Structural quality of health care refers to the availability of the physical and human resources required for the provision of care. Measures of structural quality include health facilities’ physical equipment, and measures related to staff expertise and staff coordination and organization. Even though this type of quality may not by itself ensure improved outcomes, it is important because it focuses on the availability of all inputs necessary for the provision of care, without which better health outcomes may not exist. The definition of structural quality used in this study focused on the adequate supply and functional state of resources used for the provision of health care. Structural quality, then, ensures access to health care, which is necessary for the achievement of universal health coverage.

Universal health coverage is achieved for a given economy when all residents, regardless of income, are able to have access to adequate health care without suffering financial hardship. One of the important factors for achieving universal health coverage is access to technologies for the diagnoses and treatment of illness. The availability of these inputs for the provision of health care represents structural quality. Government intervention in the health-care market affects structural quality. In Ghana, for example, the government owns more than 50% all the health facilities in the country. The government is responsible
for the availability of all physical and human resources in public facilities. The structural quality of health-care provision in the public sector is therefore subject to public norms and institutions. This study uses malaria outpatient data to explore the role of institutional factors in structural quality in Ghanaian public health facilities.

Malaria data were focused on for two reasons. First, malaria is the most common disease in Ghana accounting for more than 40% of outpatient cases and about 48% of under-five-year-olds' hospital admissions. Thus, changes in the structural quality of the treatment of malaria are likely to affect a large percentage of the population. Secondly, malaria was chosen to rule out the possible variation in structural quality as a result of variation of diseases and hence make comparison of quality possible across health facilities.

Measuring structural quality

The measures of structural quality used for this study were adequate supply of furniture and human resources as well as the functional state of equipment used for treatment. These measures are closely linked to health outcomes of treatment. The adequacy of furniture supply was measured by the facility’s ability to provide enough seats for all outpatients and beds for inpatients. Patients who do not get seats at outpatients may have to sit on the floor or stand and inpatients who do not get beds may have to lie on the floor or sit in a chair. In addition to causing discomfort, sitting or lying on the floor can increase the probability of contracting germs and hence worsen a patient’s health status. The equipment includes tools used for diagnoses as well as treatment of malaria. The correct functioning of these tools is important for proper treatment and enhanced outcomes. The supply of doctors and nurses is necessary to ensure access to treatment. A well-equipped health facility that is not staffed adequately with experts is not capable of providing adequate care to patients.

Institutional factors

The institutional factors relevant in this study were mainly the model of governance used by the government for the various health facilities and the administration of the health facilities for the workers. Specifically, the focus was on the extent of decentralization in decision making at the facility level as well as the flow of information between the government and health facilities and the administration of health facilities and health workers. Teaching hospitals in Ghana have more autonomy than other facilities in hiring and capital expenditure. Unlike the other types of hospital governed by the Ghana Health Service (GHS), teaching hospitals do not require approval from GHS for hiring and capital expenditure. Teaching hospitals, then, enjoy significant decentralization. Teaching hospitals are also referral facilities to regional hospitals, which are referral facilities for district hospitals, and in turn health centres. Hospital type then has institutional implications. In addition, institutional factors also covered the procurement process and incentives for health workers. These factors were measured through relevance and quality of procured items, opportunities for professional development through further studies and learning on the job, hiring procedure, and workers’ view of information flow.

Method

Data

The data used for the study came from a survey of health facilities in three of the ten administrative regions in Ghana. The selected regions have the three teaching hospitals in the country. The selected health facilities for each region included one teaching hospital, one regional hospital, district hospitals and health centres. The respondents for the survey were patients, health workers and facility administrators. Health workers and administrators provided information on the institutional factors described above but the unit of observation was patients. Thus health workers responses were averaged for the facilities in which they worked. The survey, which was done in 2010, was funded by the African Economic Research Consortium and ethically approved by the Ghana Health Service on clearance ID: GHS-ERC:01/1/10. Information in the survey included patient and health facility characteristics, as well as institutional factors. The unit of observation was patients and the sample size, after the removal of all missing variables, was reduced from 2,852 to 2,451 patients. There was no information on the patient population serviced by the selected facilities and so convenience sampling was used.

Empirical specification

The regression equation used for the study is:

\[ Y_i = \beta + \alpha C_i + \gamma H_i + \pi S_i + \varepsilon_i \]

Where \( Y_i \) is the dependent variable(s), \( C_i \) is a vector of variables on the patients’ characteristics, \( H_i \) represents a vector of characteristics of the health facility in which the patient received care, and \( S_i \) is a vector of variables on institutional factors as described above. The patient characteristics included age, gender, education and employment. Facility characteristics focused on facility type and the region in which it was located. The facility types were: teaching hospital, regional hospital, district hospital and health centre; and the regions: Ashanti, Greater Accra and Northern. Both the facility types and regions were coded as dummy variables with health centre and Northern region as the control variables.

There were five indicators for structural quality: outpatient overcrowding, inpatient overcrowding, functional state of equipment, doctor shortage and nurse shortage. Facilities without inpatients were coded as having no inpatient overcrowding. All indicators were dummy variables and were coded as one if the problem (e.g. nurse shortage) existed and zero otherwise. The coding for personnel shortage was first in the form of dummy variables and second as a ratio of available personnel in a facility to the required number of personnel.

Principal component analysis, explained below, was used to create quality indices from the five indicators. The indices were used as dependent variables for the regressions. The independent variables for the regressions differed only by the institutional factors as different institutional factors were relevant for different indices.
Principal component analysis was used to reduce the number of regressions for structural quality, and to create quality indices. Generally, principal component analysis is used to reduce a large number of apparent independent variables to a smaller number of uncorrelated variables referred to as principal components. The indicators of structural quality again were doctor shortage, nurse shortage, the functional state of equipment, outpatient overcrowding and inpatient overcrowding. In general, doctors are scarcer than nurses and so facilities with nurse shortages are also likely to have a shortage of doctors. Poorly functioning equipment/instrument can delay service and hence worsen any existing personnel shortage. Overcrowding (outpatient and/or inpatient) leads to overuse of equipment and hence weakens their functional state. Thus all indicators could be correlated. The principal component analysis involves the computation of independent composite variables called principal components. A principal component is the sum of the product of each indicator with its weight:

\[ PC_i = a_1 I_1 + a_2 I_2 + \ldots + a_k I_k \]

Where \( a \) represents the weight placed on each indicator and \( I \) represents an indicator. Since there are five indicators in this study \( k \) equals five. The principal components that were created from the five indicators were used in this study as structural quality indices.

**Results**

**Principal component analysis results**

The results of the principal component analysis that used the ratios for personnel shortage had very large positive weights and hence created large and positive personnel indices. However, a dependent variable with only positive values is likely to cause biased estimation as some of the predicted values of the estimation can be negative. A typical solution in such a case is to transform the variable into natural logs. However, such a transformation in the current study could create difficulty with the interpretation of the results. The analysis then used dummy variables for all quality indicators.

The literature typically reports only the principal components with eigenvalues greater than one which in this case applies to the first two principal components only (1.484 and 1.385) but these explained only 57.4% of the variation in the current data and so the third component, with an eigenvalue of 0.972, which is close to 1 was also reported to increase the variance. The first three principal components together explained 76.817% of the variation in the five indicators. The results are reported in Table 1.

**Table 1. Component matrix**

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient overcrowding</td>
<td>.830</td>
<td>.185</td>
<td>.064</td>
</tr>
<tr>
<td>Functional state of equipment</td>
<td>-.336</td>
<td>.086</td>
<td>.928</td>
</tr>
<tr>
<td>Nurse shortage</td>
<td>-.107</td>
<td>.814</td>
<td>-.124</td>
</tr>
<tr>
<td>Outpatient overcrowding</td>
<td>.809</td>
<td>.080</td>
<td>.301</td>
</tr>
<tr>
<td>Doctor shortage</td>
<td>-.124</td>
<td>.821</td>
<td>-.018</td>
</tr>
</tbody>
</table>

The first principal component had large positive weight for inpatient and outpatient overcrowding and small (in absolute value) negative weight for functional state of equipment. Facilities that got high positive scores for this index thus had a serious space and bed shortage problem and those with large negative (in absolute value) scores had poorly functioning equipment. Thus scores which are close to zero represented good functional state of equipment and no or low doctor and nurse shortages. The first principal component then was referred to in the study as the overcrowding index. The second principal component had only positive weights with the largest for doctor and nurse shortages and the lowest for functional state of equipment and outpatient overcrowding. Thus, a high score for this index represents a high shortage of personnel, hence called the personnel index. The third principal component had a large positive weight for functional state of equipment and negative for personnel shortage. The facilities with poor functional state of equipment then would score high in this principal component. The principal component was therefore called the equipment index. The three components were used as structural quality indices for the regression.

For each observation, the dependent variable equalled the quality index of the facility in which service was provided for
Regression results

With the exception of the formal sector and primary education, patient characteristics did not affect the overcrowding index. The results show that patients with primary education and/or working in the formal sector are likely to receive care in overcrowded facilities. While there was no statistically significant difference in overcrowding between the Greater Accra region and the Northern region (the control variable), the Ashanti region was the least overcrowded. Regional hospitals were highly overcrowded (coefficient: 22.683) relative to health centres, while teaching and district hospitals were less overcrowded than the health centres.

The institutional factors were all significant with the exception of the flow of information between government and facilities. The flow of information between health workers and administration reduced overcrowding. Improvement in quality and relevance of procurement increased overcrowding. The patient characteristics that affect the personnel index were, occupation of patients, level of secondary education. All were positively correlated with the index. A t-test for the equality of the coefficients of the Greater Accra and Ashanti regions showed that Greater Accra has the least personnel shortage problem followed by the Ashanti region and hence personnel shortage is most serious in the Northern region. The coefficient of teaching hospitals was negative implying that personnel shortage was more serious in health centres than teaching hospitals. While there was no statistically significant difference between health centres and regional hospitals, district hospitals were more likely to have personnel shortages than health centres.

The institutional factors showed that facilities with good information flow between administration and health-care workers were likely to have personnel shortage problems. As expected, personnel shortage was higher in facilities in which understaffing was likely to result from hiring procedures. However, facilities that provide opportunities for personnel development, and/or those in which health workers have high job satisfaction were associated with low personnel shortages.

The results on the equipment index show that age, gender, secondary education levels and employment in the formal sector have no correlation with the equipment index. The higher education and other employment coefficients were all negative and significant implying that patients with higher education and are employed are likely to receive care in facilities with good equipment. The facility characteristics coefficients show no significant difference between the functional state of equipment in the Ashanti and Northern regions but a significantly poorer functional state of equipment in the Greater Accra region relative to those in the Northern region. The equipment of teaching and district hospitals was found to be in a poorer functioning state while that of the regional hospitals was better than that of health centres.

The results on institutional factors show that after controlling for quality and relevance of procurement, facilities with a good flow of information were associated with equipment in a poor functional state. The functional state of equipment in facilities that are favoured by government policies was also good.

Discussion

The results on overcrowding across regions imply that the problem of overcrowding is less severe in the
Ashanti region than other regions, and in teaching and district hospitals than regional hospitals. These are interesting results because the Ashanti region is the most populous region with the largest number of people per health facility. The Ashanti region then, in spite of its large population, was better able to accommodate its patients, both at outpatient and inpatient levels, than the other regions. Teaching and district hospitals may have large number of patients regardless of the region in which they were located. The results here imply that these hospital types had more furniture to accommodate patients than health centres which might have smaller numbers of patients.

The results on institutional factors also imply that any government policy that could favour facilities did not have any significant impact on the problem of overcrowding. Results on the other institutional factors show that good coordination between health workers and the administration reduced overcrowding in the facilities, implying that the solution to overcrowding could be better solved internally than at the government level. The positive relationship between the overcrowding index and the quality and relevance of procurement could be that facilities that were able to procure quality items were able to attract more patients and hence become overcrowded.

Relating the result on district hospitals to the overcrowding index implies that even though personnel shortage was a problem at the district hospital level, district hospitals had enough furniture to accommodate patients to reduce overcrowding.

The reason for the negative effect of information flow on personnel shortage could be that good flow of information improves performance, all things being equal, and this could increase the number of patients and hence lead to a shortage of personnel. Such a result is important because personnel development enhances workers’ productivity and hence improves job satisfaction. The implication is that when job satisfaction increases, workers are able to increase efforts such that any problem caused by personnel shortage is mitigated.

In the case of the equipment index, good information flow could motivate workers to put in extra effort in performance which might lead to overuse of equipment. Also, the results imply that involving health-care workers in the procurement procedure may not necessarily imply good functional state of equipment but it is the relevance and quality of the product as well as the skill of the workers and the involvement of the government that ensure good functioning equipment. Teaching hospitals performed well in all three indices while regional hospitals performed poorly in all three. Since the teaching hospital variable also represents decentralization, the result could mean that decentralization is quality improving for large referral health facilities.

Limitations of the study

The use of convenience sampling could have the disadvantage of making the data less representative of the population. To minimize such an effect, the number of patients interviewed for the larger facilities was always greater than for the smaller facilities. Another limitation is that the data lacked information on patient income, which is likely to affect their choice of health facility and hence the corresponding quality index.

Conclusion

The study has shown that institutional factors relating to governance play a very important role in affecting the availability of physical and personnel inputs needed for the provision of health care. Specifically, decentralization and good coordination between facility administrator and health workers are very important factors affecting structural quality. The study recommends decentralization of regional health facilities and improvement of information flow and coordination between administrators and health workers.

Acknowledgement

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References