

Leading Causes of Limb Loss for Diabetic Patients in the CNMI

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## LEADING CAUSES OF LIMB LOSS

### **Abstract**

This study explores factors contributing to limb loss in diabetic patients within the CNMI. Through quantitative and qualitative data collected over a two month period, this study explored the impact of variables identified as contributing to limb amputation in diabetic patients in the CNMI through a survey of 50 respondents. The tested variables were identified through a current literature review, which also showed a gap in current research in relation to related contributing factors of limb loss in diabetic patients within the Pacific region. The results showed that individuals in the community disagree with previous claims that there are inadequate services and programs for diabetic patients. The four variables that were shown to have a significant impact in the community include regular blood sugar level checks, ability to maintain weight and blood pressure, physical activity, and diet. This indicated a larger issue with the average lifestyle in the community, and can be explored in further studies. Interestingly, the cultural perception of pain was not found to be a significant variable in this study.

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### **Introduction**

The issue of limb amputation in diabetic patients has been researched around the world, as the implications on quality of life and future health are considerable. In the United States, 67% of limb amputations are attributed to “diabetes and related complications,” and in 2010 there were 73,000 lower limb amputations caused by these reasons (Almekinder, 2017; n.a., 2017). However, little research has been done in the Pacific region, and even less in the Commonwealth of the Northern Marianas Islands (CNMI). Therefore, the cultural, regional, and genetic influences are not fully understood. This study shall strive to unveil the specific influencing factors within the unique community of the CNMI through researching numerous possible influencing variables.

The study expects to find a strong correlation between the cultural perception of reporting/discussing pain and limb amputation in diabetic patients. Furthermore, the study expects to find that this factor not only plays a role through hesitancy to report injury, but hesitancy to seek continuous care for the diabetic patient’s condition.

### **Literature Review**

Research into amputation causation and the effects of amputation on an individual’s life have been conducted on a global scale. Amputation is shown to decrease quality of life in situations, although variables such as acceptance of the situation may increase future health and overall well-being (Zaidi et al., 2013).

Research that currently exists on diabetic amputation is not only applicable to people of the specific ethnicity and culture of the CNMI, but can also be used as reference to show the understanding of the issue from a biological standpoint and with consideration of the global

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issue. As diabetic foot (DF) is the leading cause of nontraumatic lower extremity amputation, it is important to understand the physiological and genetic impact of diabetes, health history, and family history when assessing for related factors of amputation. One 2008 study found “nephropathy, ischemic diabetic foot, and first FBG > 200 mg/dl”<sup>1</sup> to be “independent predictors” of limb amputation in cases of DF lesions (Shojaiefard, Khorgami, & Larijani, 2008).

Through examination of various variables presented and examined through numerous studies, the main variables that can and will be applied to this study include diet, cultural influences on diet, stress, physical activity, maintaining weight and blood pressure, blood sugar level checks, proper medication, cultural perspective on reporting/discussing pain/injury, patient education, and prevention services (Shojaiefard, Khorgami, & Larijani, 2008; Nazri et al., 2016). Another study also discovered a link between glycemic control, blood pressure control, preventing heavy smoking and the incidence of lower extremity amputation utilizing the Kaplan-Meier approach to assessing for risk of death (Sahakyan, Klein, Lee, Myers, & Klein, 2011).

The Pacific Islands have had a long and torrid history with diabetes, which is only further exacerbated by the high prevalence of limb amputation in diabetic patients. Therefore, research done within the Pacific region was also closely examined.

So far, relevant research has shown that Pacific Islanders (ethnically) were more likely to suffer lower limb amputation than Caucasian and Asian population within the same community (Robinson et al., 2016). This suggests specific factors unique to the biology or culture of Pacific

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<sup>1</sup> *nephropathy* refers to kidney disease or damage, *ischemic diabetic foot* is caused by restricted blood flow to the feet's tissues, and *FBG* abbreviates for the fasting blood glucose test.

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Islanders. Furthermore, numerous studies within Australia have also found an increased risk of amputation amongst Aboriginal and Torres Strait Islander populations, though this also may be influenced by access to prevention and treatment resources (Dillon, Fortington, Akram, Erbas, & Kohler, 2017).

These studies, as well as the common appearance of Pacific Island Countries (PIC) on the top ten world rankings for diabetes prevalences displays the scope of the issue. A 1997 study set in the CNMI found that diabetes is extremely common amongst female individuals of Carolinian (a local population) descent, and that the overall prevalence of diabetic patients experiencing limb amputation in the CNMI is higher than expected when consulting United States and global statistics (Durand, Bourne, Thohey-Mote, Khorram, & Abraham, 1997). However, specific studies on limb amputation or risk for DF lesions in the CNMI could not be found.

So far, all the research into diabetes within the CNMI has focused on prevalence and local diet, and has not specifically explored the consequence of limb amputation. However, studies have identified a dearth of educational and support services for the diabetic, as well as an influential local culture and diet (Durand et al., 1997). A 2013 CNMI study found that the local diabetes prevalence was 9.8% in 2009, non-communicable diseases and related conditions caused 60.7% of all deaths in 2005, and that there was only one provider for physical therapy on island (Ichiho, Robles, & Aitaoto, 2013). Furthermore, the same 2013 Ichiho, Robles, and Aitaoto study surveyed local diabetic patients and found the following data on preventive measures and health care provision in the CNMI:

Of the respondents who had diabetes, 28.8% never checked their feet for sores or irritation; 18.6% were not seen by a doctor or healthcare provider in the last 12 months;

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27.9% did not receive a Hemoglobin A1c test in the last 12 months and 23.4% had not heard of the test for Hemoglobin A1c; 15.6% had never had a dilated eye examination, while an additional 15.6% had a dilated eye examination more than two years ago. . . . Only 23% of the respondents with diabetes reported having taken a course on self-management to learn how to manage their diabetes. (p. 20)

After a review of the existing literature on this topic, it is clear that there is an existing gap in the larger body of research: associated factors of limb loss in the CNMI region. Existing literature will be used as a foundation for this study, as it provides insight into biological factors outside of the capabilities of this project, gives baseline data of diabetes prevalence in the CNMI, and provides factor and study comparisons through limb amputation research conducted outside of the Pacific region.

### **Methodology**

To test the hypotheses, the researcher created a survey distributed to the general population on Saipan (see Appendix A for the general survey). The survey was selected as a primary form of gathering information from the general community, and the goal was to utilize qualitative data to analyze whether there was any correlation between the hypotheses and limb amputation among people living with diabetes in the CNMI.

### **Survey**

The general survey asked questions on perceptions and attitudes toward diabetes and the key factors identified through the literature review. For example, question 6--"Is hiding/downplaying pain a part of your culture?"--was specifically designed to assess the attitude towards hiding/downplaying pain in the CNMI (see Appendix A). The survey was distributed

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using the Northern Marianas College email interface (see Appendix B). The minimum target number of responses was fifty individuals. The survey contained two qualitative questions (e.g. "Have you or has someone you've known lost a limb because of diabetes? If yes, please write what you can about the cause and situation.") and eleven quantitative questions (e.g. "Are individuals in your community able to maintain their weight and blood pressure?" on a 1 to 5 scale) (see Appendix A). The data will be used to analyze perceptions of cultural concepts (i.e. pain) and to discover relationships between factors such as ethnicity and perceptions/experiences of diabetes.

### **Participants and Inclusion Criteria**

Fifty participants completed the survey. The patients were asked for demographic data, including ethnicity, and were able to list multiple ethnicities. The ethnic background of the participants were as follows: 58% Chamorro, 2% Carolinian, 38% Filipino, 8% East Asian East Asian (including China, Korea, Japan), 0% Other Asian, 10% Other Pacific Islander, and 8% Other. Thirty-two percent of the respondents were male and sixty-eight percent female, and the mean age of respondents was 23.29 ( $SD = 7.13$ ).

### **Altered Methods**

Originally, the project was planned to include interviews of diabetic patients and medical professionals, as well as survey responses to two focused surveys. However, due to limited feedback from respondents contacted, there was insufficient data to include in the final results (see Appendix C). One promising avenue was interviewing patients and medical professionals, but due to limited time, only three interviews were conducted.

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## Results

The general survey received fifty responses and eighty percent (40 individuals) of participants reported either having diabetes or someone close to them having diabetes. When asked if hiding or

downplaying pain was a part

of their culture, the 50

respondents had an average

response of 2.96 ( $SD = 1.31$ )

on a scale of 1 to 5, with 1

equating “Absolutely” and 5

“Not at all.” The median and

mode were both 3, and the range

was 4. The range was 4 for all of the following questions on the 1 to 5 scale. When asked if the perception of pain affected health care visits in their community, the mode and median were also 3, and the mean was 3.02 ( $SD = 1.19$ ). A question inquiring as to whether the average person in their community was physically active, elicited a greater deviation from the center with a mode and median of 4, and a mean of 3.76 ( $SD = 0.92$ ). When respondents were asked if they believed there was adequate patient education and prevention services for diabetes in the CNMI, the average response was 3.32 ( $SD = 1.25$ ), with a mode and median of 3. The respondents were asked if individuals from their community regularly received blood sugar checks and the mode was 5, the median was 4, and the mean was 3.62 ( $SD = 1.29$ ). When asked if individuals in their community were able to maintain their weight and blood pressure, respondents answered with a

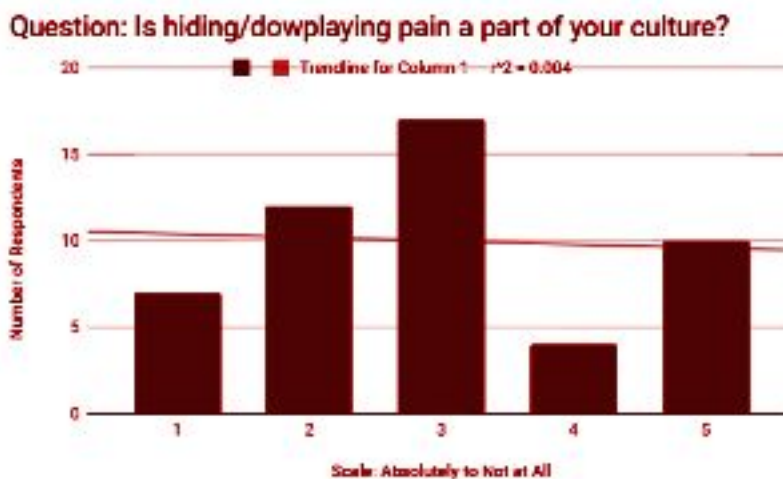


Figure 1. Question: Is hiding/downplaying pain a part of your culture? This figure displays the variety of responses to this question.



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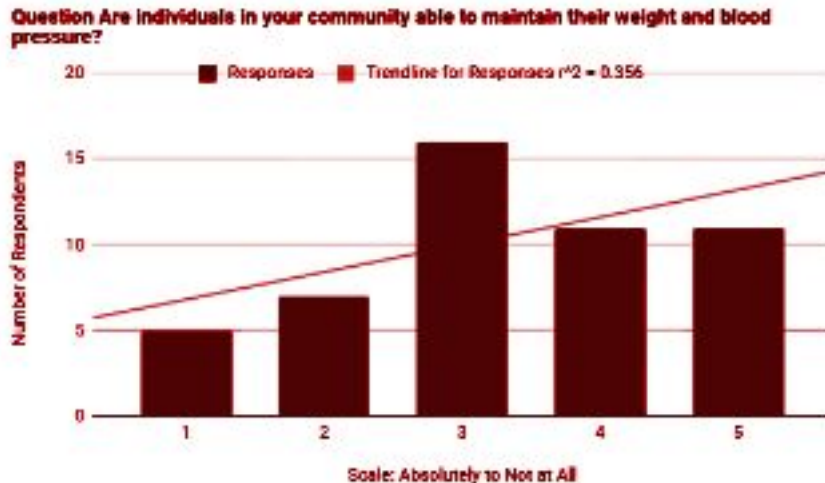


Figure 2. Question: Are individuals in your community able to maintain their weight and blood pressure? This figure displays the variety of responses to this question.

median and mode of 4 and a mean of 3.88 ( $SD = 1.0$ ). The 50 respondents were also asked if individuals in their community took their medications as properly prescribed on the 1 to 5 scale, but were also given the

choice of responding with “I do not

know” if they did not have personal experience with the subject. Of the 50 respondents, 24 responded “I do not know,” and 26 chose a response on the 1 to 5 scale. The mode was 1, the median 3, and the mean was 1.46 ( $SD = 1.47$ ). Out of the 50 respondents, 12 (24 percent of respondents) also left additional comments at the end of the survey regarding poor diets on island as a related factor to diabetes acquisition, uncontrolled diabetes, and limb loss. Comments included “The diet of our people in the CNMI contributes greatly to our health” (Respondent 5) and “(people) should be made aware of their eating habits or food choices at an early age” (Respondent 34).

### Discussion

The results of the general survey show that eighty percent of the population is affected by diabetes, whether they have it or someone close to them does. This is a significant percentage of the CNMI’s population, and it clearly displays how impactful diabetes related issues can be to the total population. Many of these respondents did not identify pain as a very

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significant part of the CNMI's culture, as the mean was 2.96 on the 1 to 5 scale, which equates to "Somewhat." The findings were similar for the category of adequate services and education programs for diabetic patients. This indicates that there is no strong negative or positive relationship with either the impact of pain perception or services/programs category, as they are both present, but neither is significantly impacting or not impacting individuals. As there was no significant results when patients were asked if a negative perception of pain was present in the culture or if it affects discussion and/or reporting of pain, the hypothesis of finding a strong correlation between the cultural perception of reporting/discussing pain and limb amputation in diabetic patients was not proven.

There was a stronger response when respondents were asked if individuals in the community were able to maintain their weight and blood pressure, were physically active, and received regular blood sugar level checks. Interestingly, although respondents indicated that there were somewhat adequate services/programs for diabetic patients, they also indicated that blood glucose tests were not readily available in the community. This suggests that there are gaps in the community's provision of diabetes detection and prevention services. According to an article from Harvard Health Publishing, individuals without diabetes or pre-diabetes should generally test their blood glucose level every year to every three years depending on their health history (n.a., 2014). By regularly checking and identifying individuals who have or at risk for diabetes, patient teaching and appropriate health regimens can be applied.

Furthermore, the respondents answered that individuals in their community were generally unable to maintain (1) their weight and blood pressure and were generally not (2) physically active. Physical activity and maintaining weight and blood pressure were two factors

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identified as contributors to not only diabetes, but also complications such as limb loss and infections (Shojaiefard, Khorgami, & Larijani, 2008; Nazri et al., 2016). Therefore, this indicates that these issues are likely impacting the rates of diabetes acquisition and limb loss on island. Furthermore, another identified contributing variable was diet, which was directly mentioned by 24 percent of individuals in the additional comment section. These three variables should further be explored in future studies.

Ultimately, this study faced limitations that should be considered and avoided in future research. The number of respondents, at 50, was too low to reach statistical significance. Additionally, the majority of respondents were reached using the Northern Marianas College email interface, therefore overrepresenting college-aged individuals and underrepresenting other groups within the CNMI's total population. Additionally, the focused surveys (distributed by email) were not successful in collecting data, as no responses were received. However, the interviews, which were done in person, were successful in collecting data, but due to the time constraints surrounding this project, not enough individuals were interviewed. Since respondents were receptive to interviewing, this method should be further explored in future studies.

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**References**

Almekinder, E. (2017, September 26). Diabetes and Amputation: Everything You Need To Know To Avoid Amputation. Retrieved October 24, 2017, from <https://www.thediabetescouncil.com/diabetes-and-amputation-everything-you-need-to-know-to-avoid-amputation/>

Dillon, M. P., Fortington, L. V., Akram, M., Erbas, B., & Kohler, F. (2017). Geographic Variation of the Incidence Rate of Lower Limb Amputation in Australia from 2007-12. *Plos One*, 12(1), e0170705. doi:10.1371/journal.pone.0170705

Durand, A. M., Bourne, J., Thohey-Mote, D., Khorram, K. D., & Abraham, I. J. (1997). Diabetes in the Indigenous Population of the Commonwealth of the Northern Mariana Islands. *Asia Pacific Journal of Public Health*, 9(1), 28-32. doi:10.1177/101053959700900106

Ichihō, H. M., Robles, B., & Aitaoto, N. (2013). An Assessment of Non-Communicable Diseases, Diabetes, and Related Risk Factors in the Commonwealth of the Northern Mariana Islands: A Systems Perspective. *Hawai'i Journal of Medicine & Public Health*, 72(5 Suppl 1), 19–29.

Mohd Yusof, N., Ab Rahman, J., Hafiz Zulkifly, A., Che-Ahmad, A., Ariffin Khalid, K., Fadzil Sulong, A., & Vijayasingham, N. (2016). Predictors of Major Lower Limb Amputation among Type II Diabetic Patients. *New Indian Journal of Surgery*, 7(3), 239-243. doi:10.21088/nijs.0976.4747.7316.4

N.a. (2013). *How often should you get your blood sugar checked?* Retrieved November 20, 2017, from

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<https://www.health.harvard.edu/diseases-and-conditions/how-often-should-you-get-your-blood-sugar-checked->

N.a. (2017). *Amputee Coalition/National Limb Loss Information Center Fact Sheet*.

Retrieved October 24, 2017, from

[http://www.amputee-coalition.org/fact\\_sheets/diabetes\\_leamp.html](http://www.amputee-coalition.org/fact_sheets/diabetes_leamp.html)

Robinson, T. E., Kenealy, T., Garrett, M., Bramley, D., Drury, P. L., & Elley, C. R.

(2016). Ethnicity and risk of lower limb amputation in people with Type 2 diabetes: a prospective cohort study. *Diabetic Medicine: A Journal Of The British Diabetic Association*, 33(1), 55-61. doi:10.1111/dme.12807

Sahakyan, K., Klein, B. E., Lee, K. E., Myers, C. E., & Klein, R. (2011). The 25-Year Cumulative Incidence of Lower Extremity Amputations in People With Type 1 Diabetes. *Diabetes Care*, 34(3), 649-651. doi:10.2337/dc10-1712

Shojaiefard, A., Khorgami, Z., & Larijani, B. (2008). Independent risk factors for amputation in diabetic foot. *International Journal of Diabetes in Developing Countries*, 28(2), 32–37. <http://doi.org/10.4103/0973-3930.43096>

Zaidi, G., Zafar, N., Noor-ul-Huda, Zubair, R., Farooq, S., & Kausar, R. (2013). Quality of Life and Adjustment among Type II Diabetes Patients With and Without Lower Limb Amputation. *Journal Of Behavioural Sciences*, 23(3), 72-86.

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Appendices

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## Appendix A

## General Survey

This is a general survey on limb loss in diabetic patients. Please answer the following questions to the best of your ability and share the survey with others who would like to as well. Thank you!

All collected information is anonymous, but you are free to leave any personal information or contact information if you wish.

\* Required

1. Do you or does someone close to you have diabetes? \*

*Mark only one oval.*

Yes

No

2. If yes, what kind of diabetes (Type 1 or Type 2), how many individuals (including yourself), and of what gender?

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3. Have you or has someone you've known lost a limb because of diabetes? If yes, please write what you can about the cause and situation. \*

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4. What is your ethnic/racial background? \*

*Check all that apply.*

Chamorro

Carolinian

Filipino

East Asian (China, Korea, Japan, etc.)

Other Asian

Other Pacific Islander

Other

5. What is your age and gender? \*

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6. Is hiding/downplaying pain a part of your culture? \*

Mark only one oval.

	1	2	3	4	5	
Absolutely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Not at all

7. Does the perception of pain affect healthcare visits in your community? \*

Mark only one oval.

	1	2	3	4	5	
Absolutely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Not at all

8. In your opinion, is the average person in your community physically active? \*

Mark only one oval.

	1	2	3	4	5	
Absolutely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Not at all

9. In your opinion, are there adequate patient education and prevention services for diabetes on island? \*

Mark only one oval.

	1	2	3	4	5	
Absolutely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Not at all

10. In your experience, do individuals in your community receive regular blood sugar checks? \*

Mark only one oval.

	1	2	3	4	5	
Absolutely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Not at all

11. Are individuals in your community able to maintain their weight and blood pressure? \*

Mark only one oval.

	1	2	3	4	5	
Absolutely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Not at all



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12. In your opinion, do diabetic individuals in your community properly take their prescribed medication? Scale your answer from 1 - 5 (Absolutely to Not at all). If you do not know, write "I don't know." \*

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13. Do you have anything to add about diabetes and/or limb loss in the CNMI? Feel free to leave any comments, stories, or insights into factors such as diet.

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**Appendix B**

This email was distributed to Northern Marianas College (NMC) students by Alexis Cabrera, a staff member from NMC, after receiving permission from NMC administration to distribute the survey. Survey respondents further indicated that they additionally forwarded the email to others in the community.




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**Limb Loss of Diabetic Patients in the CNMI Survey**  
1 message

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Alexis Cabrera <alexis.cabrera@marianas.edu> Wed, Nov 15, 2017 at 10:36 AM  
To: All Students <all.students@marianas.edu>

Good Morning Proas,

Diabetes is one of the leading diseases affecting our community, it is a major cause of blindness, kidney failure, heart attacks, strokes and lower limb amputation.

A group of NMC students from ED102 (Introduction to Research & Scholarship) are currently working on a study looking into the factors impacting limb loss in the CNMI. The study focuses on the cultural, lifestyle, and medical factors that are impacting diabetic patients, and ultimately contributing to amputations.

By filling out this survey, you can contribute to the assessment of related factors and provide valuable data for this study.

Here's the link to their survey:

<https://docs.google.com/a/marianas.edu/forms/d/1VMqo8vGe5UAVpdhhtfwul3kwEUSbWU16G5y5qzqITU/edit?usp=drivesdk>

For more information on this survey, please email any of the following students:

- [chenoa.buntsanderson@my.marianas.edu](mailto:chenoa.buntsanderson@my.marianas.edu)
- [christopher.manglona@my.marianas.edu](mailto:christopher.manglona@my.marianas.edu)
- [austin.disantos@my.marianas.edu](mailto:austin.disantos@my.marianas.edu)

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*Best Regards,*

*Alexis P. Cabrera*

**Student Leadership Coordinator**  
**NMC Office of Student Activities and Leadership**  
Tel: (670)-237-6787

Start Smart. Start at NMC. Visit the Northern Marianas College website at [www.marianas.edu](http://www.marianas.edu).

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### **Appendix C**

Originally, the project was planned to include interviews of diabetic patients and medical professionals. These two groups of people were chosen in order to highlight the personal and professional perspectives of the issue. Eight individuals were contacted for the purpose of interviewing--however, only three interviews were performed due to time constraints. All three interviewees were diabetic patients and one individual had experienced lower limb amputation. One of the individuals, who had not suffered limb loss was also a medical professional, and was interviewed with two sets of questions.

Additionally, there were two focused surveys: Focused Medical Professional Survey (FMPS) and Focused Diabetic Patient Survey (FDPS). The FMPS was distributed to medical professionals within the Northern Marianas Islands who have had professional experience with diabetes. The participants were identified through local diabetes organizations and health services. The purpose of the FMPS was to gather data from a medical perspective. The final survey was the FDPS and its respondents were to come from two sources: (1) participating local families identified through community discussions and (2) willing diabetic patients identified through medical professionals. The FDPS was targeted towards diabetic patients to identify the direct perception, awareness, and relationship to the identified variables: diet, cultural influences on diet, stress, physical activity, maintaining weight and blood pressure, blood sugar level checks, proper medication, cultural perspective on reporting/discussing pain/injury, patient education, and prevention services. Seven individuals were sent the FMPS by email, and two individuals were sent the FDPS by email. No responses were received.

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Due to limited feedback from respondents contacted, there was insufficient data to include in the final results.