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Signature Honors Project

Determining Prosthesis Acceptance: Differences in Patient Characteristics and Utilization of Rehabilitation after Lower Limb Amputation

Introduction:

People with lower limb amputations have a better quality of life with a properly fitting prosthetic device. A properly fitting prosthesis is essential to live an independent lifestyle. The fitting process slightly varies for everyone, but the consistent theme is that extensive rehabilitation increases one's ability to complete life's daily tasks. Post-amputation rehabilitation focuses on optimizing fit and function for the person with an amputation. Results from one study found that patients without a prosthetic had a lower life expectancy compared with those who had a prosthetic (Chamlian, 2014). A proper fitting device allows the person with an amputation to develop their functionality and return to activities of daily living including social interaction and integration within society.

While there are many known parts of the prosthetic rehabilitation process, we do not know the amount of rehabilitation and extensive medical care that is essential for one to live at an optimal level. Specifically, the amount of rehabilitation and medical care is not known for patients at ECU Health. This study aims to identify the quantity and quality of rehabilitation that is essential for functionality and improved outcomes for lower leg amputees with a prosthesis at ECU Health.

Additionally, the study focuses on differences in rehabilitative needs between amputee patients with vascular versus non-vascular etiologies at ECU Health. We hypothesized that patients with amputations due to vascular inadequacies will require additional medical attention and healing time. This impacts the overall amount of medical care and rehabilitation they will need to return to daily activities.

Background:

The effects of lower leg amputation are more than just physical. Rehabilitation is not a simplistic process and encompasses many components of planning, time, and effort. Individuals with lower limb amputations resulting from ischemic conditions are more likely to utilize prosthetics during rehabilitation (Chamlian, 2014). However, maintenance of the prosthesis is not frequent after discharge. Age, chronic renal failure, and the side of the amputation affect the use of a prosthesis (Chamlian, 2014).

Further reduction in the rate of amputation will require progress in the prevention and management of peripheral artery disease, especially in diabetics (Carmona et al, 2005). People with diabetes tend to experience earlier and higher mortality rates after amputation due to the complex recovery process (Chamlian, 2014). There were 1.6 million people living with amputations in 2005, with 42% being nonwhite, 38% had an amputation secondary to dysvascular disease, and additionally, a comorbid diagnosis of diabetes mellitus (Ziegler-Grham, 2008). Individuals living with limb loss have underlying conditions that may complicate the amputation process, with this trend projected to increase over time (Ziegler-Grham, 2008).

In addition to the physical aspects of amputation, the psychological effects of amputation can be overwhelming as well (Perkins & Sharp, 2012). Patients are not only suffering from physical pain, but also the mental and emotional pain of losing their limb and the recovery process (Perkins & Sharp, 2012). Individuals recovering from traumatic leg amputations frequently face challenges such as pain, psychological disorders, reduced physical and vocational abilities, and heightened risks of cardiovascular disease and mortality (Perkins & Sharp, 2012). The evidence highlights that appropriate preoperative management and operative techniques, in conjunction with suitable rehabilitation and postoperative follow-up, can lead to improved treatment outcomes and patient satisfaction.

Methodology:

To collect our data, we pulled data from 2016-2021 from ECU Health electronic health records. All ages, ethnicities, and any major lower leg amputations from the ankle and above were included. The sample size was 990 patients having prosthesis fitting and falling within our parameters. This data collection stage took six months.

The timeline for the project was as follows. The first year was spent pulling records from the five-year timeline, compiling them in an Excel spreadsheet, and then beginning initial processing.

The data is currently being analyzed to determine additional details concerning comorbidities, discharge destinations, and a more precise median for the number of visits per patient.

Results:

Our hypothesis is that an amputee who recovered from a below-the-knee amputation caused by a vascular disease will regularly have more extensive healthcare and rehabilitation than a patient who recovered from an amputation due to a non-vascular disease.

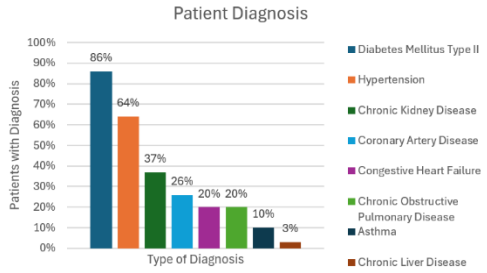

Figure 1: The percentage of comorbidities for patients with major lower extremity amputation between 2016-2021.

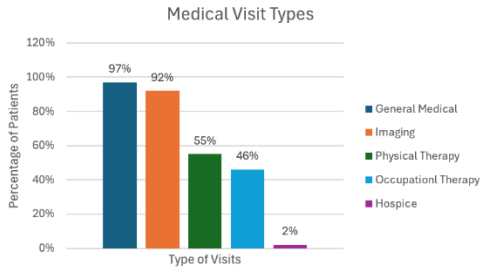

Figure 2: The percentage of different medical visits for patients with major lower extremity amputation between 2016-2021.

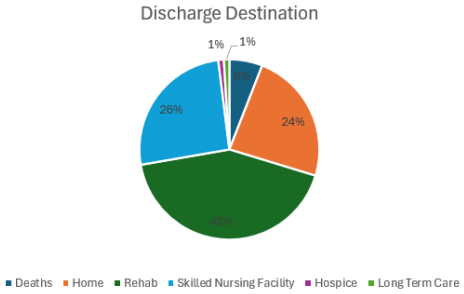

Figure 3: The discharge destinations for patients with major lower extremity amputation between 2016-2021.

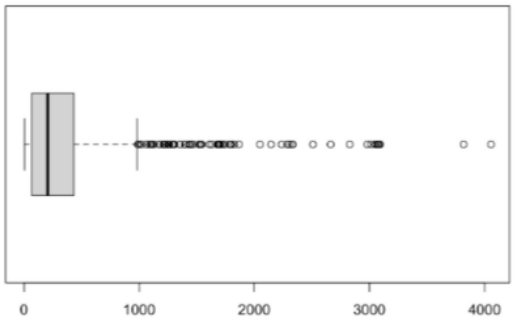

Figure 4: The number of visits for the entire sample size of 990 patients with major lower extremity amputation between 2016-2021.

Between 2016 and 2021, ECU Health reported that 990 students underwent major lower leg amputations. Only 545 out of 990 patients (55%), who underwent a major lower limb amputation at ECU Health between 2016 and 2021 received a prosthesis. Additionally, outside demographics were also gathered and recorded. There were significantly more males (67%) than females (33%). The most common race for patients was black or African American 9570), compared to white (390), and other (30).

One detailed fact obtained was secondary diagnoses for patients. This study looked at what other diagnoses a patient had in addition to receiving their amputation (Figure 1). The most common diagnosis that patients had was Diabetes Mellitus type II. Around eighty-six percent of patients had Diabetes Mellitus Type II (Figure 1). An individual with a Diabetes Mellitus diagnosis is eight times more likely to have a vascular lower leg amputation at or proximal to the trans

metatarsal level than a nondiabetic individual, due to the decreased sensations diabetic individuals have in the lower extremities (Johannesson et al., 2009).

There were 8580 amputation-related visits with an average of 8.67 visits per person. The median of visits for the entire sample size of 990 was 204 visits per patient who received a prosthesis. There was a broad range of visits per patient. The maximum was 456, and the minimum was 2 (Figure 4). Out of the 55% who received physical therapy at ECU Health, each patient received an average of 8.67 medical visits (Figure 2).

The more independent and functioning a person can live their life, the more likely they are to return to their previous living situation. Figure 3 shows the different destinations to which patients were discharged. The most common location patients were discharged to was a long-term care facility (Figure 3).

Discussion:

Peripheral artery disease is a common disease that can cause an amputation, and collateral vessels are created in instances of peripheral artery disease (Chamlian, 2014). As a blockage is formed in the blood vessel, the body creates collateral vessels, which are smaller, more narrow vessels, to go around the blockage. This way, the body can get blood flow to the appendages without restriction from the blockage. The body then continues with a constrained blood flow through the collateral vessels. The problematic portion comes when the patient has an amputation.

When the patient undergoes the amputation, they are no longer recovering from the routine blood flow restrictions, but also the loss of blood flow from the collateral vessels their body created to overcome the blockage. Vascular disease amputation has additional rehabilitation steps needed to combat the additional cut-off blood flow paths. Non-vascular disease amputations do not have additional blood flow paths to recover from.

As seen in the results, the majority of patients had an additional diagnosis during their amputation recovery. This could have been a cause of their amputation in addition to potentially inhibiting their recovery process. Diagnoses like Diabetes Mellitus Type II, hypertension, and chronic kidney disease are three major diagnoses that patients were combating (Figure 1). Two surprising portions of the study came with the same corresponding number. The number of patients who received a prosthesis and attended physical therapy are both just over half of the study size at fifty-five percent. With how well-known prosthetics are for improving quality of life, it is surprising that so few patients received a prosthesis.

This finding lays the groundwork for future research investigating the barriers patients encounter when considering prosthetic use. The study has looked a lot into the physical benefits of physical therapy, but there is also a monetary and psychological component to recovering from an amputation. Providing enhanced mental and emotional support throughout recovery may significantly improve patient outcomes. As the data is developed further, future studies could

look into an array of other barriers that may have stopped a patient from getting the best possible care.

This study could encourage additional research into what the recovery process looks like for patients outside of ECU Health. Research studies of additional hospitals will allow for a meta-analysis across studies to compare state or nationwide what the baselines are for the medical care and rehabilitation necessary for people with lower limb amputation from vascular and non-vascular etiologies to have an initial prosthesis fitting.

Conclusion:

In conclusion, our research on prosthesis acceptance of the rehabilitation process for vascular and non-vascular disease will support current research that supports a longer, more extensive recovery process for patients recovering from vascular disease. Condensing the data results to understand any outliers will help this study retrospectively identify the medical care and rehabilitation necessary for people with lower limb amputation from vascular and non-vascular etiologies to have an initial prosthesis fitting. A deeper understanding of the recovery journey for amputees could profoundly influence rehabilitation strategies and outcomes. It can give patients and providers realistic expectations for the recovery process and ease patients' mental stress during the recovery process.

The data is currently being analyzed to determine the rehabilitation and medical visits required for people to successfully receive a prosthesis. Comorbidities and discharge destinations are also being analyzed to associate with prosthesis users. This will enable researchers to gain a comprehensive understanding of the patient's recovery process.

Works Cited:

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