THE CENTRAL AFRICAN JOURNAL OF MEDICINE

Vol. 41, No. 5 May, 1995

CONTENTS

CENTRAL AFRICAN
JOURNAL OF MEDICINE

Vol. 41, No.5,1995

THE CENTRAL AFRICAN JOURNAL OF MEDICINE

ORIGINAL ARTICLES

Paediatric treatment costs and the HIV epidemic

EAS NELSON, M WEIKERT, JA PHILLIPS

SUMMARY

As the AIDS epidemic puts additional strains on the already overburdened health care systems in sub-Saharan Africa, it becomes more important to estimate the cost of the epidemic in terms of health personnel and drug treatments. A retrospective review of 250 randomly selected paediatric admissions to a referral hospital in Malawi was undertaken. Groupings of "possible/probable AIDS" and "probably not AIDS" were used in a comparative analysis of treatment costs. Estimated costs of treatments were significantly lower than those calculated in a study from Zimbabwe using different methodology. Meningitis was the most expensive condition to treat and accounted for a greater percentage of overall cost than either acute respiratory infection, diarrhoeal disease or measles.

INTRODUCTION

The first adult patient with acquired immune deficiency syndrome (AIDS) was diagnosed in Malawi in 1985, and the first paediatric patient in 1986.[1,2] In Malawi, as for most of sub-Saharan Africa, the predominant mode of HIV transmission is heterosexual, with vertical transmission from mother to baby occurring in approximately one quarter of pregnancies. Recent estimates from the Malawi AIDS Control Programme are that the HIV seropositive rate in the population aged 15 to 49 is 20 pc in urban areas and 8 pc in rural areas (10 pc overall). However, prevalence of HIV infection in infants and children in Malawi is not known because the majority of children with suspected HIV infection are not counselled or tested and no surveillance surveys have been reported. Counselling is very time consuming and other more urgent nursing and medical duties take precedence over HIV testing. There is also anecdotal evidence that as the significance of HIV infection becomes better understood, parents are more likely to refuse HIV testing of their child, as a positive result has major implications of their own health. Anonymous testing is thus necessary to obtain data on paediatric HIV prevalence.

Anonymous HIV testing for surveillance purposes has been used in developed countries,[3,4] and it is suggested that this information is essential for setting public health priorities, for making rational health policy, and for implementing and evaluating interventions.[5]

Existing and increasing poverty in parts of sub-Saharan Africa limits access to education and health, which hampers and effective response to the epidemic and facilitates the spread of HIV. AIDS also targets young, sexually active and economically productive adults which increases the poverty cycle. In such economically deprived communities, the AIDS epidemic is stressing overburdened health care systems, which are often already unable to provide adequate treatment for many potentially curable disease. AIDS patients have many hospital, and even in the absence of specific antiviral therapies, they consume disproportionate amounts of drugs, laboratory tests and personnel time. The AIDS epidemic worldwide, and in sub-Saharan

Department of Paediatrics
Kamuzu Central Hospital
Lilongwe
Correspondence to:
Dr EAS Nelson
Department of Paediatrics
6/F Clinical Sciences Building
Prince of Wales Hospital, Shatin
New Territories, Hong Kong

Africa in particular, will continue to have tremendous financial impact on national economies.

This study set out to estimate the cost of drugs and personnel for various common categories of paediatric disease with particular emphasis on the group of children thought to be clinically probably/possibly AIDS.

MATERIALS AND METHODS

It was proposed to undertake anonymous HIV testing on a random sample of paediatric admissions and to do a comparative analysis of treatment costs in the HIV positive and negative groups. However, ethical approval for anonymous HIV testing was not granted. Therefore a retrospective study to assess treatment costs was undertaken and, in an attempt to estimate treatment costs for AIDS and non-AIDS patients, each admission was assigned retrospectively to one of three groups: probably AIDS; possibly AIDS; and probably not AIDS. Assignment was done independently by two paediatricians and clinical experience was the only criterion used in assignment.

Two hundred and fifty randomly selected notes of admissions to the Paediatric Department of Kamuzu Central Hospital (KCH) in Lilongwe from 31st December 1992 were reviewed. There were 7 386 recorded admissions for 1992. Data abstracted from the notes included source of referral, dates of birth, admission and outcome, child's age and sex, admission weight, presenting complaints, outcome, admission and discharge diagnoses (up to three) and all drugs given and investigations done.

Two hundred and sixteen out of 250 notes were located and six of these notes were excluded as they had no treatment sheet available. The sample analysed was thus 210 (84 pc of intended sample). The admission number was randomly selected if the child had been admitted more than once. Length of stay (in days) and age (in months) were calculated. If the date of birth was not reported the recorded age of the child was used.

The presenting complaints and their duration were determined by using the notes of the admitting medical staff, the referring medical staff and the nursing staff in that order of priority. Admission and discharge diagnoses were coded with International Classification of Diseases (ICD) numbers. Admission and discharge diagnoses were grouped into nine categories: malaria; anaemia; respiratory disease; diarrhoeal disease; measles; meningitis; malnutrition; surgical; other medical.

The total number of doses of all medications given were abstracted from the treatment sheet. Drugs ordered but not reported being given were excluded. Blood transfusions and IV fluids were recorded but oral rehydration solution, mouth wash solution, vaccines and physiotherapy were not recorded. Surgical operations were difficult to cost and therefore not recorded. Investigations were recorded if definitely noted to have been taken.

For the purpose of calculating drug costs, the dose was estimated as a percentage of the adult dose on the basis of weight (first choice) or age (second choice if no weight recorded). This method was used rather than recording actual doses prescribed to simplify data abstraction and analysis. The four weight groups were: 1 kg to 10 kg (25 pc of adult dose); > 10 kg to 20 kg (50 pc of adult dose); > 20 kg to 30 kg (75 pc of adult dose); and > 40 kg (adult dose). The corresponding age groups were: 0 to 18 months; > 18 to 72 months; > 72 to 144 months; > 144 months. Drug costs were calculated from the Central Medical Store's price list as shown in the following example.

1 000s tablets (250 mg) of Penicillin V	= 3 292 tambala (t)
1 tablet (250 mg) of Penicillin V	= 3 292/1 000 t
1 adult dose (500 mg) of Penicillin V	= 3 292/1 000 x 2 t
8 doses for a 12 kg child	= 3 292/1 000 x 2 x 0,5 (50 pc) x 8 t
	= 26,34 t

The cost of investigations were more difficult to estimate. Christian Hospitals Association of Malawi (CHAM) charge patients for investigations and the average cost of the investigations done at three CHAM hospitals in the district was used.

Calculation of staff costs was as follows. Ten "one week" periods during 1992 were randomly selected and the number of staff of each category on the Paediatric ward (working or on leave) during each of these periods were counted and averaged. This figure of average staff was multiplied by the mean annual salary for each professional category. All categories were then summed to give the total cost of staff *per annum*. The cost of staff per patient per day or bed occupancy day (BOD) was calculated by multiplying the total annual admissions (n = 7 386) by the average length of stay (7,9 days) for

the 210 admissions in the study. The total staff cost *per annum* was divided by this figure to give the cost per BOD.

Drug costs, investigation costs and staffing cost were added to give the total in patient cost. The outpatient cost was calculated as the cost of drugs prescribed for home treatment. The total cost of treatment was the sum of the total in patient cost plus the outpatient cost. Costs in US$ were calculated using an exchange of US$1 = K4,4.

RESULTS

Data from the 210 notes, which were located and had treatment sheets, were analysed with Epiinfo 5. The sex was documented in 207 cases: 89 (43 pc) females and 118 (57 pc) males. The average age was 32 months (SD ± 39, range 1 to 168 months). Admission weights were recorded in 183 children (mean weight 8,96 kg; SD ± 5,78; range 2,2 kg to 30,0 kg). Of the children 83 pc were under paediatric medical care and 17 pc were under paediatric surgical care. The mean length of hospital stay was 7,9 days (SD ± 8,0; range 1 to 61 days).

Fifty four pc of children had fever; 35 pc cough; 24 pc diarrhoea; 20 pc swelling; 19 pc vomiting; 15 pc pain and 15 pc dyspnoea at presentation. There were 34 (16 pc) deaths, 19 (9 pc) of children who absconded and 157 (75 pc) children who were discharged home.

Cost of treatment: The average cost of treatment in Malawi Kwacha (K) were as follows: drugs and investigations K4,50 (SD ± 5,4); Staff K41,06 (SD ± 41,7); outpatient drugs at discharge K0,47 (SD ± 1,6); total cost of treatment K46,02 (SD ± 44,6) or US$10,5 (see Table III). Discharge medications were prescribed for 68/157 (43 pc) of children discharged home.

Analysis of presentation, diagnosis and cost of treatment by AIDS group: An AIDS group was defined which included those infants (n = 19) which both paediatricians assigned to Probable or Possible AIDS groups. There were 11 and 12 children thought to be probable AIDS by one or other paeditrician but probably not AIDS by the other paediatrician. These 23 children were not included in the AIDS group. Table I shows the mean age, weight stay and outcome for the AIDS group.

The infants thought to be probable/possible AIDS were significantly more likely to present with cough ($p < 0,01$) and diarrhoea ($p < 0,0001$). Fever, swelling, and vomiting as presenting complaints were not significantly different between the two groups. Infants assigned as probable/possible AIDS were significantly more likely to have a discharge diagnosis of malnutrition ($p < 0,0001$), respiratory disease ($p < 0,05$) or diarrhoeal disease ($p < 0,05$). There was no significant difference in the frequency with which discharge diagnose of malaria, anaemia, measles and meningitis were made. Table II shows the cost of treatment for the probable/possible AIDS group and the probably not AIDS group.

Table I: Outcome, age, weight and stay for children assigned to probable/possible and probably not AIDS groups (n = 210).

		Probable/ Possible AIDS (n = 19)	Probably not AIDS (n = 191)	p
Age (months)		16,9	33,3	NS
Weight (kgs)		6,3	9,3	< 0,05 Kruskal-Wallis
Stay (days)		11,5	7,5	< 0,05 Anova
Outcome	Absconded	4,0	15,0	< 0,0001 x^2
	Died	9,0	25,0	
	Home	6,0	151,0	

Table II: Treatment costs in Malawi Kwacha (K) for children assigned to probable/possible and probably not AIDS groups (n = 210).

	Probable/ Possible AIDS (n = 19)	Probably not AIDS (n = 191)	p
Drugs and investigations	K 5,14	K 4,43	NS
Staff cost	K59,94	K39,18	< 0,05*
Outpatient drugs	K0,18	K0,50	NS
Total cost	K65,26	K44,11	<0,05*

**Anova.*

Analysis of cost of treatment by diagnostic group: Table III shows the cost of treatment of the main diagnostic groups in the analysis. Five notes did not have discharge diagnoses recorded. Meningitis was the most expensive condition to treat in terms of both drugs

Table III: Costs of treatment by first discharge diagnosis (n = 210).

Diagnostic Category	Mean Stay (days)	Inpatient drug cost* (K)	Staff cost* (K)	Outpatient drug cost* (K)	Total cost* (K)/(US$)	Number patients (n) (pc)	Total cost (US$ (pc)
Malaria	4,5	4,33	23,20	0,17	27,7/6,3	39 (19)	246 (11)
Anaemia	6,4	3,92	33,28	0,02	37,2/8,5	10 (5)	85 (4)
Respiratory	4,4	2,54	22,88	0,34	25,8/5,9	25 (12)	146 (7)
Diarrhoeal	4,1	3,63	21,45	0,18	25,3/5,7	16 (8)	92 (4)
Measles	6,4	2,99	33,28	0,81	37,1/8,4	10 (5)	84 (4)
Meningitis	12,5	12,96	65,00	0,42	78,4/17,8	12 (6)	214 (10)
Malnutrition	12,7	3,91	65,87	0,20	70,0/15,9	21 (10)	334 (15)
Surgical	10,8	2,24	55,94	0,45	58,6/13,3	33 (16)	440 (20)
Other medical	10,2	6,69	52,80	1,24	60,7/13,8	39 (19)	538 (24)
No diagnosis	2,6	2,43	13,52	0,0	16,0/3,6	5 (2)	18 (1)
All patients	7,9	4,50	41,06	0,47	46,0/10,5	210	2 197 (100)

K = Malawi Kwacha. **** = cost per patient.***

and staff. Also shown is the cost of treating various conditions as a percentage of total cost.

DISCUSSION

For the reason stated in the methods, it was not possible to obtain the HIV status of the selected admissions. This is the major limitation of the study and the comparison of costs for the probable/possible AIDS group and the probably not AIDS group is thus only an approximation. However, the study gives a range of costs for treating various common paediatric conditions. The costs calculated are for drugs, medical and nursing personnel and investigations – not included are the costs of running the hospital e.g. equipment, maintenance, lights, water, administration. While the latter costs are of major long term importance they have less relevance in the short term. Whether a hospital bed contains none, one or two patients the hospital running costs are much the same. Even the costs of medical and nursing personnel are fixed in the immediate short term. Thus the main impact of the AIDS epidemic in the short term will be on drug costs and availability and on staff morale.

The study shows that those children who are clinically thought to be probable/possible AIDS are more expensive to treat than those thought to be probably not AIDS. This difference in cost is mainly because AIDS is suspected clinically in children who stay longer in hospital and require numerous treatments i.e. the way the probably/possibly AIDS group was selected predetermined that they would be more expensive to treat. It would be necessary to have actual HIV results to see how sensitive/specific this clinical assignment of AIDS was. The WHO AIDS clinical case definition was not used in this study as prospectively collected data would have been required.

Other limitations of the study need to be considered. Drug costs were based on doses of drugs actually signed for. It was noted that often drugs prescribed three to four times a day were apparently given only one to two times a day. It is possible that on a busy ward, drugs may be given but not signed for. Alternatively shortages of drugs or shortages of staff may mean that less drugs were given than prescribed. In developing countries drugs come in and out of stock and when out of stock drugs may be replaced with an alternative or with no drug. It is probable that if there were not these recurrent shortages, drug costs would be higher than those estimated.

Despite the way that the probably/possibly AIDS group in our study were selected, their estimated treatment costs were much less than those estimated in a

study from Zimbabwe. This Zimbabwe study estimated the potential national cost of drugs and staff as a result of the AIDS epidemic.[6] The study was based on methodology developed in Zambia and then applied to standard treatment regimes available in Zimbabwe. This method of estimating costs differed from our method. The cost of drugs was based on the frequency with which various diseases are known to occur in children with AIDS, and the cost of completely treating these diseases. This type of analysis may give a higher estimate of treatment costs than those incurred in practice. It was estimated that AIDS children in Zimbabwe would have an average of 5,12 treatment episodes per admission (where one treatment episode = one drug used for a full course). The average cost per treatment episode was Z$2,35 i.e. an average drug cost per admission of Z$12,05 (US$4,21).

Our data suggests that the actual cost of in-patient treatment per admission of a patient with clinical AIDS was of K5,14 (US$1,17) (Table II). This figure also includes investigations done (not included in Zimbabwe study). The Zimbabwe study was based on 1990 prices, whereas our data was based on 1993 prices. Although Zimbabwe has more to spend on health *per capita* than Malawi, it is not known whether actual costs per admission would be as high as those estimated by Jensen.[6]

The costs of investigation were included in our study but there was difficulty deciding on a realistic cost of such investigations. The cost of investigations was based on what three CHAM hospitals charged patients. It is possible that some hospitals subsidise investigations whereas others "make money" on the investigations. A number of our patients had an investigation repeated but only the cost of one investigation was included in the analysis. Furthermore, some investigations may have been done but not recorded in the notes. Thus the cost of investigations may have been underestimated.

Staff costs were based on the mean actual salary of various categories of staff and the average number of staff employed on the ward. This gave a figure of K5,20 (US$1,18) per patient per day. In the Zimbabwe study the average cost per Bed Occupancy Day (BOD) was estimated to be Z$55 (US$19,25). This calculation was based on the total "Medica Care Services Budget" divided by the total Bed Occupancy days for the whole country. Our figure was considerably lower than this. Reasons for this discrepancy may include: the Zimbabwe study calculation would probably have included hospital running costs; it is possible that data on total Bed Occupancy Days was underestimated; it is probable that nurses can look after more paediatric patients than adult patients and therefore cost per paediatric patient is less than the average patient cost.

The Zimbabwe study calculated a nursing cost per child per day of Z$1 737 (US$608) by estimating the number of episodes of various conditions per patient per lifetime and then estimating the nursing days per episode. However, in the short term more patients does not mean more staff and the actual cost per patient will decrease. If the AIDS epidemic were to increase the number of admissions by 10 pc it is unlikely that the number of nurses/doctors would increase by 10 pc. The existing staff would just be expected to look after more patients, and patients would be discharged home earlier. In our study the estimated total *per annum* cost (staff and drugs) of treating a child with probable/possible AIDS was US$59,33 (assumes four admissions per year with a cost per admission of US$1,2 for in-patient/outpatient drugs and US$13,6 for staff). In the Zimbabwe study the equivalent total *per annum* cost of treating a paediatric AIDS patient was US$625 (four admissions costing US$4,21 per admission on drugs and US$608 on nursing care). The discrepancy between these figures has important implications for health planners.

The second part of the analysis was to look at the cost of treating various disease categories. In terms of drug costs, meningitis was the most expensive condition to treat (K 12,96/US$2,95). Surgical patients were the cheapest (K2,24/US$0,51) but the cost of surgery was not included in the analysis. Meningitis was also the most expensive disease in terms of total cost per patient (drug/staff/discharge medications) at K78,38/US$17,81. As a percentage of overall cost, meningitis was the fifth most expensive group of patients to treat (10 pc), after general medical (24 pc), surgical (20 pc), malnutrition (15 pc) and malaria patients (11 pc) (Table III). Meningitis thus appears to be of greater importance in terms of cost than certain WHO priority

diseases (acute respiratory infection, diarrhoeal disease and measles). This may be a temporary phenomenon because Malawi has experienced an outbreak of meningococcal meningitis in recent years. However, it will be important to review the situation in Malawi and elsewhere.

Conclusion: Meningitis cost more to treat than certain WHO priority (acute respiratory infection, disease and measles). This may be related to a recent menigococcal outbreak but needs to be examined closer. The estimated cost of treating children in Malawi with clinical features suggestive of AIDS was US$14,83 per admission (in-patient drugs, investigations, staff and discharge medicines) or US$59,33 *per annum* (assuming four admissions per year). This compares to a *per annum* figure of US$625 calculated for Zimbabwe. Both calculations show that staff costs are the major component of total cost. It is unclear as to what extent staffing levels will increase as a result of the AIDS epidemic. It is unlikely that existing staff will just be expected to care for more and more patients. Drug consumption is expected to increase as a result of the AIDS epidemic but already many sub-Saharan African countries are experiencing continuous shortages of essential drugs. The impact of the AIDS epidemic in sub-Saharan Africa is thus likely to be less and less treatment for all patients – those with AIDS and those without AIDS.

REFERENCES

1. Delay P. AIDS in Malawi. *Malawi Med J* 1990;6(1)2–4.
2. Phillips J. HIV reactive children in KCH. *Malawi Med J* 1990;6(1):15–17.
3. Peckham CS, Tedder RS, Briggs M, *et al.* Prevalence of maternal HIV-1 infection based on unlikely anonymous testing of newborn babies. *Lancet* 1990;335:516–19.
4. Ades AE, Parker S, Berry T, *et al.* Prevalence of maternal HIV-1 infection in Thames Regions: results from anonymous unlinked neonatal testing. *Lancet* 1991;337:1562–65.
5. Centres for Disease Control. Guidelines for evaluating surveillance systems. *MMWR* 1988;37:1–18.
6. Jensen BA. The financial costs of treating AIDS in Zimbabwe. Zimbabwe Essential Drugs Action Programme (ZEDAP), 1990.