

Research Article

Study of the Clinical and Economic Aspects of Diabetic Patients Hospitalized in Matlaboul Fawzayni National Hospital Center of Touba Senegal

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Abstract

Diabetes mellitus is a chronic hyperglycemia with an enormous human and social cost. The main objective was to evaluate the clinical and economic aspects of patients followed at Matlaboul Fawzayni National Hospital Center in Touba (MFNHCT). Our study was cross-sectional, prospective, descriptive and analytical. It included all consenting patients hospitalized at Touba Hospital from January 1 to December 31, 2022. A questionnaire was administered directly to the patients. The data were entered in Excel and analyzed using SPSS software. Of the 653 diabetic patients consulted, 84 were hospitalized and enrolled. There was a female predominance with a sex ratio of 0.91. The mean age was 53.2 ± 17.83 years. Type 2 diabetes accounted for 94% of the cases. Polyuria-polydipsia syndrome and incidental discovery were the main modes of discovery with 38.10% and 35.71%, respectively. The majority of patients were treated with MHD + ADO + insulin (66.67%). Metformin was the first-line molecule in the treatment of type 2 diabetes with a prevalence of 54.90%. The most common acute complication was ketoacidosis (89.16%). The most common chronic complications were cardiovascular and renal with 30.95% and 21.43%, respectively. Among the working patients, 33.33% had repeated absences from work due to illness or medical visits. The premature death of 9.52% of our patients was due to acute or chronic complications. Catastrophic health care expenditures were found in low and middle income patients. The average cost of hospitalization for type 1 diabetes was 19,088 CFA francs compared to 23,681 CFA francs for type 2 diabetes. This mean difference was statistically significant with a p-value of 0.04 (<0.05). Average hospitalization costs were higher in patients with type 2 diabetes. Diabetes remains a heavy economic burden. Strengthening preventive measures for this disease and promoting universal health coverage will help reduce household expenditures.

Keywords

Cost, Management, Diabetes, Senegal

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1. Introduction

Diabetes mellitus is a chronic disease that is causing concern on a global scale. People are becoming aware, although far too slowly, of the enormous human and social cost of diabetes in developed and developing countries.

According to the International Diabetes Federation (IDF) [1], the number of adults with diabetes reported in 2015 was 415 million, or 8.8% of the world population. In most countries, 87 to 97% of these patients suffer from type 2 diabetes. Estimates of the number of people at risk or with undiagnosed illnesses are 46.5%. The mortality rate related to complications of the disease is 14.5%, or approximately 5 million deaths per year. In a quarter of a century (2040), one tenth of the population would be ill, which would increase the figure to more than 642 million patients. The exponential progression of the disease and its irreversible complications imposes unacceptable human, social and economic costs on countries regardless of the level of development.

IDF data reveal that more than 14 million diabetics live in the African region and Senegal ranks 32nd on the continent.

Indeed, given these data, diabetes mellitus is now considered a public health problem by all governments and practitioners. Once considered a disease of wealthy societies, diabetes has become a disease of the poor and is on the way to becoming a cause of poverty. If left unchecked, the deadly combination of communicable and non-communicable diseases will disable and kill millions of people and further hamper economic development in regions where growth is most needed [2]. Governments must now choose between spending ever-increasing amounts on emergency care and medications or making long-term, high-yield investments in the health and quality of life of millions of people by improving the living environment and encouraging lifestyle changes among populations [2]. This work was carried out in light of the increasing frequency of diabetes and its complications, the high cost of its management, and its impact in terms of days off work and disability. Its objective is to study the clinical and economic aspects of diabetic patients followed at the MFNHCT.

2. Methodology

2.1. Study Setting

The study was conducted in the department of internal medicine of Matlaboul Fawzaini National Hospital Center in Touba. It is located in the department of Mbacké with two others hospitals like this one and is, 3.5 km from the Grand Mosque in the district of Dianatoul Mahwa. This structure, which occupies an area of three (3) hectares and has a capacity of 200 beds, was inaugurated in 2002. It was established as a Level III Public Health Establishment on December 13, 2006. It includes several medical, surgical, administrative, and

technical services.

The department of internal medicine is a reference center not only for diabetes but also for other pathologies. It is essentially a diagnostic, hospitalization and outpatient treatment service.

2.2. Type and Duration of Study

This is a cross-sectional, descriptive and analytical study that took place from January to December 2022 with a clinical and economic component.

2.3. Study Population

We included all diabetic patients who were hospitalized in the department of internal medicine during the study period.

Diabetics hospitalized at MFNHCT were included.

However, diabetics who refused to participate in the survey or those who were in a comatose state where it was impossible to answer the questions were not included.

2.4. Technique and Collection Tool

We used a questionnaire to collect clinical and economic data with diabetic patients meeting the inclusion criteria.

According to the reference profile of the household economy approach (HEA) in Senegal in 2017,

1. any annual income less than 769,450 FCFA / year is considered as low.
2. any annual income between 769,450 FCFA and 1,388,100 FCFA / year is considered average.
3. any annual income greater than 2,234,500 FCFA / year is considered a high.

2.5. Data Entry and Analysis

The data were entered and analyzed with Excel. For the analysis of the database we used SPSS 18 software (a Statistical Package of Social Science).

The data analysis consisted of two parts: descriptive and analytical.

The descriptive part: consisted of calculating:

The Parameters such as the mean, the median, the extremes, the standard deviation for quantitative variables and the frequencies for qualitative variables.

2.6. Cost Calculation

The prices of the various biological and radiological assessments were entered using the hospital service price management system (Hopitalia Software).

The cost of consultations was 4000 FCFA

Annual hotel cost = 2000 FCFA \times length of hospital stay in the year

Annual travel cost = price of a trip \times number of trips / year

Annual consultation cost = 4000 FCFA \times number of consultations in the year

Annual biology cost = (Prices \times number of biological examinations carried out in the year)

Annual radiology cost = (Prices \times number of radiological examinations carried out in the year)

Annual medication cost = (drug price \times number in the year)

Annual direct cost = (Annual cost (travel + medication + biology + radiology consultations + hotels))

Average annual direct cost = direct annual cost of all patients / number of patients

The analytical part made it possible to calculate the costs of caring for diabetics and to compare the average costs by expenditure item for type 1 and type 2 diabetics using the student test. The statistical significance threshold was set at 0.05.

2.7. Ethical Considerations

Informed consent was obtained from all subjects in our study. The motivations and objectives of this study were properly explained to them. They were reassured of the strict confidentiality of all data and anonymity. For patients under 18, a verbal consent from parents was obtained before the questionnaire was administered.

3. Results

3.1. Descriptive Results

At the end of our enrollment, there were 84 patients. The average age was 53.2 years \pm 17.83 with extremes ranging from 15 to 87 years. The age group 26-65 years was the most represented (60.71%).

There were 44 female patients (52.38%) or a sex ratio of 0.91.

There were 74 married patients or 88.10% of the population while single patients represented 8.33%.

The Wolof ethnic group was the most represented (76.19%) followed by the Peul, Serer and Socé ethnic groups with respectively 13.10%; 9.52% and 1.19%.

Patients who had diabetes lasting 1 to 5 years represented 59.52% while those whose duration was greater than 10 years were 18 or 21.43%.

Polyuria-polydipsia syndrome was found in 32 patients (38.10%) followed by incidental discovery in 30 patients (35.71%).

Type 2 diabetes represented 82.14% and 48 patients (57.14%) had a history of family diabetes.

Treatment consisting of diet combined with physical exercise, an Oral Anti Diabetic and insulin was prescribed in 56 patients (66.67%); treatment based on diet and physical exercise was prescribed in only 1 patient (1.19%). Biguanides were taken by 54 patients (64.28%). Mixed insulin was used by 72 patients (88.89%) while 8 patients (9.88%) took intermediate insulin.

The acute complications found in our patients were ketoacidotic state, hypoglycemic state and hyperosmolar state with respectively 74 patients (89.16%); 06 patients (7.23%) and 3 patients (3.61%). Among the chronic complications, cardiovascular ones predominated and were found in 26 patients or 30.95% while renal involvement was present in 18 patients (21.43%). Neurological complications such as diabetic foot were present in 11 patients (13.10%).

In our population, 82 patients (97.62%) had received medical treatment; 06 patients (7.14%) had undergone limb amputation and 01 patient (1.19%) was on dialysis. The duration of treatment was more than 6 months in 30 patients (36.59%). It ranged from 1 to 4 weeks in 19 patients (23.17%) and was less than a week in 17 patients (20.73%). Hospitalization was less than a week in 28 patients (33.3%) while it ranged from 1 to 4 weeks for 66.7% of patients.

The average income in the population was 106,000 CFA francs \pm 189,096. The amounts ranged from 0 CFA francs to 800,000 CFA francs. Patients with a low income level numbered 59 (70.24%) while patients with a high income numbered 6 (7.14%).

The average cost of consultations was 8,929 CFA francs \pm 1,525 francs. The median was 9,000 francs with extremes ranging from 4,000 to 13,000 CFA francs. The consultation cost 9,000 CFA francs for 72 patients, or 85.71% of the study population; five patients, or 5.95%, had paid 13,000 for the consultation. The average cost of additional examinations was 17,250 francs \pm 9,245. The median was 17,000 francs with extremes ranging from 0 to 55,000 CFA francs. The cost of examinations cost between 10 and 20 thousand francs for 40 patients, or 48.78%. It was less than 10 thousand in 19 patients or 23.17% of the study population.

The average cost of hospitalization was 3,463 frs \pm 2,974 frs; the median was 2,000 frs with extremes ranging from 1,000 frs to 55,000 CFA francs. The cost of hospitalizations was less than 5,000 francs for 75 patients or 91.46% of the study population. It was greater than 15,000 frs for 3 patients or 3.66%.

The cost of medications was less than 10,000 frs in 23.17% of the study population or 19 cases. It was between 10 and 20 thousand in 52 patients or 63.41%.

Travel costs were less than 1,000 CFA francs in 13 patients or 15.48% of cases. They were between 1,000 and 5,000 francs in 69 patients.

The occurrence of complications increased the costs of care in general. An increase in health expenditure was noted during these complications at the level of all classes. Health expenditure was catastrophic in patients with low and middle incomes.

The cost of additional examinations was between 75,500 - 99,000 in 37 patients, or 44.05% followed by 23 patients between 50,000-75,000 or 27.38% and 15 patients greater

than or equal to 100,000 or 17.86%.

The average cost of hospitalization was 22,988 CFA francs +/-18,113 CFA francs. The median amount was 16,000 francs with extremes ranging from 6,000 to 80,000 CFA francs.

The cost of medications was between 80,000-90,000 or 39.29% followed by 100,000-150,000 or 29.76% and 60,000-79,000 or 17.86%.

Table 1. Distribution of expenses in FCFA before and during illness.

Total cost of expenses (CFA francs)	Mean	Standard deviation	Median	Extremes
Before the illness	38,910	17,679	37,000	3500 -109,000
During the illness	213,651	59,404	210,300	99,000-403,000

The average monthly income before hospitalization was 320,000 CFA francs +/- 567,289 with extremes ranging from 0 to 2,400,000 CFA francs. The average monthly income during complications had decreased and was 209,761 CFA francs +/- 379,416 with extremes ranging from 0 to 1,600,000 CFA francs.

Among the patients, 8 or 9.52% had died following acute or chronic complications of their illness.

3.2. Analytical Results

In our study, the average cost of hospitalization was higher in patients with type 2 diabetes. It was 19,088 CFA francs for type 1 diabetes versus 23,681 CFA francs for type 2 diabetes. This difference was statistically significant with a p-value of 0.04 (<0.05). Furthermore, there is no statistically significant difference between the two types of diabetes for travel, consultations, additional examinations and medications.

Table 2. Analysis of average annual costs in FCFA by expenditure item according to the type of diabetes.

Expenditure items	Type of diabetes		P-value
	DT1	DT2	
	N Mean (deviation)	N Mean (deviation)	
Travels	15 1,213.33	69 1,614	0.22
Consultations	15 9,266.67	69 8,855.07	0.34
Additional examinations	15 72,666.67	69 86,152.17	0.07
Medications	15 98,773.33	69 97,820.29	0.9
Hospitalizations	15 19,800	69 23,681.16	0.04

4. Discussions

4.1. Epidemiological and Clinical Data

The average age of diabetics was 53.2 years \pm 17.83 years

while M. N. Mbaye and A. Kane had found 43.4 ± 17.8 years [3]. Patients who were between 26 and 65 years old represented 60.71% of the sample of our study, which is super-imposable with the results found by M Aidara 82% [4] and C. Salla 76% [5]. In Dakar, Diack found in a hospital setting an average age of 58 ± 9.28 years and a higher prevalence of diabetes in the 50-60 age group [6]. The age group between 55

and 64 years was the most affected in Darou Mousty, in rural areas (15.2%) [7] and in Saint Louis, in urban areas (33.8%) [3]. In Algeria, in urban areas, the age groups between 50-59 years and 60-69 years were the most represented [8]. OGA found a higher prevalence in the 40-49 age group [9]. Female predominance was found (52.38%) with a sex ratio of 0.91. This same proportion was found by Ongnessek N. S. (56.3%) [10] and M N Mbaye A kane [3] with a sex ratio of 2.23 in favor of women. Other studies outside Senegal have also found a female predominance of 62.1% in Cotonou and 50.9% in Madagascar with a female/male sex ratio of 1.64 and 1.1 [11, 12]. However, this female predominance is not the rule in Africa; for example, in urban Tanzania, a study on cardiovascular risk factors reflected a male predominance of 55% with a sex ratio of 1.22 [13].

In our series, polyuro-polydipsia syndrome represented 38.10% followed by incidental discovery with 35.71%. Such an observation is consistent with what is described in the Western literature and with the data reported by most African authors according to which the diagnosis of diabetes is generally made in Africa on the occasion of either cardinal signs or complications [14]. In Nabil Choukair for example, 66.94% of type 2 diabetics were discovered during a cardinal syndrome and 10.33% during complications mainly dominated by repeated abscesses [15]. Similarly, data reported in Ivory Coast reveal that 76.35% of type 2 diabetics were discovered during cardinal signs of the disease [16].

Diabetes evolving between 1 and 5 years was found in 59.52% of our subjects, superimposable to the results found by Ongnessek N. S. 50%. [10].

The notion of familial diabetes was found in most patients in our series (57.14%) comparable to that reported at the main hospital in Dakar by GAULTIER et al. (50% of cases) and to Nabil Choukair by NDIAYE (58.7%) [17, 15]. Some authors have reported similar results; MONAKEBA, in Congo, had found a notion of familial diabetes in 36.1% of patients, including 24.7% in T2D and 11.6% in T1D [18].

The acute metabolic complication is dominated by ketoacidosis which represented 89.16% followed by the hypoglycemic state with 7.23%. Demb éM. S. [19] and Tour éA. I [20] reported respectively 19% and 3.5%. Leye M. Y, Leye A et al had found an incidence of 6.49% for ketoacidosis [21].

4.2. Economic Data

4.2.1. Direct Cost

(i). Consultation Fees

In this distribution of annual consultation fee amounts, patients who had an expenditure in the 2,500 to 5,000 FCFA bracket represented 44.05%.

(ii). Additional Examination Fees

Among patients who had a follow-up assessment, 44.05% of

them had paid their own assessment, which is comparable to that of Fofana Y who found 70% [22]. In this distribution of annual analysis fee amounts, patients who had an expenditure of less than 50,000 FCFA represented 10.71%, while Fofana Y. in his study found a predominance of the 10,001 to 20,000 FCFA class with a prevalence of 34.2%. This fact reflects the low standard of living of the majority of our patients, most of whom have enormous financial difficulties in bearing these costs.

Doctors in turn are faced with the problem of follow-up that this could cause.

(iii). Distribution of Transport Expenses

The expense class of 1,000 to 5,000 FCFA represented 82.14%. The average annual cost related to travel per patient was 1,614 FCFA. Overall, there is a relative weakness in transport expenses, this is justified by the fact that the majority of our patients resided in Touba.

(iv). Distribution of Drug Expenses

The average drug expense recorded during our study is 97,870.29 FCFA per year. The cost of medication was slightly higher in type 1 diabetics than in type 2 with annual averages of 98,773.33 FCFA and 97,820.29 FCFA respectively (P-value 0.9).

The majority of our patients had an annual medication expenditure between 30,000 and 60,000 FCFA with a prevalence of 63.41%. Approximately, a patient on ADO must pay between 6,825 and 24,125 FCFA per month or 81,900 to 289,500 FCFA per year. While a patient on insulin will spend approximately 8,107.5 FCFA per month or 97,290 FCFA per year. In the event of complications, these amounts can be doubled or even tripled sometimes depending on whether the patient has one or more complications. In Senegal, the State subsidizes the purchase of human insulin for nearly 300 million CFA francs per year. However, the population of type 1 diabetics represents only about 10% of Senegalese diabetics. Knowing that the monthly cost of treatment with the most commonly used oral antidiabetics (glibenclamide and metformin) amounts to an average of 14 euros, the vast majority of type 2 diabetics experience daily difficulties in ensuring a regular supply. The poor therapeutic compliance frequently noted in our daily practice is largely explained by this obstacle. In Mali, a year's supply of insulin for a patient represented approximately 38% of the annual resources of his family in 2000 [23]. In Mozambique [24], the government must spend 3.60 euros to buy an ampoule of insulin. He is thus faced with a choice of priorities between providing insulin for one person for a year, or essential medicines for 40 other patients.

In addition, the premature death of 9.52% of our patients was due to acute or chronic complications.

4.2.2. Income and Expenses

We note a decrease in annual income in all social classes. The explanation for this decrease could be a decrease in

productivity that the disease would cause in patients.

As for health expenditure, it is increasing in all income classes and is higher than 84,000 FCFA. We note that the lowest average health expenditures are observed in the "low" income class, reflecting the insufficiency of resources of this class, often limiting them in their health expenditure. The increase in health expenditures of the "middle" and "high" income classes could be explained by the fact that these classes are the predilection of civil servants and traders, who would show a particular interest in care. We note a clear increase in health expenditures in all income classes. Health expenditures respectively make up 3/5, 2/5, 1/5 of the annual income of the "low", "middle" and "high" income classes.

Health expenditures were catastrophic among the low and middle income classes, that is to say that these expenditures were higher than 40% of income.

In this comparison of income and expenditure, there is also a notable drop in total household expenditure in all income classes during the illness, this observation allows us to understand that the illness would lead not only to a drop in income but also to an increase in health expenditure at the expense of other household expenses.

This state of affairs allows us to understand the financial distress that a person with diabetes can experience. This financial setback goes beyond the sick person alone and extends to the entire family, which is illustrated by a drop in total household expenditure of diabetic patients.

5. Conclusion

Diabetes is a major public health problem due to its increasing and significant prevalence on the one hand, and its socio-economic impact on the other. The significant loss of income faced by patients is the result of the loss of productivity a corollary of the decline in physical capacity, absenteeism and even sometimes the work stoppage due to diabetes. Due to the increase in the medical cost of diabetes following the appearance of complications of the latter; it is necessary to grant patients a subsidy as soon as diabetes is discovered to support them in order to avoid the onset of such complications because human, social and economic costs are unacceptable in undevelopment countries.

Abbreviations

MFNHCT	Matlaboul Fawzayni National Hospital Center in Touba
IDF	International Diabetes Federation
HEA	Household Economy Approach
ADO	Anti Diabetic Oral

Author Contributions

Diop Cheikh Tacko: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing

Gueye Boubacar: Formal Analysis, Validation

Bop Martial Coly: Formal Analysis, Methodology, Software, Visualization, Writing – review & editing

Sougou Ndèye Marème: Validation, Visualization, Writing – original draft, Writing – review & editing

Fall Bineta: Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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