

Spatial Cost Effectiveness in the Location of Regional Infrastructure – the Case of University of Nigeria Teaching Hospital, Enugu, Nigeria

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Key words: Accessibility, Location, Infrastructure, Regional Development, Spatial Cost, Health Institution, Teaching Hospital.

SUMMARY

The study examined the spatial cost effectiveness in the location of University of Nigeria Teaching Hospital, Enugu, Nigeria (UNTH, Enugu). Using random sampling technique, it systematically sampled 443 respondents through administration of two sets of structured questionnaires to both staff and patrons of the health institution respectively. Crosstabulation was used to interpret the distance decay effects of patronage in relation to income of respondents while chi square and correlation matrix were employed to establish the effects of locations where respondents hailed from on their level of patronage in UNTH, Enugu, Nigeria. Findings revealed that groups of respondents earning highest monthly income {37,500-45,000 Naira (6.6%) and above 45,000 Naira (0.7%)} hailed from distant locations of 500-1000 kilometres to where the teaching hospital was located. Nearly half of the residents earned below 22,501 Naira monthly and hailed from locations less than 501 kilometres from the teaching hospital. This indicates that only the poor people located close to UNTH, Enugu could afford to patronize the hospital.

The correlation matrix shows a negative correlation of -0.0240 at a significant level of 0.000 between distance and hospital patronage. A negative correlation of -0.197 at a significant level of 0.000 also existed between distance and frequency of visit. Again, the table shows a negative correlation of -0.087 with a significance level of 0.067 between transport cost distance to UNTH, Enugu. These show that there was a significant relationship between distance and patronage as at the time of this study. The negative correlation deduces that a decrease in distance leads to an increase in patronage, and that due to increase in transport cost.

Similarly, a unit increase in distance and transport cost leads to a decrease in patronage. This also shows that patrons would travel to hospitals that were nearest to their residential locations where transport cost is least. The calculated Chi-square value of 85.27 was significant at 0.004 level which was less than 0.05. These show that there was a significant relationship between distance and patronage of respondents in UNTH, Enugu. The paper recommended that the income of residents among others in their socio economic attributes should be considered in locating regional infrastructure that intends to have higher order of coverage in its services to the people.

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INTRODUCTION

Teaching hospitals serve as medical training institutions and welfare centres to residents in its geographic space. They are referral points where patients with chronic and life threatening health problems are referred to from both public and private health clinics and hospitals in a region (Duckett, 2000). Their scope as training centres transcends regional boundaries of their existences. Their location therefore should be strategic because they are higher order service providers in supra urban space (Christaller, 1933; Hanmer et al, 2000 and Idachaba, 1985).

Spatial accessibility of health institutions in developing nations call for serious considerations more than their counterpart countries in developed world. Accessibility either by roads, water or air is a problem in Africa . Patients in critical health needs must find easy accessibility to health institutions in the caliber of teaching hospitals (Weiss et al, 1966; Hall et al, 2005) Besides, poor health facilities in Africa threatens their populations and risks lives of both old and young (Akinola, 1997). The existence of any health centre of higher service like that of teaching hospitals must be maximally utilized to reduce mortality rate.

In a continent where over half of the populations live below one dollar per day (Adeyinka *et al*, 2006), spatial location of teaching hospitals without serious consideration to the economy of the people is meaningless. This is because the poor might also be unwilling to go to higher order medical centres for the fear of being heavily billed. Even where treatment is made free, they must be able to afford transportation cost before free health care could be enjoined. Ordinarily, inadequate infrastructure in Africa is a manifestation of their poverty (Abegunde, 2006) and also a serious threat to their social and economic development (Wimberly, 1993). In a continent where inadequate infrastructure is the order of the day, the advantage of having teaching hospital complex must not be underutilized. This paper therefore attempted to assess the spatial cost effectiveness of the location of the University of Nigeria Teaching Hospital in Enugu, Nigeria. It has the aim of appraising the spatial location of the hospital to the economic capability of its patronizes within its region of existence.

INFRASTRUCTURE AND SUSTAINABLE REGIONAL DEVELOPMENT

Idachaba (1985) sees infrastructure as physical, social and institutional forms of capital, which aid production distribution and consumption activities as well as enhancing the quality of life. He classifies infrastructure into three broad groups namely: physical, social and institutional infrastructures. Physical infrastructure include transportation, processing, storage, irrigation and soil conservation. Social infrastructure are health, education, water and electricity while institutional infrastructure are cooperative societies, financial institutions,

agricultural research extension and training, market post and telecommunication facilities. These basic services and facilities provide an environment for productive activities of individuals and groups in human society (Bhalla, 2000). Significant in this is that location of infrastructure aids socio-economic growth and development of a region.

In other dimension, infrastructure can serve as tool in reducing poverty, sustain growth and promote regional development. This could be why Abumere et al (2002) opined that any programme for poverty reduction or indeed for the overall regional development cannot succeed unless supported by infrastructure. It was noted by Akinola (1997) that people in the awkward regions are poor because they do not have access to basic necessary infrastructure. Bhalla (2000) showed how poverty is manifested in the regions of Africa by inadequate infrastructure like safe drinking water, sanitation, housing, health, electricity, school and training institutions. For example, unsafe drinking water, lack of sanitation and unhygienic housing are directly related to the prevalence of water borne, human waste related and air borne disease like dysentery, cholera, diarrhea, tuberculosis, bronchitis, influenza, measles and malaria. He stated further, that whenever any of such diseases, attacks the rural people, there is drastic reduction in productivity and the resultant effect is poverty.

Poverty also is the main cause of rural-urban migration. Provision of infrastructure is important for the improvement of welfare on standard of living in any given region (Abegunde, 2006). Significant in these arguments is that infrastructure aids sustainable regional planning and development.

ACCESSIBILITY AND SPATIAL COST IN THE LOCATION OF HEALTH INSTITUTIONS WITHIN GEOGRAPHIC SPACE.

The argument that location influences the use of medical facility within region is not new in the literature. Distance to health service has long been recognized as an important factor in access to care with numerous studies describing an inverse relationship between distance and utilization. Jong *et al* (2004) showed that people living in areas of Australia with limited access to services have poorer health than people living in metropolitan areas.

Jones *et al* (1988) examined the relationship between asthma mortality and access to health services. Their finding was that asthma mortality relationship between geographic proximity to services, and mortality has also been demonstrated for ischaemic heart disease in Australia.

In that study, Hall *et al* (2005) found that locational accessibility has a significant effect on patterns of surgical care in people with colorectal cancer. Sexton *et al* (2000) in a related study found out that populations living outside capital cities have higher death rates than those living in capital cities in Australia.

Hall *et al* (2005) concluded that locational accessibility to services is generally not an independent predictor of utilization of medical institutions, but it is a variable that accounts

for 50% of usability. Accessibility to medical facilities is a multidimensional variable that plays a central role in the behavioral model of health service utilization.

The definition of accessibility has been refined in the medical geography literature, by distinguishing between potential and realized accessibility. Potential accessibility refers to the locational relationship between service providers (hospitals) and surrounding populations. The actual utilization patterns of these facilities form the basis for revealed accessibility, (Love and Lindquist, 1995).

Some authors considered the cost of patronizing hospitals with space Coory *et al*, 2002; Hall *et al*, 2004; Hall *et al*, 2005; Mitropoulos *et al*, 2006). According to them, they examined the socio economic attributes of the patients. These include income, education, occupation, age and gender. They believed that these influenced the choice of and degree of patronizing hospitals in a region. Coory *et al* (2002) was one of such writers. He investigated the effects of socio economic status and location on utilization of hospital. The authors found wide disparities in access. They concluded that free access to health care did not necessarily ensure equitable access. Hall *et al* (2004) examined the influence of social, economic and locational disadvantage on lung and breast cancer patients in West Australia. Their finding was that survival was poorer in patients treated in public hospitals socio economic groups.

Mitropoulos *et al* (2006) also noted that patients preferred to use local health centres than those of higher order and therefore propose a mathematical programme model for locating hospitals and primary health care centres within regions. According to them, this model would assist patients in considering travel cost in patronizing hospitals of close proximities. This indicate that hospital accessibility is significant in its spatial planning.

Two variables should be considered in analyzing hospital accessibility and spatial cost effect on residents. Mitropoulos *et al* (2006) identified these variables as minimization of distance between patients and facilities, and equitable distribution of the facilities among residents. Consideration of these variables will enable researchers to introduce a new aspect to location problem, namely public preferences and decentralization of the health care system. This study is an empirical contribution to spatial cost effects of the location of hospitals on residents.

METHOD OF STUDY

Data for this study were derived from primary source. The primary data was obtained through preparation and administration of structured questionnaires. The questionnaires were structured in two parts. They were administered on staff and residents that patronize the hospital as the time of this study.

A total of 450 questionnaires were distributed to 20% of the sample frame. Only 443 questionnaires were retrieved. The sampled units were systematically selected and the questionnaires administered randomly to 20% of the population. Table 1 shows that the questionnaires were distributed within the hospital units as follows. The consultants and

nurses had 35 and 50 questionnaires respectively. Only 33 questionnaires were retrieved from the nurses. Administrative offices had 30 questionnaires. Patients' wards had the highest number of the questionnaires. They had 204 questionnaires, out of which 200 were retrieved. The outpatients' clinics where new patients were treated before they were allocated to consultants had 101 questionnaires,. Only 100 were retrieved in this section. Visitors who came to the hospital for one reason or the other had 30 questionnaires. In all, 450 respondents were selected out of 2,250 sampling frame. Only 443 questionnaires were retrieved from the respondents. This study was based on the 443 respondents that positively responded during the interview.

Data retrieved were compiled and coded using the Statistical Packages for Social Statistics (SPSS) software. Analyses of the relationship among the different variables were interpreted descriptively and inferentially. Cross tabulation was used to interpret the distance decay effects of patronage in relation to income of respondents. The study also used chi square and correlation matrix to establish the effects of locations where respondents hailed from on their level of patronage in UNTH, Enugu, Nigeria.

Table 1: Sample Selection and Questionnaires Administered in University of Nigeria Teaching Hospital, Enugu.

Sample Size	Sampling Frame	Sample Size	Questionnaires Retrieved
Consultants Offices	175	35	33
Nurses Officer	250	50	50
Administrative Officer	150	30	30
Patients Wards	1,020	204	200
Outpatient Clinic Rooms	505	101	100
Visitors	150	30	30
Total	2,250	450	443

Source: Field survey Data, 2007

FINDINGS AND DISCUSSIONS

Income by Distance from Resdents of Respondents in the Study Area

Table 2 shows that groups of residents earning highest monthly income {37,500-45,000 Naira (6.6%) and above 45,000 Naira (0.7%)} in the study hailed from distant locations of 500-1000kilometres to where the teaching hospital is located. Nearly half of the residents earned below 22,501 Naira monthly and hailed from locations less than 501kilometres from the teaching hospital. This indicates that income of respondents in Nigeria University Teaching Hospital affected their patronage in the study area. In other words, poor people located far from UNTH could not afford to patronize the hospital.

Table 2: Crosstabulation of Income by Distance from Residences to UNTH Enugu.

Distance (Kilometre)	Income (Naira)							No response	Total
	Below 7,500	7,500-15,000	15,000-22,500	22,500-30,000	30,000-37,000	37,500-45,000	Above 45,000		
0-200	54(12.0%)	14 (3.2%)							68 (15.2%)
201-500		41 (9.3%)	79 (17.8%)	17 (3.8%)	1 (0.2%)				138 (31.1%)
501-1000				45 (10.2%)	33 (7.5%)	29 (6.6%)	3 (0.7%)	100 (22.6%)	210 (47.6%)
Above 1,000								27 (6.1%)	27 (6.1%)
Total	54 (12.0%)	55 (12.5%)	79 (17.8%)	62 (14.0%)	34 (7.7%)	29 (6.6%)	3 (0.7%)	127 (28.7%)	443 (100%)

Source: Field Survey Data, 2007.

Relationship Existing between UNTH Enugu and Level of Patronage of Respondents

Similarly, table 3 reveals the correlation matrix of the patronage factors in the study area. The table shows the quantitative measure of the level of relationships among the factors that affect the patronage of UNTH Enugu. The patronage factors include the socio-economic characteristics of the patrons and other relevant factors. These include education, income, residential location, transport cost, gender among others.

In order to investigate the relationship existing between location and patronage of the study area, four major factors were chosen from the variables. These are factor 1, 2, 3, and 11, which stand for hospital patronage, frequency of visit, transport cost from patrons' residences, and distances from patrons' residences respectively. These are the major location factors that affected the patronage of UNTH Enugu as at the time of this study. In table 4, factor 1 is the dependent variable, while factors 2, 3, and 11 are the independent variables.

As observed earlier in table 2, tables 3 and 4 also reveal that distance was significant factor of patronage. The correlation matrix shows a negative correlation of -0.0240 at a significant level of 0.000 between distance and hospital patronage. A negative correlation of -0.197 at a significant level of 0.000 also existed between distance and frequency of visit. Again, the table shows a negative correlation of -0.087 with a significance level of 0.067 between transport cost distance to UNTH, Enugu. These show that there was a significant relationship between distance and patronage as at the time of this study. The negative correlation deduces that a decrease in distance leads to an increase in patronage, and that due to increase in transport cost. Similarly, a unit increase in distance and transport cost leads to a decrease in patronage. This also shows that patrons would travel to hospitals that were nearest to their residential locations where transport cost is least.

Table 5 presents the report of Chi-square tests of significance for distance and frequency of visit. From the table, $X^2 = (85.27; P < 0.05)$. This shows that the calculated Chi-square value

of 85.27 is significant at 0.004 level which is less than 0.05. This implies that a significant

	1	2	3	4	5	6	7	8	9	10	11	12
1	1.00											
2	0.44	1.00										
3	0.27	0.06	1.00									
4	-0.22	-0.09	0.12	1.00								
5	0.16	0.26	0.13	-0.08	1.00							
6	-0.01	-0.13	0.05	0.00	0.06	1.00						
7	-0.03	-0.07	-0.06	-0.08	-0.02	-0.17	1.00					
8	0.09	0.09	0.10	-0.01	0.04	-0.03	-0.04	1.00				
9	0.08	-0.06	0.07	0.11	0.02	0.15	0.28	0.23	1.00			
10	-0.07	0.02	0.15	0.00	0.03	-0.23	0.55	0.11	-0.19	1.00		
11	-0.24	-0.20	-0.09	0.24	-0.15	0.15	-0.08	-0.04	0.22	0.00	1.00	
12	0.01	-0.05	0.06	0.20	-0.20	0.12	0.08	-0.02	0.28	-0.08	0.09	1.00

relationship exist between frequency of visit and hospital patronage.

Table 3: Correlation Matrix of the Factors that affect the Patronage of UNTH, Enugu

Key

- | | |
|-----------------------|------------------------|
| 1. Hospital Patronage | 2. Patronage Frequency |
| 3. Transport Cost | 4. Education |
| 5. Income | 6. Services Received |
| 7. Age | 8. Mode of Transport |
| 8. Occupation | 10. Purpose of Visit |
| 11. Distance | 12. Gender |

Table 4: Correlation Matrix of the four factors influencing Patronage in UNTH, Enugu, Nigeria.

	Hospital Patronage	Patronage Frequency	Distance	Transport Cost
Hospital Patronage	1.00			
Patronage Frequency	0.438	1.00		
Distance	-0.240	-0.197	1.00	
Transport Cost	0.274	0.058	-0.087	1.00

Source: Author's Field survey, 2007

Table 5: Chi-Square Test of Significance of Distance and Frequency of Visit in UNTH, Enugu.

	Value	Df	Significance
Pearson Chi-square	85.268	54	0.004
Likelihood Ratio	93.222	54	0.001
Linear by linear Association	0.405	1	0.524

No of valid cases	443	-	-
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Source: Field Survey Data, 2007.

CONCLUSION AND RECOMMENDATIONS.

The study examined the spatial cost effectiveness in the location of University of Nigeria Teaching Hospital, Enugu, Nigeria (UNTH, Enugu). Using random sampling technique, it systematically sampled 443 respondents through administration of two types of structured questionnaires to both staff and patrons of the health institution respectively. Crosstabulation was used to interpret the distance decay effects of patronage in relation to income of respondents while chi square and correlation matrix were employed to establish the effects of locations where respondents hailed from on their level of patronage in UNTH, Enugu, Nigeria.

Findings revealed that poor people locates far from UNTH, Enugu could not afford to patronise the hospital. This is because nearly half of the residents earned below 22,501 Naira monthly and hailed from locations less than 501kilometres from the teaching hospital.

The correlation matrix shows a negative correlation of -0.0240 at a significant level of 0.000 between distance and hospital patronage. A negative correlation of -0.197 at a significant level of 0.000 also existed between distance and frequency of visit. Again, the table shows a negative correlation of -0.087 with a significance level of 0.067 between transport cost distance to UNTH, Enugu. These show that there was a significant relationship between distance and patronage as at the time of this study. The negative correlation deduces that a decrease in distance leads to an increase in patronage, and that due to increase in transport cost.

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BIOGRAPHICAL NOTES

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