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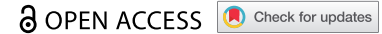


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RESEARCH ARTICLE



## Is Universal Health Coverage Affordable? Estimated Costs and Fiscal Space Analysis for the Ethiopian Essential Health Services Package

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### ABSTRACT

Estimating the required resources for implementing an essential health services package (EHSP) is vital to examine its feasibility and affordability. This study aimed to estimate the financial resources required to implement the Ethiopian EHSP from 2020 to 2030. Furthermore, we explored potential alternatives to increase the fiscal space for health in Ethiopia. We used the OneHealth Tool (OHT) to estimate the costs of expanding the EHSP service provision in the public sector in Ethiopia. Combinations of ingredient-based bottom-up and program-based summary costing approaches were applied. We predicted the fiscal space using assumptions for economic growth, government resource allocations to health, external aid for health, the magnitude of out-of-pocket expenditure, and other private health expenditures as critical factors affecting available resources devoted to health. All costs were valued using 2020 US dollars (USD). To implement the EHSP, 13.0 billion USD (per capita: 94 USD) would be required in 2030. The largest (50–70%) share of estimated costs was for medicines, commodities, and supplies, followed by human resources costs (10–17%). However, the expected available resources based on a business-as-usual fiscal space estimate would be 63 USD per capita for the same year. Therefore, the gap as a percentage of the required resources would be 33% in 2030. The resources needed to implement the EHSP would increase steadily over the projection period due mainly to increases in service coverage targets over time. Allocating gains from economic growth to increase the total government health expenditure could partly address the gap.

### ARTICLE HISTORY

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### KEYWORDS

Fiscal space analysis; essential health services package; Ethiopia; universal health coverage; resource mobilization

## Introduction

Defining an essential health services package (EHSP) is globally recognized as a critical step in advancing toward universal health coverage (UHC).<sup>1</sup> Decision makers in countries should be accountable, and service providers should understand what type of priority health interventions they should deliver to the whole population, either free or with substantial cost-sharing arrangements.<sup>1,2</sup> Cognizant of this, Ethiopia's government launched the revised EHSP in 2019, explicitly identifying interventions to address the population's health needs adequately.<sup>3</sup> The revised EHSP was built on the national health policy's goals, which target expanding the availability and accessibility of a comprehensive set of health services to the whole population equitably, without geographical and financial barriers, with acceptable

quality.<sup>3</sup> It contains 1,018 interventions from nine major program areas, including 333 reproductive, maternal, neonatal, and child health (RMNCH), 218 noncommunicable disease (NCD), 181 surgical care, and 64 multisectoral nutrition interventions. In terms of priority, 58% were categorized as high priority, 21% as medium priority, and 21% as low priority interventions.<sup>3,4</sup>

Estimating the resources required for the implementation of the EHSP is vital in examining its feasibility and affordability.<sup>2</sup> Some of the critical questions for implementers of the EHSP are: What are the total financial resources needed to scale up the EHSP? How much would be available from different sources? What are the viable methods to increase resources for health and to reduce costs?<sup>5</sup> The

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Ethiopian government needs to understand the costs and resource implications of the proposed interventions and the whole package. Cost projections and fiscal space analysis can guide the allocation of scarce resources to be in accordance with stated policy goals.

Fiscal space refers to “the budgetary room that allows a government to devote resources to specific services or activities without influencing the sustainability of its financial position.”<sup>6</sup> Conducting a costing and fiscal space analysis to inform national health plans is important to inform the progressive scale-up of the health packages based on the country’s realistic ability to pay for them.<sup>5</sup> However, few studies estimate the resource needs and fiscal space in low- and middle-income countries.<sup>7</sup> Comprehensive studies on this crucial topic in the Ethiopian setting are scarce, and the few existing examples highlight limited domestic resources and a need to prioritize. For example, Berman et al. examined the fiscal space for primary health care in Ethiopia and concluded that Ethiopia cannot adequately finance basic primary health care interventions without external sources.<sup>8</sup> Kelly et al. examined health financing in Ethiopia from public financial management perspectives and emphasized a decreasing trend in external funding and a slower increase in government expenditures on health as critical challenges for the sustainability of health financing.<sup>9</sup> Therefore, in our study, using the most recent data and applying a comprehensive approach, we aimed to estimate the financial resources required and the projected available resources to implement the revised Ethiopian EHSP from 2020 to 2030. We explored the gap and potential alternatives to increase the fiscal space for health in Ethiopia, also considering the recent COVID-19 pandemic.

## Methods

### Study Context

We conducted this study in Ethiopia in 2019. Ethiopia has a total population of about 109 million in 2020. The demographic structure in Ethiopia is characterized by rapid population growth and dominated by young age groups.<sup>10</sup> Livelihoods in Ethiopia predominantly depend on subsistence agriculture. The Gross Domestic Product (GDP) per capita in 2019 was 953

USD.<sup>11</sup> The government aspires to reach lower middle-income country status by 2025.<sup>12</sup> The economic system has shown substantial growth over the past two decades.<sup>13</sup>

Health care delivery in Ethiopia is organized in a three-tier system: primary, secondary, and tertiary levels. The primary level comprises primary hospitals serving 60,000–100,000 people, health centers serving 15,000–25,000 people, and, in rural areas, five satellite health posts (serving 3,000–5,000 people each). The secondary level consists of general hospitals serving 1.0–1.5 million people. The tertiary level consists of specialized hospitals covering 3.5–5.0 million people. There is a referral system operating among the health facilities within and between the tiers based on the catchment network model. A total of 16,563 health posts, 3,531 public health centers, and 247 public hospitals render services to populations.<sup>14</sup>

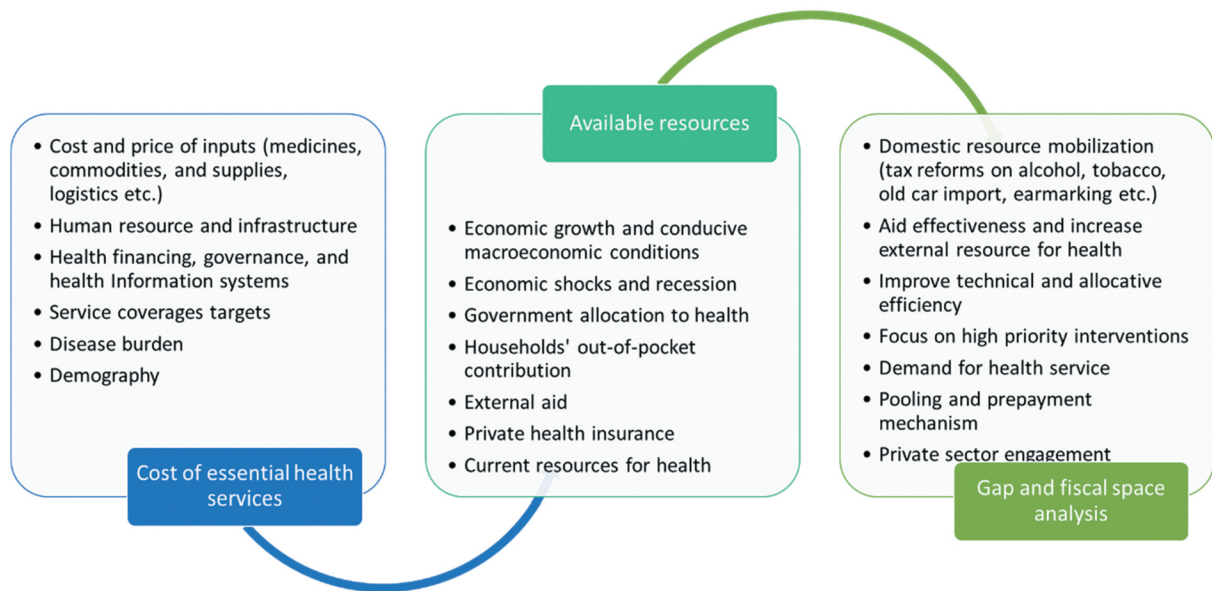
Ethiopia’s National Health Accounts (NHA) show that, in 2016/17, the country’s total health expenditure (THE) was 3.1 billion USD, accounting for 4.2% of the GDP. In two decades, the total per capita spending on health increased eightfold (i.e., from 4 USD in 1995 to 33.2 USD in 2016/17) (Table 1).<sup>15</sup>

### Study Framework

We present the conceptual framework of our analysis in Figure 1. First, we examined the cost of implementing the EHSP. Second, we projected the expected available resources. Third, we compared costs against available resources and defined the gap. Finally, we examined the impact of the recent pandemic on both costs and resources available, and we incorporated the pandemic effect in the prevailing gap.

**Table 1.** Health financing indicators from the 2016/17 NHA

Indicator	Value
Total health expenditure, USD in billions	3.1
Expenditure from government, %	32.0
Expenditure from OOP, %	30.6
Expenditure from external sources, %	35.2
Expenditure from other private sources, %	2.0
Government health expenditures, % of GDP	1.2
Government health expenditures as a share of total government expenditure, %	8.1



**Figure 1.** Conceptual framework of the study linking costs, available resources, and financial gap analysis (source: produced by the authors for this publication)

## Costing Essential Health Services

### Approach

The cost of the service package was estimated by identifying the resources needed to provide each intervention separately, and then combined, in the public sector. To facilitate the calculation process, we used the OneHealth Tool (OHT)<sup>16</sup> and entered information about population in need and resources use for each intervention into the OHT software. We combined ingredient-based bottom-up and program-based summary cost estimation techniques. The ingredient-based approach requires that all resources, in terms of medical personnel, drugs, supplies, and other commodities, are accounted for. One important source for this information was standard treatment guidelines. Costs directly incurred by the households and non-health sector costs, such as transport, food, and accommodation, were not included.<sup>17</sup> For some interventions, we lacked information on detailed resource needs, so we based costs on existing expenditure by program areas which was available at an aggregate level only. We selected the main costing approach based on the availability of input data (Table 2).

### Costing Scenarios

We set the baseline coverages (i.e., coverage entailing how many would receive the service out of those who required the service) for

the year 2017 based on published indicators by Eregata et al., Health Management Information Systems (HMIS) databases from the Ministry of Health (MoH), Demographic and Health Survey (DHS) reports, the Malaria Indicator Survey, STEPwise approach to Surveillance (STEPS) survey data for NCDs, the Service Availability and Readiness Assessment (SARA) report, and expert judgments.<sup>18–23</sup> There was substantial variation in the baseline coverage across program areas and disease categories. In general, the baseline coverage for most RMNCH and infectious disease interventions was typically in the range of 50% to 80% while it was very low for most NCD and surgical interventions (0–30%). For instance, a baseline coverage of 80% for antenatal care (ANC), 60% for Long-Lasting Insecticidal Nets (LLIN), and 54% for full immunization was taken, while a baseline coverage of 5% for anxiety disorders treatment, 3% for cervical cancer screening, and 0% for colorectal cancer screening using colonoscopy was taken.

Therefore, target coverages were established considering the baseline status and potential progression that could possibly be made within the Ethiopian health systems' capacity, based on information from deliberations with the MoH leadership. Although the milestones for UHC in Ethiopia were set based on the country context, the 80% target

**Table 2.** Core elements and costing approaches of the Ethiopian EHSP by major program

Major program	Elements	Main costing approach
RMNCH (32.7%)	Nutrition; child health; sexual and reproductive health; newborn health; maternal health services	Ingredient-based bottom-up costing
NCD (21.4%)	Cancer; cardiovascular disease; diabetes mellitus; mental disorders; substance use disorders; neurological disorders; noncommunicable eye health problems; renal diseases; respiratory diseases	Ingredient-based bottom-up costing
Surgical and injury care (17.8%)	Anesthesia; surgical care; injury care	Program-based summary costing
Multisectoral nutrition interventions (6.3%)	Multisectoral nutrition interventions in diverse sectors (e.g., agriculture, education, industry, etc.)	Program-based summary costing
Major communicable diseases (6.1%)	HIV/AIDS; tuberculosis; malaria; sexually transmitted infections; leprosy	Ingredient-based bottom-up costing
Health education and behavioral change communications (BCC) (5.6%)	Health education and promotion	Program-based summary costing
Emergency and critical care (3.8%)	Pre-hospital emergency care; basic emergency care; advanced emergency care	Program-based summary costing
Neglected Tropical Diseases (NTDs) (3.4%)	NTDs	Program-based summary costing
Hygiene and environmental health services (2.8%)	Hygiene and environmental health services	Program-based summary costing

coverage of priority interventions recommended by Disease Control Priorities (DCP-3) and the World Health Organization (WHO) was used as a guide in the deliberation process.<sup>24,25</sup> The service package remained the same across scenarios, and the difference in costs between scenarios was driven by target coverage to be reached by 2030.<sup>3,4</sup>

We developed three cost projection scenarios by varying the target coverages of the interventions and classifying them as low, medium, and high. In the low scenario, we assumed a 30% target coverage for most NCD interventions and an 80% coverage for most RMNCH and infectious disease interventions. For the medium scenario costing, we assumed a 50% target coverage for NCD interventions and a 95% target coverage for RMNCH and infectious disease interventions. For the high scenario, we estimated the cost based on a target coverage of 80% for NCD interventions and 100% for most RMNCH and infectious disease interventions. We used the medium scenario as the main scenario as it is more in line with the current globally recommended SDG-UHC commitment than the other two scenarios and better aligned with plans across different directorates in the MoH.<sup>14,24–26</sup>

### Data Sources and Analysis

In this study, we analyze the financial cost of implementing the EHSP. The total financial cost ( $TC$ ) of the EHSP was calculated by adding the medicines, commodities, and supplies costs ( $MCS_C$ ); human resources costs ( $HR_C$ ); infrastructure costs ( $I_C$ ); logistics costs ( $L_C$ ); health information systems costs ( $HIS_C$ ); health financing costs ( $HF_C$ ); governance costs ( $G_C$ ); and program management costs ( $PM_C$ ) (Equation 1).

$$TC = MCS_C + HR_C + I_C + L_C + HIS_C + HF_C + G_C + PM_C \quad (1)$$

The detailed cost assumptions and data analysis techniques are described in other publications.<sup>27,28</sup> The costing was done using the OHT for 438 of the 1,018 interventions. For the remaining 580 EHSP interventions, an Excel spreadsheet was used, and aggregate cost data were collected from various departments at the Federal Ministry of Health.<sup>16,29</sup> Each of the OHT's costing module templates was populated with country-level data for Ethiopia from

various sources. The medicines, commodities, and supplies required to deliver the interventions were identified, quantified, and multiplied by the unit price of the items.<sup>30</sup> To measure  $MCS_c$ , we obtained the unit price information from the Ethiopian Pharmaceutical Supply Agency (EPSA) and the Logistics Department of the Ministry of Health.

The human resources (HR) module was used to account for personnel costs ( $HR_C$ ) using the number of health care workers' and supportive non-health care workers' (e.g., clerks, drivers) salaries, benefits, and incentives as inputs. We also accounted for the cost of preservice training and nonspecific in-service training. HR costs for providing the interventions were also included based on the most up-to-date data from the Human Resource Department of the Ministry of Health of Ethiopia.

Regarding infrastructure cost ( $I_C$ ), the cost of construction of new, additional facilities, facility operating costs (water and electricity), and costs for the purchase and maintenance of medical equipment were included. However, we did not account for the future need for the purchase of new vehicles. The logistics ( $L_C$ ) costs include the costs of the procurement, transportation, storage, testing, and distribution of medicine, commodities, and supplies (i.e., the costs of the materials themselves are not included here).

The inputs for estimation of  $HIS_C$ ,  $HF_C$ , and  $G_C$  were collected from the Planning and Policy, Partnership and Cooperation, and Governance and Reform Directorates, respectively. We also account for the cost of program management support in this study.  $PM_C$  are the non-health care delivery costs associated with delivering an intervention program that are incurred at a level other than the intervention's point of delivery. They include costs incurred at district, provincial, and central levels and exclude costs incurred at the facility or patient levels. They include the cost of administration and planning, media and communication, law enforcement, training, monitoring, and evaluation.

All the costs were valued using 2020 USD. All the cost input data initially collected in Ethiopian birr (ETB) were first converted to USD using the average exchange rate for the year and later converted to 2020 USD using the USD GDP deflator.<sup>31</sup> An interest rate of 3% per annum was used to inflate the costs. The cost per capita was

calculated by dividing the total annual cost by the mid-year population size for the respective years. The types of data included, sources, and OHT modules employed are presented in Table 3.

### Projection of Available Resources

To explore the expected available resources, we applied a framework proposed by Tandon and Cashin as a point of departure.<sup>6</sup> This framework has five key dimensions: conducive macroeconomic conditions, reprioritization of health within the government budget, earmarked income and consumption taxes directed toward the health sector, better efficiency of existing health expenditure, and external aid (Equation 2).

$$G_t + \gamma_t B_{t-1} = T_t + B_t + A_t + O_t \quad (2)$$

The left side of the equation represents the expenditures of budgetary resources. Specifically,  $G_t$  is government non-interest expenditure in time  $t$ , and  $\gamma_t B_{t-1}$  is non-discretionary debt interest payments. The right side of the equation represents a generation of budgetary resources, which is the primary focus of this study from a health sector perspective.  $T_t$  is tax revenue,  $B_t$  is total government borrowing,  $A_t$  is external grants or aid, and  $O_t$  is other sources of funds (i.e., non-tax revenue). In order to customize the theoretical framework proposed by Tandon and Cashin<sup>6</sup> into the Ethiopian context, the projection of available resources was done using evidence from the recent NHA, projected growth rates from the World Bank, other relevant studies, and some key assumptions by the authors. The assumptions were established based on proposed reforms in the recently approved health care financing strategy and deliberations on potential innovative health financing options with the Ministry of Health, Ministry of Finance, and the National Plan Commission.<sup>32</sup>

Table 4 summarizes the main inputs for the projection model in business-as-usual, medium-increment, and high-increment scenarios. In our analysis, the budgetary room was determined by six factors. The first factor was economic growth (GDP growth). In our model, based on the World Bank 2019 estimate, an average annual economic growth rate in GDP of 8.6%, ranging from a worst

**Table 3.** Data sources for the cost of the Ethiopian EHSP

Inputs	Data	Sources	OHT modules
Medicines, commodities, and supplies	Types and number of drugs, commodities, and supplies; prices	EPSA drug list	Health services program
Human resources	Number of staff (health care and administration staff); salary and benefits; staff time utilization; staff attrition; preservice and in-service training	HHRIS; key informant interview at the HR department; expert's opinion	Human resources
Infrastructure	Number and type of health facilities; price	HMIS	Infrastructure
Logistics	Warehouses; transport; prices	HMIS	Logistics
Health information systems		HMIS	Health information system
Health financing	CBHI subsidy	Reports from PCD; NHA study	Health financing
Governance	Meetings and coordination (Joint Consultative Forum, Joint Core Coordinating Committee, MoH-RHBs Joint Steering Committee)	Reports from PCD	Governance
Program management cost	Program-specific human resources; training, supervision, monitoring, and evaluation; transport; communication; media & outreach; advocacy	WHO-CHOICE database	N/A
Coverage data	DHS, HMIS, MIS, STEPS, etc.	HMIS	N/A

CBHI = Community-based health insurance; DHS = Demographic and Health Survey; EPSA = Ethiopian Pharmaceutical Supply Agency; HMIS = Health Management Information System; HHRIS = Human Resource Information System; MIS = Malaria Indicator Survey; MoH = Ministry of Health; N/A = not applicable; NHA = National Health Accounts; PCD = Partnership and Cooperation Directorate; RHBs = Regional Health Bureaus; STEPS = STEPwise approach to surveillance.

case of 7.6% to a best case of 9.7%, was taken as input. This assumption considers that, although Ethiopia has had higher economic growth (around 10% annually), only a few countries have been found to be able to sustain such a very high growth rate over a long period.<sup>33</sup>

Second, following improved macroeconomic conditions, we assumed an increase in government health expenditure from the current 1.2% of the total GDP in business as usual to 2.4% by 2030 (twofold) in the medium-increment scenario or 3.6% (threefold) in the high-increment scenario. This reprioritization of health within the government budget is in line with international recommendations but actually on the low side. McIntyre et al. recommend a target of domestic government spending on health of at least 5% of GDP in their analysis of the relationship between government spending on health and a range of indicators related to UHC goals.<sup>34,35</sup> To achieve higher government health expenditure, an increase in tax revenue is probably one of the best options.

The third factor was external funding for health ( $A_t$ ). We assume that there will be relatively stable external financing for health in the next ten years (i.e., no change in absolute figures but with a relative decrease). Development partners recognize the need to sustain the substantial health improvement seen in Ethiopia (and other low-income countries) since the early 1990s.<sup>36</sup> Although this support is likely to continue in the years ahead, Ethiopia's transition to a middle-income country implies a decreased relative proportion of external funding for health.

The fourth factor was the magnitude of out-of-pocket (OOP) expenditure ( $O_t$ ). According to Ethiopia's 2016/17 NHAs, household OOP expenditures constituted 33% of THEs.<sup>15</sup> We assumed that OOP expenditure would be the same as the baseline (33%) in the business-as-usual scenario while it would shrink to 20% in the medium- and high-increment scenarios. A 20% OOP target is in line with WHO recommendations.<sup>36</sup> The OOP does not directly affect government spending, but it would likely decrease in relative terms when government spending on health goes up.

The fifth factor that we accounted for in the projection model was a change in other private health expenditures (i.e., mainly community-based health

**Table 4.** Assumptions for available health financing by scenario

Input parameters	Baseline (2017)	Business as usual	Moderate increment	High increment
GDP growth per year	7.6%	7.6%	8.6%	9.7%
GDP growth per year with COVID-19	NA	4.7%	5.7%	6.8%
Government THE as % of GDP	1.2%	1.2%	2.4%	3.6%
External funding for health as % of THE	35%	35%	31%	31%
Out-of-pocket expenditure as % of THE	31%	30%	20%	20%
Private health expenditure as % of THE	2%	2%	10%	10%
Efficiency	NA	Fixed*	Fixed*	Fixed*

\* Fixed at 2017 level; THE = total health expenditure; NA = not applicable

<sup>a</sup>GDP growth assumptions are based on estimates from World Bank projections.

<sup>b</sup>It is estimated that COVID-19 will shave off 2.9% of this fiscal year's economic growth in Ethiopia, and we assume that this effect will be the same in 2021. Moreover, as of 2022, the growth rate should be the same as the prediction without COVID-19.

insurance). According to the 2016/17 NHA, the contribution of other private health expenditure is only 2%. Based on the Health Sector Envisioning document, we assumed that it would increase to 10% of THE in both the medium- and high-increment scenarios while remaining the same (2%) in the business-as-usual scenario. Finally, no change in efficiency gains was assumed in this projection as a reliable baseline efficiency estimate was not available (Table 4).

We calculate the gap by comparing the projected available resources in the business-as-usual fiscal space scenario with the total cost for the medium scale-up scenario. The gap is presented as a percentage of the required resources (costs).

### Sensitivity Analysis

Using a one-way sensitivity analysis, we examined the possible impact of the COVID-19 pandemic on both the resource need and resource available side. The cost of COVID-19 ( $C_{C19}$ ) was estimated based on data from the Federal Ministry of Health COVID-19 mitigation plan.<sup>37</sup> The COVID-19 cost estimate includes expenses for health professionals' training, testing of suspected cases, isolation, and personal protective equipment for health care workers. To calculate the total cost of the EHSP during the COVID-19 pandemic ( $TC_{C19}$ ), we add the  $C_{C19}$  to the TC of the EHSP determined in sEquation 1.

$$TC_{C19} = TC + C_{C19} \quad (3)$$

The projection of available resources during COVID-19 was estimated using the World Bank's estimate that the economic impact of COVID-19 on macroeconomic growth will shave 2.9% off this fiscal year's economic growth in Ethiopia.<sup>38</sup> We assume that this

effect will be the same in 2021. Moreover, as of 2022, the growth rate will be based on a prediction before COVID-19 (Table 4). The gap during COVID-19 was calculated by subtracting the available resources based on business as usual from the base-case required resources considering COVID-19.

### Validation

As part of the EHSP revision, we also conducted validation workshops in which the costing, fiscal space analysis, and assumptions were discussed in detail. The validation workshops were held with several internal and external stakeholders of the Ministry of Health to request feedback on the preliminary results, and critical feedback was collected. For instance, the regional EHSP team provided input data and reviewed the report's first draft result. The regional EHSP team is composed of 33 members representing all regions. The second draft result report was presented to the joint steering committee (JSC), and essential inputs were collected. The JSC is composed of all regional health bureau heads and vice heads, all general directors of MoH agencies, and all directors, including those of Policy and Planning.

### Results

#### Required Resources for the Implementation of the EHSP

The total annual costs estimated to implement the Ethiopian EHSP in 2030 based on low, medium, and high scenarios are 9.3 billion USD, 13.0 billion USD, and 18.3 billion USD, respectively (Figure 2). Medicines, commodities, and



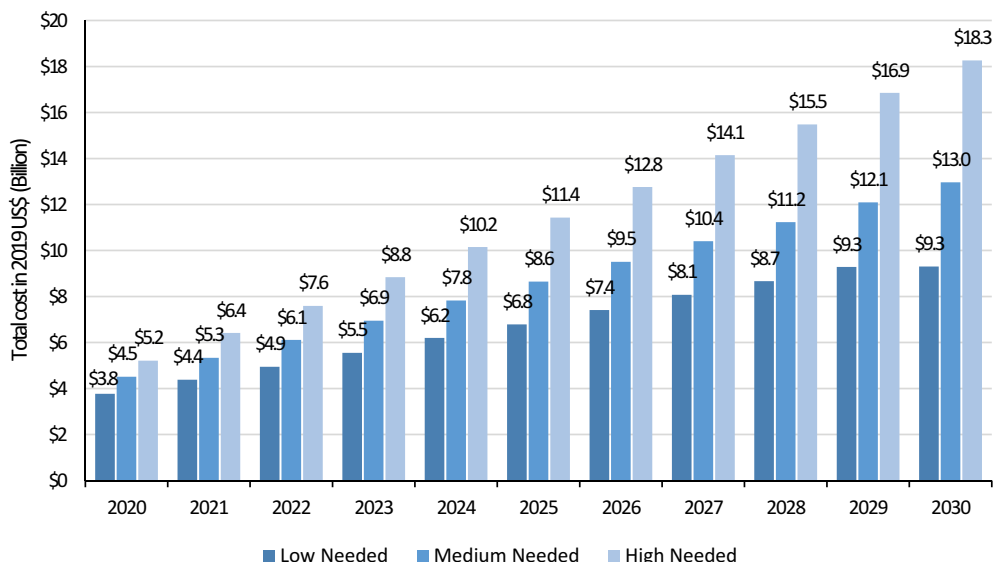


Figure 2. Required resources for the implementation of the EHSP (2020–2030)

supplies accounted for the larger share of the cost estimate, followed by HR and program management costs.

The cost of delivering the ESHP interventions per capita, adjusted for population size, is presented in Figure 3. To implement the EHSP, estimated per capita costs of 67 USD, 94 USD, and 132 USD are required based on the low, medium, and high scenarios, respectively. The resource needs steadily increased over the projection period. For example, the required resources

based on a medium scenario in 2030 (94 USD) were more than two times higher than its counterpart in 2020 (40 USD).

### Projected Available Financing

The projected health financing by scenario is presented in Figure 4. The projected available resources in 2030 would be 67 USD, 118 USD, and 167 USD based on the business-as-usual, medium-increment,

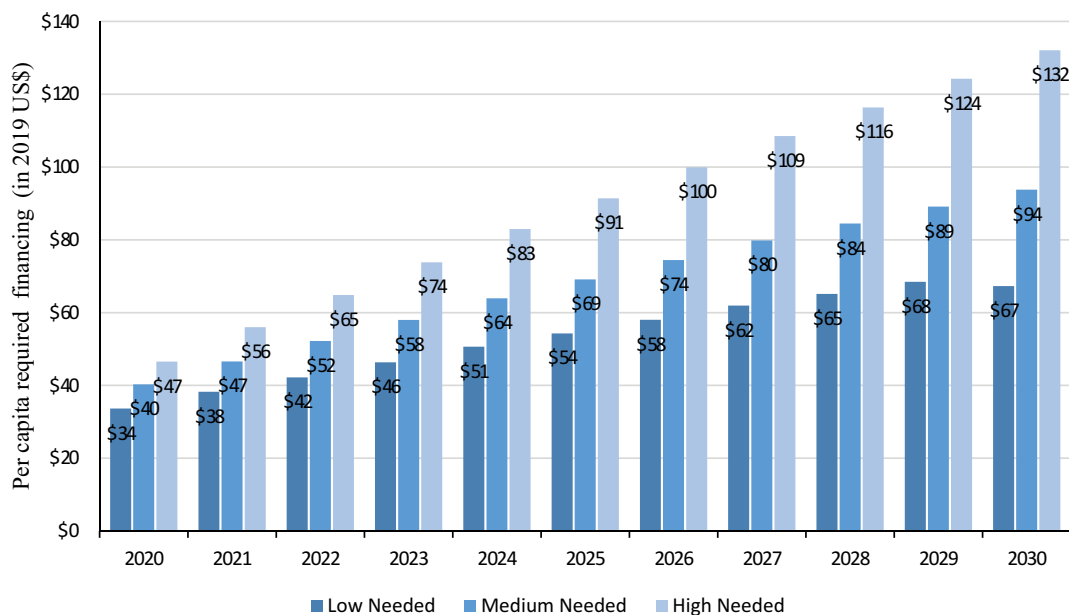
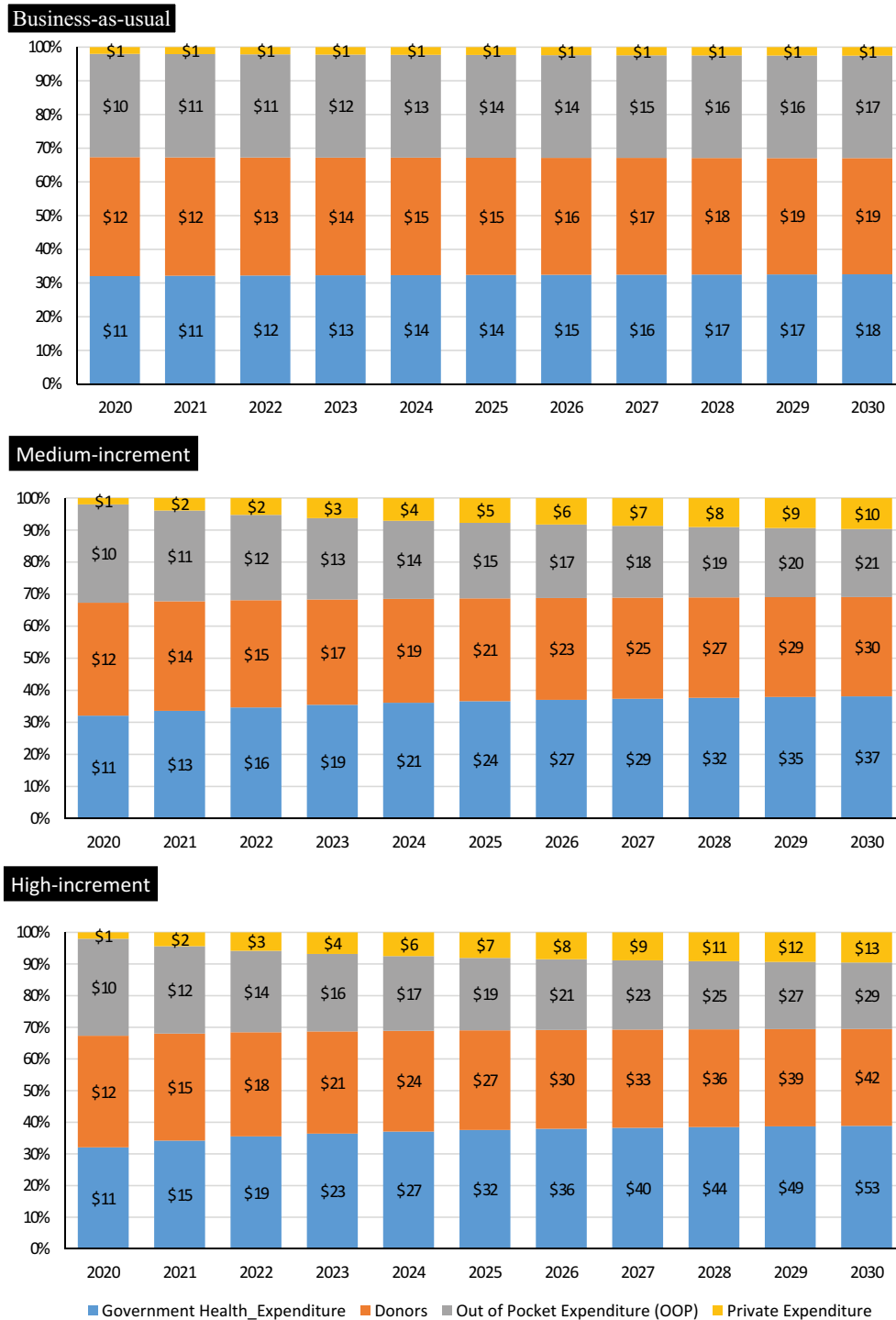


Figure 3. Per capita required resources for the implementation of the EHSP (2020–2030)



**Figure 4.** Projected total health expenditure and proportion by source of financing in business-as-usual, medium-increment, and high-increment scenarios (2019 USD per capita)

and high-increment projection scenarios, respectively. The two most important drivers of uncertainty in the projected resources available were economic growth rate and the magnitude of government spending on health as a percentage of the GDP.

### ***Fiscal Space Gap and Sensitivity to the COVID-19 Pandemic***

The resources required, projected available resources, and the gap are presented year by year from 2020 to 2030 in [Table 5](#). The left side of

**Table 5.** Estimated per capita required and available resources for implementing the EHSP (over 2020–2030) with and without COVID-19 (in USD)

Year	Resources need, available, and gap without COVID-19							Resources need, available, and the gap with COVID-19							
	Resources need			Projected resources available				Gap	Resources need			Projected resources available			
	Low	Medium	High	BaU	Medium	High	Low		Medium	High	BaU	Medium	High	Gap	
2020	33.6	<b>40.3</b>	46.5	<b>39.9</b>	52.5	63.9	<b>1%</b>	49.0	<b>55.7</b>	61.9	<b>39.5</b>	50.5	61.5	<b>29%</b>	
2021	38.3	<b>46.6</b>	56.0	<b>42.2</b>	59.1	74.2	<b>9%</b>	53.7	<b>62.1</b>	71.5	<b>41.8</b>	56.3	71.1	<b>33%</b>	
2022	42.2	<b>52.2</b>	64.8	<b>44.5</b>	65.6	84.5	<b>15%</b>	57.8	<b>67.8</b>	80.4	<b>44.0</b>	62.2	80.6	<b>35%</b>	
2023	46.3	<b>58.0</b>	73.8	<b>46.8</b>	72.2	94.8	<b>19%</b>	62.0	<b>73.7</b>	89.5	<b>46.2</b>	68.0	90.2	<b>37%</b>	
2024	50.6	<b>63.9</b>	82.9	<b>49.1</b>	78.7	105.1	<b>23%</b>	66.5	<b>79.8</b>	98.8	<b>48.5</b>	73.9	99.7	<b>39%</b>	
2025	54.3	<b>69.1</b>	91.4	<b>51.4</b>	85.2	115.4	<b>26%</b>	70.3	<b>85.1</b>	107.4	<b>50.7</b>	79.7	109.2	<b>40%</b>	
2026	58.0	<b>74.4</b>	99.9	<b>53.7</b>	91.8	125.7	<b>28%</b>	74.2	<b>90.6</b>	116.0	<b>52.9</b>	85.5	118.8	<b>42%</b>	
2027	61.9	<b>79.8</b>	108.5	<b>56.0</b>	98.3	136.0	<b>30%</b>	78.2	<b>96.1</b>	124.8	<b>55.2</b>	91.4	128.3	<b>43%</b>	
2028	65.2	<b>84.5</b>	116.4	<b>58.3</b>	104.9	146.3	<b>31%</b>	81.6	<b>100.9</b>	132.8	<b>57.4</b>	97.2	137.9	<b>43%</b>	
2029	68.5	<b>89.1</b>	124.2	<b>60.6</b>	111.4	156.6	<b>32%</b>	85.0	<b>105.7</b>	140.8	<b>59.6</b>	103.1	147.4	<b>44%</b>	
2030	67.3	<b>93.8</b>	132.1	<b>62.9</b>	117.9	166.9	<b>33%</b>	84.0	<b>110.5</b>	148.8	<b>61.9</b>	108.9	156.9	<b>44%</b>	

BaU = business-as-usual. The gaps were calculated as a percentage of need by comparing the resources needed in the medium scenario against projected available resources in a business-as-usual scenario for fiscal space.

Table 5 shows the required and projected available resources from the costing exercise without considering COVID-19. The gap ranges from 1% in 2020 to 33% in 2030 based on our model without considering COVID-19. The shaded part, on the right side of Table 5, shows the required and projected available resources taking into account COVID-19. The gap ranges from 29% in 2020 to 44% in 2030. Because of COVID-19, the gap widens by 28% in 2020 and by 11% in 2030.

The three variants for possible budget expansion paths for THE per capita are presented in Table 5 as business-as-usual, medium-, and high-increment columns. In the sensitivity analysis, we present the gap by recalculating the gap considering the diverse effects of COVID-19 on the economy and the resource need estimates for COVID-19 ( $\pm 20\%$ ), keeping all other variables constant. If the economic influence of COVID-19 remains for the whole period (until 2030), the gap would be 59% in 2030 (Additional file 1).

## Discussion

This study revealed that the per capita required cost estimates range from 40 USD in 2020 to 94 USD in 2030 in the medium scenario, which corresponds most closely to SDG targets, while the projected available resources in a business-as-usual scenario were in the range of 40 USD in 2020 to 63

USD in 2030. Therefore, the resource gap ranges from 1% in 2020 to 33% in 2030. In general, the estimate of the required resources in this study is comparable with the DCP-3, WHO, and Chatham House cost estimates for delivering essential UHC services in a low-income country. The DCP-3 estimates are in the range of 60 USD to 110 USD per capita (in 2016 USD) and the WHO estimates in the range of 92 USD to 114 USD total per capita spending (in 2014 USD) while McIntyre et al. estimate 86 USD per capita (in 2012 USD).<sup>39–41</sup> However, it is important to note that there is some difference between our estimate and the global cost estimates in terms of interventions included in the package, the baseline and target coverages chosen, and the costing approaches employed. Additionally, while the previous estimates are based on a hypothetical, multicountry, low-income health benefits package scenario, our estimate is based instead on an actual country-level plan.

The funding gap revealed in this study (1–33%) is comparable with what has been estimated in the Ethiopian HSTP (2015–2020) period. The overall gap estimated during the HSTP period was 10% to 44%, with a base-case estimate of 21%.<sup>14</sup> The gap reflected in this study is similar to that of many other low-income countries due to the shared characteristic of a high disease burden that increases resources needed and limits the

economic capacity to address it.<sup>42</sup> The funding gap can be substantially closed using strategies that can increase available resources, improve efficiency, and reduce costs.<sup>32</sup>

One of the more important strategies to narrow the gap can be to increase the resources for health from domestic and external sources. From domestic sources, expecting the Ethiopian government to spend 2.6% or 3.9% of the total GDP on health in the medium- or high-increment scenarios can be seen as ambitious given that the current government spending is much lower (1.3%).<sup>15,32</sup> As reflected in the national health care financing strategy, the government has committed to increasing the allocation of funding to the health sector by 1% each year to reach up to 15% (the Abuja Declaration target).<sup>14,43</sup> Economic growth and a substantial political commitment to prioritizing health compared to other sectors were the key factors affecting the available resources for health in all cases.

The Ethiopian government should recognize its obligation to devote the maximum possible domestic resources to health. Some innovative strategies that can increase domestic resources for health exist. Interventions can be introduced to increase health sector resources, for example, an excise tax on alcohol, tobacco, sugar, and used cars; removing the subsidy for fossil fuels and redirecting the funds to health care; and levies on financial transactions.<sup>44</sup> Such kinds of action not only increase revenue but also improve the population's health. However, immature tax collection systems, uncertain political commitment from the government, and public unwillingness can be challenging to the viability of the methods.<sup>36,44</sup> Improving private sector engagement in health can be one means to substantially increase available resources for health in Ethiopia via domestic and foreign direct investment. Furthermore, private sector engagement can also facilitate technology transfer, improve quality, and redirect resources from other sectors.

Our study indicates that the projected available resources also depend on funding from external sources. Considering the current situation of limited economic capacity, abject poverty, and high burden of disease in the country, Ethiopia alone may not be able to fully fund the health services without international aid in the short term.

Ethiopia will most likely remain one of the top recipients of overseas development assistance in the next ten years. Therefore, there should be precise arrangements between donors, the federal government, and the Ministry of Health to avoid the duplication, fragmentation, and mismanagement of aid money. One mechanism, for instance, can be improving the financial management system. There are two modes of external aid flow in Ethiopia: off budget and on budget. While on-budget aid is channeled through Federal Ministry of Finance or Federal Ministry of Health budget processes, off-budget aid goes directly to specific programs or projects. On-budget grants should be encouraged as they can be used flexibly to finance the health sector based on the EHSP priorities. On-budget grants can easily be used for strengthening the health system, such as by building the health workforce and expanding infrastructure. Furthermore, there must be a clear transition plan that guides how to fully finance health from domestic sources as the country's economy expands.

Improving the health sector's technical and allocative efficiency is another potential area in which to narrow the funding gap through an improved health financing system. The proposed mechanisms to improve efficiency include those involving medicine procurement, procedures, HR management, hospital admissions, waste, corruption, and an inefficient mix or inappropriate level of strategies.<sup>36</sup> Furthermore, taking into account the current political dynamism and expected changes due to this sector-wide reform of health service delivery in Ethiopia, a full political economy analysis is needed to critically explore the feasibility and sustainability of the implementation of the revised EHSP.<sup>45,46</sup>

### **Protecting the EHSP during COVID-19**

This study indicates that the COVID-19 pandemic further widens the resource gap. The gap can potentially increase morbidity and mortality from all other health problems, disrupt the health system, and further increase the resources needed. COVID-19's impact on the cost and available resource estimates in this study is based on very optimistic assumptions while the overall impact of COVID-19 on the economy and the health system

may be far higher than estimated in this study. Therefore, improving responses to the COVID-19 pandemic to strengthen the health system, following the whole-government or the whole-society approach, should be a high priority.

Our sensitivity analysis from the perspective of COVID-19 indicates that the gap is likely widening as the pandemic will substantially affect economic growth on the one side and increase the required resources for delivering the EHSP on the other. Investment curbs disease in terms of prevention and treatment. Further analytical work is needed to align resource needs with a realistic and feasible budget expansion path for each year that considers the impact of COVID-19 ([Appendix, Table A1](#)).

### **Limitations of the Study**

While many countries undertake costing and fiscal space analyses, these are often not published in the public domain. This is one of the first studies to publish its methods and results in a peer-reviewed journal to allow for broader dissemination. However, our study has several limitations related to cost estimation and the projection of the expected available resources. First, because of a lack of data, this study did not include a subnational analysis of cost and projected available resources. However, some studies indicate that the cost of health service delivery varies to some extent across regions in Ethiopia because of subnational heterogeneity in the element of the cost (i.e., the cost of logistics, the available health workforce, and infrastructure). According to the public expenditure review study, there is some variation across regions in terms of the percentage of resources allocated to health from total regional budgets, ranging from 6% in the Benishangul-Gumuz region to 10% in the Oromia region and 13% in the Somali region.<sup>47</sup>

Second, although using OHT in this sector-wide analysis of the cost of EHSP exercise is vital, some of the software's features were not user-friendly and specific training by OHT expert and technical support from WHO was needed.<sup>48,49</sup> Furthermore, since OHT can only help to calculate point estimates (i.e., OHT does not provide confidence

interval or probabilistic sensitivity analysis results), only one-way and multi-way sensitivity analysis results were obtained by varying the inputs values for key parameters.<sup>49–51</sup>

Third, such types of sector-wide analysis of cost are a complicated and data-hungry process. Therefore, we employed a mixed costing approach (i.e., combining ingredient-based bottom-up and program-based summary costing approaches) in that some of the inputs were based on retrospective expenditure information from reports, budgetary information, or expert judgment for the whole program.<sup>17</sup> This aggregate input estimate may not precisely reflect the current or future resources needed for the implementation of the programs at scale.<sup>17,49,52</sup> Besides, we were not able to estimate the disaggregated resource need (unit costs) by sub-program area and by intervention for those programs-based summary costing approach was employed.

Fourth, in the current study, we did not include health impact analyses as the available data did not allow us to do so, although such types of analysis could help to inform decision-making in Ethiopia in the future. Improved data availability for the sector-wide analysis of the cost and health impact of the intervention is important. Regular, continual updating of the projection is essential based on changes in the situation. Furthermore, this costing exercise did not fully account for the quality of service delivery. If the cost of quality improvement efforts were included, the cost estimate would most likely increase.<sup>53</sup>

Last, although the cost estimate for COVID-19 was based on detailed ingredient costing, the actual resource need and its impact on the economy and health financing in the long term remains unclear as the epidemic is still unfolding. Further, the costing of the EHSP was conducted before the advent of COVID-19, and this study does not account for the impact of COVID-19 on the cost of service provision for other, non-COVID conditions. Some studies show that COVID-19 will increase the cost of non-COVID-19 health services because of the additional need for personal protective equipment as well as increased waiting times, increased cost of logistics, and increased prices of some drugs (e.g., hydroxychloroquine for malaria and rheumatic arthritis).<sup>54</sup>

## Conclusion

This study reveals that there is a gap between resource needs and expected resources for the implementation of the EHSP. Furthermore, external aid, economic growth, and government commitment to reprioritize health are important determinates of the funding available to health in Ethiopia. This evidence can be applied to refine the national resource mobilization plan, the EHSP implementation plan, and the national health care financing strategy. In conclusion, the Ethiopian government, together with other stakeholders, must devise a reliable mechanism to increase the budget allocated to health from the government and other sources to improve efficiency and reduce costs.

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## Disclosure of Potential Conflicts of Interest

The authors have declared that no competing interests exist. KS is a staff member of the WHO. The author alone is responsible for the views expressed in this article, which does not necessarily represent the decisions, policies, or views of the WHO.

## Ethics Approval and Consent to Participate

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

## Availability Of Data and Material

The data sets supporting the conclusions of this study are fully available in the article.

## Authors' Contributions

AH prepared the first draft manuscript. AH and GT collected the data. AH, GT, KS, and OFN undertook the data analysis.

All the authors contributed by commenting on the draft report. All the authors saw and approved their authorship.

## References

1. Glassman A, Giedion U, Smith PC. The health benefits package: bringing universal health coverage from rhetoric to reality. In: Glassman A, Giedion U, Smith PC, editors. What's in, what's out? Designing benefits for universal health coverage. Washington (DC): Center for Global Development; 2017.
2. Glassman A, Giedion U, Sakuma Y, Smith PC. Defining a health benefits package: what are the necessary processes? *Health Syst Reform*. 2016;2(1):39–50. doi:10.1080/23288604.2016.1124171.
3. Federal Democratic Republic of Ethiopia Ministry of Health. Essential health services package of Ethiopia 2019. Addis Ababa: Ministry of Health; 2019.
4. Eregata GT, Hailu A, Geletu ZA, Memirie ST, Johansson KA, Stenberg K, Bertram MY, Aman A, and Norheim OF. Revision of the Ethiopian essential health service package: an explication of the process and methods used. *Health Syst Reform*. 2020;6(1). doi:10.1080/23288604.2020.1829313.
5. Cashin C, Özalp A. At what price? Costing the health benefits package. In: Glassman A, Giedion U, Smith PC, editors. What's in, what's out? Designing benefits for universal health coverage. Washington (DC): Center for Global Development; 2017.
6. Tandon A, Cashin C. Assessing public expenditure on health from a fiscal space perspective. Washington (DC): World Bank; 2010. Health, Nutrition and Population (HNP) Discussion Paper.
7. Barroy H, Sparkes S, Dale E. Assessing fiscal space for health in low and middle income countries: a review of the evidence. Geneva (Switzerland): World Health Organization; 2016.
8. Berman P, Mann C, Ricculi ML. Can Ethiopia finance the continued development of its primary health care system if external resources decline? *Health Syst Reform*. 2018;4(3):227–38. doi:10.1080/23288604.2018.1448240.
9. Kelly R, Hemming R, Bharali I, Glenday G, Asfaw A. Public financial management perspectives on health sector financing and resource allocation in Ethiopia; 2020. Duke Global Working Paper Series No 18. Durham, North Carolina, USA: The Center for Policy Impact in Global Health.
10. Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. World population prospects 2019. Online ed. Rev. 1. New York: United Nation; 2019.
11. International Monetary Fund. Ethiopia: GDP per capita, current prices U.S. dollars per capita; 2020 Mar 29. <https://www.imf.org/external/datamapper/NGDPDPC@WEO/ETH>.

12. Federal Democratic Republic of Ethiopia National Planning Commission. The second growth and transformation plan (GTP II) (2015/16-2019/20). Addis Ababa: National Planning Commission; 2015.
13. World Bank. GDP growth (annual %) – Ethiopia; 2020 Aug. <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=ET>.
14. Federal Democratic Republic of Ethiopia Ministry of Health. Health sector transformation plan (2015–2020). Addis Ababa: Ministry of Health; 2015.
15. Federal Democratic Republic of Ethiopia Ministry of Health. Ethiopia health accounts 2016/2017. Addis Ababa: Ministry of Health; 2019.
16. World Health Organization, Avenir Health. One Health tool; 2020 Aug 29. <https://www.avenirhealth.org/software-onehealth>.
17. Vassall A, Sweeney S, Kahn J, Gomez Guillen G, Bollinger L, Marseille E, Herzel B, DeCormier Plosky W, Cunnam L, Sinanovic E, Bautista-Arredondo S. Reference case for estimating the costs of global health services and interventions. London: LSHTM; 2018.
18. Eregata GT, Hailu A, Memirie ST, Norheim OF. Measuring progress towards universal health coverage: national and subnational analysis in Ethiopia. *BMJ Glob Health*. 2019;4(6):e001843. doi:10.1136/bmjgh-2019-001843.
19. Federal Democratic Republic of Ethiopia Ministry of Health. Ethiopia's health management information system (HMIS). Addis Ababa: Ministry of Health; 2015.
20. Central Statistical Agency (CSA) of Ethiopia and ICF. Ethiopia demographic and health survey 2016. Addis Ababa (Ethiopia) and Rockville Maryland: CSA and ICF; 2016.
21. Federal Democratic Republic of Ethiopia Ministry of Health. Ethiopia national malaria indicator survey 2015. Addis Ababa: Ministry of Health; 2015.
22. Federal Democratic Republic of Ethiopia Ministry of Health. Ethiopia STEPS report on risk factors for non-communicable disease and prevalence of selected NCDs. Addis Ababa: Ministry of Health; 2016.
23. Ethiopian Public Health Institute. Ethiopia services availability and readiness assessment 2016. Addis Ababa: Ministry of Health; 2017.
24. Hogan DR, Stevens GA, Hosseinpoor AR, Boerma T. Monitoring universal health coverage within the sustainable development goals: development and baseline data for an index of essential health services. *Lancet Glob Health*. 2018;6(2):e152–e68. doi:10.1016/S2214-109X(17)30472-2.
25. Watkins DA, Jamison DT, Mills T, Atun R, Danforth K, Glassman A, Horton S, Jha P, Kruk ME, Norheim OF, Qi J, Verguet S, Wilson D, Alwan A, Soucat A. Universal health coverage and essential packages of care. In: Jamison DT, Gelband H, Horton S, et al., editors. *Disease control priorities: improving health and reducing poverty*. 3rd ed. Washington (DC): World Bank; 2017. p. 43–65. doi:10.1596/978-1-4648-0527-1.
26. Federal Democratic Republic of Ethiopia Ministry of Health. Health Sector Transformation Plan II (2020/21-2024/25). Addis Ababa; 2020.
27. Stenberg K, Lauer JA, Gkountouras G, Fitzpatrick C, Stanciole A. Econometric estimation of WHO-CHOICE country-specific costs for inpatient and outpatient health service delivery. *Cost Eff Resour Alloc*. 2018;16(1):11. doi:10.1186/s12962-018-0095-x.
28. Sanders R. OneHealth tool intervention assumptions. Glastonbury Connecticut: Avenirhealth; 2016.
29. Microsoft Corporation. Microsoft Excel [Internet]. 2018. <https://office.microsoft.com/excel>
30. Drummond M. *Methods for the economic evaluation of health care programmes*. 4th ed. Oxford (UK); New York (NY): Oxford University Press; 2015.
31. National Bank of Ethiopia. Ethiopia: macroeconomic and Social Indicators (2018-2019). Addis Ababa: National Bank of Ethiopia; 2020.
32. Federal Democratic Republic of Ethiopia Ministry of Health. Health care financing strategy 2017–2025. Addis Ababa: Ministry of Health; 2017.
33. World Bank. Ethiopia 2019; 2020 Aug. <https://data.worldbank.org/country/ethiopia>.
34. McIntyre D, Meheus F. Fiscal space for domestic funding of health and other social services. London: Chatham House (The Royal Institute of International Affairs); 2014. Chatham Working Group on Financing, Paper 5.
35. Røttingen JA, Ottersen T, Ablo A, Arhin-Tenkorang D, Benn C, Elovainio R, Evans D, Fonseca L, Frenk J, McCoy D and McIntyre D. Shared responsibilities for health: a coherent global framework for health financing. London: Chatham House; 2014.
36. World Health Organization. *The world health report: health systems financing: the path to universal coverage*. Geneva: World Health Organization; 2010.
37. Federal Democratic Republic of Ethiopia Ministry of Health. Preparedness and response plan for the 2019 novel coronavirus in Ethiopia. Addis Ababa; 2020.
38. World Bank (Ethiopia team of the Poverty and Equity Global Practice). COVID-19: potential Poverty and Social Impacts in Ethiopia and Policy Responses (Draft Analysis). Addis Ababa; 2020.
39. Stenberg K, Hanssen O, Edejer TT, Bertram M, Brindley C, Meshreky A, Rosen JE, Stover J, Verboom P, Sanders R, et al. Financing transformative health systems towards achievement of the health sustainable development goals: a model for projected resource needs in 67 low-income and middle-income countries. *Lancet Glob Health*. 2017;5(9):e875–e87. doi:10.1016/S2214-109X(17)30263-2.
40. Watkins DA, Qi J, Kawakatsu Y, Pickersgill SJ, Horton SE, Jamison DT. Resource requirements for essential universal health coverage: a modelling study based on findings from disease control priorities, 3rd

- edition. *Lancet Glob Health*. 2020;8(6):e829–e39. doi:10.1016/S2214-109X(20)30121-2.
41. McIntyre D, Meheus F. Fiscal space for domestic funding of health and other social services. London: Chatham House, Centre on Global Health Security; 2014.
  42. Durairaj V, Evans DB. Fiscal space for health in resource-poor countries. Geneva (Switzerland): World Health Organization; 2010. World Health Report (2010) Background Paper, No 41.
  43. Federal Democratic Republic of Ethiopia Ministry of Health. Envisioning Ethiopia's path towards universal health coverage through strengthening primary health care. Addis Ababa: Ministry of Health; 2015.
  44. Stenberg K, Elovainio R, Chisholm D, Fuhr D, Perucic AM, Rekve D, Yurekli A. Responding to the challenge of resource mobilization - mechanisms for raising additional domestic resources for health. Geneva (Switzerland): World Health Organization; 2010. World Health Report (2010) Background Paper No 13.
  45. Lavers T. Towards Universal Health Coverage in Ethiopia's 'developmental state'? The political drivers of health insurance. *Soc Sci Med*. 2019;228:60–67. doi:10.1016/j.socscimed.2019.03.007.
  46. Sparkes SP, Bump JB, Özçelik EA, Kutzin J, Reich MR. Political economy analysis for health financing reform. *Health Syst Reform*. 2019;5(3):183–94. doi:10.1080/23288604.2019.1633874.
  47. World Bank. Ethiopia public expenditure review: health. Addis Ababa: World Bank; 2019.
  48. Wong J, Haw N, Uy J, Bayani D. Reflections on the use of the World Health Organization's (WHO) OneHealth tool: implications for health planning in low and middle income countries (LMICs) [version 2; peer review: 2 approved]. *F1000Research*. 2018;7(157). doi:10.12688/f1000research.13824.1.
  49. Barker C. Costing of Malawi's second health sector strategic plan using the OneHealth tool. Washington (DC): Palladium, Health Policy Plus; 2018.
  50. Nkwanyana NM, Voce AS. Are there decision support tools that might strengthen the health system for perinatal care in South African district hospitals? A review of the literature. *BMC Health Serv Res*. 2019;19(1):731. doi:10.1186/s12913-019-4583-2.
  51. UN Inter-Agency Working Group on Costing. One health tool: overview and applications for strategic planning and costing. Geneva (Switzerland): World Health Organization; 2012.
  52. Cunnamo L, Sinanovic E, Ramma L, Foster N, Berrie L, Stevens W, Molapo S, Marokane P, McCarthy K, Churchyard G, et al. Using top-down and bottom-up costing approaches in LMICs: the case for using both to assess the incremental costs of new technologies at scale. *Health Econ*. 2016;25(Suppl 1):53–66. doi:10.1002/hec.3295.
  53. Collier P, Dercon S, Mackinnon J. Density versus quality in health care provision: using household data to make budgetary choices in Ethiopia. *World Bank Econ Rev*. 2002;16(3):425–48. doi:10.1093/wber/lhf003.
  54. American Hospital Association. Hospitals and health systems face unprecedented financial pressures due to COVID-19. Chicago (USA): The American Hospital Association; 2020.



## Appendix. Sensitivity to the cost of COVID-19 and economic growth projections

**Table A1.** Resource need: available gap across years and sensitivity to COVID-19 pandemic crisis

Years	Gap as the cost of COVID-19 varied by 20%			Economic growth (GDP) reduction from 2020 through 2021		Economic growth (GDP) reduction from 2020 through 2030 by 2.9%
	Current cost estimate	Current COVID-19 cost estimate +20%	Current COVID-19 cost estimate -20%	By 2.9	By 5.0%	
2020	29%	33%	25%	29%	31%	29%
2021	33%	36%	29%	33%	35%	33%
2022	35%	38%	32%	35%	38%	45%
2023	37%	40%	34%	37%	40%	48%
2024	39%	42%	37%	39%	43%	51%
2025	40%	43%	38%	40%	44%	53%
2026	42%	44%	39%	42%	45%	54%
2027	43%	44%	41%	43%	47%	56%
2028	43%	45%	41%	43%	47%	57%
2029	44%	45%	42%	44%	48%	58%
2030	44%	46%	42%	44%	48%	59%