Research Article

Evaluation of the Cost of Therapy in the Management of Ear, Nose and Throat Infections in a Nigerian Teaching Hospital

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ABSTRACT: To determine cost of therapy to patients of Ear Nose and Throat infections in a Nigerian teaching hospital. A retrospective drug utilization evaluation in conjunction with Cost of Illness Analysis was used. One hundred and twenty two (122) randomly selected case notes containing 182 prescriptions of patients with Ear, Nose and Throat infections over one year period between year 2005 and 2006 were examined. Relevant data including demographics, diagnosis, prescribed drugs, and dosages were extracted and the associated costs; direct and indirect were evaluated. Disease occurrence was significantly higher among children of age group 0-10 years (59.3%). Otitis media was the most prevalent and occurred among 82(45.0%) patients followed by bronchopneumonia which occurred among 70 (38.5%) patients. The overall average antibacterial cost of ENT infections per patient (n=122) was NGN2940.49 (US$22.62). Bronchopneumonia and otitis media; the most frequent had average antibacterial costs per patient of NGN3675.41(US$28.27) and NGN823.27 (US$6.33) respectively. Antibacterial cost for bronchopneumonia represents 71.7% of the total antibacterial cost. Bronchopneumonia has the highest overall average cost of therapy of NGN5028.88±1393.50 (US$36.68). Antibacterial cost constitute the highest cost component (64.37%) followed by indirect cost (loss productivity) of (18.50%). Cost of therapy for these infections to patients and the nation at large is huge. Brochopneumonia treatment constitutes the greater proportion of this cost which needs to be closely evaluated.

Keywords: Pharmacoeconomics**,** Cost of illness Analysis, Antibacterial utilization, Infectious diseases, Antibacterial Cost

INTRODUCTION

Health reforms are taking place worldwide and limited resources are being used wisely even before the global economic meltdown which further compounded the financial picture. In developing countries like Nigeria, economic based operational researches to improve efficiency are rear. In addition, corruption and poor governance in the health system has led to many unproductive investment and wasteful practices in the health care sector in many developing countries (Sitthiamorn *et al* , 2001), which have contributed to the lingering problems of funding.

To provide the best value for money through outcome oriented health care interventions and to generate evidence-based information for formidable policy in health reforms, economic evaluation of therapy is a necessity particularly for infectious diseases because of their externality, cost implications and development of antibacterial resistance.

Ear, Nose and Throat infections such as otitis media, bronchopneumonia affects a good proportion of the masses and need urgent attention. Amusa *et. al.* (2005) reported an annual incident rate of otitis media of about 29.0% in children below 5 years of age in South Western Nigeria. Twenty Nine per cent under 5 years of age represents about 7.7 million cases in Nigeria. The cost of therapy in such a large number of patients is likely to be a sizeable proportion of the

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budget and is worth investigating. In the United States, acute otitis media (AOM), or inflammation of the middle ear has been reported to be responsible for 13.6 million paediatric office visits annually (CDC, 1995). An annual cost implication of $2.98 billion was estimated for these visits in 1995 alone (Takata *et al*, 1995). Such data if available in developing countries and are evidence based are useful tools in policy formulation for planning and intervention. Economic burden of infectious diseases among others is a major threat towards the attainment of health related Millennium Development Goals in developing countries particularly for populous ones like Nigeria.

Cost of Therapy also known as Cost of Illness Analysis implies the cost of the disease in question to the society at any point in time or over a period of time. It analyses only the cost and health outcomes are not evaluated (Drummond, 2005). It is the only pharmacoeconomic method that gives a comprehensive picture of the cost implications of disease conditions, from where the national cost implications could be calculated taking the incidence or prevalence rate into consideration. According to Joel and Segel (2006), Cost-of-illness studies measure the economic burden of a disease or diseases and estimate the maximum amount that could potentially be saved or gained if a disease were to be eradicated. Cost obtained from cost of illness analysis can also be used in Cost Effectiveness and Cost Benefit Analysis. Cost components in a typical Cost of illness analysis include direct and indirect
costs.

Direct cost of illness is expenditures for medical goods and services. Direct costs are further classified as direct medical and direct non-medical costs depending on whether resources has been expended directly or indirectly in production of a treatment. Examples of direct medical cost include cost of medications, consultations, consumables while those of direct non-medical include transportation to clinic, relocation expenses, home modifications for in-house dialysis among others. Indirect costs are productivity losses-the opportunity cost. These are the labour earnings that are forgone as a result of an adverse health outcome. The decrease productivity can be a result of illness, death, side effects, or time spent receiving treatment.

Indirect costs include lost earnings and productivity of both patients and family members or other caregivers who take care of them. The perspective of the study determines the cost inclusion criteria. Perspective refers to the vantage position being considered in the evaluation. These may be societal (all encompassing), hospital, third party, patient or government.

In this study, the cost of therapy to patients in the chosen health facility and the nation at large which could be useful in making decisions and policy formulation is evaluated..

METHODOLOGY:

Setting: The study was carried out in the 764-bed Lagos University Teaching Hospital, Nigeria; a tertiary health care centre. The hospital comprises of Accident and Emergency Unit, In-patient and General out-patient units. The total patients turn over in the hospital is about 10,000 monthly. The various specialities and wards as well as diagnostic facilities typical of teaching hospitals are present. Antibacterial agents if indicated are prescribed in all the departments for surgical and medical cases. Each of the hospital unit has a pharmacy unit attached.

Study design: The design was a retrospective drug utilization evaluation in conjunction with a pharmacoeconomic methodology referred to as Cost of Therapy or Cost of Illness Analysis.

Study population: One hundred and twenty two (122) randomly selected case notes containing 182 prescriptions of patients with Ear, Nose and Throat infections over one year period between year 2005 and 2006.

Perspective of analysis: The vantage position (the view point) of the study was societal perspective in which case direct and indirect costs were included as cost components.

Cost components
Drug acquisition cost -hospital value or average wholesale price
Personnel cost -Stop-time watch studies and standard cost accounting technique was used
Diagnostic Test (s) *cost*- hospital value
Transport cost- based on patient residence as evident from the case notes and transport tariff in Lagos metropolis
Indirect cost - human capita method (Hodgson and Meiners, 1982) was used. Cost due to loss of productivity as a result of hospital attendance; calculated based on time spent in the hospital and loss earnings on a 40-hour, 5 day working week.

Calculation of personnel cost: Time and Motion Studies was used in conjunction with standard cost accounting technique (Taylor *et al* 1997). Average time for 15 random observations for completion of tasks

such as consultation, dispensing and drug administration that are not directly monetised was determined and recorded. The salaries of health professionals were obtained from the accounts department of the hospital, average considered where necessary and the mean salary per minute calculated taking the total inputted hours into consideration.

Mean salary/min = $\dfrac{\text{annual salary}}{\text{Hours/wk x no of wks/annum x 60}}$

Pharmaco-economic comparators: Cost of Illness Analysis is not a comparative economic evaluation and therefore emphasis is not on different comparators. The focus is to know the comprehensive sum total/average cost of therapy base on the various inputs from where the regional or national cost implication can be estimated, taking the prevalence rate of disease in question into consideration. However, different comparators will lead to different drug acquisition cost, varied duration of therapy among others which may be sometimes taken care of by sensitivity analysis in pharmacoeconomic context if applicable.

Outcome measures: Clinical and economic outcome variables were considered. The clinical outcome of therapy was an assumed eradication of bacterial infections which in turn improved the patient quality of life. Economic outcomes include both direct and indirect costs as stated under cost components. There was no adjustment for discounting and inflation for the raw data as in the Tables and the exchange rate between the Nigerian naira or NGN and United States dollars or US$ at the time of analysis was used for consistency.

Data collection: Relevant data such as date of visit, demographics, diagnosis, type of diagnostic test, prescribed drugs, dosages, frequency of dosing and duration of therapy were extracted from the patient case notes. Follow-up visit if any, test of cure (a repeat diagnostic test within a month of therapy to ascertain complete eradication of infection or otherwise) were also noted and recorded using an appropriately designed and validated data collection forms.

Data analysis: The collected data were analysed using Epi Info (CDC, 2002). Mean cost per defined daily dose (C/DDD) and the total cost of antibacterial agents per visit for each patient were computed. Defined daily dose has been recommended for cost analysis of drugs (Neithimer, 1986). Descriptive statistics of means and percentages were used in the presentation of results. Data in proportion were analysed using chi square test and Fisher's exact test for small numbers while mean costs were compared using student 't' test. At 95% confidence interval, a 2-tailed p-value less than 0.05 was considered significant.

Discounting of cost to obtain the present value: To obtain the present value, the overall cost implications was discounted at a rate of three percent as recommended by Centre of Disease Control over five years period. The cost in year 2006 was divided by discount factor (df=0.8626 at r =3%, n=5 years) (CDC, 2010) to get the corresponding value for 2010. It should be noted that the raw data without discounting were used in the tables, the reason being that different researchers or policy makers may prefer different discounting parameters (discount rate or year)

RESULTS

Demographic data and hospital visit

Disease occurrence was significantly higher among children of age group 0-10 years (59.3%) as compared to any other age group ($p<0.05$, χ^2). There was no significant difference between male (57.7%) and female (42.3%) patients ($p<0.05$, χ^2) Follow-up visits to the hospital by patients (33.0%) was significantly lower than first visits (67.0%) by patients ($p<0.05$, χ^2) (Table 1)

Table 1: Demographic data and hospital visit among ENT Infections Patients

Age (Years)	Sex		Visit		Totaln (%)
	Male n (%)	**Female n (%)**	**First n (%)**	**Follow-up n (%)**	
0-10	66 (36.2)	42 (23.1)	65 (35.7)	43 (23.6)	108 (59.3)
11-20	4 (2.2)	5 (2.8)	8 (4.4)	1 (0.5)	9 (4.9)
21-30	9 (4.9)	13 (7.1)	20 (10.9)	2 (1.1)	22 (12.1)
31-40	15 (8.2)	5 (2.8)	18 (9.9)	2 (1.1)	20 (10.9)
41-50	2 (1.1)	3 (1.6)	5 (2.7)	0 (0.0)	5 (2.7)
51-60	3 (1.6)	9 (4.9)	4 (2.2)	8 (4.4)	12 (6.6)
>60	6 (3.3)	0 (0.0)	2 (1.1)	4 (2.2)	6 (3.3)
Total	**105 (57.7)**	**77 (42.3)**	**122 (67.0)**	**60 (33.0)**	**182 (100.0)**

ENT = Ear, Nose and Throat

Table 2:
Cost of antibacterial agents for each disease condition

Disease condition	Number of prescriptions n (%)	Total antibacterial cost NGN (US$)	Average NGN(US$)
AOM	45 (24.7)	24,526.00 (188.66)	545.02 (4.19)
CSOM	37 (20.3)	42,982.00 (330.63)	1161.68 (8.94)
B/pneumonia	70 (38.5)	257,299.00(1997.22)	3675.41 (28.27)
Tonsilitis	12 (6.6)	14,923.00 (114.79)	1243.58 (9.57)
Others	18 (9.9)	19,060.00 (146.62)	1058.94 (8.15)
Total	**182 (100.0)**	**358,790.00(2759.72)**	**1971.37(15.16)**

AOM= Acute Otitis media, CSOM= Chronic Suppurative Otitis Media B=Bronchopneumonia
Exchange Rate at the time of analysis= NGN130=US$1.00

Table 3:
Average cost of therapy for ENT infections by age group

Infection	TAC±SEM NGN(US$)	PC±SEM NGN(US$)	DTC±SEM NGN(US$)	TRC±SEM NGN(US$)	INDC±SEM NGN(US$)	TC±SEM NGN(US$)
AOM (n=45)	545.02±62.62 (4.19±0.48)	210.37±2.22 (1.62±0.02)	462.28±17.16 (3.56±0.13)	219.78±9.23 (1.69±0.07)	431.11±23.74 (3.32±0.18)	1441.10±71.04 (11.09±0.55)
CSOM (n=37)	1161.00±221.09 (8.93±1.70)	216.26±5.98 (1.66 ±0.05)	597.35±28.10 (4.60±0.22)	172.97±12.33 (1.33±0.09)	427.03±18.44 (3.38±0.14)	2023.88±233.48 (15.57±1.80)
BPN (n=70)	3675.41±1207 (28.27±9.28)	357.53±61.95 (2.75±0.48)	611.14±20.05 (30.48±0.15)	192.43±17.15 (1.48±0.13)	756.43±123.60 (5.82±0.95)	5028.88±1393.50 (38.68±10.72)
TON (n=12)	1243.58±1655.44 (9.57±12.73)	225.50±17.36 (1.74±0.13)	0.00±0.00 (0.00±0.00)	243.33±28.61 (1.87±0.22)	483.33±20.73 (3.72±0.16)	2195.75±496.10 (16.89±3.82)
OTHERS n=18	1058.94±338.81 (8.15±2.61)	219.71±11.57 (1.69±0.09)	138.89±117.36 (1.07±0.90)	236.11±17.36 (1.82±0.13)	522.22±44.36 (4.02±0.34)	2195.88±361.88 (16.89±3.82)

NB: AOM= Acute Otitis Media, CSOM= Chronic Suppurative Otitis Media, BPN= Bronchopneumonia,
TON= Tonsilitis, TAC= Total Antibacterial Cost, PC= Personnel Cost, DTC= Diagnostic Test Cost,
TRC= Transportation Cost, INDC= Indirect Cost, TC= Overall Total Cost, SEM= Standard Error of the Mean.

Clinical variables
Otitis media was the most prevalent and occurred among 82(45.0%) patients. Acute and chronic suppurative otitis media occurred in (45)24.7% and(37) 20.3% of the patients respectively. This was followed by bronchopneumonia which occurred among 70 (38.5%) patients. Treatments were largely empirical and there were documented cases of microscopy culture and sensitivity (m/c/s) test in 14 (7.7%) patients.

Cost of antibacterial agents for each disease condition
The overall average antibacterial cost of ENT infections per patient (n=122) was NGN2940.49 (US$22.62) while the overall average cost per prescription (n=182) was NGN1971.37 (US$15.16). Bronchopneumonia had the highest average antibacterial cost of NGN3675.41 (US$28.27) followed by acute tonsillitis. Otitis media, the most prevalent of the ENT infections had an average cost of NGN545.02 (US$4.19) for acute and NGN1161.68 (US$8.94) for chronic suppurative with a mean average of NGN823.27 (US$6.33). (Table 2)

Estimated National Cost Implications
Otitis media
Previously reported incidence of Otitis media in Nigeria was 29.0% in children below 5 years (Amusa *et al* 2005), giving a total of about 7,772,000 cases (7.7 million cases). This value (7.7million cases) was obtained by considering the total population of Nigeria: about 132.8 million (UNDP, 2004), the usual proportion (demographic distribution) of children below 5 years of age (20.0%).

Average Total Cost of Therapy for each ENT infection
Bronchopneumonia has the highest overall average cost of therapy of NGN5028.88±1393.50 (US$38.68±10.72). Others range from NGN1441.10±71.04 (US$11.09±0.55) for acute otitis media to NGN2195.75±496.10 (US$16.89±3.82) of tosilitis. (Table 3)

Table 4:
Cost of Therapy

Type of Cost	Total Amount NGN (US$)	Percentage Cost (%)	Average Cost NGN(US$) (n=182)
Drug acquisition	358,790.00(2759.72)	64.40	1971.37(15.16)
Personnel	49,156.40(378.13)	8.9	270.00(2.08)
Diagnostic	9,100.00(70.00)	1.6	50.00(0.39)
Transport	36,930.00 (284.08)	6.6	202.91(1.56)
Indirect	103,350.00(795.00)	18.5	567.86(4.37)
Total	557,326.40(4287.13)	100.00	3062.23(23.56)

Average antibacterial cost of Otitis media (acute & chronic) of NGN823.27 (US$6.33) gives total antibacterial drug cost for 7.7million cases of ₦6,398,454,440.00(US$49,218,880.31); This implies an annual antibacterial cost of over NGN6.3 billion (US$49milliom).While the total cost of therapy with an average of NGN1732.49 is over NGN13billion (US$100milion) annually. Discounted total cost of therapy cost to the present value gives US$115.93million using three percent discount rate over five years.

Cost of Therapy
Antibacterial cost constitute the highest cost component (64.37%) followed by indirect cost (loss productivity) (18.50%). The lowest cost component was for diagnostic tests which were carried out in only 7.7% of cases. (Table 4)

Estimated National Cost Implications
Bronchopneumonia: Previously reported prevalence of brochopneumonia was about 12.0% (Ekpe and Akpan, 2010). This implies about 3.37million cases among children in the country. Average antibacterial drug cost of bronchopneumonia in the study of NGN3675.41($28.27) gives an estimated antibacterial cost of ₦12billion (US$92,307,692.31) while the total cost of therapy with an average N5028.88 (US$38.68) gives a national cost implication of about N16.96billion. (US$130.46million). This amount gives a discounted present value of US$151.24millin at three percent over five years

Tonsilitis: The average cost of NGN1243.00 (US$9.56) for tonsillitis would give NGN124million (US$953,846.15) per 100,000 cases. This gives US$1,105,780.37 (US$1.1million) if discounted to the present value at three percent over five years.

DISCUSSION

Higher prevalence rate of these respiratory related infections among children observed is consistent with previous reports (Sitthi-amorn *et al* 2001; Amusa *et al* 2005) and may be due to low level of immunity. The poor follow-up by patients may be as a result of ignorance and/or poverty. This need to be improved upon to guarantee a re-evaluation by physicians and ensure that optimal treatment outcomes are achieved at minimal cost, to prevent a re-occurrence and minimise the likelihood of it being contracted by others in the community.

Majority of otitis media patients in Nigeria has been previously reported to belong to parents of low socioeconomic class who live in crowded environment (Amusa *et al* 2005). With an average antibacterial cost of about NGN2000.00 (US$15.39) per prescription and almost NGN3000.00 (US$23.08) per patients, a lot of money is being spent to treat these illnesses hence measures should be taken to optimise therapy. Almost two-third of the total cost of therapy was for antibacterial agents alone. Penicillins were the most widely prescribed class of antibacterial agents predominantly amoxicillin alone or in combination with clavulanic acid which is consistent with previous standard practices (ATS, 2001). This was followed by erythromycin, a macrolide antibiotic. Good prescribing and dispensing practice is paramount to the use of these agents to minimise needless expenditure and antibacterial resistance. Adherence to recommended dosage regimen as well as non-pharmacological options such as personal and environmental hygiene would go a long way to improve immunity and therapy outcomes which in-turn can minimise cost.

The overall average cost of therapy in excess of NGN5000.00 (US$36.46) for bronchopneumonia and almost NGN1500.00 (US$11.54) for acute otitis media is an indication that other non-drug cost components constitute a good proportion of the treatment cost and need to be accounted for. Out of about one-third non-drug cost proportion, the loss in productivity (indirect cost) accounted for more than half. However, indirect costs are always more difficult to evaluate and may be as high as the direct cost of therapy for some disease condition such as diabetes mellitus (Gray *et al* 1991). An estimate of the national cost implications of these conditions revealed intimidating figures of over

N13billion (about US$100 million) as estimated cost of therapy for otitis media and more than NGN16 billion (about US$131 million) for bronchopneumonia in the country. However, a major limitation as regard the estimate is the sample size and the fact that incidence rate used was regional; Southwest for otitis media and South-South for bronchopneumonia. By implication difference prevalence rate and different choice of first line agents as well as the value of the various cost components would lead to a reduction or an increase in the therapy cost. The fact that the predominant first drug of choice is in consonant with international guidelines may reduce any major changes for drug component of the total cost of therapy (ATS, 2001). The use of the mean cost of therapy will equally reduce possible effect of increasing the sample size on the cost. Appropriate discounting could be done for differences in timing and sensitivity analysis in economic sense for variables with substantial degree of uncertainty in its measurement (Drummond, 2005).

Another limitation is that some charges were assumed to be equal to cost which is not always the case. Standard charge-to-cost ratios for evaluation purposes are available in some countries such as the United State, but it equally differ from one state of US to another and have different values for urban and rural hospital within each state (CDC 2010).

More than two-third of the antibacterial cost was for the treatment of bronchopneumonia where cephalosporins were used to some extent. In the study, cephalosporins as a class constituted almost half of the drug cost. The fact that most cephalosporins are available only as injections is a contributory factor to this cost implication. This calls for prudent use and closer monitoring.

More investment in strengthening promotional and preventive health by governments and other stake holders is very important to minimise the menace of infections and the attendants huge cost of therapy. Low standard of living, weak immunity and poor sanitary conditions make the poor prone to these infections. Gwatkin and Guillot in 2000 stated that, communicable diseases in developing countries are diseases of poverty (Gwatkin and Gulliot, 2000) which is also increasing (Aigbokan (2000); DFID, 2006).

The effect of this on dwindling economy is enormous and this excludes costs associated with hospitalization in severe cases. Where injections are employed, evidence-based switch over to oral therapy has been advocated as being cost effective particularly for In-Patients. For instance, the macrolide azithromycin appears to be superior to the cephalosporin, cefuroxime, in intravenous therapy and a subsequent switch to oral therapy. This was shown in a cost effectiveness analysis of IV-to-PO switch regimens of azithromycin versus cefuroxime with or without erythromycin in the treatment of patients hospitalized with community acquired pneumonia (Paladino *et al*, 2002). According to Scheinfeld *et al* (2006), In-Patients with non-severe community acquired pneumonia can be effectively and safely treated with oral antibacterial agents from time of admission

The use of antibacterial agents should be re-evaluated for some of the respiratory tract infections as most times it may be of viral origin. This will definitely reduce cost of therapy. This can only be achieved with strengthened diagnostic facilities with eventual reduction in empiric therapy. It is also important to educate patient to stop pressurising physicians for antibiotic request. Regularly up-dated evidence-based guidelines base on prevailing sensitivity pattern in the locality are equally necessary for more prudent use of antibacterial agents. These agents are gradually becoming less useful because of resistance emanating from irrational use in hospitals and community.

Conclusion

Cost of therapy for these infections to patients and the nation at large is huge. Brochopneumonia treatment constitutes the greater proportion of this cost which needs to be closely evaluated.

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