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# Changes in Patient Knowledge and Adherence to Glaucoma Treatment After Educational Intervention

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Abstract

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Dissertation Submitted in Partial Fulfillment

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Abstract

Primary open-angle glaucoma is the most common form of glaucoma and the second-leading cause of preventable blindness worldwide. Although timely diagnosis and proper adherence to therapeutic regimen prevent blindness, patient nonadherence continues to be the greatest challenge to effective treatment. Preliminary research suggested that culturally interactive education delivery may increase patient adherence. However, this education intervention had not occurred with glaucoma treatment. The transtheoretical model of behavior change served as the framework for this study. The research questions addressed the effect that glaucoma education provided by a culturally competent patient navigator had on patient knowledge of glaucoma, adherence to medication use, and follow-up appointment attendance. This quantitative study had a longitudinal design with archival data from 206 Russian Eastern European immigrant patients. The control group had a standard appointment with an ophthalmologist, and the experimental group had an interactive educational experience with a patient navigator after the standard appointment. The navigator administered the Glaucoma Knowledge Index at three time points: before the appointment (T1), after the appointment (T2), and at a 1-month follow-up (T3). The intervention group showed a statistically significant increase in glaucoma knowledge retention at T2 and T3. However, this increase in knowledge did not correspond to a statistically significant difference in patients' adherence to follow-up eye exam attendance or ocular medication adherence. The outcome of this study may form the basis for discussions among policymakers leading to positive social change.

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# Chapter 1: Introduction to the Study

Glaucoma causes progressive damage to the optic nerve and is the leading cause of irreversible blindness worldwide (Abdull et al., 2016). Blindness from glaucoma is avoidable with early diagnosis and appropriate, sustained life-long treatment (Abdull et al., 2016; Kyari et al., 2016). With adequate knowledge, adherence to follow-up care, and proper ocular medication utilization, patients can prevent blindness from this disease. However, many patients fail to adhere to treatment recommendations and lose most of their vision (Nowak & Smigielski, 2015).

Poor outcomes in patients with glaucoma often stem from barriers to care, such as difficulty traveling to appointments, poor access to eye care, the prohibitive cost of eye exams and treatment, and ocular medication noncompliance (Davis et al., 2018; Johnson et al., 2016; C. X. Zheng et al., 2016). Another significant reason for nonadherence to treatment is a lack of understanding of the glaucoma diagnosis and its severity, especially when the patient is asymptomatic (Nowak & Smigielski, 2015; van Zyl et al., 2015; C. X. Zheng et al., 2016). The absence of symptoms in almost all glaucoma patients can increase the risk of treatment nonadherence (De-Gaulle & Dako-Gyeke, 2016). Nonadherence to ocular medication and follow-up medical care leads to irreversible vision loss, preventable falls and injuries, decreased quality of life, social isolation, and depression (Tan et al., 2018; D. D. Zheng et al., 2018).

Chapter 1 presents a discussion of the background of the research and the problem statement as well as the purpose of the study, research questions, and hypotheses. I provide the theoretical framework, the nature of the study, definitions, assumptions, scope, delimitations, and limitations. The chapter concludes with the significance of the study and a summary.

## Background

Glaucoma is a chronic optic neuropathy resulting in visual field defects, progressive vision loss, and blindness (Zhang et al., 2015). Glaucoma is the second-leading cause of irreversible blindness in the United States, with New York State reported to have one of the highest rates of glaucoma (National Academies of Sciences, Engineering, and Medicine, 2016; Prum et al., 2016). Given the rapidly aging U.S. population, the National Academies of Sciences, Engineering, and Medicine (2016) predicted that glaucoma would increase by 50% to 3.36 million people in 2020. The estimated annual U.S. health care costs associated with glaucoma are $2.9 billion, with the increasing prevalence of glaucoma expected to cause a significant economic and quality-of-life burden (Callinan et al., 2017). The prevalence of this disease varies greatly across ethnic and racial groups (Gupta et al., 2016; Hark et al., 2017; Komolafe et al., 2013; Nowak & Smigielski, 2015; Prum et al., 2016).

Primary open-angle glaucoma (POAG) is the most common form, affecting 2.2 to 2.7 million Americans (Mahabadi et al., 2019). Asymptomatic until the optic nerve damage is severe, POAG develops slowly and is associated with poor drainage of the aqueous humor, leading to elevation of intraocular pressure and subsequent damage to the optic nerve ganglion cells (Dietze et al., 2019). The prevalence of POAG is often higher in individuals of African descent, with minimal data available about POAG rates among Eastern Europeans who have immigrated to the United States (Murdoch et al., 2020; Nowak & Smigielski, 2015). However, in 2010, POAG was highest among Eastern European immigrant populations and represented 23.9% of those with POAG worldwide (Centers for Disease Control and Prevention [CDC], 2015; Nowak & Smigielski, 2015; Quigley & Broman, 2006).

Patient nonadherence to physicians' prescribed therapeutic regimen is the greatest challenge to treating patients with glaucoma effectively (Varma et al., 2016). Several barriers contribute to patient nonadherence to glaucoma treatment and follow-up care. Patients with glaucoma have reported difficulty finding transportation to eye care appointments without access to a car, someone to accompany them, and the social support needed to comply with follow-up care (Ibrahim et al., 2015; C. X. Zheng et al., 2016). Additionally, patients might lack education about their condition, experience significant discomfort from ocular glaucoma medications, receive inadequate eye drop instillation training, and deny the risk of blindness due to the asymptomatic nature of glaucoma (Davis et al., 2018; Thompson et al., 2015; Varma et al., 2016).

Livne et al. (2017) demonstrated that patient education is an essential component of the care provided by health care professionals. Educating patients about their chronic conditions will lead to improved patient participation in self-care, increased quality of life, and better psychological and physiological outcomes. Patient education also contributes to decreased stress, anxiety, and costs associated with blindness and falls. Livne et al. discovered that education influenced patients' motivation to follow recommendations, consequently improving treatment compliance. Despite these benefits, patient teaching has received little attention as, after receiving a chronic glaucoma diagnosis, patients receive insufficient information about their illness and appropriate care (Killeen et al., 2020; Livne et al., 2017).

Economic forces have driven a private-practice focus on productivity and efficiency, with performance metrics pushing physicians to see higher volumes of patients with less time for each (Rider et al., 2018). Additionally, frequent cuts in managed care reimbursements force physicians to work faster to maintain their income, decreasing the time spent in meaningful interactions and compromising the traditional patient–doctor relationship (Rider et al., 2018). In the 1995 Commonwealth Fund Survey, 41% of physicians noted a decline in the amount of time spent with patients (Dugdale et al., 1999).

Among patients complying with ocular medication treatment, inadequate education about proper administration of glaucoma drops leads to ineffective medication delivery and continuing eye damage (Davis et al., 2018). Unlike traditional medical specialties, where the role of education belongs to nurse professionals, the field of ophthalmology does not have a nursing specialty. Accordingly, there is a significant patient education gap in ophthalmological health care delivery specific to glaucoma. Despite efforts made to justify the role of ophthalmic nurses, there has been nothing done to propel this specialty forward (Moradi, 2016).

In the 1990s, Freeman developed the concept of a patient navigator to reduce barriers to breast cancer care in Harlem, New York (Freeman & Rodriguez, 2011). Since then, primary care settings have adopted the approach, as a trained person (patient navigator) engages with patients to educate them and improve health care access (Peart et al., 2018). Recently, patient navigator duties have extended to addressing barriers patients have to care, such as providing education about their conditions and coordinating appointments. These services are especially important for vulnerable populations who find their access to care compromised by a range of geographic, demographic, socioeconomic, or cultural characteristics (Peart et al., 2018). In a 1-year randomized, controlled trial, Hark, Johnson, et al. (2016) evaluated the impact of a patient navigator on glaucoma eye care follow-up adherence in an urban community setting versus an office-based setting. The researchers found that help from a patient navigator did not increase the likelihood of keeping follow-up appointments; however, the authors believed this was due to inconsistent follow-up appointment schedule and patient self-selection. Hark, Johnson, et al. did not analyze the value of patient navigators in educating patients about glaucoma or ocular medication administration.

Research has indicated that half of glaucoma cases are undiagnosed, and this rate is even higher among at-risk populations (Fudemberg, Amarasekera, et al., 2016). Without appropriate treatment and routine long-term follow-up care, glaucoma can cause irreversible vision loss (Hark et al., 2017). Patient nonadherence to glaucoma treatment exacerbates the disease, leading to irreversible blindness (Hahn & Truman, 2015). However, when patients and medical providers adhere to recommended standards of care, the risk of blindness significantly declines (Hahn & Truman, 2015; Sleath et al., 2014).

## Problem Statement

The asymptomatic nature of POAG means the disease frequently remains undiagnosed until the advanced stages (Hark, Waisbroud, et al., 2016). Early diagnosis is critical to preventing blindness; by the time patients become symptomatic, severe and irreversible damage has already occurred. Despite aggressive therapy, initiating available treatment at late diagnostic stages cannot stop disease progression (Zhang et al., 2015). POAG most affects individuals who are at risk for socioeconomic disadvantage and are unable to schedule regular eye screenings due to their lack of knowledge, inability to understand the diagnosis, and scarcity of financial means for copayments and travel (Sapru et al., 2017). Certain ethnic groups, such as Russian Eastern Europeans, have a genetic predisposition to developing POAG (Nowak & Smigielski, 2015).

Research evaluating education's effectiveness in improving health-related outcomes showed that education was a means to intentionally engage patients in self-care while promoting health equality in at-risk populations (Hahn & Truman, 2015). The provision of such education requires high-level patient–physician engagement (Hark, Waisbroud, et al., 2016). However, due to the economic pressures on medical providers, many physicians no longer have the resources for this time-consuming process (Rider et al., 2018). The gap in research addressed by the current study pertained to the effectiveness of education provided by the patient navigator in patients' native language on their knowledge and understanding of glaucoma, as well as their adherence to follow-up care and prescribed ocular medications. To reduce this gap, I analyzed archival data from a private glaucoma clinic in New York.

## Purpose of the Study

The purpose of this quantitative study was to examine the effect of education about glaucoma through a patient navigator on patient knowledge of glaucoma and patient adherence to follow-up care. The process entailed examining a randomly split convenience sample of 206 participants into two equal groups to compare whether additional education in one group produced an effect on glaucoma knowledge, adherence to ocular medication use, and follow-up appointment attendance. Group 1 was a control group that received a standard exam; Group 2 received the standard exam and additional education provided by a patient navigator. Participants were from the Russian Eastern European immigrant population at a private glaucoma specialty clinic in New York. Determining patients' glaucoma knowledge entailed the administration of the Glaucoma Knowledge Index (GKI) at three time points: before the exam (T1), immediately following the exam in Group 1 and the exam and additional education in Group 2 (T2), and at a 1-month follow-up appointment (T3). The goal of gathering data at T1 was to measure patients' baseline information about glaucoma. T2 served as a manipulation check to determine whether the provided education was effective and whether there were differences between Group 1 and Group 2 in knowledge comprehension and retention after the appointment. Finally, data gathered at T3 showed whether participants had a significant, persistent, meaningful change with a lasting effect for subsequent recommendation to health care providers. Also evaluated at the 1-month follow-up appointment was whether patients attended appointments and used their drops as prescribed.

**Figure 1**

*Consort Diagram for the Study Design*

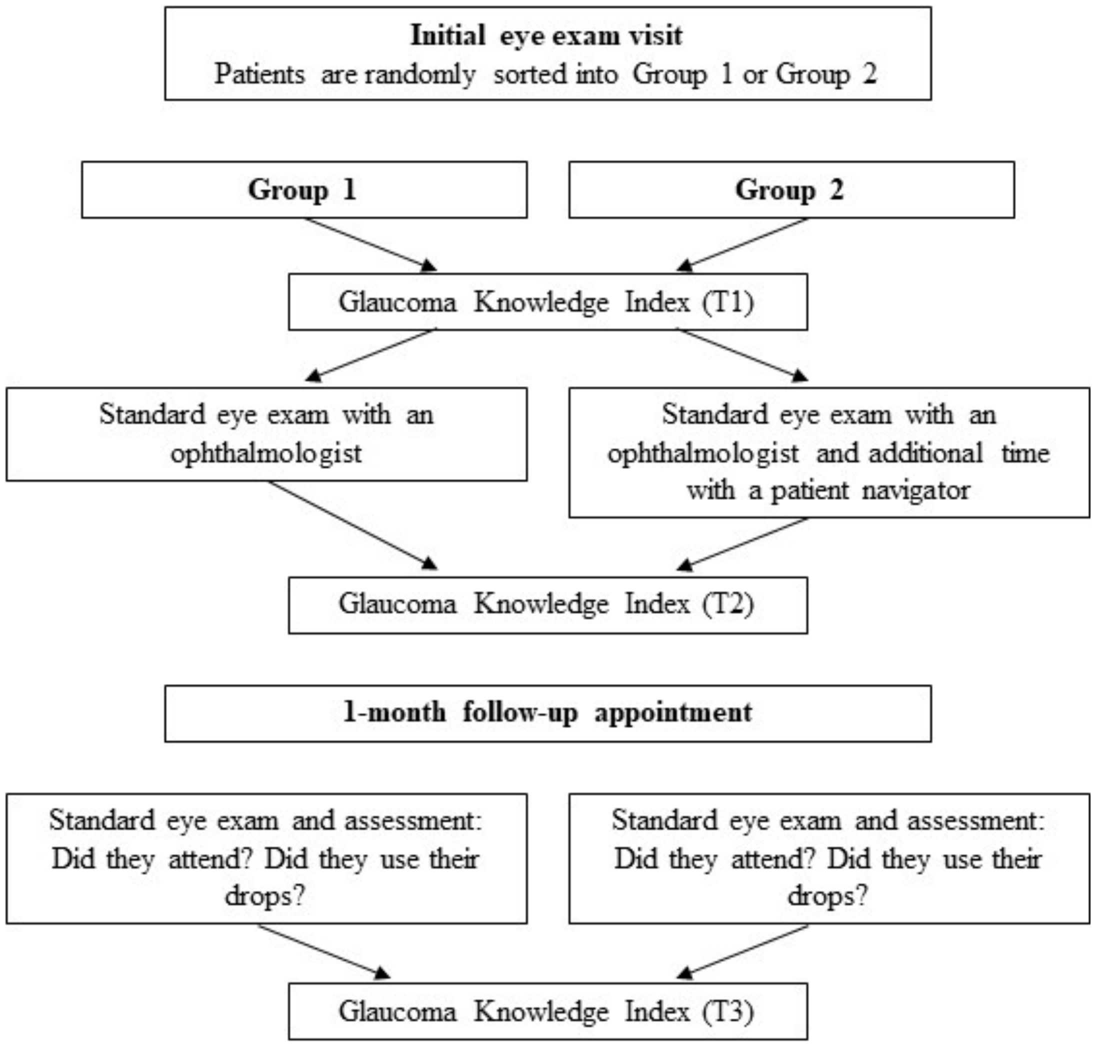


Figure 1 presents a detailed consort diagram for the study design. The study outcome could be key to encouraging ophthalmological practices treating glaucoma patients to hire and train culturally competent staff to fulfill the role of patient navigators. Additionally, the findings could bring awareness to the growing need for patient education among vulnerable, at-risk populations and encourage other researchers to conduct more extensive studies in other specialties of ophthalmological patient care.

## Research Questions and Hypotheses

This was a quantitative study with five research questions (RQs).

RQ1: Are there significant differences between pretest and posttest in knowledge of glaucoma as a function of whether patients are provided with additional education?

$H_0$1: There are no significant differences between pretest and posttest in knowledge of glaucoma.

$H_a$1: There are significant differences between pretest and posttest in knowledge of glaucoma.

RQ2: Are there significant differences between the two groups in knowledge of glaucoma as a function of whether patients are provided with additional education?

$H_0$2: There are no significant differences between the two groups in knowledge of glaucoma.

$H_a$2: There are significant differences between the two groups in knowledge of glaucoma.

RQ3: Is there an interaction effect between time and group in knowledge of glaucoma as a function of whether patients are provided with additional education?

*$H_0$*3: There is no interaction effect between the time and group in knowledge of glaucoma.

*$H_a$*3: There is an interaction effect between the time and group in knowledge of glaucoma.

RQ4: Is patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up appointment at T3 dependent on whether patients were exposed to education about glaucoma?

*$H_0$*4: The patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up appointment at T3 is not dependent on whether patients were exposed to education about glaucoma.

*$H_a$*4: The patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up treatment at T3 is dependent on whether patients were exposed to education about glaucoma.

RQ5: Is patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 dependent on whether patients were exposed to education about glaucoma?

*$H_0$*5: The patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 is not dependent on whether patients were exposed to education about glaucoma.

*$H_a$*5: The patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 is dependent on whether patients were exposed to education about glaucoma.

## Nature of the Study

This study was conducted to examine the effect of patient education about glaucoma through a patient navigator on patient adherence to follow-up care among Russian Eastern European immigrant patients at a private glaucoma clinic in New York. I used archival data with an experimental, descriptive design to evaluate whether education about glaucoma provided by a patient navigator affected patient knowledge of glaucoma, adherence to medication utilization, and attendance at follow-up appointments. Determining the experimental descriptive component was by pre- and postlevels of knowledge, medication use, and attendance to follow-up appointments. The findings from the study were sufficient to answer five RQs with the independent variable (IV) of education about glaucoma and the three dependent variables (DVs) of patient knowledge about glaucoma, attendance at follow-up appointments, and adherence to using prescribed ocular medications.

## Theoretical Framework

The theoretical framework for this study was the transtheoretical model (TTM), or the stages of change developed by Prochaska and DiClemente in the 1970s (Prochaska et al., 1992). This model holds that individuals have an enormous capacity to change harmful or undesirable behavior. This integrative, biopsychosocial model incorporates the stages through which individuals pass to achieve sustained behavioral change (Prochaska et al., 2013). The five stages are precontemplation, contemplation, preparation, action, and maintenance. Researchers have often used TTM to address behavioral changes, such as smoking cessation, drinking, or overeating. Inherent in this model is the recognition and acceptance that change unfolds over time (Prochaska et al., 2013). TTM serves as a guide to assess an individual's readiness to act on a new, healthier behavior, providing knowledge to inform providers about patients' readiness to accept new information. Providers can determine whether patients are ready to receive information about the benefits of implementing the new, changed behavior or whether this information might overwhelm them.

After receiving a novel diagnosis of glaucoma, which requires highly involved care and multiple follow-up visits, patients in the asymptomatic early stage might be resistant to adopting new behavior. TTM helped me determine why some patients are motivated to change their behavior and others are resistant. In accordance with the TTM model, because change is a phenomenon of time, bringing these patients back in 1 month for a follow-up appointment helped me to evaluate the sustainability of behavioral change.

## Definitions of Terms

The following terms received mention in this study:

*Adherence to follow-up treatment*: I measured adherence to glaucoma follow-up treatment by the participants' attendance to a mandatory follow-up examination as requested by the ophthalmologist. In the past, adherence to glaucoma follow-up treatment meant attending the follow-up medical exams and agreeing to do the diagnostic testing, as directed by the diagnosing physician (Movahedinejad & Adib-Hajbaghery, 2016).

*Adherence to the use of prescribed medication*: Measuring adherence to the use of prescribed medication was done by the information gathered at the follow-up exam. This term describes the extent to which patients administer their glaucoma medications exactly as prescribed (Newman-Casey, Blachley, et al., 2015; Newman-Casey, Shtein, et al., 2016).

*Education about glaucoma*: Education about glaucoma referred to the time the patient navigator spent with the participants after the ophthalmologist gave them the diagnosis. This education involved reviewing what POAG uses as an eye model, a description of how the disease progresses, the meaning of elevated intraocular pressure, and the importance of adherence to the ophthalmologist-prescribed treatment as well as the necessity of attending the follow-up exams. All communication was available in Russian and in English to ensure that patients could comprehend the provided information.

*Glaucoma*: Glaucoma includes several complex eye disorders causing permanent degeneration of the optic nerve and retinal cells, progressing to visual compromise and eventual blindness (Wiggs & Pasquale, 2017). Marked by an increase in intraocular pressure, glaucoma is largely asymptomatic, leading to late diagnosis. The disease is the second-leading cause of irreversible blindness in the United States (Prum et al., 2016).

*Glaucoma Knowledge Index*: Celebi (2018) developed GKI in assessing knowledge and awareness of glaucoma among subjects with glaucoma and their normal first-degree relatives. Administered in the current study at T1, T2, and T3, the GKI provided information on patients' knowledge and understanding of glaucoma.

*Knowledge of glaucoma*: Evaluating patient knowledge about glaucoma in the current study was through the GKI (see Celebi, 2018). This instrument is a way to gather basic information about an individual's glaucoma knowledge.

*Primary open-angle glaucoma*: POAG is one of the two main types of glaucoma, the other being closed-angle glaucoma. POAG affects peripheral vision first, with gradual and progressive visual field loss unnoticed until significant and permanent damage has occurred (Greco et al., 2016).

## Assumptions

One assumption of this study was that the private glaucoma clinic collected the archival data correctly, following the appropriate assessment protocol. This assumption was necessary because I was unable to confirm the means of data collection by the clinic. Another assumption was that people want to get better and take their medications as prescribed. I also assumed that patients understood they were participating under their free will and that if they had refused participation, the clinic would not have withheld or denied medical care. It was my assumption that the participants were honest in the way they answered questions and reported the use of the prescribed medications.

Assumptions for the repeated measures analysis of variance (ANOVA) included normality, sphericity, and homogeneity of variance. Testing assumptions for the chi-square test of independence were that each participant contributed data to only one cell and that the chi-square was a nonparametric test that did not assume a normal distribution. More detailed descriptions of the statistical test assumptions are in Chapter 3.

## Scope and Delimitations

McGregor et al. (2018) found poor outcomes in patients with glaucoma often attributed to barriers to care, such as limited knowledge about glaucoma, poor access to and utilization of eye care, lack of adherence to follow-up exams, and inadequate medication administration. The researchers identified additional barriers to glaucoma management and treatment to be denying the risk of blindness, lower education level, poor patient–provider communication, and low health literacy levels. These factors likely contribute to disparities related to glaucoma detection, treatment, management, and follow-up eye care. The scope of the current study was to evaluate whether exposure to education through a patient navigator would have an effect on patient knowledge about glaucoma as well as patient adherence to follow-up appointments and prescribed ocular medication. The archival data were from a private glaucoma clinic in New York serving the Russian Eastern European immigrant population.

One delimitation was that the studied population was limited to high-risk Russian Eastern European immigrants residing in New York, in geographically isolated communities with significant socioeconomic disparities. Another delimitation associated with this study was that although the practice collected data on all patients, I analyzed data only on new patients with a first-time glaucoma diagnosis. This decision was a means to eliminate possible contamination by prior diagnosis or education that I could not evaluate.

## Limitations

The chief limitation of using archival data was the inability to obtain the information directly; therefore, I could not assume that the results would be entirely accurate. Using archival data presents a researcher with multiple issues, including the inability to establish authenticity (Frankfort-Nachmias & Nachmias, 2008). The current study was limited in the generalizability of findings because the sample, consisting only of Russian immigrants residing in New York, did not reflect the general population. Participant data were from one glaucoma specialty practice that used convenience sampling. There may also have been a positive cultural bias. Because the patient navigator was a Russian immigrant, participants might have wanted to please her and put forth more effort than usual. Finally, it was not possible to assess some of the barriers that might have prevented participants from attending follow-up exams unrelated to nonadherence. Examples of these components included participant mortality, illness, or lack of transportation.

## Significance

This study was a means to determine whether providing glaucoma education at the doctor's visit through a patient navigator increased patient adherence to follow-up care. I examined the extent to which education by a bilingual patient navigator affected patients' knowledge of glaucoma at the time of the exam (T1 and T2) and the 1-month follow-up appointment (T3). Also investigated was the effect of education on adherence to follow-up care as determined by the rate of participants' return for their necessary 1-month follow-up exam appointment (T3).

Vision deterioration and blindness can have devastating effects on quality of life for patients, their families, and their friends. Irreversible blindness can be frightening, overwhelming individuals' capacity to maintain their independence, pay for needed medical care, retain employment, and provide for themselves and their families. Schakel et al. (2017) identified links between vision loss and life-altering falls, diminished social functioning, lower educational attainment, and poor emotional well-being. The authors also found that individuals with vision impairment are at a higher risk for depression, anxiety, and other psychological problems. Schakel et al.'s findings showed that as the population ages, the health care costs and economic burdens related to blindness increase, indicating the importance of vision for health and social well-being.

The negative health consequences associated with vision loss extend well beyond the eye and visual system (Glen & Crabb, 2015). The societal costs are substantial, thereby indicating the need for prevention, especially for diseases in which blindness is avoidable (Gracitelli et al., 2015). Some of the functional and affective consequences of vision loss are remediable. The present study contributed to positive social change by showing the extent to which education provided at the physician's office by a trained patient navigator after a glaucoma diagnosis affects patient knowledge about glaucoma and treatment adherence to follow-up care, both ways to prevent avoidable vision loss.

## Summary

The purpose of this quantitative study was to examine the effect of education about glaucoma through a patient navigator on patient knowledge of glaucoma and patient adherence to follow-up care. Poor outcomes in patients with glaucoma often stem from barriers to care, such as limited knowledge about eye disease, poor access to eye care, and medication noncompliance (Tan et al., 2018). A limited understanding of the insidious and asymptomatic nature of glaucoma and the necessity for lifelong treatment could contribute to follow-up eye care nonadherence. When patients comply with appropriate treatment, they can manage their glaucoma to prevent blindness. Understanding the relationship between glaucoma education, participants' retained knowledge, and adherence to follow-up care could indicate whether a trained patient navigator should provide such education as a standard practice at diagnosis.

Chapter 1 contained the purpose, rationale, theoretical framework, and background of this study. It also included the research questions and hypotheses, nature of the study, definitions, assumptions, limitations, and delimitations. The chapter concluded with the significance of the study, the summary, and the potential for social change. Chapter 2 contains an examination and a review of current literature most relevant to the research problem of this study.

# Chapter 2: Literature Review

Vision loss significantly impacts participation in daily living, imposes substantial costs on families, and places a burden on the health system and economy, making it a significant concern for public health (Congdon et al., 2004; Glen & Crabb, 2015; Gracitelli et al., 2015; Smith et al., 2019). Vision impairment leads to decreased involvement in interpersonal interactions and relationships, impacting domestic, community, and social life (Glen & Crabb, 2015; Gracitelli et al., 2015; Zhang et al., 2015). The exacerbation of consequential comorbidities, such as an increased risk of mental health problems and falls, results from the inability to move about unaided (Zhang et al., 2015). POAG, the most common form of glaucoma, is a chronic, insidious disease with serious reductions in vision occurring only in the advanced stages (Harasymowycz et al., 2016; Kapetanakis, 2016). POAG is associated with elevated intraocular pressure due to aqueous humor outflow dysfunction, and successful treatment is available with proper medication administrational and adherence to follow-up eye care (Harasymowycz et al., 2016). About half of glaucoma patients do not adhere to their medications, leading to poor clinical outcomes and irreversible vision loss (Newman-Casey et al., 2018).

The definition of patient nonadherence is a patient's failure to follow a prescribed course of treatment by the attending physician and discontinued or improper use of prescribed ocular medications (Newman-Casey, Blachley, et al., 2015; Newman-Casey, Shtein, et al., 2016; Wilhelm et al., 2018). Because therapy adherence is a primary determinant of POAG treatment success, failure to do so is a serious problem affecting not only the patient but also the health care system (Wilhelmsen & Eriksson, 2019). A significant consequence of nonadherence is that the individual will not obtain an optimal pharmacotherapeutic benefit, thereby facing increased optic nerve deterioration leading to preventable blindness (Newman-Casey, Blachley, et al., 2015; Newman-Casey, Shtein, et al., 2016). Ethnic and age disparities in poor adherence to glaucoma treatment disproportionately affect older, underserved, vulnerable, and minority populations (Chua et al., 2015; Newman-Casey et al., 2018). Therefore, it is imperative to focus research on increasing efforts and understanding the importance of implementing strategies to prevent avoidable vision loss. Such inquiry could lead to improved eye health among members of underserved communities who might experience barriers in access to eye care (Harasymowycz et al., 2016; Kapetanakis, 2016).

The purpose of the current study was to explore the effect of glaucoma education provided by a patient navigator on patient knowledge of glaucoma, patient adherence to ocular medication use, and follow-up appointment attendance in the Russian Eastern European immigrant population at a private glaucoma specialty clinic in New York. In this chapter, I cover the strategies used to search for literature, the theoretical foundation, and the study's framework. The research gaps addressed were the effects of education provided by a patient navigator on patients' understanding of their disease, the patients' attendance during follow-up appointments, and proper utilization of ocular medications.

## Literature Search Strategy

I conducted a thorough and exhaustive literature search using Cochrane Library, MEDLINE Medscape, PubMed, PsycINFO, PsycARTICLES, Google Scholar, and the Walden University library. I limited the search to sources published between 2015 and

2020. The initial search was for peer-reviewed articles. Subsequently, I accessed the CDC and the National Academies of Sciences, Engineering, and Medicine websites for current information and statistics related to glaucoma prevalence among vulnerable populations. After screening 8,634 abstracts, I selected 302 articles containing information on pathophysiology, treatment, and education relevant to ophthalmological settings specializing in glaucoma treatment. The primary keywords searched were *glaucoma*, *patient education*, *compliance*, and *adherence*. I included a combination of search terms with Boolean operators, such as *POAG glaucoma*, *glaucoma* AND *patient education*, *glaucoma* AND *treatment compliance*, *glaucoma* AND *treatment adherence*, *glaucoma* AND *patient instruction*, *treatment refusal*, *treatment nonadherence*, *patient persistence*, *patient acceptance of health care*, *self-efficacy*, *self-care*, *chronic illness* AND *self-management*, *treatment motivation*, and *stages of change*. I did not use any language restrictions.

## Theoretical Foundation

This study's theoretical framework was the TTM with its stages of change. This theory was appropriate to understand the process of intentional behavioral change in patients' self-management of glaucoma. Noncompliance with follow-up treatment and medication usage in chronic disorders, such as glaucoma, is a significant obstacle to helping patients achieve and maintain their eyesight.

### Transtheoretical Model

Prochaska and DiClemente developed TTM, or the stages of change model, to explore the process of change for smoking cessation (DiClemente & Prochaska, 1982, 1998; Prochaska & Vellcer, 1997). Prochaska and DiClemente were studying the differences between individuals who experienced quitting smoking on their own versus quitting with assistance. They created a model of intentional change, focusing on understanding the decision-making process of the individual.

In a 2-year longitudinal study, DiClemente (1981) examined why some individuals could quit smoking independently and others could not. TTM applies to behavior change through educational interventions for patient care (DiClemente et al., 1985; Prochaska et al., 2013). Individuals with chronic illnesses can struggle with the awareness that their behavior might be exacerbating the problem; therefore, merely suggesting they change their behavior might not be sufficient (DiClemente & Velasquez, 1994). Such individuals need to make the conscious decision to change their actions, producing a positive outcome through sustained behavior change (DiClemente et al., 1985; DiClemente & Hughes, 1985; DiClemente & Velasquez, 1994).

TTM draws from other theories regarding the process of decision-making, such as Janis and Mann's (1977) inquiry into decisional balance and Bandura's (1977) work on self-efficacy. Janis and Mann proposed that changing one's behavior begins with a decisional balance, when an individual considers consequences from desirable to undesirable effects before making a decision. This balance is known as the pros and cons of change. The individual then decides whether to make a behavioral change (Janis & Mann, 1977). The goal of this process is to facilitate a realistic assessment of behavior change's value and potential alternatives. After deciding to change their behavior, the individuals will then progress through the stages of change (DiClemente & Prochaska, 1982, 1998; Prochaska et al., 2013).

Bandura's (1977, 1982, 1986) self-efficacy theory refers to individuals' belief in their capacity to execute behaviors necessary to produce specific results. Bandura (1977, 1982, 1986) defined self-efficacy as the core of human functioning, reflecting an individual's ability to execute required behavior under manageable and challenging circumstances. Bandura further discussed that knowledge is not enough for individuals to complete a task under challenging circumstances; instead, they must have the conviction that they can complete it (Bandura, 1986, 1997; D. A. Cook & Artino, 2016). Bandura (1986, as cited in Cook & Artino, 2016) referred to this concept as reciprocal causation, in which the functioning of one component depends in part on the functioning of the other. Individuals who score high on self-efficacy scales tend to exert more effort and persistence in the face of difficulties and adversities than those with lower self-efficacy (Artino, 2012; Cook & Artino, 2016).

DiClemente and Prochaska (1982, 1998) built upon the concepts of decisional balance and self-efficacy to propose that changing a behavior is a deliberate process, and different people are in different stages of change and readiness. Although DiClemente and Prochaska's work began with individuals trying to quit smoking, the researchers noticed that a precipitating event frequently leads to an internal drive to consider any behavior change. Additionally, their findings indicated that such change happens predictably. When studying the relationship between individuals' readiness and their ability to quit smoking, DiClemente et al. (1985) observed that participants' utilized the processes of change, subsequently identifying a relationship between the two variables.

Upon committing to change, an individual must replace old behavior with new behavior (Prochaska et al., 1992). Sustainable change does not happen randomly; rather, it occurs in a predictable way (DiClemente & Velasquez, 1994; Prochaska et al., 1994). Additionally, sustainable change occurs based on individuals' ability to implement an internal change in their behavior due to their readiness and willingness to change (Prochaska et al., 1994). TTM addresses the five stages that individuals must navigate to achieve lasting behavior change. The theory provides an understanding of why some people can change their behavior and others cannot (DiClemente & Prochaska, 1982; Prochaska et al., 1994).

**The Stages of Change**

The stages of change in the TTM model are precontemplation, contemplation, preparation, action, and maintenance. In the precontemplation stage, individuals are unaware that their behavior might be harmful and have no intention of changing the behavior (Prochaska & Vellcer, 1997). In this stage, implementing the decisional balance of pros and cons is a means to discuss the benefits of healthy behavior with the individuals. Contemplation is when individuals begin to consider the change. In this stage, the individuals are aware of the problem and desire to change their behavior; however, they experience ambivalence about implementing change. The preparation stage is when individuals are ready for change and begin to alter their behavior. In the preparation stage, encouragement and continued explanation of pros and cons are helpful to assist individuals along the continuum of change. The action stage involves individuals making lifestyle modifications and actively changing their behavior. To successfully navigate this stage, individuals need self-efficacy to avoid temptation and relapse. Last, during the maintenance stage, individuals continually channel efforts to maintain behavior change and prevent relapse.

Individuals move through the process of behavior change through an interplay of behavioral and experiential processes (Van Cappellen et al., 2018). Although the concepts of TTM operate in an integrative loop, individuals who relapse will enter the contemplation stage and resume the process from that point (Grol & Wensing, 2020). For pervasive internalized change, individuals will have to develop self-efficacy to avoid relapse.

**Current Applications of TTM**

TTM has been used in health and medical research to explain or predict a person's success or failure in achieving a proposed behavior change (Friman et al., 2017; Prochaska et al., 2013). TTM has been applied in research related to developing positive health-behavior changes in chronic disorders in which behavior modifications are critical to maintaining patients' well-being. According to prior research, the most consistent positive outcome of interventions to improve self-care has been improved self-efficacy, which is an important element of self-management (R. J. Adams, 2010; Friman et al., 2017). This finding emerged from studies on sustained physical exercise, reducing obesity based on changing unhealthy eating habits, and medication adherence in diabetic patients (Friman et al., 2017; Kelley et al., 2016).

TTM has been a means to understand how individuals attempting to change their behavior experience stages of readiness to accept such change (Segall, 2018). K. T. Liu et al. (2018) noted that "movement through these stages often occurs in cyclic rather than linear patterns because many individuals must make several attempts to change their behavior before they meet their goals and move to the next stage" (p. 7). In moving through these stages, people can use different strategies and techniques depending on their motivation and goals (K. T. Liu et al., 2018; Segall, 2018).

Nigg et al. (2019) examined how TTM predicts behavior change processes and guides interventions among individuals interested in making changes related to physical activity. The authors found that intervention efforts focusing on processes to change cognitions related to barriers in self-efficacy and decisional balance led to sustainable changes and a renewed focus on the processes. Shakiba et al. (2018) arrived at similar findings from using a TTM-based intervention to increase fish intake as an intervention for combating cardiovascular disease in individuals in Iran. Findings from both studies indicated that when individuals have positive thoughts and attitudes toward the new behavior and the process of change, they are motivated to stay engaged with the new behavior, becoming more self-efficacious and less likely to relapse (K. T. Liu et al., 2018; Nigg et al., 2019; Shakiba et al., 2018). TTM suggests that behavior changes occur based on knowledge that leads to attitude shifts (DiClemente & Prochaska, 1998).

**Limitations of TTM**

J. Adams and White (2004) conducted a nonsystematic critical review to investigate the effectiveness of TTM-based activity promotion interventions. They found that a stage-based activity promotion program was effective in encouraging the adoption of behavioral change in the short term (fewer than 6 months); however, long-term adherence was limited and disappointing. Additionally, Horwath et al. (2013) suggested that only individuals who possessed self-liberation demonstrated significant differences consistently over time, as indicated in their longitudinal study on individuals transitioning to five or more servings of fruit and vegetables each day.

Bradshaw et al. (2016) supported Horwath et al.'s (2013) findings in a study of individuals from poorly functioning families, which included high levels of conflict, disorganization, and weak affective and behavioral control preparing for personal changes that positively impacted and improved overall family functioning. Bradshaw et al. found a need to consider other variables when examining individuals' readiness to make a sustainable change. The consideration of other variables was because there are no set criteria for determining a person's stage of change and no clear sense for how much time is needed for each stage or how long a person can remain in a stage (J. Adams & White, 2004; Bradshaw et al., 2016; Horwath et al., 2013).

Additionally, Gourlan et al. (2016) discussed that TTM incorporates a one-size-fits-all approach, which does not suit all individuals and cannot explain variation. Therefore, TTM is not generalizable to all social and cultural populations. Moreover, Marshall and Biddle (2001) stated that TTM's core constructs are of limited use based on the assumption that individuals make coherent and logical plans in their decision-making process, which is not always true. Additionally, Marshall and Biddle argued that most participants' changes did not align with those predicted.

# Glaucoma

## Structure of the Eye

Encompassing several diseases, glaucoma is characterized by increased pressure of the eye. Glaucoma leads to atrophy of the optic nerve and, if left untreated, causes irreversible blindness. The human eye splits into two segments: the anterior and the posterior chamber (Addo et al., 2016). The anterior chamber is in the front segment of the eye and holds the cornea, iris, ciliary body, and lens immersed in a fluid-like substance called the aqueous humor (Addo et al., 2016; Sridhar, 2018). The posterior segment encompasses the back two thirds of the eye and includes the vitreous humor, retina, choroid, and optic nerve (Addo et al., 2016). The aqueous humor is a clear, thin fluid in the anterior chamber of the eye continuously produced and drained as it transports nutrients to the cornea and the lens while giving the eye its shape. The aqueous humor plays an essential role in eye health because it maintains eye pressure. Any abnormality or malfunction in the drainage system of the aqueous humor leads to an impaired outflow of the aqueous humor, causing elevated intraocular pressure.

Measuring intraocular eye pressure is by determining the difference between atmospheric pressure and the pressure inside the eye (Castro et al., 2016). This number is a clinical parameter for assessing the health of the eye. The standard for normal eye pressure is between 12 and 25 mm Hg, with anything equal to or greater than 26 mm Hg considered elevated intraocular pressure. The elevated intraocular pressure affects all eye structures, causing optic nerve neuropathy that may lead to blindness. Generation and maintenance of intraocular eye pressure is by the aqueous humor circulation system

(Tamm et al., 2015). Secreted from the epithelial layers of the ciliary body, the aqueous humor exits the eye through the trabecular meshwork or the uveoscleral outflow pathways. When there is a defect in the outflow pathway, the aqueous humor builds up, increasing intraocular eye pressure (Tamm et al., 2015).

**The Visual Pathway**

The visual pathway begins in the posterior segment with the retina and the optic nerve. The retina, lining the back of the eye, comprises superimposed neurons called rods and cones, which connect and pass the information to the optic nerve (Fahy et al., 2016; Nguyen & Ethier, 2015; Wiggs, 2015). Also known as the second cranial nerve, the optic nerve sends the visual information from the retina to the brain (Freud et al., 2016). The optic nerve is the only part of the central nervous system that leaves the cranial cavity and is clinically visible (Freud et al., 2016; Martínez-Marcos & Sañudo, 2019). The optic nerve gathers information from the retina and sends it to the brain. Composing the optic nerve are retinal ganglion cells consisting of over one million nerve fibers (Freud et al., 2016; Martínez-Marcos & Sañudo, 2019), converging at the part of the retina where the optic nerve exits the eye; this is the optic nerve head (Freud et al., 2016). On retinal images, the optic nerve head looks like a crater with a cup-to-disc ratio correlated to the health of the nerve (Orlando et al., 2017).

**Glaucomatous Damage**

In the presence of glaucoma, elevated intraocular pressure exerts direct mechanical damage to the optic nerve head, destroying nerve fibers along the outer rim of the optic nerve (Chaturvedi et al., 2018). This pressure causes the cup to enlarge in a vertical oval pattern, increasing the cup-to-disc ratio (Burgoyne, 2015; Chaturvedi et al., 2018). Optic disc cupping enlargement leads to corresponding sight loss that affects the peripheral vision only; thus, most affected people are unaware of this disease (Abdullah et al., 2016; Almazroa et al., 2017). Due to the brain's ability to compensate for vision loss, patients might not detect the change until they have lost a significant portion of their eyesight (Hark et al., 2017; Hark, Waisbroud, et al., 2016). The asymptomatic nature of glaucoma and the brain's compensation means patients might not notice vision loss or experience "tunnel vision" until they have lost 40% of nerve fibers (Hark, Waisbroud, et al., 2016; Lavinsky et al., 2017). Vision loss from glaucoma is irreversible (Hark et al., 2017; Hark, Waisbroud, et al., 2016; Lavinsky et al., 2017). The four types of primary glaucoma are open-angle, angle-closure, normal-tension, and congenital.

**Primary Open-Angle Glaucoma**

Distinguishing glaucoma entails measuring the angle between the iris makes and the cornea. In POAG, this angle is open; instead, there is a block in the trabecular meshwork, a system of canals that allows the aqueous humor to circulate (B. Liu et al., 2018). Therefore, although the angle is open, once the canals malfunction and the aqueous humor does not drain properly, the intraocular eye pressure begins to increase (Kubicka-Trząska, 2020; B. Liu et al., 2018). Nerve damage occurs as the intraocular eye pressure increases and exerts pressure against the nerve fibers of the optic nerve, depriving it of oxygen and nutrients (Kubicka-Trząska, 2020). Vision loss from POAG begins with peripheral vision and slowly moves centrally (B. Liu et al., 2018).

Most people with POAG feel fine and do not notice a change in their vision at first because the initial loss of vision is on one side (peripheral), and they maintain visual acuity, or sharpness, until late in the disease (Weinreb et al., 2016). The lack of symptoms in POAG delays detection and diagnosis. Typically, POAG progresses slowly; by the time it becomes symptomatic, severe and irreversible damage has occurred in one or both eyes (Pan & Varma, 2011; Weinreb et al., 2016). The rate of progression of the visual field defect varies in patients, and treatment might not completely halt the visual field loss, despite aggressive therapy (Weinreb et al., 2016).

Minimal data are available on POAG rates in the Russian Eastern European immigrant population within the United States. However, in 2010, POAG incidence was highest among this immigrant population, representing 23.9% of those with POAG worldwide (CDC, 2015; Nowak & Smigielski, 2015; Quigley & Broman, 2006). The prevalence of POAG pseudoexfoliation glaucoma is much higher among White Americans. In the United States, the most recent 2010 statistics on POAG pseudoexfoliation glaucoma are 66% White, 19% Black, 8% Hispanic, and 7% other races (National Eye Institute, 2019). Because Russian Eastern European immigrants identify as White Americans, it is fair to assume they are part of the 66%. Genetic defects account for a significant prevalence of this disease in some ethnic and racial groups. More specifically, a strong genetic association has emerged with the lysyl oxidase-like 1 (LOXL1) gene in many POAG patients with pseudoexfoliation glaucoma (Janjua et al., 2017). Although genetic predisposition for phenotypic expression of glaucoma is better understood, intraocular eye pressure is currently the only modifiable risk factor to prevent progressive optic neuropathy and blindness from glaucoma (Mohsen et al., 2016).

**Diagnosing POAG**

Although elevated intraocular pressure is a consistent risk factor for the presence of glaucoma, several population-based studies showed intraocular pressure to be lower than 22 mm Hg in 25% to 50% of individuals with glaucoma (Behkam et al., 2019). Therefore, increased intraocular pressure may predispose individuals to POAG. However, the mere presence of elevated intraocular pressure is insufficient for the diagnosis (Behkam et al., 2019; Mohsen et al., 2016). A full ophthalmologic workup is necessary to diagnose POAG accurately. A comprehensive eye exam involves intraocular pressure measured with Goldmann applanation tonometry, the international standard for ocular pressure assessment in ophthalmic research and clinical practice, gonioscopy, optic nerve assessment visual field testing (Mohsen et al., 2016). Pachymetry, the measurement of central corneal thickness, can help interpret intraocular pressure measurements and stratify the patient's risk of developing glaucomatous visual field defects. The ophthalmologist can assess the extent of optic nerve involvement or damage via direct ophthalmoscopeIndirect ophthalmoscopy allows the ophthalmologist to view glaucomatous changes, including cupping or other signs of damage on the optic nerve, such as optic nerve hemorrhage or focal loss of the nerve fiber layer.

The extent of diagnostic involvement is exhaustive, with diagnosis requiring a highly trained ophthalmologist who is a glaucoma specialist. General ophthalmologists or those not specializing in glaucoma frequently underdiagnose glaucoma, either missing the diagnosis or as a result of patients missing their appointments (Kabat & Sowka, 2016; Nayak et al., 2011). Due to the narrowness of this subspecialty and lengthy training time, few glaucoma specialists are available in low socioeconomic and underserved areas (Rodgers et al., 2017). The absence of specialists coupled with geographic maldistribution of practice locations leaves many underserved, vulnerable, and at-risk populations without care to prevent late-stage POAG glaucoma, leading to blindness.

**Treating POAG**

At present, the only intervention proven effective for treating POAG and ocular hypertension is lowering intraocular eye pressure to prevent further progression of optic nerve neuropathy and visual loss (Weinreb et al., 2018). The American Academy of Ophthalmology Preferred Practice Pattern recommends lowering the intraocular pressure to a level that will slow the disease progression and prevent functional impairment from the disease (Feder et al., 2016; Glaucoma Research Foundation, 2018). The most effective way to achieve these recommendations is by using pressure-lowering topical ocular medications (Y. Liu & Allingham, 2017). Often the first line of medical therapy, prostaglandin analogues reduce intraocular pressure by lowering outflow resistance, resulting in increased aqueous humor flow through the uveoscleral pathway (Diaconita et al., 2018; Nguyen & Ethier, 2015). Topical ocular medications are the most common due to their convenience, simplicity, and noninvasive nature, and the patient's ability to self-administer (Diaconita et al., 2018; Weinreb et al., 2020). However, these medications can cause local adverse effects, such as conjunctival hyperemia, elongation and darkening of eyelashes, loss of orbital fat, and periocular skin pigmentation (Diaconita et al., 2018).

Adverse effects of glaucoma medications are frequent, occurring immediately or much later (Weinreb et al., 2020). The most common ocular complaint with these medications is transient stinging and burning (Davis et al., 2018; Farkouh et al., 2016). Other frequently reported symptoms include fluctuating vision, dry and itchy eyes, and retinal detachment (Nguyen & Ethier, 2015; Weinreb et al., 2020). These symptoms are bothersome but mostly toleratable. Approximately 80% of eye drops can pass through the nasolacrimal duct into the nasal mucosa and its microvasculature, causing systemic side effects (Farkouh et al., 2016; Stavert et al., 2015). These side effects include intestinal cramps, tinnitus, hearing dysfunction, diarrhea, bronchospasm, cardiac irregularities, tachycardia, arrhythmia, elevated blood pressure, depression, lethargy, fatigue, kidney stones, and anaphylaxis (Farkouh et al., 2016; Janjua et al., 2017; Stavert et al., 2015).

Laser or incisional surgeries are necessary if medications no longer adequately work and other treatment modalities cannot keep the intraocular pressure under control (Elhofi & Lolah, 2017). For extremely nonadherent patients or those with severe disease, surgery is required (Sahoo et al., 2018). Trabeculectomy is the most-performed incisional surgical procedure to lower intraocular pressure. This surgical glaucoma procedure disrupts the globe's integrity and produces a plethora of complications, most of which are vision-threatening (Elhofi & Lolah, 2017; Sahoo et al., 2018; Yook et al., 2018). Therefore, postoperative success rates are low with the possibility of developing a flat anterior chamber, infection, scarring, bleeding, and complete vision loss (Yook et al., 2018).

**Barriers in Adherence Treating POAG**

Medical pharmacological treatments are effective in controlling glaucoma (Mehuys et al., 2019; Souto et al., 2019). Unfortunately, patient adherence to glaucoma treatment and medication is an ongoing challenge (Mehuys et al., 2019). Frequent glaucoma follow-up visits are essential to evaluate patients' response to the ocular medications and to assess any adverse side effects (Feng et al., 2016; Mehuys et al., 2019). Such frequent follow-up visits have served as obstacles to proper disease management (Lazcano-Gomez et al., 2016; Mehuys et al., 2019). Moreover, unlike oral medicines, eye drops require patients to use proper techniques for successful administration (Lazcano-Gomez et al., 2016). Poorly established eye drop instillation and nonadherence lead not only to reduced treatment effectiveness but also increased costs from chronic disease (Feng et al., 2016; Souto et al., 2019). More than half of POAG patients omitted 10% of their doses, while another 15% omitted half of their doses (Gao et al., 2018; Souto et al., 2019). Newman-Casey, Robin et al. (2015) found that nearly half of individuals filling glaucoma prescriptions discontinued ocular hypotensive therapies within 6 months. Improper instillation of ocular medications can also lead to eye infection and other traumas due to overdose or touching the eye with the eye drop container (Bacon et al., 2016; Gao et al., 2018). Poor tolerance and systemic side effects of ocular medications are crucial noncompliance issues, especially when the primary disease is asymptomatic (Feng et al., 2016; Gao et al., 2018).

## Physician–Patient Therapeutic Relationship

The physician–patient relationship is a keystone of care, the medium for establishing a positive therapeutic climate and alliance to achieve a common goal between practitioner and patient (Alkureishi et al., 2016). In the context of this relationship, practitioners collect and evaluate clinical data, offer education and diagnoses, achieve compliance, and provide healing, patient activation, and support (Alkureishi et al., 2016). The patient–practitioner connection is a dynamic relationship evolving much like health care, from traditional to electronic (Cajander & Grünloh, 2019). Physicians and health care providers have a significant impact on a patient's compliance and therapeutic effects; therefore, treatment discussion and communication are integral to any diagnosis (Colloca, 2017; Hansen & Zech, 2019). When making a chronic diagnosis or dispensing information on therapeutic benefits, the provider's choice of words, clinical setting, and transparency of expected side effects will impact the patient's emotional and physical response (Heisig et al., 2015; Vögtle et al., 2016). The way physicians communicate a diagnosis and discuss possible symptoms and treatment can shape the course of the illness for years, directly affecting the disease progression and outcome (Colloca et al., 2018; Howick et al., 2018). In a study on implications of placebo effects for clinical practice, Evers et al. (2018) found that providers' positive framing resulted in advantageous neurobiological and psychological mechanisms of expectancies and increased adherence to treatment, particularly among patients with negative treatment beliefs.

The widespread implementation of electronic health records helped create convenience and care continuity, promote patient participation, and improve health outcomes (Cajander & Grünloh, 2019). However, there is little proof about the development and creation of physician–patient collaborative processes with electronic health record implementation (Cajander & Grünloh, 2019; Zulman et al., 2020). Concerns have arisen over physicians paying more attention to the patients' e-chart on the computer screen than to the real patient during a clinical interaction (Alkureishi et al., 2016). Although electronic health records provide infrastructure for billing purposes, the physicians face obstacles in completing the electronic chart and often do so while a patient is still in the exam room (Alkureishi et al., 2016). The workflow process prevents the patient from checking out and making a follow-up appointment until the physician has completed and closed that part of the chart. Although created to help physicians complete charts faster and make billing easier, electronic health records introduced a clinical burden that has become a leading cause of physician burnout (Collier, 2017; Ehrenfeld & Wanderer, 2018).

Mounting income pressures and economic forces driving the health care industry to focus on productivity, coupled with increased administrative demands of electronic health records, have led to a decline in quality time between physicians and patients (Rider et al., 2018). The 1995 Commonwealth Fund Survey found that 41% of physicians reported a decline in the amount of time spent with patients (Dugdale et al., 1999). Reduced exam room time significantly impedes the human connection central to clinical care, exacerbating physician and patient dissatisfaction (Zulman et al., 2020).

Furthermore, these deteriorating physician–patient relationships create a lack of empathy, leading to worsening illness on both emotional and physiological levels, known as the "nocebo response" (Ehrenfeld & Wanderer, 2018; Rider et al., 2018).

Nocebo response is the opposite of a placebo effect and has a substantially negative impact on patient adherence to medical treatment (Barsky, 2017). Nocebo effects can result from negative experiences and outcomes deriving from the clinical encounters (Czerniak et al., 2016). The content and the means of presenting information to patients in a clinical setting during a diagnostic procedure influence the nocebo response (Nestoriuc et al., 2016). These effects can also emerge in clinical practice by negative expectations relating to discussions of possible side effects from prescribed medications as well as treatments and progression of the disease (Bartley et al., 2016; Petrie & Rief, 2019). The nocebo effect has been apparent in situations with little time for physicians to spend with patients, a pervasive lack of discussions and conversations, a language or cultural barrier, and no opportunity for patients to ask questions and receive education about their illness (Petrie & Rief, 2019). Patients experiencing a nocebo effect tend to have negative psychological and neurobiological mechanisms of accepting their diagnoses, subsequently becoming nonadherent or even discontinuing an appropriate therapy. The nocebo effect has considerable costs in terms of impaired patient quality of life, nonadherence, and adverse health outcomes (Rezk & Pieper, 2017).

## Factors Leading to Glaucoma Treatment Nonadherence

Despite the availability of effective glaucoma therapies, such as ocular medications and adherence to follow-up care to reduce vision loss from glaucoma, nonadherence in patients is as high as 80% (Robin & Muir, 2019). Poor adherence and poor clinical outcomes disproportionately impact the most vulnerable members of society, including culturally isolated, older, and minority populations (Hark et al., 2019; Newman-Casey et al., 2018). Adherence is a complicated multifactorial phenomenon influenced by multiple variables, including patient, therapy, condition, health system, and socioeconomic factors and comorbidities (Robin & Muir, 2019). The World Health Organization (2003) defined adherence as "the extent to which a person's behavior taking medication, following a diet, or executing lifestyle changes corresponds with agreed recommendations from a health care provider" (p. 3).

Factors that influence adherence to glaucoma medications derive from multiple sources. Scholars have consistently identified significant barriers to adherence, including poor communication between physicians and patients, patients' lack of knowledge about the long-term effects of glaucoma, problems reading instructions, difficulty with drops instillation or poor technique, forgetting to take the medication, polypharmacy, health care/medication costs, and medication-related adverse effects (Tamrat et al., 2015).

**Poor Education and Patient Knowledge**

Inadequate knowledge about glaucoma, glaucoma treatment, and consequences of deficient treatment may all contribute to nonadherence or nonpersistence (Robin & Muir, 2019). Celebi (2018) conducted a cross-sectional survey of glaucoma knowledge in patients and their first-degree relatives, finding that 50% of nonadherent respondents cited knowledge about glaucoma as a barrier. Similar to other asymptomatic chronic illnesses, such as systemic hypertension, patients with glaucoma do not have clear endpoints that tangibly signal improvement. Patients may not fully understand eye pressure and its effects (Celebi, 2018).

Research shows that a tailored approach centered around the patient with initial education about glaucoma and the importance of using the eye drops can improve motivation and compliance (Tse et al., 2016). Physicians who are burdened by economic pressures, time-consuming electronic health record platforms, and overbooked schedules due to an overwhelming shortage of glaucoma specialists face significant time constraints to deliver effective educational interventions (Alkureishi et al., 2016). Inadequate time creates a void in the current paradigm of how a single physician is responsible for medical decision-making, surgical intervention, counseling and educating patients, and coordinating care in a complex medical system (Newman-Casey et al., 2018; Tse et al., 2016).

To address the inadequate time providers spend with patients, Newman-Casey et al. (2018, 2020) created a technology-based, individually tailored behavior change program designed to motivate people with glaucoma to improve their medication adherence. The implemented program consisted of paraprofessionals providing brief, glaucoma-specific motivational interviewing and counseling. The intervention did not improve patients' eye drop instillation self-efficacy or overall health activation. The time paraprofessionals spent with patients was brief, not education-focused, and not offered in a culturally competent environment where non-English speaking patients received information in their native language (Newman-Casey et al., 2020). The findings indicated that lower income, lower educational attainment, and a higher level of glaucoma-related distress all predicted less adherence to glaucoma medications. Shah (2018) provided leaflets and online tools to patients to evaluate the effectiveness of such educational tools; however, these tools did not produce long-term adherence. Shah identified a need to relay educational information needs verbally, as many patients respond favorably to discussion-based conversation and prefer a personalized, one-on-one consultation with their provider.

**Difficulties With Ocular Medication Instillation**

A critical contributing factor to continued vision loss from glaucoma is poor medication adherence (Newman-Casey, Blachley, et al., 2015). Newman-Casey, Blachley, et al.'s (2015) literature review of glaucoma treatment showed dismal rates of medication adherence; in one longitudinal 4-year study, only 48% of 1,234 glaucoma patients filled half of their prescribed medications. Medication adherence is difficult to measure, especially when based on patient self-reports. Prior studies on medication adherence indicated three main reasons for medication nonadherence (Ehrlich et al., 2019; Newman-Casey et al., 2019). Twenty to 30% of patients never fill the first prescription, and 50% never fill the second prescription. Between 20% and 50% of patients try to use their glaucoma medications but fail to instill them correctly (Newman-Casey et al., 2019). Therefore, it is critical to reassess patients during their follow-up appointments to differentiate eye drop efficacy from lack of adherence (Kim et al., 2018). A patient might report adherence but use a medication incorrectly or not take any medication due to difficulty self-administering drops (Newman-Casey et al., 2019).

Numerous studies in the United States and other countries have shown poor technique to be a considerable concern in nonadherence (Newman-Casey, Robin, et al., 2015). Newman-Casey, Robin, et al. (2015) identified that worsening glaucoma is associated with changes in visual function, but these occur gradually, often without patients' awareness. The only way to truly discern if the glaucoma is under control is through a series of follow-up appointments where the ophthalmologist can compare subsequent test results to the baseline and keep checking the stability of the intraocular eye pressure (Konstas et al., 2018). However, these visits might be as frequent as every few months, with a considerable wait time. Konstas et al.'s (2018) findings indicated that infrequency could further contribute to nonadherence, as patients might not understand the value of these visits.

Frequently, patients may need more than one medication regimen. Ocular surface disease is extremely common in glaucoma patients and a significant cause of comorbidity, requiring more than one medication treatment (Zhang et al., 2019). In these situations, nonadherence is related to patients receiving multiple medications. Researchers found that persistence declined as the number of medications increased, and compliance with medications faltered due to side effects and a lack of symptoms secondary to glaucoma itself (Weinreb et al., 2018; Zhang et al., 2019). Many patients are unconcerned about worsening glaucoma because of the lack of symptoms, whereas others might become fatalistic, give up, and stop taking their medication (Colombo et al., 2016). Both apathetic and fatalistic perceptions regarding the possibility of worsening glaucoma could cause insufficient motivation to adhere to treatment regimens.

**Approaches to Improve Adherence and Persistence**

Increasing the proportion of people who adhere to glaucoma therapy could help delay disease progression as well as subsequent vision loss and reduced quality of life. Researchers have conducted studies to address health-promoting interventions that might improve adherence to glaucoma treatment (Wolfram et al., 2019). Some of these interventions include educational and instructional videos about glaucoma and ocular medication instillation, eye drop administration trackers, automatic medication refills sent to the pharmacy, telephone calls and texts to remind patients to take their drops, and counseling sessions with motivational interviewing and behavioral modification techniques (Newman-Casey, Robin, et al., 2015). Many of these interventions had a substantial impact on improving medication adherence in the short term (Slota et al., 2015). Telephone counseling proved to be not as effective as counseling offered in person; however, few medical offices were equipped to offer in-person counseling. Moreover, interventions with adequate time to spend with the patients to address each person's needs were difficult and not sustainable for busy ophthalmological practices. To date, no standardized approaches to improving support for glaucoma patient self-management and developing health-promoting behavior have emerged (Fudemberg, Lee, et al., 2016; Slota et al., 2015; Wolfram et al., 2019).

For an intervention to be successful and sustainable, patients' perceived severity of the disease and benefits of treatment must be higher than their experiential lack of symptoms and bothersome medication side effects (Killeen et al., 2020; Wolfram et al., 2019). Time spent educating patients should include a few key factors. The patient must understand that glaucoma causes vision loss, the treatments offered by their doctor could mitigate this effect, and the barriers to following their physician's recommendation are not difficult to overcome and outweigh the perceived benefit of treatment (Davis et al., 2019). However, patient education becomes a time-consuming process for which current ophthalmology practices are not equipped. Additionally, physicians and staff do not have the time or resources to accommodate this level of involved patient care, creating a clinical void in the health care service delivery.

**Challenges of Health Care Delivery in Nonacculturated Russian Immigrant Communities**

Rates of international migration have reached unprecedented levels in the United States and worldwide. The United States has experienced a massive immigration wave, its largest in the19th and early 20th centuries, with New York facing a rapidly changing demographic landscape and an increasingly multiracial and multicultural population (New York City Department of Health and Mental Hygiene [NYC Health], 2020). New York, has a dense immigrant residential population stratified by pockets of residential nonacculturation. Acculturation happens when groups of individuals from different cultures come into continuous, firsthand contact, resulting in the assimilation of one group into the other. Eastern European Russian immigrants 65 years and older become Medicaid and social assistance beneficiaries with opportunities for subsidized housing, which inadvertently stratifies immigrant populations, creating dense, insular pockets with no need to acculturate. Such homogeneous and concentrated cultural pockets could appear at sub-zip code levels in neighborhoods throughout the borough. Additionally, homogeneous neighborhood composition creates enclaves of living and drives the need to create service delivery in culturally adherent standards (NYC Health, 2020). For instance, the area once known as Brighton Beach has received the moniker "Russian Beach" due to most of its residents being Eastern European Russian immigrants.

Language presents a challenge in serving this community, as the majority of the population's service area speaks primarily Russian (NYC Health, 2020). Insular neighborhoods resistant to acculturation face challenges and barriers to health care, such as linguistic incompatibilities, insurance eligibility, familiarity with the U.S. health care system, and the ability to connect with and understand non-Russian care providers (Kim et al., 2015; NYC Health, 2020).

Older immigrant populations already experience adaptation challenges because of cultural gaps between their values and those of the host society (Kim et al., 2015). Such experiences also result in a lack of social support from the host society, family conflicts, and racial discrimination. Individuals strive to maintain their cultural heritage and cultural identities, subsequently leading to low acculturation. Although prior research shows that advanced cultural connectedness, community strength, and participation help older immigrants gain a sense of social, cultural, and psychological significance, it inadvertently promotes nonacculturation (Kim et al., 2015; Wright-St. Clair et al., 2018), directly affecting health care delivery.

Older Russian immigrants experience difficulty seeking medical help from non-Russian-speaking providers due to language barriers and cultural misunderstandings. Access to high-quality eye and vision care is a component of a comprehensive population health approach to reduce vision impairment (Lee, 2017; McKeever et al., 2019). The present health care landscape offers health care services from Russian providers; however, few are ophthalmologists, and even fewer are glaucoma specialty providers. In addition to the lack of Russian-speaking glaucoma ophthalmology providers, conflicting clinical practice guidelines create different standards, leading to confusion regarding what care is needed and when. Limited integration among and between clinical public health series combined with insufficient cross-disciplinary training of the workforce negatively affects the diagnosis and follow-up care. Additional population distrust toward non-Russian-speaking providers hampers the ability to improve care quality by applying continuous quality improvement programs.

## Filling the Gap in Glaucoma Care Delivery

Health care provision disparities occur when beneficial medical interventions are not shared equally and arise from a complex interplay of economic, social, and cultural factors (Thornton et al., 2016). Principal causes of such health disparities stem from overlapping poverty, culture, and social injustice. These causal factors impact all aspects of the health care continuum, from prevention, detection, diagnosis, treatment, and survival to the end of life. Disparities occur principally in individuals or populations who experience insufficient resources, culturally influenced behavior, and/or social inequities. Any successful intervention must entail considering related population characteristics and sociocultural environments of proposed service delivery; otherwise, even the most efficacious interventions cannot achieve desirable outcomes (Dye et al., 2019; Thornton et al., 2016). Such considerations are not easy, as they might challenge the use of traditional or mainstream interpretations of standard evaluation techniques because of the implications of being a socially disadvantaged population (Dye et al., 2019).

Preventing vision loss and treating vision disorders begins with understanding gaps in eye care delivery, especially for older Russian immigrant adults at high risk for vision loss (Lee, 2017; McKeever et al., 2019). Demographic shifts in the U.S. population alter the prevalence of various conditions associated with vision loss because these conditions vary by race, culture, and ethnicity. Prior scholars have not demonstrated long-term adherence to glaucoma therapy in diverse populations, although short-term educational strategies have been successful (Newman-Casey et al., 2020). Successful educational interventions require time for demonstration and conversation, ocular drop instillation presentation and practice, and medication side effect discussion. When delivered in culturally competent ways and in the patients' preferred language, the interventions are most effective (Dye et al., 2019). Due to a substantial lack of specialized Russian-speaking glaucoma providers, office space limitations, no dedicated professional specialty to provide such service, asymptomatic nature of glaucoma, long waiting times to see the ophthalmologist, and a plethora of side effects associated with ocular medications, patients continue to be nonadherent to their glaucoma treatments.

**Professional Service Gap**

The field of ophthalmology is unique in its lack of hiring nurses. Although there is a positive correlation between nurse competency and patient care quality, the visibility of this career path is not yet widely accepted (Abid et al., 2018; Aw & Dury, 2016; Moradi, 2016). The eye care field consists of ophthalmologists who are medical doctors who diagnose, prescribe, and operate and optometrists who specialize in some diagnosis and treatment but mostly refractive disorders (Cicinelli et al., 2020; Shamanna et al., 2005). Opticians fit and make glasses; ophthalmic technicians perform intakes, triages, and work up patients; ophthalmic photographers take various images of patents' eyes and perform scans and visual fields (Cicinelli et al., 2020; Shamanna et al., 2005).

Educating patients about their ocular conditions has long been the provider's responsibility (Rosdahl et al., 2014; Williams et al., 2016). In a survey of patients' preferences in receiving diagnosis and care instructions, Rosdahl et al. (2014) found that 55% of respondents preferred one-on-one educational sessions from their eye care providers. However, for various reasons, ophthalmologists are no longer able to fulfill that role. Another consideration was ophthalmic nursing. Although ophthalmology is a subspecialty in a nursing curriculum, there is little room for ophthalmic nurses in clinical settings. They usually prefer the highly clinical interactions less available in ophthalmic settings (Moradi, 2016). Additionally, there has been no evaluation of the cost-effectiveness of the registered nurse position. Historically, patient navigators are useful to improve outcomes in vulnerable populations by eliminating barriers to timely diagnosis and treatment of cancer and other chronic diseases (Pratt-Chapman, 2016).

**Patient Navigators**

The first patient navigation program was in 1990 in Harlem, New York, created by the president and founder of the Harold P. Freeman Patient Navigation Institute (Freeman, 2006; Freeman et al., 1995; Freeman & Rodriguez, 2011). The program's original goal was to reduce cancer mortality by eliminating financial, communication, medical system, psychological, and logistical barriers to screening, diagnosis, treatment, and supportive care (Freeman, 2006; Freeman & Rodriguez, 2011; Valaitis et al., 2017). The scope of patient navigation has evolved to become a patient-centric health care service delivery intervention with the principal purpose of eliminating barriers occurring across the health care continuum (Valaitis et al., 2017). This program has expanded to application across the health care continuum to help patients with chronic diseases other than cancer in such areas as prevention, detection, diagnosis, treatment, education, supportive care, and end-of-life care.

In recent years, most navigation programs have been means to help patients overcome barriers to care, such as challenges with health literacy or fluency in the English language affecting comprehension of diagnosis and treatment, lack of transportation, or insufficient insurance coverage (Ko et al., 2019). Patient navigators have also strived to build and strengthen the communications and relationships between patients and health care professionals while addressing psychosocial concerns of patients and their families (Ko et al., 2019; Lopez et al., 2019). Another common role of navigators has been to close the gaps in the health care system by tracking patient care and ensuring smooth handoffs from one provider to another (Kline et al., 2019; Ko et al., 2019). Many interventions have been in predominantly minority and economically underserved areas, often in urban cancer centers (Lopez et al., 2019).

Inadequate communication between clinician and patient is a common contributor to chronic health care problems. Patient navigators can address these concerns, which are often due to a patient's lack of fluency in English, health literacy, or self-efficacy or to clinician insensitivity. (Kline et al., 2019; Lopez et al., 2019). Wells et al. (2018) conducted a nationwide cross-sectional study to assess the roles of patient navigators, successful patient navigator characteristics, and work settings. In community-based organizations and chronic health care offices, navigators frequently made arrangements and referrals to services, provided care coordination and education, and assisted with obtaining basic needs and addressing the barriers preventing patients from obtaining health care (Wells et al., 2018). Pratt-Chapman et al. (2015) found that a clinical degree is not necessary for a successful patient navigator; instead, the most important qualification was being a "cultural broker and interpreter" from the serviced communities. Additionally, patient navigators with certain personal qualities, such as being personable and willing to improve the lives of others, have the greatest success with patient treatment compliance (Duggleby et al., 2016; McMullen et al., 2016; Ustjanauskas et al., 2016). Wells et al. identified the clinical specialties that used patient navigators, including oncology, diabetes, cardiovascular disease, asthma, chronic obstructive pulmonary disease, and HIV/AIDS. Most of these conditions are chronic, like glaucoma.

There has been little evaluation of patient navigators' effectiveness in ophthalmological settings. Newman-Casey, Blachley, et al. (2015) evaluated the effectiveness of nonphysician presurgical counselors teaching patients about cataracts and cataract surgery in improving patient knowledge, decisional conflict, and patient satisfaction outcomes. Findings indicated that increased use of high-quality counseling might reduce decisional conflict about cataract surgery among patients with more limited access to health care.

Although not a patient navigator program, Newman-Casey, Blachley, et al.'s (2015) research was close to a concept study regarding surgical interventions. Hark, Johnson, et al. (2016) evaluated whether the use of a patient navigator altered adherence to follow-up eye care appointments in community-based versus office-based settings. Findings from their study showed that help from a patient navigator did not increase the long-term likelihood of keeping follow-up appointments in an office-based setting. One limitation of this study was the recruitment of subjects from a prior glaucoma study, the findings of which showed patient familiarity with the research staff, which likely increased appointment adherence across all groups. Last, the participants were self-selected and might not reflect the general patient population.

## Reasons Providing Education Has Not Worked in Prior Research

Nonadherence to medical treatment is a problem that has gained enormous attention. Researchers have conducted extensive studies to identify the cause of the problem and solutions for nonadherence. Some evidence has shown that educating patients on glaucoma management may improve medication adherence (Rao et al., 2016). Of eight studies that focused on improving patient knowledge to increase adherence to glaucoma medications, Newman-Casey, Dayno, et al. (2016) found that five showed significant short-term improvements in adherence after educational interventions, two showed nonsignificant improvements, and one showed no improvement in patients who had relatively high baseline knowledge of glaucoma. Because the studies used vastly different interventions, it was difficult to determine which aspects of each educational intervention had the most significant impact on medication adherence (Robin & Muir, 2019). According to Newman-Casey, Dayno, et al., respondents reported various difficulties administering eye drops, including aim (24%); controlling the number of drops dispensed (18%); holding steady while squeezing the bottle (10%); flinching or blinking, causing the drops not to enter the eye (10%); and squeezing the bottle (5%). Although providing patient education could theoretically remedy all these difficulties, the researchers asserted that many studies had not supported these results in the long term. Educational interventions have shown some significant improvement short term; however, this might be due to the Hawthorne effect.

The Hawthorne effect refers to research participants altering their behavior based on the awareness of being observed and participating in the trial (Parsons, 1974). Therefore, the Hawthorne effect could significantly affect the generalizability of clinical research findings. Parsons (1974) described the Hawthorne effect from a study in which subjects' response rates rose without manipulating the IVs. This study created an interest in confounding variables because of some aspect of the experiment itself, such as subject observation. Goodwin et al. (2017) examined the degree to which the Hawthorne effect altered outpatient visit content. Although an observer's presence had little effect on most patient-physician visits, it appeared to affect a subgroup of vulnerable patients. Because most participants in prior studies about glaucoma interventions were lower-income, minority, and vulnerable populations, it is possible to assume that some part of short-term behavior change could be due to the Hawthorne effect.

## Summary and Conclusion

POAG leads to progressive damage to the optic nerve and is the leading cause of irreversible blindness worldwide (Abdull et al., 2016). Blindness from glaucoma is avoidable with early diagnosis and appropriate, sustained, life-long treatment (Abdull et al., 2016; Kyari et al., 2016). With adequate knowledge, adherence to follow-up care, and proper ocular medication utilization, patients can prevent blindness from this disease. However, studies have shown that many patients fail to adhere to treatment recommendations and end up losing most of their vision (Nowak & Smigielski, 2015). Measuring adherence to medical and behavioral interventions is important to clinicians and researchers, as inadequate adherence can reduce an intervention's effectiveness.

In this quantitative study, I explored the effects of education about glaucoma provided by a patient navigator on patients' knowledge about glaucoma, adherence to follow-up visits, and ocular medication utilization. A private glaucoma clinic in New York gathered data for its internal cost-benefit analysis of hiring and training a patient navigator.

In Chapter 3, I describe the research method, purpose of study, research design, and rationale. I discuss the target population, sample and sampling procedure, and procedure used for the collection of and access to archived data. Finally, Chapter 3 presents the instrumentation and operationalization of constructs, ethical procedures, and threats to internal, external, and statistical validity.

# Chapter 3: Research Method

The purpose of this study was to determine whether education about glaucoma provided by a patient navigator affected patient knowledge about glaucoma, patient adherence to follow-up visits, and medication utilization among Russian Eastern European immigrant patients at a private glaucoma clinic in New York. This study entailed the use of archival data with a longitudinal design. In this chapter, I describe the research design and rationale, define the IV and DVs, and identify the research design and its relevance to the study. Chapter 3 presents the target population, sampling, sample size, procedure used for collecting archival data, and data analysis using Statistical Package for the Social Sciences (SPSS). Finally, I identify resource constraints associated with the research design and describe how this design is consistent with the approach needed to advance knowledge in the field.

## Research Design and Rationale

In this quantitative study, I attempted to identify whether there was an effect of education about glaucoma provided by a patient navigator on patient knowledge about glaucoma, patient adherence to follow-up visits, and ocular medication utilization. A private glaucoma clinic in New York gathered data to analyze the costs and benefits of hiring and training a patient navigator. The clinic provided the information to me in an Excel spreadsheet. From the archival data, I examined patient answers collected at three time points, making this a longitudinal retrospective study design. The IV was exposure to education about glaucoma through a patient navigator, and the DVs were patient knowledge of glaucoma, patient adherence to follow-up visits, and patient utilization of prescribed ocular medications.

Longitudinal cohort studies are appropriate to evaluate education or other medical research interventions because the design allows the researcher to follow change over time among particular individuals within the cohort (Caruana et al., 2015). The longitudinal cohort study design enables researchers to establish a sequence of events to identify and relate events to a particular exposure. I sought to evaluate whether exposure to education impacts patient outcomes, making the longitudinal cohort design the most appropriate for this study. Disadvantages of longitudinal cohort studies include incomplete or interrupted follow-up of individuals and attrition over time, and an inability to control individual exposure to an occurrence, both of which might affect the outcome (Caruana et al., 2015).

## Research Questions and Hypotheses

This quantitative study was a means to explore whether exposure to education about glaucoma provided by a patient navigator impacts patient knowledge about glaucoma, patient adherence to follow-up visits, and ocular medication utilization. The RQs and their corresponding hypotheses for this study were as follows:

RQ1: Are there significant differences between pretest and posttest in knowledge of glaucoma as a function of whether patients are provided with additional education?

$H_0 1$: There are no significant differences between pretest and posttest in knowledge of glaucoma.

$H_a1$: There are significant differences between pretest and posttest in knowledge of glaucoma.

RQ2: Are there significant differences between the two groups in knowledge of glaucoma as a function of whether patients are provided with additional education?

$H_02$: There are no significant differences between the two groups in knowledge of glaucoma.

$H_a2$: There are significant differences between the two groups in knowledge of glaucoma.

RQ3: Is there an interaction effect between time and group in knowledge of glaucoma as a function of whether patients are provided with additional education?

$H_03$: There is no interaction effect between the time and group in knowledge of glaucoma.

$H_a3$: There is an interaction effect between the time and group in knowledge of glaucoma.

RQ4: Is patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up appointment at T3 dependent on whether patients were exposed to education about glaucoma?

$H_04$: The patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up appointment at T3 is not dependent on whether patients were exposed to education about glaucoma.

$H_a4$: The patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up treatment at T3 is dependent on whether patients were exposed to education about glaucoma.

RQ5: Is patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 dependent on whether patients were exposed to education about glaucoma?

$H_05$: The patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 is not dependent on whether patients were exposed to education about glaucoma.

$H_a5$: The patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 is dependent on whether patients were exposed to education about glaucoma.

## Methodology

### Population Description

Participants were individuals of Russian Eastern European immigrant background residing in New York newly diagnosed with glaucoma. Archival data underwent examination. Excluded from the study were individuals previously diagnosed with glaucoma or knowing that they had glaucoma yet had not received treatment. This exclusion was necessary to reduce sample contamination and evaluate the education provided by the patient navigator.

**Procedures for Recruitment and Participation**

Data collection was by a private glaucoma clinic in New York serving the largest Russian Eastern European immigrant population. A glaucoma specialist ophthalmologist owns and operates the practice, seeing between 80 and 100 patients daily. Due to the underserved nature of that area, there is a 3-month waiting list for new patients. The practice owner performed a cost-benefit analysis of hiring and training a patient navigator to provide education to patients and increase patient screening efficiency. The practice collected the data during regular patient visits and new patient consultations. Using the GKI, the patient navigator administered the educational portion of the exam in Group 2 and collected the data from both groups at T1, T2, and T3 (Celebi, 2018). After the index administration, the patient navigator ensured good data quality by comparing the responses to the medical records.

The glaucoma clinic provided a Data Use Agreement (see Appendix), allowing me access to the archival dataset gathered at the facility. From this archival demographic data, I based respondent selection on the following study inclusion criteria: (a) Russian immigrant or of that descent, (b) age 45 to 80 years, (c) no known or diagnosed cognitive impairment, and (d) not previously diagnosed with glaucoma. I extracted eligible participant data from the spreadsheet, using SPSS to determine statistically significant findings between the variables.

## Data Collection

A private glaucoma clinic in New York employed and trained a patient navigator to provide education to individuals diagnosed with glaucoma, and subsequently conducted a cost-benefit analysis of hiring such an individual. The data collection was also part of the practice's efforts to improve engagement and quality of care for its patients. The practice administrator used a random number generator from RANDOM.org to split the patients into two groups. Patients assigned to Group 1 underwent a standard eye exam and received a diagnosis of glaucoma and education from a physician about their condition. Group 2 received the same exam and diagnosis as Group 1 with additional education from a patient navigator, visual representation through an eye model, materials in their native Russian language, and an involved demonstration of eye drop instillation. The patient navigator spent 20 to 30 extra minutes with the patient, allowing time for a discussion and questions. The patients were to return in 1 month for a mandatory follow-up appointment, which the clinic documented. Patients assigned to both groups answered a GKI at three times: prior to the eye exam (T1), right after the eye exam for Group 1 and eye exam and educational workshop for Group 2 (T2), and at their 1-month follow-up appointment (T3). The clinic sexported and provided the data to me into Microsoft Excel.

To avoid role confusion and evaluate the cost-benefit analysis of the patient navigator, it was necessary to specify roles. After signing in for their visit, a practice assistant escorted Group 1 patients into a screening room and administered the GKI questionnaire (T1), with responses collected via pen and paper. The patients then received the usual workup consisting of chief complaint, medication verification, and best corrected visual acuity measure. The ophthalmologist then met with the patients to conduct a standard slit lamp exam and pressure check and discuss the findings. The ophthalmologist presented the ocular medications and requested a follow-up appointment in 1 month to ensure the drops controlled the pressure. This prescreening and the exam took approximately 15 minutes. At the conclusion of this exam, the practice assistant administered the GKI (T2). The patient then scheduled a 1-month follow-up appointment with the front desk receptionist. At the follow-up appointment, the practice assistant administered the GKI during the screening (T3) prior to the medical exam by the ophthalmologist. If patients missed their follow-up exam, the clinic made one rescheduling attempt. If the attempt was unsuccessful or the patient did not show up to the rescheduled appointment, I treated the participant's information as missing data.

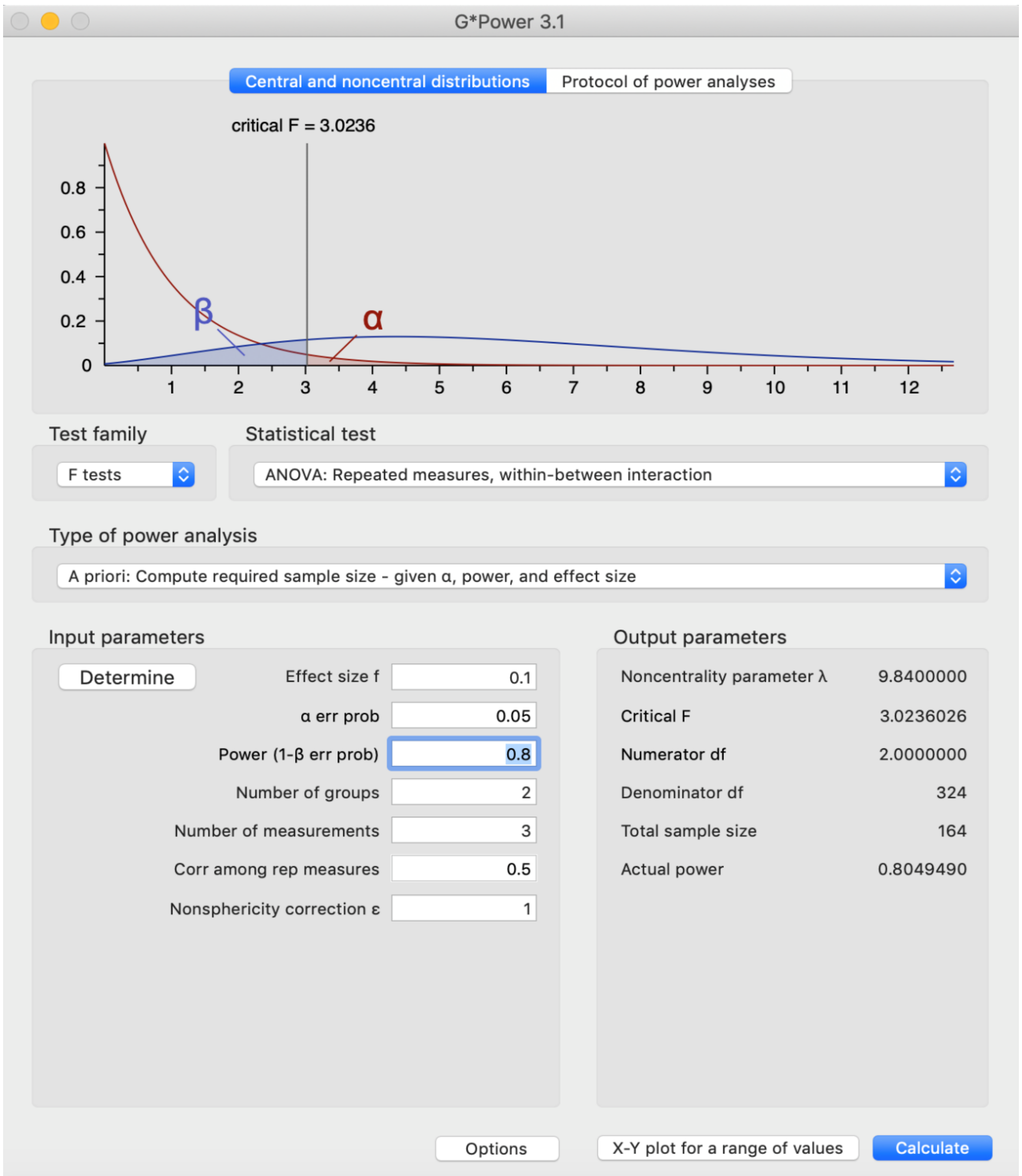
Patients assigned to Group 2 received the same care as those in Group 1. However, after the ophthalmologist exam, Group 2 patients went into the patient navigator's office, where they received education about their diagnosis with the aid of a visual model of the eye. The patient navigator also provided a handout describing glaucoma and what occurs without following proper treatment. The patient navigator also demonstrated the proper instillation of ocular drops and had the patient practice with the eye model. The take-home materials were available in English and in Russian. After the exam, the patient navigator escorted the patient to the front desk to schedule a 1-month follow-up appointment. Prior to the patient leaving the practice, the assistant administered the GKI (T2). At the 1-month follow-up appointment, the practice assistant administered the GKI during the screening (T3), prior to the medical exam by the ophthalmologist. For patients who missed their follow-up exam, there was one attempt at rescheduling the appointment, at which time (T3) they completed the questionnaire. If the office could not reach the patient or the patient did not attend the rescheduled appointment, the participant's responses had missing data and were not entered into the calculations.

**Sampling and Sampling Procedure**

The data set came from a private glaucoma clinic in New York. I conducted a G*Power analysis to calculate the minimum sample size required to detect an effect. To detect a medium effect size of partial eta-squared of 0.1 with 80% power, an industry-recommended minimum for between-subjects repeated measures, the G*Power analysis showed a need for 82 participants in each group for a total sample size of 164. This was a calculation for ANOVA, with equal sample sizes for each group (see Bakeman, 2005; Lakens, 2013). To account for an estimated 25% attrition from T1/T2 for the data gathered on the same day as T3, collected at the 1-month follow-up appointment, I used data from 206 participants at T1/T2 (103 from Group 1 and 103 from Group 2). Results from the power analysis are shown in Figure 2.

**Figure 2**

*Results From Power Analysis*




*Note.* Minimum sample size.

**Instrumentation and Operationalization of Constructs**

Celebi (2018) developed the GKI to assess patients' knowledge about glaucoma. Celebi used the GKI in a research hospital in Istanbul, Turkey, to assess knowledge and awareness of glaucoma in subjects with glaucoma and their first-degree relatives. Because the GKI is an index of knowledge, reliability is irrelevant; therefore, there was no need to compute a Cronbach's alpha (see Bland & Altman, 2002). The scale for this design was across nine questions in the analysis, including an aggregate of true-false and multiple-choice answers. I created a total score of knowledge, reporting the means and standard deviation after data analysis.

The IV in this study was education about glaucoma provided by a patient navigator. The IV was a dichotomous variable with two levels: two groups of patients. Patients in Group 1 received usual and standard care provided by an ophthalmologist during an initial visit; Group 2 patients received the same care as Group 1 with additional education provided by a patient navigator. After the patients' standard visit and a discussion with an ophthalmologist, the patient navigator spent 20 to 30 minutes providing education about glaucoma through a visual representation of an eye model and take-home materials in their native Russian language. In addition, the patient navigator conducted an involved demonstration of proper eye drop instillation. Changes in knowledge about glaucoma, one of the DVs, was the construct I examined in this study. Operationalizing knowledge changes was by participants' responses to the GKI, a nine-item index with each question worth 1 point. The questions were means to determine whether the individuals had knowledge and understanding of glaucoma, its predisposing factors, and treatment. Determining patients' understanding and knowledge about glaucoma was by calculating the number of points scored by the individual on the GKI, with the scores ranging from 0 to 9. For this study, individuals having a high level of knowledge and understanding about glaucoma (e.g., GKI scores of 8 or 9) were considered knowledgeable about glaucoma; individuals with low levels of adherence (GKI scores of 7 or lower) were considered not knowledgeable. I considered changes in knowledge about glaucoma as a function of time.

The next DV was adherence to follow-up care, a dichotomous variable measured by whether patients attended their scheduled follow-up appointments. Another DV was adherence to ocular medication utilization, which was also a dichotomous variable measured by whether patients used their prescribed ocular medications. Measurement of this variable was by patient self-report.

## Data Analysis Plan

I used SPSS to process and analyze the quantitative data. This program also allowed data cleaning and screening. Data processing techniques consisted of identifying potential outliers and testing the assumptions of each statistical analysis.

The first three research questions (RQ1, RQ2, and RQ3) required examining the extent to which patients' exposure to education about glaucoma through a patient navigator impacted their knowledge about glaucoma, as measured before and after the eye exam. The glaucoma education provided by the patient navigator was the IV, and the patients' knowledge of glaucoma was the DV. The IV had two categories: group membership (i.e., whether the participants were in Group 1 or Group 2) and time of assessment (i.e., T1, T2, or T3). The DV, a continuous measure, was the knowledge about glaucoma. The statistical analysis used to answer this research question was a repeated measures ANOVA.

The DV was continuous to determine variability, giving it prediction power. I was looking for three effects: within subjects (pretest vs. posttest scores), between subjects (Group 1 vs. Group 2), and whether there was an interaction effect. If the interaction effect was significant, the main effects of time and grouping required investigation. An interaction between the two IVs provides an understanding of whether knowledge changes over time differently depending on group membership.

One assumption for a repeated measures ANOVA is normality, with the DV and within-subjects IV normally distributed. Violating this assumption allows for the use of transformation. Another assumption was sphericity, where the variance of the difference scores for any two levels of the within-subjects IV was similar to the variance of the difference scores for any other two levels of the within-subjects IV. Mauchly's test of sphericity was a means to test this assumption, with a violation meriting the use of $p < .05$ and the Greenhouse-Geisser or Huynh-Feldt corrections. Another assumption was that of homogeneity of variance, where the standard deviation of the DV should be equal between the two groups. Testing the equality of variances entailed performing Levene's test. If $p < .05$, the Welch-Satterthwaite method is a way to make adjustments based on the degrees of freedom.

RQ4 pertained to how exposure to education about glaucoma predicts patients' adherence to follow-up treatment at T3. The IV, group membership, underwent analysis as a categorical variable with two levels, Group 1 and Group 2. The DV, whether patients showed up to the T3 appointment, was a categorical variable analyzed as a follow-up appointment attended or missed. Because of the categorical nature of the IV and DV, a chi-square test of independence was appropriate.

The fifth research question (RQ5) was specific to how exposure to education about glaucoma predicts patients' adherence to the use of prescribed ocular medications. The IV was group membership (Group 1 vs. Group 2), with the study groups independent and analyzed as a categorical variable with two levels. The DV, whether they used their prescribed ocular medications as instructed by the physician, was also a categorical variable analyzed as medication used or not used.

The chi-square test of independence was appropriate to address the fourth and fifth research questions because it is a nonparametric test designed to analyze whether there is a significant relationship between two categorical variables (McHugh, 2013; Montgomery, 2013). This statistical analysis was suitable because group status and the DVs (attendance at the follow-up and taking medication) are dichotomous variables. The chi-square test is nonparametic and does not assume a normal distribution, making it appropriate for dichotomous variables. The statistical analysis was a means to test for the relationship of group status to follow-up attendance by examining whether the distribution of *yes* and *no* in Group 1 matched the distribution of *yes* and *no* in Group 2. This kind of analysis was limited to variables in which both levels were mutually independent, such that no participant fell into both Group 1 and Group 2. The chi-square test allows for examining data at a single time point only rather than in a longitudinal fashion (McHugh, 2013). Additionally, the chi-square test is sensitive to sample size. This statistical analysis is appropriate to determine whether a relationship exists between two variables; it cannot test for a causal effect from one variable to the other (McHugh, 2013).

## Threats to Validity

### Threats to Internal Validity

Potential threats to internal validity included whether there was enough variation in the DV and the ability to index the degree of difference among people's glaucoma knowledge. Another threat to internal validity could have been having more patients than normal attend their follow-up visit (T3) due to the severity of their glaucoma symptoms, something not assessed. Last, prior to agreeing to participate in the study, patients learned that if assigned to Group 2, they might have to spend up to an extra 30 minutes with a patient navigator. If patients opted not to participate due to the requirement of extra time, there could be a difference in conscientiousness between the groups, which could have been an unstudied third variable.

### Threats to External Validity

One threat to external validity was the lack of transferability. The population assessed was Russian Eastern European immigrants in New York. Because the results apply to a narrow population and a specific situation, the findings might have poor generalizability. Another potential threat to external validity was selection bias. Because patients self-selected to participate in this study, there could have been volunteer bias, with individuals who volunteer to participate in a research project different in some ways from the general population.

## Ethical Procedures

### Agreement to Gain Access to Data

A private glaucoma clinic located in New York provided a Data Use Agreement (see Appendix), allowing me access to the archival data collected at its facility. The practice deidentified the archived data before it was available. Upon receipt of the Excel file, I extracted information relevant to the study. Subsequently, I coded data to eliminate patient identifiers and limit the risk of exposure. I did not receive or analyze data until receiving written approval from Walden University's Institutional Review Board (IRB; Approval No. 08-31-20-0725508).

### Treatment of Archival Data

The archived data remain safeguarded to prevent unwanted access. I was ethically obligated to ensure that the use of data and dissemination of findings would not harm the system that provided the data or to the people who accessed the health care system. Therefore, the use of archived data was solely for this study. The data obtained are not available to any other person or organization. I did not need to obtain patients' informed consent, as I analyzed only archival data. No treatment or invasive tests occurred during or for this study. I will maintain the deidentified archival data on a password-protected external flash drive for 5 years, after which I will destroy all files.

## Summary

Chapter 3 presented the study design, sample characteristics and sampling methods, instrumentation, data analysis, and ethical procedures. Data collection was by a private glaucoma clinic in New York, which provided a Data Use Agreement. Upon obtaining IRB approval, I conducted a longitudinal retrospective study using the obtained archival data. There was no need to contact patients for the study.

# Chapter 4: Results

The purpose of this study was to explore whether additional education about glaucoma has an effect on patient knowledge of glaucoma, patient adherence to ocular medication use, and follow-up appointment attendance. The general question that guided this research was the following: Does the independent variable (exposure to education about glaucoma through a patient navigator) have an effect on patient knowledge of glaucoma, patient adherence to follow-up visits, and patient utilization of prescribed ocular medications among patients newly diagnosed with glaucoma among the Russian Eastern European immigrant population in a private glaucoma specialty clinic in New York? I investigated this general question through five specific RQs:

RQ1: Are there significant differences between pretest and posttest in knowledge of glaucoma as a function of whether patients are provided with additional education?

$H_0$1: There are no significant differences between pretest and posttest in knowledge of glaucoma.

$H_a$1: There are significant differences between pretest and posttest in knowledge of glaucoma.

RQ2: Are there significant differences between the two groups in knowledge of glaucoma as a function of whether patients are provided with additional education?

$H_0$2: There are no significant differences between the two groups in knowledge of glaucoma.

$H_a$2: There are significant differences between the two groups in knowledge of glaucoma.

RQ3: Is there an interaction effect between time and group in knowledge of glaucoma as a function of whether patients are provided with additional education?

$H_0$3: There is no interaction effect between the time and group in knowledge of glaucoma.

$H_a$3: There is an interaction effect between the time and group in knowledge of glaucoma.

RQ4: Is patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up appointment at T3 dependent on whether patients were exposed to education about glaucoma?

$H_0$4: The patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up appointment at T3 is not dependent on whether patients were exposed to education about glaucoma.

$H_a$4: The patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up treatment at T3 is dependent on whether patients were exposed to education about glaucoma.

RQ5: Is patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 dependent on whether patients were exposed to education about glaucoma?

$H_0$5: The patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 is not dependent on whether patients were exposed to education about glaucoma.

*$H_a$5:* The patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 is dependent on whether patients were exposed to education about glaucoma.

In this chapter, I present the collected archived data and include information regarding the procedures for gathering the patients' information. Analysis of data to answer the first three RQs (examining the extent to which patients' exposure to education about glaucoma through a patient navigator impacts their knowledge about glaucoma) entailed using a repeated measures ANOVA. Answering the fourth and fifth RQs entailed conducting a chi-square test of independence.

## Data Collection

I obtained the study data from a private glaucoma clinic located in Kings County of New York, which had conducted a cost-benefit analysis for hiring a patient navigator. The data collection was also part of the practice's efforts to improve the engagement and quality of care for the patients. The clinic administered the GKI (Celebi, 2018) to 206 patients at three time points (T1, T2, and T3) between December 2018 and December 2019. The patient navigator was responsible for administering the GKI and providing education to Group 2 patients. The clinic had adequately trained and certified the patient navigator before assigning them to the patients. The patient navigator had been an ophthalmic technician for 17 years before transitioning to the role. The patient navigator was a native Russian speaker able to communicate with patients in either English or Russian, as they preferred.

# Results

## Preparing Data for Analysis

Data cleaning is a significant component of preparing data for analysis. Upon receipt of the archival data in an Excel spreadsheet, I recoded the numerical answers for the 11 questions. Some questions were multiple choice and allowed for more than one answer; some of the answers given included correct and incorrect responses. For this analysis, if a patient had selected both a correct and an incorrect answer choice, I counted the response as correct, giving the participant full credit. Recoded responses for Questions 3 through 11 were 0 = *incorrect* and 1 = *correct*. Questions 1 and 2 remained the same because they were part of demographic knowledge gathering. After removing all personal identifiers from the data set, I converted the Excel spreadsheet into an SPSS data file to record responses in a numerical format.

## Descriptive Statistics

The IV for this study was whether participants received education about glaucoma from a patient navigator. The DVs included patient knowledge about glaucoma, attendance of follow-up appointments, and adherence to using prescribed ocular medications. Tables 1 and 2 present a summary of the descriptive variables for each variable included in the data analysis.

There were 206 participants evenly split between Group 1 (control; $n$ = 103) and Group 2 (intervention; $n$ = 103). Table 1 shows the sample descriptive statistics for the categorical variables of attendance of follow-up appointments and adherence to using prescribed ocular medications for the entire sample and then separated by group. Of the

206 participants, 70.4% attended the follow-up (*n* = 145). Most of these patients reported medication adherence (*n* = 111; 53.9%), as shown in Table 1. For those in Group 1, 67 attended the follow-up (65%), of whom 47 adhered to medication (70.1%). In Group 2, 78 participants attended the follow-up (75.7%), of whom 64 adhered to medication (82.1%).

**Table 1**

*Frequencies of Demographic Variables*

| Variable | Entire sample | | Control | | Intervention | |
|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % |
| Condition | | | | | | |
| Control | 103 | 50.0 | | | | |
| Intervention | 103 | 50.0 | | | | |
| Total | 206 | 100.0 | | | | |
| Attend 3 months | | | | | | |
| No | 61 | 29.6 | 36 | 35.0 | 25 | 24.3 |
| Yes | 145 | 70.4 | 67 | 65.0 | 78 | 75.7 |
| Total | 206 | 100.0 | 103 | 100.0 | 103 | 100.0 |
| Medication | | | | | | |
| Did not adhere | 34 | 23.4 | 20 | 29.9 | 14 | 17.9 |
| Adhered | 111 | 76.6 | 47 | 70.1 | 64 | 82.1 |
| Total | 145 | 100.0 | 67 | 100.0 | 78 | 100.0 |

Table 2 presents descriptive statistics for GKI at all three time points (T1, T2, and T3) for the entire sample, and then separated by group. Across the sample, the mean GKI score at T1 was 4.28, with a standard deviation of 1.81. The mean GKI score at T2 was 8.08, with a standard deviation of 2.06; at T3, the mean was 7.63, with a standard deviation of 1.99.

**Table 2**

*Descriptives for Continuous GKI at All Three Time Points*

| Variable | *N* | Min | Max | Mean | Std. Dev | Skew | | Kurtosis | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Stat | *SE* | Stat | *SE* |
| Entire sample | | | | | | | | | |
| GKI T1 | 206 | 2 | 9 | 4.28 | 1.81 | 0.71 | 0.17 | -0.06 | 0.34 |
| GKI T2 | 206 | 2 | 10 | 8.08 | 2.06 | -0.84 | 0.17 | -0.32 | 0.34 |
| GKI T3 | 145 | 2 | 10 | 7.63 | 1.99 | -0.60 | 0.20 | -0.49 | 0.40 |
| Control | | | | | | | | | |
| GKI T1 | 103 | 2 | 9 | 4.61 | 1.98 | 0.55 | 0.24 | -0.46 | 0.47 |
| GKI T2 | 103 | 2 | 10 | 6.60 | 1.82 | -0.16 | 0.24 | -0.19 | 0.47 |
| GKI T3 | 67 | 2 | 10 | 6.22 | 1.79 | 0.06 | 0.29 | -0.12 | 0.58 |
| Intervention | | | | | | | | | |
| GKI T1 | 103 | 2 | 9 | 3.95 | 1.57 | 0.74 | 0.24 | 0.20 | 0.47 |
| GKI T2 | 103 | 4 | 10 | 9.56 | 0.90 | -3.64 | 0.24 | 17.12 | 0.47 |
| GKI T3 | 78 | 5 | 10 | 8.85 | 1.20 | -1.14 | 0.27 | 0.95 | 0.54 |

**Testing Statistical Assumptions**

Testing the statistical assumptions of the first three RQs was by using a repeated measures ANOVA. The first assumption of a repeated measures ANOVA is that DV measurement was continuous. Because I measured patient knowledge about glaucoma continuously, this assumption was met.

Examining the second assumption of normality of the DV occurred in three ways. First, I performed the Shapiro-Wilk's test to determine whether glaucoma knowledge was normally distributed at all three time points. I found this not to be the case ($p < .05$), as shown in Table 3. Next performed was a visual inspection of the histograms of glaucoma knowledge at all three time points (see Figures 3–5). The visual inspection showed that the distribution of glaucoma knowledge at T1 and T3 did not indicate a large departure from a normal distribution. However, the distribution of glaucoma knowledge at T2 showed a heavy amount of skew. Finally, I examined skewness and kurtosis at all three time points for the entire sample as well as separated by group, as shown in Table 2. In concurrence with the visual inspection, skewness and kurtosis fell within the acceptable +/-1 range, except for glaucoma knowledge at T2 for the intervention group. Figure 6 shows that the extreme level of skewness at T2 for the intervention group was due to most of Group 2 reporting high scores on glaucoma knowledge after receiving additional education. A square root transformation of each time point was necessary due to the extreme nature of skewness at T2. However, using the transformed version of GKI did not change the results of the repeated measures ANOVA. I kept the original version of the DV at all three time points to ease findings interpretation.

Testing the final assumption of homogeneity of sphericity was by using Mauchly's test of sphericity to examine whether the variance in glaucoma knowledge was equal for all possible pairs. Mauchly's test indicated a violation of the assumption of sphericity for the two-way interaction ($\chi^2(2) = 43.74$, $p < .001$, $\varepsilon = 0.79$). Because the estimated epsilon was over 0.75, the Huynh-Feldt correction was necessary to examine the interaction between GKI time and group (see Collier et al., 1967).

**Table 3**

*GKI Pairwise Comparisons Between Time Points*

| Variable | Mean difference | *SE* | *p* |
|---|---|---|---|
| GKI T1 | | | |
| T2 | -3.86* | 0.14 | < .001 |
| T3 | -3.23* | 0.14 | < .001 |
| GKI T2 | | | |
| T1 | 3.86* | 0.14 | < .001 |
| T3 | .64* | 0.09 | < .001 |
| GKI T3 | | | |
| T1 | 3.23* | 0.14 | < .001 |
| T2 | -.64* | 0.09 | < .001 |

**Figure 3**

*Histogram of GKI at Time 1 for the Entire Sample*

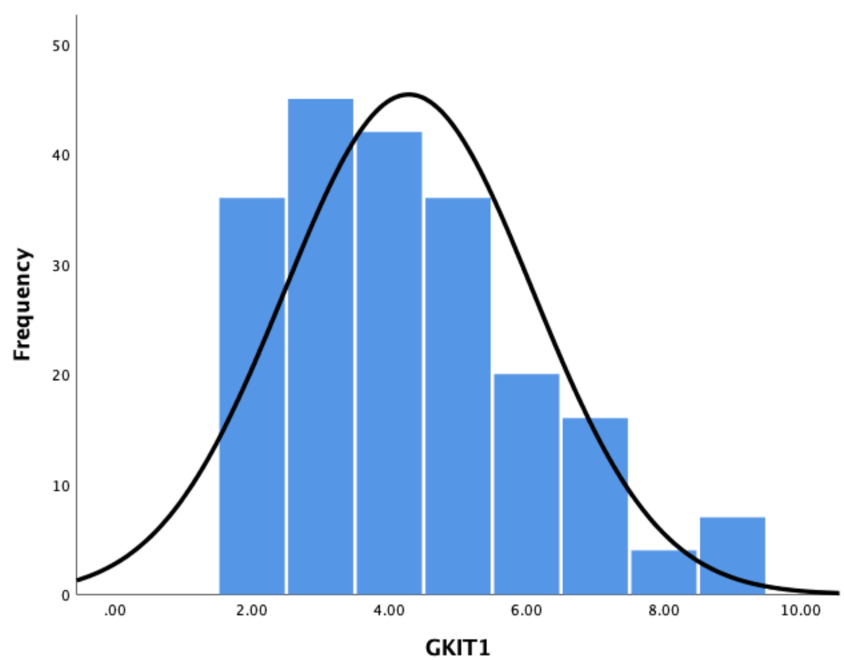


**Figure 4**

*Histogram of GKI at Time 2 for the Entire Sample*

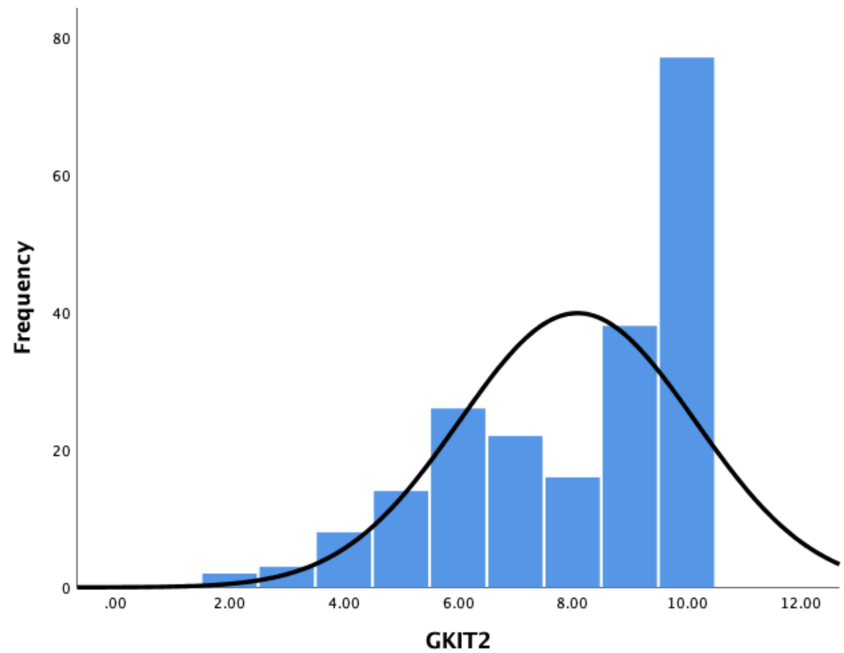



**Figure 5**

*Histogram of GKI at Time 3 for the Entire Sample*

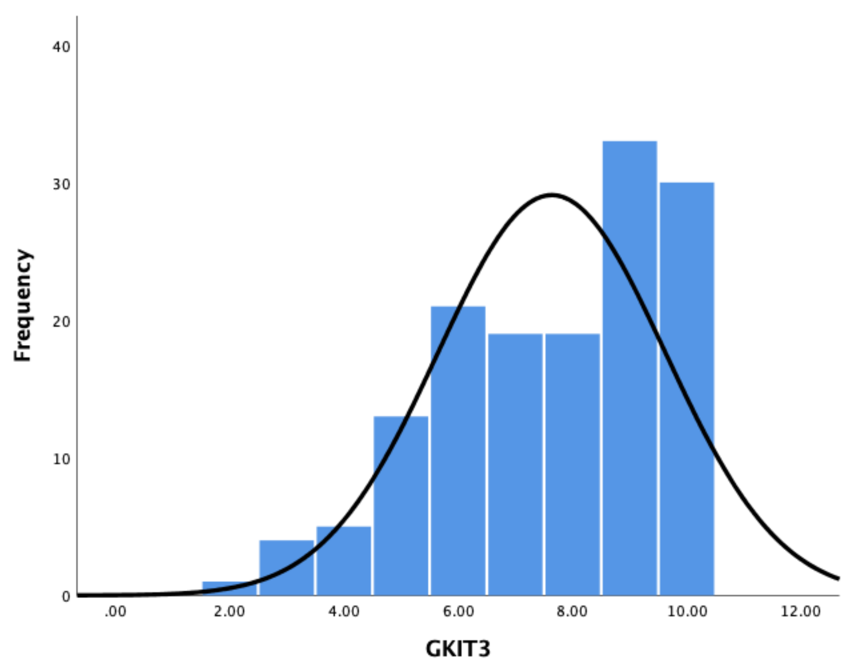
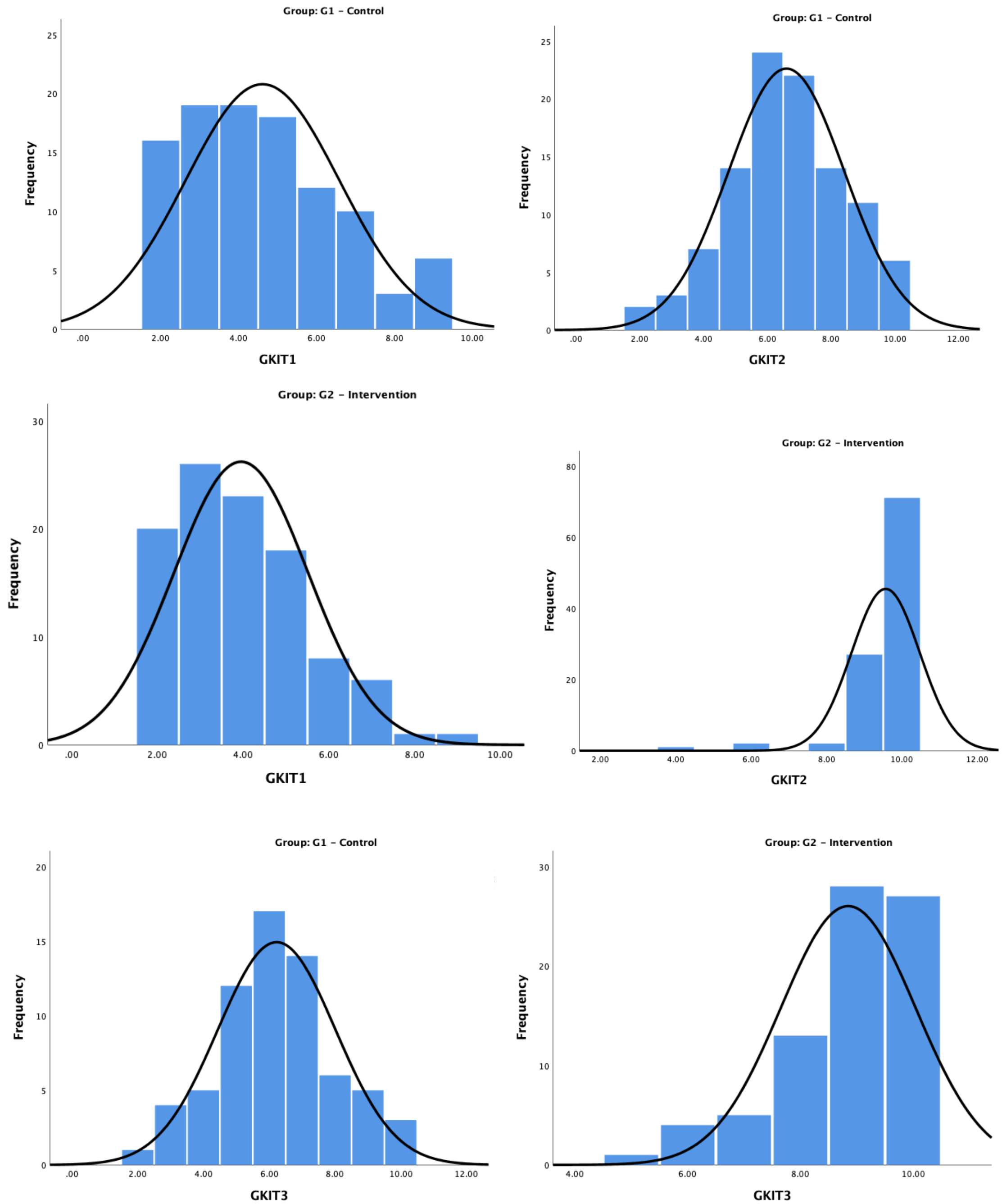


**Figure 6**

*Histograms of Glaucoma Knowledge by Time and Group*



**Glaucoma Knowledge**

I conducted a repeated measures ANOVA to examine the first three research questions. The model had a within-subjects variable of time when the clinic gathered glaucoma knowledge (T1, T2, and T3). The between-subjects variable was group, which contained two levels: Group 1 and Group 2. The model also incorporated the interaction between time and group.

RQ1: Are there significant differences between pretest and posttest in knowledge of glaucoma as a function of whether patients are provided with additional education?

$H_0 1$: There are no significant differences between pretest and posttest in knowledge of glaucoma.

$H_a 1$: There are significant differences between pretest and posttest in knowledge of glaucoma.

To determine whether glaucoma knowledge differed between time points, I examined the main effect of time in the repeated measures ANOVA. There was a statistically significant main effect of time point, such that glaucoma knowledge was significantly different between at least two time points ($F(2, 286) = 541.40$, $p < .001$, partial $\eta^2 = .79$). Pairwise dependent *t* tests indicated that all comparisons between time points were statistically significant, as shown in Table 4.

**Table 4**

*GKI Estimated Marginal Means by Group for All Time Points*

| Variable | *M* | *SE* | 95% CI |
|---|---|---|---|
| GKI T1 | | | |
| Control | 4.61 | 0.18 | [4.27, 4.96] |
| Intervention | 3.95 | 0.18 | [3.61, 4.30] |
| GKI T2 | | | |
| Control | 6.60 | 0.14 | [6.32, 6.88] |
| Intervention | 9.56 | 0.14 | [9.28, 9.84] |
| GKI T3 | | | |
| Control | 6.22 | 0.18 | [5.86, 6.59] |
| Intervention | 8.85 | 0.17 | [8.51, 9.18] |

RQ2: Are there significant differences between the two groups in knowledge of glaucoma as a function of whether patients are provided with additional education?

$H_0 2$: There are no significant differences between the two groups in knowledge of glaucoma.

$H_a 2$: There are significant differences between the two groups in knowledge of glaucoma.

For this research question, I examined the main effect of group from the repeated measures ANOVA, where group was the between-subjects variable. There was a statistically significant main effect of group, such that Group 1 ($M = 5.73$, $SD = 1.67$) overall had lower glaucoma knowledge than Group 2 ($M = 7.27$, $SD = 0.97$; $F(1, 143) = 56.13$, $p < .001$, partial $\eta^2 = .28$).

RQ3: Is there an interaction effect between time and group in knowledge of glaucoma as a function of whether patients are provided with additional education?

$H_0 3$: There is no interaction effect between the time and group in knowledge of glaucoma.

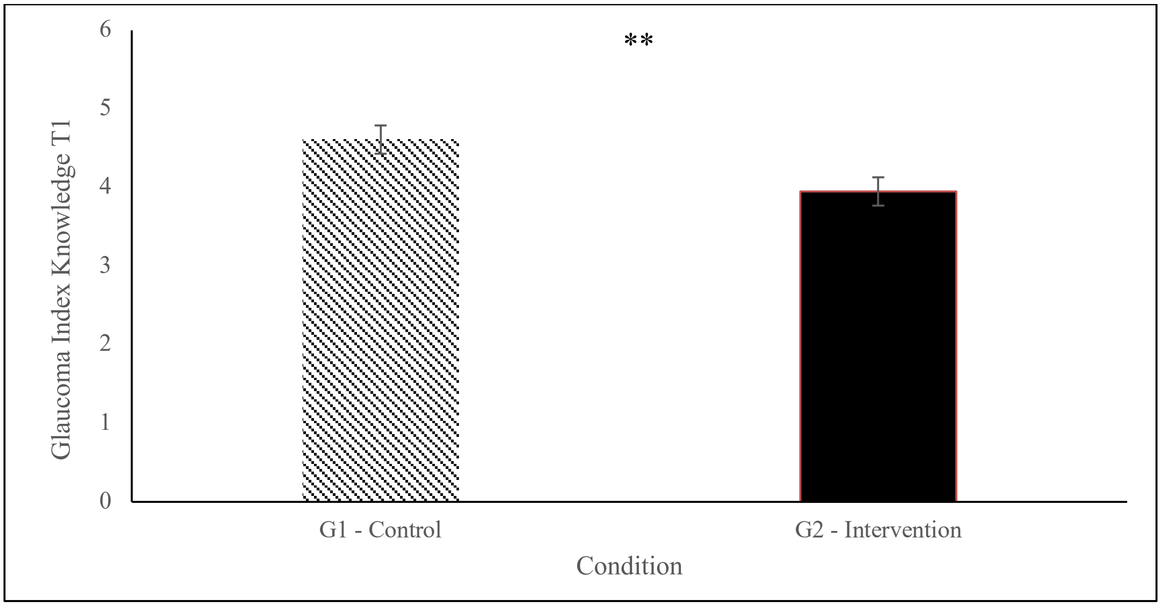
*H*a3: There is an interaction effect between the time and group in knowledge of glaucoma.

To answer RQ3, I examined the interaction from the repeated measures ANOVA between the within-subjects variable of GKI timepoint and the between-subjects variable of Group. The Huynh-Feldt correction was the means to account for the violation of sphericity. The interaction was significant even with the correction, indicating differences between the groups for at least one time point ($F(1.61, 229.77) = 134.01$, $p < .001$, partial $\eta^2 = .48$). Table 4 shows the breakdown of estimated marginal means and standard errors for condition by each time point. To decompose the interaction, I conducted a simple main effect of group at all three time points.

Figure 7 presents the baseline glaucoma knowledge at T1 for both groups. Glaucoma knowledge at T1 was statistically significantly greater in Group 1 compared to Group 2 ($F(1, 204) = 7.05$, $p < .01$, partial $\eta^2 = .03$). This difference indicates that despite participants' random assignment, the control condition had a slightly higher baseline.

**Figure 7**

*Means for Glaucoma Knowledge at Time 1 by Group*

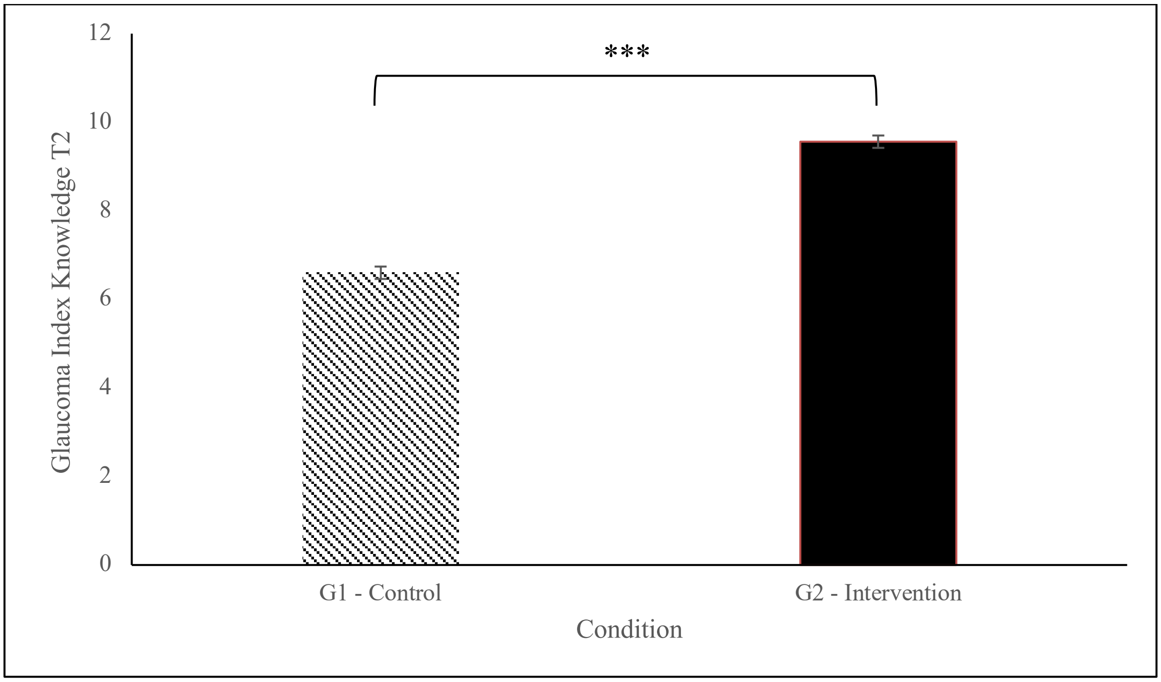



*Note.* Error bars indicate standard error of the means; ** indicates $p < .01$.

Figure 8 shows glaucoma knowledge gathered from both groups (intervention and control) at T2. The collection of this time point was on the same day as T1, immediately after the eye exam for the control group and after the exam and additional education about glaucoma provided by the patient navigator for the intervention group. At T2, glaucoma knowledge was significantly higher for the intervention group compared to the control group ($F(1, 204) = 219.33$, $p < .001$, partial $\eta^2 = .52$; see Figure 8).

**Figure 8**

*Means for Glaucoma Knowledge at Time 2 by Group*

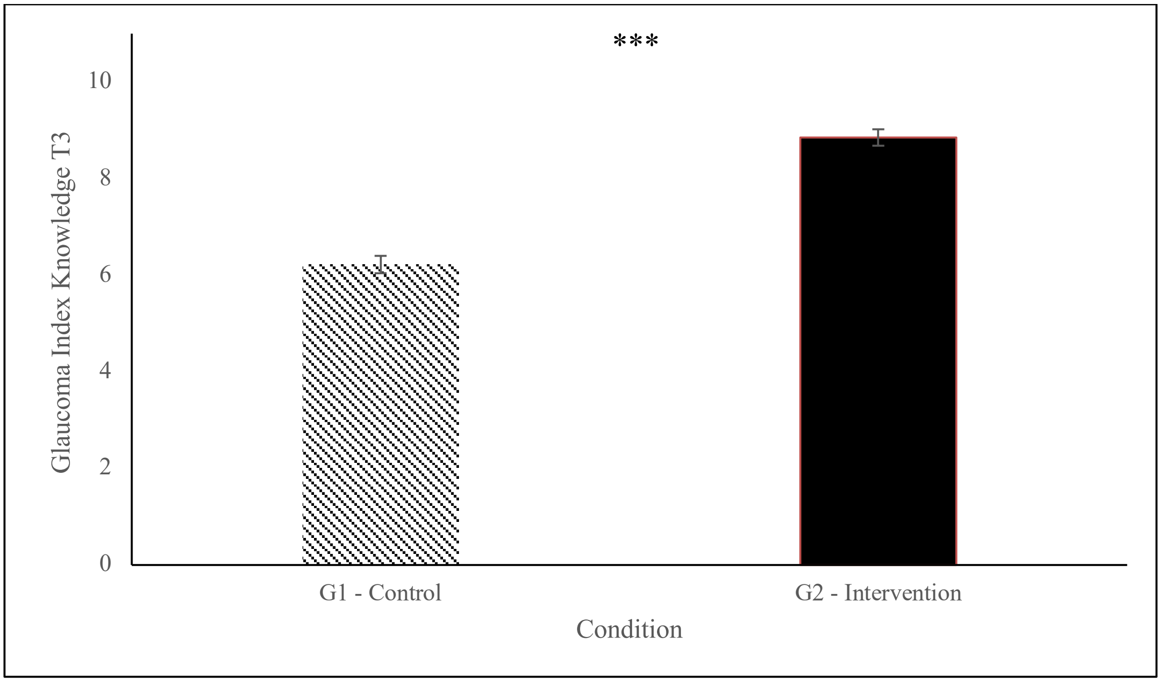



*Note.* Error bars indicate standard error of the means; *** indicates $p < .001$.

Figure 9 illustrates means for glaucoma knowledge at T3, as collected for all patients at the 1-month follow-up appointment. At T3, the intervention group still demonstrated significantly higher knowledge of glaucoma ($F(1, 143) = 110.13$, $p < .001$, partial $\eta^2 = .44$. This difference indicates that patients in the intervention group retained the increased knowledge about glaucoma at a 1-month follow-up appointment.

**Figure 9**

*Means for Glaucoma Knowledge at Time 3 by Group*

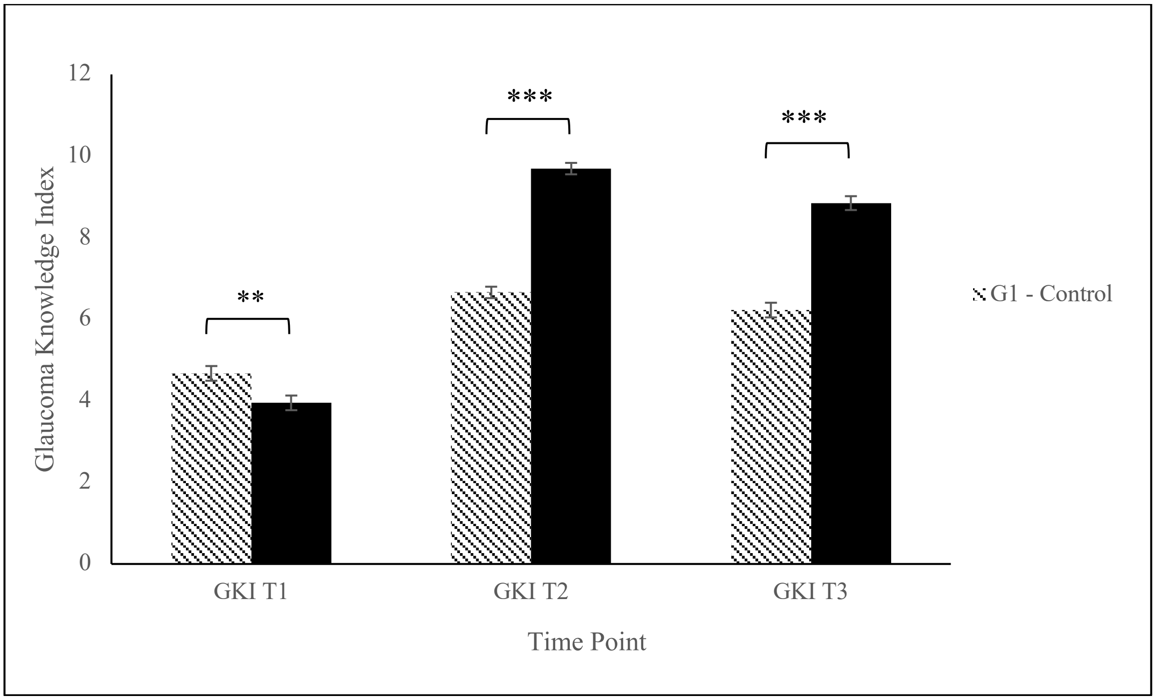



*Note.* Error bars indicate standard error of the means; *** indicates $p < .001$.

Figure 10 is a summary of the GKI results at T1, T2, and T3. The figure shows that at baseline (T1), the control group (Group 1) had greater glaucoma knowledge than the intervention group (Group 2). T2, conducted on the same day as T1, indicates a jump in knowledge for both groups, with the intervention group having a greater overall increase in knowledge. The figure also shows that at a 1-month follow-up appointment, there was a slight decrease in knowledge in both groups from T2, with the intervention group maintaining a general trend increase in knowledge from the T1 baseline.

**Figure 10**

*Glaucoma Knowledge Index at Time 2 and Time 3 by Group*

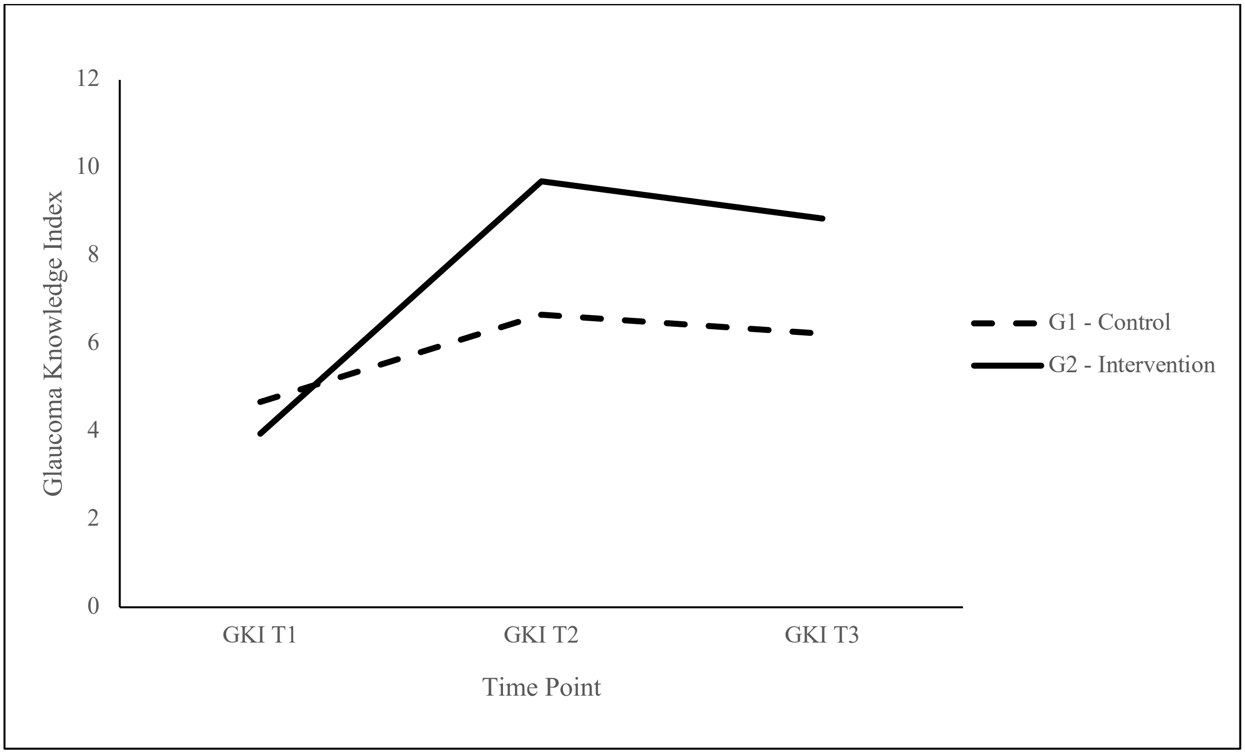



*Note.* Error bars indicate standard error of the means; ** indicates $p < .01$; *** indicates $p < .001$.

Figure 11 presents the full interaction with marginal means for conditions by each time point. The interaction shows that at T1, the control condition scored higher on the GKI than the intervention. At T2, the intervention condition scored significantly higher on the GKI, and at T3, both conditions dropped while maintaining the differential between the control and intervention conditions, with the intervention scoring higher.

**Figure 11**

*Marginal Means Interaction*




*Note.* The interaction effect.

RQ4: Is patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up appointment at T3 dependent on whether patients were exposed to education about glaucoma?

$H_0$4: The patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up appointment at T3 is not dependent on whether patients were exposed to education about glaucoma.

$H_a$4: The patients' (Group 1 vs. Group 2) adherence to attending a glaucoma follow-up treatment at T3 is dependent on whether patients were exposed to education about glaucoma.

To answer RQ4, I performed a chi-square test of independence between the variables of group and attendance at the follow-up visit (T3). There was no difference between Group 2 and Group 1 attendance for the follow-up glaucoma exam. Marginally, more participants in Group 2 attended the 3-month follow-up visit compared to participants in Group 1 ($\chi^2$ (1) = 2.82, $p$ = .09, $V$ = .12). This was apparent by the $p$ = .09, which was larger than the accepted cut-off value of α = .05, making the results not statistically significant (Cohen, 1988).

Table 5 shows the frequency breakdown by group of those who did and did not attend the follow-up. The effect size (Cramer's V) for group's relationship to follow-up attendance was small. According to Cohen (1988), Cramer's V values of .1 to .3 are considered to have a small effect size. Therefore, this study's Cramer's V value of .12 indicates the assumption of no relationship between variables of education about glaucoma provided by a patient navigator and patient's adherence to attending a glaucoma follow-up appointment.

**Table 5**

*Chi-Square Cell Breakdown for Time 3 Follow-Up Attendance by Group*

| Group | Attended follow-up | | Total |
|---|---|---|---|
| | Did not attend | Attended | |
| Group 1 | | | |
| Count | 36 | 67 | 103 |
| % within Group | 35.00% | 65.00% | 100.00% |
| % within Attend | 59.00% | 46.20% | 50.00% |
| % of Total | 17.50% | 32.50% | 50.00% |
| Group 2 | | | |
| Count | 25 | 78 | 103 |
| % within Group | 24.30% | 75.70% | 100.00% |
| % within Attend | 41.00% | 53.80% | 50.00% |
| % of Total | 12.10% | 37.90% | 50.00% |
| Total | | | |
| Count | 61 | 145 | 206 |
| % within Group | 29.60% | 70.40% | 100.00% |
| % within Attend | 100.00% | 100.00% | 100.00% |
| % of Total | 29.60% | 70.40% | 100.00% |

RQ5: Is patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 dependent on whether patients were exposed to education about glaucoma?

$H_0$5: The patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 is not dependent on whether patients were exposed to education about glaucoma.

$H_a$5*:* The patients' (Group 1 vs. Group 2) adherence to using prescribed ocular medication at T3 is dependent on whether patients were exposed to education about glaucoma.

To answer RQ5, I performed a chi-square test of independence between the variables of group and medication adherence reported at the follow-up visit (T3).

Marginally, more participants in Group 2 reported adhering to medication at T3 compared to participants in Group 1 ($\chi^2(1) = 2.84$, $p = .09$, $V = .14$). Table 6 shows the frequency breakdown of those who did and those who did not adhere to medication by Group. The $p = .09$ was below the accepted convectional industry standard of $p < .05$, making the results not statically significant.

The effect size (Cramer's V) for group's relationship to adherence to using prescribed ocular medication was small. According to Cohen (1988), Cramer's V values of .1 to .3 are considered to have a small effect size. Therefore, a Cramer's V value of .14 in this study indicates the assumption of no relationship between variables of education about glaucoma provided by a patient navigator and patient adherence to using prescribed ocular medication.

**Table 6**

*Chi-Square Cell Breakdown for Medication by Group*

| Group | Medication | | Total |
|---|---|---|---|
| | Did not adhere | Adhered | |
| Group 1 | | | |
| Count | 20 | 47 | 67 |
| % within Group | 29.90% | 70.10% | 100.00% |
| % within Attend | 58.80% | 42.30% | 46.20% |
| % of Total | 13.80% | 32.40% | 46.20% |
| Group 2 | | | |
| Count | 14 | 64 | 78 |
| % within Group | 17.90% | 82.10% | 100.00% |
| % within Attend | 41.20% | 57.70% | 53.80% |
| % of Total | 9.70% | 44.10% | 53.80% |
| Total | | | |
| Count | 34 | 111 | 145 |
| % within Group | 23.40% | 76.60% | 100.00% |
| % within Attend | 100.00% | 100.00% | 100.00% |
| % of Total | 23.40% | 76.60% | 100.00% |

## Summary

The IV was exposure to education about glaucoma through a patient navigator; the DVs were patient knowledge of glaucoma, patient adherence to follow-up visits, and patient utilization of prescribed ocular medications. Overall, patient knowledge of glaucoma at pretest differed from knowledge at posttest. There was a statistically significant main effect of the IV (education about glaucoma through a patient navigator) such that the overall intervention group had higher glaucoma knowledge than the control group. Additionally, there was a statistically significant interaction between the IV (education about glaucoma through a patient navigator) and the time of glaucoma knowledge assessment, indicating that the IV effect differed depending on the time point of assessing glaucoma knowledge. For example, Group 1 reported more glaucoma knowledge at pretest compared to Group 2, whereas Group 2 reported higher glaucoma knowledge at both posttest time points. These results indicate a rejection of the null hypotheses for RQ1, RQ2, and RQ3.

RQ4 pertained to examining whether patients' adherence to attending a glaucoma follow-up appointment at T3 was dependent on their exposure to education about glaucoma. The results indicate an inability to reject the null hypothesis, which suggests that there is no statistically significant relationship between the IV (education about glaucoma through a patient navigator) and the DV (patients' adherence to attending a glaucoma follow-up appointment). Patient adherence to follow-up visits was not dependent on education about glaucoma provided through a patient navigator.

RQ5 was specific to examining whether patients' adherence to using prescribed ocular medication at T3 was dependent on the presence or absence of exposure to education about glaucoma. From the results, it was not possible to reject the null hypothesis, suggesting that there was no statistically significant relationship between the IV (education about glaucoma through a patient navigator) and the DV (patients' adherence to using prescribed ocular medication). Patient utilization of prescribed ocular medications was not dependent on education about glaucoma provided through a patient navigator.

Chapter 5 presents a detailed interpretation of the findings within the limits and scope of the study. I also discuss the study's limitations and the implications for social change. Following a description of the methodological, theoretical, and empirical implications of this study are recommendations and a conclusion.

# Chapter 5: Discussion, Conclusions, and Recommendations

In this study, I sought to determine whether education about glaucoma provided by a patient navigator had an effect on patient knowledge about glaucoma as well as patient adherence to follow-up visits and medication utilization among Russian Eastern European immigrant patients. I used a longitudinal design, incorporating archival data from a private glaucoma clinic located in New York. Quantitative research methods were appropriate to determine whether there were significant differences between the two groups in their knowledge of glaucoma pretest versus posttest as well as whether there was an interaction effect between time and group. Additionally, the quantitative approach allowed me to determine whether adherence to attending follow-up appointments or using prescribed ocular medications were dependent on exposure to education about glaucoma. This chapter includes an interpretation of the findings, discussion of limitations encountered, recommendations for research, and implications for social change resulting from this study.

## Interpretation of Findings

After receiving Walden University's IRB approval, I obtained deidentified patient data from a private glaucoma clinic in New York. The practice had run a cost-benefit analysis of hiring and training a patient navigator to provide education to patients and increase the efficiency of patient screening. The clinic collected the data during established patients' regular visits and new patient consultations. The clinic provided me with 206 patient records that met the inclusion criteria of (a) Russian immigrant or of that descent, (b) age 45 to 80 years, (c) no known or diagnosed cognitive impairment, and (d) and not diagnosed with glaucoma in the past.

The practice collected, stored, and archived data and subsequently provided them to me in an Excel spreadsheet. I conducted the data analyses for this study using SPSS. Analyses of the first three research questions were executed by using a repeated measures ANOVA, with the fourth and fifth research questions analyzed using a chi-square test of independence. In the next section, I discuss the results of these statistical tests in relation to the current literature and the study's research questions.

**Improvement of Glaucoma Knowledge**

Data analysis indicated a significant difference between Group 1 and Group 2 at different time points of GKI assessment. Glaucoma knowledge at T1 was statistically significantly greater in Group 1 compared to Group 2 ($F(1, 204) = 7.05$, $p < .01$, partial $\eta^2 = .03$). This difference indicates that although participants received random group assignment, the control group had a slightly higher baseline GKI knowledge score than the intervention group. At T2, glaucoma knowledge was significantly higher for the intervention group compared to the control group ($F(1, 204) = 219.33$, $p < .001$, partial $\eta^2 = .52$). The clinic administered the GKI assessment at this time point immediately after the eye exam for the control group, and after the exam and additional education about glaucoma provided by the patient navigator for the intervention group. At T3, all patients completed the GKI to gauge their glaucoma knowledge at their 1-month follow-up appointment. The intervention group still demonstrated significantly higher knowledge of glaucoma ($F(1, 143) = 110.13$, $p < .001$, partial $\eta^2 = .44$), indicating they retained the increased knowledge about glaucoma at a 1-month follow-up appointment.

Data analysis showed that educational intervention provided by a patient navigator had improved patients' knowledge about glaucoma, with lasting effects into their 1-month follow-up eye appointment. Results from prior studies supported these findings, showing that glaucoma education delivered in person through individualized counseling was more effective in improving overall glaucoma knowledge in newly diagnosed patients than giving patients take-home materials or brochures or having them watch videos (McVeigh & Vakros, 2015; Newman-Casey et al., 2015; Okeke et al., 2009). Gray et al. (2012) randomized 127 newly diagnosed glaucoma patients to a personalized, individual health care assessment in addition to standard care or standard care with an ophthalmologist. Gray et al.'s intervention began with a 75-minute counseling session with a glaucoma nurse to design a 1-year personalized follow-up plan. This longitudinal study assessed patient knowledge over 1 year and included five appointments with the nurse throughout the year, each lasting 15 to 30 minutes, to further educate patients or answer questions. Intervention arm patients had a significantly greater knowledge of glaucoma ($p < .001$) at the end of the study than the control arm. Although the intervention proved efficacious when it came to knowledge retention for glaucoma patients, the cost-effectiveness of hiring a nurse to spend this time with patients proved detrimental to the practice's financial sustainability. Gray et al. suggested finding less-involved educational interventions that might not require a full-time nursing position.

Building on Gray et al.'s findings, Cate et al. (2014) evaluated a behavior change counseling program for 208 newly diagnosed glaucoma patients. The counseling included glaucoma education and motivational support from trained paraprofessional staff called glaucoma support assistants. Paraprofessional staff attended 7 hours of training about glaucoma and its treatment, barriers to adherence, and brief motivational interviewing techniques. Patients' sessions with glaucoma support assistants lasted between 15 and 60 minutes. There was no statistically significant difference in the proportion of individuals with ≥ 80% glaucoma knowledge scores, with 62.5% in the control group and 66.7% in the intervention group ($p = 0.63$). Cate et al. stated that despite finding no additional increase in patient education about glaucoma, inexpensively providing information tailored to the individual resulted in high patient satisfaction with retaining information about glaucoma.

I evaluated an intervention that was cost-effective and did not warrant a separate clinical position to provide educational support to newly diagnosed patients. The intervention might have been successful due to the provision of education by a navigator, who was a trained optician for many years before shifting into navigating. Last, this intervention might have been successful because of the cultural similarity between the navigator and the patient population, thereby creating a sense of implicit alliance.

**Adherence to Follow-Up Eye Appointments**

Data analysis for evaluating adherence to attending a glaucoma follow-up appointment at T3 indicated no statistically significant difference in Group 1 versus Group 2. Marginally, more participants in Group 2 attended the 3-month follow-up visit

($p = .09$) compared to Group 1 participants. The literature has shown compliance and adherence to attending follow-up eye exam appointments as concerns in glaucoma treatment (Davis et al., 2018; Johnson et al., 2016; C. X. Zheng et al., 2016). The low follow-up rate among newly diagnosed glaucoma patients suggests there could be significant barriers affecting follow-up adherence after receiving an ocular diagnosis (Newman-Casey, Robin, et al., 2015). Initially, Newman-Casey, Robin, et al. (2015) cited a lack of education and patients' misunderstanding their diagnosis as barriers to attending follow-up eye appointments.

Building on Newman-Casey, Robin, et al.'s (2015) findings, other researchers evaluated adherence to follow-up appointment rates with the implementation of an educational component into the diagnosis. Hark et al. (2019) found that despite various educational interventions, adherence to follow-up appointments was still lacking. Hark et al. noted that cultural, racial, and linguistic barriers between health care providers and patients significantly affected the quality of health care delivery, ability to access health care, and poor health outcomes. Hark et al. evaluated 535 participants, with 172 randomized to the intervention group and connected with a social worker who provided reminder phone calls and transportation assistance to the follow-up appointments. Even with the social worker intervention, there was no statistically significant difference between the control and intervention groups in adherence to follow-up appointments.

These results parallel other studies, which have shown forgetfulness and lack of education about the importance of attending follow-up eye exam appointments to be the most commonly cited reasons for missed eye exam visits (Murchison et al., 2017). Hark et al. (2019) suggested using a culturally competent patient navigator as an educational and supportive component of patients' treatment. Based on these recommendations, I attempted to evaluate such a service delivery through a culturally competent patient navigator. This study's findings supported prior research showing that educational interventions, although efficacious in improving patients' understanding and knowledge of glaucoma, do not improve patients' adherence to follow-up eye exam appointments.

**Adherence to Using Prescribed Ocular Medications**

Data analysis for evaluating adherence to using prescribed ocular medications at T3 indicated no statistically significant difference in Group 1 versus Group 2. Marginally, more participants in Group 2 used their ocular medications ($p$ = .09) compared to participants in Group 1. Poor adherence to medication regimens accounted for substantial worsening of the disease and increased health care costs (Feehan et al., 2016). Researchers have conducted studies to evaluate patients' adherence to their ocular pharmacology treatments (Feehan et al., 2016; McVeigh & Vakros, 2015; Movahedinejad & Adib-Hajbaghery, 2016; Newman-Casey, Robin, et al., 2015; Okeke et al., 2009). In one of the largest multisite studies, P. F. Cook et al. (2015) reported that demographic variables, such as age, gender, and occupation, cannot significantly predict patients' adherence to glaucoma treatment. Although the inconsistencies between studies could be due to the populations' characteristics, as patients age they encounter problems, such as hand tremors and memory loss, which might negatively affect their ability to use topical eye medications, thereby decreasing adherence.

Patient self-reporting was an indirect method of assessing adherence to ocular medication. Other data came from physicians' measurement of ocular pressure during the visit to confirm the pharmacological suitability of the prescribed medication. Sayner et al. (2015) highlighted particular trends in patients' compliance. Monnette et al. (2018) demonstrated that patient adherence with medication improved in the 5 days before and after the appointment with their physician. According to Newman-Casey, Robin, et al. (2015), eye drops are far more challenging to self-administer than other medications because they require physical coordination, manual dexterity, hand-eye coordination, and good vision, all of which tend to decrease in aging glaucoma patients. Scholars have also shown that adding a second medication and/or increasing the complexity of glaucoma therapy is associated with a statistically significant decrease in adherence (Frech et al., 2018).

I did not evaluate any of the contributing factors to the reasons for ocular medication noncompliance. However, it is important to note that although the services of a culturally competent patent navigator assisted patients in retaining glaucoma knowledge at a 1-month follow-up, there was no statistically significant change in adherence to medication use according to patient self-report. The study's findings indicate the difficulty of improving adherence in an asymptomatic disease that requires lifelong therapy.

## Limitations of the Study

The present study had several limitations. First, there were limitations associated with using archival data because not directly obtaining information leads to an inability to establish authenticity. Second, there is limited generalizability of findings because the sample did not reflect the general population, instead consisting only of Russian immigrants residing in New York. A single glaucoma specialty practice provided participant data, indicating convenience sampling for data collection. Because the patient navigator was a Russian immigrant, possible positive cultural bias could have been a limitation if participants wanted to please the patient navigator and put forth more effort than they would have engaged in otherwise. Finally, multiple barriers unrelated to adherence might have prevented participants from attending follow-up exams, such as participant mortality, illness, or inability to get transportation, all of which went unassessed. Due to cultural differences, the present study's findings are not generalizable to other populations.

Archival data presented a significant limitation. Using archival, or secondary, data means the researcher has not obtained the information directly; therefore, I could not ensure the results were entirely accurate, limiting the study. Using archived data presents concerns, including the inability to establish authenticity (Frankfort-Nachmias & Nachmias, 2008). Authentic research refers to research that is genuine, representing an actual data set and not a reproduction or copy. Because I did not collect the data directly, establishing authenticity was not possible.

Additionally, there was a potential for selection bias, which would skew the study results. Selection bias occurs in the absence of sample randomization, with convenience sampling leading to uncontrolled population variables (Creswell, 2012). The conveniecne smaple of 206 participants was randomly split into two groups, Group 1 and Group 2, with equal sample size of 103 participants in each. One variable not controlled in the study was participants who might have been more health conscious and eager to adhere to the study protocol. Using a convenience sample could also affect the statistical analysis due to the lack of randomization. Researchers using a nonrandom sample cannot eliminate systematic bias from the selection procedure or estimate parameters of the data such that the findings obtained are representative of the overall population (Frankfort-Nachmias & Nachmias, 2008).

The lack of a standardized patient navigator protocol for the time spent with the patient limited replicability, as necessary, to ascertain external validity and generalizability of the findings. Variables such as actual time spent with the patient navigator, frequency and duration of interappointment phone calls, appointment reminders, leaving accurate messages, and inability to assess reasons for missing appointments affected the reliability of the results. Also not controlled for were the patient navigator's gender and cultural background, factors that might have influenced participants' behavior and answers. Moreover, the patient navigator did not adhere to a rigid script during patient appointments, likely varying the discussion based on patients' needs. The patient navigator made a unilateral decision regarding what to address with each patient, thereby reducing the procedure's validity and replicability.

The data files were in an encrypted Excel spreadsheet extracted from the practice's REDCap database. I manually scanned the spreadsheet for new patients only, omitting the existing patients' information. Next, I recorded the data by their corrected answers, uploading a new Excel spreadsheet into SPSS for data analysis. By using these techniques, I was able to minimize limitations and concerns for the study, such as data contamination from existing patients. The results from this study were consistent with the findings in the literature, which showed that improved patient knowledge and understanding of glaucoma is independent of patients' adherence to follow-up appointments and use of prescribed ocular medications.

## Recommendations

The findings indicated areas for future research, including the study design. My study population had similar ethnic identification distributions and was isolated to a localized area in New York. The generalizability of results is low due to the homogeneity of the population. Studies incorporating broader demographics and diverse ethnic and racial backgrounds would allow for increased confidence in generalizing results to populations with similar ethnic identities.

Previous research has shown that providing knowledge and educating patients about glaucoma did not have a significant effect on improving their adherence to follow-up care or utilization of ocular medications. Despite prior assumptions that providing and improving strategies to educate patients about their condition would increase patient adherence to prescribed treatment, this belief is unsupported. Future studies on improving ways to engage patients in their own care are necessary. Further research could also focus on interventions targeting adherence to follow-up care and using ocular medications independently, without focusing on educational strategies.

## Implications for Social Change

Glaucoma is a chronic, progressive, and asymptomatic disease and is the second leading cause of preventable blindness worldwide (Newman-Casey, Blanchey, et al., 2015). Timely, effective, and successful treatment is necessary to reduce intraocular pressure and minimize glaucoma development and progression (Gupta et al., 2016; Hark et al., 2017). Achieving these outcomes entails frequent follow-up eye exams and eye drop administration (Gupta et al., 2016). However, adherence to medical therapies is notoriously poor, with reported nonadherence rates ranging from 30% to 80% (Prum et al., 2016). Poor adherence is associated with disease progression and blindness, leading to significant personal, societal, and economic burdens, such as the loss of health-related quality of life (Tan et al., 2018; D. D. Zheng et al., 2018). Ongoing visual field loss can impair patients' abilities to perform everyday activities through substantially reduced mobility, more falls and unnecessary trips to the hospital, and negative psychological effects (D. D. Zheng et al., 2018).

The financial burden of glaucoma rises along with disease severity. Gupta et al. (2016) found a fourfold increase in direct ophthalmology-related costs as severity increased from asymptomatic ocular hypertension/earliest glaucoma (Stage 0) through advanced glaucoma (Stage 3) to end-stage glaucoma/blindness (Stage 5). The average direct costs per patient per year were $623, $1,915, and $2,511, respectively (Feldman et al., 2020; Gupta et al., 2016; Varma et al., 2011; Yang et al., 2019). The majority of costs were medication-related at all severity stages. Individuals with late-stage disease incur additional indirect costs, placing a substantial burden on health care resources. Late disease leads to greater indirect costs, such as family and home help and rehabilitation costs, which become the predominant driver of overall expense (Feldman et al., 2020).

This study contributed to positive social change. I addressed the literature gap, investigating a specialized, culturally competent educational intervention provided to newly diagnosed glaucoma patients to evaluate its effect on improving clinical management of glaucoma. The positive impact at the individual level could be a healthier, happier, and more productive person; at the health care delivery level, the findings could contribute to creating a model of care that is empowered, informed, and patient-centered; and at the economic level, the findings indicate a need to allocate resources for more imminent issues affecting the health care of the general population. This study's outcomes could form the basis for serious discussions among policymakers. The study might also enhance the awareness of physicians and the public about the burden of glaucoma, prioritizing glaucoma care and treatment. Implications for further scientific investigations include broadly exploring factors affecting nonadherence in glaucoma patients and ways to improve adherence among the targeted population.

## Conclusion

Glaucoma is a growing problem. It is common, often underdiagnosed, costly, distressing to patients and families, and disabling. As glaucoma prevalence increases exponentially with age, its incidence is rising among the rapidly aging population (Fenwick et al., 2020). Economic and individual costs increase with disease severity; however, proactive glaucoma management can reduce the overall disease burden. Early identification and treatment of patients with glaucoma and those with ocular hypertension at high risk of developing vision loss can reduce the individual burden of disease on health-related quality of life and minimize personal and societal economic burdens.

This study showed that an in-person, individualized educational session provided by a culturally competent patient navigator was effective in improving patients' knowledge and understanding about the disease well into their 1-month follow-up appointment. However, this knowledge was independent of the patients' adherence to attending a follow-up appointment or using their ocular drops. This study showed that each patient is likely to have a unique set of issues to address to optimize adherence. It is possible that the greater the number of barriers identified, the greater the likelihood of nonadherence (see Newman-Casey, Robin, et al., 2015). It was possible to predict nonadherent behavior according to the TTM, or the stages of change, indicating individuals' enormous capacity to change harmful or undesirable behavior (DiClemente & Prochaska, 1982, 1998; Prochaska & Vellcer, 1997). Interventions focused on improving adherence should build self-efficacy, teach patients proper eye drop instillation, and address forgetfulness and difficulties with the medication schedule (Feehan et al., 2016). Providers should individualize interventions, tailoring information and approaches to address each patient's unique set of barriers. All health care providers should pay attention to their patients' predictive adherent behaviors to identify the best corrective measures to achieve optimal treatment.

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