Advancing Primary care through Dermatological Screening

Quality improvement analysis of preforming dermatological scans for Acanthosis Nigricans to assess patient need for blood glucose confirmatory testing to decreased associated morbidity of Diabetes Mellitus Type 2.

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Abstract:

Diabetes Mellitus Type 2 has been shown to increase healthcare delivery costs, while negatively impacting patient quality of life (American Diabetes Association. I believe the healthcare system can benefit from effective screening with the addition of counseling with evidenced based recommendations during outpatient visits. To investigate this belief, I sought to create a valid test that can be incorporated into clinic visits to maximize patient well-being and strengthen the physician-patient relationship. First, I created a study that would focus on Dermatological exam in relation to finger stick glucose testing to identify Acanthosis Nigricans (AN). Next, my population was selected randomly by attending community healthcare events for the Underserved hosted by United Neighborhood Health Services. Diabetes can be diagnosed based on three different criteria 2 of which this project will utilize, A. random blood glucose of >200 with symptoms B. blood sugar >126 mg/dL with a confirmed with a second reading. According to this criterion, 20% of the sample population (n=25) was found to have diabetic blood glucose levels, 80% of which had Acanthosis Nigricans. I found 44% had pre-diabetic blood glucose levels so I counseled on lifestyle modifications that can decrease their risk. Of the population it was found that 11/25 participants had AN with an average blood glucose of 124.82 mg/dL. Upon Statistical analysis there was a p=.134 that AN occurs more with elevated blood glucose levels versus those with normal blood sugars. The p value is not significant, but considering the small sample size the study does demonstrate a strong positive correlation. Also, comparing a mean blood glucose of 124.82 mg/dL to the criterion using 126 mg/dL demonstrates that this dermatological scan can help identify those at risk for elevated blood glucose levels. While, Diabetic patients were given referral letters to direct follow up testing with UNHS physician to establish a treatment plan.

Keywords: Elevated blood glucose, Acanthosis Nigricans, Quality of Life, and Prevention
**Introduction**

My medical interests have always revolved around the distribution of healthcare to the underserved. I first learned of community health centers and their service mission of upon entering a high school preceptor-ship at a Nashville Community health center. I was able to shadow physicians and learn how to deliver beneficial healthcare according to the restricted health care system. Unfortunately, these restrictions prevent patients from coming to the doctor at will. Instead they present when the condition is severe and harder to treat or when only supportive measures can be offered. Also, due to the socioeconomic status of our patients most are unable to miss work or cannot afford medical intervention resources. Underserved communities undertake environmental and social issues such that their health becomes of low priority (Gary-Webb, Giachello, Krista Maier, Skrabak). Making it the responsibility of community health center physicians to advocate for patient improved quality of life. From this it is my mission to provide patient centered care by utilizing their coverage benefits accordingly to maximize their treatment plan.

Upon entrance to the GE-NMF PCLP program I sought to combine my dermatological career interests with primary care screening techniques to increase the overall well being of patients. As a Specialist who plans to work in underserved communities, I see it necessary to find applicable methods of preventative healthcare. Through my studies I learned many rheumatologic, hematological, infectious and other disease etiologies present with dermatological manifestations. Thus, I realized screening of characteristic dermatological morphologies could facilitate primary care. Then in my Third year clinical experience I participated in the treatment of numerous Diabetic patients. I witnessed complications of acute and chronic co-morbidities as well as the benefits of early detection and treatment compliance.

As healthcare progresses the objective has grown toward patient centered health care. Fortunately, in my PCLP research I was partnered with United Neighborhood Health Services (UNHS) whose physicians are implementing patient centered health care. Witnessing these interactions enabled me to further the scope of my project. Hence I learned this requires a collaborative effort by healthcare workers.

**Background**

The rate of Type 2 Diabetes Mellitus has increased over recent years in correlation with the rise in obesity in the American population. According to the 2011 Diabetes fact sheet 8.3% of the population has diabetes, approximately 2.7 % are undiagnosed of these 12. 6% are non-Hispanic blacks and 11.8% Hispanic 7.1 % non Hispanic Caucasian (American Diabetes Association). These high-risk ethnic groups are population base of community health centers (CHCs). Thus, it should be within the objective of CHC’s to decrease the occurrence and progression of such a debilitating disease. This population in addition to other immigrant groups of the Nashville metropolitan area is known to have limited access to health care resources. An issue that causes delay in patient presentation resulting in increased consumption of healthcare resources.

DM Type 2 pathogenesis creates an environment in which the body becomes resistant to insulin due to consistently elevated levels of blood glucose. Elevated blood glucose can damage eyes,
kidney, skin, nerves, and blood vessels and susceptibility to certain infections (American Diabetes Association). Symptoms of marked hyperglycemia include polyuria, polydipsia, weight loss, sometimes with polyphagia, and blurred vision (American Diabetes Association). Unfortunately, in most instances patients are experiencing symptoms of organ damage and are not aware of it. As these symptoms of elevated blood glucose persist patients are at risk for developing acute medical emergencies. I hypothesize that if patients are screened for AN during outpatient visits and subsequent finger stick glucose is done on finding the former then the patient will most likely be found to have elevated blood glucose.

Acanthosis Nigricans is the darkened velvety appearance of skin folds that is related to a high blood sugar state. This skin manifestation along with other symptoms can present much earlier than the onset of Diabetic complications. Looking for AN during physical exam is a simple efficient method for screening because it can be done as the physician assesses the patient from head to toe. Implementing screening measures into outpatient visits can most likely lead to a decline in health care resources consumption. Also the patient physician relationship will be strengthened. Efficient use of time allows the physician to make sure all patient needs are met. Studies have been done to evaluate the efficacy of physician advocacy in the reduction of diabetes risk, complications and morbidity.

Residents of underserved communities experience social and environmental factors that increase their risk, severity of complications. Patients are not able to access healthcare readily or they are not financially able to obtain the resources needed to comply with their treatment plan. Thus physicians of community health centers have to advocate for screening modalities that make efficient use of patient encounters using resources covered by patient insurance.

**Methodology**

To maximize sample population size research was conducted at three United Neighborhood Health Care Services Community Health-Care events. The mobile unit offered physical exams and Finger stick glucose testing. Medical providers will advertise to event attendees through social interaction.

Exams begin with introduction of the improvement quality control consent forms. Consent forms were created by myself, stating that participants agreed to Finger stick glucose testing and physical exams (Figure 1.1). Also if, positive findings were found on physical exam photographic documentation would be taken without any personal identifying information. Consent was discussed, assessed for understanding, and confirmed. Participants were provided with a number based on order of presentation. Participants received a numerical value, a Diabetes fact sheet with current USPSTF recommendations and services offered by UNHS to assist community members in controlling diabetes (Figure 1.2). Participants were informed of the importance of Diabetes screening, educated on benefits of slowing the effect of elevated blood glucose levels and initiation of early Treatment to attain glucose control.

General ten minute exam including heart, lung, and abdominal auscultation; musculoskeletal and neurological assessment; and dermatological scan with focus on Acanthosis Nigricans (Figure 2.1). Patients were questioned time last meal and its dietary components they had glucose
readings (Figure 2.2). Patients informed of their results, indications of risk reduction, and referral letters for diabetic blood glucose levels. Referral letters were created by myself indicating the patients blood glucose reading, pertinent positive symptoms, and directions for patients to establish follow up with UNHS physicians (Figure 1.3).

Data was recorded in an excel spread sheet, analyzed with statistical software. First the sample size was isolated based on normal, pre-diabetic, or diabetic blood glucose levels. Then, the sample was evaluated for how many participants had Acanthosis Nigricans and the average blood glucose level of each group.

**Results**

*Finger Stick Glucose Results*

The three healthcare events yielded a sample population of twenty-five participants (n=25). Of these 20% were found to have Blood glucose levels qualifying them as Type 2 Diabetic 126 mg/dL. 2/5 (40%) of these patients had a random blood glucose above 200 mg/dL plus symptoms; while 3/5 (60%) had an >126 mg/dL fasting blood glucose. These patients were counseled on life style modification techniques according to current UPSTF recommendations. All were given a referral form to follow up with UNHS. While 44% (11/25) of participants were found to have elevated Fasting blood glucose qualifying them as pre-diabetic (100 mg/dL-125mg/dL). Lastly, 9/25 36% of participants were found to have normal fasting blood glucose levels (Figure 3.1). About 16/25 (64%) of patients were not aware of resources provided by UNHS or that their coverage was accepted or that UNHS existed.

*Physical Exam Results of Acanthosis Nigricans*

11/25 Participants found to have Acanthosis Nigricans on physical exam (Figure 3.2). An average blood glucose of 124.82 mg/dL was found in this group. While those not presenting with AN had an average blood glucose of 105.43 mg/dL (Figure 3.3). Analysis shows that 7/25 participants with AN actually had an elevated blood glucose. The entire sample size was found to have a p=.134, which is not statistically significant, but considering the small sample size this value is adequate (Figure 3.4). Upon Statistical analysis there was a p=.134 that AN occurs more with elevated blood glucose levels versus those with normal blood sugars ( Appendix). The p value is not significant, but considering the small sample size the study does demonstrate a strong positive correlation. Also, comparing a mean blood glucose of 124.82 mg/dL to the criterion using 126 mg/dL demonstrates that this dermatological scan can help identify those at risk for elevated blood glucose levels.

**Discussion**

Venturing out into the community allows CHCs to expand their patient base through a method I describe as the multiplier effect. Meaning a specific population set can be selected based on their trend to accompany another specific population to events aimed at benefiting the latter solely. Completion of research with United Neighborhood’s mobile unit enabled for random
selection Nashville citizens that most likely to live in underserved communities. An appropriate sample population was gathered and screened according to the parameters of this study.

Of this population this project found that 20% had qualifying blood glucose levels for type 2 Diabetes. This follows the high rate of diagnosed diabetics in the United States, supporting reasons for instituting methods for early detection. Further more, 44% of participants that are high risk for the development of type 2 Diabetes. As these patients continue with their current life style they will become part of the high percentage of undiagnosed Type 2 Diabetes in the country. Therefore it is pertinent to institute interventional counseling to pre-diabetic patients to retard Diabetes Type 2 morbidity the progression of Type 2 Diabetes. Hence, physician interest for healthier communities through preventative standards is crucial. A 64% identification elevated blood glucose of the sample size demonstrates screening does identify those at risk. Additionally, the p= .134 demonstrates a positive correlation between high blood sugars and the presence of Acanthosis Nigricans. Lastly there is a 1.18 mg/dL difference between the average blood glucose level of our group with AN and the 126 md/dL requirement for the diagnosis of Diabetes Type 2. So there is benefit in using AN as a identifier for those at risk of Diabetes Mellitus Type 2.  AN is easily identified due to its geographical location and its characteristic morphology.

My objective to demonstrate that sub specialties in medicine can be useful in promoting healthier individuals to facilitate primary care was completed through skin examinations in conjunction with finger glucose sticks. I found that 80% of those with diabetic qualifying blood glucose levels had AN. The average blood glucose of those with AN is 124.82. So it is beneficial to have finger glucose testing completed if AN is found on physical exam. If CHCs take the responsibility to preform dermatological scans during clinic visits, they would have to institute a new infrastructure. For example, screening labs can be done after the history and physical if AN is present. Then positive finger blood glucose tests should be prompted to the provider the following day to establish follow up appointments. This will allow for the early detection to slow the progression of micro-vascular injury due to elevated blood glucose. Also, early detection will delay macro-vascular injury leading to a decreased risk for Type 2 Diabetic associated co-morbidities; such as CAD, arteriosclerosis, hypertension, and hyperlipidemia, and further improving patient quality of life. Which is supported by previous research that there is increase occurrence of co morbid diseases in those with DM Type 2 versus healthy individuals (American Diabetes Association).

Institution of screening methods incorporated into outpatient visits has the potential to decrease morbidity, lifetime health care costs, and mortality. A study found that the earlier age of onset Type 2 Diabetes Mellitus is associated with an increased lifetime health care expense they will endure versus a non-diabetic patient (Xiaohui ,Barker, Albright , Thompson , and Gregg). Therefore it is valuable to institute screening for the at risk to be identified, medically address as necessary to avoid high health care cost due to treating Diabetes Mellitus 2 and its co-morbidities. Education is key to health care improvement. Better understanding allows patients comply to medical treatment. Physicians are educated on USPSTF recommendations and can include them in the treatment plan. Furthering patient’s knowledge with the USPSTF
recommendations will allow them to improve their quality of life. Efforts by physicians to increase patient outreach in communities with restrictive health care coverage can be beneficial for both the patient and CHC. The patient receives optimal healthcare while CHC will grow as it accomplishes its mission. It is best done by CHC since they are familiar with the limitations of the coverage provided to underserved communities. CHCs would be the most knowledgeable to instruct the patient on how to maximize their healthcare coverage.

The issue arises of patient health care coverage covering screening done outside of national recommendation. Meaning if screening is done earlier or more frequently than indicated, it will not be covered by patient health insurance. If CHCs take on the responsibility of conducting follow up blood glucose levels on AN presentation during dermatological screening for AN on physical exam at outpatient encounter, they will incur the associated cost. Raises the financial question if CHCs can afford this, since their funds are already limited. According to CHCs’ mission, this financial sacrifice may be worthwhile. As pioneers they will eventually lower health care costs by decreasing morbidity and mortality, thus causing a valuable decrease in excess health care resources. Consequently benefiting the government. Raises the question of the governments support in CHCs’ effort to improve national health care or will the government leave the healthcare system in a delinquent cycle until health care providers are forced to find an alternate solution?

In conclusion I found that Acanthosis Nigricans does correlate with elevated blood glucose levels demonstrates that it is a quick identifier of patients at risk for Diabetes Mellitus Type 2. The data does still support that CHCs’ effort to engage the community to conduct screenings measurements does increase patient knowledge to follow up for medical condition.

Recommendations

My project identified efficient methods to expand outreach and quickly identify at risk patients. As I conducted this quality improvement control study I learned factors that can be adjusted to yield a better outcome. For example, I was unsure of how UNHS’s mobile unit functioned at their health care events. Prior knowledge would allow for everyone scheduled to work to be made aware of the screening goals and research tactics. Also, the staff that comprised the mobile unit was not known. Now it is evident that at minimum a medical assistant, physician, and volunteer should be present. The flow of the unit should be project introduction, explain consent, physical exam, and finger stick glucose screening test is to be completed last. I found that there was hesitation with study participation due to the fear that Finger Glucose Sticks are painful. Once I explained the indications and benefits of screening patients become comfortable. Then with all gathered information providers should assess what national recommendations would best benefit the participant. Ending the patient encounter with printed follow-up instructions, and community resources available to them.

Instead of referral letters, the ability to book follow up appointments at time of screening for a secondary confirmatory glucose value would be more concrete. At time of booking have a template of the patient encounter, so the follow up physician is aware of topics addressed at the initial visit. This allows time for the patient to begin incorporating life style modifications into
their routine. By the time they arrive at their confirmatory appointment the patient can tell the physician what modifications were working and obstacles implementing others.

Need of confirmatory blood glucose levels due to possible error of participants not being in a fully fasted state at time of initial screening. Issues affecting the population size include selecting patients based on phenotype of race and obesity or visible AN. There for medical providers should always screen everyone because not all Type 2 diabetics fit the stereotypical phenotype.

**Conclusion**

Diabetes Mellitus Type 2 is ever prevalent in our communities causing increased consumption of healthcare resources and decreased patient quality of life. It has become the responsibility of Community Health Centers to advocate for methods that increase patient well-being and efficient use of health care resources. There is a need for a useful method for identifying at risk patients. To address this need, my study validated detecting AN on physical exam and subsequent finger stick glucose testing is associated with an elevated blood glucose level. Such a efficient identifier allows for early intervention to decrease concomitant morbidity, mortality and health care cost. It is believed these measures will increase patient compliance and satisfaction. Lastly, this project proved Mobile units to be an efficient approach to expand patient out reach. Increasing the patient base of Community Health Centers will improve the overall health of the underserved community.
References

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Appendix

Figure 1.1:

GE-NMF PCLP & United Neighborhood Health Services Inc.
Quality Improvement Control Consent Form

Consent for Blood Glucose Screening and Physical exam Dermatological Photo Documentation:

Patient Name: : ____________________________________________.
Date of Birth: ____________________________.
Date of Service: ____________________________.
Location of Service: ________________________________________.

I ____________________________ (NAME) authorize and direct that research scholars and participants of GE-NMF may collect blood glucose sample through Finger stick glucose screening. In addition, I will undergo a general physical exam to maximize health care prevention. The nature and purpose of the operation, possible alternative methods of treatment, and the risks involved, and possible benefits have been explained clearly to me. No warranty or guarantee has been made as to the results or cures.

I hereby authorize the above named medical providers to council myself on health care prevention tactics and/or referral to a UNHS Inc. Primary Care Physician for follow up healthcare.

I ____________________________ (NAME) authorize and direct the above named medical providers to take photo documentation of any medically relevant Dermatological findings related to my finger stick glucose screening. My personal information will not be identified with the photographic samples.

I further acknowledge that all blanks or statements requiring insertion or completion were filled in before I affixed my signature.
Patient Signature: ____________________________.

Date & Time: : ____________________________.

The undersigned certifies that he/she is the patient’s parent(s) or
the above minor and authorize their consent to the above proceedings.

Parent(s) signature: ____________________________.

Figure 1.2:

Care for those with Diabetes

There is no cure for diabetes, but it can be diagnosed early and it can be
treated. You can take control of your diabetes and avoid many of the
complications of the condition.

United Neighborhood Health Services provides a full range of care for
those with diabetes at all clinic locations.

DIABETES PROGRAM: We have a special program that offers:

- Health education
- Nutrition counseling
- Personal fitness plan
- Support groups
- Exercise groups

**Call for more information and an appointment today: 620-UNHS

See your doctor at least twice a year and have three tests:

- HbA1c: This measures your blood sugar and should be 8 or less.
- Blood pressure: This should be 130/80 or less.
- Cholesterol: This should be under 200.

Once each year:
• See a dentist.
• Have an eye exam.
• Have a foot exam.
• Get your flu shot.

Daily:
• Have a food plan and follow it.
• Get 30 minutes of activity.
• Don’t smoke.
• Take your medications.
• Wear proper shoes and check your feet.

Figure 1.3:

GE-NMF PCLP & United Neighborhood Health Services Inc.
Quality Improvement
Control Referral Form

Referral to a Primary Care Physician for follow up of Blood Glucose Screening and Physical exam:

Name of Patient: __________________________.
Date of Finger stick glucose testing: ________________.
Blood Glucose level ________________.

Patient reported symptoms of:

  Increased Urination frequency  Increased Thirst

  Fatigue  Weight loss  Numbness/tingling

  Decreased wound healing  Blurred Vision
Referral to Dr. Carrier for follow up of elevated blood glucose levels found on finger stick glucose screening. Thank you for your participation in creating healthier neighbors in our community.

Referring entity: GE-NMF PCLP UNHS Inc. Research Scholar

Figure 2.1:

Figure 2.2
Figure 3.1: Blood Glucose Distribution of Sample Size

- >126 mg/dL
- 100-125 mg/dL
- <100 mg/dL
Figure 3.2: 

Presence of AN in Sample Size

<table>
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<th>Presence of AN</th>
<th>Blood Glucose Mean</th>
<th>N</th>
<th>Std. Deviation</th>
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<td>11</td>
<td>43.504</td>
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<td>105.43</td>
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Figure 3.3: 

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<th>Std. Deviation</th>
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<td>124.82</td>
<td>11</td>
<td>43.504</td>
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<tr>
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Figure 3.4: 

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<td>Within Groups</td>
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<td>Total</td>
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</table>
Figure 4.1:

![Image of the neck area with a label]

Figure 4.2:

![Image of the arm area with a label]
Figure 4.5:

Figure 4.6: