Technical efficiency in public health dispensaries: Evidence from Imenti-South sub-county, Kenya

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ABSTRACT

Back ground

The Imenti sub-County in Meru County inherited a large health system infrastructure from the Central Government but the performance of this system remains unknown. Meru is a rapidly growing county in terms of population, which is projected to reach 1.6 million in 2018. The demand for medical services is also growing. This study had the following objectives: to determine the level of technical efficiency in public health dispensaries; to estimate the input reductions and output increases needed to reduce inefficient public dispensaries; to determine the factors influencing the level of efficiency in sample dispensaries.

Methods

The two stage Data Envelopment Analysis was used to estimate efficiency levels and the Tobit method to explain efficiency variations. The data on output variables were obtained from the County health records, while the input data were collected through a facility survey.

Results and conclusion

Forty-one percent of the dispensaries were found to be inefficient, with the average variable returns to scale efficiency being 70%. The means for constant and scale efficiencies were 55% and 80%, respectively. The factors influencing variation in efficiencies include gender of the head nurse, education of the head of the management board, and dispensary sizes. The county health board can increase the volume of health service delivered by dispensaries by up to 38 percent without increasing staff or facilities but will require additional resources to implement the efficiency measures.

Keywords: Technical efficiency; Data Envelopment Analysis; Health system; Dispensaries; Kenya

Introduction

Since Kenya gained its independence, the public health system has been managed solely by the ministry of health at the national level. After the elections of 2007 there was for the first time, a coalition government that led to the ministry of health being split into two (Ministry of medical services and Ministry of health services and sanitation) each headed by an independent cabinet secretary. Currently, though the ministry is being headed by one cabinet secretary the new constitution has devolved much of the health functions to the counties. The National Government provides leadership in health policy development; manages national referral health facilities, helps in capacity building and technical assistance to the counties. County health services is the responsibility of the county government, these services include health facilities, pharmacies, ambulatory services, promotion of primary healthcare, licensing and control of sales of food to public, cemeteries, funeral parlours and crematoria, and waste management (KPMG Africa, 2014).

The Kenyan health system

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 1946). On the other hand, the health system includes all activities whose primary purpose is to promote, restore or maintain individual's physical, mental and social well-being (WHO, 2000). The health system in Kenya is hierarchical in nature that begins with primary healthcare, the lowest unit being the community -- that handles mainly self-limiting cases, with the complicated cases being referred to higher levels of healthcare system. The current structure consists of six levels as follows; level 1:community (villages, households, families, individuals) which contributes to health through promotive and preventive health services (KSPAS, 2004); level 2: dispensaries and clinics; this level provides the link between the community based health care and the formal health system; level 3: health centres, maternities, nursing homes; level 4: primary referral facilities; level 5: secondary referral facilities; and level 6: tertiary referral facilities (Kenyatta national hospital and Moi teaching and referral hospital). The six levels are planned to be revised to four referral levels, namely, Community Health services, Primary health care facilities, County referral health facilities and national referral hospitals (MoH, 2014).

Successive administrations in Kenya have taken measures to improve health sector in terms of infrastructure (building new and expanding existing facilities) sourcing of funding for specific diseases or health programmes e.g. HIV/AIDS, malaria, polio etc. The current government's policy of providing free maternal care is a step towards achieving millennium development goal of reducing child mortality (MDG 4) and improving maternal health (MDG 5). In the financial year 2013/2014 the government of Kenya allocated Ksh 34.7bn for preventive and curative health services (Dorah and Nesoba 2013). The allocation to health has grown over the years since independence; however, Kenya has not attained the Abuja target of allocating 15% of the government budget to health. According to the World Health Statistics 2015, Kenya is lagging behind the Abuja target. The African Region average is 11.4%, the global average is 11.4% while the Kenyan is at 5.9%. In addition Kenya has low per capita spending in relation to the region and the world at large.

Almost half of Kenya's total health expenditure is taken care of by the external sources which are far much higher than the regional average of 11.5%. The private sector on the other hand contributes 59% to total health expenditure in Kenya which is10% higher than the regional average and 17% higher than the global average. Out of pocket expenditure in the year 2012 was high at 76% compared to regional and global average of 60% and 52%, respectively. Kenya was not generally doing very well in achieving the health related MDGs, in relation to the set target for 2015 though it had achieved the target for having the measles immunization to children under one year old (Mwabu et al, 1995). Some of the challenges facing the country's health system is the shortage of skilled personnel and medical supplies (medication and other consumables) (complicated by rampant industrial unrests by health workers). Devolution implementation problems have also affected the pace of achieving the health related goals. Thus, there is need to ensure that all resources allocated to health care are utilized efficiently. To deal with the inefficiencies and inequalities in the health sector, the government over the years has undertaken various reforms that include, extension of preventive health services and family planning services; harmonization and decentralization of healthcare delivery system; introduction of medical insurance scheme; selective integration of traditional and modern medicine; and introduction of user-fee charges in government run health facilities (Mwabu, et al,1995). Though on the other hand, introduction of user fees in public facilities, contributed to a fall in the utilisation of inpatient and outpatient services [6]. In addition there is much being done by international donors towards specific programs NASCOP diseases like HIV/AIDS.
The constitution of Kenya gives every person right to access health services including reproductive health care and emergency services, education, right to be free from hunger, right to clean safe water among other rights (Kenya Law Report, 2010). Despite the rights, in the Kenyan constitution, inequity is evident in the Kenyan health system and other related sectors as shown in table 1 (WHO, 2015)

Table 1 Health Inequities DHS 2008-2009

Indicators	Sex		Residence		Wealth quintile		Education level of woman	
	Male	Female	Rural	Urban	lowest	highest	none	Secondary & higher
Contraceptive prevalence modern methods (%)			37	47	17	48	12	52
Antenatal care coverage: at least 4 visits (%)			44	60	36	63	35	64
Birth attended by skilled health personnel (%)			37	75	20	81	19	72
DTP3 immunization average among 1year olds	83	90	86	88	78	90	82	92
Children under five who are stunted (%)	37	33	37	27	44	25	39	25
Under five mortality rate (per 1000 live births)	90	77	85	75	97	69	86	58

Source: World Health Statistics 2015.

The meru county

Meru County lies within the central part of the former eastern province. Being located on the slopes of Mount Kenya and along the Equator has significantly influenced the county's natural conditions. There are several rivers that originate from the catchment areas within Mount Kenya and Nyambene ranges and have a very high influence on the agricultural activities that drive most of the county's economy (Republic of Kenya, 2013). The most dominant is livestock keeping and farming that includes cash crops like coffee, tea and the controversial stimulant Khat (Miraa). Food crops are in plenty and especially bananas are gaining popularity as income earner to the small farmers. The County is made up of eight administrative sub-counties and nine parliamentary constituencies. The population as per 2009 census was 1,356,301 which is approximately 3.5% of the Kenyan population with a population growth rate in 2012 estimated at 2.1% [10]. This population is projected to be slightly above 1.53 million persons by end of 2015 and 1.6 million by 2017 (KNBS, 2013). Meru County has 462 health facilities of which 31% are health dispensaries and 20% of these dispensaries are public health dispensaries. About 56% of public health dispensaries in Meru County are in Imenti South sub-county (MoH, 2015).The county boosts of 98% coverage for immunisation of children below the age of 5 with all the vital vaccines. This has resulted in the reduction of the mortality rate of children below five years by 26% between year 2000 and 2012. However, the county is faced with the challenge of HIV/AIDS with its prevalence at 6.3% and that of malaria standing at 15% (MCDP 2013).

Measurement models and concepts

Information on the various variables that influence production and cost of health services has been provided by the literature on the production and cost functions. Variables that are consistent with economic theory have been applied in a substantial number of studies, thus making them useful in deciding the variables to be used in these types of studies. In the theory of production, it is important to note that physical amounts of factor inputs are used in the production functions. On the other hand, due to the challenge of measuring the physical amount of inputs, particularly with respect to capital, some of the reviewed studies used cost value for the amount of inputs. For instance (Forsund et al, 1980) used actual cost of plant to measure capital input, while (Zere E, 2000) used recurrent expenditure as a proxy for quantities of inputs in hospitals.

It is apparent that the approaches that are currently being used in the estimation of frontiers are broadly classified as parametric and non-parametric. Parametric approach consists of the deterministic and stochastic frontier models, while non-parametric approach is dominated by the data envelopment analysis (DEA). Besides, there is evidence that both approaches seem to converge on the level of average efficiency, but diverge on scoring individual producers. G. Ferrier and C.A.K. Lovell in 1990, Recommended that both approaches be applied to the same set of data on the basis of the strengths and weaknesses of the two approaches, to improve the reliability of the results of efficiency analysis. In the estimation of the econometric model, both ordinary least squares and maximum likelihood methods have been used. This notwithstanding, the estimates from maximum likelihood method have been noted to be more efficient (Schmidt, P. and C.A.K. Lovell, 1979).

Efficiency measurement

Efficiency refers to the degree to which a health decision making unit (DMU) uses the available health resources (human resource, health facilities, equipments) to produce the maximum health related outputs (number of patients treated, number of children immunized) and outcomes (number of life years gained, quality of a given quality) (Kirigia et al, 2004). There are three main ways of measuring efficiency that meet the requirements of researchers, healthcare managers and policy makers (Culyer et al, 1992b). Technical Efficiency refers to the utilization of productive resources in the most technologically capable manner. Also Technical Efficiency means the system gets maximum possible output from a given set of inputs. Within the perspective of healthcare services, technical efficiency possibly will then refer to the physical relationship between the resources used (capital, labor and equipment) and health outputs (number of patients treated, patient-days, etc.) or outcomes (lower mortality rates, longer life expectancy, etc.) achieved (Palmer S, and Torgerson DJ, 1999).

Allocative Efficiency refers to the capability of a certain organisation to use its inputs in the best possible proportions, given their respective prices and with the available production technology. In other words Allocative Efficiency is concerned with the process of choosing between the different technically efficient amalgamations of inputs used to produce the maximum possible outputs. "Palmer and Torgenson, in 1999, illustrated healthcare-related allocative efficiency in an example, a policy of changing from maternal age screening to biochemical screening for Down's syndrome. Biochemical screening uses fewer amniocenteses but it requires the use of another resource – biochemical testing. Since different combinations of inputs are being used, the choice between interventions is based on the relative costs of these different inputs."

When you combine Allocative Efficiency and Technical Efficiency you determine the degree of productive efficiency (also identified as total economic efficiency). As a result, if a healthcare organisation uses its resources wholly allocatively and technically efficient, in that case it can be said to have realized total economic efficiency. Alternatively, to the extent that either allocative or technical inefficiency is present, at that moment the organisation will be functioning at less than total economic efficiency.

In the production of health care, health facilities should act efficiently in terms of using their inputs to obtain maximum output. In most economies, efficiency in one year affects the budget of health facilities in the following year. Dispensaries produce numerous outputs using multiple inputs, and for this reason the study utilised Data Envelopment Analysis (DEA) to estimate their efficiency.

Data Envelopment Analysis (DEA)

DEA is a technique originally described by Farrell (1957) and later developed as a benchmarking technique by Charnes, Cooper and Rhodes (1978) initially to evaluate non-profit and public sector organisations. The objective of the DEA is to measure performance of each producer relative to the best practice in the sample of producers concerned. The initial task is to determine which of the set of producers, as represented by observed data, form an empirical production function or envelopment surface. The producers that lie on the empirical production frontier or surface are deemed efficient, otherwise inefficient (Ali, A. I. and Seiford, L. M. 1993). There are two types of envelopment surfaces in DEA referred to as constant returns to scale (CRS) and variable returns to scale (VRS). The appropriateness of either CRS or VRS is determined by economic and other assumptions about the data to be analysed [19]. In the CRS, increase in all factors of production by a certain proportion would result in the increase in output by the same proportion. However, in the VRS, output changes more or less proportionately than the changes in all inputs.

DEA can be used for comparing service units taking into account all resources used and services provided, indentifying the most efficient and inefficient units. It can be used to calculate the level of adjustments required to make the inefficient units as efficient as the benchmark ones; it estimates the amount of additional service that can be provided by an inefficient unit without need to increase the resources. DEA helps inform DMU on what quantities of inputs can be transferred from the inefficient units to improve their efficiency. However, DEA has a limitation that it is likely to overestimate the inefficiencies since it does not decompose the error term into inefficiency and statistical noise and data measurement errors (Forsund et al, 1980). Nevertheless DEA has a major advantage:..
piecewise linear production frontier formulated by DEA has been found to be generally more flexible in approximating the true production frontier than even the most flexible parametric functional form (Worthington, Andrew and Higgs, Helen 2004) .
DEA defines a single input and a single output technical efficiency (*TE*) as:

TE = Output / Input

Conversely, in more practical scenario dispensaries have multiple inputs (health workforce, medicines, non-medical supplies, capital inputs) and outputs (preventive, curative, rehabilitative services) and the equation is modified to accommodate this reality. Thus Technical efficiency (*TE*) of a DMU (a dispensary) can be expressed as a maximum ratio of total sum of weighted outputs to total sum of weighted inputs (Charnes A, Cooper WW, *Rhodes E. 1978*, Bundi, 2016).

$$Efficiency = \left(\frac{Weighted\ sum\ of\ dispensary\ outputs}{weighted\ sum\ of\ dispensary\ inputs}\right)$$

According to Charnes *et al*, efficiency of a target dispensary from the set “j” can then be obtained by solving the following fractional programming model:

$$maxTE = \left(\frac{\sum_{r=1}^{s} u_r\, y_{r0}}{\sum_{i=1}^{m} v_i\, x_{i0}}\right)$$

Subject to: $\left(\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}}\right) \leq 1$

$\mu_i \geq 0$; i = 1..........m
$v_r \geq 0$; r = 1............s

where: Y_{rj} is the amount of health service output r (r = 1,…, s) from dispensary j; X_{ij} is the amount of health system input i (i = 1,…, m) in j^{th} dispensary; u_r is the weight given to health service output r; v_i is a weight given to health system input i; and n is the number of dispensaries in the sample.

Conceptual framework
In the production process, a dispensary turns inputs (factors of production) into outputs (health services). The dispensaries use multiple inputs to produce multiple outputs and this was the reason why DEA was developed. The interaction between inputs, process and outputs during production is as shown in the figure below

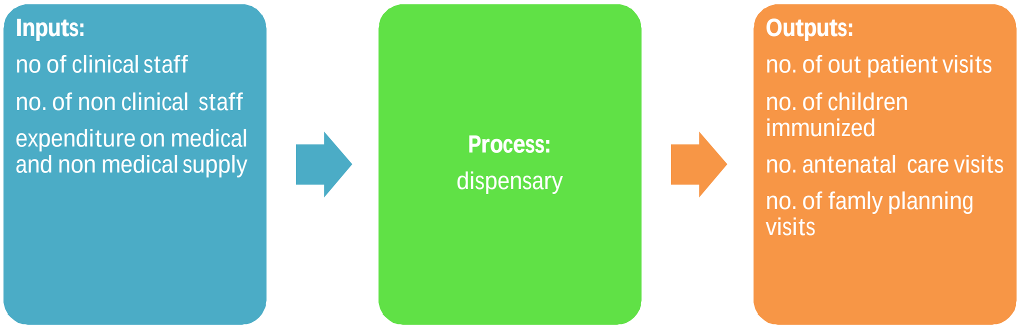

Figure 1. Relationship between health inputs, process and outputs.

The basic concept underlying efficiency is that there needs to be inputs (resources) that are processed to yield desired outputs (products) and the resources are scarce. This means that the output will be limited. Efficiency is measured in two basic ways; Allocative efficiency, meaning how various inputs are combined to produce a certain output. Technical efficiency, means achieving maximum outputs at the least cost. The combined effect of allocative and technical efficiency measures the overall efficiency (Coelli TJ, 1996). Technical efficiency will be between 1 and 0 compared to peer dispensaries. Technical efficiency can be determined by using minimum amount of resources to produce a given amount of output or producing maximum amount of output from a given amount of inputs. Thus if more than necessary is used to produce a certain amount of output or the output produced from a given quantity of resource is less than expected, then in the two cases the system is inefficient (Charnes et al, 1994). This implies that inefficiency is the degree of how many unnecessary resources have been spent in a given process. Using DEA enable comparison of DMU efficiency against realistic benchmarks and on the other hand compare against peers.

First stage model specification
According to Charnes A, Cooper WW, *Rhodes E. 1978* technical efficiency (TE) of a target DMUs is the maximum ratio of weighted outputs to weighted inputs subject to the condition that similar ratios for individual units (dispensary) be less than or equal to one. This is obtained by solving the following fractional programming model:

$$maxTE = \left(\frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Subject to: $\left(\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}}\right) \leq 1$

$\mu_i \geq 0;\ i = 1\ldots\ldots\ldots m$
$v_r \geq 0;\ r = 1\ldots\ldots\ldots\ldots s$

where: Y_{rj} is the amount of health service output r (r = 1,…, s) from dispensary j; X_{ij} is the amount of health system input i (i = 1,…, m)in j^{th} dispensary; u_r is the weight given to health service output r; v_i is a weight given to health system input i; and n is the number of dispensaries in the sample.

Charnes *et al* 1978 converted model (1) into the following constant returns to scale (CRS) linear programming model:

$$Max\ E_0 = \sum u_r y_{rj0} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

$$subject\ to: \sum_{r=1}^{s} v_i x_{ij0} = 1$$

The latter constraint means that all DMU's are either on

$$\sum_{i=1}^{m} u_r y_{rj} - \sum v_i x_{ij} \le 0,\ j = 1,\ldots,N.$$

or below the frontier. Model (2) implies that if a dispensary increases the amount of all health system inputs by the same proportion, outputs will increase by exactly the same proportion as the inputs, e.g. doubling of all inputs lead to a doubling of outputs. This CRS model assumes that DMUs' are operating at an optimal scale of production, and hence, technical efficiency is equal to scale efficiency.

However, in reality a dispensary could manifest constant returns to scale (CRS), increasing returns to scale (IRS) or decreasing returns to scale (DRS). In an IRS (or economies of scale) scenario, if a dispensary increases the amount of all health service inputs by the same proportion output will increase by a larger proportion than each of the inputs, e.g. a doubling of all inputs will lead to more than a doubling of outputs. In case a dispensary is experiencing DRS (or diseconomies of scale) a doubling of all inputs would lead to less than doubling of output. The relative efficiency score (E) lie between 0, which means the DMU is completely technically inefficient, and 1 implying DMU is completely technically efficient.

Second stage model specification

There are environmental and institutional factors that were beyond the management control but they influence the efficiency score in one way or another. To find out how these factors impacted on the efficiency score a regression was performed. However, due to the nature of the efficiency score (0-1) the ordinary least squires (OLS) yields biased result. The efficiency score is referred to as censored and limited to the interval 0-1 and for this reason a (censored) Tobit model was used to analyse the relationship (Hoff A, 2007) . This calls for the classical linear regression model to be adjusted accordingly.

$$Y = \beta_0 + \beta_i X_i + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where Y, is the dependent variable explained by a vector of independent variables X_i. The β_i are unknown regression coefficients, β_0 represents a constant and ε is the error term.

$$y_t^* = \beta X_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

$$y_t = y_t^*\ if\ y_t^* > 0;\ \ y_t = 0\ otherwise.$$

y_t^* is the unobserved latent variable and y_t is the DEA score. X_t is a vector of observation specific variables for DMU k that affect its efficiency score through the vector of parameters β to be estimated.

Sample Selection and data collection

The selection of the Meru County was non-probability but the sub-County selected was the one with the largest number of public health dispensaries, that is, 17 (17% of the public dispensaries, 11% of all the dispensaries in county), as per the Ministry of Health website in 2015. The study utilised all the public health dispensaries in the sub-county for analysis.

Data on the facility outputs was collected by the principal researcher centrally from the county information system offices and visited the facilities to collect data on various inputs especially the number of personnel. Health is multidimensional and thus assessing the quality of life of patients is rather subjective (Clewer A and Perkins D, 1998). Because of this it is challenging to measure health improvement with accuracy, thus dispensary output is measured as intermediate health services assumed to improve health services (Grosskopf S and Valdmanis 1987)

DEA Software

Based on Dyson et al 2001 there are some DEA data guidelines and protocols (at times referred to as rule of thumb) that govern the measurement of technical efficiency using the DEAP 2.1 to ensure errors are minimised. One being getting a balance between the number of variables and the sample size (Dyson, R.G, 2001) recommends that the sample size be approximately two times the product of the number of inputs and outputs. Going by this rule the variables of antenatal care visits and the family planning visits were combined to form maternal health care visits. This led to having three outputs: general outpatient visits, immunisation visits and maternal health care visits. There were two inputs used in the analysis; number of medical staff and the number of support staff in the dispensaries.

The data on the inputs and outputs were entered into excel sheet, organised into a table, and then pasted into a notepad for use by DEAP 2.1 software. The DEAP runs on data organized in a particular format, without data preceding the input data. The instruction file tells the program the file that holds the data and the file to which DEA output will be deposited. The instruction file also tells DEAP the size of the sample as well as whether the efficiency calculation is output oriented or input oriented. It also informs the program whether calculations of efficiency levels are to be done under constant or variable returns to scale assumptions. The scores efficiency scores that were calculated were subsequently analysed using regression methods.

Results and Discussion

The study involved the entire population of the public dispensaries in the sub county which were 17 in number. Table 8 shows the technical and scale efficiency levels for individual dispensaries in the study. Out of the 17 dispensaries, 7 (41%) were technically efficient [30]. Among the inefficient facilities, 50% scored below 50% and the score among the inefficient facilities ranged between 18% and 94%. The average score for the sample of 17 dispensaries was 70% and the average for the inefficient ones was 50%.

Approximately 47% of the 17 facilities were scale inefficient, which is usually associated with size of the facility either being too large or too small. The average scale efficiency for the sample was 82% with scores of the inefficient dispensaries ranging from 6% to 90%. The scale inefficient dispensaries had an average score of 62% implying that if all the inefficient dispensaries had an optimal size, output would have increased by 38% without increasing the inputs. About 6 (35%) of the dispensaries manifested decreasing returns to scale; 18% of the decision making units (DMU) had increasing returns to scale, and 47% had constant returns.

Table 2 Summary of Technical Efficiency Scores

DMU	**crste**	**Vrste**	**Scale**	**DMU**	**Crste**	**Vrste**	**Scale**
1	0.644	0.644	1.000	10	0.627	0.773	0.811 drs
2	0.560	0.776	0.722 drs	11	0.727	1.000	0.727 drs
3	0.365	0.404	0.903 drs	12	1.000	1.000	1.000
4	0.529	1.000	0.529 irs	13	0.456	0.563	0.811-drs
5	0.660	0.947	0.697 drs	14	0.086	0.190	0.455 irs
6	1.000	1.000	1.000	15	0.201	0.201	1.000
7	1.000	1.000	1.000	16	0.182	0.182	1.000
8	0.381	0.381	1.000	17	0.061	1.000	0.061 irs
9	1.000	1.000	1.000	**mean**	**0.558**	**0.709**	**0.748**

Source: Bundi 2016

Note: crste = technical efficiency from CRS DEA vrste = technical efficiency from VRS DEA scale = scale efficiency = crste/vrste.

Table 3 summary of output targets

DMU	Output 1	Output	Output	DMU	Output 1	Output	Output
1	11279	613	1714	10	12189.333	650	1715.333
2	13099.667	687	1716	11	14010	724	1718
3	11649.2	0.00	174202	12	9326	79	805
4	3974	0.0	500	13	12189.333	650	1715.333
5	13099.667	687	1716.667	14	3974	0	500
6	8697	631	1467	15	11279	613	1714
7	11279	613	1714	16	11279	613	1714
8	11279	0	1714	17	420	0	16
9	15083	1508	2764				

Table 4 Summary of input targets

DMU	Input	Input 2	DMU	Input 1	Input 2
1	3	2	10	4	2.333
2	5	2.667	11	6	3
3	4	2	12	3	1
4	2	2	13	4	2.333
5	5	2.667	14	2	2
6	4	1	15	3	2
7	3	2	16	3	2
8	3	2	17	2	1
9	8	3			

Further analysis shows the increases on output and reduction of inputs that are required to make the inefficient dispensaries efficient. About 40% of the inefficient dispensaries require less than 50% increase in general outpatient visits and 50% of them need above 100% increase that is they need to attend to double the number of the patients they attended during the period of study. Approximately 43% of the inefficient dispensaries are efficient in immunisation; however 50% of them need more than 100% increases in number of immunisations with one requiring close to 2000% increase on this dimension. In relation to maternal health visits on the other hand, 70% of the inefficient dispensaries require over 100% increase; this means they are operating at half their capacity in this aspect, with only 20% of them requiring less that 50% increase in maternal health-related visits.

Table 5 Determinants of Efficiency (Tobit Regression): Dependent Variable is Technical Efficiency (Absolute *t*-Statistics in Parentheses)

Variables	Log Variable Returns to Scale Efficiency	Log Constant Returns to Scale Efficiency	Log Scale Efficiency
Head Nurse (1=Female)	-0.573 (1.28)	-0.729 (1.57)	-0.157 (0.35)
Education of Board Head (1=College; 0= Secondary)	0.074 (0.22)	0.347 (0.98)	0.271 (0.79)
Log Total Staff	0.409 (0.93)	1.293 (2.85)	0.883 (2.01)
Constant	-.210 (0.180)	-1.92 (1.61)	-1.749 (1.49)
R-squared	0.196	0.154	0.288
P-value for F-Statistic	0.4017	0.0213	0.206
N	17	17	17

The regression results in Table 5 show that the gender of the head nurse, education level of the chairman of the facility's board of management influence technical efficiencies. Efficiency in dispensaries that are headed by female nurses is about 72% lower than in facilities that are managed by men but this difference is only statistically significant at 10% level. The dispensaries with board of management chaired by college educated people have higher efficiency levels than the dispensaries chaired by persons with secondary education. However, this difference is statistically insignificant. The coefficient on log of the size of a dispensary influences technical efficiency. Large dispensaries have more staff and are more efficient. For example, a percentage increase in the number of total staff increases scale efficiency by .88 percent, while a percent increase in total number of staff increases constant returns to scale efficiency by 1.29 percent.

CONCLUSION AND POLICY IMPLICATIONS

From the analysis of the study, it is evident that the inefficiency experienced at the dispensaries is output related. This calls for campaigns by the health sector in the sub-county to increase the volume of the services rendered by the dispensaries. Also, the dispensaries may wish to encourage promotive health care so as to increase attendance at outpatient and maternal departments. On the case of immunisation, there is better performance there but follow up work is necessary to ensure that the children complete their vaccinations as required. This is because in some dispensaries the number of the fully immunised children is less than the number that received specific vaccines.

Further studies need to be done covering the entire Meru county health facilities at their respective levels and in other counties in the country. This would facilitate measurement of dispensaries' performance in line with the Sustainable Development Goal 3, i.e., healthy lives and well-being for all at all ages (United Nations, 2015).

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