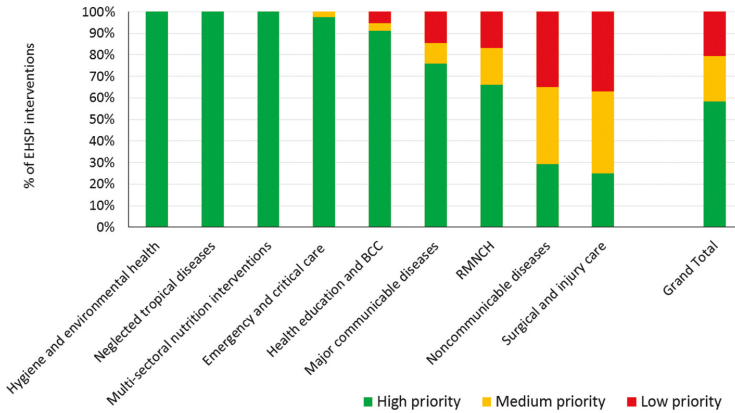
Figure 3. EHSP interventions by major program area and level of priority
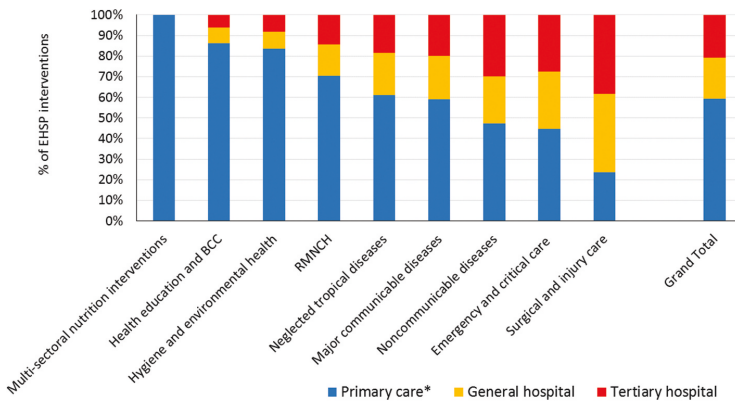

Figure 4. EHSP interventions by major program area and delivery platform
* Primary care includes community-based interventions, health posts, health centers and primary hospitals.

revised EHSP also provides possible ways to finance the package. The costs of the interventions were estimated to determine the budget impact, and the expected available resources in the next 10 years were estimated using basis-case, low-case and high-case scenarios.[19]

Experiences of Other Countries

The process of revising the Ethiopian EHSP shared many similarities with other African, Asian and Latin American counties' experiences in terms of using evidence and multiple criteria, involving a wide range of stakeholders and maximizing public participation in decision-making.[9,41-43] For instance, multiple criteria such as disease burden information, effectiveness, cost-effectiveness analysis, equity impact, FRP and the budget impact was employed in benefit package revisions in Mexico, Chile, Thailand, the Philippines and Ghana.[44-49] In Malawi and Zimbabwe, however, only cost effectiveness and disease burden information was used to set priorities.[50,51]

Regarding public participation and stakeholder engagement, evidence from both high-income and low-income settings indicates that engaging all stakeholders from the initial stage of the revision process through the final stage is not only vital to
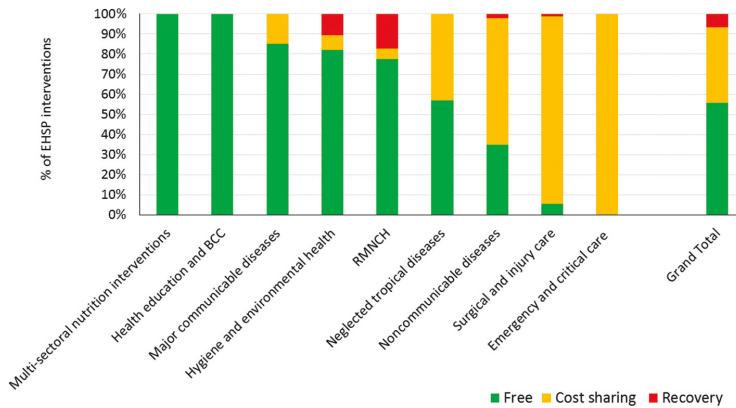
Figure 5. EHSP interventions by major program area and payment mechanism

increasing the acceptability of the final health service package but also helpful in addressing the concerns of various groups.[52] As in the Ethiopian case, the revision process in Chile, Thailand and Malawi was participatory.[44,51,53] However, in the Ethiopian revision process, the public participation did not involve the direct participation of the citizenry. In the next round of revision of the EHSP, we recommend that town hall meetings be conducted to elicit public opinion directly.

The main difference between the Ethiopian EHSP and those of many other countries is the comprehensive scope of the interventions in the package. In the Ethiopian EHSP, 1,018 interventions, ranging from multisectoral population-level policy interventions (e.g., enforcing the taxation of alcohol, cigarettes, *khat* and sugary beverages) to specific and specialized clinical services (e.g., palliative care for colorectal cancer) were included. Unlike in the Ethiopian case, the benefits package in some other countries was neither comprehensive nor explicit. For example, the Mexican EHSP began with 90 interventions[48] and expanded over time to 297, and Zimbabwe's EHSP has only 65 interventions.[50] In Malawi, 67 interventions are included.[51] Having an explicit, comprehensive health service package is an opportunity to ensure the inclusion of important interventions from all program areas in the benefits package.[12,35] This is especially important in settings such as Ethiopia, where the institutional and technical capacity to continuously update the package is limited.

Limitations

We believe that lessons learned from the revision of the Ethiopian EHSP can be useful to other low-income countries. The revision aimed to be an extensive, participatory, inclusive, evidence-based, democratic and transparent decision-making process. There were, however, limitations related to data sources and analytic approaches that merit consideration when applying the findings of this study in other settings.

The first limitation was that the Delphi technique was applied to systematically generate equity and FRP scores based on expert opinion because of the limited available data on the equity and FRP impacts of the interventions. This approach is a good way to synthesize expert opinion when other data are not available. Although the application of the Delphi technique provided the opportunity to explore the equity impact and FRP from a wider perspective (i.e., including socioeconomics, geography, gender, age, etc.), it is less precise and prone to various types of biases. Therefore, more studies on equity impact analysis and more FRP studies should be conducted. Had more extended cost-effectiveness analyses been conducted, we would have had more relevant evidence available. Furthermore, methods development could advance the application of the Delphi method and other nominal group techniques in a way that could provide a better estimate of the equity and FRP impact of interventions.

A second limitation was the lack of contextualized cost-effectiveness analyses. Although we extracted cost-effectiveness information for a large majority of the interventions from peer-reviewed articles of good quality and from a comprehensive systematic review provided by DCP3 and others, the transferability and standardization of the results remain imperfect because of factors including inconsistent designs (discounting, perspective, currency, etc.) and inconsistent and nontransparent reporting. In addition, demographic, epidemiologic, and health system variation across setting where the original studies were conducted has made transferability of cost-effectiveness ratios more challenging.

A third limitation concerns our general approach to benefit package design. There are three approaches to defining an EHSP: positive listing, negative listing and a mix of the two approaches. We applied a positive listing approach. A mixed approach might have been better in a situation in which there were significant data limitations on the cost and impact of several interventions. High-cost interventions with modest health impacts (e.g., new immunotherapies for cancer) can be listed in the negative list based on evidence from high-income countries. This could have informed decision makers about what not to invest in.[53] Because health needs, disease patterns and health care technology change quickly over time, however, the MoH has a plan to institutionalize a continuing health technology assessment (HTA) mechanism for assessment and appraisal of new technologies and update the list of interventions on an ongoing basis. In addition, the Ethiopian government should revise the EHSP regularly every five year.

Lack of expertise in health economics and HTAs in the country can be another limitation, but the long-term investment in the Disease Control Priorities–Ethiopia project has largely circumvented that limitation in this setting. Therefore, continuous capacity building and the training of health economists are crucial to strengthening the use of evidence in strategic purchasing for UHC in Ethiopia and other low- and middle-income countries.[54]

Conclusion

The revision of Ethiopia's EHSP used a participatory, inclusive, evidence-based prioritization process. The interventions included in the EHSP were comprehensive, assigned to health care delivery platforms and linked to financing mechanisms.

Availability of Data and Material

The data sets supporting the conclusions of this article will be fully available.

Disclosures of Potential Conflicts of Interest

GTE, AH and ADG were employees at the Ethiopian Federal Ministry of Health and AA was Minister of Health during the project period. The other authors declare no conflict of interests

Ethics Approval and Consent to Participate

The study was approved by the Institutional Review Board (IRB) of the Ethiopian Public Health Institute (Ref: EPHI/6.13/607).

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Date

Institutional Review Board (EPHI-IRB)

<u>Certificate of Protocol Approval</u>

EPHI-IRB Meeting No. *031*

Protocol number: *EPHI-IRB-124-2018*

Protocol Title: *Defining the Ethiopian Essential Health Service Package for Universal Primary Care: Evidence, Process, and Implementation.*	
Principal Investigator	*Getachew Teshome*
Institute	*Ministry of Health*
Study site/s	*Ethiopia*
Type of Review	☑ Full-Board ☐ *Expedited*
Decision of the meeting	☑*Approved* ☐ Approved with Recommendation

I. Elements approved-
    1. Protocol Version No. *Ver 001*
    2. Protocol Version Date: *27 Oct, 2018*

II. Obligations of the PI-
    1. Should comply with the standard international & national scientific and ethical guidelines
    2. All amendments and changes made in protocol and consent form needs IRB approval
    3. The PI should report SAE within 10 days of the event
    4. End of the study, including technical reports, thesis works and manuscripts should be reported to the IRB

III. Details of recommendation (if approved with recommendation) _____
Institution Review Board (IRB) Approval date: *27 Oct, 2018*
Approval period: from *27 Oct, 2018* to *26 Oct, 2019*
Follow up report expected in: 3 Months _____ *6 Months* ☑ ___ 9 Months_____ One year_____

Chairperson, IRB
Signature _____
Date __ 22 / 2018 አ/ብ

Director General
Signature _____
Date _____

Ebba Abate (Dr)
Director General

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