Effect of Health Sector Grants on Availability and Quality of Healthcare in Kenya

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Effect of Health Sector Grants on Availability and Quality of Healthcare in Kenya

By

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Abstract

This study seeks to investigate the effect of health sector grants on availability and quality of primary healthcare in Kenya while focusing on the effect of Health Sector Services Fund (HSSF), an innovative financing mechanism in which funds are channeled directly from the national government to the lowest tiers of healthcare providers in the country: the dispensaries, health centres and first level hospitals. Specifically, we sought to establish the effect of HSSF on availability and quality of healthcare in the country as measured by essential drug availability and provider illness diagnostic accuracy, respectively. The study used data from the Health Service Delivery Indicators and Public Expenditure Tracking Survey (SDI-PETs) conducted in Kenya in 2012/13. The analysis was based on basic microeconomic theory - the principal-agent theory. We appropriately used Ordinary Least Squares and probit models in regressing availability and quality of healthcare measures on HSSF status and a variety of control variables while controlling for endogeneity of HSSF receipt. The regression results point to the importance of Health Sector Services Grants (HSSF) amount and receipt in improving availability of essential drugs and quality of care, respectively. Thus, direct and increased funding to lower level health facilities enhances availability of individual essential medicines at the facility level. Similarly, HSSF funding was important in influencing accuracy in illness diagnosis. Other factors such as facility type and access to power influenced availability of essential drugs while health worker age-group and health worker training as indicated by cadre type were important determinants of provider process quality of healthcare.

Key words: health financing, financial incentives, essential medicines, provider competency, health facilities

1. Introduction

1.1 Introduction and Motivation

Service provision/delivery coupled with other factors such as social determinants is a fundamental input in improvement of population health status. Improving service delivery, therefore, is important for achievement of both international and national goals of enhancing population health. Strengthening of health services is recognized as a priority for meeting the basic health needs of any country's population (Peters et al., 2009). A good health service delivery system entails, among other characteristics, enhanced availability of healthcare inputs, including drugs and other medical supplies and provision of quality health care (UN Human Rights, 2019; WHO, 2010).

Availability of healthcare inputs helps in optimizing access to healthcare (Carillo et al., 2011; Andersen, 1995; Aday and Andersen, 1974) since it presents an opportunity for the population to obtain healthcare when required (Gulliford et al., 2002). However, quantitative improvement of healthcare, for instance through enhanced availability of infrastructural inputs, is necessary but not a sufficient step towards improvement of health outcomes (Powell-Jackson, Mazumdar and Mills, 2015; Okeke and Chari, 2014). In addition to enhanced access and better health infrastructure, quality of care is increasingly being recognized as critical to achievement of better health outcomes, hence the shift in policy debate to its improvement (Lee, Madhavan and Bauhoff, 2016; Peabody et al., 2006).

The Sustainable Development Goals (SDGs) consider access to quality healthcare services as one of the indicators of health-related SDG Goal 3 (Pisano et al., 2015). Kenya's policy framework recognizes the role of both availability of health infrastructural inputs and healthcare quality in improving the health of her citizenry. The Constitution of Kenya grants rights to health care (Government of Kenya, 2010) whose actualization is premised on, among others, adequate supplies of essential medicines. In addition, the constitution provides for devolution of health care with the aim of promoting availability of health care at the grassroots (Government of Kenya, 2010). Kenya's current development blueprint - the Kenya Vision 2030 - targets to ensure that the entire population has access to quality and effective health services (Government of Kenya, 2007).

There have been considerable efforts to enhance health system human resources, infrastructure, medical supplies and equipment over the past two decades in Kenya

(Mugo et al., 2018; Ministry of Health, 2013). This has led to notable improvement in health outcomes in the country over the years, with statistics indicating a general decline in child and maternal mortality (Dutta et al., 2018; Ministry of Health, 2016; Kenya National Bureau of Statistics, Ministry of Health/Kenya, National AIDS Control Council/Kenya, Kenya Medical Research Institute, National Council for Population and Development/Kenya, and ICF International, 2015) and overall improvement in life expectancy (Ministry of Health, 2016; World Bank, 2014). Generally, available statistics show that the country is doing well in terms of availability of key equipment and essential medicines/drugs recommended for a health facility (Mugo et al., 2018; Martin and Pimhidzai, 2013). Nonetheless, some essential elements of healthcare service delivery are still inadequate. It was observed, for instance, that drug availability for mothers and children stood at 59% and 78%, respectively, in 2013 (Mugo et al., 2018; Martin and Pimhidzai, 2013). This poses a hindrance to achievement of better health for mothers and children in the country.

Along with existing gaps on availability of key infrastructure inputs, there are quality of care gaps in terms of clinical performance. The Service Delivery Indicator (SDI) survey, funded by the World Bank and data collected in 2012/13 by Kenya Institute of Public Policy Research and Analysis (KIPPRA) and Kimetrica, indicated that there was provider knowledge gap in illness diagnosis and in adherence to illness treatment guidelines. Specifically, the survey observes that only 16% of the providers were able to correctly diagnose five (5) tracer conditions, namely: malaria with anaemia, diarrhea, pulmonary tuberculosis, diabetes and pneumonia (Martin and Pimhidzai, 2013). Also, only 43% of providers in public facilities adhered to clinical guidelines for the five (5) tracer conditions, with only 13% of healthcare providers adhering to at least half of the clinical guidelines.

Health financing is a key input in the provision of quality healthcare as it enhances provision of healthcare facilities, purchase of drugs and health equipment, personnel remuneration and operations and maintenance (Kimani et al., 2004). Indeed, how communities pay for healthcare together with the amount of resources devoted to health not only affects the care that people receive but also its quality (Chalkly and Malcomson, 1998). While sources and magnitude of financing are important in health service delivery, a resource allocation mechanism that incentivizes provision of basic health facilities as envisaged in the international and national commitments, identifies funds priority areas and promotes accountability for funding and health outcomes is essential. Giacomini, 1996) observe that any system of funding creates financial incentives but two scenarios are possible, a policy maker may design choices not motivated by the desire to communicate policy objectives through financial incentives and; a policy maker may choose to use financial incentives as the instrument for communicating policy objectives and changing behaviour.

The call for use of health sector financial incentives, both at the household level (demand side) and facility level (supply side) is mostly intended for behaviour change through encouragement of utilization and provision of quality healthcare services, respectively (Mills, 2014). Existing literature documents the contribution of demand

side financial incentives mainly by conditional cash transfers to change household behaviour (Glassman et al., 2013; Lagarde, Haines and Palmer, 2009). A focus on the supply side also points to the important role of financial incentives, largely, pay-for-performance/results grants (where payments are based on predefined healthcare provider performance (Fan et al., 2013) in improving provider quality of healthcare (Gertler and Vermeersch, 2013; Olken et al., 2014. Incentives may also be used in removal of financial barriers with a focus on improving care (McLoughlin and Leatherman, 2003).

Kenya's devolved system of governance in 2010 led to the delegation of some government services previously provided by the national government to the forty-seven (47) county governments (KPMG Africa, 2014). This system saw the division of healthcare responsibilities between the county and national governments. Accordingly, essential health service delivery is assigned to county governments, while the national government retains health policy, technical assistance to counties, and management of national referral health facilities. Devolution resulted to fiscal decentralization, which was assumed to provide incentives to the decentralized county governments for efficient service delivery through better targeting of development interventions to local community needs and the inherent increased competition among the local governments for national grants (Davoodi and Zou, 1998). The main source of funding for the county governments include an equitable share of the national revenue (at least 15%), the Equalization Fund for marginalized communities representing 0.5% of the national revenue and conditional and unconditional grants from the national government (Commission on Revenue Allocation, 2014). Between 2014/15 and 2016/17, the share of budgetary allocation to health in the counties increased from 56% to 59% (Republic of Kenya, 2018). The county governments also generate revenues from property taxes, business licenses and entertainment taxes. The national allocations to counties are normally given as a block grant and counties determine the share to be allocated to health. Some national allocations to county health sectors are, however, conditional in nature. These include allocations to: county referral hospitals (level 5 hospitals), free maternal healthcare and compensation for foregone user fees (Republic of Kenya, 2017). It is also important to note that the private sector, mainly consumers, remain the largest source of health financing in Kenya, contributing to about 40% of healthcare funding in 2015/16 compared to a contribution of 37% and 23% by the public sector and donors, respectively, in the same period (Republic of Kenya, 2018).

County governments' health sector services also benefit from direct funding from the national government and donors through an innovative health financing system known as the Health Sector Services Fund (HSSF). HSSF channels funds directly from the national government to the lowest tiers of healthcare providers in the country, hence partly solving the problem of access to finance at these levels; the dispensaries, health centres and lower-level hospitals. The fund was operationalized in the country in 2010 after its initial pilot in Coast region in 2005 (Opwora et al., 2010). The structure and the conditions of the fund are likely to incentivize the funded health facilities to

comply with government accounting procedures (World Bank, 2014) and to strengthen community accountability through inclusion of community members in the fund management at the facility level (Waweru et al., 2013). HSSF funding sources are the government and development partners, mainly Danish International Development Agency (DANIDA) and the World Bank. The funds are credited directly to the facility's bank account quarterly and managed by the Health Facility's Management Committee (HFMC). The main purpose of the funds is to pay for the facility's operational expenses (Republic of Kenya, 2009), including facility maintenance, refurbishment, support staff, allowances, communications, utilities, medical supplies, fuel, community-based activities to improve the quality of services (Waweru et al., 2013; Health Rights Advocacy Forum, 2012). Table 1.1 presents the total number of health facilities receiving HSSF disbursements since October 2010.

Table 1: Total number of health facilities receiving disbursements since October 2010

Financial Year	Period of disbursement	Health Centres	Dispensaries
2010/11	1st disbursement	589	
	2nd disbursement	589	
	3rd disbursement	653	
2011/12	1st disbursement	673	482
	2nd disbursement	706	2092
	3rd disbursement	718	2291
	4th disbursement	720	2296
2012/13	1st disbursement	765	2330
	2nd disbursement	770	2384
	3rd disbursement	751	2349

Source: Waweru et al. (2013)

The uniqueness of the design of HSSF (World Bank, 2014) presents an opportunity to analyse the effect of direct funding approach on availability and quality of primary level healthcare. This study focuses on how incentivizing provision of medical supplies and quality of healthcare through removal of financial barriers (HSSF attempts to address delay in disbursement of funds from the Ministry of Health to the lowest levels of healthcare) could lead to improved service delivery through improvement in the availability of essential medicines at the facility and provider quality of care. HSSF also incentivizes adherence to accounting guidelines and community involvement (Health Rights Advocacy Forum, 2012), which could affect quality of healthcare provision. Given the uniqueness of the HSSF, we sought to examine the effect of this healthcare grant on healthcare service delivery measures, mainly availability of essential tracer medicines and quality of healthcare as measured by provider illness diagnostic accuracy in Kenya.

The concepts of availability and quality of healthcare as used in this study are guided by Donabedian's framework for quality of care assessment, which categorizes

healthcare quality measures into three domains: structure, process and outcomes (Donabedian, 1988). Structural measures are most relevant to availability (Kuhlthau, 2011) and mainly focus on the environment in which healthcare takes place - the buildings, human resources and availability of medical supplies and equipment. Process quality entails what is done in providing and receiving care. Process quality measures are a direct measure of facility-level healthcare quality (Mant, 2001). Outcome measures of quality refer to the impact of availability and quality on recipients of healthcare. This study assesses availability and quality of healthcare as indicated by provider competency in clinical performance.

1.2 The Research Problem

A good number of the Kenyan population (40%) who use public facilities for outpatient services seek healthcare from levels 2 and 3 of healthcare facilities; that is, the dispensaries and health centres (Ministry of Health, 2014; Republic of Kenya, 2018). As such, the responsibility of provision of primary healthcare falls heavily on dispensaries and health centres. An assessment of health service delivery at these levels indicates that the availability of infrastructure such as water, sanitation and electricity is generally positive. However, there are performance gaps in terms of essential drugs' availability and provider knowledge. While essential tracer drugs are always supposed to be available, the Service Delivery Indicator Report observes that none of the health facilities had all essential drugs as recommended by the World Health Organization (Martin and Pimhidzai, 2013). Even more disconcerting is the finding that there is provider knowledge gap in illness diagnosis with only 16% of the providers being able to diagnose correctly five (5) common illness, namely malaria with anaemia, diarrhea, tuberculosis, diabetes and pneumonia (Martin and Pimhidzai, 2013).

Kenya's healthcare system seeks to enhance access to quality healthcare for all Kenyans through Universal Health Coverage (UHC). To achieve this goal, Kenya needs innovative means to mobilize and utilize financial resources (Barasa et al., 2018; Dutta et al., 2018; Government of Kenya, 2007). While the current reforms in the country targeting expansion of health insurance through the National Hospital Insurance Fund (NHIF) are critical for achievement of UHC, it may not be sufficient to meet other investment requirements such as availability of commodities, equipment and the workforce (Dutta et al., 2018). Basically, funding mechanisms to health facilities, in particular lower level healthcare facilities, remain a challenge. Previously in Kenya, only 50% of the targeted healthcare grants could reach these facilities due to delays at the Ministry of Finance and Ministry of Health headquarters, shortfalls in quarterly allocations, liquidity problems and failure to comply with government accounting procedure (Health Rights Advocacy Forum, 2012). This translated to low coverage and poor quality of health services in Kenya's healthcare system. With the devolved system of governance, the sub-national governments receive block grants. The allocation of these grants to the various sectors is mostly discretionary. On average, the county

budget allocations to health is low (approximately 5%), implying lower health facilities share, hence impacting on the quality of healthcare (Kimathi, 2017).

Kenya's HSSF was established specifically to deliver operational finances directly to primary health care facilities, which include the dispensaries and health centres (Health Rights Advocacy Forum, 2012). The receipt of the fund by health facilities is based on work and expenditure plans approved and confirmed by the District Health Management teams (Health Rights Advocacy Forum, 2012). The innovative approach to disbursement of HSSF is expected to address the challenges of financing, which will in turn enhance availability of essential medical supplies and delivery of quality essential health services in an equitable and efficient manner. Indeed, results-based financing and direct-to-facility funding mechanisms (of which HSSF is an example) has been credited for ensuring quality and availability of health care (Lee, Tarimo and Dutta, 2018).

Existing empirical studies document the effect of financial incentives, in particular, the role of financial incentives directed to healthcare workers in improving healthcare quality (Gertler and Vermeersch, 2013; Olken et al., 2014. The HSSF financial incentive, however, differs from the health worker incentives in that the incentive aims at removing financial barrier at the facility level, hence the need to investigate the effect of this fund on availability and quality of healthcare in Kenya. To the best of our knowledge, a few studies empirically examine the role of grants such as HSSF in improving the performance of primary health care facilities in Kenya, hence the focus of this paper. This study addresses the existing gap in health financing literature by investigating the effect of HSSF, a health sector grant on availability and quality of healthcare.

1.3 Research Questions

The questions pursued in the study are:

1. To what extent has HSSF addressed availability of essential medicine in Kenyan primary health facilities?
2. What are the effects of health sector grants on provider process quality of healthcare in Kenya?

1.4 Objectives of the Study

The objectives of the study are to:

1. Examine the effect of HSSF on availability of essential drugs at lowest levels of healthcare in Kenya
2. Investigate the effect of HSSF on provider process quality of healthcare as measured by accuracy in illness diagnosis in Kenya

1.5 Significance of the Study

The Constitution of Kenya 2010 and the consequent devolved system of governance calls for establishment of new health financing mechanisms that will ensure equitable and effective service delivery in the key service sectors of the economy, which includes the health sector. An adoption of granting framework that will incentivize quality healthcare provision is essential for the achievement of these objectives (Chen et al., 2014). This will in turn help in achieving the Kenyan citizen's constitutional right to highest standard of health (Republic of Kenya, 2010) and the health-related SDG Goal 3, which aims at ensuring healthy lives and promoting well-being for all ages (Pisano et al., 2015).

An empirical study on the effect of grants channeled to the health sector on availability and quality of healthcare measures will contribute to the debate on appropriate healthcare funding mechanism for the devolved system of governance in Kenya. The study will be important to policy makers, practitioners and consumers of healthcare services, both at the national and sub-national levels of government.

2. Literature Review

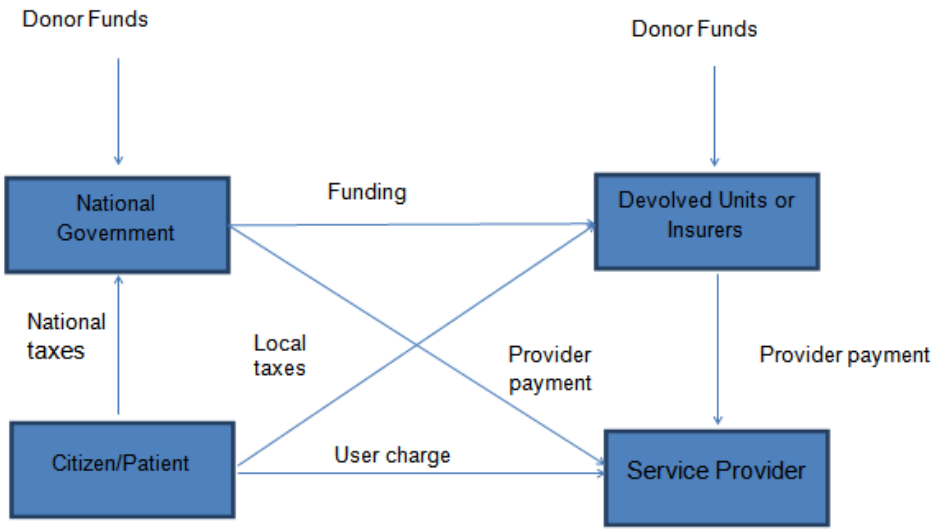
2.1 Theoretical Literature

Inter-governmental transfers or grants are used to fund specific needs or influence specific expenditures at the point of use. They are also used to fund programmes and projects that address socio-economic objectives such as equity and fairness. This is because public goods and services may be under-provided, yet they can yield positive externalities and promote equity (Besley and Ghatak, 2003). Accordingly, such inter-governmental transfers are common in sectors supporting human development such as education and health.

The classification of inter-governmental transfers is in most cases dependent on their objectives (Spahn, 2012). Broadly, there are general-purpose transfers or unconditional grants and the conditional transfers also referred to as earmarked grants. Yet, in other strands, transfers can either be discretionary grants, which are normally ad hoc in nature, or block grants which are channeled towards specific expenditure areas such as health, education or infrastructural development (Boadway and Shah, 2007). Conditional grants have certain reporting and purchasing requirements (World Bank, 2010) and they may be matching or non-matching. Unlike non-matching grants, matching conditional grants requires the recipient to match the transfer received with own funding (Broadway and Shah, 2007). Matching requirements can be either open-ended, meaning the central government matches the level of resources the recipient provides, or closed-ended, meaning that funds are matched to a specified limit (Broadway and Shah, 2007).

In this context of inter-governmental transfers, the World Health Organization (2008) provides a framework of sources of funds and the flow of those funds in the health system for a typical developing country as shown in Figure 1. According to WHO (2008), the national government depends on national-level taxes and donor funding. The national government then transfers resources to the devolved government according to prescribed criteria. The sub-national government authorities also depend on locally administered taxes and donor aid. The health service providers (dispensaries, health centres and hospitals) are funded by the citizen/patients through user fees, local government authorities and directly from the national government. Such direct funding of service providers by the national government is the focus of this study.

Figure 1: Sources of healthcare funds



Source: World Health Organization (2008)

The direct flow of funds from the national government to health facilities is mostly designed as a form of a grant with incentives to motivate the recipients to undertake specified activities and projects and, therefore, achieve the desired outcomes (Shah, 2006). Such types of grants carry out conditions for their utilization, either specifying conditions at the input or output level (Shah, 2006). The special-purpose grants laden with incentives are normally provided because, theoretically, incentives motivate and cause compliance and effort, which lead to the desired results (Bonner et al., 2000).

The theory of incentives is therefore used to understand the mechanisms by which funding designs, for example conditional grants, achieve specific social outcomes. According to Maskin, Laffont and Hildenbrand (1982), there is non-coincidence of goals between the principal and the agent, and the principal is concerned about the performance of the agent. Because of such disparity of intentions, grants laden with incentives may be used by government ministries to induce public service providers to act accordingly. In this case, compliance can be induced through monitoring either directly or through various forms of supervision (Sappington, 1991).

According to Rosenthal et al. (2004), the effect of financial incentives on healthcare quality is analysed based on the magnitude/size of the incentives, the element of competition in the funding model, and the targeted dimensions of healthcare quality. Specifically, it is expected that performance increases with the size of incentives; competitive grants improve performance better than non-competitive ones and, finally, the standard three categories of health quality measurement, that is structure, process and outcome differ on the resources and level of commitment required to achieve them. Conrad and Perry (2009) similarly propose that the design of incentives

will depend on the quality dimension desired. Financial incentives in the health sector are further classified according to whether the incentive is general in terms of focus, or selective whether they focus on rewards or penalties and finally based on the incentive's certainty, frequency and duration (Conrad and Perry, 2009). Finally, as Conrad and Perry (2009) state, healthcare quality is not only driven by financial incentives but other factors such as organizational structure, market environment, and policy and regulatory environment.

2.2 Empirical Literature Review

A growing body of empirical literature investigates the effect of various transfer programmes on health and health outcomes, finding that the effect of transfers/grants is mixed depending on the design and conditionality of the grant. A commonly used form of grant in decentralized system of government is the inter-governmental transfers from the national to local governments. A number of empirical studies document the effect of these transfers on public spending, particularly in education and health sectors. Arvate, Mattos and Rocha (2015) sought to examine the causal effect of conditional versus unconditional grants on education and health expenditures in Brazil. The results indicate that conditional education and health transfers have a greater effect on health spending than unconditional transfers, although the coefficient for health transfers was low (0.848), perhaps because of expenditure in other areas.

Existing studies also document the role of performance-based grants where payments are based on predefined performance (Fan et al., 2013). In Rwanda, Gertler and Vermeersch (2013) examine the effect of such grants on quality and productivity of healthcare providers and health outcomes. The study observed that there is a positive relation between Performance Based Financing (PBF) and provider skills, and on health outcomes. Financial incentives targeted directly to the pay of health personnel (general practitioners in the UK) were found to improve achievement rates of health indicators covered in the incentive scheme but led to neglect of non-incentivized indicators (Doran, et al., 2011). A randomized field experiment conducted by Olken et al. (2014) in Indonesia to test the importance of performance incentives to villages in improving health and education outcomes established that there was an increase in labour supply from health providers and efficient use of health and education funds.

Bonfrer et al. (2013), on the contrary, observed that while performance-based financing resulted in an increase in overall facility score, there was no effect on perceived quality of care as reported by patients in Burundi. The study applied the difference-in-difference method on primary data collected between 2006 and 2010 from households and panel data collected from healthcare facilities.

Empirical studies on the effect of various funding mechanisms include a study in Nigeria by Uzochukwu et al. (2002), which found that primary health care facilities that benefited from a drug revolving fund initiative were more likely to be stocked with essential drugs compared to those facilities not covered in the revolving scheme.

Additionally, drugs in the covered facilities would last a longer period of 6.1 weeks compared to 1.1 weeks in non-funded facilities. In Kenya, a study by Mecca et al. (2014) established that implementation of the National Hospital Insurance Fund (NHIF) significantly increased expenditure on essential drugs in Webuye District Hospital. However, the effect of NHIF on essential drugs stock-out rates was negative but insignificant.

Studies conducted in Kenya document the implementation experiences of HSSF and are largely descriptive. For instance, Waweru et al. (2016) sought to evaluate the HSSF programme one year and six months after its national implementation in health centres and dispensaries, respectively. Based on district and facility-based data, the results indicate that there was a variation in expenditure figures depending on the facility location, with urban-based facilities reporting expenditures on sanitation and minor renovations while rural-based facilities spent on casual labourers, essential drugs, food and referrals. Improvement in quality as indicated by cleanliness, waiting time and treatment given was reported as well.

An overview of the literature conducted so far indicates that there is a likely positive link between incentivized financial grants and health service delivery. However, given the differences in the design of different grants, there is need to apply an empirical model to study the effect of health sector grants on health service delivery measures in Kenya. Thus, this study conducts an analysis of the effect of HSSF on healthcare availability and provider quality of healthcare in the country.

3. Methodology

This study aimed at assessing the effects of HSSF grant on healthcare availability and facility level quality of primary health care in Kenya. We therefore discuss the theoretical model employed, the estimation model and data sources.

3.1 Theoretical Framework

This study is based on the agency problem. The agency problem arises due to mismatch of the agent's (health facilities) preferences and the objectives of the principal (Ministry of Health) (Poitevin, 2000). The objectives of the Ministry include a well-functioning primary healthcare facility stocked with essential drugs and with skilled and motivated health personnel that dispenses accurate diagnoses. However, these objectives may be contrary to the preferences of the management and staff of the primary healthcare facilities. For instance, stocking facilities with essential drugs or retaining and motivating highly skilled health workers who can offer accurate clinical diagnosis may not be their priority expenditure. Therefore, the Ministry of Health relies on incentives such as a grant based on specified performance metrics (e.g. work and expenditure plans, formation of Health Management Committees) and supervision to influence health facility spending on essential drugs and skilled/ motivated health personnel.

The specified agency problem is characterized by the aspect of agent's costs and the principals' expected benefits. According to literature (Poitevin, 2000; Mullen, Frank and Rosenthal, 2010), such a relationship is modeled as follows: the agent chooses an investment in quality denoted by q. This quality qq is not observable to the principal. According to Mullen, Frank and Rosenthal (2010), the quality invested in could be multidimensional, formally represented as $q_1 \ldots\ldots\ldots\ldots q_j$.

Following this exposition, Mullen, Frank and Rosenthal (2010) indicate that the principal derives benefit $B(q)$ when the agent chooses qq level of quality. The authors note that $B(q)$ may also be unobservable to the principal. Similarly, the cost the agent incurs in producing quality at level q is denoted as $C(q)$ in this case is weakly increasing in qq and strictly convex, with a global minimum. The typical costs in a health facility setting are either fixed or variable and could include the opportunity cost of purchasing drugs, and the effort exerted by the health personnel.

Mullen, Frank and Rosenthal (2010) further observe that since the principal is

unable to observe the level of quality q the agent invests in, and the resultant benefit of that quality investment $B(q)$, what is observed are instead a set of signals, which indicate the quality invested and are denoted as $y = (y_1 \dots \dots \dots y_K)$. These indicators are partly due to the quality q invested, indicating that other factors apart from the agent's choice of quality invested could also contribute to the observed signal as denoted in equation (1) below:

$$y = \mu(q) + \varepsilon \quad (1)$$

Where $\varepsilon_k \mathrm{I}\, q \sim F_k, k = 1 \dots \dots K$ with $E[\varepsilon_k \mathrm{I}\, q] = 0$ and $E[\varepsilon_k \varepsilon_{k'} \mathrm{I}\, q] = 0$

In this paper, such indicators are the presence of essential drugs in health facilities and the level of diagnostic accuracy of diseases among the facility health personnel.

Since the health facilities under consideration are public and not-for profit health facilities, we assume that these facilities are reimbursed/compensated for their cost through lump-sum health sector transfers such as HSSF, which is channeled directly to these facilities to enhance provider quality of healthcare. It is important to note that the payment mechanisms do not depend on quality of healthcare provided as is the case with pay for performance.

Let $R(y)$ denote compensation to the health facility. Then, $R(y) = C(q)$. The agent in this case chooses qq to minimize cost:

$$\frac{\partial C}{\partial q} = 0, j = 1,\dots, j \quad (2)$$

The regulator's/Ministry's preferences are given by the difference between the benefit when agent chooses quality qq and total cost of production (Ma, 1994). That is:

$$B(q) - C(q) \quad (3)$$

Solving equation (3) yields efficient allocation of quality enhancement efforts. Therefore[1]:

$$q = f(R, X) \quad (4)$$

Where XX denotes other factors that affect determination of provider quality of healthcare.

3.2 Estimating Strategy

Following Mullen, Frank and Rosenthal (2010) and guided by the study's objective to assess the effect of HSSF on health facility quality performance, we focus on estimating the effect of HSSF on quality q, which is unobserved, for the health

facilities $i \ldots\ldots\ldots\ldots N$. Since we cannot observe the q, we rely on estimating the effect of HSSF on observed availability and quality performance measures; that is, availability of essential drugs and health worker diagnostic accuracy, respectively. These measures reflect the unobserved quality stated in equation (1). Accordingly, equation 5 is estimated as:

$$Y_i^* = \beta_0 + \beta_1 HSSF + \beta_i X + \varepsilon_i \quad (5)$$

Where Y_i^* is a measure of healthcare availability and quality; that is, either drug availability composite index and its components or accuracy in illness diagnosis composite index together with individual components. In both estimations, the primary independent variable is the presence or absence of HSSF funding in the health facility, which is represented by a dummy variable where 1 indicates receipt of the fund and 0 otherwise. We also considered log of HSSF amount in shillings, which is a continuous variable. The control variables (X) include non-HSSF facility funding (that is NHIF capitation), facility location (rural/urban), supervisory visits, log of number of outpatient visits, facility ownership, facility type, access to power source. We included healthcare worker characteristic (gender, age and cadre type) and whether the healthcare worker was present during an unannounced visit as controls in the health worker diagnostic accuracy estimation model.

This study seeks to establish the effect of HSSF grant on availability of essential drugs and provider process quality of healthcare (measured by illness diagnostic accuracy). Two sets of regression models were estimated; linear regression models for the availability and quality of healthcare composite indices, which are continuous variables, and probit models to estimate the effect of HSSF on individual components of the availability and quality of healthcare indices, which are dummy variables. Thus, the regression equations were estimated as follows:

Estimating the effect of HSSF grant on essential drug availability

Essential drug availability composite index

The dependent variable is a composite index measuring the availability of recommended essential drugs at facility level. SDI-PETS data (2012) collected information on availability of both adult (maternal) and children tracer drugs. We used Principal Correspondence Analysis (PCA) on a list of twenty-four (24) essential medicines to develop an essential drug availability composite index. This variable is continuous in nature, with more positive values indicating high quality of healthcare and more negative values pointing to low quality of healthcare. The linear regression model used in estimating equation for essential drug availability is stated as:

$$Drug\ availability_i = \beta_0 + \beta_1 HSSF_i + \beta_i X_i + \varepsilon_i \quad (6a)$$

Individual essential drugs/medicines

We also sought to estimate the effect of HSSF on each of individual components of the essential drug composite index. Specifically, we regressed HSSF receipt on each of the 24 essential drugs/medicines. Each of these medicines is measured as a dummy variable, where 1 indicates availability of non-expired drug at the facility and 0 otherwise. Given the nature of the variable, we estimate a bivariate probit regression model as follows:

$$y_i = \begin{cases} 1 \; if \; z_i = X_i\beta + \varepsilon_i > 0 \\ 0 \; otherwise \end{cases} \quad (6b)$$

Where y_i is binary response indicator, in this case the individual essential drug and X_i is a vector of explanatory variables, which include HSSF receipt and amount, NHIF capitation, facility ownership, facility type, number of outpatient visits, supervisory visits, access to power and a functioning computer. Z_i is a latent variable and $\varepsilon_i \sim N(0,1)$ are random errors.

Estimating the effect of HSSF grant on illness diagnostic accuracy

Illness diagnostic accuracy index

The dependent variable measures how correctly health workers in a facility diagnose five diseases, namely malaria with anaemia, diarrhea, tuberculosis, diabetes and pneumonia. The diagnostic information was collected using clinical vignettes where the researcher imitates a patient with specific symptoms that are presented to the healthcare provider for diagnosis. Diagnostic accuracy is scored as 1 for correct diagnosis and 0 otherwise. Applying PCA to correctly diagnosed illnesses, we computed an illness accuracy composite index which was used as a proxy for provider process quality of healthcare. Thus, the dependent variable is a continuous variable. A higher average indicates higher quality of healthcare and vice versa.

The estimation model is presented as:

$$Accurate\ illness\ diagnosis\ index_i = \beta_0 + \beta_1 HSSF_i + \beta_i X_i + \varepsilon_i \quad (7a)$$

Individual illness diagnostic accuracy

We also estimated the effect of HSSF receipt on individual components of accuracy in illness diagnosis index, which comprises of five illnesses. These variables are measured as dummy variables where 1 indicates accurate illness diagnosis and 0 stands for failure to correctly diagnose an illness. The probit estimation model is

similar to equation (3(b) where $y_i y_i$ is now a measure of accuracy in diagnosis of each of the five tracer conditions. In addition to the explanatory variables included in essential drug availability model, additional variables which are health worker-related characteristics were included in this model. These variables include health worker gender, age, cadre type and absenteeism.

The primary independent variable in each of the above stated estimation equations is the presence or absence of HSSF funding in the health facility, which is represented by a dummy variable where 1 indicates receipt of the fund and 0 otherwise. We also included HSSF amount (a continuous variable) in equations 6(a) and 7(a).

Estimation issues

We suspect that the receipt of HSSF is potentially endogenous in our model due to possible reverse causality between HSSF receipt and facility quality of healthcare measures. This may arise from the fact that better managed health facilities are likely to meet the HSSF requirements. Consequently, estimating the Ordinary Least Squares (OLS) model is likely to result in inconsistency in the estimated coefficients. We use Instrumental Variable (IV) approach (Green, 2000) where distance from health facility to the district headquarters as measured by travel time by care was used as the instrumental variable.

3.3 Definition and Measurement of Variables

Dependent variable

The dependent variables in this study are availability and quality of healthcare, which were measured using essential drug availability composite index, and provider/healthcare worker diagnostic accuracy composite index, respectively. We also considered individual components of the indices; that is, availability of individual 24 recommended drugs and diagnostic accuracy for the five tracer illnesses, respectively. The indices are continuous variables while individual components are dummy variables where 1 indicates availability of individual essential drug or accurate illness diagnosis and 0 otherwise.

Explanatory variables

The choice of independent variables included in the regression analysis was based on existing theoretical and empirical literature. We take into consideration, as explanatory variables, the HSSF variable, facility-level characteristics and health worker characteristics.

HSSF and other sources of funding

The key variable of interest in this paper is the HSSF grant. The receipt of HSSF/amount is expected to be positively related to availability and quality of healthcare measures. This expected relationship is informed by the theory of incentives, which postulates that financial incentives such as grants motivate service providers to improve delivery and quality of services (Conrad and Perry, 2009; Rosenthal et al., 2004). The other source of funding considered is NHIF capitation, which is expected to have the same effect as the HSSF on measures of healthcare availability and quality.

Facility ownership and facility type

Facility ownership is considered as one of the factors that may affect quality of healthcare (Sloan, 2000). Empirical literature observes that in most of the developing countries, private health facilities are most likely to stock the essential drugs compared to the government-owned health facilities (Basu et al., 2012; Djankov and McLiesh, 2005; Lindelow, Serneels and Lemma, 2003). In addition, empirical evidence has indicated that private health facilities outperform similar level public health facilities in terms of health personnel diagnostic accuracy (Das et al., 2012; Boller, 2003). Yet, other studies demonstrate that public healthcare givers have better diagnostic accuracy (Mills et al., 2002). The facility variable is therefore measured as a dummy variable for government-owned versus privately-owned non-profit health facilities.

In theory, drug availability and utilization patterns (an indicator of correct diagnosis), varies between the facilities depending on the level (World Health Organization, 1993). This is confirmed by some empirical studies (see Guyon et al., 1994). Facility type is measured as a categorical variable where a dispensary, a health centre and a hospital are coded as 1, 2 and 3, respectively.

Facility location

Location is an important determinant of drug availability and diagnostic accuracy. Holding other variables constant, facilities located in urban areas are more likely to have most of the essential drugs and its staff more likely to give the correct diagnosis (Rowe et al., 2005). In this study, facility location is measured as a dummy variable where 1 is rural-based facility and 0 otherwise.

Facility size

Regarding outpatient visits, it is postulated that facilities with more visitors were comparatively more likely to stock essential drugs and provide satisfactory diagnosis. Empirical evidence is mixed on the effect of health facility visit volumes on quality, with some studies finding difficulties in coping with the high volumes and demand

on patient care, thus compromising quality (Holdsworth, Garner and Harpham, 1993) while other studies finding no evidence of quality adulteration especially where the facilities on choice do not have significant infrastructural differences (Leonard, Mliga and Haile Mariam, 2002). We use number of outpatient visits in the last three months prior to the survey as a proxy for facility size.

Access to source of power

The status of physical infrastructure amenities such as electricity affects staff attraction, retention and motivation. A facility without basic infrastructure and social amenities will invariably not attract qualified personnel, and thus adversely affect the diagnostic quality (Mueller et al., 2011). In addition, lack of electricity will limit the drugs that can be stocked in a facility (Chen et al., 2014). Electricity availability is essentially a factor of the quality of health facility and has ultimate bearing on the quality indicators such as drug availability and diagnostic quality (Amaghionyeodiwe, 2008). This explanatory variable is measured as a dummy variable, indicating whether a facility had access to either electricity or solar power.

Access to functioning computer

Utilization of Information Communication and Technology (ICT) enhances availability and quality of healthcare services (Duplaga, 2004). We include availability of a functioning computer as a proxy for ICT in a health facility. The variable is measured as a dummy variable where 1 indicates availability and 0 otherwise.

Supervisory visits

The study further postulates that supervision of the health facility and health personnel has a positive effect on the health care quality metrics. Empirical studies reveal that frequent supervision resulted to better treatment quality (Zurovac et al., 2004; Gopalan, et al., 2014). In addition, Rowe et al. (2005) found that institutionalization of supervision in health facilities in resource constrained settings helped improve quality indicators, including availability of essential drugs. The supervisory visits variable is a dummy variable coded as 1 if a health facility received a supervisory visit and 0 otherwise.

Health worker characteristics

Other expected determinants of diagnosis accuracy in the health facility are the healthcare worker sex, cadre type and age, and absenteeism level at the health facility. The effect of sex is not known a priori, since previous studies do not isolate gender differences in healthcare worker competency in illness diagnosis (Ochoa et al., 1998;

Balicer et al., 1998). Regarding the age of the healthcare provider, it is theoretically postulated that a positive relationship exists between age and diagnostic accuracy (Custers, Regehr and Norman, 1996). The basis for this expectation is that diagnosis is based on prior experience, and thus the longer the experience, the richer the knowledge to draw upon (Eva, 2002).

Cadre type is a dummy variable representing the health worker's training level (Maestad et al., 2010). It is expected that health workers with higher training (doctors) provide high quality services as opposed to those at the lower level cadres, who include the clinical officers and the nurses. Empirical studies evaluated lend credence to the intuition that the higher cadre health workers were more likely to offer accurate diagnoses (Tibballs and Weeranatna, 2010; van der Linden, Reijnen and de Vos, 2010; Guyon et al., 1994).

Finally, the basis for expecting absenteeism to have a negative effect on diagnostic accuracy is the expected lack of diagnosis at all if there are no substitute health personnel in the facility or inferior/inaccurate diagnosis offered by the unqualified alternative or even hurried-up diagnosis by the time-constrained healthcare provider (Goldstein et al., 2013 Chaudhury et al., 2006).

Table 2: Variables, measurement and expected sign

Variable	Measurement	Expected Sign
Dependent variables Process quality of health care (Illness diagnostic accuracies)	Continuous composite index Dummy variable for each of the illnesses (Yes=1; No=0)	
Availability of healthcare (Essential drug availability)	Continuous composite index Dummy variable for each of the essential drugs (Yes=1; No=0)	
Explanatory variables		
Receipt of HSSF funding HSSF amount	Dummy variable (Yes=1; No=0) Continuous variable	Positive
NHIF capitation	Dummy variable (Yes=1; No=0)	Positive
Facility ownership	Dummy variable (Private=0; Public=1)	Negative
Facility type	Dummy variable (Dispensary=1; Health Centre=2; Hospital=3)	Positive
Facility location	Dummy variable (Urban=0; Rural=1))	Negative
Outpatient visits	Number of outpatients in the last 3 months	Positive
Access to source of access to power (electricity or solar)	Dummy variable (Yes=1; No=0)	Positive
Access to functioning computer	Dummy variable (Yes=1; No=0)	Positive
Supervisory visits	Dummy variable (Yes=1; No=0)	Positive
Additional variables to the accuracy in illness diagnosis model		
Healthcare worker sex	Dummy variable (Male=1, Female=0)	Positive
Provider cadre type	Dummy variable (Doctor=1, Clinical Officer=2, Nurse=3)	Positive

Provider age-group	Dummy variable (25 years and below=1; 26-35=2; 36-35=3; 46-55=4; over 56 years)	Positive
Absenteeism	Dummy variable (Yes=1; No=0)	Negative
Instrumental Variable		
Travel time to district headquarters by car	Dummy variable (1=0-10 minutes; 2=20-30 minutes;3=31-60 minutes, 4= over 1 hour) Dummy variable (<=60 minutes=0, Over 60 minutes=1)	Negative

3.4 Data Sources

This paper used data from Health Service Delivery Indicators and Public Expenditure Tracking Survey (PETS) conducted in Kenya in 2012/13. This data collected information from 294 public and non-profit private health facilities and 1,859 healthcare workers at three levels of healthcare; that is, dispensaries, health centres and first level hospitals. The survey collected data on quality of service delivery as indicated by environment in which healthcare is conducted, including availability of key inputs such as drugs, medical equipment and infrastructure and provider and health worker knowledge and effort. Besides, this data collected information on facility sources of funding, including HSSF grant which was introduced in primary health facilities between 2010 and 2011.

4. Data Analysis and Empirical Results

4.1 Construction, Components and Dimensions of Availability and Quality of Healthcare Measures

4.1.1 *Drug availability composite index*

We applied the PCA on the list of twenty-four (24) World Health Organization (WHO) recommended essential drugs at the facility level to develop a drug availability composite index. According to Greenacre (2017), the dimensions are calculated by the analysis to bring out the significant features of the associations among the different drugs. In this analysis, the inertia amount accounted for by the principal axis (the principal inertia, also called the Eigenvalue) is 0.0121, which represents 64% of the total amount. Each of the individual essential drug is analysed as per the response categories (Yes for available or No for not available). Each response category has unique weight associated with it (mass). The overall quality of each drug measures the deviation of the estimated from the true profile elements, with the difference from one being the error. Thus, according to Greenacre (2017), the higher the percentage of the overall quality, the higher the quality of the display of elements in the two-dimension map.

4.1.2 *Accuracy in illness diagnosis composite index*

Healthcare worker's accuracy in diagnosing five tracer conditions, mainly acute diarrhoea, pneumonia, malaria with anaemia, diabetes mellitus and pulmonary tuberculosis was subjected to PCA to develop average diagnostic composite index for each facility, which is a measure of process quality of healthcare in this study. In this case, the first factorial axis alone explains 88% of the total inertia.

Table 3: Descriptive statistics

Variable	**Sample size**	**Proportion (%) or mean**	**Std. Deviation**	**Min.**	**Max.**
Essential drug availability index	293	4.77e-11	1.00	-1.91	2.80
Illness diagnostic accuracy index	625	-1.88e-09	1.13	-4.10	1.36
Received HSSF (Yes=1, 0 otherwise)	293	0.51	0.500	0	1
Log of HSSF amount	142	13.10	1.12	10.92	16.87

NHIF funds (Yes=1, 0 otherwise)	294	0.14	0.34	0	1
Facility location of healthcare facility (rural=1, urban=0)	293	0.30	0.46	0	1
Travel time by car to district headquarters (1=0-10 minutes; 2=20-30 minutes;3=31-60 minutes, 4= over 1 hour)	294	2.21	0.94	1	4
10 minutes and below		21.77			
11 to 30 minutes		39.00			
Over 30 minutes		24.15			
Over 1 hour		14.29			
Facility ownership	292	0.54	0.50	0	1
Facility type					
Dispensaries		34.69			
Health centres		50.00			
Hospitals		15.31			
Number of outpatient visits	293	3198	5281	0	57000
Supervisory visits	292	0.89	0.31	0	1
Healthcare provider cadre type	623				
Doctors		4.77			
Clinical officers		39.01			
Nurses		56.22			
Healthcare worker sex	623	0.41	0.49	0	1
Healthcare provider age group (25 years and under=1, 26-35=2, 36-45=3,46 and over=4)	623				
25 years and below		7.41			
26-35		45.70			
36-45		23.86			
46 years and above		23.03			

Source: Author's computation from Kenya Health Service Delivery Indicators and Public Expenditure Tracking Survey (PETS) 2013

To gain more insight into the data, we conducted a descriptive analysis of the distribution of HSSF by some selected facility characteristics. From Table 4, the distribution of HSSF across facility type shows that majority of health centres (60%) were in receipt of HSSF. The remaining 40% was shared equally among the dispensaries and hospitals.

Table 4: HSSF by facility type

	Facility type			**Total**
Received HSSF	**Dispensary**	**Health centre**	**Hospital**	
Yes	20.14	59.72	20.14	49.15
No	48.32	40.94	10.74	50.85
Total	34.47	50.17	15.36	100

Source: Kenya Health Service Delivery Indicators and Public Expenditure Tracking Survey (PETS) 2013

Table 5 shows that majority of the facilities in receipt of HSSF (76%) were in rural areas as opposed to 24% which were urban-based. Still, majority of rural-based healthcare facilities (64%) did not benefit from the grant. The likely explanation for this distribution is that most primary level healthcare facilities are based in the rural areas as opposed to urban areas.

Table 5: HSSF by facility location

	Facility Location		**Total**
Received HSSF	**Rural**	**Urban**	
Yes	76.39	23.61	49.15
No	64.43	35.57	50.85
Total	70.31	29.69	100.00

Source: Source: Kenya Health Service Delivery Indicators and Public Expenditure Tracking Survey (PETS) 2013

One of the requirements for receiving the HSSF grant is that there must be a Health Management Committee (HMC) in place. A look at the association between HSSF receipt and presence of HMC (Table 6) indicates that 99% of facilities in receipt of the grant had a management committee in place. On the other hand, 80% of the facilities who did not receive the fund indicated that they had a management committee in place. We note, however, that other reasons (for instance absence of approved workplans) could have hindered the facilities from receiving the fund.

Table 6: HSSF by Health Management Committee

	HMC in place		**Total**
Received HSSF	**Yes**	**No**	
Yes	99.31	0.69	49.15
No	80.00	20.00	50.85
Total	92.99	7.01	100.00

Source: Kenya Health Service Delivery Indicators and Public Expenditure Tracking Survey (PETS) 2013

The descriptive analysis also considered the amount of HSSF received. Table 7 presents the distribution of the amount of HSSF received by different facility type and facility location. Compared to health centres and hospitals, majority of the dispensaries did not receive HSSF. Most of health centres received between Ksh 400,001 and Ksh 500,000 while majority of the hospitals received Ksh 1,000,000 and above. In addition, 91% of urban facilities did not receive any amount of HSSF compared to 46% of rural facilities. This is in line with earlier descriptive statistics.

Table 7: Distribution of HSSF across facility type in the study period

Range of HSSF Funding (Ksh)	Dispensaries	Health Centres	Hospitals	Total	Rural	**Urban**
0	72	51	14	137	91	46
1 to 100,000	14	1	0	15	13	2
100,001 to 200,000	8	1	0	9	4	5

200,001 to 300,000	0	4	0	4	3	1
300,001 to 400,000	0	7	1	8	6	2
400,001 to 500,000	4	65	0	69	59	10
500,001 to 600,000	0	1	0	1	0	1
600,001 to 700,000	0	1	1	2	2	0
700,001 to 800,000	0	1	1	2	2	0
800,001 to 900000	0	1	1	2	1	1
900,001 to 1,000,000	0	2	1	3	2	1
1,000,001 to 1,500,000	0	1	5	6	4	2
1,500,001 to 2,000,000	0	0	4	4	4	0
2,000,001 to 3,000,000	0	1	4	5	4	1
3,000,001 to 4,000,000	0	1	4	5	1	4
Over 4,000,000	0	0	7	7	2	5

Source: Kenya Health Service Delivery Indicators and Public Expenditure Tracking Survey (PETS) 2013

The descriptive analysis also focused on other sources of funds besides the HSSF. These sources include discretionary funding from the now defunct Ministry of Public Health and Sanitation (MOPHS), funds from the then Ministry of Local Authorities to municipalities called Local Authority Transfer Fund (LATF), funding from parliament-controlled Constituency Development Fund (CDF), capitation from the state-owned National Hospital Insurance Fund (NHIF), donors and non-governmental organizations (NGOs) and funding from other sources, mainly income generating activities.

Table 8 presents the distribution of health facilities (percentages) by source of funds. Most of the facilities charged user fees. Few dispensaries (27%) received HSSF compared to health centres and hospitals who received 63% and 67%, respectively. NHIF capitation was mostly received by hospitals compared to other facility types.

Table 8: Distribution of facility sources of funds in the study period (% of facilities)

	Facility Type			**Facility Location**	
Funding type	**Dispensaries**	**Health Centres**	**Hospitals**	**Rural**	**Urban**
HSSF	27	63	67	76	24
MOPHS	1	1	17	50	50
LATIF	1	1	0	100	0
CDF	2	9	10	95	5
NHIF capitation	2	5	38	56	44
Donor	14	9	14	63	37
NGOs	2	1	2	80	20
Other funding	2	6	17	55	45
User Fees	95	95	98	73	27

Source: Kenya Health Service Delivery Indicators and Public Expenditure Tracking Survey (PETS) 2013

The outpatient size is the number of outpatient visits to the facility in the past three (3) months, and is a proxy measure for facility size. User fee charges was the most common source of funding for all the facilities irrespective of facility size. HSSF was a common source of funding for facilities with many patients as opposed to small-sized facilities. A similar trend was observed with NHIF capitation (Table 9).

Table 9: Distribution of facilities funded by sources and outpatient size

Outpatient size (Number)	Percentage of health facilities funded from these sources							
	HSSF	**MOPHS**	**LATF**	**CDF**	**NHIF capitation**	**Donors**	**User fees**	**Other funding**
0-500	11	0	3	0	0	11	89	8
501-1,000	33	0	0	2	9	11	98	9
1,001-1,500	54	0	3	18	5	13	92	13
1,501-2,000	39	3	0	3	6	12	100	6
2,001-2,500	68	0	0	16	5	5	95	0
2,501-3,000	44	0	0	0	19	13	100	6
3,001-4,000	72	8	0	16	8	19	100	8
4,001-5,000	75	6	0	6	13	13	94	0
5,001-10,000	96	8	4	8	13	4	88	0
over 10,000	75	25	0	0	31	13	100	13

Source: Kenya Health Service Delivery Indicators and Public Expenditure Tracking Survey (PETS) 2013

4.2 Empirical Results: Effect of HSSF on Availability and Quality of Healthcare

In this section, we report the results of the empirical analysis on the effect of HSSF, a health sector grant, on availability and quality of healthcare in Kenya. We first report on the first stage results where we conduct endogeneity tests for the potentially endogenous HSSF receipt variable. This is followed by a presentation of estimated results from the linear regression models (for essential availability of healthcare and quality of healthcare measures) and probit models for the various individual variables (both specific essential drugs and illnesses correctly diagnosed) used in the development of respective availability and quality of healthcare composite indices.

4.2.1 *Effect of HSSF on Essential Drug Availability*

Effect of HSSF receipt on essential drug availability composite index

To begin with, we present the first-stage results of the HSSF model and instrumental variable for the diagnostic tests in Table 10. The instrumental variable is measured as 4 distance dummy and one distance dummy as presented in columns 2 and 3 in Table

10. Three statistic diagnostics of the 2SLS regression model and their related p-values guide the interpretations of the differences observed in the results compared to those of OLS regression. First, the under-identification tests were significant, $\chi^2(1) = 8.92$, $p < 0.063$ and $\chi^2(1) = 8.81$, $p < 0.0030$, suggesting that our instrument (that is, the distance to headquarters dummy) was significantly correlated with HSSF receipt. Second, the Cragg-Donald test and its p-value, $\chi^2(3) = 2.54$, $p < 0.469$ suggests that it was reasonable to exclude distance to health facility from the prediction availability of care in the second stage of the 2SLS regression. From the table, the Sargan-Hansen test of over-identifying restrictions has a p-value of 0.47, implying that we do not reject the validity of the instrumental variable in this study. This test is not applicable in model 2 since it is exactly identified. Finally, the Hausman test in HSSF models 1 and 2 were not significant. This indicated that endogeneity was not biasing the estimate of the effect of HSSF grant on drug availability in a problematic way. The results of these tests imply that we interpret the OLS regression results, since 2SLS regressions can sometimes yield inconsistent coefficients (Baum, 2009)

Table 10: First stage regression results for drug availability model

Explanatory variables	HSSF Model 1	HSSF Model 2
Facility ownership	0.046 (0.065)	0.046 (0.064)
Facility type (Reference category: Dispensary)		
Health centre	0.009 (0.029)	-0.009 (0.028)
Hospital	-0.030 (0.048)	-0.028 (0.047)
Facility location	0.017 (0.021)	0.015 (0.020)
Log of number of outpatients	0.018* (0.011)	0.017* (0.011)
Log of HSSF amount received	-0.005 (0.019)	-0.005 (0.013)
Functioning computer available	-0.032* (0.018)	-0.032* (0.018)
Access to power	-0.010 (0.021)	-0.005 (0.018)
Supervisory visits	0.006 (0.047)	0.009 (0.046)
NHIF capitation funds	-0.008 (0.036)	-0.008 (0.034)
Instrumental variables		
Travel time by car to nearest District headquarters (Reference:0-10 minutes)		
11-20	-0.004 (0.026)	
21-30	-0.008 (0.025)	
31-60	0.003 (0.024)	
Over 60 minutes	0.061** (0.029)	
Travel time dummy variable		(0.065)***(0.022)
Constant	-0.071 (0.193)	-0.077 (0.184)
Observations	141	141
Instrumental variables diagnostic tests		
Under-identification test	$\chi^2(1) = 8.92$, $p < 0.063$	$\chi^2(1) = 8.81$, $p < 0.0030$
Wald F Statistic	$\chi^2(1) = 2.13$, $p < 0.0811$	$\chi^2(1) = 8.92$, $p < 0.063$
Overidentification test	$\chi^2(3) = 2.54$, $p < 0.469$	
HSSF endogeneity test	$\chi^2(1) = 0.35$, $p < 0.552$	$\chi^2(1) = 0.48$, $p < 0.487$

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Source: Authors computation

The regression results from the Ordinary Least Squares model are presented in three stages. In the basic model, we first regress HSSF receipt, HSSF amount received, facility ownership and facility type variables on essential drug availability (see model 1). We then add log of outpatient (model 2) and finally we include other control variables; that is, facility location, supervisory visits, access to power source, availability of a functioning computer and NHIF funding in model 3.

The reported results in Table 11 show that HSSF receipt was not significant in influencing availability of healthcare as measured by essential drug availability composite index. This finding was consistent across all the three models. We observe that while the effect of HSSF receipt on healthcare availability was not significant, the amount of HSSF had a positive and significant effect on availability composite index across the models. Interpreting the results, an increase in log of HSSF amount by one unit increases essential drug availability score by 0.3. The study did not find any significant effect of NHIF receipt - another source of funding - on healthcare availability.

Among facility characteristics, the study established that the effect of facility ownership was negatively significant for the basic models (models 1 and 2), implying that government-owned facilities as opposed to privately-owned ones decreased the index score by 0.7 units. This finding is in line with other studies (Basu et al., 2012; Djankov and McLiesh, 2005; Lindelow, Serneels and Lemma, 2003) which found that private health facilities were more likely to be stocked with drugs as opposed to public health facilities. However, the effect of facility ownership on essential drug availability index disappeared with addition of other control variables in the main model (model 3). Facility location had a significant effect on availability of healthcare measure. Contrary to our expectations, the results show that rural as opposed to urban-based health facilities increased the availability score by 0.5 units when other factors are held constant.

Considering facility type/level, the effect of higher levels of care was found to be negatively related to the essential drug availability index score. A health facility classified as a health centre as opposed to a dispensary decreases the index score by 0.4 units. This is in contrast with a study in Bangladesh by Guyon et al., 1994 which established that availability of essential drugs was higher in the higher level facilities (63%) as compared to the lower health facilities (46%). The effect was not significant for a hospital, which is a higher-level facility when compared to a dispensary. The surprising finding could be associated with higher demand for drugs in these facilities.

The results further show that essential drug composite index increased significantly among health facilities with access to source of power. Access to either electricity or solar power increased the essential drug availability index score by 0.3 units. This could be explained by enhanced storage capability accorded by availability of power source (storage of some essential drugs requires refrigeration). A similar conclusion was made by Amaghionyeodiwe (2008) who found that electricity availability was an essential factor in influencing quality of health facility.

Table 11: Effect of HSSF receipt on essential drug availability index

	(1)	(2)	(3)
Variables	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	0.437	0.476	0.400
	(0.632)	(0.633)	(0.603)
Log of HSSF amount	0.287***	0.319***	0.319***
	(0.0870)	(0.0941)	(0.0917)
Facility ownership	-0.716*	-0.709*	-0.450
	(0.389)	(0.389)	(0.442)
Facility type: Reference Category=Dispensary			
Health centre	-0.228	-0.242	-0.403**
	(0.194)	(0.195)	(0.200)
Hospital	0.349	0.351	-0.0714
	(0.318)	(0.319)	(0.335)
Log of number outpatients		-0.0634	0.0133
		(0.0693)	(0.0719)
Facility location			0.504***
			(0.140)
Supervisory visits			-0.365
			(0.325)
Access to power			0.324**
			(0.127)
Functioning computer available			-0.0205
			(0.126)
NHIF capitation funds			0.282
			(0.241)
Constant	-3.348***	-3.275***	-4.376***
	(1.120)	(1.123)	(1.287)
Observations	142	142	141
R-squared	0.376	0.380	0.465

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Effect of HSSF receipt on individual essential drug availability

This study further conducted an analysis on the effect of HSSF receipt on each of the essential drugs/medicine. To ensure that our estimations are correct, we first estimate a Linear Probability Model (LPM) for one individual essential drug (oxytocin) using predicted HSSF grants. We repeat the same model using actual HSSF grants plus HSSF grants residual. The results of the LPM are presented in Table 12. The results of the effect of predicted HSSF variable and actual HSSF plus HSSF residual on availability of oxytocin (an antibiotic) are similar (see models 1 and 2). We therefore conclude that our calculations are correct and we proceed with regression of probit models.

Table 12: Linear probability model

	(1)	(2)
Explanatory Variables	**Model 1**	**Model 2**
Actual HSSF receipt		0.239 (0.312)
Predicted HSSF receipt	0.229 (0.310)	
HSSF residual		-0.285(0.346)
Facility ownership	0.101 (0.256)	0.109 (0.257)
Facility type: Reference Category (Dispensary=1)		
Health centre	0.347*** (0.0638)	0.348*** (0.0639)
Hospital	0.418*** (0.106)	0.419*** (0.107)
Log of number of outpatients	-0.00383 (0.0339)	-0.00349 (0.0339)
Facility location	0.0778 (0.0647)	0.0786 (0.0648)
Supervisory visits	0.184* (0.0977)	0.186* (0.0979)
Access to power	0.0897 (0.0609)	0.0893 (0.0611)
NHIF capitation funds	0.0435 (0.0951)	0.0431(0.0952)
Functioning computer available	0.0146 (0.0569)	0.0143 (0.0570)
Constant	-0.104 (0.522)	-0.117 (0.524)
Observations	288	288
R-squared	0.180	0.180u

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Having confirmed the accuracy of our estimation, we estimated the binary probit models for each essential drug availability. The estimation results (average marginal effects) of the probit models for each of the 24 recommended essential drugs are reported in Annex 1. For each drug, we present both the basic model (with a few variables) and overall probit models, which includes all the control variables.

From the presented results in Annex 1, we observe that for some of the drugs, the effect of HSSF on their availability was positive and significant as expected, while in other cases, the effect was unexpectedly negative. Still for other drugs, the effect was not significant at all. Specifically, a look at the antibiotics/ antibacterial drugs indicate that the effect of HSSF receipt on cefixime (model 3), amoxillin and benzathine benzylpenicillin availability was significantly positive at 10%, 5%, and 1%, respectively. HSSF receipt increases the probability of cefixime, amoxillin and benzathine benzylpenicillin availability by 1.5%, 0.9% and 0.9%, respectively. The effect of HSSF on the availability of other antibiotics, including benzylpenicillin, azithromycin, ampicillin, gentamycin metronidazole and ceftriaxone was not significant.

Among the ocytocics, HSSF receipt was significant (at 10%) in increasing the likelihood of availability of nifedipine by 0.8. There was no significant effect of this

grant on probability of availability of other ocytocis such as ocytoxin and misoprostol. A look at vitamins and supplements indicates that the effect of receiving HSSF on availability of vitamin A capsule is negative and significant at 5% (for the basic model) while there was no significant effect on probability of calcium gluconate availability. Other medicines whose availability was negatively-related with HSSF receipt were: magnesium sulphate, oral rehydration salts (basic model), zinc salts (basic model) and sodium chloride solution. Given that HSSF receipt increases availability of other essential medicines, the negative effect could be explained by prioritization of some drugs by the health facilities. It could also imply a high demand for some essential medicines. As expected, the probability of availability of Betamethasone, an anti-inflammatory, increased significantly at 5% confidence level by 1.1 with receipt of HSSF as opposed to non-receipt.

Focusing on other control variables, NHIF capitation, another source of funding, increased the chance of finding benzathine benzylpenicillin, azithromycin, folic acid supplements and artesunate, an antimalarial by 0.8, 0.6, 0.8 and 0.4, respectively. However, the variable was negatively-related to availability of cefixime. Facility ownership had a negative effect in determining the probability of availability of azithromycin, gentamycin, metronidazole, ceftriaxone and nifedipine. This finding implies that there was a lower probability of having these five drugs in a public health facility as opposed to a private not-for-profit health facility.

The level of health facility (facility type) was also important in determining the probability of drug availability. Some drugs such as benzathine benzylpenicillin, ceftriaxone, nifedipine, artesunate and calcium gluconate were more likely to be available in a hospital as opposed to a dispensary. Other drugs such as sodium chloride were more likely to be available in a health centre when compared to a dispensary. Metronidazole, ocytocin, misoprostol and betamethasone were likely to be found in both health centres and hospitals as opposed to dispensaries.

Facility location variable had a significant negative effect of availability of drugs, which include cefixime and ceftriaxone, implying that these drugs were more likely to be found in health facilities located in urban areas. Other drugs such as amoxicillin, vitamin A capsules, magnesium sulphate, iron supplements, oral rehydration salts and zinc salts were likely to be found in rural as opposed to urban areas.

The number of outpatient visits in a facility during the last three months prior to the survey was found to be positively-related to availability of most of the essential drugs. An increase in number of outpatient visits significantly increased the probability of availability of benzathine benzylpenicillin, ampicillin, ceftriaxone, ocytoxin, nifedipine, vitamin A capsule, calcium gluconate, magnesium sulphate, medroxyprogesterone acetate and zinc salts. However, the effect of this variable on availability of artemisin was negative and significant, which implies that an increase in number of outpatient visits decreased the probability of availability of this medicine.

The effect of availability of access to power, which is either electricity or solar power, in influencing availability of some drugs was positive and significant as anticipated. This variable was found to increase the chance of availability of some medicines such

as ceftriaxone, ocytoxin and nifedipine. This is perhaps because these medicines require refrigeration services, or availability of power may enhance security services, hence preventing loss of these drugs.

4.2.2 *Effect of HSSF on quality of care*

Effect of HSSF on accuracy in illness diagnosis composite index

The IV tests presented in Table 13 show that endogeneity was not biasing the estimate of the effect of HSSF grant on quality of healthcare measure, thus we apply the linear regression model in establishing the effect of HSSF grant on accuracy in illness diagnosis.

Table 13: First stage regression results for quality of care model

Explanatory Variables	HSSF Model 1	HSSF Model 2
Facility ownership	-0.031 (0.107)	-0.030 (0.106)
Facility type (Reference Category: Dispensary)		
Health centre	-0.004 (0.035)	-0.004 (0.035)
Hospital	-0.030 (0.048)	-0.012 (0.058)
Facility location	0.018 (0.023)	0.016 (0.022)
Log of number of outpatients	0.025* (0.012)	0.017* (0.011)
Log of HSSF amount received	**-0.007(0.016)**	-0.008(0.016)
Functioning Computer available (0.021)	**-0.040****	-0.039*(0.020)
Access to power	0.012 (0.032)	0.013 (0.031)
Supervisory visits	0.009 (0.052)	0.012(0.052)
NHIF capitation funds	-0.001 (0.046)	-0.008 (0.034)
Healthcare worker characteristics		
Cadre type		
Clinical Officers	(0.008) (0.048)	0.006 (0.046)
Doctors	0.042 (0.052)	0.039 (0.050)
Worker sex	0.010 (0.017)	0.011 (0.017)
Health worker age-group (Reference Category: 25 years and below)		
11-20	0.030 (0.049)	0.030 (0.048)
21-30	0.007 (0.052)	0.007 (0.051)
31-60	-0.010 (0.055)	-0.009 (0.054)
Over 60 minutes	0.020 (0.062)	0.022 (0.061)
Health worker present in the facility	(0.003) (0.040)	-0.009 (0.038)
Instrumental variables		
Travel time by car to nearest District headquarters (Reference:0-10 minutes)		
11-20	-0.002 (0.030)	
21-30	-0.012 (0.029)	
31-60	-0.005 (0.028)	
Over 60 minutes	0.067** (0.033)	
Travel time dummy variable		0.073 (0.024)
Constant	-0.085 (0.275)	1.53 (2.526)

Observations	141	130
Instrumental variables diagnostic tests		
Under-identification test	$\chi^2(4) = 10.05$, $p < 0.0396$	$\chi^2(1) = 9.83$, $p < 0.0017$
Wald F Statistic	$\chi^2(1) = 2.24$, $p < 0.0693$	$\chi^2(1) = 8.99$, $p < 0.0033$
Overidentification test	$\chi^2(3) = 0.62$, $p < 0.893$	
HSSF endogeneity test	$\chi^2(1) = 2.04$, $p < 0.1531$	$\chi^2(1) = 1.64$, $p < 0.2003$

This section presents the linear model regression results on the effect of HSSF receipt on process quality of healthcare among healthcare workers in a health facility as measured by accuracy in illness diagnosis. The linear model regression results are presented in Table 14. We first estimate the basic model (model 1) where we estimate a linear regression of the effect of HSSF receipt variable and HSSF amount on healthcare worker diagnostic accuracy, while controlling for health worker characteristics (gender and age). We then include health worker cadre type and absenteeism variables (model 2). Model 3 includes other control variables such as number of outpatient visits, facility characteristics (ownership, location and type), and NHIF capitation as another source of facility funding. From the presented results, the effect of HSSF receipt on provider quality of healthcare as measured by accuracy in illness diagnosis is positive and statistically significant. However, we observe that the effect of HSSF amount on quality of care was not significant. Also, NHIF capitation fund was not statistically significant.

Considering health worker characteristics, we see that age and cadre type were important factors in determining provider accuracy in illness diagnosis. The effect of healthcare provider's age group on diagnostic accuracy is negative and significant for 36-45 category. When compared to those aged 25 years and below, health care workers aged between 36 years and 45 years decreased the accuracy index by 0.9 units. The score was not significant for the other age groups. This finding is in contrast with other studies such as Custers et al. (1996).

A look at cadre type indicates that health worker training was an important factor in affecting accuracy in illness diagnosis. While being a clinical officer as opposed to a nurse did not have a significant effect on quality of healthcare measure, being a doctor as opposed to a nurse significantly increased the quality of healthcare index score by 1 unit (model 3). This collaborates with findings by Maestad et al., 2010; Tibballs and Weeranatna, 2010; van der Linden, Reijnen and de Vos, 2010; and Guyon et al., 1994.

Access to power was significantly related to quality of healthcare measure, with the results showing a positive effect. This could perhaps be related to the positive effect of having reliable infrastructure such as electricity on the health system, including access to health information (Chen et al., 2019).

Table 14: Effect of HSSF receipt on accuracy in illness diagnostic index

	(1)	(2)	(3)
Variables	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	1.795**	1.790**	1.690*
	(0.863)	(0.868)	(0.880)

Log of HSSF amount received	0.00724	0.0242	-0.103
	(0.0864)	(0.0961)	(0.152)
Health worker sex	0.201	0.187	0.204
	(0.161)	(0.161)	(0.163)
Health worker age-group (Reference Category: 25 years and below)			
26-35	-0.547	-0.532	-0.681
	(0.400)	(0.400)	(0.464)
36-45	-0.767*	-0.706	-0.884*
	(0.427)	(0.429)	(0.493)
46-55	-0.684	-0.641	-0.849
	(0.451)	(0.457)	(0.518)
56 and above	0.0318	0.0252	-0.194
	(0.525)	(0.526)	(0.585)
Health worker cadre type (Reference group: Nurse)			
Clinical officer	0.125	0.0753	0.128
	(0.388)	(0.389)	(0.439)
Doctor	0.842**	0.805*	0.950*
	(0.416)	(0.424)	(0.481)
Health worker present in facility		0.489	0.581
		(0.342)	(0.360)
Log of outpatients		-0.0180	-0.0415
		(0.104)	(0.111)
Ownership			-1.029
			(1.002)
Facility type (Reference group: Dispensary)			
Health centre			-0.0622
			(0.330)
Hospital			0.104
			(0.552)
Facility location			-0.00512
			(0.215)
Supervisory visits			-0.328
			(0.492)
Access to power			0.524*
			(0.298)
Functioning computer available			-0.122
			(0.194)
NHIF capitation Funds			0.362
			(0.407)
Constant	-0.454	-0.959	1.896
	(1.456)	(1.542)	(2.538)
Observations	130	130	130
R-squared	0.270	0.283	0.333

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Source: Author's computation

Effect of HSSF on accuracy in individual illness diagnosis

This section discusses results of the effect of HSSF on diagnostic accuracy of five tracer conditions used in development of diagnostic accuracy composite index. The results from the probit model estimates for the five illnesses are presented in Annex 2. The results indicate that the HSSF receipt was not significant in influencing healthcare worker accuracy in illness diagnosis of the five tracer conditions (acute diarrhoea, diabetes mellitus, pneumonia, pulmonary tuberculosis, and malaria with anaemia).

The results point to the importance of health worker characteristics; that is, healthcare worker age-group and sex in determining accuracy in diagnosis of some of the illnesses. Considering health worker age, for instance, the study observes that the probability of diagnosis of acute diarrhoea, pneumonia and pulmonary tuberculosis increases with increase in age group. Health workers aged between 26 and 35 years were more likely to correctly diagnose diarrhoea and pulmonary tuberculosis 0.8 each when compared to those aged 25 years and below. As for pneumonia, the probability of correct diagnosis increased with health workers aged between 36 and 45 years as opposed to those 25 years and below by 1.2. Health worker sex was associated with diagnosis of diabetes mellitus, with the results showing that being male as opposed to female increased the probability of correct diagnosis by 0.6.

Health worker cadre was negatively related to pneumonia diagnostic accuracy. Being a nurse as opposed to a doctor decreases the probability of diagnosing pneumonia by 1.3 (model 3). We also focus on absenteeism parameter where the results show that a health worker's absence decreases the probability of correct diagnosing of acute diarrhoea. A healthcare worker who was absent was less likely to correctly diagnose acute diarrhoea by 0.7 when compared to a health worker who was present during an announced visit.

A look at the control variables indicates that facility type was an important variable in influencing healthcare worker process quality of healthcare. Working in a health centre as opposed to a dispensary increased the probability of correctly diagnosing acute diarrhoea illness by 0.3 units. When compared to working in a dispensary, working in a health centre and a hospital increases the probability of correct diagnosis of malaria with anaemia illness by 0.3 and 0.4, respectively. This finding was in contrast with the case of diabetes mellitus where the probability of diagnosis was lower in a hospital than in a dispensary by 0.11. Unlike other tracer illnesses, the probability of accurately diagnosing pulmonary pneumonia increased by 0.1 when a facility receives a supervisory visit.

5. Summary, Conclusion and Recommendations

This paper sought to examine the effect of health sector grants on healthcare service delivery as measured by facility level availability and quality of healthcare. The indicators for availability and quality of healthcare are availability of essential drugs and accuracy in illness diagnosis. The results of the analysis indicate that availability of some essential drugs was low (ampicillin, azithromycin, cefixime, metronidazole, magnesium sulphate). While we note that some drugs in the same classification were available, the low availability of these essential drugs implies that health facilities would not be able to respond to patient's urgent treatment needs.

This study highlights the importance of health sector grants, specifically HSSF amount, in determining essential drug availability composite index. Further, HSSF receipt increases the chance of availability of individual essential drugs at the facility level, including cefixime, benzathine benzylpenicillin and nifedipine. However, while HSSF receipt had a positive effect on quality of healthcare measure, HSSF amount was not important in influencing provider process quality of healthcare; that is, accuracy in illness diagnosis. This is perhaps because the design of the fund does not motivate provision of quality healthcare by health workers.

Among the control variables, facility type was a significant determinant of both availability and quality measures. A higher level of facility type, that is a health centre or hospital as opposed to dispensary was associated with both higher score of drug availability and better accuracy in illness diagnostic accuracy. Facility location and ownership were key in influencing essential drug availability measure.

Additionally, access to source of power and number of outpatient visits had a significant influence on essential drug availability composite index. Also, age of healthcare provider had a significant effect on health worker diagnostic accuracy.

Based on the observed results, there is need to institute funding programmes aimed at improving facility level and health worker quality of healthcare in the country. These programmes should focus on channeling grants directly to health facilities and should have a component of pay for performance to motivate health workers to improve on quality of healthcare. This will also curb absenteeism among healthcare workers, and further enhance provider quality of healthcare.

Besides the funding mechanism, there is need for an increase in level of funding especially to the lowest level of healthcare. The importance of facility type in

influencing both availability of healthcare and process quality of healthcare points to the need to increase funding at the lowest levels of primary healthcare, mainly at the dispensary level, with the aim of improving quality of healthcare at this lower level.

Worker training is an important factor in enhancing health worker quality of healthcare. Besides formal training, continuous refresher courses should be offered to health workers at all levels and especially at the lower cadres since they remain the majority and are located more in the rural areas.

Development of infrastructure is key in improving healthcare quality. The country should therefore focus on enhancing access to source of power, mainly electricity or alternative sources. This will enhance both availability of essential drugs at the lower levels and reduce uneven distribution of health workers across the county.

Notes

1 In Ma (1994), W(t) represents B(q) in equation 3.

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Annex

Annex 1: Essential drug availability-individual medicines

	Antibiotics/Antibacterials					
	Cefixime			Amoxicillin		
	(1)	(2)	(3)	(1)	(2)	(3)
Explanatory Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
HSSF receipt	0.407	0.616	1.340*	0.623*	0.652*	0.876**
	(0.547)	(0.576)	(0.765)	(0.358)	(0.368)	(0.405)
Facility ownership	-1.053**	-1.014*	-0.555	-0.269	-0.290	-0.202
	(0.522)	(0.535)	(0.555)	(0.362)	(0.366)	(0.394)
Facility type (Reference Category=Dispensary						
Health centre	0.152	0.105	0.177	0.142	0.0966	0.0950
	(0.259)	(0.265)	(0.305)	(0.199)	(0.204)	(0.217)
Hospital	0.533	0.227	0.419	0.334	0.169	0.0854
	(0.346)	(0.402)	(0.501)	(0.280)	(0.321)	(0.381)
Log of number of outpatients		0.212	0.0578		0.101	0.181
		(0.131)	(0.152)		(0.102)	(0.113)
Facility location			-0.576**			0.442**
			(0.292)			(0.213)
Supervisory visits			-0.786**			0.0662
			(0.341)			(0.328)
Access to power			0.465			-0.163
			(0.292)			(0.205)
Functioning computer available			0.639			0.0586
			(0.551)			(0.208)
NHIF capitation funds			-1.050**			0.381
			(0.510)			(0.346)
Constant	-1.479***	-3.143***	-2.139	0.563	-0.144	-1.163
	(0.573)	(1.182)	(1.600)	(0.400)	(0.840)	(1.145)
Observations	292	289	288	292	289	288

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

	Antibiotics/Antibacterials					
	Benzathine benzylpenicillin			Benzylpenicillin		
	(1)	(2)	(3)	(1)	(2)	(3)
Explanatory Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	0.784**	0.927***	0.942***	-0.384	-0.466	-0.445
	(0.321)	(0.339)	(0.364)	(0.350)	(0.362)	(0.391)
Facility ownership	-0.227	-0.245	-0.139	-0.369	-0.427	-0.352
	(0.322)	(0.331)	(0.351)	(0.343)	(0.348)	(0.372)
Facility type (Reference Category=Dispensary						
Health centre	0.320*	0.279	0.279	0.360*	0.459**	0.415*
	(0.184)	(0.191)	(0.204)	(0.207)	(0.217)	(0.228)
Hospital	1.109***	0.842***	0.735**	0.621*	0.784**	0.649
	(0.289)	(0.322)	(0.371)	(0.332)	(0.374)	(0.428)
Log of number of outpatients		0.203**	0.226**		-0.107	-0.0418
		(0.0956)	(0.106)		(0.106)	(0.117)
Facility location			0.108			0.348
			(0.205)			(0.226)
Supervisory visits			-0.159			-0.448
			(0.320)			(0.391)
Access to power			0.163			0.376
			(0.198)			(0.249)
Functioning computer available			0.300			0.118
			(0.192)			(0.226)
NHIF capitation funds			0.787**			-0.0417
			(0.388)			(0.347)
Constant	-1.479***	-3.143***	-2.469**	0.563	-0.144	1.101
	(0.573)	(1.182)	(1.081)	(0.400)	(0.840)	(1.238)
Observations	292	289	288	292	289	288

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

	Antibiotics/Antibacterials					
	Azithromycin			Ampicilin		
	(1)	(2)	(3)	(1)	(2)	(3)
Explanatory Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	-0.0741	0.0359	-0.0659	-0.519	-0.370	-0.569
	(0.345)	(0.356)	(0.392)	(0.557)	(0.563)	(0.678)
Facility ownership	-0.892***	-0.835**	-0.748**	-0.622	-0.595	-0.819
	(0.341)	(0.345)	(0.373)	(0.559)	(0.563)	(0.677)
Facility type (Reference Category=Dispensary						
Health centre	0.0586	0.0524	-0.0408	0.0845	-0.0294	-0.0217

	(0.184)	(0.189)	(0.203)	(0.240)	(0.249)	(0.265)
Hospital	0.437*	0.345	0.0136	0.0827	-0.359	-0.326
	(0.249)	(0.287)	(0.339)	(0.327)	(0.402)	(0.471)
Log of number of outpatients		0.0845	0.0874		0.251**	0.233*
		(0.0899)	(0.100)		(0.122)	(0.132)
Facility location			0.209			-0.159
			(0.200)			(0.247)
Supervisory visits			-0.514*			0.451
			(0.270)			(0.481)
Access to power			0.207			-0.0374
			(0.191)			(0.261)
Functioning computer available			0.0413			0.00578
			(0.194)			(0.255)
NHIF capitation funds			0.556**			0.00388
			(0.259)			(0.356)
Constant	-1.479***	-3.143***	-0.882	0.563	-0.144	-2.624*
	(0.573)	(1.182)	(1.059)	(0.400)	(0.840)	(1.421)
Observations	292	289	288	292	289	288

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

	Antibiotics/Antibacterials					
	Gentamycin			**Metronidazole**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Explanatory Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	-0.331	-0.109	-0.350	-0.294	-0.265	-0.540
	(0.313)	(0.332)	(0.358)	(0.390)	(0.402)	(0.455)
Facility ownership	-0.557*	-0.461	-0.635*	-1.169***	-1.241***	-1.351***
	(0.311)	(0.324)	(0.345)	(0.393)	(0.406)	(0.452)
Facility type (Reference Category=Dispensary						
Health centre	0.293	0.290	0.223	0.579***	0.537***	0.468**
	(0.190)	(0.196)	(0.207)	(0.191)	(0.196)	(0.208)
Hospital	0.332	0.230	0.0613	3.227***	3.028***	2.907***
	(0.269)	(0.310)	(0.355)	(0.473)	(0.496)	(0.525)
Log of number of outpatients		0.135	0.167		0.133	0.129
		(0.0953)	(0.105)		(0.101)	(0.110)
Facility location			-0.00663			-0.214
			(0.209)			(0.207)
Supervisory visits			-0.0936			0.0283
			(0.312)			(0.306)
Access to power			0.339			0.164
			(0.211)			(0.204)

Functioning computer available			0.180			0.227
			(0.202)			(0.197)
NHIF capitation funds			0.0523			0.590*
			(0.312)			(0.325)
Constant	-1.479***	-3.143***	-0.606	-0.187	-1.097	-1.307
	(0.573)	(1.182)	(1.074)	(0.407)	(0.828)	(1.110)
Observations	292	289	288	292	289	288

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

	Antibiotics/Antibacterials			**Ocytocics/anti-oxytocis**		
	Ceftriaxone			**Ocytoxin**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Explanatory Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	-0.0197	0.253	0.162	-0.0782	-0.101	0.0324
	(0.347)	(0.369)	(0.388)	(0.307)	(0.317)	(0.336)
Facility ownership	-1.416***	-1.383***	-1.236***	-0.440	-0.478	-0.324
	(0.347)	(0.365)	(0.374)	(0.306)	(0.310)	(0.323)
Facility type (Reference Category=Dispensary						
Health centre	0.322*	0.237	0.144	0.975***	1.024***	1.032***
	(0.190)	(0.198)	(0.209)	(0.183)	(0.190)	(0.204)
Hospital	1.876***	1.599***	1.346***	1.447***	1.475***	1.435***
	(0.294)	(0.332)	(0.375)	(0.293)	(0.326)	(0.382)
Log of number of outpatients		0.268***	0.165		-0.0156	0.00868
		(0.101)	(0.109)		(0.0939)	(0.104)
Facility location			-0.396*			0.131
			(0.207)			(0.203)
Supervisory visits			0.0654			0.490*
			(0.287)			(0.297)
Access to power			0.465**			0.395**
			(0.193)			(0.201)
Functioning computer available			-0.0743			0.351*
			(0.197)			(0.195)
NHIF capitation funds			0.301			0.464
			(0.301)			(0.334)
Constant	0.165	-1.875**	-1.378	0.125	0.250	-1.703
	(0.373)	(0.819)	(1.089)	(0.338)	(0.769)	(1.061)
Observations	292	289	288	292	289	288

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

	Ocytocics/anti-oxytocis					
	Misoprostol			Nifedipine		
	(1)	(2)	(3)	(1)	(2)	(3)
Explanatory Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	0.582	-0.0934	-0.368	0.704**	0.835**	0.845**
	(0.646)	(0.969)	(1.183)	(0.330)	(0.355)	(0.388)
Facility ownership	-0.580	-1.280	-1.447	-0.858***	-0.947***	-0.687*
	(0.631)	(0.975)	(1.190)	(0.320)	(0.339)	(0.359)
Facility type (Reference Category=Dispensary						
Health centre	0.955***	0.964***	0.991**	0.137	-0.0113	-0.236
	(0.353)	(0.361)	(0.386)	(0.190)	(0.198)	(0.215)
Hospital	2.222***	2.084***	2.176***	1.291***	0.845***	0.166
	(0.397)	(0.442)	(0.515)	(0.270)	(0.305)	(0.365)
Log of number of outpatients		0.0616	-0.0283		0.304***	0.193*
		(0.131)	(0.144)		(0.0998)	(0.111)
Facility location			-0.420			0.0827
			(0.274)			(0.206)
Supervisory visits			0.268			-0.0533
			(0.412)			(0.283)
Access to power			0.349			0.518***
			(0.283)			(0.196)
Functioning computer available			-0.00776			-0.616***
			(0.311)			(0.207)
NHIF capitation funds			-0.304			0.463
			(0.325)			(0.287)
Constant	-2.465***	-2.211	-1.759	-0.549	-2.695***	-1.679
	(0.727)	(1.360)	(1.756)	(0.362)	(0.824)	(1.111)
Observations	292	289	288	292	289	288

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

	Vitamins and Mineral Supplements					
	Vitamin A Capsules			Calcium Gluconate		
	(1)	(2)	(3)	(1)	(2)	(3)
Explanatory Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	-0.748**	-0.512	-0.287	0.119	0.171	0.0861
	(0.371)	(0.397)	(0.439)	(0.410)	(0.452)	(0.500)
Facility ownership	-0.359	-0.251	-0.121	-0.138	-0.337	-0.417
	(0.354)	(0.374)	(0.410)	(0.407)	(0.447)	(0.492)
Facility type (Reference Category=Dispensary						
Health centre	0.260	0.295	0.259	0.500**	0.341	0.262
	(0.228)	(0.234)	(0.251)	(0.226)	(0.235)	(0.251)

Hospital	-0.192	-0.284	-0.582	1.525***	0.939***	0.808**
	(0.289)	(0.344)	(0.419)	(0.271)	(0.312)	(0.378)
Log of number of outpatients		0.125	0.240*		0.405***	0.472***
		(0.111)	(0.127)		(0.111)	(0.126)
Facility location			0.820***			0.228
			(0.245)			(0.233)
Supervisory visits			-0.150			-0.253
			(0.358)			(0.316)
Access to power			-0.384			0.265
			(0.239)			(0.219)
Functioning computer available			-0.447*			0.0129
			(0.258)			(0.227)
NHIF capitation funds			0.295			-0.221
			(0.360)			(0.294)
Constant	1.739***	0.658	0.479	-1.446***	-4.261***	-4.905***
	(0.425)	(0.914)	(1.298)	(0.466)	(0.963)	(1.313)
Observations	292	289	288	292	289	288

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

	Anticonvulsants/Antiepileptics			**Contraceptives**		
	Magnesium Sulphate			**Medroxyprogestrone acetate**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Explanatory Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	-0.748**	-0.512	-0.287	-0.716*	-0.696*	-0.287
	(0.371)	(0.397)	(0.439)	(0.382)	(0.419)	(0.439)
Facility ownership	-0.359	-0.251	-0.121	-0.683*	-0.866**	-0.121
	(0.354)	(0.374)	(0.410)	(0.384)	(0.422)	(0.410)
Facility type (Reference Category=Dispensary						
Health centre	0.260	0.295	0.259	0.383**	0.259	0.259
	(0.228)	(0.234)	(0.251)	(0.183)	(0.190)	(0.251)
Hospital	-0.192	-0.284	-0.582	1.283***	0.782***	-0.582
	(0.289)	(0.344)	(0.419)	(0.248)	(0.283)	(0.419)
Log of number of outpatients		0.125	0.240*		0.338***	0.240*
		(0.111)	(0.127)		(0.0926)	(0.127)
Facility location			0.820***			0.820***
			(0.245)			(0.245)
Supervisory visits			-0.150			-0.150
			(0.358)			(0.358)
Access to power			-0.384			-0.384
			(0.239)			(0.239)

Functioning computer available			-0.447*			-0.447*
			(0.258)			(0.258)
NHIF capitation funds			0.295			0.295
			(0.360)			(0.360)
Constant	1.739***	0.658	0.479	-0.0160	-2.324***	0.479
	(0.425)	(0.914)	(1.298)	(0.404)	(0.800)	(1.298)
Observations	292	289	288	292	289	288

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

	Anti-anaemics					
	Iron Supplements			**Folic acid Supplements**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Explanatory Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
HSSF receipt	0.186	0.294	0.483	0.425	0.338	0.442
	(0.330)	(0.350)	(0.378)	(0.376)	(0.388)	(0.417)
Facility ownership	-0.525	-0.379	-0.251	-0.437	-0.463	-0.292
	(0.334)	(0.349)	(0.371)	(0.384)	(0.391)	(0.415)
Facility type (Reference Category=Dispensary						
Health centre	-0.0763	-0.0414	-0.109	0.0540	0.0811	-0.00768
	(0.194)	(0.199)	(0.212)	(0.217)	(0.222)	(0.237)
Hospital	0.0233	0.191	0.00812	-0.0750	0.0233	-0.464
	(0.263)	(0.304)	(0.362)	(0.285)	(0.324)	(0.390)
Log of number of outpatients		-0.0637	0.0308		-0.0795	-0.0321
		(0.0968)	(0.107)		(0.104)	(0.115)
Facility location			0.562***			0.476**
			(0.204)			(0.223)
Supervisory visits			-0.0288			0.0463
			(0.317)			(0.374)
Access to power			0.192			0.384
			(0.205)			(0.239)
Functioning computer available			0.0477			0.0251
			(0.201)			(0.225)
NHIF capitation funds			0.150			0.830*
			(0.308)			(0.429)
Constant	0.989***	1.291	-0.220	1.067**	1.684*	0.325
	(0.379)	(0.809)	(1.111)	(0.432)	(0.874)	(1.214)
Observations	292	289	288	292	289	288

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

	Antimalarials					
	Artemisin			Artesunate		
	(1)	(2)	(3)	(1)	(2)	(3)
Explanatory Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
HSSF receipt	-0.293	-0.184	0.132	0.433	0.487	0.452
	(0.364)	(0.403)	(0.466)	(0.340)	(0.349)	(0.368)
Facility ownership	-0.304	-0.105	-0.221	-0.0856	-0.0457	-0.0763
	(0.360)	(0.397)	(0.451)	(0.334)	(0.341)	(0.353)
Facility type (Reference Category=Dispensary						
Health centre	-0.0142	0.0710	0.436	0.427**	0.434**	0.438**
	(0.217)	(0.229)	(0.268)	(0.189)	(0.195)	(0.206)
Hospital	0.212	0.721*	1.643***	0.266	0.294	0.254
	(0.320)	(0.396)	(0.514)	(0.264)	(0.305)	(0.354)
Log of number of outpatients		-0.243**	-0.228*		-0.00319	0.0323
		(0.112)	(0.128)		(0.0928)	(0.101)
Facility location			-0.175			0.132
			(0.242)			(0.203)
Supervisory visits			0.578*			-0.0911
			(0.317)			(0.280)
Access to power			-0.285			-0.143
			(0.237)			(0.197)
Functioning computer available			0.627***			0.201
			(0.241)			(0.195)
NHIF capitation funds			-0.516			0.446*
			(0.326)			(0.268)
Constant	1.453***	3.039***	1.725	-1.171***	-1.195	-1.608
	(0.414)	(0.934)	(1.288)	(0.383)	(0.767)	(1.035)
Observations	292	289	288	292	289	288

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

	Solutions Correcting Water, Electrolyte and Acid Base Disturbance					
	Oral Rehydration Salts			Zinc Salts		
	(1)	(2)	(3)	(1)	(2)	(3)
Explanatory Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
HSSF receipt	-1.368**	-0.952	-0.709	-0.939***	-0.703**	-0.562
	(0.552)	(0.620)	(0.666)	(0.341)	(0.354)	(0.379)
Facility ownership	-0.388	-0.0489	0.0662	-0.582*	-0.463	-0.418
	(0.437)	(0.515)	(0.574)	(0.330)	(0.341)	(0.356)
Facility type (Reference Category=Dispensary						

Health centre	-0.206	-0.205	-0.206	-0.143	-0.196	-0.271
	(0.329)	(0.335)	(0.359)	(0.204)	(0.208)	(0.226)
Hospital	-0.341	-0.142	-0.431	0.376	0.301	0.0712
	(0.449)	(0.581)	(0.639)	(0.339)	(0.403)	(0.443)
Log of number of outpatients		0.0934	0.213		0.170	0.277**
		(0.167)	(0.185)		(0.109)	(0.118)
Facility location			0.863**			0.698***
			(0.354)			(0.222)
Supervisory visits			-0.227			0.0873
			(0.559)			(0.322)
Access to power			-0.0223			0.131
			(0.372)			(0.229)
Functioning computer available			0.0721			0.0639
			(0.368)			(0.219)
NHIF capitation funds			0.565			0.279
			(0.547)			(0.353)
Constant	3.049***	1.945	0.482	1.905***	0.515	-1.141
	(0.647)	(1.374)	(1.747)	(0.395)	(0.869)	(1.177)
Observations	292	289	288	292	289	288

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

	Solutions Correcting Water, Electrolyte and Acid Base Disturbance			**Anti-inflammatories/ Antipruritics**		
	Sodium Chloride Solution			**Betamethasone**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Explanatory Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	-0.805**	-0.786**	-0.896**	0.875**	1.150***	1.082**
	(0.361)	(0.375)	(0.396)	(0.410)	(0.441)	(0.474)
Facility ownership	-0.397	-0.444	-0.412	-0.474	-0.367	-0.287
	(0.341)	(0.349)	(0.357)	(0.394)	(0.417)	(0.447)
Facility type (Reference Category=Dispensary						
Health centre	0.476**	0.505**	0.471**	0.904***	0.857***	0.732***
	(0.215)	(0.225)	(0.239)	(0.229)	(0.234)	(0.251)
Hospital	0.759**	0.671*	0.594	1.981***	1.802***	1.433***
	(0.366)	(0.400)	(0.445)	(0.300)	(0.337)	(0.383)
Log of number of outpatients		0.0543	0.0160		0.190*	0.112
		(0.111)	(0.122)		(0.107)	(0.117)
Facility location			-0.238			-0.0155
			(0.253)			(0.220)
Supervisory visits			-0.00111			-0.0316

			(0.335)			(0.297)
Access to power			0.372			0.238
			(0.251)			(0.215)
Functioning computer available			0.102			-0.605***
			(0.233)			(0.226)
NHIF capitation funds			0.0889			-0.00927
			(0.367)			(0.274)
Constant	1.527***	1.149	1.038	-1.910***	-3.472***	-2.199*
	(0.405)	(0.908)	(1.261)	(0.461)	(0.922)	(1.205)
Observations	292	289	288	292	289	288

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Annex 2: Accuracy in illness diagnosis- individual illnesses

	Acute Diarrhoea			Diabetes Mellitus		
	(1)	(2)	(3)	(1)	(2)	(3)
Explanatory variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	-0.170	-0.206	-0.191	0.169	0.212	-0.114
	(0.174)	(0.202)	(0.237)	(0.191)	(0.215)	(0.462)
Health worker sex	-0.0891	-0.0333	-0.0441	-0.747***	-0.614***	-0.631***
	(0.174)	(0.189)	(0.193)	(0.209)	(0.223)	(0.228)
Health worker age-group (Reference Category: 25 years and below)						
26-35	0.577*	0.663**	0.776**	0.234	0.265	0.265
	(0.311)	(0.322)	(0.343)	(0.345)	(0.353)	(0.371)
36-45	0.343	0.484	0.532	0.181	0.311	0.288
	(0.344)	(0.360)	(0.382)	(0.390)	(0.401)	(0.423)
46-55	0.171	0.339	0.444	0.178	0.241	0.209
	(0.345)	(0.375)	(0.392)	(0.392)	(0.416)	(0.433)
56 and above	0.233	0.620	0.767	-0.322	-0.296	-0.389
	(0.422)	(0.481)	(0.504)	(0.450)	(0.496)	(0.513)
Health worker cadre type (Reference Category=Doctor)						
Clinical officer		-0.0127	0.207		-0.102	-0.0191
		(0.475)	(0.537)		(0.569)	(0.655)
Nurse		-0.460	-0.212		-0.550	-0.508
		(0.491)	(0.576)		(0.577)	(0.694)
Absent		-	-		-0.488	-0.606
					(0.582)	(0.610)
Log of number of outpatient visits		-0.133	-0.183		0.00972	0.0356
		(0.108)	(0.119)		(0.119)	(0.132)
Facility ownership			0.0156			0.245
			(0.0539)			(0.457)
Facility type (Reference Category: Dispensary)						
Health centre			0.328*			-0.273
			(0.169)			(0.247)
Hospital			0.202			-0.511
			(0.275)			(0.464)
Facility location			-0.142			0.0107
			-0.538			(0.249)
Supervisory visits			(0.352)			-0.0930

			-0.324			(0.366)
Access to power			(0.375)			-0.180
			0.0676			(0.386)
Functioning computer available			0.0676			-0.126
			(0.217)			(0.241)
NHIF capitation funds			-0.117			0.401
			(0.319)			(0.428)
Constant	0.587	1.649	2.246*	1.961***	2.450*	2.775*
	(0.443)	(1.141)	(1.365)	(0.524)	(1.340)	(1.657)
Observations	278	253	253	274	262	262

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

		Pneumonia		**Malaria with Anaemia**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Explanatory variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	-0.113	-0.182	-0.140	-0.106	-0.120	0.0859
	(0.203)	(0.235)	(0.298)	(0.159)	(0.181)	(0.373)
Health worker sex	-0.586***	-0.361	-0.378	-0.00928	0.145	0.128
	(0.215)	(0.234)	(0.245)	(0.159)	(0.171)	(0.175)
Health worker age-group (Reference Category: 25 years and below)						
26-35	0.375	0.337	0.506	0.226	0.244	0.261
	(0.341)	(0.363)	(0.398)	(0.316)	(0.330)	(0.339)
36-45	0.941**	1.080**	1.170**	0.331	0.328	0.369
	(0.455)	(0.483)	(0.509)	(0.346)	(0.364)	(0.374)
46-55	-0.223	-0.0489	0.0709	0.117	0.433	0.455
	(0.368)	(0.404)	(0.431)	(0.353)	(0.379)	(0.389)
56 and above	-0.230	0.208	0.276	-0.419	-0.287	-0.257
	(0.449)	(0.526)	(0.547)	(0.456)	(0.532)	(0.545)
Health worker cadre type (Reference Category=Doctor)						
Clinical officer		0.363	0.355		0.842**	0.852*
		(0.596)	(0.723)		(0.408)	(0.447)
Nurse		-0.678	-0.924		0.187	0.163
		(0.582)	(0.765)		(0.430)	(0.488)
Absent		0.0117	0.0381		-0.244	-0.220
		(0.528)	(0.584)		(0.372)	(0.376)
Log of number of outpatient visits		0.0121	0.0549		0.0278	0.0408
		(0.129)	(0.143)		(0.0946)	(0.105)
Facility ownership			0.0103			-0.0852
			(0.145)			(0.367)
Facility type (Reference Category: Dispensary)						
Health centre			0.0927			0.211

			(0.256)			(0.210)
Hospital			0.164			0.359
			(0.607)			(0.357)
Facility location			-0.473			-0.0276
			(0.305)			(0.198)
Supervisory visits			-0.565			0.118
			(0.411)			(0.311)
Access to power			-0.466			-0.238
			(0.437)			(0.340)
Functioning computer available			0.401			0.226
			(0.261)			(0.196)
NHIF capitation funds			-0.509			-0.153
			(0.396)			(0.282)
Constant	1.845***	1.725	2.139	-0.468	-1.195	-1.627
	(0.526)	(1.395)	(1.731)	(0.427)	(1.050)	(1.286)
Observations	278	266	266	278	266	266

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

		Pulmonary Tuberculosis	
	(1)	**(2)**	**(3)**
Explanatory variables	**Model 1**	**Model 2**	**Model 3**
HSSF receipt	-0.170	-0.206	-0.191
	(0.174)	(0.202)	(0.237)
Health worker sex	-0.0891	-0.0333	-0.0441
	(0.174)	(0.189)	(0.193)
Health worker age-group (Reference Category: 25 years and below)			
26-35	0.577*	0.663**	0.776**
	(0.311)	(0.322)	(0.343)
36-45	0.343	0.484	0.532
	(0.344)	(0.360)	(0.382)
46-55	0.171	0.339	0.444
	(0.345)	(0.375)	(0.392)
56 and above	0.233	0.620	0.767
	(0.422)	(0.481)	(0.504)
Clinical Officer		-0.0127	0.207
		(0.475)	(0.537)
Nurse		-0.460	-0.212
		(0.491)	(0.576)
Absent		-	-
Log of number of outpatient visits		-0.133	-0.183

		(0.108)	(0.119)
Facility ownership			0.0156
			(0.0539)
Health centre			0.328*
			(0.169)
Hospital			0.202
			(0.275)
Facility location			-0.142
			-0.538
Supervisory visits			(0.352)
			-0.324
Access to power			(0.375)
			0.0676
Functioning computer available			0.0676
			(0.217)
NHIF capitation funds			-0.117
			(0.319)
Constant	0.587	1.649	2.246*
	(0.443)	(1.141)	(1.365)
Observations	278	253	253

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

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