PERFORMANCE OF HOSPITALS IN CROSS RIVER STATE, NIGERIA: A COMPARATIVE ANALYSIS OF RURAL AND URBAN PUBLIC SECONDARY CARE INSTITUTIONS USING PRODUCTIVITY INDICATORS

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Abstract

This study analysed the performance of secondary care hospitals in Cross River State using simple productivity ratios with data for the period 2010-2014. Three categories of simple productivity ratios with a total of five indicators were analysed. The study analysed labour productivity using number of admissions per employee and number of admissions per nurse; capital productivity using number of admissions per bed; and structural quality indicators using number of nurses per bed and number of doctors per bed. There were productivity improvements for nine hospitals in admissions per bed and ten for admissions per nurse while productivity was static or declined in three and one hospital respectively for these labour productivity indicators. Nine hospitals witnessed capital productivity improvements while five had improvements in hospital quality. Rural hospitals were more labour productive while urban hospitals were more capital productive showing a relatively higher improvement in quality. The relative low productivity of labour in urban hospitals, with more employees, points to some level of labour redundancy in these hospitals which may result in wastage of resources spent on human personnel without a commensurate input in terms of man hours. Capital provision in rural hospitals, labour and hospital quality productivity improving measures such as remuneration for hours of work done and specialized staff/nursing training could enhance productivity of public secondary care hospitals in the state.

Keywords*: Productivity ratio,* Hospital performance, Inputs and Outputs.

Jel Classification: D24, I12, I11, J21, H51

Introduction

The goals of health systems the world over can be assessed viz-a-viz the ability to improve the population health, meet health expectations of the majority of the people it serves and apply financial and materials resources meant for the sector in a fair and equitable manner. The first two goals have been traditionally examined using measures such as life expectancy and total mortality while the third goal can be measured by the level of productivity and efficiency in resources usage within the health care system.

The concept of productivity is a measure of effectiveness in the use of economic resources and has become increasingly useful as organisations aim at minimizing resource wastage and maximizing outputs. Productivity improvement is critical for improvement in population health and meeting health expectations. This is even more needful given the sectors' growth profile as the health sector constitutes about one-tenth of activities in modern economic systems (Evan et al 2010).

Within the health care system, hospitals are the major players with a large share of health care resources expended by it. Hospitals are the key functional units of the health sub-sector of the economy and a major consumer of both human and financial resources meant for this sector in both developing and developed economies. In the eighties and early nineties in developed countries, the sector alone accounted for 58 percent of gross health expenditure in the United Kingdom, 49.5 percent in United States and 58.7 percent for the Netherlands. In Nigeria, it is estimated that the hospital system consumes over 60 percent of human and materials resources meant for the health care system. (Nwosu, 2000)

Even though hospitals are the major consumers of healthcare resources, there is little evidence to show in terms of delivering on their core mandate of improving life due to poor health indices including high mortality rates in Nigeria. Statistics show that the rating of Nigerian health sector performance and by extension that in Cross River State, are currently worse than the average for sub-Saharan Africa. For instance the World Health Organisation (WHO) ranking of the health system placed the country at the 187^{th} position out of 190 countries in the year 2000. The country's under-five mortality rate

is put at 201 per 1,000 live births (NDHS, 2004), maternal mortality ratio of 800 per 100,000 live births (WHO, 2004), malaria prevalence of 919 per 100,000 population (WHO, 2002) and HIV/AIDS adult prevalence rate of five percent and an estimated 3.5 million new infections yearly (NDHS, 2008). According to the United Nations International Children Emergency Fund (UNICEF, 2009), life expectancy at birth declined to 44 years which is lower than the African average of 46 years and below the average of that of least developed countries which is 53 years.

The situation in Cross River State is not better in any way. For example, estimate puts the infant Mortality Rate in the state at 75 per 1000 live-births compared with the national average of 69 per 1000 live-births and the under-five mortality rate at over 157 per 1000 live-births compared with the national average of 128 per 1000 live-births. The average Maternal Mortality Rate (MMR) for Nigeria is 576 per 100,000 live births as at 2013 while for Cross River State it is between 545 maternal deaths per 100,000 live births; the highest in the South-South geopolitical zone at the time (HERFON, 2006; CR-SEEDS-2,). The percentage of women attending ante natal is about fifty five percent and only about 35% of pregnant women are attended to at birth by skilled attendants.

Table 1: Summary of demographic, socioeconomic and health indicators in Cross River State

Indicator	**Year**	**Estimate**	**Source**
Total population	2006	2.89million	SPC
Annual population growth rate		4.03%	SPC
Life expectancy at birth	2006	55 years	SPC
Adult literacy:	2006	61.7%	NPC
Male		60.7%	
Female		39.3%	
Total Fertility rate (per woman)	2008	5.4%	NPC
Women attending ante natal care	2010	55%	TCF
Birth attended by skilled health worker	2010	35%	TCF

Full immunization by 1 year old	2010	74%	TCF
HIV prevalence	2010	7.1%	FMoH
Maternal mortality ration (per 100,000 live births)	2010	545	TCF
Infant mortality rate (per 1,000 live births)	2010	75	TCF
Under five mortality rate (per 1,000 live births)	2010	157	TCF

Source: SPC-State Planning Commission, NPC-National Population Commission, TCF-Tulsi Chanrai Foundatiuon, FMoH-Federal Ministry of Health.

According to the 2009 Nigeria health systems report, Cross River State when compared with other states in the South-South geopolitical region lags behind in terms of human resources for health and per capita government health expenditure. The dismal performance in the health sector is linked not only to the poor human resources for health and dwindling budgetary allocation for the health sector, but also to poor performance and low productivity of these resources.

The performance of hospitals may vary due to the effectiveness of management, differences in the quality of services rendered, the degree of funding and the operational environment of the hospital (Pierce, 2001). Previous studies that evaluated the performance of hospitals have been undertaken mainly outside the sub-saharan Africa region and the results have been mixed. For instance, while Chansky, Garner and Raichoudhary (2015) and Gu and Li (2015) found improvement in hospital performance over the period of investigation, Sharpe, Bradley and Messinger (2007) as well as Fisher (2007) posited that performance of hospitals actually declined. In the light of the inconclusive results obtained by these studies, this study uses simple productivity ratios to measure the partial factor productivity of public secondary care hospitals in Cross River State comparing rural and urban hospitals. Human resources and capital productivity of these hospitals were examined. Specifically the study has the following objectives:

1. to estimate the productivity indices of public secondary care hospitals in Cross River State, analyzing their differences in terms of location (rural and urban) and
2. to analyse the trend in the productivity of these hospitals over a five year period (2010-2014) for productivity change.

The remainder of the paper is organized thus; section two is the empirical and theoretical review, section three is the methodology while sections four and five are results and discussion and conclusion and recommendations respectively.

Theoretical Issues

Production Theory

Production theory or function in contemporary Economic literature traces the link or relationship between inputs and final output. The process of transforming inputs to outputs (finished goods and services) may take place in various sectors such as manufacturing, transportation, education, banking and healthcare.

Basically, it estimates the relation between output, Y, and other input factors used mostly labour (L), materials (M) and capital (C) (Ludwig, 2008). This relationship can be represented mathematically thus; $Y = f (L, M, C)$
Where : Y = Output, L = Labour, M = Materials, C = Capital
Firms or Decision Making Units (DMUs) produce outputs by combining factor inputs which are known traditionally as factors of production.

The concept of productivity is used as a benchmark for assessing the performance of production units. Thus, ensuring rising productivity is synonymous with profitability increase, costs reduction and increased competitiveness within the production unit's sector. Productivity, which is described as the ratio of outputs to inputs, can be analysed at various levels – economy-wide, industry, firm/agency and operational unit, with the results applied for decisions and policy at these levels.

Productivity indicators

There are two broad classes of productivity indicators: partial productivity indicators and total factor productivity indices. A partial productivity indicator measures an organizations' output in relation to a single input factor. Simple indicators are also known as "performance ratios" and are defined as the ratio of final output produced to a single input factor utilized in the production process. Labor productivity index, for example, can be defined as the number of admitted patients in a hospital for every hospital employee. Productivity indicators can also be derived for given units, departments or segments of the production process, for intermediate outputs and inputs or between inputs and the final outputs. The number of medical files treated for every administrative worker, for instance, can be considered as a partial productivity measure. The advantage of partial indicators is that they are easy to construct and understand and are useful for making adjustments in input usage and re-aligning output to desired production objective

Empirical literature

Empirical studies on performance of decision making units such as the hospital have tend to focus on a particular input measure such as labour or evaluated multifactor productivity growth (MFP) over time. For instance Sharpe, Bradley and Messinger (2007) examined the labour productivity of hospital in Canada for the period 1987-2006 with the result revealing labour productivity decline of -0.69% over the period of investigation. In a related study, Chansky, Garner and Raichoudhary (2015) evaluated the labour productivity of hospitals in USA for the eriod 1993 and 2012 and found productivity improvement of 1.5% over the period for this class of health care institutions. In a study with focus on particular health service provider i.e nursing homes, Gu and Li (2015) while examining labour productivity in Canada, found that there was improvement in productivity by 0.2% for the period 1984-2009. In addition to evaluating the productivity of a particular input, some studies also evaluated multiple factors. Some of such studies in which results revealed productivity improvements include Nghiem, Coelli and Barber (2011) and Spitalnic, Heffler, Dickensheets and Knight (2016), while studies by Fisher (2007) and Harper, Khandrika, Kinoshita and Rosenthal (2010) found productivity decrease. In a study which compared the productivity (efficiency) of rural and urban hospitalsin the United States,

Toodi, Featherstone and Young (1998) found a marginally higher efficiency for urban hospitals (0.72%) than rural hospitals (0.71%). Researchers in sub-saharan Africa may have been averse to analyzing the performance of hospitals given the relatively scanty literature in this field in the continent and the few studies outside the continent have tended to concentrate on labour and capital productivity. Not much have been investigated in the literature related to structural quality indicators which are key to policy formulation. This study therefore fills this gap by analyzing the performance of hospitals within the sub-saharan Africa context and in a way relevant for policy formulation as it examines the structural quality indicator. The study also makes a comparison between rural and urban hospitals to find out if spatial differences could be a factor which affects the performance of hospitals.

Measuring hospital performance

There are various ways of measuring the performance of a hospital. While some researchers make use of ratios, others use certain hospital indices. For instance Maruotti (2007) used measures such as average length of stay, discharge rates and inpatient beds. Using these measures makes it easy for the performance of groups of hospitals with similar characteristics to be compared. Thus a hospital with a shorter average length of stay and a particular output may be considered more productive than one with a longer average length of stay.

The use of simple ratios is another way of measuring performance. According to Zere Asbu (2001), ratio analysis has to do with the examination of various key ratios in a gradual and differentiated manner for a group of hospitals with comparable characteristics in order to find deviations from the norm. Simple ratios are also known as performance or productivity-type indicators and in most cases simple indicators do not require quantitative analysis using multivariate stochastic or deterministic methods. Filippini and Farsi (2004) classified productivity indicators into two main groups; partial productivity measures and total factor productivity indices. Partial productivity indicators measure the relationship between a hospital output to a single input factor e.g labour productivity relates the number of patients treated for every hospital employee and number of case files treated per administrative worker. Total factor productivity (TFP) on the other hand, is the ratio of the index of total

output quantity measure to the index of the total input quantity. TFP are relative measures which can be used between two hospitals or one hospital in two different years. Examples of index numbers include Tornquist index, Fisher index and Malmquist index.

The quality of labor force is assessed by either the percentage of certified physicians or proportion of qualified and teaching nurses; or the number of physicians per bed and number of nursing staff per bed

Types of Simple indicators of hospital

Filippini and Farsi (2004), defined the simple indicators of hospital performance in four categories namely productivity, output characteristics, cost structure and other hospital characteristics. The productivity indicators are divided into two groups which represent the partial productivity of labor and capital. This type of indicator depends on the number of cases or the number of patient-days. The major shortcoming of Capital productivity indicators which is usually uses number of beds as proxy is that this measure merely approximates capital stock.

The second category includes certain characteristics of inputs/outputs which do not give direct measures of productivity but are however essential for effective hospital performance. These indicators are relevant for policy formulation and managerial performance analysis. The input indicators measure the quality of the hospital's personnel and equipment and are known as structural quality measures. The output indicator has to do with the share of different hospital outputs as well as the average length of hospitalization. They include outpatient care, semi-hospitalizations and hospitalizations of more than a day.

The third category of simple indicators is the cost characteristics of hospitals including the shares and prices of both capital and labour input factors. The price of capital is measured as capital expenditure divided by the number of beds while the price of labor is considered using four categories of personnel namely physicians, nurses, other medical staff and administrative/ other support staff.

The fourth type of simple indicators which has to do with the hospital characteristics relates to the ownership status of the hospitals, affiliation of physicians for instance the number of private affiliated physicians and the hospital public status.

Methodology

The research design adopted in this study is the e*x post facto* design, since the study seeks to explore how hospital input variables influence output, both of which have already occurred before the researcher undertook the investigation. The study is descriptive in nature and analyses relationships of the variables using mean, maximum, minimum and simple ratios.

Data Sources and Distribution of Hospitals

Secondary data for employees (doctors and nurses), patient admissions and hospital beds were collected from all the 11 public hospitals rendering secondary health care in Cross River State for the period 2010-2014. These are the public hospitals rendering secondary health care services in the states which fall within the scope of this study. The distribution of these hospitals per senatorial district shows that there are 5 public hospitals in the south, 2 in the central and 4 in the northern senatorial districts. The data for the study were collected from the Department of Planning, Research and Statistics and the Directorate of Administration and Accounts of the State Ministry of Health. The Research and Statistics department receives monthly reports from all public hospitals in the state. These reports are thereafter published in the yearly report of the Ministry.

Study Variables: Productivity Indicators

The study made use of number of employees (doctors and nurses), number of patients on admission and the number of hospital beds for each year. These data was used to construct productivity indices such as labour and capital productivity. Labour productivity is the ratio of total number of admissions to employee while capital productivity is the ratio of total number of admissions to number of beds. Labour productivity in this study is estimated using two indicators; the number of admissions per total employee and the number of admissions per nursing staff. Capital productivity is measured using the number of admissions per bed.

Result and Discussion

Descriptive Statistics

The descriptive statistics for the data analysed showed mean admissions of 1002 patients, 60 beds and 107 employees in the hospitals studied for the period 2010 and 2014. The data revealed wide variations as the maximum number of admissions, number of beds and number of employees were 3640, 138 and 361 with the minimum at 4, 16 and 21 respectively. The standard deviation for the number of admissions was 995.7 while that for number of hospital beds and employees stood at 34.8 and 97.7 respectively.

The size of the public secondary care hospitals in Cross River State included in this study on the average declined by 3.4% for the period 2010-2014. Six hospitals witnessed increase in hospitals size, two hospitals decreased in size while three were static during the period. All urban hospitals increased in size while only three of the eight rural hospitals increased in size.

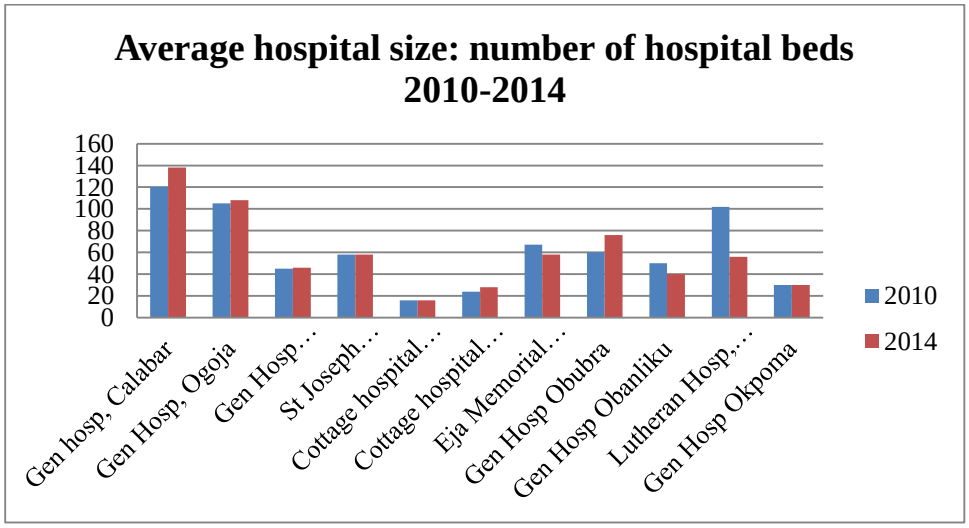


Figure 1: Average Hospital Beds in Selected Public Secondary Care Hospitals in Cross River State.

The total number of employees in the hospitals show that there is an average increase of 12.9% in the number of employees in all hospitals for the period 2010-2014 with six hospitals witnessing increase and five recording decrease in the average number of employees. The three urban hospitals had increase in

employees while five out of the eight rural hospitals recorded decrease in number of employees.

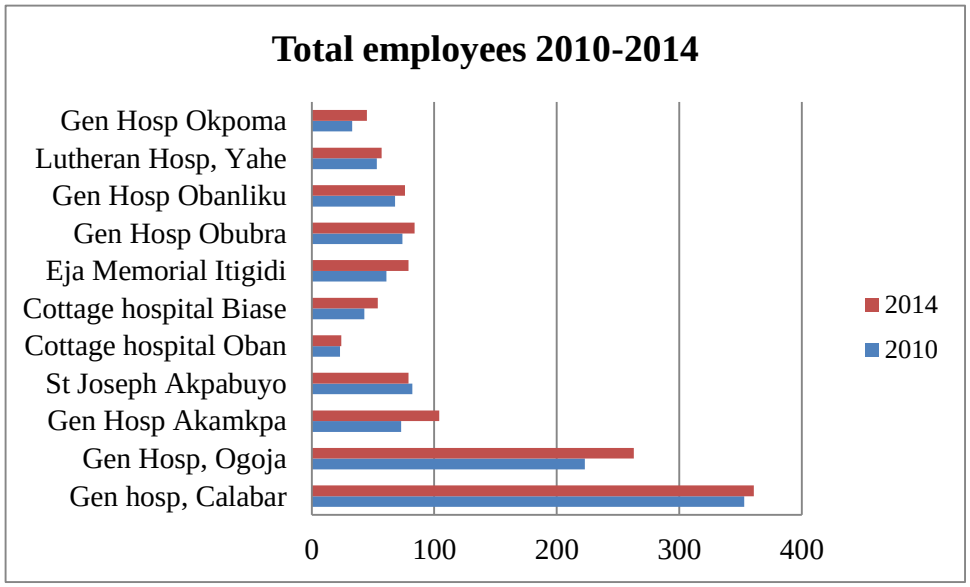


Figure 2: Total Employees in Selected Public Secondary Care Hospitals in Cross River State.

The number of admissions for all hospitals rose by over 118 percent for the study period. The three hospitals with the highest average increase in the number of admissions are General hospitals in Okpoma, Ogoja and Obubra while those with the lowest average increase are General Hospital, Calabar; St Joseph hospital, Akpabuyo and Cottage hospital, Oban.

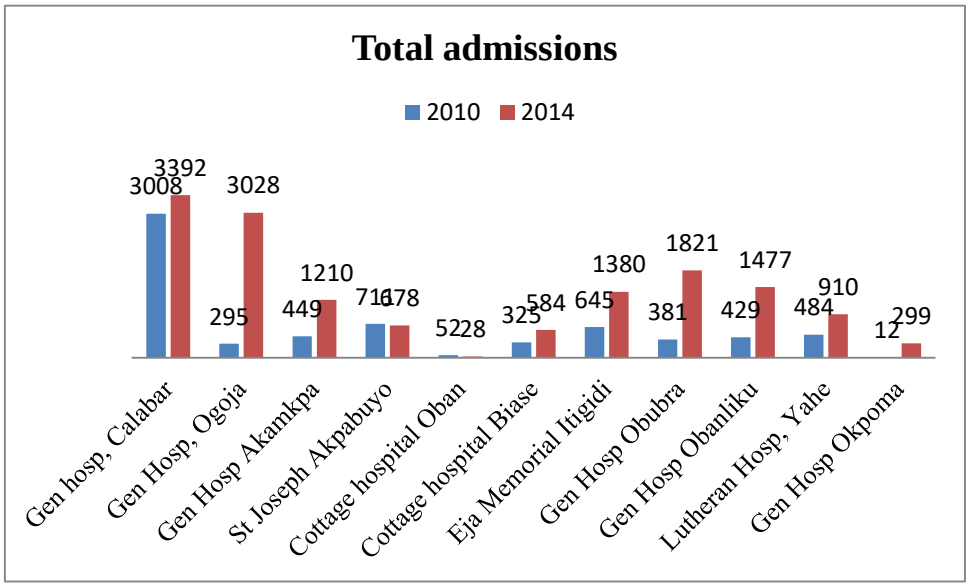
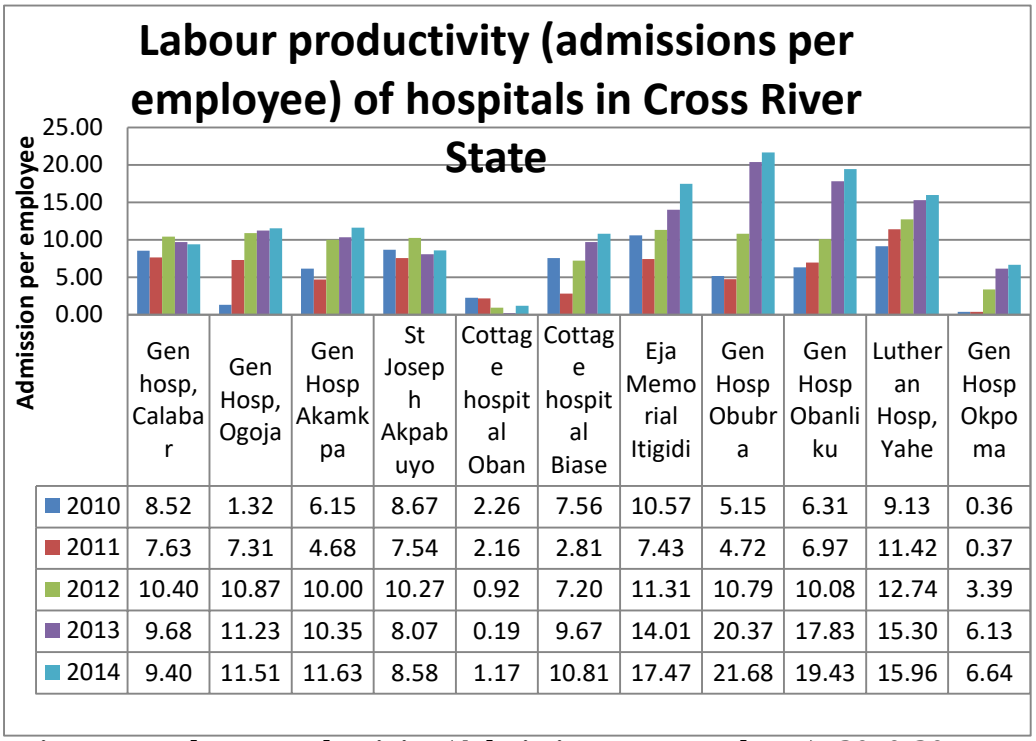


Figure 3: Total admissions in Hospitals in Cross River State: comparison for 2010 and 2014

Labour Productivity of Hospitals

Labour productivity in this study is estimated using two indicators; the number of admissions per total employee and the number of admissions per nursing staff. On the whole, out of eleven hospitals, nine had labour productivity improvement while two had productivity decline with the average productivity of all the hospitals put at 8.80. Admissions per employee is plotted in figure 4 and it shows that rural hospitals show a fairly stable rise in average productivity for the period rising from 6.25 in 2010 to 12.72 in 2014 with an average productivity of 8.84 while that of urban hospitals is 8.71 below the productivity of the entire group of hospitals.



	Gen hosp, Calabar	Gen Hosp, Ogoja	Gen Hosp Akamkpa	St Joseph Akpabuyo	Cottage hospital Oban	Cottage hospital Biase	Eja Memorial Itigidi	Gen Hosp Obubra	Gen Hosp Obanliku	Lutheran Hosp, Yahe	Gen Hosp Okpoma
2010	8.52	1.32	6.15	8.67	2.26	7.56	10.57	5.15	6.31	9.13	0.36
2011	7.63	7.31	4.68	7.54	2.16	2.81	7.43	4.72	6.97	11.42	0.37
2012	10.40	10.87	10.00	10.27	0.92	7.20	11.31	10.79	10.08	12.74	3.39
2013	9.68	11.23	10.35	8.07	0.19	9.67	14.01	20.37	17.83	15.30	6.13
2014	9.40	11.51	11.63	8.58	1.17	10.81	17.47	21.68	19.43	15.96	6.64

Figure 4: Labour Productivity (Admissions Per Employee); 2010-2014

As depicted in figure 4, average labour productivity (admissions per employee) of urban hospitals rose from 5.3 to 6.5 between 2010 and 2011 but remained fairly stable at 10 between 2012 and 2014 while that of rural hospitals witnessed a slight decline from 6.3 to 5.4 between 2010 and 2011 but maintained a steady rise from 5.4 to 12.7 from then to 2014.

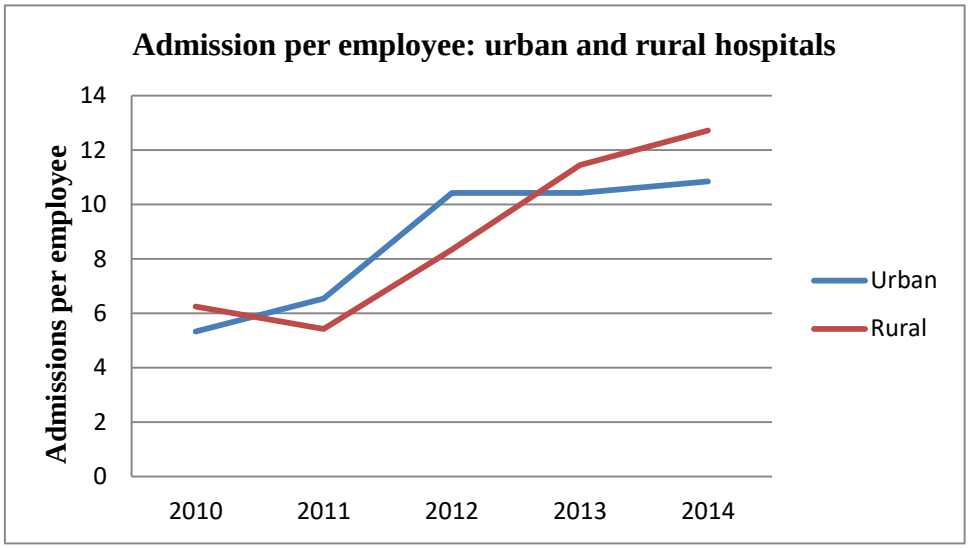


Figure 5: Labour Productivity (Admissions Per Employee): A Comparison of Rural and Urban Hospitals.

The second indicator of labour productivity is number of admissions per nurse, using this indicator ten hospitals had productivity increase while one (cottage hospitals, Oban) experienced a productivity decline. The top three hospitals with highest productivity increase over the period had productivity ranging from 17.4 and 23.1 and were rural hospitals while those with the lowest ratios had average productivity ranging from -1.2 to 1.4 had two rural and one urban hospital. The average productivity increase between 2010 and 2014 for all hospitals is 133%, while that of rural and urban hospitals are put at 135.4% and 129% respectively.

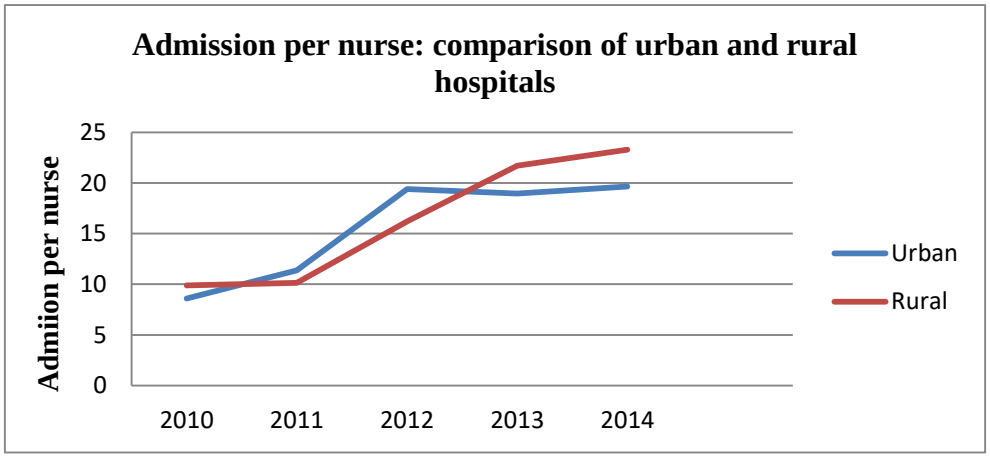
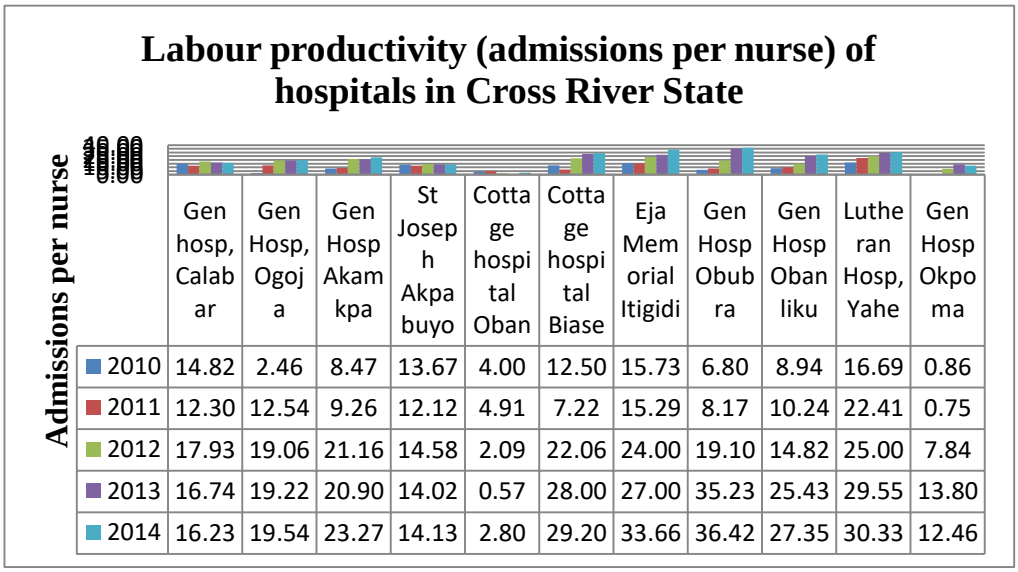


Figure 6: Labour Productivity (Admission Per Nurse): A Comparison of Urban and Rural Hospitals.



	Gen hosp, Calabar	Gen Hosp, Ogoja	Gen Hosp Akamkpa	St Joseph Akpabuyo	Cottage hospital Oban	Cottage hospital Biase	Eja Memorial Itigidi	Gen Hosp Obubra	Gen Hosp Obanliku	Lutheran Hosp, Yahe	Gen Hosp Okpoma
2010	14.82	2.46	8.47	13.67	4.00	12.50	15.73	6.80	8.94	16.69	0.86
2011	12.30	12.54	9.26	12.12	4.91	7.22	15.29	8.17	10.24	22.41	0.75
2012	17.93	19.06	21.16	14.58	2.09	22.06	24.00	19.10	14.82	25.00	7.84
2013	16.74	19.22	20.90	14.02	0.57	28.00	27.00	35.23	25.43	29.55	13.80
2014	16.23	19.54	23.27	14.13	2.80	29.20	33.66	36.42	27.35	30.33	12.46

Figure 7: Labour Productivity (Admissions Per Nurse); 2010-2014

Capital Productivity of Hospitals

Capital productivity is measured using the number of admissions per beds. Three hospitals witnessed productivity decline while nine had productivity improvements. There is a productivity increase of 131.8% for all hospitals between 2010 and 2014 with rural hospitals having a higher average

productivity increase (148%) than urban hospitals with average productivity increase of 108.7%.

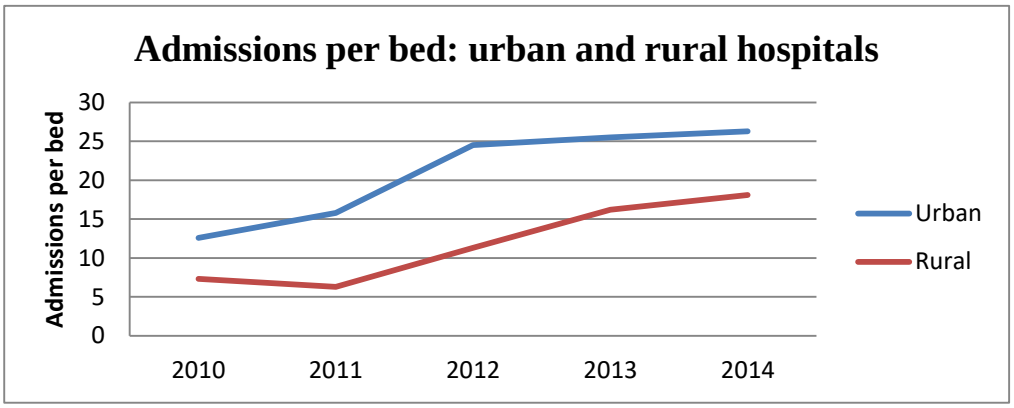
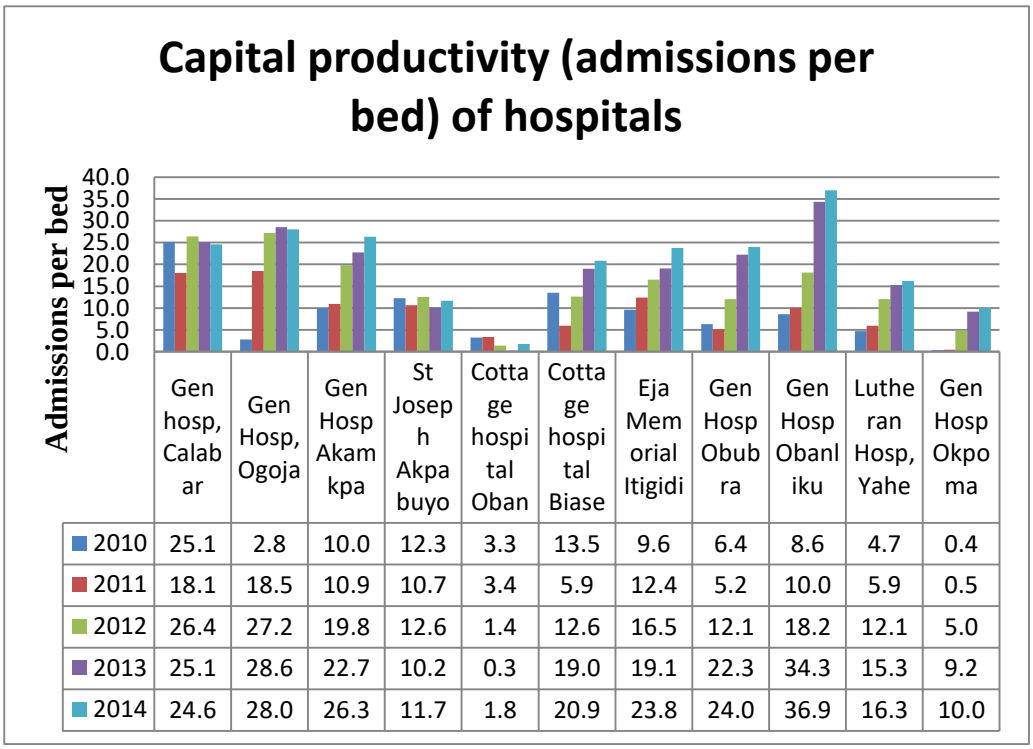


Figure 8: Capital Productivity; A Comparison of Rural and Urban Hospitals

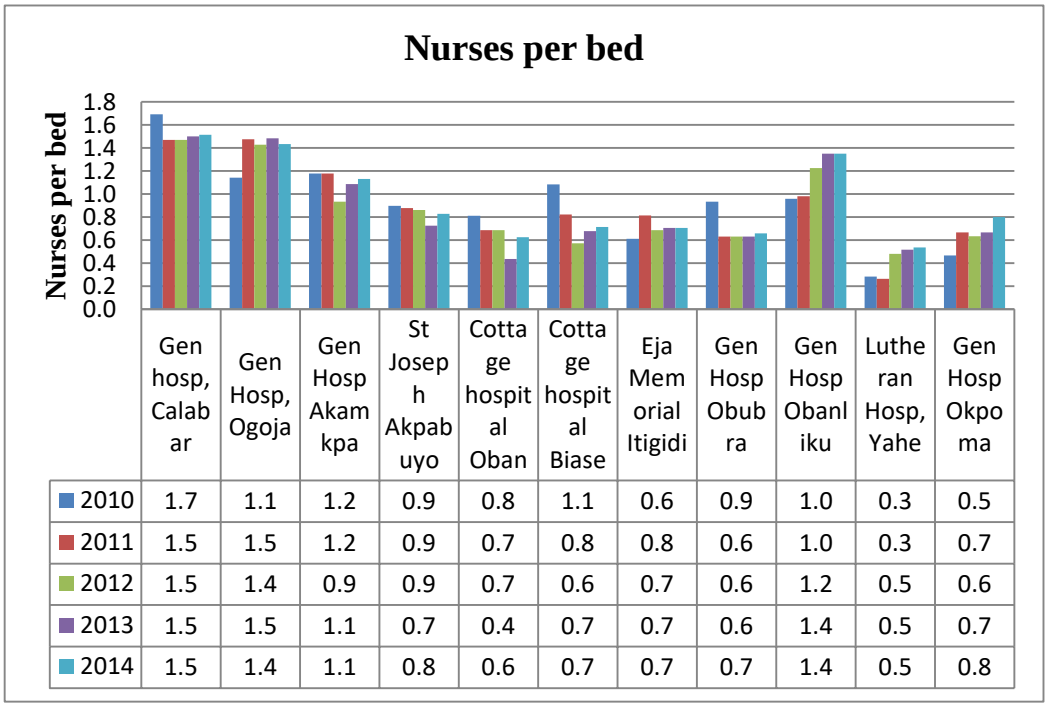


	Gen hosp, Calabar	Gen Hosp, Ogoja	Gen Hosp Akamkpa	St Joseph Akpabuyo	Cottage hospital Oban	Cottage hospital Biase	Eja Memorial Itigidi	Gen Hosp Obubra	Gen Hosp Obanliku	Lutheran Hosp, Yahe	Gen Hosp Okpoma
2010	25.1	2.8	10.0	12.3	3.3	13.5	9.6	6.4	8.6	4.7	0.4
2011	18.1	18.5	10.9	10.7	3.4	5.9	12.4	5.2	10.0	5.9	0.5
2012	26.4	27.2	19.8	12.6	1.4	12.6	16.5	12.1	18.2	12.1	5.0
2013	25.1	28.6	22.7	10.2	0.3	19.0	19.1	22.3	34.3	15.3	9.2
2014	24.6	28.0	26.3	11.7	1.8	20.9	23.8	24.0	36.9	16.3	10.0

Figure 9: Capital Productivity of Hospitals in Cross River State; 2010-2014

Structural Quality Indicators

These indicators do not directly measure productivity but can affect hospital performance and represent factors that may be relevant for policy formulation. In this study, two of such indicators are explored which are number of nurses per bed and number of doctors per bed



	Gen hosp, Calabar	Gen Hosp, Ogoja	Gen Hosp Akamkpa	St Joseph Akpabuyo	Cottage hospital Oban	Cottage hospital Biase	Eja Memorial Itigidi	Gen Hosp Obubra	Gen Hosp Obanliku	Lutheran Hosp, Yahe	Gen Hosp Okpoma
2010	1.7	1.1	1.2	0.9	0.8	1.1	0.6	0.9	1.0	0.3	0.5
2011	1.5	1.5	1.2	0.9	0.7	0.8	0.8	0.6	1.0	0.3	0.7
2012	1.5	1.4	0.9	0.9	0.7	0.6	0.7	0.6	1.2	0.5	0.6
2013	1.5	1.5	1.1	0.7	0.4	0.7	0.7	0.6	1.4	0.5	0.7
2014	1.5	1.4	1.1	0.8	0.6	0.7	0.7	0.7	1.4	0.5	0.8

Figure 10: Number of Nurses Per Bed

Seven hospitals had a drop in the number of nurses per bed while four had improvements in this ratio. Five of the hospitals with deterioration in nurses/bed ratio are rural while two are urban. A comparison of the urban–rural ratio for this indicators shows that urban hospitals are more productive with an average productivity of 1.4 while that of rural hospitals is 0.7. Virtually all the hospitals had no change in the number of doctors per bed due to the small number of doctors and the negligible change in number each year for the period of this analysis.

Summary of findings

The study found a general decline in the size (using number of beds) of hospitals by 3.4% and this is more in rural hospitals. There was an increase in the number of employees by about 13% with high concentration of these employees in urban hospitals. Admissions in public hospitals rose by over 100 per cent during the period with rural hospitals witnessing a higher increase. Two hospitals in northern senatorial district and one in the central had the highest rise in admissions while the three hospitals with the lowest admission increase are located in the southern senatorial district.

The labour productivity using admissions per employee shows that nine hospitals had improvements while three had decline for the period 2010-2014. Rural hospitals were more productive than urban hospitals. Productivity using admissions per nurse indicates that ten out of eleven hospitals had productivity improvements and rural hospitals were relatively more productive than urban hospitals. Capital productivity using admissions per bed indicates productivity improvements for nine hospitals with rural hospitals being more productive. In the structural quality indicator using number of nurses per bed, urban hospitals were more productive than rural hospitals.

Individual hospital analysis showed that the three hospitals with the highest consistent productivity improvements for four indicators (admissions per employee, admissions per nurse, admissions per bed and nurse per bed) are General hospital, Obanliku (with best improvement in capital productivity and hospital quality indicator); General hospital Obubra (with best indicator in the two labour productivity indicators) and General Hospital, Ogoja (second best improvement in capital and hospital quality productivity indicators). Conversely, hospitals with the worst productivity improvements or even decline in productivity for all indicators are Cottage hospital, Oban, St Joseph hospital Akpabuyo and General hospital, Calabar.

Relatively more hospitals had productivity improvements for four indicators (33 hospitals for 4 indicators) than those with decline or no productivity change (13) during the period of the study. Rural hospitals were more productive in the two labour productivity indicators than urban hospitals while the reverse was the case for the capital and hospital quality indicator. This

result shows that rural hospitals substitute more labour for capital while urban hospital (though with a higher percentage of the human resources for health) substitute capital for labour.

Conclusion and recommendations

The study analysed labour productivity using number of admissions per employee and number of admissions per nurse; capital productivity using number of admissions per bed; and structural quality indicators using number of nurses per bed and number of doctors per bed. There were productivity improvements for nine hospitals in admissions per bed and ten for admissions per nurse while productivity was static or declined in three and one hospital respectively for these labour productivity indicators. Nine hospitals witnessed capital productivity improvements while five had improvements in hospital quality. Rural hospitals were more labour productive while urban hospitals were more capital productive showing a relatively higher improvement in quality. The relative low productivity of labour in urban hospitals, with more employees, points to some level of labour redundancy in these hospitals which may result in wastage of resources spent on human personnel without a commensurate input in terms of man hours. Capital provision in rural hospitals, labour and hospital quality productivity improving measures such as remuneration for hours of work done and specialized staff/nursing training could enhance productivity of public secondary care hospitals in the state.

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APPENDICES

One: Average Hospital size (number of beds) of Public Secondary Care Hospitals in Cross River State 2010-2014

Hospital	**Year**					**Total**	**Overall**
	2010	**2011**	**2012**	**2013**	**2014**		
General hospital, Calabar	120	138	138	138	138	672	134.4
General Hospital, Ogoja	105	105	105	105	108	528	105.6
General Hospital Akamkpa	45	45	46	46	46	228	45.6
St Joseph Akpabuyo	58	58	58	58	58	290	58
Cottage hospital Oban	16	16	16	16	16	80	16
Cottage hospital Biase	24	28	28	28	28	136	27.2
Eja Memorial Itigidi	67	43	48	58	58	274	54.8
General Hospital Obubra	60	76	76	76	76	364	72.8
General Hospital Obanliku	50	50	40	40	40	220	44
Lutheran Hospital, Yahe	102	102	56	56	56	372	74.4
General Hospital Okpoma	30	30	30	30	30	150	30
Total	677	691	641	651	654	3314	662.8
Overall	62	63	58	59	60	302	60.4

Source of data: Cross River State Ministry of Health, Calabar

Two**: Total Employees of Secondary Care Hospitals in Cross River State 2010-2014**

Hospital	Year					Total	Overall
	2010	2011	2012	2013	2014		
General hospital, Calabar	353	327	350	358	361	1749	349.8
General Hospital, Ogoja	223	266	263	267	263	1282	256.4
General Hospital Akamkpa	73	105	91	101	104	474	94.8
St Joseph Akpabuyo	82	82	71	73	79	387	77.4
Cottage hospital Oban	23	25	25	21	24	118	23.6
Cottage hospital Biase	43	59	49	55	54	260	52
Eja Memorial Itigidi	61	72	70	79	79	361	72.2
General Hospital Obubra	74	83	85	83	84	409	81.8
General Hospital Obanliku	68	72	72	77	76	365	73
Lutheran Hospital, Yahe	53	53	53	56	57	272	54.4
General Hospital Okpoma	33	41	44	45	45	208	41.6
Total	1086	1185	1173	1215	1226	5885	1177
Overall	98.7	107.7	106.6	110.4	111.4	534.8	106.96

Source of Data: Cross River State Ministry of Health, Calabar

Three: Total Admissions of Secondary Care Hospitals in Cross River State 2010-2014

S/n	Hospital	Year					Total	Overall
		2010	2011	2012	2013	2014		
1	General hospital, Calabar	3008	2496	3640	3466	3392	16002	3200.4
2	General Hospital, Ogoja	295	1944	2859	2998	3028	11124	2224.8
3	General Hospital Akamkpa	449	491	910	1045	1210	4105	821
4	St Joseph Akpabuyo	711	618	729	589	678	3325	665
5	Cottage hospital Oban	52	54	23	4	28	161	32.2
6	Cottage hospital Biase	325	166	353	532	584	1960	392
7	Eja Memorial Itigidi	645	535	792	1107	1380	4459	891.8
8	General Hospital Obubra	381	392	917	1691	1821	5202	1040.4
9	General Hospital Obanliku	429	502	726	1373	1477	4507	901.4
10	Lutheran Hospital, Yahe	484	605	675	857	910	3531	706.2
11	General Hospital Okpoma	12	15	149	276	299	751	150.2
	Total	6791	7818	11773	13938	14807	55127	11025.4
	Overall	617.4	710.7	1070.3	1267.1	1346.1		

Source of Data: Cross River State Ministry of Health, Calabar

Four: Hospitals with best Improvements and Slow Improvements/Decline in Productivity for all Indicators

Productivity indicator	Best improvements	Average ratio	Slow improvements/ decline	Average ratio
Admissions per Employee	Gen hosp Obubra	16.53	Cottage hosp. Oban	-48.4
	Gen hosp. Obanliku	13.13	St Joseph Akpabuyo	-1.0
	Gen hosp. Ogoja	10.19	Gen hosp. Calabar	0.87
Admissions per Nurse	Gen hosp Obubra	29.62	Cottage hosp. Oban	-1.2
	Gen hosp. Obanliku	18.41	St Joseph Akpabuyo	0.45
	Gen hosp. Itigidi	17.93	Gen hosp. Calabar	1.4
Admissions per bed	Gen hosp. Obanliku	28.3	Cottage hosp. Oban	-1.5
	Gen hosp. Ogoja	25.2	St Joseph Akpabuyo	-0.6
Nurses per Bed	Gen hosp Obubra	17.6	Gen hosp. Calabar	-0.5
	Gen hosp. Obanliku	0.4	Cottage hosp. Oban	-0.2
	Gen hosp. Ogoja	0.3	Cottage hosp. Biase	-0.4
	Gen hosp. Okpoma	0.3	Gen hosp. Obubra	-0.3

Source: Authors Computation Using Field Data

Five: Number of Hospitals with Productivity Improvements and Decline Per Indicator

S/n	Productivity indicator	No. of hosp. with improvements	No of hosp. static or decline
1	Admissions per Employee	9	3
2	Admissions per Nurse	10	1
3	Admissions per bed	9	3
4	Nurses per Bed	5	6
	Total	**32**	**13**

Source: Authors Computation Using Field Data