

The Economic Impact of Hospitalization for Diabetic Foot Infections in a Caribbean Nation

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Abstract

Context: Foot infection is the most common complication of diabetes mellitus in the Caribbean. Diabetic foot infections place a heavy burden on health care resources in the Caribbean.

Objective: To evaluate the treatment-related costs for diabetic foot infections in a Caribbean nation.

Methods: We identified all patients with diabetic foot infections in a 730-bed hospital serving a catchment population of approximately 400,000 persons from June 1, 2011 through July 31, 2012. The following data were collected: details of infection, antibiotic usage, investigations performed, number of physician consultations, details of operative treatment, and duration of hospitalization. Total charges were tallied to determine the final cost for inpatient treatment of diabetic foot infections.

Results: There were 446 patients hospitalized with diabetic foot infections, yielding approximately 0.75% annual risk for patients with diabetes to develop foot infections. The mean duration of hospitalization was 22.5 days. Sixteen patients (3.6%) were treated conservatively without an operative procedure and 430 (96.4%) required some form of operative intervention. There were 885 debridements, 193 minor amputations and 60 major amputations, 7102 wound dressings, 2763 wound cultures, and 27,015 glucometer measurements. When the hospital charges were tallied, a total of US \$13,922,178 (mean, US \$31,216) were spent to treat diabetic foot infections in these 446 patients during 1 year at this hospital.

Conclusions: Each year, the government of Trinidad and Tobago spends US \$85 million, or 0.4% of their gross domestic product, solely to treat patients hospitalized for diabetic foot infections. With this level of national expenditure and the anticipated increase in the prevalence of diabetes, it is necessary to revive the call for investment in preventive public health strategies.

Introduction

Diabetes mellitus affects between 10.9%¹ and 20%² of the general adult population in the Caribbean. These patients have 15%³ to 25%⁴ lifetime risk of developing foot infections, making it the most common complication of diabetes requiring surgery. In fact, diabetic foot infections account for 75% of the surgical bed occupancy in Barbados⁵ and 29% of bed occupancy in Trinidad and Tobago.⁶ When they occur, diabetic foot infections negatively affect patient health and social

well-being, but the economic impact has not been thoroughly assessed in the Caribbean. We evaluated the charges accrued by patients with diabetes who required hospitalization for the treatment of diabetic foot infections in a Caribbean nation.

Methods

This study was performed at the San Fernando General Hospital in Trinidad and Tobago. This is a 730-bed hospital that serves a catchment population of approximately 400,000 persons living in and

around the city of San Fernando. The local institutional review board granted ethical approval to collect data on all patients presenting with diabetic foot infections at this facility from June 1, 2011 through July 31, 2012.

The patients were identified on admission registers and their data recorded prospectively on a form designed for the study purpose. The following data were collected: details of infection, antibiotic usage, investigations performed, number of physician consultations, details of operative treatment, and duration of hospitalization. All data were entered into a spreadsheet (Microsoft Excel v14, Redmond, WA) and analyzed with the Statistical Package for Social Sciences (SPSS v 12, SPSS Inc, Chicago, IL), version 12.0. Descriptive statistics were generated as appropriate.

In all cases, the services provided were codified using current procedural terminology where available. The charges associated with inpatient treatment of all patients with diabetic foot infections were tallied over the study period, and the mean charge per admission per patient was calculated.

We estimated the yearly national expenditure using the following equation: [expected number of persons with diabetes] × [annual risk for a patient with diabetes to develop foot infections] × [mean number of admissions per patient per year] × [mean charge per admission].

Results

Approximately 60,000 patients with diabetes are served by the San Fernando General Hospital, representing 15% of the catchment population.^{1,2} There were 446

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patients hospitalized with diabetic foot infections, yielding approximately 0.75% annual risk for patients with diabetes to develop foot infections.

The study population included 205 women and 241 men at a mean age of 57 years (standard deviation [SD] = 12 years, median = 56 years, range = 24 to 93 years). There were 416 persons with type 2 diabetes and 30 with type 1 diabetes. These patients lived with diabetes for a mean duration of 14 years (SD = 8 years, median = 13 years, range = 1 month to 55 years). In the outpatient setting, these patients received insulin in 157 cases (35.2%), oral medication in 204 (45.7%), and combinations of insulin with oral therapy in 85 (19.1%).

Although 271 patients (60.8%) reported compliance with their outpatient medications at the time they were hospitalized, there was poor correlation with objective HbA_{1c} measurements. Three hundred thirty-four patients (74.9%) had HbA_{1c} levels of 7.1% or greater to suggest inadequate glycemic control in the prehospitalization period.

At the time of presentation, 129 patients (28.9%) admitted to regular use of tobacco products and 212 (47.5%) had preexisting complications of diabetes apart from foot infections: 98 (22.0%) had retinopathy, 135 (30.3%) had ischemic heart disease, and 63 (14.1%) had renal impairment.

Three hundred twenty-seven patients (73.3%) had a history of hospitalizations for foot infections, with 288 (64.6%) of these occurring within a year of the current hospitalization. During previous hospitalizations, 72 patients (16.1%) had an amputation. The mean number of hospitalizations in the 12-month period before the current admission was 1.85 hospitalizations per patient (SD = 0.74 hospitalization, range = 1 to 4 hospitalizations). Each hospitalization lasted for a mean duration of 22.5 days (SD = 15 days, range = 2 to 60 days).

Sixteen patients (3.6%) presented early and were treated conservatively without the need for an operative procedure. They were treated with wound dressings, antibiotics, hypoglycemic medications, and clinical observation.

The remaining 430 patients (96.4%) required some form of operative intervention, with 885 debridements in 418

(93.7%), 193 minor amputations in 176 (39.7%), and 60 major amputations in 60 (13.5%).

Overall, there were 7102 wound dressings performed (mean = 15.9, SD = 3.17); 2763 wound cultures (mean = 4.97, SD = 0.48); 8885 blood investigations for white cell count, electrolytes, and HbA_{1c} level (mean = 19.93, SD = 1.5); and 27,015 glucometer measurements (mean = 60.57, SD = 9.96).

When the charges were tallied, a total of US \$13,922,178 (mean = \$31,216, SD = \$14,830, range = \$3,763-\$89,516) in charges were accumulated to treat diabetic foot infections in these 446 patients during 1 year at this hospital.

The most recent population census documented 1,317,714 persons living in Trinidad and Tobago⁵ and approximately 197,657 persons (15% of the general population) have diabetes.¹² With approximately 0.75% annual risk, 1482 persons with diabetes will develop serious foot infections requiring hospitalization every year.

Using these findings, we calculated the national expenditure: [annual risk to develop foot infections (0.75%)] × [number of persons with diabetes in Trinidad and Tobago (197,657)] × [mean number of admissions per patient per year (1.85)] × [mean charge per patient per admission (\$31,216)]. Inhospital treatment of this condition demanded an estimated national expenditure of US \$85,701,185 per year in Trinidad and Tobago.

Discussion

Trinidad and Tobago is the largest Anglophone island nation in the Eastern Caribbean, with a population of 1,317,714 persons at the most recent national census.⁵ The World Bank estimated the islands' gross domestic product among the highest in the region at US \$23.99 billion.⁷

The Government of Trinidad and Tobago provides free health care to all legal residents through a network of public health care facilities, which are managed by Regional Health Authorities (RHA) under the auspices of the Ministry of Health.⁸ There are no user fees generated at the point of service for patients who access the health care system. Instead the RHAs are responsible for all charges accrued during health care delivery, and these are

funded from a yearly budget allocated to each RHA by the Ministry of Health.

The San Fernando General Hospital, which serves approximately 60,000 patients with diabetes, is one such public hospital. This population places a significant demand on the health care delivery system. This is highlighted by the high prevalence of diabetic complications in our patients at the time of presentation: renal impairment in 14.1%, limb loss in 16.1%, retinopathy in 22.0%, and ischemic heart disease in 30.3%.

These patients are also predisposed to diabetic foot infections that lead to significant morbidity and premature mortality in the Caribbean.^{5,6,9-11} In Trinidad and Tobago, there was approximately 0.75% annual risk for patients with diabetes to develop foot infections that required hospitalization. This is lower than the 2% annual risk reported by Richard and Schuldiner⁴ in 2008, but in that study the risk was reported for all foot complications whereas we report the annual risk only for serious foot infections requiring hospitalization.

Many patients experience amputations and permanent disability or functional dependence after recovering from severe infections. Apart from the negative consequences on individual patient health, there is negative impact on social, economic, and health care sectors that remains to be accurately quantified in Caribbean nations.

The overall cost to treat unselected complications of diabetes has been estimated to range from US \$218 million¹² to US \$467 million¹³ across the Caribbean per year. However, it is important for each country to have objective data on their national expenditure because this information will significantly affect policymakers' decisions when formulating their own national health care policies. To our knowledge, there has been no previous accurate assessment of the specific costs incurred when treating diabetic foot infections in Trinidad and Tobago.

The charges accrued during the treatment of patients with diabetic foot infections at this city hospital was US \$13,922,178 in a single year or US \$31,216 per patient for each admission. This is actually a conservative estimate because we did not count patients who were man-

aged as outpatients and/or discharged from the Emergency Department without being hospitalized.

The figures were comparable with reports from other countries where the average charge (US dollars) per patient to treat diabetic foot infections was reported to be: \$24,710 in Great Britain,¹⁴ \$26,509 in Sweden,¹⁵ \$27,930 in the US,¹⁶ \$33,540 in Sweden,¹⁷ and \$41,984 in Belgium.¹⁸ It is difficult to compare charges directly because there is significant variation in the cost of supplies, availability and use of investigations, physician remuneration, facility reimbursements, and treatment protocols in each country. It is clear, however, that each country is burdened by high costs to treat this disease.

We calculated a national expenditure of US \$85,701,185 per year to treat patients who are hospitalized with diabetic foot infections in Trinidad and Tobago. This is a significant demand on the national budget of Trinidad and Tobago, accounting for 0.4% of the national gross domestic product.⁷ Considering that the prevalence of diabetes and its complications are anticipated to increase across the region,^{6,9-11} there is an urgent need to strengthen preventive public health measures.

There are already several well-developed primary care initiatives aimed at preventing complications of diabetes in Trinidad and Tobago. In 2006, the Ministry of Health introduced dedicated diabetic clinics that were placed strategically at high-traffic areas within the community.¹⁹ Dedicated personnel were specially trained to staff the diabetic foot clinics (eg, primary care clinicians, counselors, podiatrists, diabetes educators, physiotherapists), hosting regular foot care workshops and public educational lectures aimed at persons with diabetes.¹⁹ The intention was to give patients with diabetes unimpeded and convenient access to these services in the community. It was also hoped that patients who developed foot infections would present early with the absence of user fees at the point of care.

One year after the diabetic clinics were implemented, Singh et al²⁰ followed 361 patients enrolled in the clinics who were deemed to be at high risk for foot infections. They reported only 4% ulceration rate in high-risk patients, and when

infections did develop, 54% healed without operative intervention.²⁰ However, when we evaluated the efficacy of these preventive strategies 6 years after their introduction to Trinidad and Tobago, it was evident that the services were not being used effectively because none of the patients we encountered with severe diabetic foot infections were enrolled in diabetes clinics.²¹ Additionally, 52% of patients led unhealthy lifestyles with sustained high-risk practices and 43% were never counseled on foot care by a health professional.²¹

Additionally, Islam et al¹⁹ followed 257 patients with severe diabetic foot infections in Trinidad and Tobago and reported that 30% of them opted to use home remedies instead of seeking medical attention. This accounted for an unacceptably long delay of 6.2 days between detection of the foot infection and commencement of medical care.¹⁹ Several high-risk behaviors were also observed, with 37% regularly walking barefoot and 43% not performing regular foot inspections.¹⁹

Although much has been invested into the preventive measures for complications of diabetes and diabetic foot infections, there is room for improvement. Unless the existing preventive strategies are optimized, the nation will continue to spend 0.4% of its gross domestic product on this solitary disease process.

Some strategies the nation should consider are an increased use of educational campaigns focusing on healthy lifestyle practices,²²⁻²⁵ regular foot inspection,²⁶⁻²⁸ the dangers of home remedies¹⁹ and of walking barefoot,²⁶ the use of proper-fitting footwear,²⁶⁻³⁰ and avoidance of high-risk behavior.¹⁹

Conclusion

Each year, the Government of Trinidad and Tobago spends US \$85,701,185, or 0.4% of their gross domestic product, solely to treat patients hospitalized with diabetic foot infections. With this level of national expenditure and the anticipated increase in the prevalence of diabetes, it is necessary to revive the call for investment in preventive public health strategies. ♦

Disclosure Statement

The author(s) have no conflicts of interest to disclose.

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