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Referral Source, Visit Modality, and the Delivery of Diabetes Education in Pennsylvania

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Abstract

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Abstract

Diabetes education is a principal component of optimal diabetes care that is often underutilized despite the known benefits that include reductions in complications as well as improved glycemic control and self-management knowledge. The purpose of this quantitative study was to examine the association between the completion of diabetes education, referral source, and visit modality. Because the completion of diabetes education is multifaceted, Levesque's theoretical framework of health access, which incorporates dimensions of the accessibility of services and the abilities of potential users in the utilization of health services, was used to ground the study. A retrospective chart review was conducted for adult patients with Type 2 diabetes within one health system in Pennsylvania. Logistic regression analyses were completed, and no statistically significant relationship was found between the completion of diabetes education, the specialty of the referring physician, and the modality of visit scheduled. When covariates were included in the logistic regression models, older individuals were found to be more likely to complete diabetes education; for every 1-year increase in age, individuals were 2.7% more likely to complete diabetes education. African Americans were found to be 69.5% less likely than White individuals to complete diabetes education. These results may be utilized as the foundation for future prospective studies to better understand the completion of diabetes education. The results of this study may also influence positive social change through more informed health service organization decision-making and public policy directives as well as better targeted interventions to improve diabetes education completion rates.

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Dedication

This dissertation is dedicated to the individuals that have inspired and supported me. Allyson, thank you for your encouragement and perseverance throughout this entire process. Joseph, thank you for reminding me to take a break sometimes and live a little. Ella, you always motivate me to do my best work. To my parents, thank you for your continued and unrelenting support.

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Chapter 1: Introduction to the Study

Diabetes education is an important health service that is aimed at improving the self-management techniques that patients understand and possess while providing foundational knowledge on the disease process, complications, and strategies to improve diabetes control (Chatterjee et al., 2018; Powers et al., 2015). The primary goals of diabetes education are to mitigate, prevent, or delay complications, such as diabetic retinopathy, diabetic nephropathy, organ damage, extremity amputations, and other serious health conditions impacted by poor diabetes control (Davies et al., 2018; Eborall et al., 2016). Diabetes education may also focus on the psychosocial and behavioral aspects of diabetes care that are indispensable in addressing care concerns and complications yet potentially overlooked (Young-Hyman et al., 2016). Issues associated with cultural differences, social determinants of health, and technological advances and platforms for managing diabetes may also be addressed through diabetes education (Davis et al., 2022).

The prevalence of diabetes, burden of the disease, and the incidence and severity of complications are not distributed equally across population groups; consequently, inequality is present across many socioeconomic factors and among racial/ethnic groups (Barnard-Kelly & Chernavvsky, 2020; Hsu et al., 2012). I conducted this study to further the knowledge base of factors that are associated with the completion of diabetes education. Knowledge gained from this study may be used to impact further research, policy decisions, and clinical decisions aimed at improving diabetes education completion. Furthermore, positive social change may be promoted by better targeting

interventions to reduce inequality; this may include advancing knowledge to better predict individuals that are less likely to complete diabetes education and deteriming the most effective allocation of resources.

In this chapter, I discuss the significance and nature of the problem. The relevant supporting literature, theoretical framework, and purpose of the study are described. The research questions and hypotheses are clearly stated. Additionally, I present the assumptions and potential limitations of the study as well as the variables, research questions, and hypotheses. Finally, I conclude the chapter with a discussion of the social change implications and a summary.

Background

Patients completing diabetes education have had better success in their overall diabetes care, including lower complication rates and better diabetes control, than patients not receiving diabetes education (Beck et al., 2017; Kent et al., 2013). The American Diabetes Association (2021a) recognized diabetes education as an essential piece of optimal diabetes care and has advocated for health system improvements and the reduction of financial barriers to make diabetes education more accessible. Despite the strong clinical support and evidence of the positive attributes and impact of diabetes education, participation and completion rates for diabetes education are low (Horigan et al., 2017; Schäfer et al., 2014) While past research efforts have examined the completion of diabetes education while focusing on patient outcomes, there has been extremely limited inquiry into how the specialty of the referring physician or the modality of visit scheduled are associated with completion rates. Therefore, I conducted this study to

advance knowledge in the field of diabetes education and explore the association between physician specialty, modality of visit, and the completion of diabetes education.

Problem Statement

The prevalence of diabetes has risen to historically high levels in the United States. Over 11% of adults in the United States have diabetes, and 1 in 3 U.S. adults have prediabetes that can develop progressively into Type 2 diabetes (American Diabetes Association, 2021b). Access to diabetes care and diabetes education is not equally distributed across racial/ethnic groups or geographic locations (Gaskin et al., 2014). Rural residents are less likely than urban residents to complete diabetes education (Hale et al., 2010). Barker et al. (2016) noted that telehealth services have been extremely useful in addressing inequality along geographic, transportation, and logistical issues, but there are still discrepancies and inequality among individuals utilizing telehealth services.

Patients receiving care from endocrinologists have achieved faster control of their diabetes than patients only receiving care from a primary care physician (Setji et al., 2019). Additionally, endocrinologists are more likely than primary care physicians to follow the treatment, monitoring, and complication screening recommendations of the American Diabetes Association (Leinung et al., 2000). However, Davidson et al. (2010) noted that primary care physicians treat over 90% of individuals with Type 2 diabetes in the United States. Therefore, it was important and relevant to examine the association between the specialty of a referring physician and the completion of diabetes education.

The cost and economic burden of diabetes care is high; out of all Medicare costs, 1 in 3 dollars is spent on diabetes care (Strawbridge et al., 2017). Diabetes education has

repeatedly been demonstrated as a cost-effective tool to reduce overall health costs and improve health outcomes (Duncan et al., 2009; Turner et al., 2018; Urbanski et al., 2008). Because diabetes education is an important health service aimed at improving patient outcomes while reducing complications and costs, it is important for health service organizations to understand factors that influence the completion of the service. Therefore, the specific research problem addressed through this study was that it was not known if patients were more or less likely to complete diabetes education based on referral source of endocrinologists or primary care physician or visit modality of in office or telehealth within a health system in Pennsylvania. Pennsylvania was chosen as the study location due to my familiarity and experience with health service providers and systems in the state. With this study, I sought to build upon past research findings and expand knowledge in the discipline of health services. Examining the relationship between referral source, visit modality, and the completion of diabetes education can be valuable to health service organizations through influencing future decision-making and resource allocation.

Purpose of the Study

The purpose of this quantitative, retrospective study was to examine the association between the completion of diabetes education, referral source, and modality of visit. The dependent variable was the completion of diabetes education, while the independent variables were the specialty of the referring physician and modality of visit. In this study, I examined if there were differences in diabetes education completion rates across referral sources of endocrinology and primary care physicians and the visit

modalities of in office or telehealth while controlling for the covariates of gender, race, age, and geographic location.

Research Questions and Hypotheses

Research Question 1: What is the predictive relationship between the completion of diabetes education within 6 months from referral and the referral source of endocrinologist or primary care physician when controlling for gender, race, age, and geographic location?

$H_0$1: There is no predictive relationship between the completion of diabetes education within 6 months from referral and the referral source of endocrinologist or primary care physician when controlling for gender, race, age, and geographic location.

H_a1: There is a predictive relationship between the completion of diabetes education within six months from referral and the referral source of endocrinologist or primary care physician when controlling for gender, race, age, and geographic location.

Research Question 2: What is the predictive relationship between the completion of diabetes education within 6 months from referral and modality of visit, in office or telehealth, that is scheduled when controlling for gender, race, age, and geographic location?

$H_0$2: There is no predictive relationship between the completion of diabetes education within 6 months from referral and the modality of visit,

in office or telehealth, that is scheduled when controlling for gender, race, age, and geographic location.

H_a2: There is a predictive relationship between the completion of diabetes education within 6 months from referral and the modality of visit, in office or telehealth, that is scheduled when controlling for gender, race, age, and geographic location.

Conceptual Framework for the Study

I used Levesque's conceptual framework of health care access to ground this study. Levesque et al. (2013) provided a framework that described health care utilization as rooted in five dimensions of accessibility of services and five abilities of potential users. In this framework, health service organizations may operate as facilitators or barriers to service utilization. The five dimensions of accessibility of service are approachability, acceptability, availability and accommodation, affordability, and appropriateness. Various obstacles to service utilization are noted and include the cost of services, location of health resources, and the way in which resources are organized by health systems or other health service organizations.

Levesque's model also included certain features of health providers and populations that intersect with service delivery; these features are referred to as dimensions of ability and provide further explanation of how health care services are utilized (Levesque et al., 2013). This model of health care access has been used in research on many health services and specifically on diabetes services. Mulyanto et al. (2019) examined how approachability to diabetes services, such as the knowledge of

available health services and the means to utilize these services, were important factors in the delivery of services. Levesque's framework was applicable to the research questions in this study because health service delivery is multifaceted and there are numerous factors than can interact, interfere, or influence health service delivery. Further applications and information regarding this conceptual framework are discussed in greater detail in Chapter 2.

Nature of the Study

To address the research questions in this quantitative study, I used a correlational research design. The correlational design is typically used to measure the degree, association, or relationship between variables (Creswell & Creswell, 2018). A correlational design and quantitative methodology aligned with the research questions of this study because I attempted to determine the strength of a relationship between variables. In this study, I employed a retrospective chart review. A clinical research data warehouse associated with an academic medical center was used to help identify patients meeting the inclusion criteria for this study. Data were manually abstracted from patient records. I performed logistic regression analyses with the assistance of Statistical Package for the Social Sciences (SPSS).

The dependent variable in this study was the completion of diabetes education; this variable had a dichotomous outcome in which the options were the patient did or did not complete diabetes. There were two categorical independent variables in this study. The first independent variable was the specialty of the referring physician. The potential values for this variable were primary care physician or endocrinologist. The second

independent variable was the visit modality scheduled for diabetes education. The two options for this variable were an in-office appointment or a telehealth appointment. The covariate variables were gender, race, age, and geographic location. Gender was a categorical variable with options of male and female. Race was a categorical variable with options of White, African American, other, and not specified. Age was a continuous variable. Geographical location was a categorical variable with options of urban, suburban, and rural.

Definitions

Diabetes education: The process of facilitating the knowledge, skill, and ability necessary for diabetes self-care (Powers et al., 2015).

Diabetes educator: An individual certified by the Association of Diabetes Care and Education Specialists that possesses specialized training, knowledge, and clinical skills to provide diabetes education (Sherr & Lipman, 2015).

Endocrinologist: A physician that has completed a residency in internal medicine and a fellowship in endocrinology (Romeo et al., 2020).

In-office appointment: An appointment that was conducted face-to-face within the confines of a physician office or medical practice setting (Donelan et al., 2019).

Primary care physician: A physician that has completed a residency in general internal medicine, family medicine, or general pediatrics (Goodfellow et al., 2016).

Telehealth appointment: An appointment that occurred through an electronic device, such as a computer, tablet, or cellphone, that contained audio and/or video communication capabilities (Donelan et al., 2019).

Type 2 diabetes: A metabolic disease that is caused by either the inadequate secretion of insulin beta cells in the pancreas or a lack of insulin sensitivity among tissues; in Type 2 diabetes, patients experience blood glucose levels that are elevated (Galicia-Garcia et al., 2020).

Assumptions

This study was a retrospective chart review that was based on data manually abstracted from the electronic health records of an academic medical center. Patients with Type 2 diabetes treated within 10 endocrinology and primary care departments that were referred to diabetes education were identified for this study. I assumed that information contained in the electronic health record was accurate and reliable. The academic medical center provided significant and recurrent training for staff to ensure records were correct, and processes and policies were in place to ensure the records were recorded and maintained appropriately. This assumption was necessary because it was not feasible or possible for me to conduct an independent audit of the academic medical center's policies, procedures, or record accuracy.

Three variables were abstracted from the medical records that were not subjective or subject to value analysis or bias. I was independent from the referral process or completion of diabetes education and no independent judgments were made about the variable values. Each value had a clear outcome that was not subject to interpretation. The variable values were clearly identifiable and were supported by the electronic health record. I assumed that the patients were informed of their appointments and that patients agreed to the modality of visit that was scheduled. This assumption was necessary

because it was not possible to audit the scheduling procedures of each past appointment. However, the academic medical center utilized an automated system to remind patients of appointments and the appointment modality at least 48 hours in advance. Additionally, the appointments that were made for this study were only scheduled when the patient agreed to the appointment. Patients that declined to be scheduled for diabetes education were not scheduled or included in this study.

Scope and Delimitations

In this study, I specifically evaluated the association between the completion of diabetes education, the specialty of the referring physician, and the modality of visit because there was limited knowledge of how these factors are related. This retrospective study was based on quantitative data collected on adult patients with Type 2 diabetes that were referred to diabetes education in select physician practice locations associated with an academic medical center. I selected these locations to make the research feasible due to ease of access of records. If records from different facilities or organizations were included, the approach would not have been feasible.

Because the data that were collected for this study were from one academic medical center and are not representative of the larger U.S. population, caution must be used when attempting to generalize the results and conclusions of this study. However, at the time of this study's publication, there was no evidence that indicated the completion of diabetes education varied widely between states or that patient or provider perspectives of diabetes education are extensively different across regions. Therefore, the risk of external validity concern for this study was minimal.

Levesque's theoretical framework of health access includes several dimensions of health access that comprised factors related to health providers or health systems as well as patients (Levesque et al., 2013). In this study, I only examined two factors of health access; it was not an inclusive study of all potential factors or dimensions of health access that may influence or impact the delivery of diabetes education. Therefore, while the association between the completion of diabetes education, specialty of the referring physician, and visit modality were examined in this study, it did not account for all the factors that may influence or impact the delivery of diabetes education.

Limitations

A known limitation of the study was a lack of readily and publicly available secondary data for the variables, thus making data collection and approval from the partner site imperative. The partner site's electronic health system did not have a method of recognizing that diabetes education had been completed automatically; therefore, a retrospective chart review was needed to obtain the variable values to answer the research questions and complete the study. Because patient charts were accessed to obtain the variables for the study, an additional challenge of the study was collecting and storing data to meet all regulatory and Institutional Review Board (IRB) directives. Compliance and research training were required by the partner organization before IRB approval could be obtained. Additionally, to comply with all regulations and requirements issued by Walden University and the partner organization, I followed specific processes to minimize potential risks to patients and properly store data. Data were de-identified and stored separately from any possible patient identifiers.

There are many issues and confounding factors that may influence an individual's ability to complete diabetes education. Many logistic factors may make it difficult for patients to complete diabetes education, but patients must also be willing to receive the health service. In this study, I examined the association of only two factors with the completion of diabetes education. Additional research was needed to clarify the associations due to the complex factors that may influence the completion of diabetes education.

The data period for this study coincided with the COVID-19 pandemic; therefore, more diabetes education visits may have been scheduled as telehealth appointments than in time periods outside the pandemic. Patients may have been more resistant to participate in diabetes education or visit their physician office due to exposure risk. Finally, some appointments for diabetes education may have been cancelled on short notice due to COVID-19 risk, cautions, or exposures. In this situation, the patient was responsible for rescheduling the appointment.

To account for any potential bias in the data collection process, I did not make any subjective measurements, decisions, or conclusions for the variable values. The variable values in this study were discrete and clearly identifiable. Due to the nature of the variables, any researcher could reach the same conclusions in determining the binary outcome for each variable.

Significance

This study was significant in that it addressed the lack of knowledge of factors that influence or inhibit the delivery of diabetes education. Understanding the differences

in the completion of diabetes education due to referral source and visit modality in Pennsylvania can help inform health managers and clinicians. The findings of this study are beneficial for other health systems and health service organizations in the United States so further resources and support can be allocated effectively. The complication rates of diabetes and the severity of complications are not evenly distributed across ethnicities, income levels, and various other social and physical characteristics. By assessing the predictive relationship of referral source and visit modality, more attention or resources can be allocated to individuals or health providers that are less likely to complete diabetes education, resulting in improved outreach and rectifying issues of equity and accessibility. These steps will help to produce positive social change.

Public policy may be informed based on the results of this study. With the results of this study, policymakers may opt to continue the use of telehealth and permanently expand efforts to improve issues of health care access and utilization. Similarly, policymakers may have an increased focus on referrals from primary care physicians or endocrinologists depending on the study results. These decisions may help to improve the accessibility of key health services and shift the allocation of resources to areas of need.

Summary

In the United States, the prevalence of diabetes has reached the highest level ever identified. Diabetes education has been recognized and clearly identified as an integral health service associated with improved diabetes outcomes; however, patients do not always complete diabetes education when referred by their physicians (American Diabetes Association, 2021a ; Beck et al., 2017; Horigan et al., 2017; Kent et al., 2013;

Schäfer et al., 2014). In this chapter, I explained why this study needed to be conducted, described the theoretical framework that grounded the study, and discussed the context of the research and its application to the discipline of health services. The research problem, methodology, significance, purpose, and the nature of the study were also detailed. In Chapter 2, I will provide additional background on diabetes, diabetes education, the theoretical framework, and past research on why patients do not complete diabetes education.

Chapter 2: Literature Review

The research problem addressed in this study was that it was not known if patients were more or less likely to complete diabetes education based on their referral source or modality of visit scheduled within health systems in Pennsylvania. There was a gap in the literature in which it was not known if patients under diabetes care by their primary care physician or an endocrinologist have higher or lower completion rates for diabetes education. Likewise, it was not known if patients utilizing telehealth appointments have higher or lower completion rates of diabetes education than those individuals electing for in-office appointments. The purpose of this study was to examine the association between referral source, modality of visit, and the completion of diabetes education.

In this literature review, I offer an overview of diabetes education, the efficacy and effectiveness of diabetes education, Levesque's conceptual framework of health access, barriers to the completion of diabetes education, participation rates, and the use of telehealth in diabetes education. Diabetes education has been defined by the American Diabetes Association as the ongoing process of facilitating the knowledge, abilities, and skills that are necessary for a patient to provide self-care (Duncan et al., 2009; Powers et al., 2015). Diabetes education has been repeatably demonstrated to reduce complication rates of diabetes, improve compliance, facilitate better self-management, and reduce the economic burden and costs associated with diabetes (Beck et al., 2017; Chatterjee et al., 2018; Chrvala et al., 2016; He et al., 2017; LaManna et al., 2019). Conversely, individuals that do not complete diabetes education are 4 times more likely to develop

complications than those individuals that did complete diabetes education (Kent et al., 2013).

The prevalence of diabetes and those at risk of diabetes are at all-time high levels. There are 37 million adults and children in the United States with diabetes, while 96 million U.S. adults have prediabetes; diabetes is costly and deadly while disproportionally impacting underrepresented groups and contributing to racial disparities in health (American Diabetes Association, 2021a). Additionally, the Centers for Disease Control and Prevention (2022) has acknowledged the inequality of diabetes prevalence due to education level and financial status while also recognizing the importance of diabetes education as a cost-effective tool to have a positive impact on diabetes-related outcomes. Therefore, the Centers for Disease Control and Prevention has allocated resources to increase access and participation in diabetes education services (Houston & Edwards, 2019). Within the Commonwealth of Pennsylvania (2018), policymakers and public health leaders have also recognized the rising costs, mortality, and complications associated with diabetes while working to improve access and utilization of diabetes education.

Inequality in diabetes care and access to diabetes education has been found across many socioeconomic, racial/ethnic, and geographic factors (Gaskin et al., 2014). Disparities and inequality within diabetes care and diabetes education leave many sectors of the population without access to appropriate or timely services. African Americans are among one racial minority group that have disproportionately faced a myriad of issues and experienced worse diabetes outcomes than other groups (Peek et al., 2013).

Rosentsock et al. (2014) also found racial disparities in diabetes mortality across large urban areas in the United States. Access to care alone is not the sole or single factor influencing racial disparities in diabetes care, but it is one of many issues affecting equitable access to services (Heidemann et al., 2016). Therefore, the current literature established significant inequalities and disparities that are a target for improvement and positive social change.

Along geographic lines, participation in diabetes education has been lower among rural residents than individuals living in urban or metropolitan areas (Hale et al., 2010). Additionally, Siopis et al. (2020) found that while disadvantaged, remote, and rural individuals had the greatest need for intervention to help with diabetes care, there was limited access to these services in many rural areas. Telehealth has been profoundly useful in addressing the unique needs of rural and geographically isolated individuals. Barker et al. (2016) found that rural patients have distinctive barriers to participation in diabetes education due to the access and availability of services while also viewing telehealth as an effective solution and alternative to face-to-face sessions.

Despite the well-known benefits of diabetes education, completion rates remain low. While there is some variation between countries and studies, it has been estimated that as many as 93% of patients with diabetes do not complete diabetes education (Schäfer et al., 2014; Wadher, 2010). In an examination of Medicare enrollees, Duncan et al. (2009) found that only 4% of patients with diabetes received diabetes education. These low participation rates are present among various demographic, geographic, and socioeconomic statuses, but overall, individuals with diabetes maintain low referral and

completion rates for diabetes education (Rabi et al., 2006). For instance, in a study of federally qualified clinics and patient-centered medical homes serving disadvantaged populations, only 53.5% of patients were referred to diabetes education and 34% of those referred received any diabetes education (Alsayed Hassan et al., 2020). Pennsylvania made diabetes education a focal point of public health in the 21st century; still, for 2019, the lifetime completion rate of diabetes education for adults with diabetes ranged between 48%–66% for Pennsylvania residents (Pennsylvania Department of Health, 2020). There remain discrepancies based on sample populations and particular groups, but the overall literature on diabetes education completion rates has established significant areas for concern and improvement given the known benefits of diabetes education.

The literature review contains several sections that include a discussion of the literature search strategy, seminal literature, conceptual framework, and literature supporting the methodology. Additionally, in this literature review I provide detailed analysis of the literature specific to diabetes education, barriers to completion, physician specialties, and the use of telehealth. With this literature review, I intended to inform the reader of the key developments in the field while also highlighting research gaps and areas in which this study may extend knowledge in the field.

Literature Search Strategy

I used a systemic search process to identify relevant literature in Google Scholar, Thoreau, and EBSCO. To emphasize current literature, initial searches were completed for literature published in the last 5 years (i.e., 2016–2021). However, due to the lack of literature published on diabetes education and physician referrals, the search parameters

were expanded to include literature published in the past 10 years (i.e., 2011–2021). I examined literature older than 10 years if it was cited in more recent work; older works were also reviewed for prominent and prolific authors as well as influential or seminal literature in the field. The following several keywords and phrases were used to facilitate the search of academic literature on diabetes education and physician referrals in databases: *diabetes education, diabetes service delivery, diabetes education referrals, diabetes and physician referral, diabetes and barriers, diabetes education and completion, diabetes education and attendance, diabetic education, diabetes self-management,* and *physician referral and completion.* A mix of qualitative, quantitative, and mixed-methods studies were found. Studies focusing on health outcomes or outside the scope of health services were largely excluded from the literature search; instead, the scope of the search was primarily focused on the delivery of diabetes education and the role of physician referrals in the health service delivery process.

Seminal and Influential Literature

Given the lack of depth and quantity of literature on diabetes education, physician referrals, and the use of telehealth, it was difficult to classify seminal literature. Because the first formal diabetes education classes were popularized in the late 1970s, most of the research and literature on diabetes education is relatively modern (Jörgens & Porta, 2020). Previously, diabetes education was incorporated into the role of nurses and consisted of more informal teaching and counseling (Allen, 2003). Similarly, telehealth is a relatively newer concept, and the literature surrounding this topic is addressed in later sections in this chapter. Still, there are several studies that are critically relevant to both

the field and this study. The influential literature involves both the need for diabetes education, the difficulties or barriers impacting service completion, and how physicians or specialists can influence referral patterns and service completion.

Lack of Current Research and How This Was Handled

There is very limited research on the association of how a physician's specialty or modality of visits are related to the completion of diabetes education. Outside of some research into why referrals to diabetes education are not made or completed, there is scarce academic literature surrounding analysis of physician referrals and how physician specialty is related. Moreover, there is limited research into diabetes education completion rates between telehealth and in-office appointments. I addressed this lack of current research by reviewing recent literature on physician referrals and health services related to diabetes care. Additional research was identified in these areas. Additionally, the publication date range of literature was expanded to provide additional literature and context. The findings and implications of these studies are discussed in additional detail later in this chapter.

Conceptual Framework

Given the numerous factors that influence the completion of diabetes education, a theoretical foundation of health access and service completion that encompasses health system and health provider components as well as patient-based factors was necessary. I selected Lévesque's conceptual framework of health access as the conceptual framework for this study due to these factors and the intricacy of issues impacting the completion of diabetes education. Despite strong recommendations from health providers and public

health advocates, low attendance and completion of diabetes education services remain (American Diabetes Association, 2021a; Beck et al., 2017; Horigan et al., 2017; Kent et al., 2013; Schäfer et al., 2014). The barriers to patient attendance and completion of diabetes education are multifaceted and encompass many social, behavioral, and logistical factors as well as operational and access issues from health providers and health systems (McSharry et al., 2019). Understanding and assessing these phenomena with a framework including various factors from patients and health providers was essential, and Lévesque's work provided a strong and well-rounded foundation for the current study.

Theory Origin

The origin of Lévesque et al.'s (2013) conceptual framework of health care access was rooted in works of health service supply and definitions of health access. Earlier attempts of health access frameworks were less inclusive and focused on supply side issues. Health services were often deemed accessible by factoring in components, such as geographic location, price, and the acceptability of services, that permitted individuals to receive the services (Bashshur et al., 1971). While health care access was viewed as an important matter of health policy and used in measurements of health system performance, Aday and Andersen (1974) found that access and the completion of health care services was far more complex and dependent on individual choices and providers than as presented in government policy. Other researchers began to incorporate additional issues and elements of accessibility to further the complexity and comprehensiveness of health access definitions and frameworks. Donabedian (1973) offered a definition of

accessibility that included health system characteristics or structures that can impede or promote health service delivery.

With the recognition and acknowledgement that numerous health system and patient-related factors influence health access, the analysis and definitions of health care access quickly transitioned away from health care service supply solely and attention began to focus on more complex factors (Penchansky & Thomas, 1981). Mooney (1983) found health access as a function of both supply and demand, thus incorporating more systemic factors than a supply of health services. Daniels (1982) provided a focus on the more ethical dimensions of health access and issues of equity and equality. Adding to these dimensions, Haddad and Mohindra (2002) focused on the opportunity with which patients and providers are able to utilize health services in conjunction with their needs. Gulliford et al. (2002) noted that health care access is not solely dependent on an adequate supply of services but rather that issues of affordability, physical accessibility, and acceptability of services are important in defining access. Shengelia et al. (2003) furthered these viewpoints of access by advancing the concepts of utilization and access as defining features of health system performance and as a metric for proper analysis.

These earlier authors provided a foundation of health access theory that was a catalyst for Levesque's works. Definitions of health access have transformed over the past half century to be more comprehensive and to include various health system and patient factors or components; this change has shifted attention away from strict health service supply and incorporated other factors that influence health access and the delivery of health services. Definitions of health access and the analysis of health service

accessibility have undergone a transformation from direct supply side metrics to include assessments of the costs, geographic availability, timeliness of service availability, logistical factors, and the social or cultural acceptability of the service (Haggerty et al., 2011; Levesque et al., 2006).

Major Theoretical Propositions

Levesque's framework considers both the health system perspective and patient perspective on access. Levseque et al. (2013) proposed a conceptual framework that incorporated five dimensions of accessibility of the health care system along with five abilities of patients: The dimensions of accessibility are approachability, acceptability, availability and accommodation, affordability, and appropriateness, while the abilities of patients are to perceive, seek, reach, pay, and engage. Within this framework, the dimensions of accessibility and abilities of patients are interlated to the understanding of health care needs, the perception of needs and desire for care, health care seeking, health care reaching, health care utilization, and the understanding of health care consequences. This conceptual framework is often called patient-centered access to health care. The authors noted that the various dimensions of access are not mutually exclusive; rather, the dimensions are often intertwined, semidependent, and can influence each other at varying times. Access to health care services is a result of the many dimensions and determinants that interact.

Use of Theory in Modern Literature

Lesvesque and Sutherland (2020) provided an additional look into how health system performance and a conceptual framework of access are necessary for objective

analysis. The authors found that health system performance metrics are best measured when grounded in a conceptual framework that includes outcomes in relation to patient needs and health system or provider processes. One example provided by the authors was that it is not possible to measure the accessibility of a service directly, but rather the completion of services needs to be considered relative to the needs and expectations of patients and providers. Cu et al. (2021) examined the successful use of Levesque's framework in recent literature and found that researchers were able to use it to comprehensively assess the often complex and dynamic process of health service access and completion. Because issues of health access and service completion are often dependent on numerous factors, the authors noted that Lesveque's framework is particularly useful in exploring these complex issues of access barriers among patient populations experiencing inequality or health disparities due to its multifaceted approach.

Rationale for Choice

The conceptual framework provided by Lesveque can be applied to the delivery of diabetic education because there are a multitude of factors that impact its completion and overall access. There is an interconnection between patient perception for the need of services, the practicality and logistics of providing the service, and the need for providers to refer patients to the service. Therefore, a conceptual framework that incorporates both patient and provider components was well suited for research on diabetes education. Delivering diabetes education is dependent on meeting the dimensions of health system accessibility while also meeting the abilities of patients. The variables examined in this study involved accessibility and the completion of health services that were dependent on

meeting logistical barriers as well as patient-perceived barriers. Thus, Levesque's conceptual framework of patient-centered access to health care was best suited for this study.

Relevancy of Theory to Current Study

Levesque's conceptual framework has been used frequently in research related to diabetes services. Recurrently, these works have sought to understand issues with access to care for screenings and complication management that focus on both supply and demand factors (Mulyanto et al., 2019; Mwangi et al., 2018; Mwangi & Macleod et al., 2017; Piyasena et al., 2021). Levesque's conceptual framework has also been applied in research on telehealth, geographic availability, patient isolation, and factors limiting or hindering a patient's ability to travel to medical appointments (Curtis & Price, 2018; Ha & Jung-Choi, 2022; Haggerty et al., 2014; Magny-Normilius et al., 2021; Patel et al., 2020). These authors have demonstrated the varied, diverse, and complex issues that impact access to health services.

There has been limited use of Lesveque's conceptual framework on diabetes education; however, the complexity of issues impacting the delivery of diabetes education made it well suited for such an approach. A conceptual framework that incorporated a multifaceted and multidimensional foundation was relevant to the current study as both patient and health system factors are important to the delivery of diabetes education. While the scope of the present study was on health service delivery and factors affecting service completion, there are numerous other factors that can influence a patient's willingness and ability to complete diabetes education. Therefore, Levesque's

conceptual framework that encompasses multiple dimensions of accessibility and abilities was ideal for the current study.

Relevancy to Research Questions

With the first research question, I addressed whether there were differences in completion rates of diabetes education among referrals from primary care physicians or endocrinologists. This research question incorporated various factors of engagement, trust, health literacy, and appropriateness of services that can be different between physicians of different specialties. Patients may also perceive health care needs differently while under the care of a primary care physician or specialist in diabetes care. With the second research question, I addressed whether there were differences in completion rates of diabetes education when the service was offered in office or by telehealth. This research question attempted to analyze service utilization and completion while reducing potential logistical or transportation barriers. Hence, Levesque's conceptual framework that includes issues of availability and accommodation as well as the ability to reach patients was relevant.

Current Peer-Reviewed Articles

Much of the research attention on diabetes education has been focused on three primary topics including the importance of diabetes education, low completion rates, and low referral rates. Additionally, other authors have focused on dietary and lifestyle intervention strategies as part of diabetes education which demonstrated reduction of complications and remission of diabetes among participants (Lean et al., 2018; Siopis et al., 2021b). Lastly, barriers to patient attendance have also been an important focus of

modern research. I have summarized and discussed this research in the following sections.

Efficacy of Diabetes Education and Low Participation Rates

In reviewing the impact of diabetes education on health outcomes, Steinsbekk et al. (2012) found that participation in a diabetes education program provided substantial benefits in glycemic control and improved diabetes knowledge and self-management skills. The authors established clear benefits of diabetes education from clinical perspectives. However, there remains difficulty in achieving 100% attendance or completion of services despite these beneficial results. Horigan et al. (2017) found that patients did not attend or complete diabetes education due to two primary themes. The first theme was that patients did not attend or complete diabetes education primarily due to logistical, medical, or financial reasons. The second theme was that patients had a denial of diagnosis, negative feelings toward education, or a lack of perceived benefit. Other authors have explored each individual theme or reason more extensively, but Horigan et al. provided a systemic review that remains important to understanding why patients do not attend diabetes education. Similarly, Findlay-White et al. (2020) found that nonattendance of diabetes education was associated with the emotional, cognitive, and social issues associated to diagnosis, but these factors were often masked by perceived or real practical barriers to attendance.

Bajaj et al. (2016) examined attendance rates for diabetes education among patients before and after seeing a diabetes specialist; the authors found that diabetes education completion was 28% before a referral to the specialist and 67% after referral.

This study demonstrated the potential for higher attendance and completion rates for patients seeing a diabetes specialist or endocrinologist, but the authors did not directly compare referrals from endocrinologists or primary care physicians. Rather, the authors examined diabetes education before and after seeing a specialist. Additionally, the study was conducted in Canada which has health system features that vary significantly from the United States. Despite the differences in this study to the current study, Bajaj et al. introduced a significant finding to the field of diabetes education research that I built upon in the current study.

Factors Influencing Completion Rates of Diabetes Education

Many factors are known to influence the completion of diabetes education. A multitude of issues and barriers may need addressed or identified to facilitate the delivery of diabetes education (Zare et al., 2020). Some of these factors are outside the scope of the current study, but a brief discussion is necessary to provide appropriate context. There are mixed results in identifying factors, statuses, or clinical conditions that can predict attendance or completion of diabetes education based on sex, age, body mass index, or the length of diabetes diagnosis (Gucciardi, 2008). However, other factors including physical and socioeconomic barriers, health system features, and physician referral patterns have been more distinctly identified as influencing the completion rates of diabetes education.

Physical and Socioeconomic Barriers

Individuals with diabetes and lower socioeconomic status have disproportionately worse health outcomes than individuals with higher incomes and

educational attainment (Rawshani et al., 2016; Suwannaphant et al., 2017). Despite these known disparities and efforts to improve access to diabetes education, disadvantaged individuals with lower socioeconomic status have poor rates of diabetes education completion (Gucciardi et al., 2007). Uninsured individuals or those covered by Medicaid receive referrals for diabetic education at a lower rate than those with commercial or other insurance (Shaw et al., 2011).

There are also patient-based factors associated with socioeconomic status that impede the completion of diabetes education. The inability to take time away from work has been recognized as a significant barrier that unevenly affects lower income patients (Adams et al., 2013). Similarly, patients with lower socioeconomic status are more adversely impacted by transportation issues that limit their ability to receive diabetes education or other diabetes care (Allory et al., 2020; Stotz et al., 2021; Temple & Epp, 2009). Patients in rural areas are disproportionately impacted by potentially long travel distances to receive diabetes education or the limited availability of diabetes educators that travel to remote areas (Baek et al., 2021; Gammoh et al., 2021). These socioeconomic and physical barriers make it more difficult for some patients to receive diabetes education than others.

Health System Factors

Despite the identification of diabetes education and dietetic services as a tool to reduce the costs of diabetes care and complication rates, calls remain for increased attention and inclusiveness of diabetes education within health systems (American Association of Diabetes Educators, 2018; Siopis et al., 2021b). The rising prevalence of

diabetes has placed additional strains on health systems while most primary care physicians do not feel they have adequate time to teach and educate patients with diabetes. A lack of diabetes educators further deteriorates issues of access among many geographically isolated and medically underserved areas (Chomko et al., 2016). The lack of access to diabetes education is compounded by the inability of many outpatient physician offices to provide even basic education (Maryniuk et al., 2013).

Physician Referrals

Powers et al. (2015) identified four critical times in which patients should be referred to diabetes education; these times include a new diagnosis of Type 2 diabetes, as part of annual health maintenance and prevention of complications, when transitions in care occur, and when new complicating factors influence or disrupt self-management. However, physician referrals to diabetes education have not universally occurred at these critical times. Common themes for physicians not referring patients include an absence of awareness towards diabetes education program availability, a lack of openings in diabetes education programs, unavailable evening and weekend hours, and language or communication barriers between physicians and patients (Gucciardi et al., 2011). While these findings on physician preferences and experiences mirror responses and themes from patients, not all physician practices or providers have had trouble in referring patients to diabetes education. Technological advancements, a heightened focus on referrals to diabetes education, and practice-based diabetes education models have reduced some of the physician barriers of referrals to diabetes education (Krall et al., 2021).

Several authors have explored the use of standardized referral criteria and the implementation of algorithms to improve physician compliance in referring patients. Krall et al. (2018) found that patients in physician practices utilizing an algorithm to help identify the need for a referral to diabetes education were 1.9 times more likely to be referred to diabetes education than patients in practices not using a referral algorithm. Therefore, the authors demonstrated that technology and strict attention to the diagnosis and progression of diabetes can improve referral rates to diabetes education. James (2021) found similar success with increasing referrals when a referral algorithm was embedded in the electronic health record; without these enhancements, diabetes education was found to be underutilized. The attitude, encouragement, and engagement of the referring physician has also been shown to influence diabetes education completion; therefore, it is important for referring physicians to effectively communicate the goals and need for diabetes education (Harris et al., 2018).

Studies Related to Methodology, Key Variables, and Concepts

Researchers have approached the study of diabetes education primarily through retrospective chart reviews and occasionally interventional studies. In the current study, I utilized a retrospective chart review to abstract key variables. Retrospective chart reviews are popular in health services and medical research, but there are several weaknesses to this methodology including issues with data abstraction and sampling (Vassar & Matthew, 2013). Still, there are several important strengths of utilizing a retrospective chart review including the ease of obtaining useful and organized data. In the following

sections, I have examined and discussed the applicability of key variables and concepts to the methodology and research questions.

Methodology

Several authors have utilized a retrospective chart review to study the completion of diabetes education, attendance, and referral patterns. Azam et al. (2017) demonstrated the feasibility of such research through the analysis of referral patterns among more than 10,000 patient records identified through a clinical research data warehouse; the authors found that age at diagnosis, insurance status, race/ethnicity, language, and a history of diabetes complications were all significantly associated with a referral to diabetes education. Brown-Podgorski et al. (2021) utilized a similar methodology of chart review in their analysis of identifying patient needs and how likely providers were to refer patients to diabetes education. Luo et al. (2022) also used a retrospective chart review to assess diabetes education participation differences among rural and urban adults. The authors of these studies demonstrated the applicability of retrospective chart review to research on diabetes education completion and how the association of various factors may be assessed.

I used binomial logistic regression in the current study to assess the association between the completion of diabetes education, the specialty of the referring physician, and the modality of visit. Logistic regression has frequently been used in health services research as a method of predicting binary outcomes or observations (Bagley et al., 2001; Hosmer et al., 1991; Srimaneekarn et al., 2022). In the current study, the binary outcome was completing diabetes education or not completing diabetes education. Logistic

regression has been used in various health research topics including health literacy (Tipirneni et al., 2018). More recently, logistic regression has been used as a statistical test on COVID-19 vaccine acceptance (Elhadi et al., 2021). Regarding the completion of diabetes education, Bruce et al. (2003) examined socioeconomic factors and health status variables through logistic regression with completion of diabetes education as the dependent variable. Consequently, binomial logistic regression remains a largely utilized statistical test in health services research.

Variables and Concepts

There are several past works that support the variables and concepts I assessed in the current study including the completion of diabetes education, specialty of referring physician, and modality of visit. Physician specialty and how it is associated with health service completion has only been marginally explored in the literature; however, the concept of physician specialty impacting service completion aligns with Levesque's conceptual framework of health access and is therefore explored in the current study. Telehealth and the completion of diabetes education have widely been explored and utilized as variables in the literature.

Completion of Diabetes Education

The dependent variable in the current study was the completion of diabetes education. The completion of diabetes education has been frequently used as a dependent variable in logistic regression analyses to test the association of independent variables including socioeconomic factors and health statuses (Bruce et al., 2003; Hooks-Anderson et al., 2015). The authors of these studies demonstrated a statistically significant

association between diabetes education completion rates and race/ethnicity, insurance status, age at diagnosis, language, and a history of diabetes complications. While these studies have demonstrated the applicability and use of diabetes education completion as a dependent variable, no research utilizing this methodology with a focus on the referring physician's specialty, or the modality of visit utilized was found in the literature.

Physician Specialty

Diabetes is a progressive disease and endocrinologists are often referred the most uncontrolled or noncompliant patients whereas primary care physicians see more newly diagnosed and more controlled patients; however, patients that are seen by endocrinologists can obtain glycemic control quicker than those patients only seen by primary care physicians (Setji et al., 2019). Despite these findings, the literature remains divided on the role of physician specialty and the impact on diabetes compliance or outcomes. In a review of pharmacy claims data to obtain diabetes medication adherence and compliance, Kirkman et al. (2015) found that there was no statistically significant difference in medication compliance based on prescriber or physician specialist. These studies established the use and efficacy of physician specialty as a variable, but no direct analysis of diabetes education was considered in the studies examining physician specialty. Therefore, the lack of known knowledge on how physician specialty is associated with diabetes education completion warranted additional exploration.

There is some research into how primary care physicians address diabetes and related issues such as weight management and dietary counseling. These studies attempt to illicit differences in management, compliance, or approaches to care that may help to

understand potential differences in diabetes education completion rates. Primary care physicians may perceive a lack of capability in providing widespread diabetes education or nutritional counseling (Crowley et al. 2020). Conversely, patients may not always appreciate recommendations or referrals to education from their primary care physicians on these subjects. Wermeling et al. (2014) found that while some patients did appreciate direct communication from their primary care physician regarding weight management and diabetes, others found the advice unhelpful or offensive. However, Siopis et al. (2021a) found that the predominant source of referral to dietetic services for individuals with Type 2 diabetes came from general practitioners and only few referrals came from an endocrinologist. This study involved only 30 participants so it may be difficult to generalize the results, but the authors offered findings that indicated much more research was necessary into referral completion based on physician specialty.

Diabetes Education by Telehealth

Telehealth has been established as an important modality for providing diabetes education. Bashshur et al. (2015) found that diabetes education completed by telehealth was highly effective and that patients experienced improved glycemic control. Levin et al. (2013) also found that telehealth was an effective tool in addressing the multifaceted challenges of diabetes management and education. Meanwhile, Siminerio et al. (2014) found that diabetes education by telehealth improved patient empowerment, self-care, and adherence to diet and glucose monitoring. In a direct comparison between in-person diabetes education and diabetes education completed through telemedicine, Izquierdo et al. (2003) found that both education modalities were equally effective in improving

glycemic control and reducing diabetes-related stress. It is also important to note that diabetes education completed by telehealth was effective even among individuals with little computer experience or literacy (Melo et al., 2020). These authors have demonstrated the high efficacy of diabetes education completed through telehealth, but little remains known on if completion rates of diabetes education are different in comparison to in-office visits.

Much attention has been paid to the impact of telehealth on patients in rural areas to address geographic isolation and limited service availability. West et al. (2010) found that diabetes education completed by telehealth was especially effective in improving diabetes self-management among underserved, elderly rural adults. However, the benefits of diabetes education through telehealth were not limited to rural patients; rather, Walker et al. (2011) found that patients in urban areas also benefited from diabetes education through telehealth. The authors of these studies have demonstrated high patient satisfaction and efficacy of diabetes education completed through telehealth, but there remains little research into patient attendance or completion rates between in-office diabetes education or telehealth services.

Summary and Conclusions

In this literature review, I provided an overview of the major literature in the field of diabetes education and discussed barriers to completion. Additionally, I reviewed research into telehealth and service completion by physician specialty. In this literature review, I established the relevancy of the variables and key concepts while also identifying significant themes.

The first major theme I identified in the literature was that diabetes education has been established as effective, but patient participation and physician referrals are not universal. Rather, patient participation and physician referral rates are low despite the widely known benefits of diabetes education. Many authors have explored individual reasons for the poor completion of diabetes and various factors have been identified. The second major theme I denitified in the literature was that inequality and disparities are present among populations in overall diabetes care and particularly access to diabetes education. These inequalities and disparities may be based on geographic locations, racial or ethnic statuses, and socioeconomic factors.

The breadth of literature on diabetes education was associated with reasons for nonattendance and systemic issues with referring patterns. It remains unknown how the impact of physician specialty or the use of telehealth is associated with the completion of diabetes education. Despite a depth of literature on the importance and efficacy of diabetes education, research efforts to better understand patient nonattendance have been productive, but these efforts have not included factors that the current study addressed. Therefore, I intended to extend the known feasibility of methodology and variables in diabetes education research while further extending the examination of reasons, factors, or inequalities that influence the delivery of diabetes education within a health access framework. Furthermore, I sought to identify potential differences, shortcomings, or areas requiring additional attention to better understand the delivery of diabetes education among health systems in Pennsylvania.

I identified a gap in the literature in understanding or assessing the association between the completion of diabetes education, modality of visit, and the referring physician's specialty. There were studies and support within the literature that demonstrated the feasibility of using these variables; likewise, the methodology I utilized in the current study had been widely applied by researchers exploring similar topics. Therefore, while a gap in knowledge existed in the current literature, there were strong foundations for applying a similar methodology and variables to research on the completion of diabetes education. In Chapter 3, I will review the methodology and variables for the current study that I outlined in the literature review above.

Chapter 3: Research Method

The purpose of this retrospective study was to examine the association between the completion of diabetes education, the specialty of the referring physician, and the modality of visit scheduled as either in person or by telehealth. This valuable information can be utilized to enact positive social change while improving the understanding of service delivery amongst an indispensable health service for diabetes care. By better understanding the associations that impact the delivery of diabetes education, resources can be better allocated to improving patient attendance and completion rates. This chapter includes a thorough review of the research design, setting, and sample used in this study. Additionally, in this chapter, I discuss the variables, procedures for data collection, and sample characteristics.

Research Design and Rationale

I addressed the research problem through a review of secondary data obtained with the assistance of a clinical research data warehouse and the partner organization. The data were abstracted from the medical records of an academic medical center in Pennsylvania. Once appropriate patients were identified through inclusion criteria, a chart review was performed to ascertain the variables for this study. Retrospective chart reviews are advantageous because they enable relative ease in accessing health records within specified timeframes while also increasing suitable potential subjects for participation (Hess, 2004). By using this research design, I was able to directly answer the research questions. Because the research questions could be answered and the research design was sufficient to do so and recognized in the field, the choice of a

retrospective chart review adequately allowed me to advance knowledge in the discipline of health services and diabetes education.

Retrospective chart reviews are cost effective, time efficient, and less intrusive to patients than experimental research designs (Gregory & Radovinsky, 2012). I conducted this study without outside financial support, so a retrospective chart review was the most cost-effective and feasible methodology to answer the research questions. Retrospective chart reviews have been previously utilized in the study of diabetes education (Marcincic et al., 2017). However, at the time of this dissertation, there was very limited research assessing the specialty of the referring physician and the modality of visit on the completion of diabetes education. With this study, I sought to address this gap in the research and strengthen the understanding of factors that are associated with the completion of diabetes education.

Methodology

I conducted this study to answer two research questions. The first research question addressed whether there was an association between the completion of diabetes education and the specialty of the referring physician. The second research question addressed if there was an association between the completion of diabetes education and modality of visit. To answer these research questions, I randomly selected a sample from patients at an academic medical center that met the established inclusion criteria. Information for two independent variables, one dependent variable, and four covariate variables was abstracted from medical records through a manual chart review. The data collection and analysis methods are further described in the following subsections.

Logistic regression was utilized as a statistical test for this study, and the results are reported as odds ratios with a 95% confidence interval.

Variables

The dependent variable for this study was the completion of diabetes education. This variable had a binary outcome, and the two possible outcomes were that diabetes education was completed within 6 months from referral or diabetes education was not completed within 6 months from referral. The first independent variable was the specialty of the physician that referred the patient to diabetes education. The two possible selections for this variable were primary care physician or endocrinologist. The variable value, primary care physician, encompassed both internal medicine and family practice physicians. Because the study only included primary care and endocrinology departments, no other physician specialties were included. The second independent variable was the modality of visit scheduled. The two possible selections for this variable were an in-office appointment or a telehealth appointment.

I used four covariate variables in this study: gender, race, age, and geographic location. Gender was a categorical covariate variable, and the possible selections were male, female, and unknown; no other values were recorded in the electronic health record of the academic medical center. Race was a categorical covariate variable with the possible selections of White, African American, other, and not specified. Age was a continuous covariate variable that was recorded in years of age at time of referral to diabetes education. Geographic location was a categorical covariate variable, and the possible selections were urban, suburban, and rural.

Sampling and Sampling Procedures

I conducted this study by analyzing secondary data obtained through a retrospective chart review of individuals referred to diabetes education. Probabilistic sampling was used to construct a statistically relevant sample. Participants were selected for this study by meeting specific inclusion criteria. The inclusion criteria were a diagnosis of Type 2 diabetes, a referral placed to diabetes education, and age equal to or greater than 18 years old at the time the referral to diabetes education was placed. The search criteria were limited to 10 physician office locations in Pennsylvania that included five primary care locations and five endocrinology locations. Each primary care physician department shared a physical location or office building with the endocrinology department but operated as a separate department. All department locations were affiliated with one academic medical center that served as a partner organization for this study. Patients referred to diabetes education from January 1, 2021 to December 31, 2021 were included in this study. There were no exclusion criteria. I submitted a query of the electronic health records with the assistance of the partner organization's clinical research data warehouse team that yielded 2,210 unique patients who met the inclusion criteria.

Using G*Power3, I conducted an a priori analysis that indicated that a sample size of 209 was needed. Based on typical parameters for health service research, an expected power of .95 and an alpha of .05 were used for this study (see Faul et al., 2007). The probability of Outcome 1, completing diabetes education within 6 months of a referral, was .6, and the probability of Outcome 2, not completing diabetes education within 6 months of a referral, was .35. To ensure a proper sample size was met, I randomly

selected 300 patients from the 2,210 who met the inclusion criteria for study analysis. To select these participants, patients meeting the inclusion criteria were placed in random order in a Microsoft Excel spreadsheet and the first 300 patients were selected as the sample of this study. This was a simple random sample in which each participant had an equal chance of being selected.

Population

For this study, the population was adults with Type 2 diabetes that received care within one academic medical center in Pennsylvania. The academic medical center provides patient care services to more than 500,000 patients annually. Furthermore, the academic medical center operates over 25 physician offices and outpatient sites. There are approximately 1.1 million individuals in Pennsylvania that have been diagnosed with Type 2 diabetes (Dall et al., 2014). The academic medical center routinely provides service to more than 50,000 of these Pennsylvania residents that have diabetes each year. The prevalence of diabetes in Pennsylvania is spread across all geographic areas, age ranges for adults, and genders; however, males have higher rates of Type 2 diabetes than women and individuals aged 65 years old or older have higher rates of Type 2 diabetes than younger adults (Garcia-Dominic et al., 2014).

Procedures for Recruitment, Participation, and Consent

Because this study was a retrospective chart review, there was no active recruitment of patients for this study. I queried the electronic health records of the partner organization to identify patients meeting the inclusion criteria. Informed consent was not obtained prior to the research being conducted. There has been debate over this

procedure, but informed consent is not feasible in retrospective chart reviews. Researchers have evaluated the ethical considerations related to not obtaining consent in retrospective chart reviews, but the potential harm to patients may be minimized when practices to anonymize or de-identify data are in place (Haynes et al., 2007; Mackey et al., 2016; McCarthy et al., 2008). I obtained a Waiver of Health Insurance Portability and Accountability Act (HIPAA) Authorization from the partner academic medical center's IRB because it was not feasible to contact each possible study participant and seek participation approval.

Data Collection

I selected the sites for data collection based on their patient volumes, location in a variety of areas in Pennsylvania, the availability of medical records for patients, approval to use records, and the willingness of the partner organization to allow access to data with a collaborating researcher. To submit an IRB application with the partner organization, I was required to attend specialized training on the use of patient medical records, ethical issues associated with research, research conduct, and regulatory provisions and statues pertaining to research. Once these requirements were met, I applied for and received IRB approval from the partner organization. I also applied for and received IRB approval from Walden University.

At the time of IRB submission and approval, all patient records were already in existence. I conducted the chart review at a minimum of 6 months after the patient was referred for diabetes education. I accessed patient medical records to abstract data from them in a closed area and alone to prevent unauthorized access. Data entry and storage

were completed in a password-protected, Microsoft Excel file. The medical record numbers of patients in the sample were stored in their own file; this file only contained a linking value that could be used to locate their participant number in the data set with variable values. The data set with variable values did not contain any unique patient identifiers, such as name, address, phone number, date of birth, or social security number. The data set with variable values will be stored on a password-protected computer that will be kept for 7 years. The file containing medical record numbers will not be stored on the same computer. The file with the medical record numbers and linking value will be stored for 7 years as well in case the data needs to be verified or audited with the medical record numbers later.

I assumed that information contained in the electronic health record was accurate and recorded in a reliable manner. The partner organization provided substantial training for new employees and yearly mandatory training on proper documentation techniques for all employees to safeguard the reliability of information contained in the medical record. To ensure the data collection for this study was done accurately, careful consideration and attention were paid to the data abstraction process. Mi et al. (2013) noted that the abstraction of information, variables, and outcomes from the medical record can be done reliably by researchers. Moreover, a methodological process and the abstraction of information with simple complexity, such as the variables in this study, can have high reliability, validity, and reproducibility.

Variable Operationalization

Dependent Variable

The dependent variable was the completion of diabetes education within 6 months of referral. The completion of diabetes education was not a discrete field in the partner organization's electronic health record; therefore, I completed a chart review to determine if the patient completed diabetes within 6 months of referral. If diabetes education had been completed, the health record contained a formal progress report and description of activities completed during the education session as documented by the diabetes educator. In the database, the completion of diabetes education was coded as 0 if it was not completed and 1 if it was completed. For example, a patient that completed diabetes within 6 months of the referral being placed was coded as 1.

Independent Variables

The independent variables were (a) specialty of the physician referring the patient to diabetes education and (b) modality of visit scheduled. The specialty of the referring physician and the modality of visit scheduled were recorded in the partner organization's electronic health record and were abstracted during the chart review. The referring physician specialty was coded as 0 if it was primary care and 1 if it was endocrinology. For example, if the patient was referred to diabetes education by their primary care physician, it was coded as 0. The modality of visit scheduled was coded as 0 if it was in office and 1 if it was telehealth. For example, if the patient was scheduled for an in-office appointment, it was coded as 0.

Covariate Variables

The covariate variables were (a) gender, (b) race, (c) age, and (d) geographic location. Gender, race, and age were recorded in the partner organization's electronic health record and were abstracted during the chart review. Gender was coded as 0 for female and 1 for male. Race was recorded as 0 for White, 1 for African American, 2 for other, and 3 for not specified. Age was a continuous variable that was reported in whole years at the time of referral to diabetes education. Geographic location was obtained through cross referencing the patient's county and municipal residence location to density and location information obtained from the U.S. Census Bureau. The patient's county and municipal residence location were recorded in the partner organization's electronic health record, and I compared this information to U.S. Census Bureau data that were delineated by the U.S. Office of Management and Budget to reflect population densities. The U.S. Census Bureau (2020) provided county and municipal level categorizations that include urban metropolitan statistical areas, suburban micropolitan statistical areas, and rural areas. A similar approach to categorization has been used when evaluating counties of residence for categorization of rural or urban status in health services research (Luo et al., 2022). Geographic location was coded as 0 for urban, 1 for suburban, and 2 for rural.

Data Analysis Plan

The goal of data analysis was to examine the association between the completion of diabetes education, the specialty of the referring physician, and the modality of visit scheduled as either in person or by telehealth. I used SPSS Version 28, licensed through Walden University, to conduct the data analysis. An Excel spreadsheet was used to

record data abstracted from the medical record. The spreadsheet was uploaded directly into SPSS, and a manual review of the transferred data was completed to ensure that data were properly and accurately uploaded to SPSS. I performed logistic regression analyses to determine if the referring physician's specialty or the modality of visit predicted the completion of diabetes education. Logistic regression allows for determination of the effect of variables on an outcome to be assessed (Roalfe et al., 2008). Covariate variables were included to control for factors that may influence the completion of diabetes education. The following research questions and hypotheses guided this study:

Research Question 1: What is the predictive relationship between the completion of diabetes education within 6 months from referral and the referral source of endocrinologist or primary care physician when controlling for gender, race, age, and geographic location?

$H_0$1: There is no predictive relationship between the completion of diabetes education within 6 months from referral and the referral source of endocrinologist or primary care physician when controlling for gender, race, age, and geographic location.

H_a1: There is a predictive relationship between the completion of diabetes education within 6 months from referral and the referral source of endocrinologist or primary care physician when controlling for gender, race, age, and geographic location.

Research Question 2: What is the predictive relationship between the completion of diabetes within 6 months from referral and modality of visit, in office or

telehealth, that is scheduled when controlling for gender, race, age, and geographic location?

$H_0$2: There is no predictive relationship between the completion of diabetes education within 6 months from referral and the modality of visit, in office or telehealth, that is scheduled when controlling for gender, race, age, and geographic location.

H_a2: There is a predictive relationship between the completion of diabetes education within 6 months from referral and the modality of visit, in office or telehealth, that is scheduled when controlling for gender, race, age, and geographic location.

Assumptions of Logistic Regression

Laerd Statistics (n.d.) noted that there are four assumptions of logistic regression. The first assumption is that the dependent variable is dichotomous; in this study, the dependent variable was dichotomous. There were two possible outcomes for the dependent variable. Either the patient completed diabetes education within 6 months from referral or did not complete diabetes education within 6 months from referral. The second assumption in logistic regression is that there are one or more independent variables. The independent variables may be continuous or categorical. In my study, there were two categorical independent variables. The third assumption of logistic regression is that there is an independence of observations; furthermore, the dependent variables must have mutually exclusive and exhaustive categories. In this study, the dependent variable met this assumption as a patient had either completed diabetes or not. There were no other

options and therefore the two options are both mutually exclusive and exhaustive. Kabaila (2021) noted that the Durbin-Watson statistic is useful in examining the independence of observations. I examined this statistic during my data analysis and found that the assumption was met. The fourth assumption of logistic regression is that there is a linear relationship between any continuous independent variables and the logit transformation of the dependent variable. Shrestha (2019) exhibited the importance and utility of the Box-Tidwell test to check linearity. I utilized this method to test the assumption and I reviewed the SPSS output and confirmed linearity. Therefore, the assumption was met.

Interpretation of Results

The results of logistic regression analysis are often presented as odds ratios. Odds ratios are directly derived from the regression coefficients and therefore demonstrate the change in the odds of an event occurring given a unit change in the independent variable (Peng et al., 2002). Likewise, Stoltzfus (2011) noted that odds ratios reveal the strength of association or contribution to the outcome. In the current study, I reported the odds of the outcome occurring versus not occurring for each variable. A 95% confidence interval was used in this study so that the true value of odds was likely to be captured.

Threats to Validity

As the validity of the study may have been impacted or threatened by uneven distributions of participants, I utilized descriptive statistics to review the distribution of data including age, gender, and geographic location (urban, suburban, rural). The random selection of a sample within patients that met the inclusion criteria should have mitigated

concerns regarding the uneven distribution of participants. Additionally, covariate variables were used in this study to control for gender, race, age, and geographic location. A second threat to validity was the potential for errors to be made in the manual abstraction of data. Although Brundin-Maher et al. (2018) noted that electronic data abstraction may reduce errors in comparison to manual abstraction, electronic abstraction was not possible in this study. The completion of diabetes education was not a stored field or unique value in the electronic health record of the partner organization and thus needed to be manually reviewed and coded. Nonetheless, data abstraction from medical records remains a common, effective, and reliable method of collecting data (Zozus et al. 2015).

Ethical Considerations

Before data collection was commenced, I obtained IRB approval from the partner organization and Walden University (Walden IRB Approval No. 08-30-22-1035143). A service agreement was also completed with the clinical research data warehouse associated with the partner organization to describe the specifications of data collection and the potential dissemination of data or findings. Secondary data were used in this study so informed consent of participants was not feasible. Still, to comply with the partner organization's IRB process, I obtained a Waiver of HIPAA Authorization from the partner organization. As there was no active recruitment of participants and the study was retrospective by design without an intervention, there were minimal or no concerns regarding the early withdrawal of participants, participants refusing participation, or the

potential for predictable adverse events. Likewise, there were no follow-up interviews or requirements due to the retrospective study design.

As this study included a chart review, there was concern over access to patient records, confidentiality, and the safekeeping of data. I was the only person accessing patient records to complete the chart review and abstraction of data. Individual patient information was not shared with anyone. The list of medical record numbers for patients in this study will be kept for 7 years. A data set without discrete or identifiable patient data will also be kept for 7 years in case an audit is necessary. The data set used for this study contained a linking variable that could be used to match the de-identified data with medical record numbers, but no confidential or identifiable data were stored in the data set.

Summary

In this chapter, I provided an overview of the methodological approach that was used in this study. I defined the independent and dependent variables and detailed the possible variable values. Additionally, I discussed the research design of the study as well as the population, sample, sampling method, and inclusion criteria. I described the data collection and data analysis processes and addressed potential threats to validity. I characterized the steps taken to ensure privacy and confidentiality; these steps included the obtainment of a waiver for HIPAA from the partner academic medical center. I also provided a brief description of the statistical method used in the study. In Chapter 4, I will present the results of the study.

Chapter 4: Results

The purpose of this study was to determine if there is an association between the completion of diabetes education, the specialty of the referring physician, and the modality of visit scheduled. Through a retrospective chart review, I collected and then analyzed data to address the following research questions and hypotheses:

Research Question 1: What is the predictive relationship between the completion of diabetes education within 6 months from referral and the referral source of endocrinologist or primary care physician when controlling for gender, race, age, and geographic location?

$H_0$1: There is no predictive relationship between the completion of diabetes education within 6 months from referral and the referral source of endocrinologist or primary care physician when controlling for gender, race, age, and geographic location.

H_a1: There is a predictive relationship between the completion of diabetes education within 6 months from referral and the referral source of endocrinologist or primary care physician when controlling for gender, race, age, and geographic location.

Research Question 2: What is the predictive relationship between the completion of diabetes within 6 months from referral and modality of visit, in office or telehealth, that is scheduled when controlling for gender, race, age, and geographic location?

$H_0$2: There is no predictive relationship between the completion of diabetes education within 6 months from referral and the modality of visit, in office or telehealth, that is scheduled when controlling for gender, race, age, and geographic location.

H_a2: There is a predictive relationship between the completion of diabetes education within 6 months from referral and the modality of visit, in office or telehealth, that is scheduled when controlling for gender, race, age, and geographic location.

In this chapter, I provide an overview of the data collection process and any unexpected challenges or limitations. Descriptive demographic statistics are reported as well as the results of the logistic regression analyses. Several tables are included to outline the results of the statistical analyses. Additionally, I summarize the answers to the research questions.

Data Collection

Data collection was completed based on the procedures presented in Chapter 3. I collected data for individuals in the sample through a retrospective chart review. Participants included individuals referred to diabetes education during 2021 from 10 departments consisting of primary care and endocrinology locations. Participants were required to have a diagnosis of Type 2 diabetes and be age 18 years or older at the time of the referral. Variables abstracted from the electronic health record included the completion status of diabetes education, specialty of the referring physician, modality of visit scheduled, gender, age, race, and geographic location. I completed the data

collection process over a period of 10 days and included data from 300 participants. A Microsoft Excel spreadsheet was used to record the variable values. No identifiable patient information was stored in this spreadsheet. Once the participant data was input into the spreadsheet, it was then loaded into SPSS for review and analysis. There were no missing values.

One potential issue discovered during the data collection process was the treatment of participants with multiple appointments scheduled. Because the dependent variable was defined as completion of diabetes education within 6 months of the referral being placed, some patients had multiple appointments scheduled before completing the appointment. In these situations, the patients cancelled or rescheduled their appointments. The modality of visit scheduled was recorded as the appointment that was completed. For patients that cancelled or rescheduled appointments but did not ultimately complete diabetes education within 6 months of the referral being placed, the last appointment within the 6-month period was recorded for the modality of visit scheduled.

Baseline Descriptive and Demographic Characteristics of the Sample

To assess the demographic characteristics of the sample, I conducted a univariate analysis. The sample included 54.0% (n = 162) females and 46.0% males (n = 138). The distribution of race in the sample did not demonstrate substantial diversity. The sample contained 76.7% (n = 230) White participants, 14.0% (n = 42) African American participants, and 9.3% (n = 28) participants that had race coded as Other. The sample contained 56.7% (n = 170) individuals that resided in an urban area, 30.7% (n = 92)

individuals from suburban areas, and 12.7% (*n* = 38) individuals that were from rural areas.

In this study, age was a continuous variable; however, for reporting purposes, age was categorized into groups. The mean age of participants was 57.1 years at the time of referral. A majority of the sample included individuals between 51 and 70 years of age. Individuals aged 51–60 comprised 28.0% (*n* = 84) of the sample, while individuals aged 61–70 years comprised 27.3% (*n* = 82) of participants. Younger individuals made up less of the sample, but individuals less than or equal to 30 years still made up 4.3 % (*n* = 13) of the sample and individuals aged 31–40 comprised 6.3 % (*n* = 19) of the sample. Older individuals were also included in the sample with individuals aged 71–80 comprising 15.0 % (*n* = 45) of the sample. The last age group, individuals greater than or equal to 81 years of age, made up 0.01 % (*n* = 2) of the sample.

The sample was likely representative of the larger population of the academic medical center. While patient demographic information was not readily available for the population within the academic medical center, data from the recent census in Pennsylvania was consistent with the sample (U.S. Census Bureau, 2022b). The academic medical center provides services throughout Pennsylvania and should therefore have a patient population analogous to that of Pennsylvania. In the 2020 U.S. census, White individuals comprised 81.0 % of the Pennsylvanian population and 76.7 % of the sample. Likewise, African Americans comprised 14.0 % of the sample and 12.2 % of the population in Pennsylvania. Lastly, females comprised 54.0 % of the sample, while females are 50.6% of the population in Pennsylvania.

Summary Statistics for Variables

Summary descriptive statistics were also generated for the dependent and independent variables. The analysis showed that 84% (n = 252) of individuals referred to diabetes education did complete diabetes education within 6 months of the referral. Conversely, 16% (n = 48) of individuals referred did not complete diabetes education within 6 months. Of the 300 patients in the sample that were referred to diabetes education, 30% (n = 90) of the referrals came from primary care physicians, whereas 70% (n = 210) of the referrals were from endocrinologists. The summary analysis also indicated that 54.3% (n = 163) of the individuals referred to diabetes education were scheduled for an in-office appointment. Individuals scheduled for telehealth appointments for diabetes education comprised 45.7% (n = 137) of participants.

Justification for Covariates

To reduce the chance of distorted results due to the possible effect of covariates on the independent and dependent variables, I included four covariate variables (i.e., gender, race, age, and geographic location) in this study. Gender, race, and age were categorical variables, while age was a continuous variable. The inclusion of covariates was based on the heterogeneity of the population and the established effects of gender, race, age, and geographic location on health service utilization.

Study Results

In this section, I provide detailed results of the logistic regression analyses and descriptive statistics for the independent variables. The results of each research question are reported individually under their respective heading. The covariate results are also

presented for each research question. In this section, I also individually review the statistical assumptions of logistic regression.

Descriptive Statistics

Findings showed that 210 patients were referred to diabetes education by endocrinologists. Of the 210 patients referred by endocrinologists, 87.0% (n = 174) completed diabetes education within 6 months of referral, whereas 13.0% (n = 36) did not complete diabetes education. Primary care physicians referred 90 patients to diabetes education. Of these 90 patients referred by primary care physicians, 86.6.% (n= 78) completed diabetes education within 6 months of the referral and 13.4% (n = 12) did not complete diabetes education.

In terms of visit modality, 163 patients were scheduled for in-office appointments. Of these 163 patients, 82.8% (n = 135) completed diabetes education within 6 months of referral, whereas 17.2% (n = 28) did not complete diabetes education. There were 137 patients scheduled for telehealth appointments. Of these 137 patients, 85.4% (n = 117) completed diabetes education within 6 months of referral, while 14.6% (n = 20) did not complete diabetes education.

Statistical Assumptions

Prior to completing the statistical analyses, I reviewed the statistical assumptions of logistic regression. Because the dependent variable in this study had only two exclusive options, the first assumption of a dichotomous dependent variable was met. The study included two independent variables, and therefore, the second assumption of one or more independent variables was met. The third assumption of logistic regression requires

independence of observations, and the dependent variable had mutually exclusive and exhaustive categories. In this study, either the patient did or did not complete diabetes education within 6 months of a referral being placed. Additionally, the Durbin-Watson statistic was calculated to be 2.266, which indicated the sample data were not autocorrelated; thus, the third assumption was met. Lastly, the fourth assumption of logistic regression was met by reviewing the SPSS output for linearity of the continuous variable of age and reviewing the Box-Tidwell test to confirm linearity. Once the statistical assumptions were met, I performed statistical analyses for each research question.

Research Question 1

Results from logistic regression indicated that there was no statistically significant predictive relationship between referral source of endocrinologists and primary care physicians (EXP(B) = .744; p = .411; see Table 1). Because the confidence interval for referral source of endocrinologists passes through one and the p value was greater than 0.05, no statistically significant relationship was observed, and the null hypothesis failed to be rejected. The results indicated less than 1% of the variance in the criterion was explained by referral source alone as per the Nagelkerke R^2 (.004).

Table 1

Odds Ratio for Completion of Diabetes Education by Referral Source

							95% C.I. for EXP(B)	
Variable	B	S.E.	Wald	*df*	Sig.	EXP(B)	Lower	Upper
Referral source - Endocrinologist	-.296	.360	.677	1	.411	.744	.367	1.506

Constant	1.872	.310	36.438	1	<.001	6.500

The results of the logistic regression detailed in Table 2 indicated that adding covariates was a better fit by predicting 8.5% of the variance using Nagelkerke R^2. The model indicated race and age were statistically significant predictors of completing diabetes education in the model examining the specialty of the referring physician and the completion of diabetes education within 6 months of referral. The odds of completing diabetes education within 6 months from referral were 69.5% less likely for African Americans (EXP(B) = .305; p = .008). than White participants. Age in years at time of referral (EXP(B) = 1.027; p = .029) was positively associated with the completion of diabetes education, meaning that with each 1-year increase in age, the odds of completing diabetes education within 6 months from referral increased by 2.7%. Referral source, gender, and geographic location had no effect on the model's ability to predict the completion of diabetes education by referral source.

Table 2

Odds Ratios for Impact of Covariates on Prediction of Completion of Diabetes Education by Referral Source

							95% C.I. for EXP(B)	
Variable	B	S.E.	Wald	*df*	Sig.	EXP(B)	Lower	Upper
Referral source – Endocrinologist	-.259	.375	.476	1	.490	.772	.370	1.610
Gender – Male	.054	.328	.028	1	.868	1.056	.555	2.010
Age	.026	.012	4.794	1	.029	1.027	1.003	1.051
Race – White			.7281	2	.026			
Race – African American	-1.186	.445	7.119	1	.008	.305	.128	.730
Race – Other	-.273	.583	.220	1	.639	.761	.243	2.386
Geographic location – Urban			1.600	2	.449			
Geographic location – Suburban	-.245	.414	.352	1	.553	.782	.348	1.760

Geographic location – Rural	-.642	.510	1.589	1	.208	.526	.194	1.428
Constant	.776	.805	.930	1	.335	2.173		

Research Question 2

I conducted a logistic regression analysis to evaluate the predictive relationship between the completion of diabetes education and individuals scheduled for in-office appointments and telehealth appointments. The analysis revealed that there was no statistically significant predictive relationship between patients scheduled as telehealth and in-office appointments (EXP(B) = 1.213; p =.544; see Table 3). Because the confidence interval for the visit modality of telehealth includes one and the p value was greater than 0.05, no statistically significant relationship was observed, and the null hypothesis failed to be rejected. The results indicated less than 1% of the variance in the criterion was explained by referral source alone as per the Nagelkerke R^2 (.002).

Table 3

Odds Ratio for Completion of Diabetes Education by Visit Modality

							95% C.I. for EXP(B)	
Variable	B	S.E.	Wald	*df*	Sig.	EXP(B)	Lower	Upper
Visit modality – Telehealth	.193	.319	.368	1	.544	1.213	.649	2.267
Constant	1.573	.208	57.385	1	<.001	4.821		

Adding covariates to the original model was a better fit because it predicted 8.4% of the variance using Nagelkerke R^2. The results of the logistic regression detailed in Table 4 demonstrate that the odds of completing diabetes education within 6 months from referral were 69.7% less likely for African Americans than White individuals (EXP(B) = .303; p = .007). The odds of completing diabetes education within 6 months of referral

increased 2.6% with each increase in age at the time of referral (EXP(B) = 1.026; p = .032). Visit modality, gender, and geographic location had no effect on the odds of completing diabetes education.

Table 4

Odds Ratios for Impact of Covariates on Prediction of Completion of Diabetes Education by Visit Modality

							95% C.I. for EXP(B)	
Variable	B	S.E.	Wald	*df*	Sig.	EXP(B)	Lower	Upper
Visit modality – Telehealth	-.174	.340	.262	1	.609	.840	.432	1.635
Gender – Male	.057	.328	.030	1	.862	1.059	.556	2.015
Age	.026	.012	4.617	1	.032	1.026	1.002	1.051
Race – White			7.317	2	.026			
Race – African American	-1.194	.446	7.162	1	.007	.303	.126	.727
Race – Other	-.281	.585	.231	1	.631	.755	.240	2.375
Geographic location – Urban			2.030	2	.362			
Geographic location – Suburban	-.279	.420	.441	1	.507	.757	.332	1.723
Geographic location – Rural	-.726	.511	2.023	1	.155	.484	.178	1.316
Constant	.730	.804	.826	1	.363	2.076		

Summary

I collected and analyzed data from the electronic health records of individuals referred to diabetes education. The first research question was meant to assess a difference in the completion status of diabetes education between individuals referred by primary care physicians or endocrinologists when controlling for gender, race, age, and geographic location. Using logistic regression, the null hypothesis failed to be rejected. There was no statistically significant relationship between referral source and the completion of diabetes education.

The second research question focused on the modality of visit scheduled and the relationship between the completion of diabetes education when controlling for gender, race, age, and geographic location. I used logistic regression to complete a statistical analysis. The null hypothesis failed to be rejected as no statistically significant relationship was present between the modality of visit scheduled and the completion of diabetes education.

While no statistically significant relationship was found for referral source or modality of visit, two covariates demonstrated a statistically significant effect on the odds of diabetes education completion for both research questions. African Americans were found to be less likely than Whites to complete diabetes education. Additionally, older individuals were more likely to complete diabetes education.

In the proceeding chapter, I will discuss the research findings and the implications of the results. Additionally, I will interpret the results in further detail, outline the significance of the results, and highlight the implications for social change. Lastly, in the next chapter, I will provide recommendations for further research and how to improve completion rates for diabetes education.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this study was to examine the association between the completion of diabetes education, the referring physician's specialty, and the modality of visit scheduled. In this study, I examined potential differences in diabetes education completion rates from patients referred by endocrinologists and primary care physicians and for patients scheduled for in-office appointments and telehealth appointments. The key findings of the study were that there was no statistically significant relationship between the referring physician's specialty and the completion of diabetes education or between the modality of visit scheduled and the completion of diabetes education. Interestingly, two covariates, age and race, were found to be statistically significant in predicting diabetes education completion.

Interpretation of the Findings

There is a lack of quantitative research that examines health service factors that influence the completion of diabetes education: therefore, I conducted this study to provide a new and distinct quantitative investigation into the completion of diabetes education. The primary objecttive of the study was to expand knowledge in the discipline by examining if there was an association between the completion of diabetes education, the specialty of the referring physician, and the modality of visit scheduled. The results indicated there was no statistically significant relationship for referral source (EXP(B) = .744; p = .411) or visit modality (EXP(B) = 1.213; p =.544). The effect of covariates (i.e., age, race, gender, and geographic location) were also examined. In the models with covariates, age and African American status were found to be statistically significant

predictors of the completion of diabetes education within 6 months of referral. While the results did not indicate a statistically significant predictive relationship between the specialty of the referring physician, visit modality, and the completion of diabetes education, this study was still helpful in extending knowledge in the discipline because it provides a baseline study to support further research objectives.

Because diabetes education remains an essential and effective health service in the optimal care of diabetes (American Diabetes Association, 2021a), understanding factors that influence the completion of diabetes education is important in the field of health services. Patients that outright declined a referral to diabetes education or were never referred by their physician were not included in the study. Therefore, caution must be exhibited when generalizing the study results to all patients with Type 2 diabetes, but the study retains value in assessing individuals that were referred to diabetes education.

Diabetes Education Completion

The results indicated a high diabetes education completion rate, with 84.0% of referred patients completing diabetes education within 6 months from the referral being placed. This finding contradicted some past research into diabetes education completion rates as other authors have found that up to 93% of patients with diabetes do not ultimately complete diabetes education (Schäfer et al., 2014; Wadher, 2010). However, this past research was focused on global populations and not individuals within Pennsylvania or the U.S. health system. Additionally, these works were not limited to patients that were distinctly referred and scheduled for diabetes education; instead, the authors looked at broader populations of individuals with diabetes. Research focused on

the United States has indicated slightly better completion rates. In an examination of patients referred to diabetes education, Ruppert et al. (2010) found that 83% of patients ultimately completed diabetes education. The current study supported this finding because 84% of the referred patients in the current study did complete diabetes education. Still, given the known importance of diabetes education and historically low completion rates, more research is needed to understand health system factors that influence completion rates and why some patients are not referred to diabetes education.

Specialty of Referring Physician

Because there was limited or no specific literature dedicated to the completion of diabetes education based on the specialty of the referring physician, this study has contributed initial knowledge to the discipline. Past research reviewing physician specialty differences in diabetes care has found mixed results in diabetes outcomes and compliance between primary care physicians and endocrinologists; however, none of these past studies on physician specialty differences were focused specifically on the completion of diabetes education (Kirkman et al., 2015; Setji et al., 2019). Rather, the past studies examined the specialty of the referring physician and diabetes outcomes that were focused on medication compliance or achieving glycemic control.

Kirkman et al. (2015) found that there was no statistically significant difference in diabetes medication adherence based on the prescribing physician's specialty. However, in evaluating glycemic control between patients receiving their primary diabetes care from endocrinologists or primary care physicians, Setji et al. (2019) found that patients under the care of endocrinologists were able to achieve glycemic control quicker than

patients seen only by primary care physicians. While there was a known divergence in the literature prior to the current study, I expected my research to favor Setji et al.'s findings in that endocrinologists would have more success with compliance and, thus, have higher diabetes education completion rates. This proposition was supported by the findings of Leinung et al. (2000) that indicated compliance with treatment recommendations is better for endocrinologists than primary care physicians in the management of diabetes. Ultimately, the current study did not support the findings of Setji et al. and agreed with the findings of Kirkman et al. in that there was no difference in service completion, adherence, or compliance between physician specialties.

Other literature on physician referrals or referral sources to diabetes education has focused on when to refer patients or how physicians perceive the need for diabetes education and refer patients to diabetes education programs (Gucciardi et al., 2011; Harris et al., 2018; Krall et al., 2018; Powers et al., 2015). This research has highlighted the importance of diabetes education referrals and when to refer patients, but there remains limited knowledge on how a physician's specialty influences the completion of diabetes education. Powers et al. specifically outlined critical times in which to refer patients to diabetes education and the efficacy of diabetes education in improving outcomes but did not explore referral patterns or completion rates between physician specialties.

Bajaj et al. (2016) examined diabetes education completion before and after referral to a specialist and found higher diabetes education completion rates after referral to a specialist. Their study emphasized early referrals to diabetes specialist centers at the

onset of a diabetes diagnosis to compare complication rates and risk management between specialists and primary care physicians. Their study was not directly focused on the referring physician specialty as a factor in the completion of diabetes education, but the authors provided key knowledge to the field by examining diabetes education completion rates before and after referral to a specialist. In contrast, the current study unequivocally examined diabetes education completion rates and found no statistically significant difference in completion rates between physician specialties. Therefore, the current study provided a baseline or foundational approach to how physician specialty is associated with the completion of diabetes education. Further research is necessary to explore a potential relationship or differences between how health services, including diabetes education, are utilized based on referring physician specialty.

Visit Modality

The current study did not find a statistically significant relationship between the modality of visit scheduled and the completion of diabetes education within 6 months of referral. The current study provides foundational knowledge to the field because there is a lack of research comparing diabetes education completion rates between telehealth and in-office appointments. Much of the past research on telehealth and diabetes education has focused on the effectiveness, support, and adoption of services (Bashshur et al., 2015; Levin et al., 2013; Melo et al., 2020; Siminerio et al., 2014). While the current study was not aimed at examining the efficacy of diabetes education completed through telehealth appointments, the results confirmed the past findings of strong support and adoption of

telehealth services, showing that 85.4% of referred patients that were scheduled for telehealth appointments completed diabetes education within 6 months from referral.

Telehealth remains a newer frontier among health service applications. While telehealth is helpful to rural individuals, there are broader applications to reducing inequality. More specifically, the benefits of diabetes education provided through telehealth appointments are not limited to overcoming transportation or geographic issues; rather, patients in all geographic areas can benefit from diabetes education offered through telehealth appointments (Walker et al., 2011). Additionally, as Izquierdo et al. (2003) found that diabetes education conducted by telehealth appointments was equally effective as in-office diabetes education in improving glycemic control, offering diabetes education by a patient's choice of visit modality has broader implications for improving diabetes education completion rates. The high diabetes education completion rate for telehealth appointments shown in the current study is encouraging for future applications and research into telehealth service utilization.

Focusing on inequality and health access issues, Barker et al. (2016) found that telehealth services can be useful in addressing the logistical, transportation, and geographic constraints or limitations in completing health services. Accordingly, telehealth has been important in reducing the impact of geographic isolation and transportation issues on the completion of health services. However, the results of the current study did not indicate that individuals were more likely to complete a health service based solely on the modality of visit scheduled. Concerns remain about inequality in telehealth service utilization (Melo et al., 2020). Zhang et al. (2021) found that

uninsured individuals and individuals with limited access to broadband were less likely to utilize telehealth services. Similarly, Gallegos-Rejas et al. (2022) found that individuals with lower socioeconomic status, culturally and linguistically diverse individuals, and individuals with disabilities were less likely to utilize telehealth services. The current study did not directly address inequality in diabetes education completed through telehealth, but future research into this area is necessary to better understand the completion of diabetes education by diverse individuals.

An important distinction regarding the current study is that it was completed entirely during the COVID-19 pandemic, so pandemic regulations may have skewed the utilization of telehealth services versus traditional, in-office appointments. Approximately 45% of the patients in the current study were scheduled for telehealth appointments. This large percentage of telehealth appointment utilization during the COVID-19 pandemic was consistent with the findings of other researchers. Anthony (2021) found that telehealth services rapidly rose from approximately 1% of appointments prior to the COVID-19 pandemic to upwards of 70% of appointments during peak COVID-19 infection periods. Likewise, Karimi et al. (2022) found dramatic increases in telehealth service utilization during the COVID-19 pandemic in which as many as 25% of individuals utilized telehealth services within their 4-week study period. The current study results confirmed the high utilization rates of telehealth appointments during the COVID-19 pandemic. A repeat study conducted during time periods with less stringent pandemic regulations for in-office appointments or social gatherings may have different results.

Covariates

Race

Gaskin et al. (2014) found that access to diabetes care and diabetes education is not equally distributed across racial groups. The current study findings confirmed that racial/ethnic statuses influence the completion of diabetes education. In examining diabetes control, Saydah et al. (2007) found that African Americans were less likely than Whites to achieve optimal glycemic control. Likewise, Heidemann et al. (2016) found that African American patients had higher diabetes prevalence and worse control of their diabetes than White patients. The current study results aligned with these findings, indicating that African Americans were 69.5% less likely to complete diabetes education than Whites. Race remains an important factor in diabetes inequality and the completion of diabetes education.

Age

Perkins et. al (2021) found that younger individuals were less likely than older individuals to complete diabetes education. While Garcia-Dominic et al. (2014) found that individuals over 65 years of age have higher rates of Type 2 diabetes than younger adults, there are concerns about younger individuals not achieving optimal diabetes care and completing diabetes education. Individuals diagnosed with Type 2 diabetes as young adults have higher lifetime risks for complications, including cardiovascular disease, kidney disease, extremity amputation, and diabetic retinopathy (Huo et al., 2016; Kelsey et al., 2016; Rhodes et al., 2012; Solis-Herrera et al., 2014). The current study findings confirmed that older individuals were more likely to complete diabetes education than

young individuals. Specifically, the results indicated that for each 1-year increase in age, an individual was 2.7% more likely to complete diabetes education within 6 months from referral. This extension of knowledge in the field is important to addressing disparities for younger individuals with Type 2 diabetes that are less likely to complete diabetes education.

Gender

The study results did not indicate that gender was a statistically significant predictor of diabetes education completion, but the current study did extend knowledge in the field by examining this covariate. Some past research has examined gender differences in diabetes service utilization and diabetes outcomes, but there is limited research into gender differences and the completion of diabetes education. Specifically, concerning underrepresented groups, Hawkins et al. (2016) found that men have strong beliefs about maintaining a strong image and controlling their own actions that may negatively influence their health behaviors. Likewise, African American and Latino men are less likely than women to complete diabetes education or to have optimal diabetes control (Hawkins et al., 2019; Liburd et al., 2007). While these studies have provided foundational knowledge in the field, larger studies are needed to generalize the findings across racial groups. Because men have higher rates of Type 2 diabetes than women, it is important to continue research into potential gender differences as a predictor of diabetes education completion (Garcia-Dominic et al., 2014).

Geographic Location

In the current study, geographic location was not a statistically significant predictor of the completion of diabetes education. These results differed from past research in the discipline, but the study conditions were not completely similar. Hale et al. (2010) found that rural residents were less likely than urban residents to complete diabetes education, but telemedicine services were not readily or universally available to all the participants; additionally, the authors utilized a broad definition of rural that may have masked the exact impact on truly remote or very small rural counties. While the current study results contradicted these previous findings, there were significant differences in methodologies, definitions, and diabetes education service offerings to explain the divergence in findings.

There have been many health system changes in the past decade that may have contributed to the variation in study results. Since 2010, more than 106 rural hospitals have closed, resulting in additional health care access limitations and reductions in service availability for rural residents (McCarthy et al., 2021). Relating to diabetes education programs, Probst et al. (2019) found that 62% of rural counties in the United States had no diabetes education programs, and those rural counties that had diabetes education programs available had higher education and income levels; operating diabetes education programs in rural areas is often not cost effective, which makes it difficult to establish additional programs. Given these recent health system changes and a reduction in local service availability for some individuals, it is important to continue research into the use of telehealth in addressing disparities in service completion among individuals

from various geographic locations. The current study findings did extend knowledge in the field of health services because telehealth services may decrease the impact of rural residents in traveling long distances to receive diabetes education and the limited availability of diabetes educators in rural areas.

Conceptual Framework

Levesque et al. (2013) provided a conceptual framework of health care access that established the utilization of health care services is rooted in five dimensions of accessibility of services and five abilities of potential users. The five dimensions of accessibility of service are approachability, acceptability, availability and accommodation, affordability, and appropriateness, while the five abilities of potential users are the abilities to perceive, seek, reach, pay, and engage. I used these dimensions of accessibility of service and the abilities of potential users to guide the current study and better understand the complexity of health service access and service delivery. Based on Levesque's conceptual framework, there are factors that need to be aligned or addressed for successful health service completion. More specific to diabetes education, Zare et al. (2020) established that there are a myriad of issues and barriers that need to be addressed to facilitate the completion of diabetes education.

Several of the dimensions of accessibility of service and abilities of potential users were previously mitigated or addressed by the partner academic medical center to better facilitate the delivery of diabetes education. All diabetes education included in this study was offered at no charge to patients. Potential cost issues should have been mainly alleviated, but there may still be other costs impacting patient attendance that are difficult

to measure or account for such as lost wages, transportation costs, and other financial barriers. Additionally, all participants in the study were offered the choice of an in-office or telehealth appointment; this should have reduced many of the logistic barriers associated with completing diabetes education, but not all patients have the capability or capacity to complete a telehealth appointment. Krall et al. (2021) found that practice-based diabetes education reduced many of the barriers faced by physicians in referring patients to diabetes education. In the current study, each physician office had a diabetes educator completing in-office visits in the same location as the physician; therefore, some of the issues associated with the accessibility of services may have been mitigated in this study by the partner academic medical center's allocation of resources.

While the partner academic medical center attempted to address many of the dimensions of accessibility of service and abilities of potential users, the completion of diabetes education remains a complex issue with numerous barriers. Levesque's conceptual framework has many elements, and it may not be possible to preemptively address each issue or barrier for each individual patient. One potentially difficult issue in the completion of diabetes education is the patient's ability to perceive the benefits. Health service organizations and health care providers have continued to struggle in helping patients understand the perceived benefits of diabetes education. Negative attitudes or feelings towards diabetes education and the lack of a perceived benefit remain critical barriers for patients to complete diabetes education (Horigan et al., 2017). Findlay-White et al. (2020) expressed that perceived or real barriers may be complicated by emotional, cognitive, and social issues associated with the diagnosis of diabetes.

Given the known benefits of diabetes education but low completion rates, it remains a challenge for health service organizations to properly convey the benefits of diabetes education and improve completion rates (Schäfer et al., 2014; Wadher, 2010). Perceiving the benefits of a health service is only one ability of a potential user according to Levesque's conceptual framework, but this area remains a significant challenge in the context of diabetes education.

Limitations of the Study

The results of the current study should be considered in light of several limitations. The quick adoption and sustained use of telehealth services during the COVID-19 pandemic may have led to a disproportionate percentage of diabetes education visits being scheduled as telehealth. If I would have conducted the current study during a time period outside of the COVID-19 pandemic, the amount of telehealth versus in-office appointments scheduled by participants may have been significantly different. However, the higher telehealth utilization may point to an emerging trend in healthcare moving forward. Predmore et al. (2021) found that nearly two thirds of individuals preferred to maintain at least some use of telehealth services in the future. Still, it may be difficult to generalize the results to time periods outside of the COVID-19 pandemic or to larger populations.

A second limitation of the study was that I conducted the study within only one academic medical center in Pennsylvania. Other medical centers or health systems may have varied diabetes education completion rates that could be attributed to differences in health access issues, the fees or costs associated with diabetes education, or the

availability of diabetes educators within physician practices among other factors. Additionally, some health systems or health service organizations may have fewer health service offerings via telehealth appointments making it difficult to generalize the study findings to other geographic areas or populations.

A third limitation of the study was that I assumed and relied upon the electronic health record to be accurate at the time of data abstraction. It was impossible to confirm whether age, race, gender, and geographic location were accurate, but this assumption was necessary to complete the study. Visit modality, referral source, and the completion of diabetes education were verified in the electronic health record. It is unlikely yet possible that the electronic health record was widely inaccurate for these variables. The accuracy and quality of data recorded and abstracted from electronic health records have been well studied. While more developed standards may be needed across health service research, the use of electronic health records and the satisfactory quality of data have been supported (Feder, 2018; Kahn et al., 2015). Furthermore, Zozus et al. (2015) noted that data abstraction from medical records remains an effective and reliable method of collecting health data and is widely used in health service research.

As noted in Chapter 1 and supported by the conceptual framework for this study, there are many issues and confounding factors that may influence an individual's ability to complete diabetes education. Therefore, it can be difficult to effectively account for numerous confounding factors that may differ greatly between individuals, geographic areas, or health systems. Still, throughout this study, I attempted to account for covariates including age, race, gender, and geographic location. Despite the stated limitations, the

results of this study are helpful for future investigations as additional covariates and factors are examined.

Recommendations

Due to potential cost, time constraints, and efficiency concerns, an interventional or prospective cohort design was not feasible for my dissertation project. However, the results of the retrospective study that I completed suggest future research efforts accounting for additional covariates would be meaningful to better understand the completion of diabetes education. It would be prudent to add income and education as covariates to future studies to understand how socioeconomic factors influence the completion of diabetes education. Fleischer et al. (2016) found that disparities exist among diabetes prevalence yet there is limited research into how socioeconomic status, income, or education levels influence the completion of diabetes education. Furthermore, diabetes education programs targeted at culturally diverse or underserved populations have been successful in improving glycemic control, but little research has been completed to understand the specific socioeconomic factors associated with the completion of diabetes education (Brown et al., 2021).

Future prospective studies are key to better understanding the completion of diabetes education within the context of Levesque's dimensions of accessibility of services. Variables to understand how patients perceive the benefits of diabetes education at the time of the referral as well as variables to understand patient's abilities to attend and level of engagement are crucial to furthering knowledge in the discipline. I also recommend that future studies examine how long it takes from an initial diagnosis of

Type 2 diabetes to when diabetes education is completed. Due to the potential and severity of complications related to diabetes, it is important to better understand the factors that delay or impede the completion of diabetes education.

Implications for Social Change

Based on the results of this study, I expect that positive social change will be initiated through more informed health service organization decision-making and public policy directives. Public policy in Pennsylvania has already been focused on improving completion rates of diabetes education.The Commonwealth of Pennsylvania (2018) took action to improve access to diabetes education and utilization; these efforts were undertaken due to the recognition that diabetes education can decrease mortality and reduce complications. The results of the current study can be used to target interventions more effectively toward younger individuals with Type 2 diabetes and African Americans. The results of current study indicated these individuals are less likely to complete diabetes education. Therefore, targeting programs and policies towards underrepresented groups and younger individuals with Type 2 diabetes may be helpful in improving diabetes completion rates among potentially vulnerable populations and enacting positive social change.

Given the vast research on the positive outcomes and reduction in complications associated with the completion of diabetes education, there remain opportunities to improve equality in access to care, acceptance in education, and health outcomes (Duncan et al., 2011; Turner et al., 2018; Urbanski et al., 2008). The results of the current study helped to identify predictors of diabetes education completion and can be the basis

for focusing efforts on younger individuals and African Americans that are less likely to complete diabetes education within 6 months from referral than older individuals and Whites. Likewise, health service organizations may also choose to help or allocate resources toward individuals that are less likely to complete diabetes education.

Conclusion

Diabetes education remains an underutilized yet critically important component of optimal diabetes care (American Diabetes Association, 2021a; Beck et al., 2017; Horigan et al., 2017; Kent et al., 2013; Schäfer et al., 2014). The overarching goal of the current study was to determine if there was an association between referral source, visit modality, and the completion of diabetes education. While I did not find a statistically significant relationship between the referring physician's specialty, modality of visit scheduled, and the completion of diabetes education, the current study did extend knowledge in the field and helped to better understand the complex factors that influence the completion of diabetes education. As there has not been any research on how the specialty of the referring physician or the modality of visit scheduled influence the completion of diabetes education, this current study served as a basis or foundation for health service organization decision-making and future research efforts.

With an already established Healthy People 2030 goal aimed at increasing the number of people diagnosed with diabetes who receive diabetes education (Pennsylvania Department of Health, 2020), efforts such as the current study that are aimed at understanding factors that influence the completion of diabetes are impactful. Understanding the predictive indicators of the completion of diabetes is critically

important to addressing inequality and promoting positive social change. The current study has presented an original examination into the association between the referring specialty physician, modality of visit scheduled, and the completion of diabetes education that can be used as a foundation and catalyst for informed decision making and future research.

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