Examining the Relationship Between Primary Care Provider Emotional Intelligence and Glycemic Control

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EXAMINING THE RELATIONSHIP BETWEEN PRIMARY CARE PROVIDER
EMOTIONAL INTELLIGENCE AND GLYCEMIC CONTROL

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The Faculty of the School of Medicine
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Master of Medical Science

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Table of Contents

ABSTRACT ............................................................................................................................. iv

CHAPTER 1: INTRODUCTION .............................................................................................. 1

1.1 Background .................................................................................................................... 1
   1.1.1 Type II Diabetes ...................................................................................................... 1
   1.1.2 Factors Influencing Type II Diabetes Control and Management in the Primary Care Setting ........................................................................................................ 2
   1.1.3 Emotional Intelligence .......................................................................................... 3

1.2 Statement of the Problem .............................................................................................. 4

1.3 Goals and Objectives .................................................................................................... 5

1.4 Hypothesis ..................................................................................................................... 5

1.5 Definitions ..................................................................................................................... 6

1.6 References ................................................................................................................... 7

CHAPTER 2: REVIEW OF THE LITERATURE ................................................................... 9

2.1 Introduction ................................................................................................................... 9

2.1.1 Proposed Causal Pathway ....................................................................................... 10

2.2 Review of the Literature .............................................................................................. 11
   2.2.1 Blue Steps ............................................................................................................. 11
   2.2.2 Green Steps ........................................................................................................... 18
   2.2.3 Pink Steps ............................................................................................................. 19

2.3 Review of Methodology ............................................................................................... 25
   2.3.1 Study Design ......................................................................................................... 25
   2.3.2 Selection Criteria ................................................................................................. 26
   2.3.3 Potential Confounding Variables ........................................................................... 27
   2.3.4 Independent Variable: WLEIS ............................................................................ 28
   2.3.5 Dependent Variable: HbA1c ................................................................................ 29
   2.3.6 Sample Size and Statistical Significance .............................................................. 29

2.4 Conclusion .................................................................................................................... 30

2.5 References ................................................................................................................... 31

Chapter 3: Methods ............................................................................................................. 35

3.1 Study Design ................................................................................................................ 35

3.2 Study Population and Sampling ................................................................................ 36

3.3 Study Recruitment .................................................................................................... 37

3.4 Subject Protection and Confidentiality ..................................................................... 38

3.5 Study Variable and Measures ................................................................................... 38

3.7 Data Collection .......................................................................................................... 40

3.8 Sample Size Calculation .......................................................................................... 41

3.9 Analysis ....................................................................................................................... 41
3.10 Timeline and Resources ........................................................................................................ 42
3.11 References .......................................................................................................................... 43

Chapter 4: Conclusion .................................................................................................................. 44
4.1 Advantages and Disadvantages ......................................................................................... 44
4.2 Clinical Significance ........................................................................................................... 45

APPENDICES ............................................................................................................................. 46
Appendix A: Wong Law Emotional Intelligence Scale (WLEIS) .................................................... 46
Appendix B: Consent Form ......................................................................................................... 47
Appendix C: Sample PCP Intake Form ...................................................................................... 50
Appendix D: Sample Size Calculation ...................................................................................... 53
Appendix E: Variable and Analysis Type .................................................................................. 54
The patient-provider relationship is an important component of chronic disease management. One key aspect of a positive patient-provider relationship is a healthcare provider’s “emotional intelligence,” one’s ability to recognize, understand, and manage their own as well as other’s emotions, which has a known positive effect on patient satisfaction. However, no studies have examined whether a healthcare provider’s emotional intelligence influences health outcomes in chronic disease. This study aims to determine whether glycemic control in adult patients with type II diabetes is correlated with a primary care provider’s emotional intelligence. Specifically, we will carry out a cross sectional study using retrospective data to determine the relationship between provider’s emotional intelligence on the Wong Law Emotional Intelligence Scale and their diabetic patients’ three most recent HbA1Cs. We hypothesize that higher emotional intelligence will be correlated with improved glycemic outcomes in patients with diabetes.
CHAPTER 1: INTRODUCTION

1.1 Background

1.1.1 Type II Diabetes

About 1 in 10 Americans live with diabetes mellitus; of that number approximately 95% have type II diabetes. Type II diabetes mellitus (T2DM) is a disease characterized by hyperglycemia, insulin resistance, and impaired pancreatic insulin secretion. The decreased efficacy of insulin in the body causes a buildup of unused glucose leading to a host of negative sequelae. There are a variety of risk factors for developing T2DM. However, most fall into the category of “modifiable lifestyle factors” including obesity, sedentariness, and diet. Different lab tests are used to make the diagnosis of T2DM. Fasting plasma glucose and Hemoglobin A1c (HbA1c) are the two most commonly used glycemic tests for the general, nonpregnant population. HbA1c is useful in T2DM monitoring and management because it represents a mean blood glucose concentration over a period of about three months. Glycemic control and HbA1c values are inversely related; the tighter the glycemic control over the last three months, the lower the HgA1c. A patient is considered to have prediabetes at an HbA1c between 5.7% and 6.4%. A formal diagnosis of T2DM can be made when a patient’s HbA1c rises above 6.5%.

The disease complications of T2DM can be seen in almost every organ system and can have a large effect on overall morbidity and mortality. On a macrovascular level, the buildup of unused glucose can cause atherosclerosis, which can eventually lead to MI and stroke. Microvascular changes associated with diabetes can cause retinopathy, nephropathy, poor wound healing, and neuropathy. Patients with poor glycemic control are at higher risk for developing these complications; thus the higher the HgA1c the greater the risk of complication.
1.1.2 Factors Influencing Type II Diabetes Control and Management in the Primary Care Setting

The goals of treatment of T2DM are to maximize time in a normoglycemic state while simultaneously minimizing macrovascular and microvascular complications. As stated above, there are many factors that can affect a patient’s glycemic control. Often the first steps a Primary Care Provider (PCP) takes in managing a patient with T2DM is education and encouraging lifestyle changes. One of the main modifications that PCPs advocate for adjustments to diet. Five commonly cited pillars of diabetes nutrition counseling are: weight management and increased physical activity, caloric intake, consistency in day-to-day carbohydrate intake, nutritional content, and timing of meals and snacks. Another component of diabetes counseling is the role weight loss and exercise play in glycemic management. Weight loss alone has been shown to improve both insulin resistance and impaired insulin secretion in patients with T2DM. General recommendations for all T2DM patients are to incorporate 30 minutes of moderate physical activity more than four days a week, in conjunction with losing 5-10% of initial body weight. Optimizing diet, weight, and exercise in patients with T2DM requires a significant amount of education, need assessment, motivational interviewing, and counseling by the PCP.

Patients are often started on pharmacologic agents after failing to meet desired HbA1c targets with solely lifestyle modifications. Both creating and tailoring effective medication regimens, and patient adherence are needed for successful pharmacologic management of T2DM. With so many anti-hyperglycemic medication classes and individual medications on the market, PCPs are tasked with choosing the appropriate therapy for their individual patient’s needs. The most successful therapies maximize glycemic control while minimizing adverse
effects. PCPs often attempt to pair medications with certain side effects to with patients who could benefit from those effects. For example, SGLT2 inhibitors are known to cause weight loss, so are often used in patients with obesity. Even after appropriate medications have been chosen, a regimen can still fail if there is a lack of patient adherence. According to the literature, an estimated 65-85% of patients with T2DM are not adherent to their medication. This is one of the highest rates of nonadherence of any chronic disease and has a multitude of contributing factors including complexity and frequency of dosing, medication side effects, and lack of education. For example, when using insulin patients often have to calculate doses and self-administer the injections up to four times per day which can be a large challenge. Lack of medication adherence is closely tied to poor glycemic control and development of negative sequela.

1.1.3 Emotional Intelligence

Emotional Intelligence (EI) is the ability to monitor one’s own and others’ emotions, to discriminate among them, and to use information to guide one’s thinking and actions. It is also described in psychology literature as: “the concept describes a group of human potentials allowing individuals to identify emotions, integrate emotional information in thought and problem solving, understand complex emotional situations and manage emotional experiences and displays in an adaptive manner.” The modern concept of emotional intelligence was first formally introduced in 1990 by Peter Salovey and John D. Mayer. However, concepts like “social intelligence” that described one’s ability to “comprehend and manage other people” have been published since the 1930. There are numerous models of describing and measuring emotional intelligence, each slightly tweaking from Salovey and Mayor’s foundation. When discussed in research, emotional intelligence is often broken into four domains: appraisal and
expression of emotions in the self, appraisal and recognition of emotions in others, regulation of emotion in the self, and use of emotion to facilitate performance. People who have developed their emotional intelligence have the ability to first understand their own motives and emotions as well as the motives and emotions of others, and how those two entities are related and interact. Increased emotional intelligence has been linked to increased job performance, social relationships, positive perception by others, and academic achievement.

1.2 Statement of the Problem

Type II Diabetes is one of the most prevalent chronic diseases in the world. In the last 10 years, there have been over 20,000 published articles on T2DM management, as well as regularly updated management recommendations and guidelines from large medical and public health governing bodies such as the CDC, WHO, and ADA. In addition, a wide variety of management options are available, including highly effective pharmaceuticals. However, of patients with T2DM undergoing medical management and treatment, a majority, 56%, are still considered to have uncontrolled disease. Despite providers working to optimize all the known factors of poor diabetes control, many patients still cannot achieve desired glycemic outcomes. As morbidity and mortality associated with T2DM continues to grow worldwide, it is necessary to consider all of the factors that could influence glycemic control to ensure high quality patient care.

The patient-provider relationship (PPR) is known to play an important role in chronic disease management. In addition, past studies have shown that a positive PPR is correlated to improved glycemic control in patients with T2DM. However, there has been little research into which specific components of the relationship could have effects on clinical outcomes. The PPR is so multifactorial it is difficult to tease out and isolate contributing factors.
and to measure the weight each factor holds. Without narrowing down and subdividing a concept as large as the patient-provider relationship, it is challenging for providers to know what specific aspects they can control and improve.

Besides the lack of more nuanced division of the components of the PPR, there is also a void of research into the quantitative effects the PPR has on patient outcomes in chronic disease. To date, there have been numerous studies that have outlined the PPR’s influence on subjective, qualitative measures such as patient satisfaction, subjective improvement of symptoms, and disease related anxiety. Though those are all very important components of patient care, in T2DM, quantitative measures of disease have a much larger impact on disease associated morbidity and mortality. To best assess for the PPR’s role in T2DM management, research into its effects on quantitative disease measures is necessary.

1.3 Goals and Objectives

In this cross-sectional study, we aim to investigate the relationship between a primary care provider’s emotional intelligence and hemoglobin A1c values in their adult patients with T2DM. To examine this relationship, we will use the Wong Law Emotional Intelligence Scale (WLEIS) to assess provider’s EI, and patients’ mean HbA1c to measure glycemic control. The relationship between these two values, while controlling for confounding variables, will show if increased provider emotional intelligence is correlated with lower HbA1c in adult patients with diabetes.

1.4 Hypothesis

We hypothesize that higher emotional intelligence in primary care providers will be correlated with improved glycemic outcomes in patients with type II diabetes.
1.5 Definitions

*Type II Diabetes (T2DM)*: a chronic disease characterized by insulin resistance and relative impairment in insulin secretion resulting in hyperglycemia

*Primary Care Provider (PCP)*: a physician (MD or DO), nurse practitioner, or physician assistant, as allowed under law, who provides, manages, coordinates a patient’s acute and chronic medical concerns with generalist training

*Hemoglobin A1c (HbA1c)*: a minor component of hemoglobin to which glucose is bound, a measure of blood glucose concentration. Measures average glycemic control over a three-month span

*Glycemic Control*: time spent in a euglycemic state, minimizing time in hypo- or hyperglycemic states

*Patient-Provider Relationship (PPR)*: a fiduciary, interpersonal relationship between a patient and their health care provider

*Emotional Intelligence (EI)*: the ability to monitor one’s own and others’ emotions, to discriminate among them, and to use information to guide one’s thinking and actions
1.6 References


CHAPTER 2: REVIEW OF THE LITERATURE

2.1 Introduction

We conducted a review of the literature from December 2021 through June 2022 using PubMed, Ovid Medline, PsychINFO, and Cochrane Library. Primary searches used a combination of MeSH terms including: “diabetes,” “physician-patient relations,” “empathy,” “emotional intelligence,” and “treatment outcome.” Additional searches included type II diabetes, type 2 diabetes, impaired glucose tolerance, IGT, EI, EQ, patient-provider relationship, patient-physician relationship, patient-doctor relationship, adherence, patient satisfaction, trust, symptoms, HbA1c, hemoglobin A1c, glucose, and clinical outcomes. The search was limited to articles published in English between 2010 and 2022. All articles with pertinent titles and abstracts were evaluated. Relevant references were also evaluated and included in the literature review.
2.1.1 Proposed Causal Pathway

The below figure is the proposed causal pathway linking PCP Emotional Intelligence and HbA1c. It will act as a framework for the following literature review. Each arrow will have a section dedicated to examining the previous studies conducted relevant to that relationship.

**Proposed Causal Pathway**

![Proposed Causal Pathway Diagram]

*Figure 1: Proposed causal pathway linking Emotional Intelligence, as a component of the PPR, to HbA1c that will be expanded on throughout Section 2.2.*
2.2 Review of the Literature

2.2.1 Blue Steps

**PPR + Patient Satisfaction**

Patient satisfaction is defined in the literature as “a measure of a patient or family’s opinion of care received from medical staff” and is used as a measure of health care quality $^{30}$. Dissecting the nuance of factors affecting patient satisfaction is an entire field in itself. However, one prevailing theme throughout the literature is that patient satisfaction is not only influenced by a provider’s “technical performance,” but also by their level of “interpersonal care.” There is an abundance of literature dedicated to improving the technical performance aspect of care; however, to ensure the highest quality of care and patient satisfaction, factors that influence interpersonal care cannot be ignored. This section will examine previous research on the relationship between the PPR, empathy, and EI on patient satisfaction in the context of chronic disease.

Systemic Lupus Erythematosus (SLE), similar to T2DM, is a complex chronic disease that requires frequent follow up, intricate medication dosing and adjustment, and is associated with high morbidity and mortality $^{31}$. Bennett et al. sought to investigate what role the PPR played in both adherence to SLE medications as well as patient satisfaction scores $^{32}$. To measure the PPR, this study employed the “Physician-Patient Alliance Inventory,” a validated quantifiable measure that reflects the PPR, to the 193 patient participants $^{33}$. The “General Adherence Inventory” and “Medical Patient Satisfaction Scale” were used to measure the independent variables. Using Pearson correlation, they found that the PPR was positively associated with both patient satisfaction (.82, $p<.001$), and treatment adherence (.23, $p<.001$). Though this study showed strong associations in its results, its findings are limited by lack of
diversity in the sample population (mostly Caucasian, even though SLE is more prevalent in patients of African descent) as well as not controlling for socioeconomic factors in the analysis.

Building off of Bennett’s earlier work, Waard et al. aimed to better understand the factors that influence the quality of care of older adults by looking at the relationship between the PPR and patient satisfaction. This cross-sectional study looked at 653 older adults living in residential homes in The Netherlands. The PPR was measured using the 13 question Leiden Perioperative care Patient Satisfaction questionnaire (LPPSq) and was compared against responses to a simple question: “which report mark do you give your GP?” scored on a 20-point Likert scale. Based on responses to the LPPSq, patients were categorized into “low,” “medium,” and “optimal” groups and then evaluated using multiple linear regression in relation to their answer to their “report mark” response. A weaker PPR was significantly associated with lower patient satisfaction (p<.001). However, the group found no difference in patient satisfaction between the “medium” and “optimal” LPPSq groups. The group asserts in their discussion that though the concepts of patient satisfaction and PPR are often intertwined, satisfaction is more clearly influenced by the PPR instead of the other way around. The study lacks in broad external validity due to its very specific sample population. In addition, the simplicity and lack of formal validation of the dependent variable measure makes it difficult to interpret the weight of these findings.

Within the broad category of the PPR, researchers have begun to look closer into the components of the PPR and their individual effect on patient satisfaction. A study by Hojat et al. took the concept of the PPR influencing patient satisfaction and attempted to specifically evaluate empathy’s role in satisfaction scores. Hojat, a leader in the field of empathy’s effects in medicine, and his team surveyed 535 adult outpatients seen in primary health clinics under the
umbrella of a single institution. They measured the effects of empathy on satisfaction with the Consumer Assessment of Healthcare Provider and Systems (CAHPS) survey compared to the results of the Jefferson Scale of Patient Perceptions of Physician Empathy (JSPPPE), both externally validated scales. Secondary outcomes were also recorded and included perceptions of preventative tests recommended by the PCP including colonoscopy, mammogram, and prostate specific antigen screenings. The results showed a .93 correlation between perceived physician empathy and patient satisfaction. In addition, they found a .98 correlation between patient perceived empathy and patients’ perceptions of preventative screening tests recommended by the PCP. The study was mainly limited by its single institution inclusion, and only 20% response rate to the mailed survey which could introduce sampling bias.

In a novel approach, a group of researchers in Greece set to study the relationship between emotional intelligence and patient satisfaction by conducting two simultaneous studies, one looking at patient perceived physician EI and one looking at physician self-reported EI \(^{36}\). “Study 1” tested patient perceived physician EI in relation to patient reported satisfaction using Greek versions of the Wong Law Emotional Intelligence Scale (WLEIS) and Patient Satisfaction Questionnaire. The sample included 100 adult patients who were seen by 8 physicians in various specialties. The study produced a significant correlation between WLEIS scores and patient satisfaction (.53, p<.001). In “Study 2,” the group compared 30 physician responses to the Emotion Regulation Questionnaire, a measure of EI, to 139 Patient Satisfaction Questionnaire responses. The results suggested that physicians’ emotional reappraisal and personal emotional repression skills, components of EI, are positively associated with patient satisfaction (.17, p<.001 and .10, p<.01, respectively). This study’s main strength is that it was able to operationalize the relationship between EI and satisfaction from both the patient and physician
perspective. One limitation of “Study 1” was that its physician sample only included specialists and no PCPs; in addition, number of visits with the physician was not controlled for.

**PPR + Trust**

One study aimed to investigate if a positive PPR, lead to increased patient trust, and in turn increased patient satisfaction. The study sample consisted of 372 British adult patients followed by PCPs. “Trustworthiness” was measured using the “Wake Forest Scale,” a validated scale to measure patient trust in their physician. Satisfaction was measured using the “DoH/NHS GP-Patient Survey,” a commonly used patient satisfaction tool used in the UK. This study also looked at many secondary outcomes including practice orientation and patient perception of performance. The most significant finding was that 15 out of 16 of the Wake Forest Scale’s questions were significantly associated with patient satisfaction scores (p<.0001). The one component not associated with patient satisfaction was “my doctor follows the rules.” These results add to previous research and go a step further by illustrating a specific pathway, trustworthiness, in which the PPR can affect patient satisfaction.

**PPR + Pain and Symptom Burden**

PPR’s effects extend past more experience-based measures such as satisfaction and trust into more disease focused measures such as pain and symptom burden. One study from the University of Iowa aimed to investigate the relationship between the PPR, using the Physician-Patient Relationship Scale (PPRS), and somatic symptom burden, using the Somatic Symptom Inventory (SSI). Participants were 310 general adult patients of the University of Iowa Family Care Center; the study excluded patients with serious medical or psychiatric conditions. This cross-sectional study also included many secondary outcomes including utilization of care, adherence to care, treatment response, and satisfaction. The multivariate regression analysis
demonstrated that adherence (.26, p<.0001), satisfaction (.62, p<.0001), and frequency of visits (.115, p=.0009) were all positively correlated with the strength of the PPR. In addition, the research group found that there was a significant correlation between treatment response and PPR (.46, p<.0001). This paper suggests that there is a therapeutic quality to the PPR that has significant effects on symptom burden as well as many other quality measures. The major drawback of this study is that though it included a general population on patients who were seen for a variety of reasons in the family care clinic, and only somatic symptom burden was measured.

Another paper sought to examine the relationship between physician empathy and one of the most prevalent diagnoses, the common cold $^{28}$. This study is highly cited throughout the empathy/PPR research sphere because it found a significant difference in duration of the common cold symptoms between patients who perceived higher levels of provider empathy compared to those who perceived lower levels of empathy. The study population consisted of 350 patients aged 12 and up where there was a clinical suspicion for a cold and the patients were not found to have any other pathology. Data from the Consultation and Relational Empathy (CARE) and the Wisconsin Upper Respiratory Symptom Survey (WURS-44) was analyzed using a Kaplan-Meier Survival Curve. The curve represented “time to end of common cold,” and symptoms resolved one day earlier in those patients seen by providers with higher perceived levels of empathy (7.01 days compared to 8.01 days, p=.017). These results suggest when a patient perceives empathy from a healthcare provider the duration of common cold symptoms change significantly. Compared to T2DM, the common cold is a very acute concern; however, the demonstration of symptom burden’s relationship to provider empathy is important when looking at the casual pathway of EI and clinical outcomes.
Lastly, looking at empathy’s effects on a chronic condition, a paper from India examined physician empathy on migraine symptoms. In the introduction, the authors note that they choose to study migraine care because of the need for tailored care, close follow up, and level of disease burden on the patient, which is very similar to T2DM. This prospective cohort study followed 53 women who were diagnosed with migraine without aura within the first month of consulting with the physician. The sample excluded those with concomitant psychiatric diagnoses. The results of the Migraine Disability Assessment Questionnaire (MIDAS) were compared against CARE scores measuring physician empathy. In addition to the main outcomes, the study also measured patient compliance using self-developed Likert scale questionnaire which asked about compliance to diet, exercise, sleep, and medications. The results showed a significant positive correlation between CARE scores and migraine symptoms and disability over three months (r = .9, p<.001). Secondarily, there was also a positive correlation between CARE scores and both total compliance score, as well as all four categorical domains (total compliance score: r = .921, p<.001). The prospective cohort design, as well as the measurements of secondary outcomes that influence the casual pathway are strengths of this study. The small sample size as well as reliance on solely patient reports of dependent variables are limitations of the study.

PPR + Adherence

Studies cited in earlier sections found that the PPR, and more specifically, empathy, have a positive effect on adherence. However, in those studies, adherence was measured as a secondary outcome. A study from China specifically examined provider factors that influenced treatment adherence in the general outpatient population. This study enrolled 597 patients seen in outpatient offices across all specialties and primary care. They measured a variety of interpersonal measure variables, but most notability included a self-developed Likert scale to
measure the “individual-level medic-patient relationship,” the equivalent measure of the PPR. This scale incorporates questions from a variety of other PPR questionnaires. To measure adherence, the group employed a survey inquiring about adherence in “overall treatment,” medication, reading medication instructions, diet, exercise, and lifestyle (smoking, drinking, sleep). Results were analyzed using multiple linear regression and showed a significant positive relationship between PPR and adherence and all of its sub-sections (0.18, p<.001). This paper added to the literature in that it showed a clear relationship between PPR and adherence in a large sample that touched many different specialties in medicine. However, a major limitation of the study is hindered external validity due to the uniqueness of the state-run Chinese healthcare system. In addition, adherence was measured by self-report which has the potential to introduce bias.

Hypertension and T2DM are often discussed together when talking about prevalent chronic conditions that require high levels of care and are associated with high morbidity and mortality. Ward et al. aimed to assess the association between the PPR and antihypertensive medication adherence in a large-scale study of 2,198 Medicare beneficiaries. This study is unique in that it did not rely on patient reported adherence, but rather used Medicare prescription data and cross checking with pharmacy data to match both the filling of prescriptions as well as the appropriate timing of refills. PPR was measured by the Patient Perception of Physician Scale (PPPS). Another unique strength of this study was because it used Medicare data, the group was able to more accurately control for confounders including accurate Charlson Comorbidity Index Scores. Analysis showed that patients who had a stronger PPR (≥37 points on PPPS) were more likely to be adherent to antihypertensive medications as compared to those who scored <37 on the PPPS (OR 1.341, 95% confidence interval = [1.101, 1.632], p=.0035). This study provides
high quality quantitative evidence of an association between chronic disease medication adherence and PPR. This study is limited by only looking at older adults, as by nature of using Medicare data. In other literature reports, older adults tend to have a stronger relationship with their healthcare provider, so this sample may be slightly biased. In addition, this study did not delineate between patients whose hypertension was managed by a PCP versus those managed by a PCP in tandem with a cardiologist or other specialist.

One paper aimed take a more nuanced look into the PPR and look at provider empathy directly and its role in diabetes treatment adherence. Eltaher et al. set out to assess the relationship between frequency of diabetes medication adherence and physician empathy in primary care centers across Saudi Arabia. This cross-sectional study compared CARE scores to General Medication Adherence Scores (GMAS). Secondarily, they were able to access HbA1c data and analyze it in relation to physician CARE scores. The sample included 391 adult patients with type I or II diabetes who were initiated on medical treatment across 41 primary health centers. The group found a significant correlation between physician empathy and adherence (.408, p<.001), as well as HbA1c (.471, p<.001). These results are in line with previous studies looking at empathy and adherence; however, this study was able to take their results a step further and analyze empathy’s effects on clinical measures including HbA1c. This study was limited by its cross-sectional nature and did not largely expand on the confounders it controlled for.

2.2.2 Green Steps

In the proposed casual pathway model, there are many steps that influence each other and act as intermediaries between the PPR/EI and clinical outcomes, denoted with green arrows (Figure 1).
There have been many older studies that have showed a significant negative relationship between perceived pain and patient satisfaction. One more recent study demonstrated that patient satisfaction suffers when perceived pain is greater (-2.545, p=.012)\(^43\). Also, looking at satisfaction, another study from the University of Utah measured patient satisfaction scores in relation to documented overall medication adherence \(^44\). They found a strong association between increased patient satisfaction and adherence in primary care settings (.4, p<.0001). Patient satisfaction was also significantly influenced by the patient’s trust in their healthcare provider \(^45\). This study observed a correlation of \(r=.55\) (p<.01) between the level of trust a patient had in their provider and the reported level of satisfaction. Moving through the intermediate steps of the proposed pathway, a cross sectional study aimed to examine the factors of adherence, including trust in healthcare provider, in patients with T2DM \(^46\). They concluded that a patient’s trust in their provider was positively correlated with medication adherence (\(r=.416\), p<.05). Lastly, numerous papers have showed that increased adherence is significantly associated with decreased symptom burden in a wide variety of diseases \(^47-50\).

\subsection*{2.2.3 Pink Steps}

\textit{Adherence + Clinical Outcomes}

It is widely accepted that an increase in adherence, both to lifestyle changes and diabetes medication, is closely associated with improved clinical outcomes. A large-scale systematic review of the literature was conducted by Doggrell et al. showed that irrespective to measurement method, demographic, and age medication adherence is negative associated with HbA1c in patients with type II diabetes \(^51\). This review cited 22 individual high-quality studies which measured medication adherence both qualitatively through patient questionnaire and quantitively through pharmacy data. In addition, there have been many studies that have
examined the relationship between lifestyle change adherence and clinical outcomes in patients with T2DM. Another sweeping review investigated the effects of adherence to physical activity and dietary recommendations on HbA1c. They found a negative relationship between HbA1c and physical activity advice from a provider (-0.43%, 95% CI, -0.59% to -0.28%). The studies cited also observed a decrease in HbA1c with dietary guidance from a provider (-0.58%, 95% CI, -0.74% to -0.43%). Adherence to both prescription medication and lifestyle adjustments are both essential components in the management of T2DM.

**PPR + Clinical Outcomes**

The papers cited above all look at the effects of the individual steps of the proposed causal pathway. However, this section will focus on studies to date that aimed to measure the relationship between the PPR, its components, and clinical outcomes in patients with T2DM.

A large study focusing on diabetes management in the primary care setting aimed to measure the effect the PPR had on quantitative outcomes in patients with T2DM. The group enrolled 4095 patients from 30 different primary care centers in the greater Seattle area. Each participant completed a validated scale, originally used in patients with bipolar illness but revised for diabetes, that measures strength of the PPR. The primary outcomes measured were ICD documented diabetes complications and HbA1c from the EMR. Secondarily, the research group looked at self-reported level of diabetes self-care practices (diet, exercise, blood glucose testing, and foot care), adherence, and smoking cessation. Using logistic regression and mediation analysis, the study found a significant negative association between PPR and a HbA1c >8% (4.3, p=.04). In addition, significant relationships were found between the strength of the PPR and all secondary outcomes, most notably diabetic self-care practices (33.3, p<.001). Strengths of this study include the large sample size, access to patient EMR data, and access to pharmacy data.
The main limitations of this study are only measuring HbA1c as an ordinal variable, >8% or <8%, instead of a continuous variable; and, though revised for diabetes, the use of a scale developed for bipolar illness.

Parchman et al., building off of past studies, focused on participatory decision making (PDM) and the PPR, aimed to formulate a casual model linking PPR to clinical outcomes in patients with T2DM. This study took place across 5 independent primary care practices in Texas and enrolled 141 patients with T2DM. PPR was measured using a self-developed questionnaire and evaluated against responses to the Morisky Scale measuring medication adherence, HbA1c, systolic blood pressure (SBP), and LDL. PPR data analysis showed that there was a small but significant decrease in HbA1c (-.44, p=.03), as well as decreases in SBP and LDL, when adjusted for confounding variables. However, this study is limited by its patient sampling methods. To participate in the study, the patient had to proactively contact the study coordinator. This method favors those who are more actively engaged in their health and thus could introduce bias.

In addition to the studies that have focused on the PPR in a broad sense, others have honed in on investigating what role the individual aspects of the PPR play in clinical outcomes in T2DM. Empathy’s effects are most commonly studied throughout the literature. One of the most notable studies in this domain is by Hojat et al. which looked at 29 PCPs and their 891 patients with T2DM. PCPs enrolled in this study completed the Jefferson Scale of Empathy (JSE). The patient with T2DM panels of those PCPs were then analyzed and HbA1c and LDL for each patient were recorded. Instead of recording both JSE scores and clinical measures as continuous variables, the study categorized them ordinally into high/medium/low control glycemic groups and high/medium/low empathy PCPs and reported as frequency and percent distributions. The
paper found significant differences in the number of patients with <7.0% HbA1c in the high empathy (HE) PCP group compared to the low empathy (LE) PCP group. There were also significantly more patients with HbA1c >9.0% in the LE PCP group compared to the HE PCP group ($x^2 = 22.04, p<.001$). Secondarily, there was a similar significant difference in LDL control across the groups as well ($x^2 = 15.55, p<.001$). The team then performed logistic regression controlling for demographics of both the PCP and patient, geographic area, duration of PPR, and type of practice. Logistic regression results indicated that physician empathy individually influenced clinical outcomes in both HbA1c (OR: 1.8, $p<.001$) and LDL (OR: 1.8, $p<.001$) when comparing the HE PCP group to the LE PCP group. The cross-sectional nature of the study does not allow for it to establish a cause-and-effect relationship of PCP empathy and glycemic control in patients with T2DM. Another limitation was the relatively low sample size (n=29) of PCPs. This study was a landmark study in the field of empathy in medicine research and has been widely cited throughout the literature.

However, a more recent study from 2019 that aimed to reproduce Hojat’s results failed to find an association between PCP empathy and clinical outcomes in patients with T2DM. Chaitoff et al. noted that Hojat’s single institution study had a small sample size and limited number of confounding controls. This study aimed to replicate Hojat’s findings in a larger, more diverse cohort of patients when controlling for more variables. Chaitoff’s group was able to enroll 51 PCPs and 4176 of their patients with T2DM across the Cleveland Clinic Health System. Again, JSE was used as the independent variable and compared against retrospective EMR recorded HbA1c and LDL. One main difference in the studies was this study reported variables both ordinally, in the same categories described by Hojat, as well as continuously. Many additional controls were included in the multivariate analysis including insurance type,
annual income, BMI, and Charlson Comorbidity Index. On analysis, there was no association between JSE scores and HbA1c or LDL. In the discussion section, the group cites newer data, recent ubiquity of statins prescriptions that aid glycemic control, increased prevalence of health system performance measurements and performance linked reimbursement as proposed reasons for discrepancies in results from the previous study. Hojat published a response to this study and attributed the divergence in results to the difference in baseline patient sample, JSE score subdividing, and confounding institutional factors due to the Cleveland Clinic having mandatory empathy training for all PCPs.

**Empathy + Clinical Outcomes**

Building on research examining the relationship between short term measures of glycemic control, some groups decided to look at how PCP empathy can influence disease complications associated with T2DM. A group sought to measure the rate of acute metabolic complications in relation to PCP JSE scores. This large-scale study of 242 PCPs and their patients with T2DM identified disease complications by using retrospective EMR. They recorded the number of patients who were hospitalized with ICD codes for diabetic ketoacidosis (DKA), hyperosmolar hyperglycemic state (HHS), diabetic coma. Similar to the Hojat study, the PCPs were placed into three groups based on JSE scores (high, moderate, low) and the rates of patients with disease complications were compared across the groups using z-tests then multiple linear regression to control for confounders. In the high empathy group, there was a rate of 4.0 acute metabolic complications per 1000 patients, whereas the moderate group yielded higher rates, 7.1 and 6.5, respectively (z=2.51, p<.01). The logistic regression model produced an odds ratio of .59 comparing low to high JSE scoring PCPs, meaning having a highly empathic PCP was associated with a 41% decrease in the odds of developing an acute metabolic complication. This
study adds to the literature supporting empathy’s role in T2DM management and the results are strengthened by the large, complete data sets made possible by Italy’s universal health coverage and the lower rates of PCP switching which eliminates many confounding variables. A criticism of this paper, similar to Hojat’s, is that though the Italian healthcare systems aids with some confounding the group did not adjust for comorbid conditions which could have significantly influences the results.

The last set of studies were both by Dambha-Miller et al. a group from the University of Cambridge based interested in researching PCP empathy and T2DM’s negative clinical sequelae. The first study focused on PCP empathy’s effects on incidence of cardiovascular disease (CVD) in patients with T2DM 58. This study is unique in that it was structures as a prospective cohort, limiting potential for reverse causality. 867 patients with T2DM, seen by 49 different PCPs, were followed for 10 years between 2004 and 2014. PCP empathy was assessed using CARE scores and the main outcomes measured were first recorded CVD event and all-cause mortality. CVD events included myocardial infarction, revascularization, nontraumatic amputation, stroke, or fatal CVD event. The multivariate analysis showed that patients who reported higher empathy from their PCP had a 10% decreased risk of all-cause mortality compared to those seen by low empathy PCPs (HR .49; 95% CI, 0.27-0.88, p=.01 and HR 0.60; 95% CI, 0.35-1.04, p=.05, respectively). Though not statistically significant, patients of high empathy PCPs also trended toward lower risk of first CVD events. Similar to the Hojat study, this paper is limited by its use of ordinal reporting of CARE score instead of continuous variables that can be evaluated using multiple logistic regression.

The second Dambha-Miller et al. study also looked long term T2DM care and specifically examined remission rates of T2DM compared to PCP CARE scores 59. Instead of a
10-year period, this study looked at T2DM remission, defined as HbA1c <6.5%, after five years. 628 CARE assessments were scored and categorized into tertials (high, moderate, low), similar to past studies. The results showed that patients who reported higher PCP empathy were slightly, but significantly, more likely to achieve remission at 5 years (OR 1.03, 95% CI, 1.01-1.05, p=.01). This equates to 3% higher odds of remission with each unit increase in PCP empathy. The strength of this study is that it measures a major goal of T2DM care, disease remission. This is study is relevant because it suggests that empathy plays a small but significant role in the complex process of remission in patients with T2DM. One limitation of the study is that it did not control for continuity of care, so it is possible that patients saw other providers outside of their PCP over the 5 years and that could confound the results.

### 2.3 Review of Methodology

The following section is a review of methodology that is relevant to the proposed study. A more detailed description of this study’s proposed methods is included in Chapter 3.

#### 2.3.1 Study Design

The proposed study will be a cross-sectional study using retrospective EMR data aiming to evaluate the relationship between PCP emotional intelligence and HbA1c in adult patients with T2DM.

The choice to conduct a cross-sectional study is in line with previous studies that have measured the effects of the PPR and other provider characteristics. Section 2.2 reviews many of these studies, and all but three were cross-sectional. These outlier studies were all designed as prospective cohorts; however, with this project’s timeline a prospective cohort study would not be feasible. Though cross-sectional studies are only able to measure provider characteristics in one point in time, many previous studies in the field have shown that, without
intervention, traits such as empathy and EI are relatively stable throughout a lifetime \textsuperscript{60,61}. Since these measurements are mostly fixed, researchers are able to use cross-sectional studies to increase scale thus increasing power.

2.3.2 Selection Criteria

A complete list of inclusion and exclusion criteria can be found in Chapter 3. Selection criteria for this study was chosen by blending methods from the previous empirical studies discussed in Section 2.2. Because this proposed study will be measuring characteristics of both PCPs as well as patients with T2DM, there are separate inclusion and exclusion criteria for both groups.

Patients with Type II Diabetes

This study will be focused on adults aged 18-65 with an ICD-10 code for T2DM. To be included in the study patients must have had at least two visits with the PCP in the last year, two thirds of their overall visits in 2020-2022 were with that PCP \textsuperscript{55,62}. In addition, the patient must have at least three HbA1cs recorded in the EMR between January 2020 and January 2022 \textsuperscript{26}.

Patients will be excluded from the study if they were pregnant at any point between January 2020 and January 2022 \textsuperscript{59}. Since dialysis can greatly affect glycemic control and medication dosing, patients with ICD-10 codes for either dialysis or end stage renal disease will not be eligible to participate \textsuperscript{41}. To minimize confounding variables, patients who are also followed by an endocrinologist for diabetes management will be excluded. Lastly, this study will not enroll patients who have a current procedural terminology (CPT) code for continuous glucose monitoring devices.
Primary Care Providers

To be included in this study, the PCP must be a board certified MD or DO in either family medicine or internal medicine. The PCPs must be a part of the YNHH for the entire two-year time period of the study. We will be including PCPs who are five or more years post residency. The participating PCP must have at least 45 patients with T2DM on their patient panel. The PCP will be excluded if they are listed as a PCP on the YNHH website, specialize in women's health or pediatrics.

2.3.3 Potential Confounding Variables

Identifying confounding variables, especially in a cross-sectional study, is an essential way to maintain the validity of findings. Confounding variables will be adjusted for during the multivariate linear regression analysis. For this study there are three main groups of confounding variables to control for: patient/PCP demographic variables, patient variables, and PCP variables.

The demographic variables recorded for both groups are the standard age, race, and sex. An increase in BMI also leads to an increase in insulin, both natural produced and externally administered, thus, to determine the relationship between HbA1c and EI the analysis must adjust for patient BMI. In addition, both Charlson Comorbidity Index score and length of time with T2DM diagnosis have been found to have significant impacts on HbA1c and have been controlled for in previous similar studies. The use of insulin will be recorded and adjusted for as a categorical variable, since the complexity of dosing and administration could alter the results. Potential confounding variables in the PCP group revolve mainly around training. Past papers have adjusted for the number of years in practice, MD versus DO training, family medicine versus internal medicine residency, and presence of fellowship training.
2.3.4 Independent Variable: WLEIS

PCP’s Wong Law Emotional Intelligence Scale (WLEIS) scores will be the main independent variable. There are many distinct EI measurement tools discussed in the literature each with their own strengths and weaknesses. The two main categories of EI measurement tools are performance-based and self-report\(^6^4\). In performance-based EI tests, participants are tasked with emotion-based problems and their responses are scored according to various criteria. On the other hand, self-report measures employ mostly descriptive statements and ask the participants to score themselves on how closely they relate to the statement using a Likert scale. Self-report is the most commonly used type of EI assessment due to its accessibility and ease of scoring\(^6^5\). The major criticism of self-report tools is that they measure self-perception as opposed to performance\(^6^6\).

Knowing that this study wanted to minimize barriers to PCP participation, a self-report tools was preferable due to its accessibility, short time to complete, and ease of scoring. There are over 20 self-report EI tools used in various niches in the literature. Large scale systematic reviews have evaluated the tools by comparing internal validity, reliability, and structural characteristics\(^6^6,6^7\). For the goals of this study, the WLEIS is the most specific and validated measure of EI. It has an internal validity of .89 and has positive correlations with other popular EI tools such as the Trait Meta-Mood Scale (TMMS) and emotional quotient inventory (EQ-i)\(^1^7,6^7\). The WLEIS 16 question online tool that is used to evaluate emotional intelligence in the workplace\(^6^8\). The scale is split into four groups of consisting of four questions. Each question group represents one for each classical domain of emotional intelligence: self-emotional appraisal (SEA), appraisal and recognition of emotions in others (OEA), regulation of self-emotion (ROE), and use of emotion to facilitate performance (UOE). The scale is answered and
graded using a 7-point Likert scale ranging from 1 “strongly disagree” to 7 “strongly agree.” A sample of the WLEIS can be found in Appendix A.

2.3.5 Dependent Variable: HbA1c

Hemoglobin A1c is the gold standard and most widely used test to estimate average glycemic control in about a three month span. In addition to measuring current glycemic control, HbA1c values also accurately predict future morbidity and mortality attributed to T2DM. The American Diabetes Association recommends drawing either point-of-care or formal lab HbA1c on all patients with T2DM every three months.

2.3.6 Sample Size and Statistical Significance

Though no studies to date have examined the relationship between emotional intelligence specifically and HbA1c, minimum sample size was able to be estimated using past studies in empathy and the overall PPR. Of all the studies discussed in Section 2.2 that assessed provider emotional characteristics and HbA1c, only one reported HbA1c as a continuous variable that effect size could be extrapolated from. Dambha-Miller et al. observed that the average HbA1c in patients seen by high empathy PCPs was 6.44, compared to 6.51 in the group with a low empathy PCP. From those results, we estimated an effect size of ~.07. In this cross-sectional study, we aimed to minimize both type I and type II errors by choosing an alpha of .05 and beta of .05. Using these values, we deduced that this study must enroll 3,155 patients with T2DM to achieve 95% power. According to current prevalence data on T2DM and average PCP panel sizes, to achieve a patient sample of 3,155, a minimum of 24 PCPs must be enrolled. This sample size is in line with the larger studies outlined in Section 2.2 and will strive to achieve a higher power than many previous studies.
2.4 Conclusion

This review of the literature highlights the casual pathway between emotional intelligence and glycemic control. Data from several previous well-designed studies illustrate the many avenues that the PPR can influence patient satisfaction, medication adherence, trust, and pain/symptom burden. These intermediate steps, in turn, have been shown to have palpable effects in glycemic control and outcomes in patients with T2DM. However, there is still a gap in the literature directly about EI, as a component of the PPR, and its role in T2DM management. In addition, the literature review shows a lack of studies that utilize multivariate linear regression when analyzing the PPR and clinical outcomes. This void of quality studies leaves the connection between EI and HbA1c unknown.

We propose a cross-sectional study that will employ multivariate linear regression to investigate the relationship between PCP EI using as measured by the WLEIS and their patient’s HbA1c when controlled for possible confounding variables. This research aims to add to the literature on provider characteristics’ influence on health outcomes.
2.5 References


Chapter 3: Methods

3.1 Study Design

This single institution, multi-site, cross-sectional study of primary care providers and their patients with type II diabetes will be conducted within the Yale New Haven Hospital System over a two-year period from January 2022 to January 2024. This study aims to examine the relationship between primary care providers’ emotional intelligence as measured on the Wong Law Emotional Intelligence Scale (WLEIS) and hemoglobin A1c values in their patients with adult type II diabetes.

To achieve this goal, we will first administer the Wong Law Emotional Intelligence assessment to participating PCPs (see section 3.2 for inclusion/exclusion criteria, and section 3.3 for study recruitment). WLEIS scores range from 0 to 112; each PCP’s score will be recorded and reported as a continuous variable. In addition, we will collect demographic and other variable data included in Table 1.

Panels of participating PCPs will be examined via JDAT report to identify patients with type II diabetes that meet the inclusion criteria for the study. Once patients have been identified, the research team will pull all recorded HbA1C values during the period of January 2022 through January 2022. Mean HbA1C value will be our dependent variable representing glycemic control. This value will also be reported as a continuous variable.

All patient data, including HbA1c, will be gathered from the electronic medical record (EMR) system Epic. Because data will be retrospective, there will be no intervention, and all data will be protected patients will not need to be notified about their participation in the trial. An IRB application and PCP consent forms will be submitted, and approval will be obtained (Appendix B). Patient confidentiality is outlined in section 3.4.
3.2 Study Population and Sampling

In this study there will be two categories of participants: primary care providers and patients with type II diabetes.

Primary Care Providers (PCPs)

Inclusion Criteria:

We are defining a PCP as any MD or DO that are board certified in and currently specializes in internal medicine or family medicine. Our study will be limited to providers in the Yale New Haven Health (YNHH) system, which has 56 different locations that offer primary care services. To be eligible for the study, PCPs must have a minimum of five years post residency experience in a primary care role, and in the YNHH system for at least two years. In addition, PCPs must have at least 45 diabetic patients in their patient panel.

Exclusion Criteria:

PCPs will be excluded if they are listed as a primary care provider but specialize in women’s health or pediatrics.

Patients

Inclusion Criteria:

To be included in this study patients must be listed on the eligible YNHH PCP’s patient panel for primary care services. They must be 18-65 years old at the time of their first visit, with the ICD10 code for type II diabetes mellitus (E11). Patients must have at least two outpatient visits with the participating PCP in the last 365 days and have had at least 2/3 of their primary care visits with the participating PCP. Lastly, they must have at least three documented HbA1C values over between January 2020 – January 2022.

Exclusion Criteria:
Patients will be excluded if they are pregnant or had been pregnant between January 2020 and January 2022. Patients who use a continuous glucose monitor, identified by a current procedural terminology (CPT) code 95250 or 95251 will not be included in the sample. In addition, patients who are being simultaneously followed by an endocrinologist for diabetes care will be excluded.

3.3 Study Recruitment

Primary Care Providers

Primary care providers in the YNHH system will be identified using the YNHH physician search engine available on their website. Once all primary care providers are identified, we will apply the “family medicine/internal medicine” filter to exclude all PCPs who are not board certified in family medicine or internal medicine or those who focus on women’s health or pediatrics.

Eligible PCPs will be contacted via email by the research team to inform them of the study and study objectives. PCPs will be able to click a link to a survey to complete an online informed consent and to provide information demographics (Appendix C). Those who meet all the eligibility criteria will then be prompted to complete the online version of the Wong Law Emotional Intelligence Scale (WLEIS).

Patients

The research team perform a chart review of patient panels of the PCPs that complete both the intake questions and the WLEIS. To access patient panels and data we will submit a YNHH Joint Data Analytics Team (JDAT) data request to produce a list of patients with type II diabetes that meet all inclusion criteria. Each patient will be given a random numerical identifier based on their medical record (MR) number to maintain data confidentiality, patient anonymity,
and ensure no patient is double counted. The requested data report will also provide patient demographic information, comorbidities, BMI, and all HbA1C values from January 2020 to January 2022.

### 3.4 Subject Protection and Confidentiality

Prior to the initiation of the study, we will receive approval from Yale University’s institutional review board (IRB). Consent forms will be electronically sent to the eligible PCPs (Appendix B). This study is considered a “Retrospective Chart Review” study that would involve minimal human risk. All research staff will complete Health Insurance Portability and Accessibility Act (HIPAA) training before the start of the study. When the data is collected, each enrolled patient will be assigned a random numerical identifier and all personal identification of subject identity will be stripped. Any protected health information will be accessed only by HIPAA trained research staff and accessed through secure electronic health records on encrypted devices. Since this study will be using retrospective EMR information only, subjects will not be informed of their participation in the study.

### 3.5 Study Variable and Measures

The main objective of this research is to examine the relationship between primary care providers’ emotional intelligence as measured on the Wong Law Emotional Intelligence scale and hemoglobin A1c values in their patients with adult type II diabetes.

**Independent Variable**

PCPs’ scores in the Wong Law Emotional Intelligence Scale (WLEIS) will be the study’s main independent variable (Appendix A). The WLEIS is a 16-question online tool that is used to evaluate emotional intelligence in the workplace. The scale is split into four groups of consisting of four questions. Each question group represents one for each classical domain of
emotional intelligence: self-emotional appraisal (SEA), appraisal and recognition of emotions in others (OEA), regulation of self-emotion (ROE), and use of emotion to facilitate performance (UOE). The scale is answered and graded using a 7-point Likert scale ranging from 1 “strongly disagree” to 7 “strongly agree.” The WLEIS is widely used throughout the literature and shows good convergence with prior EI measurement tools such as Bar-On, EQ-i and Trait Meta-Mood\(^1\). It is used as a reliable way assess one’s EI in a timely manner and is the most commonly used scale in studies on emotional intelligence in healthcare\(^2-4\).

Scores from completed WLEISs range from 0 to 112 and will be reported as a continuous variable with standard deviations.

**Dependent Variable**

Glycemic control will be measured using the enrolled patient’s mean HbA1C value recorded between January 2020 and January 2022. HbA1C is an accurate and standard way to measure glycemic control over a period of two to three months\(^5\). It is also an accurate way to predict the odds of developing complications from diabetes, such as retinopathy and CAD\(^6\). To capture a larger period of time, our study will be averaging all recorded HbA1Cs during the time period. These average HbA1C values will be reported as a continuous variable with standard deviations.

3.6 Confounding Variables

Due to the nature of this cross-sectional study, there will be many confounding variables that will need to be controlled for. Categories highlighted with (*) will be reported as continuous variables, all others will be reported as categorical variables. Confounding variables will be controlled for through multiple logistic regression.
<table>
<thead>
<tr>
<th>Both PCP and Patient Variables</th>
<th>Patient Variables</th>
<th>PCP Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Age*</td>
<td>- BMI*</td>
<td>- Years of practice*</td>
</tr>
<tr>
<td>- Race</td>
<td>- Insurance type</td>
<td>- MD vs DO</td>
</tr>
<tr>
<td>- Sex</td>
<td>- Charlson Comorbidity Index score*</td>
<td>- Family med vs internal med</td>
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<tr>
<td></td>
<td>- Length of time with type II diabetes diagnosis *</td>
<td>- Number of total patients on patient panel *</td>
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<td></td>
<td></td>
<td>- Number of patients with type II diabetes on patient panel *</td>
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<td>- Fellowship training</td>
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Table 1: Confounding Variables by Population

### 3.7 Data Collection

**PCP WLEIS Score and Confounding Collection**

As stated in section 3.3, a link to the consent forms (Appendix B), intake forms (Appendix C) and WLEIS questionnaires (Appendix A) will be distributed to eligible PCPs via Yale’s Qualtrics XM platform and YNHH email. Qualtrics XM is a HIPPA compliant platform that will also securely record and house the PCP data.

**Patient HbA1C and Confounding Collection**

Once PCP data is recorded, our team will access each PCP’s full patient panel using the Epic Slicer Dicer tool Tool 7. Each patient on the panel will be deidentified and assigned a random number identifier based on their EMR number to ensure that no patient will be double counted. Our study will use the ChartSweep tool to access and organize all patient EMR information. ChartSweep is an open-source, HIPPA compliant, tool for performing retrospective chart review research in any EMR system, including EPIC 8. Information that will be pulled from the EMR will include: three most recent HbA1C values between January 2020 – January 2022, age, BMI, insurance type, marital status, Charlson Comorbidity Index score, date of original type II diabetes diagnosis.
3.8 Sample Size Calculation

Sample size was calculated using G*Power 3.1 software. Based on previous similarly designed studies of empathy and HbA1C discussed in Section 2, the estimated effect size will be \(\sim 0.07\). We chose an alpha value of \(0.05\), beta of \(0.05\). To achieve a power of \(0.95\), our minimum sample size is 3155 patients. Since this is a cross sectional study, we will not need to correct for participants lost to follow up. See Appendix D, for full calculation and effect size derivation.

According to a Mayo Clinic report, the average number of patients per PCP panel in an academic setting is 1396. The CDC estimates that in the adult US population, type II diabetes has a prevalence of 9.6\%. Using those values, we estimate that each PCP will have about 134 adult patients with type II diabetes. To reach our sample size we would need to enroll a minimum of 24 PCPs. However, most literature looking at provider factors influencing patient glycemic control use healthcare provider sample sizes of over 100, so we would also aim to enroll at least 100 PCPs.

In addition, since this is a cross sectional study using retrospective EMR data with no patient involvement, we would hope to surpass the minimum sample size. We aim to evaluate all eligible patients with type II diabetes of PCPs who submit the WLEIS and meet inclusion criteria.

3.9 Analysis

All data collected will be analyzed using Statistical Analysis System Software (SASS). Categorical demographic characteristics of both the PCPs and patients, outlined in Section 3.6, will be evaluated using chi-square test and reported in proportions. Continuous demographic characteristics will be evaluated using student t-tests and reported as mean ± SD.
Both WLEIS scores and mean HbA1C values will be recorded as a continuous variables. Their relationship will be analyzed using simple linear regression. We will adjust for confounding variables (Section 3.6) using multiple linear regression.

See Appendix E, for a table of all variables and their associated statistical analysis.

3.10 Timeline and Resources

This study will take place between January 2022 and January 2024. We account two months for IRB approval. In month three we will begin the PCP recruitment process; we estimate that it will take approximately six weeks to identify all eligible YNHH PCPs, distribute WLEISs, and receive them back. After that, the process of extracting patient panels from the EMR, identifying all adult type II diabetic patients, applying inclusion/exclusion criteria, finalizing patient sample, and deidentifying will take about two months. Another month will be spent gathering and averaging the three most recent HbA1C values for all patient participants. Once all data is gathered and organized, performing all statistical analysis of the data will take up to four months. Lastly, synthesizing the analysis and finalizing the manuscript will take another four months.

This research will access data from all YNHH primary care locations. Secure computers will be required for data collection and analysis. The primary investigator (PI) is Dr. Katie Gielissen, and the student primary investigator will be Mary Cate Gallagher, PA-SII.
3.11 References


Chapter 4: Conclusion

4.1 Advantages and Disadvantages

This study’s unique research question and design will be able to fill the gap in literature on healthcare provider emotional intelligence and how it relates to clinical outcomes in adult patients with T2DM. One of the major strengths of this study is that it will be able to access a large sample of patients. This study will be conducted in a large academic health system, and it is looking at type II diabetes, one of the most prevalent diseases. In addition, this study will use retrospective EMR data to measure glycemic control, so it is not limited or biased by patient participation. There are 596 PCPs in the YNHH system that would be eligible to participate in this study, so to achieve the minimum sample size of 24, there would only need to be a 9% response rate. However, we estimate there will be a higher response, thus increased validity. As mentioned in Section 2.4, this will be the first study to analyze the relationship between EI and clinical outcomes in diabetes using multiple linear regression analysis. This will allow for a more nuanced and interesting evaluation of the data. Lastly, we were able to compile a sizeable list of confounding variables that will be controlled for from various sources. Previous cross-sectional studies have been limited by their narrow list of controls; however, by pulling from multiple sources we will be able to strengthen our findings.

This proposed study also has limitations. One fundamental limitation is that it will be a cross-sectional study. Cross-sectional studies are limited in showing cause and effect relationships and are also subject to influence from confounding variables. In addition to the cross-sectional nature, this paper is also limited by the fact that the main independent variable is a self-report tool that is subject to bias. Though the WLEIS is the most validated and applicable tool for this study, self-report measurements are more subjective than third-party evaluations.
Due to the study design, we will not be measuring any secondary outcomes along the proposed causal pathway (as outlined in Section 2.2). Lastly, this study is also limited by the accuracy of EMR data. Though it is the most accurate and accessible objective information available, it is still subject to input errors which could influence results.

4.2 Clinical Significance

Type II diabetes is one of the most prevalent and costly diseases and is a main source of morbidity and mortality in America. Though there is an abundance of research into optimizing diabetes management, a majority, 56%, of patients continue to have uncontrolled disease. The management of diabetes is complicated and is influenced by numerous factors outside of the healthcare provider’s control. However, if there is a positive relationship between PCP EI and HbA1c, provider emotional intelligence awareness, education and training could have tangible effects on the well-being of patients. Improving provider emotional intelligence would be one disease intervention that does not require any patient involvement. These findings could give insight to healthcare providers on how their own personal characteristics can influence their patients’ outcomes.
APPENDICES

Appendix A: Wong Law Emotional Intelligence Scale (WLEIS)

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<tbody>
<tr>
<td>1</td>
<td>1. I have a good understanding of my own emotions.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>2</td>
<td>2. I have a good understanding of the emotions of people around me.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>3</td>
<td>3. I really understand what I feel.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>4</td>
<td>4. I always know whether I am happy or not.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>5</td>
<td>5. I am sensitive to the feelings and emotions of others.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>6</td>
<td>6. I am a good observer of others' emotions.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>7</td>
<td>7. I can always control my temper so that I can handle difficulties rationally.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>8</td>
<td>8. I always set goals for myself and then try my best to achieve them.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>9</td>
<td>9. I am always capable of controlling my own emotions.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>10</td>
<td>10. I would always encourage myself to try my best.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>11</td>
<td>11. I am a self-motivating person.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>12</td>
<td>12. I can always calm down quickly when I am very angry.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>13</td>
<td>13. I can always rationalize and control my temper so that I can handle difficulties rationally.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>14</td>
<td>14. I am quite capable of controlling my own emotions.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>15</td>
<td>15. I can always calm down quickly when I am very angry.</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
</tr>
</tbody>
</table>

This table represents the questions and responses of the Wong Law Emotional Intelligence Scale (WLEIS). Each question is accompanied by a scale ranging from strongly disagree to strongly agree, allowing for a more nuanced understanding of emotional intelligence.
Appendix B: Consent Form

**COMPOUND AUTHORIZATION AND CONSENT FOR PARTICIPATION IN A RESEARCH PROJECT**
YALE UNIVERSITY SCHOOL OF MEDICINE
YALE NEW HAVEN HOSPITAL

**Study Title:** EXAMINING THE RELATIONSHIP BETWEEN PRIMARY CARE PROVIDER EMOTIONAL INTELLIGENCE AND GLYCEMIC CONTROL

**Principal Investigator:** Katie Gielissen, MD, MHS  
**Co-Investigator:** Mary Cate Gallagher, PA-SII  
**Funding Source:** Yale University School of Medicine Physician Associate Program

**Invitation to Participate and Description of Project**

You are invited to participate in a research study investigating primary care provider emotional intelligence and its effects on glycemic control in patients with type II diabetes. You have been asked to participate because you are a primary care provider in the Yale New Haven Health System. Approximately 100 PCPs will participate in this study.

In order to decide whether or not you wish to be a part of this research study you should know enough about its risks and benefits to make an informed decision. This consent form gives you detailed information about the research study. This forms covers all aspects of the research: its purpose, the procedures that will be performed, any risks of the procedures, and possible benefits. Once you understand the study, you will be asked if you wish to participate; if so, you will be asked to sign this form.

**Description of Procedures**

If you agree to participate in this study, you will complete an online version of the Wong Law Emotional Intelligence Scale (WLEIS). Once the form is collected the research team will access your patient panel and using Epic ChartSweep record retrospective HbA1c values from your patients with type II diabetes. These glycemic values will be examined in relation to your WLEIS score.

**Risks and Inconveniences**

We do not anticipate any major risks in participating in this study. The only participation will be completing the online WLEIS, which will take approximately 15 minutes.

There is a small risk of breach of your WLEIS score. All patient information will be properly deidentified and stored on encrypted devices. All research staff will be thoroughly trained and certified in the privacy of research studies.
Benefits

Benefits of participation in this study may include insight into provider characteristics that impact patient health outcomes. In addition, your WLEIS score will be made available to you when you submit your form.

Economic Consideration

There will be no compensation for your participation in this research study.

Confidentiality and Privacy

Any identifiable information that is obtained in connection with this study will remain confidential and will be disclosed only with your permission or as permitted by U.S. or state law. Information will be kept confidential by using only identification numbers on study forms, storing signed forms in locked cabinets, and password protecting data stored on a computer. When the results of the research are published or discussed in conferences, no information will be included that would reveal your identity unless your specific permission for this activity is obtained. No information about your health that will be collected in this study.

Representatives from Yale University, the Yale Human Research Protection Program, and the Yale Human Investigation Committee (the committee that reviews, approves, and monitors research on human subjects), who are responsible for ensuring research compliance have approved this study protocol.

By signing this form, you authorize the use and/or disclosure of the information described above for this research study. The purpose of the uses and disclosures you are authorizing is to ensure that the information relating to this research is available to all parties who may need it for research purposes.

All health care providers subject to HIPAA (Health Insurance Portability and Accountability Act) are required to protect the privacy of your information. The research staff at the Yale School of Medicine and those hospitals involved in this study are required to comply with HIPAA and to ensure the confidentiality of your information.

Voluntary Participation and Withdrawal

Participation in this study is voluntary. You are free to choose not to take part in this study. Refusing to participate will involve no penalty or loss of benefits to which you are otherwise entitled (such as your health care outside the study, the payment for your health care, and your health care benefits). However, you will not be able to enroll in this research study and will not receive study procedures as a study participant if you do not allow use of your information as part of this study.

Withdrawing from the Study
If you do become a subject of this study, you are free to stop and withdraw at any time during its course.

To withdraw from the study, you can call a member of the research team at any time and tell them that you no longer wish to participate. Withdrawing from the study will involve no penalty.

**You do not give up any of your legal rights by signing this form.**

**Authorization and Permission:**

_I have read (or someone has read to me) this form and have decided to participate in the project described above. Its general purpose, the particulars of my involvement, and possible hazards and inconveniences have been explained to my satisfaction. My signature also indicates that I have received a copy of this consent form._

By signing this form, I give permission to the researchers to use [and give out] information about me for the purpose described in this form. By refusing to give permission, I understand that I will not be able to be in this research study.

Name of Subject: ______________________________________

Signature: ____________________________________________

Date: __________

_______________________________________ _______________

Signature of Principal Investigator Date

Or

_______________________________________ _______________

Signature of Person Obtaining Consent Date

If after you have signed this form you have any questions about your privacy rights,

please contact the _Yale Privacy Officer at (203) 432-5919._

If you have further questions about this project or if you have a research-related problem, you may contact the Co-Principal Investigator, Mary Cate Gallagher. If you would like to talk with someone other than the researchers to discuss problems, concerns, and questions you may have concerning this research, or to discuss your rights as a research subject, you may contact the _Yale Human Investigation Committee at (203) 785-4688._
Appendix C: Sample PCP Intake Form

PCP Intake Form

1. Name

2. Are you currently practicing as a primary care provider in the Yale New Haven Health System?

Mark only one oval.

☐ Yes
☐ No

3. Medical Degree

Mark only one oval.

☐ MD
☐ DO

4. Board Certification

Mark only one oval.

☐ Family Medicine
☐ Internal Medicine

5. Have you completed a fellowship? If yes, what specialty?
6. Age

7. Race

*Mark only one oval.*

☐ American Indian
☐ Asian
☐ Black
☐ Native Hawaiian
☐ White
☐ Other: ____________________________

8. Sex

*Mark only one oval.*

☐ Male
☐ Female
☐ Other: ____________________________

9. How many patients do you currently have on your primary care panel?

________________________

10. How many patients with type II diabetes do you currently have on your primary care panel?

________________________
11. Residency graduation year

   Example: January 7, 2019

12. Location of primary office
Appendix D: Sample Size Calculation

<table>
<thead>
<tr>
<th>Type:</th>
<th>Regression</th>
<th>Significance level (α):</th>
<th>0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power:</td>
<td>0.95</td>
<td>Predictors (p):</td>
<td>2</td>
</tr>
<tr>
<td>Effect:</td>
<td>Medium</td>
<td>Effect type:</td>
<td>f</td>
</tr>
<tr>
<td>Effect Size:</td>
<td>0.07</td>
<td>Digits:</td>
<td>6</td>
</tr>
</tbody>
</table>

There are many ways to calculate the sample size for the linear regression.

1. When you calculate the power of the entire model compares to the null model, \( H_0: Y = b_0 \).
   The sample size \( 3155 \) will gain the power of \( 0.990020 \), the probability to reject an incorrect \( H_0 \).

3155 patients with T2DM needed to reach significance
1396 patients per average PCP panel
9.6% of patient population in the US has T2DM

\[ 1396 \times 0.096 = 134 \text{ patients with T2DM on each PCP's panel} \]

\[ \frac{3155}{134} = 23.5 \text{ PCPs needed to enroll minimum significant number of patients with T2DM} \]
## Appendix E: Variable and Analysis Type

<table>
<thead>
<tr>
<th>Variable</th>
<th>Recording Method</th>
<th>Analysis</th>
<th>Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c</td>
<td>Continuous</td>
<td>Simple/multiple linear regression</td>
<td>$\beta + CI$</td>
</tr>
<tr>
<td>WLEIS score</td>
<td>Continuous</td>
<td>Simple/multiple linear regression</td>
<td>$\beta + CI$</td>
</tr>
<tr>
<td>Age</td>
<td>Continuous</td>
<td>Student T test</td>
<td>Mean + SD</td>
</tr>
<tr>
<td>Race</td>
<td>Categorical</td>
<td>Chi squared</td>
<td>Proportions</td>
</tr>
<tr>
<td>Sex</td>
<td>Categorical</td>
<td>Chi squared</td>
<td>Proportions</td>
</tr>
<tr>
<td>BMI</td>
<td>Continuous</td>
<td>Student T test</td>
<td>Mean + SD</td>
</tr>
<tr>
<td>Insurance Type</td>
<td>Categorical</td>
<td>Chi squared</td>
<td>Proportions</td>
</tr>
<tr>
<td>Charlson Comorbidity Index score</td>
<td>Continuous</td>
<td>Student T test</td>
<td>Mean + SD</td>
</tr>
<tr>
<td>Length of time with T2DM diagnosis</td>
<td>Continuous</td>
<td>Student T test</td>
<td>Mean + SD</td>
</tr>
<tr>
<td>Years of practice post residency</td>
<td>Continuous</td>
<td>Student T test</td>
<td>Mean + SD</td>
</tr>
<tr>
<td>MD vs DO</td>
<td>Categorical</td>
<td>Chi squared</td>
<td>Proportions</td>
</tr>
<tr>
<td>Family Med vs Internal Med</td>
<td>Categorical</td>
<td>Chi squared</td>
<td>Proportions</td>
</tr>
<tr>
<td>Number of total patients on panel</td>
<td>Continuous</td>
<td>Student T test</td>
<td>Mean + SD</td>
</tr>
<tr>
<td>Number of patients with T2DM on panel</td>
<td>Continuous</td>
<td>Student T test</td>
<td>Mean + SD</td>
</tr>
<tr>
<td>Fellowship</td>
<td>Categorical</td>
<td>Chi squared</td>
<td>Proportions</td>
</tr>
</tbody>
</table>