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Cost-minimization analysis of antimicrobial therapy in a tertiary healthcare institution in Nigeria

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Abstract

Cost Minimization Analysis of antimicrobial therapy in a tertiary health care institution in a developing economy country was carried out. The most applicable tool for generic equivalent drugs was used in Ahmadu Bello University Teaching Hospital, a tertiary healthcare Institution in Nigeria, between 2005 and 2007. Relevant information such as diagnosis, cost of drugs (in Naira – ₦), dosage, duration of therapy among others were obtained retrospectively from patient case-notes for which antibacterial are the mainstay of therapy and dispensed prescriptions. The mean cost per defined daily dosage (DDD) of generic and branded for each antibacterial was computed. These were compared using Student's *t*-test. The outcome measure was potential eradication of bacterial in question by the respective antibacterial drug. The analyses showed that the use of expensive branded drugs were very rampant even when the much cheaper generic equivalent is available. The differences in the mean cost/DDD were very significant for all the antimicrobial agents at $p<0.05$. For example the mean cost/DDD of ciprofloxacin was ₦267 for branded product and ₦80.00 for generic ($t = 421.2$ at $p<0.05$).Sensitivity analysis also Confirm this decision. Prescriptions of expensive branded drugs were rampant even when the much cheaper generic equivalents are available. The mean cost per Defined Daily Dose of Branded and Generic equivalent were significantly different for all antibiotics applicable for cost minimization analysis, with Generic Products much cheaper than Branded equivalent.

Keywords: Pharmacoeconomics; Cost-minimization analysis; Antimicrobial; Generic; Branded

Introduction

Health organizations, government, and individuals have been forced by the prevailing circumstances of economic crisis to be increasingly oriented towards cost containment due to escalating nature of health expenditure. Allocation to health sector is increasing as a result of cost increment, not only because of the growing population but also due to new health development. Subsequent total health care spending as well as per capital spending is increasing. More so with the developing nature of economy in many countries such as Nigeria where per capita income is very low, there is need for utmost consideration of cost containment measures. Medical, ethical and societal concerns about costs, access and quality of

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care are causing health practitioners to consider a more comprehensive model for medical decision making rather than traditional approaches.

The objective of pharmacoeconomic study is to influence policy making and affect decision taking. Cost Minimization Analysis is the applicable methodology when therapeutic options have or are assumed to have equivalent outcome (Botman *et al.*, 1996). This is particularly useful in formulary drug selection (Switft and Ryan, 1975, Rubbin and Keller, 1983).

Experimental

Design. The study was retrospective. Time and motion studies in conjunction with standard cost accounting techniques were employed.

Hospitals used in the study. Ahmadu Bello University Teaching Hospital Zaria. A Tertiary Health Institution in Kaduna State, Nigeria was used.

Patients. Out-patients with documented antibacterial usage in selected diseases for which antibacterial agents are the mainstay of therapy.

Sampling. Patients case-notes were consecutively sampled while systematic sampling was used for dispensed prescriptions. The systematic sampling was based on twelve calendar month year with a sampling interval of three months.

Treatment options. Generic equivalents were evaluated. These include branded and their respective generic products. In evaluating them, the same dosage form, equal strength and the same frequency of dosing were considered. For the purpose of this study, drugs that are chemically equivalent are assumed to be bioequivalent and therapeutically equivalent. Therefore the same therapeutic outcome was assumed for both generic and branded products of each drug. Eradication of bacterial was the outcome measure.

Data Collection. 1018 Out-Patient case notes for selected diseases were sampled and examined this were facilitated using diagnostic coding cards. 1527 prescription were sampled systematically and examined. The prescribed/dispensed drugs, particularly antibacterial, between 2005 and 2007 were recorded. Other relevant data such as patient demographic data, diagnosed concurrent illness, diagnostic tests (if any), dosage of drugs, duration of therapy, follow-up visits (if any) physician's remark at each visit and the cost of drug were all recorded.

Choice of method of analysis. Cost Minimization Analysis (CMA) also referred to as Cost-Cost Analysis was used. It is a form of analysis where only costs of the various options are compared. It is basically applicable to therapeutic options with equivalent efficacy (e.g. generic equivalents) or when such an assumption is made.

Computation of Data. The cost per defined daily dosage (DDD) of each antibacterial for each patient was calculated. DDD units are recommended by World Health Organization for analysis of drug use. One DDD represents the usual daily dosage of antibacterial per day e.g. Tab Erythromycin 1g per day in 4 divided doses (Netheimer, 1986).

Cost and perspective of analysis. All doses of the drug considered were prescribed in the institution. Therefore the economic perspective of the institution was chosen. Only the drug costs, a component of direct medical costs were used in the analysis since other costs e.g. physician office visits, and transport would e very similar among patients having assumed the generic equivalent to be of comparable effectiveness. There was no adjustment for inflation or discounting in the analysis, costs were fairly stable and both options (generic and branded) were used within the year under review. However, the

mean cost of each option was used due to slight variation in some cases.

Sensitivity analysis. Sensitivity analysis was performed to test whether the decision changes when specific variables are altered within reasonable range in favour of less cost options. This was done for the cost/DDD of branded and those of generics. The cost/DDD of generics was increased several folds and compared with those of branded. For example, the cost/DDD of generic doxycycline capsule was ₦7.00 while that of branded doxycycline by as high as 900% (₦70.00) did not change the decision as to the fact that it is much more of lower cost (cheaper) compared to the branded.

Statistical analysis. The Student's *t*-test was used to compare the various values of mean cost/DDD of each antibacterial (branded and generic) to establish if the two options differ significantly.

Results and Discussion

Results for Cost Minimization analysis and Sensitivity analysis are given in Tables 1 and 2 respectively.

Table 1: Mean cost/DDD of selected antibiotics for Cost Minimization Analysis (CMA)

Antibiotic	Defined Daily Dose (DDD)	MEAN COST/DEFINED DAILY DOSE(DDD)				
		Branded (₦)	Frequency of prescription	Generic (₦)	Frequency of prescription	*t* at p<0.05
Ciprofloxacin tab	500mg bid	267±0	148(87.6%)	80±2	21(12.4%)	421.2
Cotrimoxazole tab	960mg bid	40±0.9	202(83.1%)	8±0.2	41(16.9%)	453.5
Augmentin tab	375mg bid	300±2	125(80.6%)	200±1	30(19.4%)	392.2
Erythromycin tab	500mg qid	50±1	40(54.1%)	24±1	34(45.9%)	112.1
Rifampicin tab	600mg o.d	30±0.5	70(74.5%)	15±0.2	24(25.5%)	206
Doxycycline	100mg bid	70±0.9	40(64.5%)	7±0.1	22(35.5%)	139.8
Benzathine penicillin Inj.	2.4 iu	20±0.5	35(66.0%)	17.42± 0.2	18(34.0%)	27.2
Ampiclox Syrup	250mg qid	72±1	40(66.7%)	40±0.5	20(33.3%)	165.3

Table 2: Sensitivity analysis for Cost-Minimization Analysis of antimicrobial agents

Alteration in variables	Mean cost/DDD (₦)
1.Incresing the mean cost/DDD of Generic Ciprofloxacin tablet by 50%(₦40.00)	120.00
2.Decreasing the mean cost/DDD of Branded Ciprofloxacin tablet by 50%(₦133.50)	133.50
3.Increasing the mean cost/DDD of Generic Cotrimoxazole tablet by 75%(₦6.00)	14.00
4.Decreasing the mean cost/DDD of Branded Cotrimoxazole tablet by 75%(₦30.00)	10.00
5.Increasing the mean cost/DDD of Generic Augmentin tablet by 25%(₦50.00)	250.00
6.Decreasing the mean cost/DDD of Branded Augmentin tablet by 25%(₦75.00)	225.00

Results indicated that the use (prescription) of branded drugs which were more expensive was rampant even when the much cheaper generic options were available. The mean cost per Defined Daily Dose of Branded and Generic equivalent were significantly different for all antibiotics applicable for cost minimization analysis.

Quinolones. The quinolones used was ciprofloxacin tablet. The mean cost/DDD of ciprofloxacin was ₦267.00 for branded and ₦80.00 for generic. In other words we would be able to treat 3 patients on generic for the cost of using branded to treat one patient. There is statistically difference in the mean cost per DDD of Branded and Generic equivalent of ciprofloxacin ($t = 421.2$; $p<0.05$). The branded ciprofloxacin was prescribed 148 times (87.6%) compared with Generic equivalent prescribed only 21 times (12.4%).

β-Lactams. The cost per DDD of branded ampiclox syrup was ₦72.00 while that of generic was ₦40.00. The mean cost per DDD of augmentin tablet was ₦300.00 and ₦200.00 for branded and generic respectively. There is statistically difference in the mean cost per DDD of Branded and Generic equivalent of augmentin ($t=392.2$; $p<0.05$). The branded augmentin was prescribed 125 times (80.6%) compared with Generic equivalent prescribed only 30 times (19.4%).

Sulphonamide. Co-trimoxazole had a mean cost of ₦40.00 per DDD for branded and ₦8.00 for generic. There is statistically significant difference in the mean cost per DDD of Branded and Generic equivalent of cotrimoxazole ($t=453.5$; $p<0.05$). The branded cotrimoxazole was prescribed 202 times (83.1%) compared with Generic equivalent prescribed only 41 times (16.9%).

Macrolides. The mean cost per DDD of erythromycin tablet was ₦50.00 for branded and ₦24.00 for generic. There is statistically significant difference in mean cost/DDD of Branded and Generic equivalent of erythromycin ($t=112.1$; $p<0.05$). The branded erythromycin was prescribed 40 times (54.1%) compared with Generic equivalent prescribed only 34 times (45.9%).

Tetracyclines. Doxycycline was ₦ 70.00 per DDD for branded and ₦ 7.00 for generic. There is statistically significant difference in the mean cost per DDD of branded and generic equivalent of doxycycline ($t=139.8$; $p<0.05$). The branded doxycycline was prescribed 40 times (64.5%) compared with Generic equivalent prescribed only 22 times (35.5%).

Others. The mean costs per DDD of branded drugs were all higher than those of generic equivalents. These include rifampicin and benzathine penicillin. The difference was statistically significant. Branded products were more frequently prescribed than their generic equivalents for all antibacterials analyzed.

Antibacterial agents account for the highest proportion of the drug budget in many countries and constitute the largest group of drugs purchased. These include developing countries like Nigeria where financial resources are scarce (WHO, 1988, Davey *et al.*, 1992). Efforts designed to reduce expenditure for this class of drugs as well as to use them more effectively would be advantageous.

Cost Minimization Analysis showed that branded drugs were used even when the generic equivalents were available. This was rampant despite the higher cost of branded which were much more expensive. A sensitivity analysis on the drug cost did not affect the conclusion hence the result is valid. There was no rationale for branded drugs to e used if the generic equivalent is available and there is guarantee on its effectiveness. Lack of assurance in efficacy/effectiveness of some generics may be a militating factor due to chaotic drug distribution system in Nigeria which facilitates faking and counterfeit products (Suleiman and Tayo, 2003).

Generic substitution has long been applied in formulary system. It has the benefits of discouraging the use of less than optimal drug therapy, competitive bidding and reduce inventory. These benefits have in some cases been quantified as direct drug and inventory saving (Switft and Ryan, 1975, Rubin and Keller, 1983). Generic drug programme are today probably the most relevant economic strategy for drug supply. If generic substitution does not exist, price competition will not exist either and prices of drug will swell (WHO, 1996).Generic substitution which applied CMA stimulates bioequivalency comparisons and help to prevent the stocking of less than optimal products. This can e facilitated in collaboration with drug regulatory agency

such as National Agency for Food, Drug Administration and Control (NAFDAC).

A mechanism for comparing costs such as CMA can lead to more rational prescribing and limit the number of drug products included in each therapeutic class. Cost of antibacterials would e reduced as well as patients drop out of treatment because of cost. This is an established fact (La-Ruche *et al*., 1995, Gomo, 1995). Use of very expensive drugs which are not affordable due to poverty/cost has negatively affected therapeutic outcome (Giwa and Tayo, 2001). People may be ill or require medical services but not have enough money to pay for them because of high cost (Kata *et al*., 1997). Pharmacoeconomic analysis helps to make decisions about whether a new drug should be included in the formulary on the principle that if a drug is not better than a comparable product it should not cost more. If it is superior to existing therapies but more expensive (a common denominator) and funds are available any extra expenditure should represent "value for money (Kata *et al*., 1997).

Conclusion

Prescription of expensive branded drugs was rampant even when much cheaper generic equivalents are available. The mean cost per Defined Daily Dose of Branded and Generic equivalents were significantly different for all antibiotics applicable for cost-minimization analysis. It is concluded that economic evaluation, such as cost-minimization analysis of drug therapy is of paramount importance in policy and decision making to facilitate more rational choices/prescription. All the stakeholders need to be enlightened and work collaboratively in this regard.

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