Provider Process Quality of Healthcare and its Determinants in Kenya

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Abstract
This study seeks to examine the factors that influence provider process quality of healthcare for childhood illnesses in Kenya as indicated by accuracy in illness diagnosis. To do this, the study first employed an ordered logit model on the 2018 Kenya Health Service Delivery Indicators survey data, but then finally opted for the generalized ordered logit model after the Brant test invalidated the proportional odds assumption. The analysis was based on basic microeconomic theory-the principal-agent model. The regression results reveal that health workers with higher level of education, in higher cadres and who had been trained on Integrated Management of Childhood Illnesses were more likely to provide high quality healthcare when presented with childhood illnesses symptoms. Also, being male causes a positive coefficient of the ability to provide quality healthcare. Health facility characteristics, mainly higher facility tier, government ownership and urban location were significant particularly for provision of high-quality healthcare. The results call for implementation of strategies that seek to enhance lower cadre health worker's child care management, infrastructural development across the country and even distribution of healthcare workers.

Key Words: Healthcare provider; Health worker; Quality of Healthcare; Childhood illness; Diagnostic Accuracy

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1. Introduction

The concept of quality of healthcare is multi-dimensional in nature and different definitions have been put forth towards its measurement (Piligrimienė and Buciuniene, 2008; Blumenthal, 1996). Donabedian's 1980 structure-process-outcome framework is commonly adopted in assessment of quality of healthcare provision (Counte, 2007). Structural (structure) quality measures assess infrastructure of healthcare settings, including availability and capability of equipment, the policy environment and availability of resources within an institution. Process quality measures examine the extent of implementation of recommended healthcare guidelines by healthcare providers. Outcome measures evaluate the health effects resulting from care received by a patient (Donabedian, 1988).

Improvement in quality of healthcare has been a subject of health policy in developing countries in the recent past (Lee, Madhavan and Bauhoff, 2016; Peabody *et al*., 2006). This is probably due to the realization that quantitative improvement of healthcare, through increased access to healthcare services and enhanced availability of infrastructural inputs, do not necessarily result in better health outcomes (Powell-Jackson, Mazumdar and Mills, 2015; Okeke and Chari, 2014; Souza *et al*., 2013). As such, availability of quality essential healthcare services is one of the targets of the health-related Sustainable Development Goal (SDG) 3 which aims at ensuring healthy lives and promoting well-being for all at all ages (Leadership Council Sustainable Development Solutions Network (LCSDSN), 2015). Kenya's effort to improve the overall health status of her citizenry is reflected in the country's commitment to offer quality healthcare services as articulated in various policy documents[1].

Over time, healthcare service delivery in Kenya has improved considerably, with existing surveys pointing to increased availability of structural inputs such as medical equipment and essential medical supplies (Kenya Institute for Public Policy Research and Analysis (KIPPRA), 2018). However, there is still under provision especially in terms of process quality of healthcare measures. Various Service Delivery Indicators (SDI) surveys indicate that there is provider knowledge in illness diagnosis and in adherence to illness treatment guidelines. For instance, the 2018 Kenya Health SDI survey shows that only 20% of healthcare providers arrived at a correct diagnosis of four tracer conditions (severe dehydration, pneumonia, pulmonary tuberculosis and diabetes mellitus (type II)) while 44% adhered to clinical guidelines for management of these conditions (World Bank, National Council for Population Development (NCPD) and United Nations Population Fund (UNFPA), 2019).

Two of the tracer conditions in the 2018 Kenya Health SDI survey, that is, severe dehydration due to diarrhea episode and pneumonia are among the leading causes of the under-five deaths in Kenya (Kenya National Bureau of Statistics (KNBS), Ministry of Health (MoH), National AIDS Control Council (NACC), Kenya Medical Research Institute (KEMRI), National Council for Population and Development (NCPD), and ICF International, 2015). Yet, the two conditions had the lowest diagnostic accuracy rate at 32% for severe dehydration and 82% for pneumonia (World Bank, NCPD and UNFPA, 2019). Given the place accorded to child health, particularly as a key indicator of population health and as a predictor of productivity in adulthood (Hertzman *et al*., 2010; Blanco,

[1] Constitution of Kenya (GoK, 2010), Kenya Vision 2030 (GoK, 2007) and Kenya Health Policy (KHP) (Ministry of Medical Services (MOMS) and Ministry of Public Health and Sanitation (MOPHS), 2012)

2003), an understanding of factors that contribute to health worker provision of quality child healthcare is important for health policy intervention.

There is ample evidence that availability of physical inputs such as medical supplies, beds, trained medical staff, laboratory (Kraska, Weigand and Geraedts, 2017; Ross and Vakentesh, 2015; Nyongesa, Onyango and Kakai, 2014; Naseer, Zahidie and Shaikh, 2012) has a positive influence on patient satisfaction with healthcare. However, some studies indicate that structural inputs are not necessarily important in improving processes of care (Leslie, Sun and Kruk, 2017; Maestad, Torsvik and Aakvik, 2010). Unlike structural and outcome measures of healthcare quality, process quality measures are more useful in providing feedback for quality improvement as they provide information that is actionable (Rubin, Pronovost and Diette, 2001). They are also more responsive to differential quality of care and are a direct measure of facility-level quality of healthcare when compared to structural quality (Mant, 2001).

Research studies document the effect of a myriad of factors on quality healthcare delivery. Health worker characteristics such as age and sex are among these factors. Systematic reviews point to worse performance on process quality measures among older healthcare workers, largely due to deteriorating clinical knowledge and less adherence to treatment standards (Choundry, Fletcher and Soumerai, 2015; Norton, Dunn and Soberman, 1997). Some research studies report better quality of healthcare among female health workers (Norton, Dunn and Soberman, 1997) while others indicate a small effect (Kim *et al.*, 2005) or no effect at all (Maestad, Torsvik and Aakvik, 2010; Hansen *et al.*, 2008).

One other health worker related factor that has an influence on provider process quality of healthcare is physician's level of training. Higher health worker cadre is associated with provision of high quality healthcare (Uwemedimo *et al*., 2018; Maestad, Torsvik and Aakvik, 2010; Hansen *et al*., 2008). However, some empirical works conclude that lower level cadres were more compliant with clinical guidelines (Bawate *et al*., 2016; Selemani *et al*., 2013) possibly due to their high presence in rural areas, lack of alternative diagnoses and treatment and the fact that higher cadres' clinical judgement may override proposed guidelines (Selemani *et al*., 2013). Besides professional training, studies show that targeted training in management of childhood illnesses results in improved processes of care among the under-five (Tawfiq, Alawi and Natiq, 2020; Lal *et al*., 2020; Nguyen *et al*., 2013).

Empirical works have also highlighted the effect of facility related factors on quality of healthcare. Herrera *et al*., (2014) observe that facility ownership was not a consistently significant factor in influencing provider quality of healthcare measures. Some studies examining effect of facility type on quality of healthcare conclude that lower level facilities registered better performance (Uwemedimo *et al*., 2018; Hu *et al*., 2016). The effect of facility location on provider quality of healthcare indicates that provision of quality healthcare is inclined to urban-based health facilities (Thornton *et al*., 2017; Spasojevic 2015; Lin *et al*., 2010)

From the foregoing, a number of empirical studies examine factors influencing provider quality of healthcare. However, only a few of these studies relate to quality delivery of child health (Uwemedimo *et al*., 2018; Hansen *et al*., 2008). Those related to child health are mostly inclined towards examining the effect of Integrated Management of Childhood Illnesses (Tawfiq, Alawi

and Natiq, 2020; Lal *et al*., 2020; Nguyen *et al*., 2013). Moreover, all of the reviewed studies do not explain why healthcare provision may be of extremely low quality, low quality or high quality. This paper therefore seeks to examine factors influencing provider process quality of healthcare in Kenya, with a focus on accuracy in diagnosing common childhood illnesses. It contributes to existing knowledge on quality of healthcare by adopting an ordered logit model to identify factors associated with probability of provision of different levels of healthcare quality.

The remainder of this study is organized as follows: Section 2 presents the models and describes the data. Section 3 presents the estimation results as well as discussions of the generated results. Lastly, section 5 discusses the conclusions from the study.

2. Methodology

2.1. Theoretical Model

The study considers a healthcare provider, defined as a healthcare worker who may be a doctor, a clinical officer or a nurse. The patient (a surveyor who acts as a case study patient) has symptoms of two different childhood illnesses (pneumonia and severe dehydration) which he or she presents to the healthcare worker for correct diagnosis. We assume that the "patient" does not have precise information about his or her state of health and relies on the healthcare provider to make accurate diagnosis. Thus, the provider-patient interaction depicted is an agency one where the doctor is expected to maximise the patient's welfare and utility function through accurate illness diagnosis. The application of the agency theory is based on McGuire's (2000) work and several other papers in health economics (Conrad and Perry, 2009; Mullen, Frank and Rosenthal, 2010; Frank, 2004).

Formally stated, the objective of the healthcare worker is to maximize a combination of own net pay and patient's health. Both outputs are influenced by the quality and quantity of service. Quality generally refers to patient experience with care, clinical quality and quality of service and health outcomes. Quantity entails among others, units of service and units of treatment episodes (Conrad and Perry, 2009). Applying the labour economics theory, the quantity and quality of treatment is assumed to depend on physician's effort and remuneration (Thurston and Libby, 2002). The physician's utility function is as expressed in equation 1.

$$U = U(W, e) \qquad 1$$

Where w is the healthcare worker's income, in this case, the health worker salary which is fixed and determined by the government or institution and e is the physician effort.

Following Calub (2014), we add a quality of healthcare variable denoted Q to the physician utility function since providing quality healthcare services yields psychic benefits to the physician. The new physician utility function is stated in equation 2:

$$U = U(W, e, Q) \qquad 2$$

This quality variable is not observable to the principal but he or she can observe its benefits (Mullen, Frank and Rosenthal, 2010). What is observed instead are a set of signals, which indicate the quality invested and are denoted as:

$$y = y_1 \ldots\ldots\ldots y_k \qquad 3$$

The observable indicator is defined in this study as health worker diagnostic accuracy when presented with childhood illness symptoms. These indicators are partly due to quality invested (Q) and also, as a result of other control variables as indicated in theoretical and empirical literature.

2.2. Empirical Model

The dependent variable is a three-category ordered variable representing the total cases correctly diagnosed. Hence the use of a polychotomous model, specifically ordered logit regression model (Green, 2002). Assuming the underlying response model (latent regression model) is as specified in equation 4:

$$y_i^* = \beta' X_i + \varepsilon_i, i = 1, \ldots, n \qquad 4$$

Where $X_i = [1, X_{i2}, X_{i3}, ..., X_{ik}]$ is a vector of explanatory variables. This includes both healthcare worker individual characteristics as well as facility characteristics. $\beta = [\beta_1, \beta_2, ..., \beta_k]$ is a vector of parameters to be estimated. y_i^* is a latent and continuous measure of provider quality of healthcare.

The observed and coded provider quality of healthcare, y_i is determined from the model as follows:

$$y_i = \begin{cases} 0 \text{ if } -\infty \le y_i^* \le \mu_1 \; 0 \text{ cases} \\ 1 \text{ if } \mu_1 < y_i^* \le \mu_2 \;\; 1 \text{ case} \\ 2 \text{ if } \mu_2 < y_i^* \le \infty \;\; 2 \text{ cases} \end{cases} \qquad 5$$

Where μ_i represents thresholds (cut points) estimated along with parameter vector β.
From equations (4) and (5), the probabilities associated with the coded responses are derived as follows:

$$Pr\,o\,b(y_i = j|X_i) = \varphi(\mu_j - \beta' X_i) - \varphi(\mu_{j-1} - \beta' X_i) > 0 \qquad 6$$

Where $j = 1, ..., J$ is response category; $\Pr ob(y_i = j)$ is the probability that individual i responds in manner j; ϕ is the cumulative logistic distribution and μ_j's are the equivalent of μ's in equation (5)

The likelihood function is presented in equation (7). This equation is maximized and solved iteratively by numerical methods to yield maximum likelihood estimates (MLE) of the ordered logit model.

$$L = \prod_{i=1}^{n} \prod_{j=0}^{J} \varphi(\mu_j - \beta' X_i) - \varphi(\mu_{j-1} - \beta' X_i)^{m_{ij}} \qquad 7$$

To compute MLE, a log-likelihood function is obtained by taking the logarithm of the likelihood function to yield equation (8):

$$log\ L = \sum_{i=1}^{n}\sum_{j=0}^{j} m_{ij}\ log\left[\phi\left(\mu_j - \beta'^{X_i}\right) - \phi\left(\mu_{j-1} - \beta'^{X_i}\right)\right] \qquad 8$$

Where m_{ij} =1 if $y_i = j$ and 0 otherwise.

2.3. Description of Variables

Dependent Variable

The dependent variable is health worker process quality of healthcare defined as accuracy in childhood illness diagnosis (Chen, Dutta and Thomas, 2014; Donabedian, 1988). Using vignettes, the 2018 Kenya Health SDI survey asked medical personnel in different cadres to diagnose four illness conditions. Two of these illnesses were common childhood tracer conditions, that is, severe dehydration and pneumonia. The response was coded as 1 for correct diagnosis and 0 for wrong diagnosis of each of the illnesses. These responses were summed up to obtain the outcome variable defined as the total number of correctly diagnosed cases out of the possible two childhood illnesses. The outcome variable is coded as ordered categorical variable taking the values between 0 and 2 representing inability to correctly diagnose any of the illnesses and accurate diagnosis of both illness cases, respectively.

Independent Variables

The choice of independent variables included in the regression analysis is based on existing theoretical and empirical literature. A summary of the explanatory variables is presented in Table 1.

Table 1: Summary of Study Variables

Variable	Definition and Range
Provider quality of healthcare	Total cases of childhood illnesses correctly diagnosed (0 cases=1, 1 case=2, 2 cases=3)
Health worker Characteristics	
Sex	Sex of health worker (male=1, Female=0)
Age	Age of health worker in years
Age in years squared	Age squared
Cadre Type	Categorical variable for healthcare provider/worker cadre (Nurse=1, Clinical officer=2, Medical Doctor/physician=3)
Education level	Categorical variable for education level attained (Basic (primary and secondary) =1, College=2, Degree/Post-graduate=3
IMCI training	Trained on IMCI (Trained=1, Not-trained=0)
Caseload	Number of outpatient visits per day per health worker
Facility Characteristics	
Facility location	Dummy variable for location (Urban=1, Rural =0)
Ownership	Categorical variable for facility ownership (Government=1, Private-not-for-profit=2, Private-for-profit=3)
Facility Tier	Categorical Variable for facility tier (Dispensary and clinic=1, Health Center=2, Hospital=3)
Time to sub-county headquarters	Travel time by car in minutes to sub-county headquarters
Time squared	Travel time squared
Availability of internet services	Proxy for access to information technology (Yes=1, No=0).

2.4. Data sources

The study utilized Health Service Delivery Indicators data collected in Kenya in 2018. Service Delivery Indicators (SDI) is a nationally representative set of indicators collected with the overall objective of estimating the quality of service delivery in education and health sectors. A total of 4430 health workers were assessed for competence in diagnosis and treatment of selected child and adult-related illnesses. The data collection survey instrument was structured around five modules: module 1 collected information on facility including facility ownership and type, infrastructure, medical supplies and medical equipment availability; module 2 focused on healthcare worker characteristics such as cadre type, age, gender, education level and absenteeism; module 3 assessed medical personnel knowledge through the use of clinical vignettes to diagnose hypothetical cases of patients with illnesses such as severe dehydration, pneumonia, diabetes and pulmonary tuberculosis; module 4 collected information on facility funds, that is, receipts and facility expenditures together with information on financial management; module 5 captured information on family planning. To conduct analysis on the determinants of provider process quality of healthcare at the facility level, modules 1, 2 and 3 were merged using the 'merge' STATA command based on common facility and staff identifiers in the datasets.

3. Empirical Results and Discussions

3.1. Sample Description

The analytic sample descriptive statistics are presented in Table 2. Results show that majority of health workers (55%) arrived at a correct diagnosis of one out of the two cases of childhood tracer conditions, that is, severe dehydration and pneumonia. Overall, 26% of healthcare workers were able to correctly diagnose both childhood illnesses while 18% were unable to provide an accurate diagnosis of any of the cases. Diagnostic accuracy rate for individual childhood illnesses was 29% for severe dehydration and 78% for pneumonia. These results largely point to an existing quality gap in diagnosis of childhood illness conditions. This has an implication on health outcomes in that, patients are likely to receive the wrong medication and treatment.

As regards health worker characteristics, there was an equal representation (50%) of male and female healthcare workers who on average were 38 years of age. Majority of the health workers were nurses (60%) with the rest being clinical officers (36%) and medical doctors/physicians (4%). Most of these workers (81%) had attained college level of education while 58% had been trained on Integrated Management of Childhood Illnesses (IMCI). The average health worker caseload was 13%.

Healthcare facilities were largely government owned (63%) with the remaining facilities being private-for-profit (25%) and private-not-for-profit (12%). On average, 77% of the healthcare facilities were in the first tier of healthcare facilities which mainly includes dispensaries and clinics. The facilities were mostly located in rural areas (73%) and were within a distance of less than an hour by car to sub-county headquarters (63%). Less than half of the healthcare facilities (32%) were accessible to internet/email services during the survey period.

Table 2: Sample Description

Variable	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
Total cases correctly diagnosed					
0 cases	4071	0.18	0.39	0	1
1 case	4071	0.55	0.50	0	1
2 cases	4071	0.26	0.44	0	1
Severe dehydration	4083	0.30	0.46	0	1
Pneumonia	4071	0.78	0.41	0	1
Sex	4294	0.50	0.50	0	1
Age	4294	37.56	12.25	19	99
Age squared	4294	1560.80	1203.75	361	9801
Cadre type	3998	1.44	0.58	1	3
Nurse	3998	0.60	0.49	0	1
Clinical Officer	3998	0.36	0.48	0	1
Medical Doctor/ Physician	3998	0.04	0.20	0	1
Education level	4075	1.95	0.44	1	3
Basic (primary/secondary)	4075	0.12	0.33	0	1
College	4075	0.81	0.39	0	1
Degree/post-graduate	4075	0.07	0.25	0	1
IMCI training	4294	0.58	0.49	0	1
Case load	4277	13.10	42.77	0	1607.143
Facility ownership	4294	1.63	0.86	1	3
Government	4294	0.63	0.48	0	1
Private-not-for-profit	4294	0.12	0.32	0	1
Private-for-profit	4294	0.25	0.44	0	1
Facility Tier	4294	1.29	0.58	1	3
Dispensary or clinic	4294	0.77	0.42	0	1
Health Center	4294	0.17	0.37	0	1
First level hospital	4294	0.06	0.24	0	1
Location	4294	0.27	0.44	0	1
Time to Sub-County headquarters	4294	0.63	1.12	0	12
Time squared	4294	1.65	6.57	0	144
Availability of Internet services	4294	0.32	0.47	0	1

Source: Author's computation from SDI survey data, 2018

3.2. Empirical Results and Discussions

The objective of this study was to examine the determinants of process quality of healthcare among the healthcare workers as indicated by provider knowledge of childhood illnesses. The dependent variable is the total number of illnesses correctly diagnosed and ranked into three mutually exclusive categories; no cases correctly diagnosed (category 1), one case correctly diagnosed (category 2) and two cases correctly diagnosed (category 3). These categories have a natural order, that is, categories 1, 2 and 3 represent extremely low quality, low quality and high quality respectively. Subsequently, ordered logit is applied in the estimation of relevant probabilities. We

employ the logit model since the assumptions of standard normal (standard logistic) distributions of error term in probit or logit models usually produce similar estimation results (Wooldridge, 2013).

To start with, we conduct diagnostic tests on the ordered logit model to establish its correctness. Specifically, we undertook the proportional odds assumption/parallel regression test for this purpose. The model summary and diagnostic tests results are presented in Table 3. From the table, 3962 observations in the SDI Health survey data set were utilized in the analysis and the ordered logit model convergence was achieved after five iterations. The log likelihood ratio Chi-Square test (LR Chi-squared (17) = 332.42, p= 0.0000) indicates that the ordered logit regression model as a whole is statistically significant in predicting cumulative probability for provider diagnostic levels when compared to the null model with no independent variables.

The Pseudo R-squared also known as McFadden's R-squared is 0.0426 suggesting that the relationship between the response variable, that is, provider quality of care and the predictor variables is small. Unlike ordinary least square R squared, pseudo-R squares are based on maximisation of model log-likelihood and do not represent the proportion of explained variance, but rather the improvement in model likelihood over a null model (Hemmert, *et al*., 2016). To test the parallel regression assumption for the ordinal logistic model, we conduct the Brant test using the STATA program 'brant, detail' command. The test results in Table 3 show significant chi-square values for 'all model' and also for 6 out 17 variables. This indicates that the proportional odds assumption that the dependent variable's categories are parallel is violated. Consequently, the generalized ordered logit model, a model that relaxes the parallel assumption model for the variables that violate this assumption is estimated (Williams, 2006).

Table 3: Ordered Logistic Model Summary and Diagnostic Tests

Model Summary			
Iteration 0: log likelihood = -3898.9574			
Iteration 1: log likelihood = -3734.8193			
Iteration 2: log likelihood = -3732.75			
Iteration 3: log likelihood = -3732.7474			
Iteration 4: log likelihood = -3732.7474			
Ordered logit estimates		Number of observations =	3962
		LR chi2(17) =	332.42
		Prob > chi2 =	0.0000
Log likelihood = -3732.7474		Pseudo R2 =	0.0426
Model Diagnostic Test- Brant Test			
Variables	**Chi2**	**P-value**	**Degrees of Freedom**
All	80.50	0.000***	17
Sex	0.17	0.682	1
Age	0.17	0.682	1
Age squared	0.37	0.540	1
Clinical Officer	38.51	0.000***	1
Medical Doctor/ Physician	6.87	0.009***	1
College	0.01	0.934	1
Degree/post-graduate	0.18	0.675	1
IMCI training	0.41	0.524	1
Case load	0.47	0.493	1
Private-not-for-profit	0.16	0.689	1
Private-for-profit	5.82	0.016**	1
Health Center	10.44	0.001**	1
First level hospital	12.97	0.000***	1
Location	6.41	0.011**	1
Time to Sub-County headquarters	2.05	0.152	1
Time squared	1.52	0.218	1
Availability of Internet services	0.42	0.518	1

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's computation from Kenya SDI Health survey data, 2018

The results of the estimated generalized ordered logit model are presented in Table 4. Specifically, we present corresponding marginal effects for each diagnostic accuracy/provider quality of healthcare category. Marginal effects present results as differences in probabilities and are therefore more informative than odds ratios. In addition, they are easy to interpret (Breen, Karlson and Holm, 2018).

Among the health worker characteristics, sex variable was found to be statistically significant at the level of 10% for the category of accurate diagnosis of none of the cases, one case and both cases. The results show that male compared to female health workers are 1.5% less likely to provide an incorrect diagnosis of the childhood illnesses and also 0.6 % less likely to provide a correct diagnosis of only one out of the two illness conditions. They are 2% more likely to provide

a correct diagnosis of both childhood illnesses. The finding contrasts with existing empirical studies which indicate that female health workers portrayed better performance (Reid *et al*., 2010; Norton *et al*., 1997) and no gender differential at all (Jackson, Farkas and Scholcoff, 2020; Maestad, Torsvik and Aakvik, 2010; Hansen *et al*., 2008) in process quality of care. Our finding is reasonable given the distribution of health workers across the various levels of training. The proportion of female health workers is reportedly high among the nurses and lower among the higher levels of training, that is, clinical officers and medical doctors (World Bank, NCPD and UNFPA, 2019).

In health worker cadre groups, clinical officer variable is statistically significant at 1% for none of the cases and both cases categories and at 5% for one case category. A clinical officer compared to a nurse is 19.3% less likely to arrive at an incorrect diagnosis of childhood tracer conditions, 3.7% more likely to correctly diagnose one of the two cases and 15.5% more likely to diagnose both childhood cases correctly. The medical doctor variable is statistically significant at 1% and 5% for zero cases and both cases, respectively. Compared to a nurse, a medical doctor is 18.3% less likely to provide an incorrect diagnosis of the childhood illnesses while he or she is 11.3% more likely to correctly diagnose both cases of childhood illnesses. The significant effect of medical doctor and clinical officer cadres on illness diagnostic accuracy implies that higher level of training improves provider knowledge which in turn enhances provision of quality healthcare. The finding is as expected and in line with other existing empirical studies (Uwemedimo *et al*., 2018; Maestad, Torsvik and Aakvik, 2010; Hansen *et al*., 2008) but in contrast with some studies where lower cadre was associated with higher provider quality of healthcare (Bawate *et al*., 2016; Selemani *et al*., 2013).

Health worker education level is statistically significant with a negative coefficient for inaccurate diagnosis and a positive coefficient for correct diagnosis of both childhood illnesses. College level of education is statistically significant at 1% across all the three categories. Compared to health workers with basic level of education, those with college level of education are 5.2% less likely to provide an incorrect diagnosis of any of the childhood illnesses and 1% less likely to arrive at a correct diagnosis of one of the two illnesses. They are 6.2% more likely to arrive at a correct diagnosis of both illnesses. Degree or postgraduate variable is statistically significant at 1% for the zero cases and both cases categories. This level as opposed to basic level of education is negatively correlated with inaccurate diagnosis of childhood illnesses and positively correlated with accurate diagnosis of both childhood illnesses. This variable could explain the difference in performance in quality of healthcare among different cadres.

Training in Integrated Management of Childhood Illnesses (IMCI) is statistically significant at 1% across all the outcome categories. Health workers with training in IMCI are 3.1% and 1.2 % less likely to fail in diagnosis of any of the illnesses and to diagnose only one of the two illnesses respectively. They are 4.3% able to correctly diagnose both illnesses when compared to those who were not trained in IMCI. This finding corroborates other existing studies where the ICMI variable has been found to be effective in enhancing quality of healthcare (Tawfiq, Alawi and Natiq 2020; Lal *et al*., 2020; Maestad, Torsvik and Aakvik, 2010).

As regards health facility characteristics, ownership, facility level and location were significant across all or some of the provider quality categories. The private-not-for profit health variable is

statistically significant at 1% for the zero, one and two cases of correct diagnosis of childhood illnesses. Specifically, health workers in a private-not-for-profit health facility as opposed to government health facility are 3.6% and 1.2% likely to provide an incorrect diagnosis and correct diagnosis of only one out of the two childhood illnesses respectively. They, on the other hand, are 4.8% less likely to correctly diagnose both cases of childhood illnesses. Private-for-profit variable is statistically significant at 1% for correct diagnosis of one of the two illnesses and for both cases. Health workers in a private-for-profit health facility are 6.7% more likely to provide a correct diagnosis of only one out of the two cases and 8.7% less likely to correctly diagnose both cases when compared to those in government health facilities. Contrary to the prevailing assumption that private health facilities are more efficient than public health facilities (Rosenthal and Newbrander, 1996), the finding in this study supports other research studies (Bamiselu *et al*., 2016; Basu *et al*., (2012) which reported better performance in public health facilities.

Health Center variable is statistically significant at 1% and 5% for accurate diagnosis of none of the case and one of the cases respectively. Health workers in a health center were 4.2% more likely than those in dispensaries to arrive at an incorrect diagnosis of childhood illnesses and 6.5% less likely to accurately diagnose one of the two cases. This is in line with studies that have reported better performance among lower levels of healthcare (Hu *et al*., 2016). Those in hospitals were 16.3% less likely (at 1%) to correctly diagnose one out of the two cases and 15.4% more likely (at 1%) to correctly diagnose the two illnesses when compared with those working in dispensaries. This may perhaps be associated with higher representation of medical personnel in higher cadres at the hospitals (World Bank, NCPD and UNFPA, 2019).

The location variable is statistically significant at 1% and 5% for correct diagnosis of one and both childhood illnesses respectively. Health workers employed in urban-based health were 5.9% less likely to provide a correct diagnosis of one out of the two illness conditions and 3.9% more likely to arrive at a correct diagnosis of both cases. The finding is supported by existing empirical studies (Thornton *et al*., 2017; Lin, Madhavan and Bauhoff, 2010) and in contrast with other studies (Yan, Wan and Li, 2011; Farmer *et al.*, 2005) that report a high level of satisfaction with healthcare in rural areas.

Table 4: Generalised Ordered Logit Model-Determinants of Provider Process Quality of Healthcare

Variable	0 Cases Diagnosed (extremely poor)		1 Case Diagnosed (poor)		2 Cases Diagnosed (High quality)	
	Marginal Effects	**Z-statistic**	**Marginal Effects**	**Z-statistic**	**Marginal Effects**	**Z-statistic**
Health Worker Characteristics						
Sex	-0.015*	-1.76	-0.006*	-1.74	0.020*	1.76
Age	-0.001	-0.44	-0.000	-0.44	0.001	0.44
Age squared	0.000	0.65	0.000	0.64	-0.000	-0.65
Cadre Type (Reference category: Nurse)						
Clinical Officer	-0.193***	-16.20	0.037**	2.10	0.155***	9.36
Medical doctor	-0.183***	-7.39	0.070	1.58	0.113**	2.41
Education level (Reference category: Basic level)						
College	-0.052***	-3.34	-0.010***	-4.86	0.062***	3.81
Degree/post graduate	-0.068***	-2.77	-0.019	-1.58	0.087**	2.50
IMCI training	-0.031***	-3.61	-0.012 ***	-3.41	0.043***	3.62
Case load	0.000	0.56	0.000	0.55	-0.000	-0.56
Health Facility Characteristics						
Ownership (Reference category: Government)						
Private-not-for-profit	0.036**	2.41	0.012***	3.16	-0.048***	-2.61
Private-for-profit	0.020	1.21	0.067***	3.25	-0.087***	-5.03
Facility Tier (Reference category: Dispensary)						
Health Center	0.042 **	2.52	-0.065***	-3.04	0.023	1.20
Hospital	0.009	0.35	-0.163***	-4.80	0.154***	4.81
Location	0.020	1.14	-0.059***	-2.68	0.039**	2.10
Time to sub-county headquarters	-0.000	0.57	-0.000	-0.57	0.001	0.57
Time squared	0.000	0.52	0.000	0.52	-0.000	0.52
Access to internet services	-0.003	0.26	-0.001	0.26	0.004	0.26
	Observations		3,962			
	Log likelihood		-3691.9361			
	Prob>Chi2		0.0000			
	Pseudo R2		0.0531			

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's computation from Kenya SDI Health survey data, 2018

4. Conclusion and Policy Recommendations

This study sought to examine determinants of provider process quality of healthcare as measured by health worker/provider accuracy in illness diagnosis for common childhood tracer conditions in Kenya. The two childhood illnesses considered, that is, severe dehydration (which results from diarrhea) and pneumonia are among the leading causes of childhood illnesses in the country. The study employed a generalized ordered logit model on the 2018 Kenya Health SDI data.

The study points to low provider knowledge in diagnosis of childhood illnesses hence sub-optimal quality of healthcare in Kenya. Among the factors that contribute to high quality of healthcare are: being male, higher provider education level and cadre, training in IMCI, higher facility tier and urban location. Based on this finding, there is need to design training programmes to enhance lower cadre health worker's care management, given their involvement in provision of healthcare through the task shifting strategy. The strategy arises from the shortage and uneven distribution of medical doctors coupled with a high burden of infectious diseases in the country. It addresses the health worker shortage by making use of already available human resource through delegation of tasks requiring high skills to health workers with lower qualification (WHO, 2006). This could be done through refresher courses and continued training in Integrated Management of Childhood Illnesses (IMCI).

Better performance in quality of healthcare among urban-based healthcare facilities and facilities in higher tiers could be linked to inequality in distribution of health human resources and infrastructural inputs. The policy implication of this finding is that there is need to have balanced infrastructural development and equipping of all the facilities across the country. The existing strategy to train, recruit, deploy and redistribute healthcare workers should be fully implemented, especially with the devolution of health services in the county.

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