

Cost of treating Insulin-requiring diabetes in children and adolescents

Onyiriuka N. , Ezomo O. O. , Onyiriuka R. C.

Department of Child Health, University of Benin Teaching Hospital and Department of Economics and Statistics, School of Postgraduate Studies, University of Benin, Benin City, Nigeria

Correspondence address: Dr. Alphonsus N. Onyiriuka, Department of Child Health, University of Benin teaching Hospital, PMB 1111, Benin City, Nigeria

E-mail: alpndiony@yahoo.com

didiruka@gmail.com

Abstract

Background: Childhood diabetes care imposes a heavy economic burden on the patient's family and all those involved in the provision of this care need to be aware of what factors drive cost.

Methods: Using an interviewer-administered questionnaire data was obtained from eleven respondents (parents of diabetic children) on their expenditure on items of direct cost such as insulin, syringes, cotton wool, methylated spirit, transportation, consultation, and glucometer with the test strips. Data was also obtained on income of the household, ability to cope with payment for medical care and sources of money used for such payment.

Results: The estimated mean monthly direct cost of routine diabetes care was ten thousand nine hundred and fifty Naira [(N10,950+4,698); 95% Confidence Interval, CI = 8,674-13,726] with purchase of insulin accounting for 51.1% of this cost. Money spent on purchase of insulin alone represented 43.7% of the average monthly household income. Eighty percent of the parents expressed varying degrees of difficulty coping with payment of direct cost of diabetes care.

Conclusion: Insulin-requiring diabetes imposes a heavy economic burden on the family of the patient with cost of purchase of insulin contributing the highest proportion among items of direct cost.

Key words: Diabetes mellitus, insulin, children, adolescents, direct cost, financial cost, Nigeria.

Introduction

Childhood diabetes mellitus is a chronic non-communicable disease that requires life long, continuous medical care and presents a high burden for the individual, the family and the society.¹ The assessment of the financial burden of a chronic illness involves measuring indices such as direct, indirect and intangible costs of care respectively. The direct

cost relates to used resources for insulin, syringes, cotton wool, methylated spirit, hospitalization, consultations, transportation, and management of complications. The direct cost may be further subdivided into routine cost of diabetes care which includes items such as insulin, home blood glucose monitoring(test strips), and miscellaneous items (syringes, cotton wool, methylated spirit) and non-

Insulin-requiring diabetes

routine cost of diabetes care which relates to cost of in-patient treatment, purchase of glucometer, and payment for services by other physicians and laboratories. The indirect cost relates to productivity losses due to absenteeism, disability and premature death due to the illness. The intangible cost relates to the cost implications of pain, anxiety, inconvenience and other factors which decrease quality of life of the patient and his/her relatives.²⁻⁴ It has been documented that health care expenditures for people with diabetes mellitus is 2 to 3 times higher than for those who are not affected by diabetes.⁵ A report from Costa Rica indicated that people with diabetes mellitus made 1.55 times more medical visits and had 1.98 times more hospitalizations than people without the disease.⁶ Diabetes mellitus represents a considerable burden on resources of the individual/his family and the health-care system. However, it has been recognized that measurement of that cost is difficult.² The difficulties of arriving at accurate, or at least, satisfactory financial cost of care has been documented by various authors, even in the developed countries.^{7,8} It has been pointed out that the price of material rises as methods of treatment become more sophisticated.^{9,10} Cost-of-illness studies is required to evaluate the economic effects of treatment. All those involved in the care of the child/adolescent with diabetes need to be aware of what factors drive cost. Research on the costs of chronic illness is important for shaping social policies and services for the chronically ill.⁷ Individual countries need their own diabetes care cost estimates because inaccuracies may occur when costs are estimated from different countries with different economic, health and accounting systems.² In fact, Beran et al^{11,12} have documented that in none of the three countries they surveyed was there one single price for insulin. They emphasized that prices was dependent on location of purchase, the complexity of the supply chain and the method by which the medicine was purchased. The prevalence of diabetes mellitus is increasing in both developing and developed countries.¹³⁻¹⁵ In fact, it has been documented that the paediatric incidence of type 1 diabetes is rising by 3 to 5% each year with a worldwide estimate that approximately 70,000 children below the age of 15 years develop type 1 diabetes annually.¹⁶ A periodic cost-of-care survey, therefore, offers an affordable means of monitoring trends in resources utilization and costs of supplies and services in caring for patients with diabetes. Information on cost-of-illness studies should be used to raise awareness and lobby for allocation of resources. Although some studies in Nigeria have investigated the clinical aspects of type 1 diabetes mellitus,¹⁷⁻¹⁹ little or no attention has been paid to the direct cost of diabetes care. Barcelo et al² in a study in Latin America and the Caribbean

concluded that research into the health economics of diabetes is still insufficient and should be prioritized.

The present study, therefore, sought to estimate the direct cost of diabetes care for children and adolescents presenting with insulin-requiring diabetes at the University of Benin Teaching Hospital (UBTH), Benin City, Nigeria.

Methods

The study was conducted at the University of Benin Teaching Hospital (UBTH) between January to June, 2011. Consent was obtained from the patients and their parents after explaining the relevant details of the study to them. Interviewer-administered questionnaire was used in obtaining information from the patient/parent on the occupation, level of education and the approximate income of the parents. During the interview, the parents were asked to state their income. As expected, some parents did not have a fixed monthly income. For those without a fixed monthly income, the interviewer tried to remind the respondent of all income received from various sources during the recall period under review. In this circumstance, the amount volunteered by the respondent as income is expected to be an approximate figure. This sum was noted by the interviewer. Data on items of direct cost, such as cost of insulin, syringes, methylated spirit, cotton wool, transportation to and from hospital, laboratory investigations, glucometer with the test strips, consultation fees and previous hospitalization were also obtained and recorded. The cost of the various items was confirmed and recorded from the receipts issued to the patient/parents. Where receipts were not available, we liaised with the appropriate departments of the hospital to obtain the cost. UBTH has a brochure containing the prices of various items. Aspects of direct cost were assessed and documented every four weeks during their visits to the Paediatric endocrine-metabolic clinic. Each of the patients was provided with an exercise book for entering amount of money spent on relevant items of direct cost of diabetes care. Such entries were examined and noted during each of their visits to the Paediatric endocrine-metabolic clinic. For the purpose of this study, each patient was followed up for six months.

Drugs: The total daily dose of insulin was documented for each patient including the number of insulin syringes used. This was computed for each month. All the receipts for purchase of insulin, syringes, methylated spirit and cotton wool were examined and the amount stated in it was recorded.

Consultations and hospitalization: The cost of consultation which included consultation fees during each visit and the

cost of transportation for the patient and his/her relation was recorded. The hospital bill for previous hospitalization was obtained from the receipt issued to the parents. Where the receipt for previous hospital bill was not available, it was obtained from the cash-record book of the relevant hospital ward.

The cost of some of the items related to medical care were verified by visiting recognized and registered pharmacy shops within Benin City to get the price of such items. In this regard, at least three different registered pharmacy shops were visited and the average price of each item was determined. Statistical analysis involved calculation of percentages, means, standard deviations, and 95% confidence intervals.

Results

Eleven (27.5%) of 40 patients seen in the paediatric endocrine clinic of the Department of Child Health, University of Benin Teaching Hospital, Benin City had diabetes mellitus and were the subject of this study.

Table 1: Details of direct cost of diabetes care per patient per month among 11 children and adolescents with insulin-requiring diabetes.

Items of direct cost	Mean cost [Nigerian Naira (N)]+	95% CI*	Percent of Total cost
Insulin	5,600+3,321	3,637-7,563	51.1
Syringes	2,400+756	1,953-2,847	21.9
Consultations	350+201	231-469	3.2
Transportation	600+202	481-719	5.5
Self monitoring of blood glucose (SMBG):			
-Test strips	1,200+856	694-1,706	11.0
Laboratory investigations	500+178	395-605	4.6
Miscellaneous (methylated spirit, cotton wool)	300+187	189-411	2.7
Total cost	10,950+4,698	8,674-13,726	100.0

+1 US Dollar = 150 Nigerian Naira (N)

*CI = Confidence Interval

Cost of in-patient treatment and purchase of glucometer were excluded from this table because they were not routine monthly expenditure.

The estimated mean direct cost of routine diabetes care was ten thousand nine hundred and fifty Naira (N10,950) per patient per month, with insulin accounting for 51.1% of this direct cost (Table 1). When the other miscellaneous items (syringes, cotton wool, methylated spirit) required for the administration of the insulin was added to the cost of insulin therapy, it was N8,300 per patient per month, representing 75.8% of total direct cost of routine diabetes care. Money spent on the purchase of insulin represented 43.7% of the average monthly household income but rose to 64.8% when other miscellaneous items required for insulin administration was added to cost of insulin. As shown in Figure 1, 50% of the parents spent between 60,000 and 70,000 Naira during the initial hospitalization at the time of diagnosis of diabetes in their children.

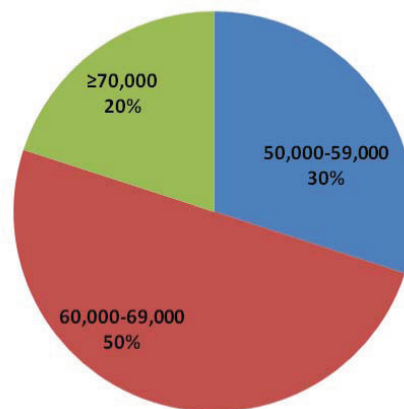


Fig. 1:Amount in Naira spent during initial in-patient treatment

Insulin-requiring diabetes

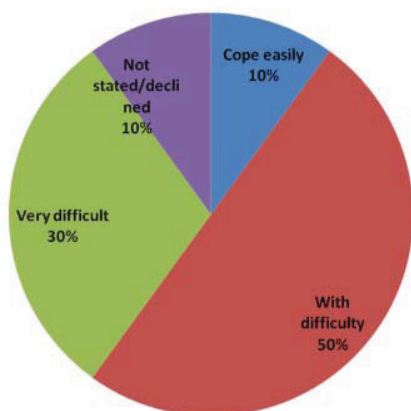


Fig. 2: Parental ability to cope with payment for direct cost of diabetes care.

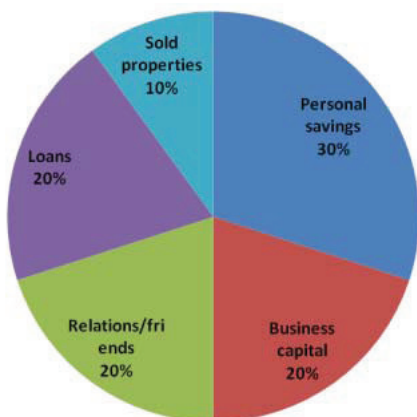


Fig. 3: Major sources of money used for paying for direct cost of diabetes care.

With regard to parental ability to cope with payment for direct cost of routine diabetes care, majority (80%) expressed varying degrees of difficulty (Figure 2). In one-third of the respondents, personal savings was the major source of money for paying for direct cost of diabetes care (Figure 3). The mean monthly income declared by the parents of the patients was N12,810±8,514 (95% Confidence Interval, CI = 7,778 - 17,841). When the mean total direct cost of diabetes care was related to the mean monthly income of the parents, it showed that it represented 85.5% of their monthly income. The average distance travelled per patient per visit was 18.6±7.5 Km (95% CI= 14.2 - 23.0). The patients were usually accompanied to the follow-up clinic by their mothers. None was accompanied by the father. A glucometer cost between 6,500 to 8,000 Naira (excluded in Table 1 because it is not a routine direct cost as it is

not purchased monthly). The mean hospital bill paid for in-patient treatment was 65,000±39,400 Naira (95% Confidence Interval, CI= 41,716 - 88,284). The two leading sources of money for payment of initial hospital admission bill were friends/relations (40%) and loans (30%). Other sources were personal savings (20%) and Organisations' donation (10%). The calculated mean monthly insulin requirement based on the prescribed dosage was to be 620 Units per patient per month. Only one (9.1%) of the patients with diabetes was enjoying the National Health Insurance Scheme (NHIS) which commenced in Nigeria several years ago.

Discussion

The monthly direct cost of diabetes care for children and adolescents with insulin-requiring diabetes seen in our hospital was relatively high (N10,950). However, this was lower than N16,974 reported among adults with insulin-requiring diabetes seen at the Federal Medical Centre, Abeokuta, Nigeria.⁴ The inclusion of pocket money (N739.7 per week), feeding (N733 per week) and accommodation (N366 per week) among items of direct cost in that study⁴ may account for their higher cost. Reports on direct cost of care in children and adolescents with diabetes mellitus was not available for comparison. A study from Latin America and the Caribbean² reported a direct cost of 58.4 US Dollar (approximately N8,760; 1 USD= 150 Naira) per month per patient which was lower than the cost reported in the present study. The lower cost reported by Barcelo et al,² may be accounted for by the inclusion of non-insulin-requiring diabetes in their study population. The mean direct cost of care has been reported to be higher in diabetic patients requiring insulin compared to their counterpart who do not require insulin.⁴ Besides, the authors stated that their estimates were conservative and in some cases they intentionally underestimated the true cost of different items and there was lack of coverage of continuous care for a significant proportion of their study population.² In this regard, the design of the present study has some advantage. Unlike cost estimates derived from patients with diabetes who were identified from the general population or diabetes register, the design of the present study has the advantage of interviewing the parents/patients face-to-face thereby obtaining a relatively precise estimates of the costs of various items of direct cost. The implication is that our information concerning costs and utilization patterns of the individual patients was collected directly rather than estimating the cost from aggregated categories as were the case in some studies.^{2,20-22}

In the present study, purchase of insulin accounted for 51.1% of the total direct cost of diabetes care. Similar finding

has been reported from Tanzania, Malawi, Mozambique and Zambia.^{12,23,24} The high proportion of direct cost contributed by purchase of insulin might be due to the erratic supply of insulin in most African countries, even in large hospitals.²⁵⁻²⁷ The complexity of the insulin supply chain, the location of purchase and the method by which the insulin was purchased are other contributors to the high cost.¹¹ For instance, in Benin City, Nigeria the cost of one vial of insulin was N2,800 (approximately 18.7 US Dollars) compared to 10.88 US Dollars in Bamako, Mali.¹² Mendis et al²⁸ in their survey examined the availability and affordability of medicines (including insulin) for chronic diseases in Bangladesh, Brazil, Malawi, Nepal Pakistan and Sri Lanka and concluded that there is a need to improve the availability and affordability of medicines for chronic diseases. In present study, the cost of an insulin syringe was N40 (0.27 US Dollar). This is higher than 0.04 US Dollar reported from Mozambique but much lower than the 1.5 US Dollars reported from Zambia.¹² The high cost of insulin syringes in Zambia was attributed to non-availability in the public sector compelling patients to purchase it private commercial outlets who included value-added taxes on syringes thereby increasing the cost.¹² Data from the present study indicated that insulin was costly relative to the average household monthly income (accounted for 43.7% of household monthly income). Similar observation has been noted in Sudan.²⁹ The erratic supply of insulin in most African countries may account for its high cost.²⁵⁻²⁷

In the present study, the direct cost of routine diabetes care represents a major burden on the lean resources of families of children with diabetes mellitus as only 10% of parents stated that they could easily cope with the payment. This is reflected in the expressed difficulty by 80% of the respondents concerning coping with paying from their pockets for the routine diabetes care of their children. Similar finding has been reported from a tertiary hospital in Ilorin, Nigeria.³⁰ This out-of-pocket payment for direct cost of routine diabetes care by parent might be at a considerable social cost to the family because other consumption and investment needs have to be sacrificed as the health needs of a family member cannot be ignored. With the continuous upward adjustment of user charges in our hospitals, there is the need to protect the poorer users against excessive health expenditures. This is what the national health insurance scheme (NHIS) sought to provide in various countries where it is being implemented.³¹⁻³⁴ Although the NHIS is still in its infancy in Nigeria, its potential benefits was illustrated in one of our patients who was enjoying its services because it provided insulin on a regular basis for this patient. Having relieved the family

of the cost of insulin (a major component of direct cost in the present study), they were better able to provide for the other items of direct cost thereby promoting a better diabetes care of this patient.

In the present study, the major source for money for payment of initial in-patient hospital bill was through friends/relations. Similar finding has been reported in another tertiary hospital in Nigeria.³⁰ Most respondents paid for direct cost of routine diabetes care from their personal savings, though with great difficulty. This difference in sources of money for payment may be explained by the fact that items of direct cost have to be paid out-of-pocket at the point of purchase or utilization of services. In contrast, in-patient hospital bills allow time for the parents of the diabetic child to source for money through consultations with friends and relations.

This study has some limitations. Firstly, the results of this study is limited by the small sample size. Secondly, self-reported incomes in the case of respondents without a fixed monthly income are subject to reporting bias. There could have been under-reporting of household income resulting in over-estimation of the percentage of income spent on purchase of insulin. In conclusion, despite the limitations, the study showed that diabetes care imposes a heavy economic burden on the family of the child with diabetes and that majority of these families encountered difficulties paying for the direct cost of care of their children, with purchase of insulin being a major contributor to the direct cost of diabetes care. Provision of insulin at a reduced cost is advocated.

References

1. Sperling MA. Diabetes mellitus. In: Kaplan SA, ed. Clinical Pediatric Endocrinology. 2nd ed. Philadelphia, W.B. Saunders Company, 1990: 127-164.
2. Barcelo A, Aedo C, Rajpathak S, Robles S. The cost of diabetes in Latin America and Caribbean. Bull World Health Org 2003; 81: 19-27.
3. Songer TJ. Assessing direct and indirect cost of diabetes. In: Williams R, Tuomilehto J, Bjork S, eds. The Economics of Diabetes Care: An International Perspective. Wellingborough, Blackwell Science, 2000.
4. Amoo G, Ogunlesi AO. Financial cost of treating Nigerian in-patients with schizophrenia. Afr J Med Sci 2005; 34: 15-23.
5. Rubin RJ, Altman WM, Mendelson DN. Health care expenditures for people with diabetes mellitus, 1992. J Clin Endocrinol Metab 1994; 78: 809A-F.

Insulin-requiring diabetes

6. Morice A, Rosello M, Arauz AG, Sanchez G, Padilla G. Diabetes mellitus en Costa Rica: un analisis interdisciplinario.[Diabetes mellitus in Costa Rica: an interdisciplinary analysis] Costa Rica: Instituto de Investigacion y Ensenanza en Nutricion y Salud, 1999. [In Spanish].
7. Shillitoe RW. Psychology and Diabetes: Psychosocial Factors in Management and Control. London, Chapman and Hall Ltd , 1988: 215-241.
8. Williams DRR. Health services for patients with diabetes. In: Jarrett RJ, ed. London, Croom Helm, 1986: 57-75.
9. Harsant PR. Harnessing resources. Diabetic Med 1984;1: 65-67.
10. The Diabetes Control and Complications Trial Research Group. Resource utilization and costs of care in the diabetic Control and Complications Trial. Diabetes Care 1995; 18(11): 1468-1478.
11. Beran D, McCabe A, Yudkin JS. Access to medicines versus access to treatment: the case of type 1 diabetes. Bull World Health Org 2008; 86(8): 648-649.
12. Beran D, Yudkin JS, de Courten M. Access to care for patients with insulin- requiring diabetes in developing countries: case studies of Mozambique and Zambia. Diabetes Care 2005; 28:2136-2140.
13. Kadiki OA, Roaied RB. Incidence of type 1 diabetes in childhood (0-14 years) in Benghazi, Libya (1991-2000). Diabetes Metab 2002; 28: 463-467.
14. Elamin A, Omer MI, Zein K, Tuvemo T. Epidemiology of childhood type 1 diabetes in Sudan, 1987-1999. Diabetes Care 1992; 15: 1556-1559.
15. Wild S, Rogie C, Sicrete R, King H. Global prevalence of diabetes estimate for 2005 and projection for 2030. Diabetes Care 2004; 27: 1007-1014.
16. Danne T, Lange K, Kordonouri O. New developments in the treatment of type 1 diabetes in children. Arch Dis Child 2007; 92: 1015-1019.
17. Anochie IC, Nkangieneme KE. Childhood diabetes in Port Harcourt, Southern Nigeria. Diabetes International 2002; 12: 20-21.
18. Ibekwe MU, Ibekwe RC. Pattern of type 1 diabetes mellitus in Abakaliki, Southeastern Nigeria. Paediatric Oncall [Serial online] 2011 [cited July 1]; 8 Art # 48. Available from: http://www.paediatriconcall.com/fordocor/medical_original_article/diabetes.asp.
19. Opara P, Anochie IC, Eke FU. Childhood diabetes mellitus in Port Harcourt: Any change in prevalence and outcome? Port Harcourt Med J 2008; 2: 126-129.
20. Villareal-Rios E, Salinas-Martinez AM, Medina-Jauregui A, Garza-Elizondo ME, Nunez-Rocha G, Chuy-Diaz ER. The cost of diabetes mellitus and its impact on the health spending in Mexico. Arch Med Res 2000; 31: 511-514.
21. American Diabetes Association. Economic consequences of diabetes mellitus in the U.S. in 1997. Diabetes Care 1998; 21: 296-309.
22. Dawson KG, Gomes D, Gerstein H, Blanchard JF, Kahler KH. The economic cost of diabetes in Canada, 1998. Diabetes Care 2000; 25: 1303-1307.
23. Chale SS et al. Must diabetes be a fatal disease in Africa? Study of cost of treatment. BMJ 1992; 304(6836): 1215-1218.
24. Vaughan PGL, Mills A. Diabetes in developing countries: its importance for public health. Health Policy Planning 1989; 4: 97-109.
25. Amoah AG et al Facilities and resources for diabetes care at regional health facilities in southern Ghana. Diabetes Res Clin Pract 1998; 42(2): 123-130.
26. Yudkin JS. Insulin for the world's poorest countries. Lancet 2000; 355(9207): 919-921.
27. Watkins PJ. Delivering care for diabetes in Ethiopia. Trans Roy Soc Trop Med 1999; 93(4): 355-356.
28. Mendis S, Fukino K, Cameron A, Laing R, Fillipe A, Khatib O, et al. The availability and affordability of selected essential medicines for chronic diseases in six low- and middle-income countries. Bull World Health Organ 2007; 85: 279-288.
29. Eltom M, Thompson C. Management of diabetes in Sudan. Diabetes Forum, Norwegian Diabetes Association 2005; 2(2): 32-34.
30. Akande TM, Ogunrinola EO. Health care financing among in-patients of tertiary health facility in Ilorin, Nigeria. Niger J Clin Pract 1999; 2(1): 1-4.
31. Chu TB, Liu TC, Chen CS, Tsai YW, Chiu WT. Household out-of-pocket medical expenditures and national health insurance in Taiwan: income and regional inequality. BMC Health Serv Res 2005; 5: 60.

32. Obermann K, Jowett MR, Alcantara MO, Banzon EP, Bodart C. Social health insurance in a developing country: the case of the Philippines. Soc Sci Med 2006; 62: 3177-3185.
33. Limwattananon S, Tangcharoensathien V, Prakongsai P. Catastrophic and poverty impacts of health payments: results from national household surveys in Thailand. Bull World Health Organ 2007; 85: 600-606.
34. National Health Insurance Scheme. Handbook. 2nd edition. Abuja, Heritage Press, 2002: 1-16.