

Original Research Article

Causes and Concerns of diabetic subjects with lower limb amputation(s) in Trinidad

Running title: diabetics with lower limb amputation

Abstract

Aim: This study seeks to examine the major causative factors for lower limb amputations amongst a Trinidadian diabetic patients as well as to analyse the resulting concerns of said patients.

Study setting and Design: This study mainly comprised patients who were subject to or will be subject to lower limb amputations of differing degrees and were selected via a random stratified methodology. Questionnaire used was designed as to attain data on patient medical history as well as intrinsic and opinionated results.

Methods: This study comprised 35 patients who were subject to LEAs of differing degrees and these patients were selected via a random stratified methodology. After obtaining informed consent questionnaire were used to attain subjective and objective data as it pertains to the cause and effects of lower limb amputations. Statistical analysis was done using SPSS to test for distribution and correlations.

Results: A number of factors were taken into account and measured as it pertained to the cause of having an amputation. Our study noted that the major factors like diet, alcohol consumption and infection became the reason for amputation.

Conclusions: The data of this study showed that the patients are to ensure better self-care and preventative lifestyle changes are to be implemented as to prevent the need for amputations.

Keywords: Causes and concerns; Diabetes, Lower limb amputation

28 **Introduction**

29 Diabetes in itself accounts for over a million deaths annually with an additional 3 million
30 deaths as a result of side effects [1]. Furthermore over 400 million persons as of 2014 have
31 been diagnosed with diabetes globally with a current increase in said figure[1]. Trinidad is
32 also heavily affected by diabetes with it accounting for the second leading cause of death
33 within the region[2]. Patients who are affected by diabetes also fall victim to complications
34 such as cardiovascular distress, renal failure and possible amputations[1].

35 In a study conducted in 2014 by Naraynsingh et al. (3) aimed to investigate event outcomes
36 of early vs delayed medical treatment after home remedies of diabetic foot infections. They
37 concluded that there are negative outcomes when patients delay conventional medical therapy
38 in favor of home remedies and that persons with diabetes who wish to try home remedies are
39 encouraged to seek medical advice in addition as a part of holistic care.

40 The economic impact of uncontrolled diabetic foot infection places an enormous burden on
41 the government controlled public health system leading to a lack of resources for optimal
42 treatment thus, essentially leading to more amputations. In a study done by Cawich et al. (4)
43 investigating the economic impact of hospitalizations for diabetic foot infections in a
44 Caribbean nation, 446 hospitalized persons with diabetic foot infections were identified in a
45 catchment area of 400, 000 yielding approximately 0.75% annual risk for person with
46 diabetes to develop foot infections. The mean duration of hospitalization was 22.5 days.
47 Sixteen patients (3.6%) were treated conservatively and 430 (96.4) were treated with some
48 form of operative intervention. Each year, the government of Trinidad and Tobago spends US
49 \$85 million, or 0.4% of their gross domestic product, solely to treat patients hospitalized for
50 diabetic foot infections. With this level of national expenditure and the anticipated increase in
51 the prevalence of diabetes, it is necessary to revive the call for investment in preventive
52 public health strategies.

53 As glucose management worsens in diabetic patients there is a degradation of sensory and
54 motor functions in the lower limb amputations (LEA's). As a result, abnormalities in the
55 pattern of walking and plantar pressures in the feet develop. This results in peripheral
56 neuropathy leading to the development of ulcers. Ulcers are the initial sign to worsening
57 diabetes leading to limb amputation [5].

58 With respect to the occurrence of amputations, it has been noted that persons within the
59 Caribbean have been reported to have the highest rates of Lower Extremity Amputations
60 (LEAs)[6]. Herein it was noted that patients were subject to LEAs mostly due to inadequate

61 footwear. However other factors may be at play as it pertains to major causative factors such
62 as age, sex, medication and diet[7, 8].

63 Furthermore, patients' concerns after the occurrence of the LEA is also a realm which
64 requires examination. Whilst the survival rates have been aptly studied as it pertains to
65 patients who have undergone surgery [9] the general concerns of the patients themselves
66 requires examination. In this regard, this study seeks to investigate both the causative factors
67 for LEAs amongst diabetic patients as well as concerns of said patients within the Caribbean
68 island nation of Trinidad.

69 **Materials and Methods**

70 Data was collected from patients attending clinics and admitted in Port of Spain General
71 Hospital (POSGH), San Fernando General Hospital (SFGH), and Eric Williams Medical
72 Sciences Complex Hospital (EWMSC). This study mainly comprised patients who were
73 subject to or will be subject to LEAs of differing degrees. These patients were selected via a
74 random stratified methodology. We have used questionnaire which were given to participants
75 to complete and returned questionnaires were only taken into consideration if over 85% of the
76 questions were answered. The questionnaire was designed as to attain data on patient medical
77 history as well as intrinsic and opinionated results. This study was approved by the
78 University of the West Indies, St. Augustine Campus ethics committee. Informed consent
79 was obtained from all individual participants included in the study. Once data was collated, it
80 was then subject to statistical tests via SPSS to test for distribution and correlations.

81 **Results**

82 **Clinical data**

83 Altogether, 35 patients returned acceptably completed questionnaires with there being an
84 even representation of males and females averaged 57 years of age $\pm$ 11.8. Based on the
85 attained data it was firstly noted that most of the patients were diabetic for more than 20 years
86 as this reflected 35.3% of the sampled population. Furthermore the average BMI was
87 recorded at 27.8 ± 5.2 and this in turn stipulated a mostly overweight sample. It was also
88 noted that of these patients, 19 (54.3% of valid respondents) reported having hypertension
89 whilst 16 (45.7% of valid respondents) reported peripheral vascular disease. Only 1 patient
90 (2.9% of valid respondents) presented with venous insufficiency. A subset of the population
91 was also questioned about their medical history as it relates to complications to the lower
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limbs (Fig 1). Herein, it was noted that the most common complications which were previously existing were peripheral vascular disease and hypertension.

Of these patients, 16 (45.7%) stated that this was their first amputation whilst 14 (40%) stated that it was not. Of those who were subject to a previous amputation it was most commonly a previous toe amputation with that reflecting 7 of the 14 patients. Furthermore of these patients, 8 (22.9% of sample population) presented with foot lesions. Of these persons, the causative factors were explored (Fig 2) and it was noted that ulcers accounted for the majority of cases.

We have collected the information about Oumedication and noted most commonly used drugs were insulin, metformin and acetosalicylic acid (ASA) (table 1).

Patient self-care/initiative

With respect to initiative, 26 patients (74.3% of the sample population) reported that they made the effort to ensure that they followed up with their diabetic clinic. Of these patients, 22.9% reported that they followed up with the clinic between 1 and 5 years with a cumulative 88.5% reporting that they followed up within 20 years.

Furthermore, patients were questioned about their diet and 46% of patients expressed that they followed the West Indian diet which in itself is high in carbohydrates, meats, fats, sugars and sodium with low counts of fruits, vegetables and fibre (Table 2).

It was also noted that 28 patients (77.1% of the sample population) admitted to consuming sweets/desserts/sodas/sweetened juices on a regular basis. This study also noted that 23 patients (65.7% of sample population) reported that they monitored their blood sugar at home and majority stated they monitored it twice a week. The patients who did not monitor their blood sugar at home claimed that the inability to read or the cost of the test kits were the major deterrents.

Patient lifestyle and history

Concerning the patient history and lifestyle collected, the first parameter was that of a family history of diabetes and 5.7% reported having a close family member or ancestor presenting with diabetes. It was noted that only 14 patients (40%) admitted to being habitual smokers and most of these stated they had been smoking for over 20 years with there being an average of 9 ± 7 cigarettes daily. There were far more drinkers in the sample with a reported 24 patients (68.6%) admitting to being regular drinkers. The most commonly consumed alcohol

was that of beer followed by rum and whiskey. Drinks were reported to have been consumed on a weekly basis with an average of 6 ± 3 drinks taken.

Reason for amputation and their feelings after

Amongst the 33 patients who replied to the cause of their amputation, 19 (57.58%) stated that it brought on due to diabetes and infection whilst the remaining 14 reported an event split between diabetes and trauma (21.21%) and diabetes and ischaemia (21.21%). After having the amputation, the emotional state of the patients was recorded and it was noted that most patients were sad as (Fig 3). A major concern reported by patients was the fear of being a burden to their family (Fig 4).

Furthermore, 31 patients (88.6%) of respondents claimed that they believed that their amputation may have been prevented. The most common preventative measure was that of adhering to a better diet and exercise regime as well as visiting a doctor sooner when complications arose.

Discussion

From the initial surveys carried out, each participant's medical history showed an early indication to the risk of additional future amputations if worsened. These included: Callouses- 6.67%, which forms as a result of keratinization of skin cells and if left untreated could have resulted in foot ulcerations[10]. Electrical shock to lower limb- 8.89% may have been as a result of poor occupational health and safety equipment or attire at their workplace resulting in such injuries. As a result, not only the nerves, but tissue and vascular damages may have been incurred depending on the degree of shock suffered by the patient[11]. The loss of sensation in this area has led to 50-70% of non-traumatic amputations according to studies conducted by Vinik et al (2018)[12].

Foot ulcers-17.28% which in studies conducted by Hunt (2011) indicated the incidence of foot ulcers in well developed countries were 2.5% -10.7%, meanwhile Trinidad's incidence is at 17.28% in the population examined[13]. Foot ulcers range between 5 grades of severity, from superficial ulcers of Grade 1, those penetrating ligaments at Grade 2, abscess formation in Grade 3, localized gangrene in Grade 4 and excessive gangrene at Grade 5[13]. If left untreated a simple Grade 1 ulcer can develop into a Grade 5 over a short period of time resulting in amputation of the infected limb and surrounding tissue.

Although heart attacks do not directly result in amputation it is the initial risks of lack of circulation to the lower limbs. If blood is unable to reach the extremities, considering these patients are diabetic, circulation is further affected as the erythrocyte aggregation is increased. As a result, clots are more likely to form[14]. From this clot, vascular damages incur, tissues are affected and ulcers begin to form, amputations occur.

Hypertension, although the most prevalent disease suffered by most patients in this research has been a significant contributor to the onset of diabetes, according to research conducted by Pemayun et al [15] Meanwhile, other researchers indicate contrastingly in the study. The underlying link between hypertension and amputation may have been through atherosclerosis resulting in heart attacks and blood clots or the onset of nephropathy to diabetes, worsening, to cause amputations.

Loss of foot sensation can be as a result of mentioned variables such as electrical shock, foot ulcers, even loss of circulation and usually an indicator worsening diabetes and as mentioned causes 50-70% of amputations. This is experienced by 15.56% of the population sampled and mainly caused due to lack of preventative care and proactive treatment to early warning signs

Peripheral vascular diseases (PVD) suffered by 22.22% of patients in the sample could have been as a result of atherosclerosis relating to the premises on which amputations occurred for patients' history of heart attack and hypertension. Another cause of PVD was the loss of elasticity of arteries which may have resulted due to age of the patients. Considering the sample size consisted of patients over the age of 50 with 61% suffering from diabetes for over 10 years, this is a plausible reason for amputations.

Trauma to lower limb affecting 4.44% of the population could have been as a result of an accident resulting in invasive injury. If these injuries were not treated callouses and ulcers would have developed leading to amputations.

Foot swelling suffered by 13.33% of the sample on visits to the clinic could have been caused due to build-up of fluids or a natural inflammatory response by the body when infected or injured. Considering 80% of the sample size did confirm foot lesions being present the swelling of feet can be validated.

The medicines prescribed were not only focused on diabetes such as metformin, but hypertension, aspirin and heart conditions, simvastatin, suffered by the patients as well as treatment for pain and side effects some pills may have on the stomach requiring omeprazole. In modern day western medicine practices many tablets prescribed are a norm. However, patients do not accept this norm lightly as not only do the medications have side effects, affecting each patient differently, it is costly. Considering these patients are older than 50

years old facing retirement, resulting in pensions as their only source of consistent income makes monthly purchasing of these drugs difficult. While some patients may have support from family members others do not. Meanwhile, the government provides the Chronic Disease Assistance Plan (CDAP) which can alleviate some costs. However, there is an inconsistency in the provision of the drugs since there is a large population in need with a limit to the drugs issued monthly. In addition to this, not all drugs mentioned are available on the CDAP programme and there is still a need to purchase drugs monthly.

Amputations not only affect the emotional and psychological state of the individual but the family they are surrounded by. Considering these patients have lost a limb or part of, assistance will be required to carry out mundane tasks, much support is required at this time. The relationship between the individual and family will be further affected by the outlook the patient has on his/her amputation. While some patients become depressed or angry because of their loss resulting in poor attitudes towards the family, thus making the process of care more difficult, some patients may be supportive and find ways to become independent again without requiring family support. From the data collected, while most patients were sad, the sacrifices their family had to make may have taken a toll on them as they considered themselves a burden. While some were understanding of their situation, knowing their actions were not proactive to prevent their disease, accepted the outcome. Some were angry, possibly with themselves for lack of proactive behavior which could have eliminated their threat of worsening diabetes leading to amputation. Some were afraid, this may have affected those who lacked family, such as the 42% in which the families were not affected and therefore living on their own and learning to function handicapped was an intimidating thought. A select few were happy of their outcome, possibility existed that they required support financially or emotionally previously and were now getting the required attention due to their disability.

Conclusion

Based on the data posited above it was noted that a number of factors played a role in the need for amputations amongst diabetic patients. The most noteworthy were that of diet and drinking in conjunction with infections. Among the population surveyed there is a low level of initiative towards self-care and, high concern among the amputees either do to fear before or sadness associated with the amputation in spite of a majority of the subjects feeling that their respective families were not affected by the procedure. The majority of the causes and

concerns are due to deficits in knowledge of preventive measures towards diabetes and emotional aspects that come with amputation.

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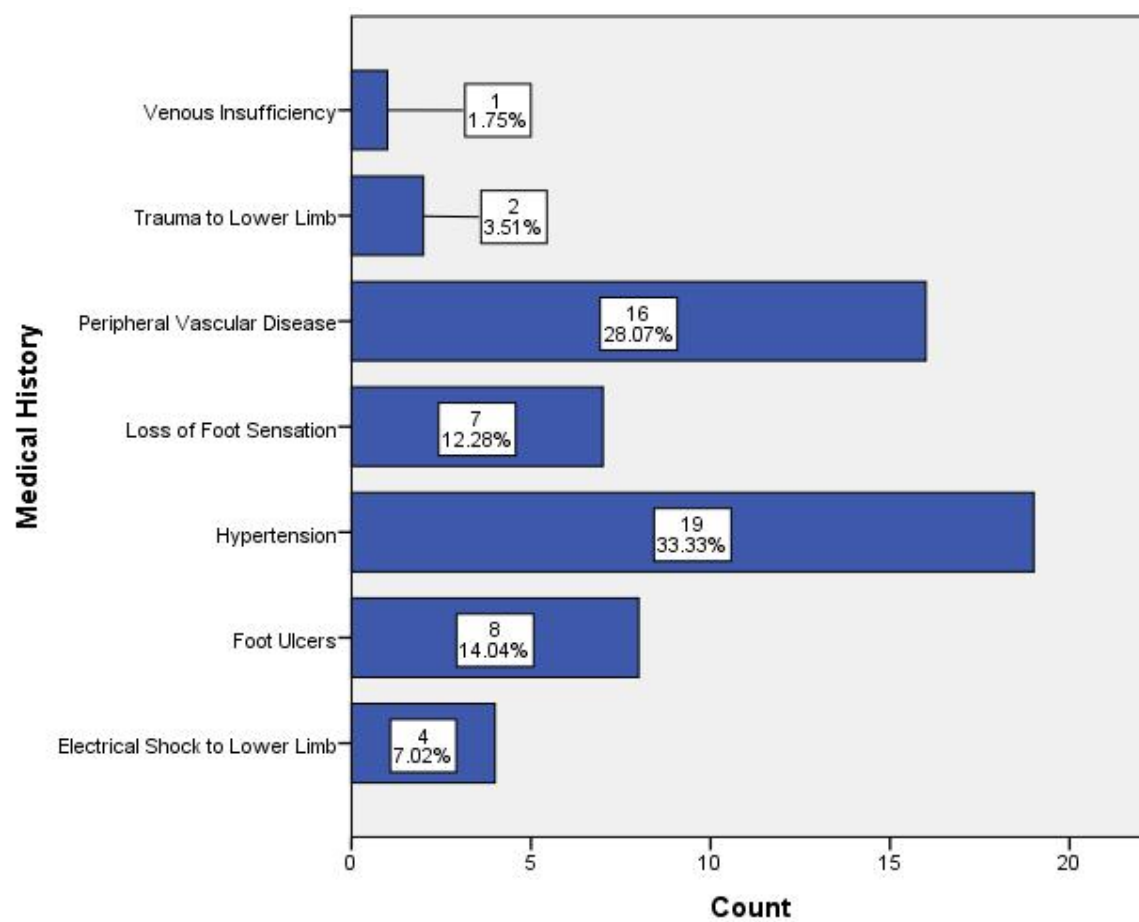
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Table 1: Drugs used by patients

Drug	Count	Percent
ASA	13	10.74
Atenolol	6	4.96
Augmentin	2	1.65
Bezide	1	0.83
Bisodol	1	0.83
Ceftriaxone	1	0.83
Clopidogrel	1	0.83
Coreg	4	3.31
Daflon	1	0.83
Enalapril	9	7.44
Folic Acid	2	1.65
Gliclazide	8	6.61
Glimepiride	1	0.83
Glucophage	1	0.83
Hydralazine	1	0.83
Insulin 70/30	18	14.88
Iron Sulfate	4	3.31
Lasix	5	4.13
Metformin	18	14.88
Mydriacyl	1	0.83
Neosoralen	1	0.83
Nifedpine	10	8.26
Omez	1	0.83
Plavix	1	0.83
Rosuvastatin	1	0.83
Simlo	2	1.65
Simvastatin	4	3.31
Sitagliptin	1	0.83
Trimetazidine	2	1.65
Total	121	100

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Fig 1: Reported pre-existing complications amongst sampled patients.

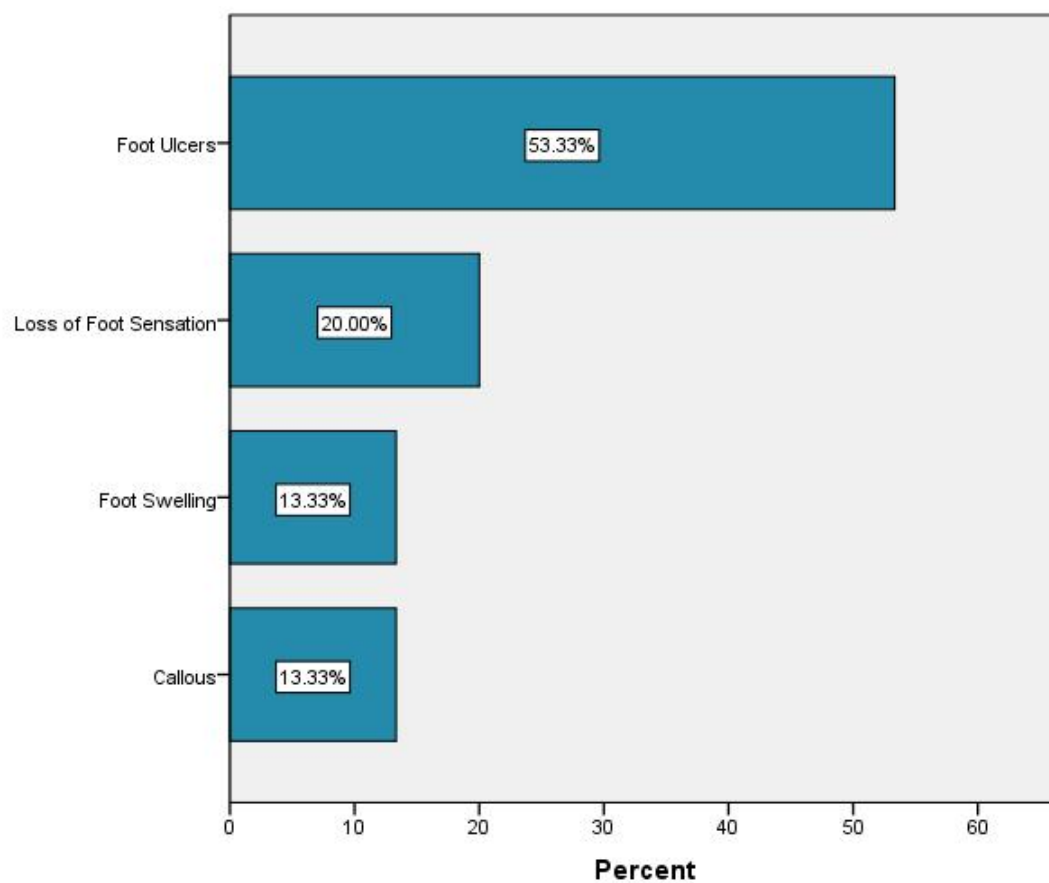


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Fig 2: Causative factors for foot lesions.



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Table 2: Diet employed by patients

Diet consumed	Number (%)
DASH (green leafy vegetable)	1 (2.0)
Diabetic diet	11 (22.0)
Low carbohydrate diet	4 (8.0)
Low fat diet	3 (6.0)
Low sodium diet	8 (16.0)
West Indian diet	23 (46.0)

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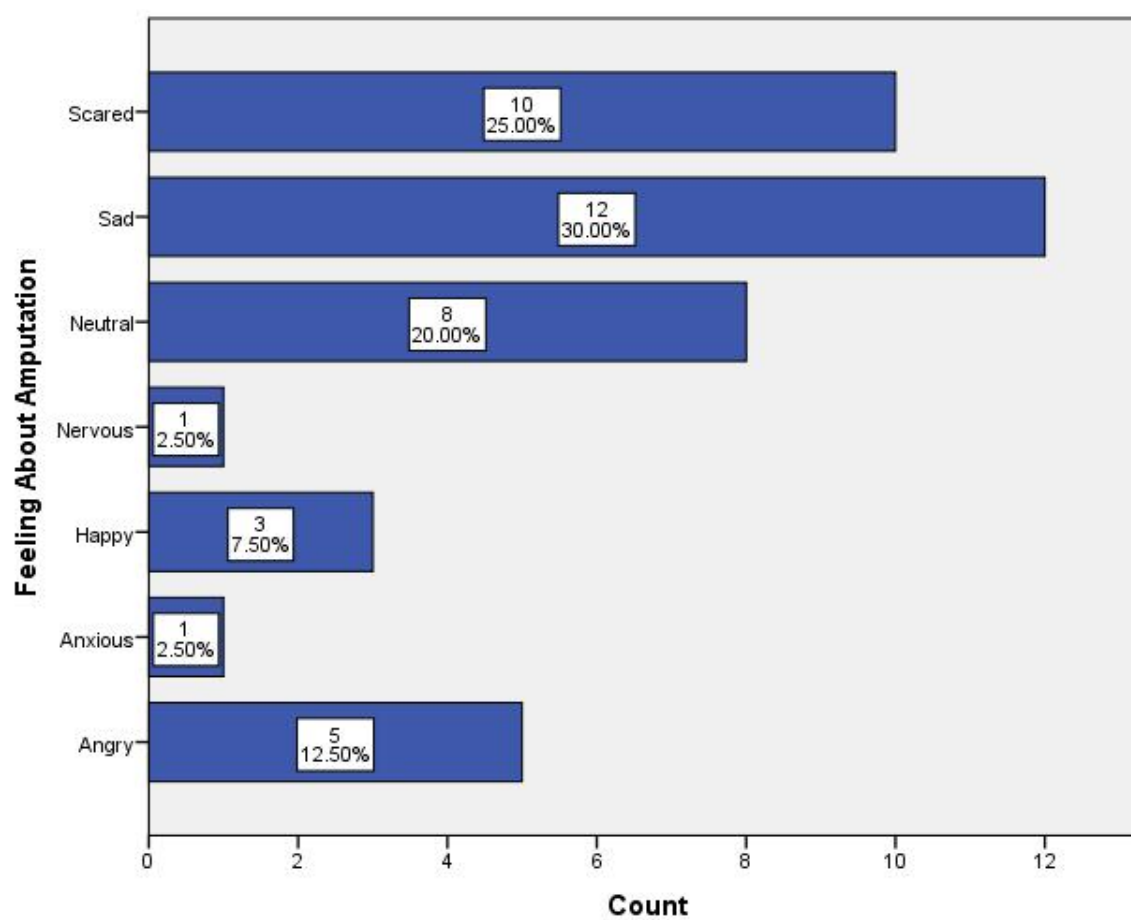
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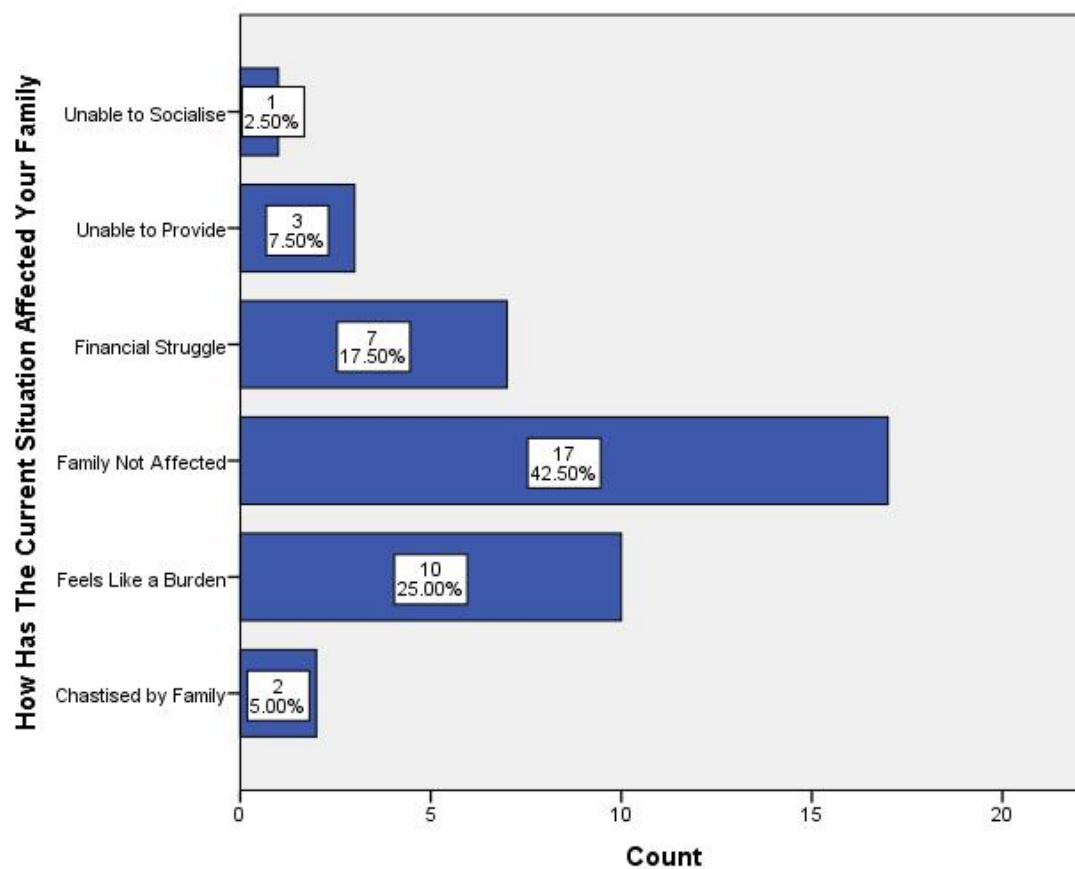
284 **Fig 3:** Patients' feelings about their amputation



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287 **Fig 4:** How the amputation has affected the patients' families.



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