

## Traditional Methods of Health Education are not enough to Reduce Major Lower Limb Amputations in Trinidad & Tobago; A Seven Year Retrospective Study

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**Received:** 12 August 2021; **Accepted:** 10 September 2021

**Citation:** Islam S, Shah A, Jarvis J, et al. Traditional Methods of Health Education are not enough to Reduce Major Lower Limb Amputations in Trinidad & Tobago; A Seven Year Retrospective Study. J Med - Clin Res & Rev. 2021; 5(9): 1-6.

### ABSTRACT

**Background:** Major lower extremity amputation is defined as any amputation of the limb performed above the level of the ankle. Indications often include severe infection, ischemia, trauma and tumours. Total amputation rate in Trinidad and Tobago (T&T) is not yet known. Data is only available from a single center in Trinidad and Tobago over a two year period and not from the entire country and the number of total amputation was based on simple speculation and general estimate. The aim of this study is to first time document the exact annual amputation rate in T&T with their demographic characteristics and also to find out whether the existing methods of health education are effective in reducing amputations.

**Methods:** A retrospective review of all lower limb amputations was performed in all 5 public hospitals in Trinidad and Tobago from January 2012 to December 2018. Annual major lower limb amputations in the 10 private hospitals were also documented. Data collected on patients demographics included patient's age, sex, race, and amputation type.

**Results:** A total of 3586 (85.87%) major lower limb amputations were performed in the public and 590 (14.13%) in the private hospitals over our 7 year study period. The average annual major lower limb amputation rate in T&T is about 600 (596.5) with an average daily rate of 1.63.

The mean age of our study group was 65.7 (23-103) years with a male to female ratio of 1.2:1. Afro Trinidadian accounted for 1962 (47%), Indo Trinidadian 1899 (42%) and other 11%. The predominant type of amputations was above knee 55.06% (n=2299) compared to below knee 44.94% (n=1877). Diabetic foot complications accounted for the majority of amputations in this study. The amputation rate has not declined over the years; rather there has been an annual increase over the study.

**Conclusions:** The annual major lower limb amputation rate in T&T is significantly higher than previous estimates. This is very costly in the context of our limited resources and alarming on our already exhausted economy. This study shows that diabetes and peripheral vascular disease continue to be major risk factors for lower limb amputations: this negatively impacts the overall health of our society. Current methods have failed to reduce amputations. We recommend an integrated multidisciplinary approach involving doctors, diabetic nurse counselors, dieticians, podiatrists, physiotherapists, social welfare officers, politicians, religious leaders and social scientists. Continued education on diabetes, its complications and foot care as well as modifications of current methods are essential to minimize limb loss.

## Keywords

Major lower limb amputation, Trinidad & Tobago, Diabetic foot infections.

## Introduction

Major lower limb amputations are those performed above the level of the ankle. The common reasons are sepsis for reasons which include infection, ischemia, trauma and tumours. In the developed world, as many as 12-50 per 100, 000 major lower limb amputations are performed annually and most are due to diabetes and peripheral vascular disease [1]. Interestingly, diabetic patients were found to have a ten-fold increased risk of major lower limb amputation, with amputations being performed at a younger age than in non-diabetic patients [2]. In recent years, studies in these regions have found a significant decrease in major lower limb amputation rate, an outcome impacted upon by changes in primary health care and more specifically in diabetic foot care [3,4].

In developing regions like the Caribbean, however, published data on major lower limb amputations appears to be limited although, in clinical practice, lower limb amputations are common. Early studies in Trinidad and Tobago showed that significant numbers of major lower limb amputations were being performed and that most patients were diabetic. Rahaman et al and Naraynsingh et al reviewed the numbers of amputations performed at just one public hospital in Trinidad and found alarming numbers being done: an average of approximately 132 per year in the early 1980's and 94 per year in the early 1990's [5,6]. More recently in 2013, Islam et al prospectively studied a cohort of diabetic patients admitted with foot infections at a single center and found that 44% of these required major lower limb amputation within 1 year of admission. In that study, only 57% of those patients reported having been previously counseled on diabetic management and diabetic foot care [7]. These numbers are high for a country with a comparatively small population of just over 1.3 million.

In 2017, the Health Ministry of Trinidad and Tobago recognized that local annual amputation rates were estimated at approximately 500 cases and aimed to reduce this number by 20% over the next year. However, the actual national amputation rate remained unknown as previous studies were performed at either single or a few institutions.

We therefore sought to investigate the numbers of major lower limb amputations performed in Trinidad and Tobago over the years and also to see whether the traditional methods of health educations have made any impact to curb the trend downward.

## Methods

From January 2012 to December 2018 we retrospectively reviewed all major lower limb amputations performed at the five main public healthcare catchment regions in Trinidad and Tobago: Southwest Regional Health Authority (SWRHA), North Central Regional Health Authority (NCRHA), Northwest Regional Health Authority (NWRHA), Eastern Regional Health Authority (ERHA) and Tobago Regional Health Authority (TRHA).

Data was also collected from the 10 major private institutions across the country. Major lower limb amputations were defined as those performed above the level of the ankle. Patients with amputations below the ankle, those who underwent amputations for trauma and tumours and those whose records were not accessible were excluded from this study. Demographic and operative data were obtained from surgery and patients' medical records.

## Statistical Analysis

Data were entered into Microsoft Excel spreadsheet version 2010 and analyzed by simple calculations. Percentages and proportions were used to describe categorical variables.

## Results

A total of 3586 major lower limb amputations were performed in Trinidad and Tobago over the 7- year period studied in the 5 public hospitals. This amounted to an average annual rate of 512.28 and an average daily rate of 1.40 major lower limb amputations. 35% (n=1255) of these amputations were done at SFGH, 25% (n=898) at EWMS, 23% (n=817) at POSGH, 12% (n=418) at SGRH, and 5% (n=198) at TRH.

There are 10 major private hospitals in the country. Data from these hospitals showed that an average of 8.4 (6-14) major lower limb amputations annually. Therefore the total annual amputation rate in T&T per year is about 600 (596.5) with an average daily rate of 1.63 [Table 1].

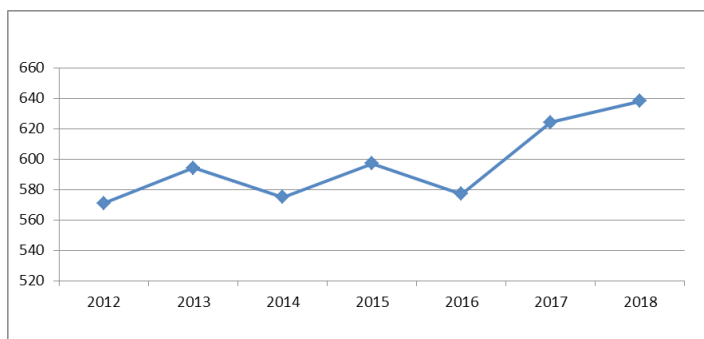
**Table 1:** showing the number of major lower limb amputations performed in public and private hospitals of Trinidad and Tobago per year from January 2012 to December 2018.

Hospitals	No of Major Lower Limb Amputation per Year							
Year	2012	2013	2014	2015	2016	2017	2018	
Public Hospitals	487	505	497	515	498	537	547	3586
Private Hospitals	84	89	78	82	79	87	91	590
Total	571	594	575	597	577	624	638	4176

The mean age of our study group was 67.7 (23-103) years. 55% (n=2297) of them were male & 45% (n=1879) female with a male to female ratio of 1.2:1. However, it was observed that the mean age of amputation in our population has increased steadily during the study period from 63.3 to 71.2 years. The ethnic composition of our study population is as follows; 47% (n=1962) Afro-Trinidadians, 42% (n=1899) Indo-Trinidadians, and 11% (n= 315) others.

Regarding amputation type, it was noted that above knee amputations were performed more frequently compared to below knee amputation accounting 55.06% (n=2299) and 44.94% (n=1877) respectively. This increase in percentage of above knee amputation suggests the presence of significant degree of atherosclerosis in our Caribbean population which often makes their feet unsalvageable. Although, the trends of amputation type generally the same over the years however on close observation it was noted that recently the number of below the knee amputations were slowly increasing, but the overall amputation rate had not decreased rather increased slowly.

The overall trend in the number of amputations performed nationally did not appear to change significantly between the years 2012 to 2016 but since then it has increased in numbers [Figure 1]. The exact reasons for this trend were not known as yet.



**Figure 1:** Line graph illustrating the trend of total major lower limb amputations per year in Trinidad and Tobago.

## Discussion

Trinidad & Tobago (T&T) is a southeastern twin-island Caribbean nation situated close to the South American continent, northeast of Venezuela and northwest of Guyana separated by the Gulf of Paria and two narrow marine channels. Trinidad is the larger of the two, with an area of about 4,828 square kilometers (km) (1864 square miles). Tobago, on the other hand is much smaller, with an area of about 300 square kilometers (116 square miles) lies 30 km to the northeast of Trinidad. According to the latest UN data (midyear 2020), the total population of T&T is estimated at 1,399,488 of which the total population of Tobago was over 60,874 at the 2011 census [8]. Trinidad is multiethnic, while Tobago's population is primarily of African descent, with a growing proportion of East Indian's from Trinidad and Europeans. The ethnic composition of the T&T are as follows- Afro-Trinidadian (37.5%), Indo-Trinidadian (40%), mixed-race (18.5%), and Chinese (0.5%) [8].

The health care services are completely free to all the residents and citizens of T&T, and are provided through a series of local and district health care centers with 5 major tertiary hospitals (4 in Trinidad and 1 in Tobago) under the Regional health authorities. In addition to this, 10 private hospitals also provide care to the population.

Diabetes is a preventable lifestyle disease that overwhelms our already exhausted health care system financially. More than 200,000 people are now living with diabetes, in Trinidad and Tobago; however 25% of them are not aware of it. One-third of the children in both primary and secondary schools are either overweight or having juvenile diabetes [9].

Peripheral arterial disease is the leading cause of major lower limb amputations [10]: when patients develop non-salvageable / critical ischaemia or severe, extensive infections. Other causes of major lower limb amputations such as trauma or tumours are encountered much less frequently and account for less than 3% of amputations performed.

Islam et al in their prospective study in 2013 noted that the most common cause for amputations in T&T is diabetic foot infections; trauma and footwear-related injuries account for 50.7% & 42.4% of foot sepsis [7].

Patients with extensive peripheral arterial disease most often have co-existing comorbidities: commonly diabetes mellitus, hypertension or end- stage renal disease or a combination of these. Smoking history often contributes to morbidity. Particularly when these diseases are poorly controlled, extensive atherosclerosis ultimately diminishes arterial blood flow to the lower extremities, leading to ischaemia, gangrene and the subsequent risk of superimposed infection. It is obvious therefore, that strict control in the management of these chronic diseases and the ability to recognize signs of limb ischaemia or infection is paramount to preventing lower limb amputation.

The incidence of certain risk factors, like diabetes mellitus, seems to be increasing in prevalence in first world countries [10] and this may be contributing to an increased rate of amputations. Several studies in these regions have shown that overall rates of major amputations are seeing a downward trend, but the indications for amputation appear to be changing. In the United States, a study by Kalbaugh et al over a 17 year period found a decrease in amputation rates but no change in the prevalence of diabetes, suggesting that improvements in diabetes management and prevention were still needed. Additionally, a decrease in amputations due to infection was purported to be possibly due to improvements in wound care and earlier recognition of failed wounds [11]. Similarly, studies across Europe have also reflected decreased amputation rates due to improvements in primary healthcare as well as increased availability and advances in lower limb revascularization procedures [3,4].

In 2007, leaders of West Indian nations convened at a summit aimed at addressing this major healthcare problem and through the resulting Declaration of Port of Spain, they developed a plan to reduce the health and economic burden of non-communicable diseases within the region through expanding the accessibility of healthcare and educating the public [12].

In Trinidad and Tobago, where access to public healthcare is free for the general population, several programs were initiated, some specifically targeting the prevention and proper control of diabetes mellitus. Such programs included the Diabetic Foot Care Management Programme within the North West Regional Health Authority to improve diabetic foot care and recognize patients who require more aggressive foot care early to prevent limb loss. A report on the outcomes of this program suggested a low rate of diabetic foot ulceration and a 54% rate of ulcer healing with appropriate non-surgical management [7].

Despite implementation of the above programme by the different health authorities in conjunction with the Ministry of the health, our amputation rates are still alarming and increasing.

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Several recent studies on diabetic foot infections in Trinidad and Tobago noted that poor glycemic control [7], unhealthy dietary practices [13], failure of early recognition of the diabetic foot infection [14], delayed presentation due to the use of home remedies [15,16] and alternative medicine [17] as well as overall poor attitude of our patients towards their health despite adequate knowledge continued to be the main culprit.

Therefore, it is obvious from the above studies that traditional methods of health education are not working well enough to reduce amputations.

At the same time, the economic impacts of major lower limb amputations are enormous. In 2014, Cawich et al analyzed the economic impact of diabetic foot infections in the Caribbean and specifically in Trinidad and Tobago, recognizing that 70% of diabetics have peripheral neuropathy, with up to a 25% lifetime risk of foot ulceration [18]. Their study found that diabetic foot infections are the leading cause of surgical ward admissions and inpatient treatment of such costs approximately US \$85 million per year. In fact, they estimated that approximately 29% of healthcare expenditure in Trinidad and Tobago was spent on diabetic foot care and treatment of complications [18]. The results of their study suggested that there were still great challenges and need for improvements in the care and prevention of diabetes and diabetic foot complication, despite the enrollment and implementation of prevention programs.

The current 12% prevalence rate of diabetes in Trinidad and Tobago (over 117, 000 individuals) further highlights the major burden that this disease has on our nation [19].

In 2017, the Ministry of Health aimed to reduce local lower limb amputation rates by 20% the following year, recognizing a significant amputation rate estimated at 500 per year [20]. To do this, they targeted their focus towards non-communicable disease prevention and control. However, as this study shows this has not been.

Our study shows our lower limb amputation rates have in fact been higher than previously estimated and continue to increase especially the last 2 years of the 7 year period that we examined. Similar to local studies performed over the last 30 years, hundreds of major lower limb amputations continue to be performed annually and the majority of amputees are diabetic with AK amputations, which greatly limits their mobility and ability to perform basic functions as well as functions that contribute to the production of our society [5,6,21].

Furthermore, our study has found that the number of amputations performed in 2018 has actually increased from the previous year by 5.6%, suggesting that despite the ongoing progress of programs aimed at prevention of non-communicable diseases like diabetes, more needs to be done in order to have a significant impact on the rates of lower limb amputations.

The population's access to public healthcare in Trinidad and Tobago is generally divided into 5 regional health authorities, each charged with the responsibility for providing efficient healthcare to the population. From our study, we found that the majority (35%) of major lower limb amputations were performed at the South West Regional Health Authority. We assume that this proportionately large percentage is due to the fact that this Regional Health Authority individually serves a greater portion of the national population, as compared to other Regional Health Authorities. However, it is unknown from this study whether other factors such as patient education, access to health care, impact of chronic disease prevention programs or other factors have contributed to the larger number of amputations within this region alone. It follows, therefore, that more detailed studies are required in the future in order to assess the impact of individual factors that affect the amputations rates within each regional health authority. This may perhaps allow us a better understanding of why our national amputation rates have not decreased as hoped from the time of implementation of the Declaration of Port of Spain and where improvements are needed to ultimately prevent limb loss.

In a recent Knowledge, Attitude and Practice (KAP) study at a Tertiary Hospital in Trinidad over 1005 diabetic patients, Islam et al noted that the patients of T & T have good overall knowledge on diabetes, foot care, and its preventative measures. Often however, they do not practice proper foot care and diabetic control. These poor attitudes of our population toward their personal health seem to be a great factor for not reducing lower limb amputations [13].

Proposed ways to further tighten diabetic control on patients living with this chronic disease includes:

As the existing methods of health education shown to have little or no effect in reducing the amputation rate, we need to rethink and revise our strategies considering our population dynamics, their attitudes towards their health and try to incorporate all these social factors when implementing our future steps.

1. Integrated Patient education programs- As Health education to the patient only seems to have no effect in decreasing the amputation rate in our country, it appears that advice to the caring family members and other care givers may contribute to a better outcome.

The finding of different local and regional studies on diabetic foot, or amputation and its overall impact on their personal, familial, social life need to be highlighted during the discussion. They need to be made aware that similar situations can happen to them, their children, and their families as well.

2. The recent banning of soft drink or sweet beverage at School or College compound level is a welcome move by the Education Ministry and it needs to be continued.

3. A significant proportion of the population of Trinidad and Tobago are not well educated and may require intensive and frequent teaching of the basic understanding of the natural history of chronic diseases and their complications. Patients will also benefit greatly from ongoing advice regarding lifestyle modifications as well as teaching on how to monitor them at home. Specifically for patients with diabetic foot wounds,

emphasis on daily foot inspection, appropriate foot wear as well as attending diabetic foot care clinics is of utmost importance in order to ensure wounds are kept clean and to recognize spreading sepsis early. Patients should also be educated on noticing signs of diabetic foot sepsis and encouraged to seek urgent medical attention when this occurs.

4. Ongoing education of the general public on preventive measures for chronic diseases, including advice on when, how and where to access facilities for screening.
5. Ongoing training of healthcare professionals at primary healthcare centers for appropriate diabetic foot wound care and to recognize and adequately diagnose diabetic foot sepsis and refer to the necessary institutions for prompt management.
6. Better access to orthotic services for appropriate footwear for diabetic wounds. This serves to decrease the incidence of neuropathic ulceration and reduce the risk of foot sepsis.
7. Enhanced availability of lower limb revascularization services. In some cases of lower limb infection in patients with peripheral arterial disease, with or without other comorbidities, access to revascularization may mean the possibility of limb salvage with minor tissue loss.

## Conclusion

Our study demonstrates that the national amputation rate of Trinidad and Tobago continues to be significant and has not shown a downward trend over the years, as was hoped. The results of this study show that chronic diseases like diabetes, hypertension and associated peripheral vascular disease continue to be a major risk factor for major lower limb amputations, which negatively impacts the overall health of our society. Poor glycemic control, unhealthy lifestyles, improper footwear, delayed presentation of foot sepsis with the use of alternative topical agents continued to be the main reason for amputation in T&T. Traditional measures have failed to address this issue. We advocate for integrated and continued education on preventive foot care in diabetics and patients with peripheral vascular disease of the lower limbs, as well as improvements in chronic disease prevention and control within our healthcare system. Future research needs to be conducted to explore the reasons of our population attitude towards their health and thereby modify strategy based on the finding to curve this high amputation trends down.

## Acknowledgement

The authors deeply acknowledged the significant contribution of late Dr. Kevin King, for providing this data from Tobago Regional health Authority just before his demise. We pray for his departed soul, may he rest in peace.

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