Measuring Efficiency of Public Primary Hospitals in Ethiopia

Resource Tracking and Management Project, Primary Health Care Cost Study: Paper 4

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Foreword

Measuring resource efficiency and productivity of primary health care facilities is one of the core components of the RTM project. The other four components focus on resource mobilization, resource allocation, resource utilization, and resource targeting for primary care. The PHC cost study is expected to provide timely and relevant evidence on the financing sources for the provision of primary care services; actual costs of providing PHC services and specific exempted services in health facilities; specific revenue sources for each health facility; and the current productivity of resources with potential for policies to promote efficiency gains.

Part of a series of papers, this fourth document examines the productivity and efficiency of resource use in primary hospitals, and identifies possible areas for improvement and future analytical work to assess efficiency in resource use and allocation. The same efficiency analysis was done for health centers. The findings, along with those from the health center analysis, can contribute to the FMOH’s 5-year Health Sector and Transformation Plan, the second Growth and Transformation Plan, and improving advocacy towards more domestic resources for health – one of the goals under the National Health Care Financing Strategy.

Readers should note that efficiency comparisons for individual health facilities such as those presented here may be influenced by other unmeasured factors, suggesting caution in drawing strong conclusions about individual facility performance from these results.

Suggested citation:

<table>
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<tr>
<th>Acronyms</th>
<th>Description</th>
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<tr>
<td>DEA</td>
<td>Data Envelopment Analysis</td>
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<td>DEAP</td>
<td>Data Envelopment Analysis Program</td>
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<tr>
<td>DRS</td>
<td>Decreasing Returns to Scale</td>
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<td>EFY</td>
<td>Ethiopian Fiscal Year</td>
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<td>ETB</td>
<td>Ethiopian Birr</td>
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<td>FMOH</td>
<td>Federal Ministry of Health</td>
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<td>GDP</td>
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<td>GTP</td>
<td>Growth and Transformation Plan</td>
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<td>HEW</td>
<td>Health Extension Worker</td>
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<td>HR</td>
<td>Human Resource</td>
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<td>Health Sector Transformation Plan</td>
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<td>IPD</td>
<td>Inpatient Department</td>
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<td>IHME</td>
<td>Institute of Health Metrics and Evaluation</td>
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<td>IRS</td>
<td>Increasing Returns to Scale</td>
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<td>LB</td>
<td>Live birth</td>
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<td>MCH</td>
<td>Maternal and Child Health</td>
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<td>MDG</td>
<td>Millennium Development Goal</td>
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<td>MOFEC</td>
<td>Ministry of Finance and Economic Cooperation</td>
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<td>PHC</td>
<td>Primary Health Care</td>
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<td>PHCU</td>
<td>Primary Health Care Unit</td>
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<td>OPD</td>
<td>Outpatient Department</td>
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<td>RTM</td>
<td>Resource Tracking and Management</td>
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<td>SDG</td>
<td>Sustainable Development Goal</td>
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<td>SNNPR</td>
<td>Southern Nations, Nationalities, and Peoples’ Region</td>
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<td>SPA+</td>
<td>Service Provision Assessment Plus</td>
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<td>USAID</td>
<td>United States Agency for International Development</td>
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<td>UHC</td>
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Terms & Definitions

**Average:** The arithmetic average, which is the sum of all values for a specific variable divided by the total number of observations for that variable. This is prone to be influenced by extreme values due to potential outliers (very small or large values in the data that are not within the normal distribution).

**Efficiency:** An attribute of performance measured by examining the relationship between a specific product of the health care system (also called an output) and the financial value of the resources used to create that product (also called inputs). A primary health care facility would be efficient by maximizing output for a given set of inputs or to minimize inputs used to produce a given output.

**Outpatient Equivalent Visits:** Different patient visits scaled to be comparable outpatient visits. This captures the use of facility inputs to produce an inpatient discharge, maternal and child health visit, or delivery relative to production of an outpatient visit. The average cost per patient for outpatient, inpatient, maternal and child health, and delivery departments was used as a means to estimate outpatient equivalent weights.

One inpatient discharge = 7.57 outpatient visits
One MCH visit = 1.43 outpatient visits
One delivery = 4.38 outpatient visits

**Data Envelopment Analysis:** A non-parametric approach to measure technical efficiency. Efficiency scores (pure technical and scale) are estimated through the application of DEA for each primary hospital, capturing a facility’s relative resource use or inputs such as current staffing to produce care.

**Outpatient Department:** Curative services that do not require admission and provided in the outpatient department. Some outpatient treatments are provided in the Maternal and Child Health (MCH) department, but these were classified under the MCH department.

**Inpatient Department:** Provides procedures that require a patient to be admitted and have close monitoring during and after such procedure.

**Maternal and Child Health (MCH) Department:** Provides non-emergency maternal and child health services (such as immunizations or ante-natal care and some acute treatment), excluding deliveries.

**Delivery Department:** Provides basic obstetric care (health centers) and comprehensive obstetric care (primary hospitals), including pre-and post-delivery care.

**Cost:** Defined as the monetary value of non-capital, recurrent expenditures incurred and resources used to produce a defined set of health service outputs or to operate specific health facilities. The recurrent costs include drugs and supplies, salaries, and other operational costs (e.g., electricity, running water, maintenance, etc.), which are incurred on a regular basis that can be allocated as direct costs or indirect costs.

**Pure Technical Efficiency:** The minimum level of resources used for a unit of output. Wastage or inefficiencies occur when more resources than necessary are used to produce a level of output.

**Scale Efficiency:** Refers to the size and structure of a health provider, where a health facility might be too large (small) for its level of operation causing in(efficiencies) of scale.

**Unit Cost:** Total cost, or expenditure plus the value of resources used (e.g., in-kind or drugs and supplies consumed), incurred by a health facility or department to provide service for one patient.

**Primary health care unit (PHCU):** The unit of organization encompassing primary health care facilities and related community-based activities, including primary hospital, primary health center, health post, and the health or women’s development army.

**Woreda:** A district in Ethiopia that is the third administration level that typically encompasses 100,000 people. A PHCU is usually within one woreda.
Primary Health Care Facilities in Ethiopia

**Primary hospital:** A health facility within the PHCU that provides inpatient and ambulatory services this includes all services offered from health centers as well as emergency surgical services, including caesarean sections and blood transfusions. It is a referral center for health centers that reside within the primary hospital’s catchment area. This health facility typically has an average inpatient capacity of 35 beds and a staff of 53 people. Serves 60,000-100,000 people in a woreda. Investment in primary hospitals is still ongoing so not all PHCU’s are linked with primary hospitals and some primary hospitals may serve several woredas.

**Health center:** A health facility within the primary health care system that provides promotive, preventive, curative and rehabilitative outpatient care including basic laboratory and pharmacy services. This health facility typically has the capacity of 10 beds for emergency and delivery services. Health centers serves as a referral center for health posts, and provide supportive supervision for health extension workers (HEWs). Serves 15,000-25,000 people in a woreda.

**Health post:** A health facility within the primary health care system that mainly provides promotive and preventive health care services. A typical health post has two HEWs and they provide services in the health facility and in the community (often going house-to-house). Serves 3,000-5,000 in a woreda.

1 Description of primary health care facilities in Ethiopia adapted from FMOH (1) and Alebachew, Hatt, and Kukla (2).
Executive Summary

Ethiopia’s health sector over the last 20 years has seen unprecedented expansion particularly for its primary health care (PHC) system. The development of the health sector was made possible by strong political commitment, a substantial increase in external support, and rapid economic growth. Plans for continued investments in PHC include improvements in efficiency of resource use as it moves into a new transformational phase starting with the Health Sector Transformation Plan (HSTP) and second Growth and Transformation Plan (GTP II) from 2015/16-2019/20.

Significant resources are needed to achieve all of the health targets laid out in the HSTP and GTP II. A funding gap of 4.37 billion birr or 28% of the resources required to achieve the health targets set out in HSTP and GTP II was estimated over the next 5 years. Efficiencies in the health sector potentially free up resources to be used on the provision of quality health care, and can help achieve the funding needed to achieve HSTP and GTP II targets.

Little evidence exists to document whether resources are used to maximize efficiency and productivity among PHC facilities. One analysis of Ethiopia’s health posts found that only 25% of the sampled health posts (60 health posts) in Tigray region were found to be efficient in 2007/08. This report presents evidence on efficient allocation and use of resources among 24 primary hospitals across the 4 major regions – Amhara, Oromia, Southern Nations, Nationalities, and Peoples’ Region (SNNPR), and Tigray. This is the second round of efficiency analyses, where health centers were measured in another report (Mann, Dessie, Adugna, and Berman (3)). Health posts could not be included in such analyses because of data limitations.

Cost efficiency is measured as the relationship between a specific product (output) and the financial value of the resources used to create that product (inputs). A primary hospital is efficient by minimizing inputs used to produce a given output or maximizing output for a given set of inputs. The analysis in this report focuses on total primary hospital efficiency, department-level efficiency, and input efficiency, where some primary hospitals and departments appeared to be more efficient compared to others in terms of resource use relative to output, output production, and pure technical and scale efficiency.

Primary hospital expenditures increased slightly as the number of outpatient equivalent visits increased, but horizontal and vertical spreads indicate possible inefficiencies within the sampled primary hospitals. Some primary hospitals had high spending but low output. Other primary hospitals appear to be more efficient with low levels of spending relative to output. Economies of scale occur as more people are accessing care from primary hospitals. However, a wide variation in these findings, most likely due to low utilization, points to the need for increased focus on demand generation activities for this level of care as a mechanism to improve efficiency, and not solely on supply-side factors.

Output production by skilled professionals is very low for primary hospitals in Ethiopia, despite claims of health worker shortages based on global normative recommendations. The average number of outpatient equivalent visits per clinical staff per day is 2.54. This is slightly lower than output production found among health centers in Ethiopia, at 3.7 outpatient equivalent visits per clinical staff per day (3). Studies conducted in Kenya and Ghana found an average of almost 6 and slightly more than 5 outpatient equivalent visits per medical staff per day, respectively, for public hospitals in 2011 (4,5).

Data envelopment analysis (DEA) was used to estimate technical efficiency scores (pure technical efficiency and scale efficiency) for the 24 primary hospitals. Efficiency scores range from 0 (completely inefficient) to 100% (efficient). Only 29% of the primary hospitals were pure technically efficient. The average pure technical efficiency score among the inefficient primary hospitals is 55%, implying that on average, the inefficient primary hospitals could reduce their inputs by 45% without reducing outputs. Only 4 primary hospitals were scale efficient. The average scale efficiency score among the inefficient primary hospitals was 65%, indicating a potential increase in total outputs by 35% within the existing primary hospital capacity and size. An increase in outputs would reduce unit costs of service provision at primary hospitals however this depends on the demand for health care services,
which relies more on individual preferences to care, perceptions of quality, and accessibility – factors not necessarily within the control of a health provider. An input cost savings was estimated if the 17 inefficient primary hospitals became as efficient as the pure technically efficient primary hospitals in the study, given current output levels. This breaks down to an input savings of 647 clinical and 937 non-clinical staff or 31 million birr in human resource expenditures, 60 million birr for drugs and supplies and 96 million birr for indirect expenditures. These estimates are a high standard. They reflect the savings that would be realized if all primary hospitals were as efficient as the primary hospitals along the efficiency frontier.

This analysis for primary hospitals demonstrates some potential areas where improvements in resource allocation and use could lead to more efficient health service provision. However, additional evidence on the most cost-effective health providers for certain primary care services is needed. Caution should be used in assessing the performance of individual health facilities with results like these because they do not show why potential efficiencies or inefficiencies occur. There may be other unmeasured factors accounting for these differences.

Further data collection and analysis is also needed to identify strategies to improve efficiency.

This would help provide the FMOH with a more complete picture of cost efficiency and ways to improve it for a more efficient and equitable primary care system. Such work includes conducting site visits to health facilities that were found to be least and most efficient to understand factors influencing findings and using the Service Provision Assessment Plus (SPA+) survey data to conduct a more representative, comprehensive efficiency analysis for the primary care system.
Introduction

Universal health coverage (UHC) is the main goal for Ethiopia’s health sector in the coming decade, as it transitions into a middle-income country (6). Strengthening primary health care (PHC) is the identified path for Ethiopia to achieve UHC as outlined in the country’s 20-year health sector strategy, “Envisioning Ethiopia’s Path Towards Universal Health Coverage Through Primary Health Care”. This strategy outlines areas of focus to ensure a quality and equitable health system that is sustainable, efficient, and adaptable to meet the health needs of a changing population between now and 2035. Continued strong investments into the PHC system (community, health posts, health centers, and primary hospitals) are anticipated to result in further health outcome improvements (6).

Ethiopia’s health sector over the last 20 years has seen unprecedented expansion particularly at the primary care level. Public health spending was biased towards hospitals and urban centers prior to 2005 (7). The Ethiopian government shifted this focus beginning with the implementation of the Health Extension Program, rapidly scaling up the construction of health posts from 4,211 in 2004/05 to 16,048 by 2012/13 (8,9) and deployment of frontline cadre of health workers to provide preventive and promotive health services. This has been accompanied by continued expansion of the health centers and introduction of new level of care within the primary health care unit (PHCU), primary hospitals. A “flooding” policy to address shortages in the health workforce was instituted during the past 20 years under the Health Sector Development Programmes (HSDPs).

The development of the health sector was made possible by strong political commitment, a substantial increase in external support, and rapid economic growth (10). Public health expenditure almost doubled from 1995-20111 (constant 2012 $US dollars). Rapid growth in gross domestic product (GDP) saw an average of 9% real growth in GDP from 1999-2012 (11). This allowed for the tripling of the overall government budget (constant 2010 prices) during the same time period and in turn more resources for health2. External resources also increased from $US6 million to $US836 million (constant 2012 $US dollars) from 1995 to 2011 (10). This continued external support was critical for PHC development, with half of PHC expenditures coming from external resources in 2011 (12). The increased focus on health from global partners was aligned with the Millennium Development Goals (MDG) (10,13). This focused global support towards a more targeted focus on reducing poverty and hunger, improvement of maternal and child health outcomes, equality and women’s empowerment, universal primary education, ensure environmental sustainability, and combat major disease such as malaria and HIV/AIDS (http://www.unmillenniumproject.org/goals/gti.htm). Since 2016, the Sustainable Development Goals (SDGs) have brought in even more priorities to the global arena (MGDs: 8 goals and 18 targets versus SDGs: 17 goals and 169 targets). Decision-makers must address the growing demand for quality health care services and available resources alongside competing priorities from other sectors.

Ethiopia’s five-year Health Sector Transformation Plan (2015/16-2019/20) calls for improvements in efficiency of resource use along with continued investments in PHC. Over these five years, Ethiopia plans to achieve UHC by expanding PHC coverage to everyone through improved access to quality basic curative and preventative health care services and strengthening implementation of the nutrition program (6,14). Significant resources are needed to achieve all of the health targets laid out in the HSTP and the second Growth and Transformation Plan (2015/16-2019/20) (GTP II) such as reducing the maternal mortality ratio from 420 per 100,000 live births (LBs) in 2014/15 to 199 per 100,000 LBs by 2019/20 and reducing under-5 child mortality from 64 per 1,000 LBs in 2014/15 to 30 per 1,000 LBs by 2019/20 (6,14). A funding gap of 4.37 billion birr or 28% of the resources required emerged from the estimated resource need to achieve the identified health targets in HSTP and GTP II and resources available over

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1 Authors calculations using data collated from the National Health Accounts from 1995-2011 for Ethiopia (10).
2 Authors calculations using Ministry of Finance and Economic Cooperation (MOFEC) audited data from National Accounts (38).
these 5 years (6,14). Efficiencies in the health sector potentially free up resources as one of the five ways to generate fiscal space for health (15). More efficient resource allocation and use was also one of the main focus areas for the Health Care and Financing Strategy (1998-2015) (11), and continues to be emphasized in Ethiopia’s National Health Financing Strategy (2015-2035).

Care should be taken not to draw overly strong conclusions from simple efficiency measures. They do not control for some important confounders, such as difference in case mix and disease severity and also do not show why potential efficiencies (or inefficiencies) are occurring. More analytical work is needed to identify solutions to improve the efficiency of primary hospitals.

This report is part of a series, and a similar efficiency analysis was done for a sample of public health centers. See Mann, Dessie, Adugna, and Berman (3) for more details.

How efficiency is defined

This study uses the concept of cost efficiency. This is an attribute of performance that is measured by examining the relationship between a specific product of the health care system (also called an output) and the financial value of the resources used to create that product (also called inputs). Based on this definition, a primary hospital would be efficient by minimizing inputs used to produce a given output or maximize output for a given set of inputs.

Purpose

Few studies were found on efficiency and productivity among PHC facilities. One health system analysis in 2007 found Ethiopia to be globally efficient using Data Envelopment Analysis across 180 countries categorized by the WHO economic development status (14,15). Another study found Ethiopia’s health system to be one of the lowest ranked countries for efficiency (169 out of 191 countries) using a non-deterministic frontier production function analysis (17). An efficiency analysis on Ethiopia’s primary care system was limited to estimating the efficiency of select health posts in the Tigray region. This study found that in 2007/08 75% of the health posts could increase the number of preventative and curative activities given the current resources and outputs produced, while most of the health posts were at the optimal size suggesting the number of staff were enough at that point in time (18).

This report presents evidence from a sample of primary hospitals on their relative efficiency, that is, compared to each other. It also explores areas where inefficient primary hospitals could become more efficient by maximizing resource use through either a reduction of inputs given the level of output or increase output given the level of inputs. Finally, it discusses future analytical work to guide the Federal Ministry of Health (FMOH), and lower health administrative levels, on a strategic direction for more efficient resource allocation and use that could ultimately free up more resources to provide quality essential health care. The same methods and analysis was applied to health centers (3). Health posts are a critical entry point of care for the PHCU however it was not feasible to conduct an efficiency analysis due to data limitations as explained in Berman et al (16).
Methods

This section of the report reviews the study design, the approach used to measure efficiency, and the limitations of data sources and approaches used to measure efficiency.

PHC cost study design

Data on the costs or resources used to provide services at PHC facilities (primary hospitals, health centers, and health posts) came from a PHC cost study conducted by the Resource Tracking and Management (RTM) project and FMOH (19,20). All inputs and outputs were measured retrospectively for one full year: Ethiopian fiscal year (EFY) 2006 and 2007/08 (Gregorian calendar 2013/14 and 2015/16) for primary hospitals to avoid any cost distortions related to seasonal effects. A total of 24 primary hospitals were included in the analysis, and were sampled from the four big regions – Tigray, Amhara, Oromia, and Southern Nations, Nationalities, and Peoples’ Region (SNNPR) (19).

Primary hospital departments or cost centers are inpatient department (IPD), outpatient department (OPD), maternal and child health (MCH) department, and delivery department. Inpatient care consists of providing curative services that do not require admission and exclude maternal and child health (MCH) specific services because these were classified under the MCH department. Services provided in the MCH department are comprised of non-emergency maternal and child health services (such as immunizations or ante-natal care), excluding deliveries. The Delivery department provides comprehensive obstetric care, including pre- and post-delivery care. This study does not include the change in unit costs over time due to changes in salary increases, drugs costs, and service provision since the data is collected for specified period of time.

Data was collected from health facilities and other related health and financial administrative offices, pulling from health care utilization (drug consumption, utilization rates, etc.), financial, and administrative records (e.g., formal staff assignments, job descriptions, etc.). A top-down costing framework was used to estimate total and unit costs by departments (inpatient, outpatient, maternal and child health, and deliveries) and health facilities. Refer to Berman, Alebachew, Mann, Agarwal, and Abdella (19,20) for further details on the methods and results of this costing approach.

Efficiency analysis approach

Cost efficiency is examined in three ways: 1) total health facility efficiency; 2) cost center or department-level efficiency; and 3) input efficiency or productivity. The main research questions for this efficiency analysis of primary hospitals are:

- Is there a relationship between total facility and department level spending (inputs) and number of outpatient equivalent visits (outputs)?
- How productive are human resources in health facilities – comparing outputs to staffing levels?
- How effectively are primary hospitals resources being translated into services, and what is the right mix of inputs given the level of outputs that would make a primary hospital more efficient compared others?
- Do primary hospitals have the absorptive capacity for an increase in health service demand? This last question is of particular importance given the roll out of the community-based health insurance scheme across the country and the soon-to-be implemented social health insurance.

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3 See Berman, Alebachew, Mann, Agarwal, and Abdella (19) for details why two different fiscal years were used in the cost study.
One problem that often affects analysis of efficiency for multi-function health facilities is the heterogeneity of outputs – primary hospitals provide an array of different services. In our previous report calculating unit costs, we simply added together the different outputs for each department, not accounting for the value of inputs to produce different outputs, a limitation clearly stated in the paper (20). In similar work done by the Institute for Health Metrics and Evaluation (IHME), they estimated outpatient equivalents for public health facilities in Ghana by weighting different types of outputs. For example, on average one inpatient bed-day equated to 3.8 outpatient equivalent visits, while one birth equated to 10.9 outpatient visits (4).

In this report, the average cost per patient served by department was used to estimate the weights applied to generate outpatient equivalent visits for primary hospitals. The average cost per patient for OPD, IPD, MCH, and Delivery departments among primary hospitals were 349 Ethiopian birr (ETB), 2641 ETB, 498 ETB, and 1531 ETB per patient, respectively (20). It was estimated that one inpatient discharge equates to 7.57 outpatient visits, one MCH visit is 1.43 outpatient visits, and a delivery equals 4.38 outpatient visits. Outpatient equivalent visits were used as the output for the total health facility efficiency analysis along with the Data Envelopment Analysis (DEA). The department-level efficiency analysis used the unweighted outputs.

Health facility efficiency is compared across primary hospitals through a series of graphs based on different measures of inputs and outputs. This is done both for the whole primary hospital and across departments within primary hospitals. Total health facility efficiency examines the relationship between total expenditure and total output through a series of scatter plots and graphing per capita health spending disaggregated by rural and urban areas. Departmental efficiency assesses variations of expenditure and output by department and composition of volume of services by department.

Input efficiency explores human resource (HR) productivity and technical efficiency. Human resource productivity is assessed by measuring the relationship between clinical staff and primary hospital outputs along with the range and composition of output production for clinical staff.

Technical efficiency, consisting of pure technical efficiency and scale efficiency, is measured by using a non-parametric analytical technique known as Data Envelopment Analysis (DEA). A health facility is pure technically efficient when the minimum level of resources is used (inputs) for a unit of output (21,22). Wastage or inefficiencies occur when more resources than necessary are used to produce a level of output. Scale efficiency refers to the size and structure of the primary hospital, where a primary hospital might be too large or small for its level of operation causing inefficiencies of scale (21)(22). Service provision or output for the DEA model is defined into outpatient equivalent visits for four departments: inpatient discharges, outpatient visits, MCH visits, and deliveries. The inputs in the model consist of clinical (e.g., health officers, nurses, midwives) and non-clinical staff (e.g., janitorial staff, data and finance managers, pharmacists, etc.), HR expenditures, drugs and supplies expenditures, and indirect expenditures such as electricity and running water. This estimation is relative to the other primary hospitals in the study rather than the optimal mix of inputs and outputs for all primary hospitals in Ethiopia. It is possible that primary hospitals deemed more efficient might have higher utilization rates compared to others due to other factors such as close proximity to an urban center, better quality of services, and so on.

Another efficiency analysis approach is measuring whether a health facility is allocative efficient or if inputs are used in optimal proportion given prices in order to minimize production cost for a given output (18,21,23). This report only focuses on technical efficiency of primary hospitals.

Both Stata and Microsoft Excel are used to make all graphs presented in this report. The Data Envelopment Analysis program (DEAP) Version 2.1 designed by Coelli (24) is used for the DEA to estimate the technical efficiency scores for an input-based model.
Primary Hospital Findings

Total health facility efficiency

Fig. 1 graphs total expenditure with total patient volume calculated in resource-weighted outpatient equivalents as described above for primary hospitals. Each observation is color-coded by regional state. The solid black line is based on a two-variable regression that models the relationship between expenditure and output within the sampled primary hospitals, or the “linear fit”. All primary hospitals above this line are spending more per outpatient equivalent visit compared to those that are either on or below it. We find a very gradual increase in overall expenditures as the level of outpatient equivalents increases. One primary hospital in Amhara with an extremely high total expenditure relative to output is likely distorting the relationship between expenditure and outpatient equivalent visits among the other primary hospitals.

In the health center efficiency analysis, there was a more noticeable positive relationship between health facility expenditure and outpatient equivalent visits (3). The sampled primary hospitals have similar annual expenditure levels but with a wide range of outpatient equivalent visits. Inefficiencies in resource use might be attributed to these horizontal spreads, and in a few cases (e.g., a primary hospital in Amhara) vertical spreads in the data. Primary hospitals with high levels of output relative to total spending might appear to be the most efficient but this depiction of the relationship between expenditure and output does not capture any quality differences in services provided among these health facilities.

We expect as patient volume (output) increases, the cost per patient would decrease, indicating economies of scale. Fig. 2 demonstrates a decrease in cost per patient for primary hospitals (one outlier for cost per contact from Tigray and one from Amhara were excluded). Although there is some random variation, or a wide dispersion around the linear fit, of costs per outpatient equivalent visits for similar output levels.

Fig. 1 Total primary hospital expenditure in birr by outpatient equivalent visits
Fig. 2 Primary hospital expenditure per outpatient equivalent visit in birr by total outpatient equivalent visits (no outliers)

Note: Per capita spending is based on the reported catchment population from the primary hospitals where total primary hospital expenditure was divided by catchment population. The number of primary hospitals in the sample for each geographic area is represented as n=#.
Equity is one of the core goals for the HSTP (2015/16-2019/20). We assess a relatively crude estimate of equitable resource allocation with the average per capita spending (in birr) for primary hospitals by region (Fig. 3). Per capita or per person health spending\(^4\) is a based on each hospital's catchment area population. Primary hospitals in Amhara and SNNPR are spending at least 40 ETB less per person compared to Oromia and Tigray. However, the average catchment population for the studied primary hospitals in Oromia (222,050) and Tigray (45,996) are substantially less compared to those in Amhara (1,218,844) and SNNPR (564,059).

**Department-level efficiency**

Varying degrees of inefficiencies are present when looking more closely at the inputs and outputs at the department level for primary hospitals. Fig. 4 shows the graphs displaying total expenditures (excluding extreme values\(^5\)) in birr and outputs by department for primary hospitals. IPD spending is more positively associated with IPD discharges. Some primary hospitals experienced high levels of expenditures but relatively low volumes of discharges. This indicates potential inefficiencies such as overstaffing of the inpatient department relative to volume and/or possible over-prescribing of drugs and supplies in this department. Some primary hospitals, experienced low level of spending but relatively higher volumes of discharges, illustrating that these primary hospitals might be more efficient in resource use compared to others in the sample. Further exploration into such cases would uncover potential factors influencing these findings.

An increasing relationship is present for outpatient spending and patient volume. A wide vertical spread is evident around 40,000 OPD visits. Primary hospitals in Tigray are spending very low levels of expenditure compared to outpatient volumes. On the other hand, some primary hospitals located in Amhara and SNNPR have high level of expenditure relative to outpatient volumes.

The MCH department also experienced an increasing relationship between expenditures and outputs. However, potential inefficiencies are evident with primary hospitals with the same volume of MCH visits but a large difference in expenditures (horizontal spread) or the same level of spending but differences in the number of MCH visits (vertical spread). Similar to the MCH department, spending in Delivery departments increases as deliveries increase. Although some primary hospitals are spending substantially more per delivery - those above the black line - compared to those that are on or below the black line.

As previously stated, we would expect a decreasing relationship between expenditures per patient as the number of outputs increases – demonstrating economies of scale. Fig. 5 shows that the four departments experienced a decrease in spending per contact as output increases, although wide dispersions around the line is present even among primary hospitals in the same region. Perhaps, primary hospitals with the lower number of outputs could figure out ways to increase outputs such as deliveries while maintaining the same level of cost per output. Understanding why some primary hospitals have higher outputs relative to expenditures across departments could be investigated to better understand the factors influencing these findings. Some of the departments estimated expenditure per patient had extreme values, which were excluded in the graphs to avoid masking the linear relationship being examined. These outliers consisted of one primary hospital for IPD, two for OPD, two for MCH, and two for delivery (19).

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\(^4\) The per capita or person health spending was estimated by dividing total primary hospital expenditure by the catchment population.

\(^5\) One extreme value for IPD, OPD, and Delivery expenditures was found; in order to display the trend between expenditures and outputs more clearly these values were excluded from the graphs depicted in Fig. 4. No extreme values for MCH expenditures exist for primary hospitals.
Fig. 4 Total expenditures in birr (no outliers) and outputs by department for primary hospitals
Fig. 5 Expenditures per output in birr (no outliers) and total output by department for primary hospitals
Removing the extreme values of unit cost for the department-level analysis allowed us to identify whether economies of scale are present among primary hospitals that were not anomalies in the data. Such values should be examined further, rather than ignored, to determine the causes of such high unit costs, whether it be extremely low utilization by department but high costs (such as over staffing while very few are uses services from that department), potential leakages or wastage of health spending by department, error in record keeping (over-reporting expenditures or under-reporting utilization), or primary hospitals providing better quality of care (and thus more costly) compared to others.

Fig. 6 shows the composition of service outputs averaged across all studied primary hospitals (total) and by region, which could also explain some of the overall expenditure differences across departments. It is interesting and significant to note that primary hospitals activity is largely dominated by outpatient services. One might question whether this should so much be the case if the primary health care referral system was working effectively. Specifically, OPD services account for a majority of the services provided (57%) among the studied primary hospitals. MCH services account for substantially less of total primary hospital outputs compared to health centers at 14% versus 42%, respectively (3). Inpatient discharges account for only 3% of total output for the studied primary hospitals; not surprisingly, this is higher compared to health centers (0.4%) (3) as only some health centers provide basic inpatient care and primary hospitals provide more comprehensive inpatient care. Although we would expect higher volumes for primary hospitals to be for inpatient care instead of outpatient care. Focusing on expanding some departments in primary hospitals compared to health centers (e.g., IPD), along with encouraging patients to utilize the higher level of primary care services for certain types of care, may lead to more optimal resource use within the PHCU. More analytical work is needed before such actions are taken.

**Fig. 6 Composition of volume of services provided at primary hospitals**

<table>
<thead>
<tr>
<th></th>
<th>Inpatient Discharges</th>
<th>Outpatient Visits</th>
<th>MCH Visits</th>
<th>Deliveries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oromia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amhara</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SNNPR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tigray</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Input efficiency**

We explore input efficiency for primary hospitals by relating human resource levels in facilities to measures of output to provide estimates of human resource productivity and technical efficiency.
Human resource productivity

Staffing a primary hospital with clinical staff, or individuals that provide services directly to patients, is mostly determined by government norms and not determined much by patient load. FMOH has set a minimum staffing requirement for primary hospitals. Primary hospitals should have at least 53 total clinical and non-clinical professionals (clinical: physicians, health officers, midwives, and nurses; non-clinical: cleaning staff, pharmacists, administrators, etc.) (1). On average, the sampled primary hospitals have 161 total staff, consisting of 71 clinical staff and 90 non-clinical staff, substantially higher than the minimum requirement (19). Primary hospitals are a relatively new primary level facility and the rollout has been gradual, leading to a higher than standard catchment population (7.5 times more) and most likely the reason for the higher staffing volume compared to the government standard (19). One primary hospital is within the standard catchment population range of 60,000 to 100,000 with 85,000 people within the defined area. This particular primary hospital has 86 clinical staff and 79 non-clinical staff, with a total of 165 staff – three times higher than the minimum requirement of 53.

Referring to Fig. 7, primary hospitals above the black line have more clinical staff relative to the facility volume of outpatient equivalents compared to primary hospitals that are either on or below it. The primary hospitals with a higher number of clinical staff relative to total patient volume highlights a potential overstaffing problem relative to volume, thus creating differences in the productivity of human resources in producing health outputs. Overall, primary hospitals show a positive relationship between clinical staff and outpatient equivalents, indicating some relationship between clinical staffing and outputs.

**Fig. 7 Clinical staff compared to total patients served (outpatient equivalent visits) for primary hospitals**

![Clinical staff compared to total patients served](image)

Primary hospital clinical staffing relative to outpatient equivalent visits per catchment population show very different patterns (Fig. 8). The cluster of primary hospitals, mostly in Amhara and Oromia, have a wide vertical spread indicating that there is a high variation in clinical staffing even with similar outpatient equivalent per contact rates. For example, two primary hospitals with a similar outpatient equivalent per catchment population ratio of 0.1 have clinical staff as high as 114 (a primary hospital in SNNPR) or as low as 22 clinical staff (a primary hospital in Oromia).
We explore health staff productivity by assessing the composition of the number of outpatient equivalent visits experienced by each primary hospital’s clinical staff per day (Fig. 9). The average number of outpatient equivalent visits per clinical staff per day is 2.54 This ranges from 1.5 to 5.8, where Tigray had the highest average number of visits per clinical staff per day while Oromia had the lowest. These levels of productivity are very low reflecting an imbalance between service capacity (represented by clinical staffing) and service demand. A similar finding of possible overstaffing was evident among the studied health centers, with an average of 3.7 outpatient equivalent visits per clinical staff per day (3).

Global reports identify significant health workforce shortages when assessing density of key clinical staff (e.g., ratio of physicians per 10,000 population), especially among Sub-Saharan African countries (25,26). The density per 10,000 population for skilled professionals in 2010 for Ethiopia, Kenya, and Ghana was 2.7, 9.9, and 13.6, respectively (25). These most recent estimates of skilled professionals are significantly below the health workforce (physicians, nurses and midwives) norm of 22.8 per 10,000 population from the World Health Report 20066 (25).

Other recent normative recommendations are even higher, e.g. 34.5 skilled professionals per 10,000 population by the International Labour Organization in support of its regulation on Social Protection, the World Social Security Statistics 2010/2011, and a background paper for The World Health Report 2010; and a target of 59.4 skilled professionals per 10,000 population, estimated by the World Health Organization (WHO) and United States Agency for International Development (USAID) for the Ending Preventable Maternal Deaths initiative, to reduce global maternal deaths to 50 per 100,000 live births by 2035 (25).
Despite claims of significant health workforce shortages, output production of skilled professionals remains extremely low relative to demand or volumes. Other Sub-Saharan African countries demonstrated low levels of productivity of clinical staff among public hospitals. Kenya had an average of almost 6 outpatient equivalent visits per medical staff per day, while in Ghana it was slightly more than 5 outpatient equivalent visits per medical staff per day in 2011 across public hospitals measured (4,5). There is no golden rule for the optimal level of output production for a health facility. Low output production could be reasonable if the health system anticipates significant increases in demand in the future, and taking measures to make this happen, such as implementation of health insurance schemes. Or inefficiencies in the use of resources to deliver services could be attributing to the relatively high unit costs.

**Technical efficiency (potential resource equivalents gained)**

We used DEA to estimate the gap between actual and relative efficient resource use in the primary hospitals studied. This type of analysis has been widely used to determine the relative efficiency of both public and private health care providers in Sub-Saharan Africa. In Kenya, 56% of public health centers were found to be technically inefficient, with an average 35% reduction of inputs could be reduced without reducing outputs and outputs could increase by 30% under the current capacity and size of the health centers (27). Several studies in Ghana found varying degrees of inefficiencies for different levels of public and private health care providers (4,22,28). In 2001, DEA was used to show that only 30% of public primary health clinics in South African Province of Kwazulu-Natal were technically efficient (29). Health centers in Burkina Faso were found to be relatively efficient, where the technically inefficient health centers could only reduce inputs by 9% without decreasing outputs while on the other hand they could only increase outputs, on average, by 3% without expanding the size and capacity of the health centers (30). More than half of the studies district hospitals in Namibia were technically inefficient with an average technical and scale efficiency score of 74.6% and 76.8%, respectively, in 2000/01 (31).

Only one DEA study was found for Ethiopia’s health system focusing on government-run health posts in Tigray region. Among the 60 health posts studied, 70% and 30% were found to be pure technically and scale inefficient, respectively (18). The average technical efficiency score among the inefficient health posts was 42%, meaning that 58% of the inputs could be reduced while maintaining the same level of output. The average scale efficiency score among the inefficient health posts was 90%, or outputs could increase only by 10% given the current capacity (size and structure) of the health posts. However, it is possible that it may not account for all services provided outside of the health post. One recent study found that health extension workers spend, on average, 43% of their time providing services at the health post, with the remaining time delivering services in the community and travel time to households along with other work-related non-service delivery activities such as attending trainings and meetings (32).

We estimated efficiency scores (technical and scale) through the application of DEA for each primary hospital, capturing a facility’s resource use or inputs such as current staffing to produce care (4). The estimated technical and scale efficiency scores for the sampled primary hospitals are shown in Table 1. Efficiency scores range from 0 (completely inefficient) to 100% (efficient). Only 7 out of 24 (29%) primary hospitals were technically efficient, while the remaining 17 (71%) were technically inefficient for EFY 2006 and 2007/08. The average technical efficiency score among the inefficient primary hospitals is 55%. This implies that, on average, the inefficient primary hospitals could reduce their inputs by 45% without reducing outputs. Only 4 out of 24 primary hospitals were scale efficient, while 20 were scale inefficient. The average scale efficiency score among inefficient primary hospitals is 65%, inferring a potential to increase total outputs by 35% within the existing capacity and size. An increase in outputs would reduce unit costs of service provision at primary hospitals however this depends on the demand for health care services, which relies more on individual preferences to care, perceptions of quality, and accessibility – factors not necessarily within the control of a health provider. Another option would be to find cost savings by reducing inputs among inefficient primary hospitals.

7A health post in Ethiopia is typically staffed with 2 front-line health workers known as health extension workers (HEWs). Services provided at this level are mostly preventative services and some basic curative health care services (e.g., immunizations).
Table 1. Technical and scale efficiency scores for primary hospitals

<table>
<thead>
<tr>
<th>Primary Hospitals</th>
<th>Technical Efficiency Score (%)</th>
<th>Scale Efficiency Score (%)</th>
<th>Returns to scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital 1</td>
<td>1</td>
<td>0.57</td>
<td>drs</td>
</tr>
<tr>
<td>Hospital 2</td>
<td>0.80</td>
<td>0.65</td>
<td>drs</td>
</tr>
<tr>
<td>Hospital 3</td>
<td>0.56</td>
<td>0.58</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 4</td>
<td>0.57</td>
<td>0.64</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 5</td>
<td>0.47</td>
<td>0.93</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 6</td>
<td>0.89</td>
<td>0.67</td>
<td>drs</td>
</tr>
<tr>
<td>Hospital 7</td>
<td>0.36</td>
<td>0.96</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 8</td>
<td>0.55</td>
<td>0.39</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 9</td>
<td>1</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>Hospital 10</td>
<td>1</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>Hospital 11</td>
<td>0.62</td>
<td>0.79</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 12</td>
<td>0.75</td>
<td>0.38</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 13</td>
<td>0.68</td>
<td>0.19</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 14</td>
<td>1</td>
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<td>-</td>
</tr>
<tr>
<td>Hospital 15</td>
<td>1</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>Hospital 16</td>
<td>0.51</td>
<td>0.46</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 17</td>
<td>0.50</td>
<td>0.94</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 18</td>
<td>1.00</td>
<td>0.59</td>
<td>drs</td>
</tr>
<tr>
<td>Hospital 19</td>
<td>0.40</td>
<td>0.46</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 20</td>
<td>0.75</td>
<td>0.73</td>
<td>drs</td>
</tr>
<tr>
<td>Hospital 21</td>
<td>0.38</td>
<td>0.66</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 22</td>
<td>0.27</td>
<td>0.98</td>
<td>irs</td>
</tr>
<tr>
<td>Hospital 23</td>
<td>1.00</td>
<td>0.45</td>
<td>drs</td>
</tr>
<tr>
<td>Hospital 24</td>
<td>0.31</td>
<td>0.96</td>
<td>irs</td>
</tr>
<tr>
<td><strong>Total Average</strong></td>
<td><strong>0.68</strong></td>
<td><strong>0.71</strong></td>
<td></td>
</tr>
</tbody>
</table>

drs = decreasing returns to scale  
irs = increasing returns to scale

Table 2 highlights the input reductions needed to make the 17 inefficient primary hospitals as efficient as the most technically efficient primary hospitals in this study given current output levels. This implies that input reductions could save a total of 187.03 million birr (54% of total annual expenditure among studies primary hospitals) for the study years without any reduction in output. This breaks down to an input savings of 647 medical and 937 non-medical staff or 31 million birr in human resource expenditures, 60 million birr for drugs and supplies and 95.98 million birr for indirect expenditures.
Table 2. Changes in inputs to make inefficient primary hospitals efficient

<table>
<thead>
<tr>
<th>#</th>
<th>Inefficient Primary Hospitals</th>
<th>Technical Efficiency Score (%)</th>
<th>HR Costs</th>
<th>Drugs and Supplies Costs</th>
<th>Indirect Costs</th>
<th>Medical Staff</th>
<th>Non-Medical Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hospital 2</td>
<td>0.80</td>
<td>1,665,764</td>
<td>918,718</td>
<td>899,713</td>
<td>15</td>
<td>59</td>
</tr>
<tr>
<td>2</td>
<td>Hospital 3</td>
<td>0.56</td>
<td>1,839,070</td>
<td>3,110,484</td>
<td>1,661,474</td>
<td>22</td>
<td>53</td>
</tr>
<tr>
<td>3</td>
<td>Hospital 4</td>
<td>0.57</td>
<td>1,108,586</td>
<td>893,091</td>
<td>2,045,664</td>
<td>25</td>
<td>34</td>
</tr>
<tr>
<td>4</td>
<td>Hospital 5</td>
<td>0.47</td>
<td>3,945,587</td>
<td>3,359,995</td>
<td>2,385,755</td>
<td>34</td>
<td>77.611</td>
</tr>
<tr>
<td>5</td>
<td>Hospital 6</td>
<td>0.89</td>
<td>1,702,925</td>
<td>330,601</td>
<td>1,592,247</td>
<td>35</td>
<td>8.604</td>
</tr>
<tr>
<td>6</td>
<td>Hospital 7</td>
<td>0.36</td>
<td>4,108,828</td>
<td>3,077,584</td>
<td>9,363,703</td>
<td>54</td>
<td>120.115</td>
</tr>
<tr>
<td>7</td>
<td>Hospital 8</td>
<td>0.55</td>
<td>1,031,822</td>
<td>1,128,466</td>
<td>2,628,256</td>
<td>32</td>
<td>35</td>
</tr>
<tr>
<td>8</td>
<td>Hospital 11</td>
<td>0.62</td>
<td>584,325</td>
<td>242,600</td>
<td>1,704,614</td>
<td>24</td>
<td>35.066</td>
</tr>
<tr>
<td>9</td>
<td>Hospital 12</td>
<td>0.75</td>
<td>581,987</td>
<td>295,437</td>
<td>1,649,123</td>
<td>53</td>
<td>17</td>
</tr>
<tr>
<td>10</td>
<td>Hospital 13</td>
<td>0.68</td>
<td>814,268</td>
<td>268,477</td>
<td>1,177,953</td>
<td>21</td>
<td>39</td>
</tr>
<tr>
<td>11</td>
<td>Hospital 16</td>
<td>0.51</td>
<td>1,901,800</td>
<td>20,172,207</td>
<td>39,872,388</td>
<td>27</td>
<td>35.221</td>
</tr>
<tr>
<td>12</td>
<td>Hospital 17</td>
<td>0.50</td>
<td>2,242,217</td>
<td>5,517,158</td>
<td>3,038,609</td>
<td>30</td>
<td>63</td>
</tr>
<tr>
<td>13</td>
<td>Hospital 19</td>
<td>0.40</td>
<td>1,301,081</td>
<td>3,674,904</td>
<td>2,656,775</td>
<td>46</td>
<td>50.247</td>
</tr>
<tr>
<td>14</td>
<td>Hospital 20</td>
<td>0.75</td>
<td>1,915,589</td>
<td>2,753,733</td>
<td>4,692,013</td>
<td>16</td>
<td>54.101</td>
</tr>
<tr>
<td>15</td>
<td>Hospital 21</td>
<td>0.38</td>
<td>1,834,697</td>
<td>3,296,361</td>
<td>4,918,841</td>
<td>52</td>
<td>59.364</td>
</tr>
<tr>
<td>16</td>
<td>Hospital 22</td>
<td>0.27</td>
<td>2,178,993</td>
<td>6,706,741</td>
<td>9,545,713</td>
<td>83</td>
<td>110.4</td>
</tr>
<tr>
<td>17</td>
<td>Hospital 24</td>
<td>0.31</td>
<td>2,251,364</td>
<td>4,302,393</td>
<td>6,143,357</td>
<td>76</td>
<td>85.217</td>
</tr>
</tbody>
</table>

Total Cost Saving

|               | 31,008,902 | 60,048,949 | 95,976,198 | 647 | 937 |

In terms of factors that could explain efficiency differences and might be addressed by initiatives to improve efficiency, both demand and supply side factors can be important. On the demand side, one study in Bangladesh found that clients’ perceptions of health care providers skill and competency and satisfaction were important predictors of utilizing community clinic services (33). Another study in rural South Africa found by using geographic information systems that there was a significant decline in usage of health care services with an increase in travel time to primary care providers (34). Quality service provision might be more important compared to improved access in order to increase primary care utilization, as demonstrated in one study conducted in rural Nepal (35).

Supply side factors related to planning such as fiscal transfers from national to sub-national levels based on a defined formula, negotiation powers of a local government, and allocating human resources based on standards or norms instead of workload or output may cause inefficiencies. Close to 60% of the woreda’s overall budget allocation comes from fiscal transfers of block grants from the federal and regional levels (11). This rather limited budget is constrained by competing sector priorities to health such as education and agriculture. Furthermore, anecdotal evidence points to potentially some woredas with stronger negotiation abilities, compared to others, which leads to greater budget allocations. The use of staffing standards or norms may lead to an imbalance between staff and
patients served, thus an inefficient allocation of human and financial resources compared to patient load. Health facilities with low patient-loads may experience an underutilization of allocated human resources, while facilities with high patient-loads may not have enough human resources to meet patient needs.

Limitations of study

The main limitations of this study are due to the data collected to conduct the PHC cost study, which this analysis pulls from, and approaches used for the efficiency analysis. The total sample used is based on two separate time periods, EFY 2006 and EFY 2007/08. Berman et al demonstrated no statistically significant differences between the two data collection time periods for primary hospitals (19). Although we don’t think these are significant, the findings presented in this paper might be influenced by time variant factors, such as salary increases or medical need based on weather anomalies (e.g., the recent drought experienced in parts of Ethiopia).

Each woreda is to have a primary hospital and there are over 800 woredas in Ethiopia. Primary hospitals are still a relatively new primary care facility. This study does not address any of the potential future efficiency implications that may arise as more primary hospitals are established across the country. As of 2014, only 56 primary hospitals were established in Ethiopia (36). The sampled primary hospitals analyzed in this study account for almost half of the existing primary hospitals (43%).

Efficiency scores produced by the DEA models are sensitive to the health facility sample and model specification. These scores are based on the relative efficiency from the other primary hospitals in the sample and not based on the optimal mix of inputs and outputs for all primary hospitals in Ethiopia. If a different DEA model was specified, or one used different inputs and outputs, then one may get different results in the efficiency scores and cost savings. Additionally, the input savings estimates are based on savings that could be achieved by reallocating resources if the inefficient primary hospitals were as efficient as the primary hospitals along the frontier, or the most efficient ones. This is a rather optimistic scenario. An alternative approach would be to assume that the least efficient primary hospitals could be as efficient as the average technical efficiency score. This would result in a smaller input savings than reported here but still presumed to be a significant cost reduction.

Other factors might be influencing the efficiency findings. For example, one primary hospital might appear to be “efficient” with low unit cost per output. However, that facility might have lower costs because it is lacking key resources such as experiencing regular stock-outs8. Primary hospitals with relatively low efficiency might be due to low utilization rates based on remote placement of health facility, limited access to road infrastructure; factors beyond the control of the health sector.

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8 This was not accounted for, and one of the limitations, in the PHC cost study (20).
Conclusions and Way Forward

This analysis for primary hospitals demonstrates some potential areas where improvements in resource allocation and use could lead to more efficient health service provision within the high-level primary care facility. Cost efficiency was assessed for total primary hospital efficiency, department-level efficiency, and input efficiency. Some primary hospitals and departments appeared to be significantly more efficient compared to others in terms of resource use relative to output, input productivity, and pure technical and scale efficiency.

Primary hospitals expenditures increased slightly as the number of outpatient equivalent visits increased. Horizontal and vertical spreads indicate possible inefficiencies within these health facilities. Some primary hospitals had high spending but low output, which may indicate inefficiency in resource use such as over staffing relative to utilization rates. Other primary hospitals appear to be more efficient with low levels of spending relative to output.

Certain factors are not captured in the data used for this analysis that might also influence expenditures levels, like quality of service provision (e.g., clinical staff spending more time with patients or keeping a readily available stock of unexpired drugs and pharmaceutical supplies), which may inherently have higher costs.

Economies of scale occur as more people are accessing care from primary hospitals. Studies have measured the impact of patient load on the cost per visit for primary care facilities. One such study found that a 1% increase in patient load statistically significantly decreased cost per visit by 27% (37). Service volumes may increase for primary hospitals with the introduction of social health insurance and scale-up of community based health insurance schemes, and thus may decrease the cost per visit. Mechanisms to improve efficiency should also focus on demand generation activities for this level of care (e.g. reducing physical and financial access to health care services), and not solely on supply-side factors (e.g., more equitable resource allocation for health care providers).

Among the sampled primary hospitals, we found differences in the distribution in spending across regions. Per capita spending among primary hospitals located in Amhara and SNNPR was at least 40 birr less compared to primary hospitals locating in Oromia and Tigray. However, there are substantially higher catchment populations for primary hospitals located in Amhara and SNNPR compared to Oromia and Tigray, and thus driving this finding.

Some departments within primary hospitals appear to be more efficient in resource use compared to others. All departments show a positive linear relationship between department level expenditures and outpatient equivalent visits. Relatively high spending and low output or high output and low spending still exist across primary hospital departments. The former relationship indicates possible inefficiencies in resource use relative to output levels such as too many staff or primary hospitals forced to procure drugs and pharmaceutical supplies from private dispensaries, which are more costly, due to stock-outs.

Referring to global normative recommendations, such as from the WHO, Ethiopia faces a substantial health worker shortage; however, health worker productivity is very low for primary hospitals. The studied primary hospitals have on average 2.54 outpatient equivalent visits per clinical staff per day. This is even lower than the average for health centers, at 3.7 (3). Tigray has the highest outpatient equivalent visits per clinical staff per day (5.8), while Oromia has the lowest (1.5). This overall low output production for primary hospitals is brought on by low demand and high supply of clinical staff. The studied primary hospitals have higher staffing than the government norm, most likely due to the higher defined catchment areas covering multiple woredas rather than the envisioned one primary hospital for each woreda. The low health worker productivity findings are consistent with estimates of health worker productivity in other developing countries such as Kenya and Ghana.
Seventy-one percent of the primary hospitals sampled were purely technically inefficient, suggesting wastage or inefficiencies are occurring because more resources than necessary are being used given the level of output. A potential cost-savings of 187.03 million birr for the study years was estimated if certain inputs were reduced such as clinical staff, drugs and supplies wasted, and indirect expenditures. These are factors that a health provider can control however the reduction of some of these inputs such as clinical staff would not necessarily be a good policy. Another way to improve such costly inefficiencies would be to increase output. Almost all of the primary hospitals were scale inefficient with an average scale efficiency score of 65%, suggesting that on average these inefficient primary hospitals could increase their output levels by 35% given their size and capacity. It would be beneficial for the FMOH to continue the adoption of demand generation activities such as behavior change communication to increase outputs for primary hospitals.

One must be very cautious in drawing strong conclusions from this analysis because this current analysis does not show why potential efficiencies (or inefficiencies) are occurring among the sampled primary hospitals. Strategies to address inefficiencies highlighted in this report for primary hospitals are still not clear, more work needs to be done.

Additional questions arise as a result of the findings presented in this report. Such questions include: What internal and external factors have influenced the efficiency findings? Does an efficient primary hospital provide quality and equitable health care or does efficiency occur with inadequate provision of health services due to factors such as stock-outs – reducing costs to the facility potentially along with a patient served? What is the most appropriate funding and input mix for primary hospital service delivery in order to be most cost-efficient?

Producing further evidence that attempts to answer these and other questions on efficiency of primary care providers would provide the FMOH with the complete picture of cost efficiency and ways to improve it for a more efficient and equitable primary care system. Proposed activities for the Health Economics and Financial Analysis case team in the next EFY attempt to answer such questions in order to support the HSTP and National Health Finance Strategy implementation. Suggested activities for future efficiency analytical work consist of:

- Conducting site visits to health facilities that were found to be least and most efficient to understand factors influencing findings.
- Improve data collection done by health facilities (this will also facilitate in the improvement of the planning and budgeting process). Identify areas to strengthen the information system and improve data quality.
- Use the Service Provision Assessment Plus (SPA+) survey data to conduct a more representative, comprehensive efficiency analysis for the primary care system.
- Conduct analysis to estimate allocative efficiency for primary hospitals and health centers.
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