Relationship between schizophrenia, diabetes, and the length of hospital stay, with patient's gender as the moderator.

by

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ABSTRACT

The prevalence of diabetes and obesity is significantly higher in patients diagnosed with schizophrenia than those without schizophrenia, and the increased risk of death is six-fold for patients diagnosed with both schizophrenia and diabetes mellitus, compared to those only with schizophrenia. Gender has been identified as a factor influencing schizophrenia and diabetes in various ways, but few previous scholars had addressed the effect of patients' gender as a moderator to the healthcare costs associated with hospitalizations related to schizophrenia and diabetes. This researcher performed quantitative correlational analysis using data from the Healthcare Cost and Utilization Project to explore the relationships between schizophrenia, diabetes, patients' gender, and length of hospital stay. The analyses revealed that patients' gender is a significant moderator in two instances. Firstly, the effect of having schizophrenia on length of stay decreases from female to male (β = -.068, $p < 0.05$). Secondly, the effect of having diabetes on length of stay increases from female to male (β = .150, $p < 0.05$). There was no statistical evidence found to conclude that gender is a significant moderator on the effect of both schizophrenia and diabetes on the length of stay. The findings of the study expanded the literature on the use of self-regulation theory, which posits that certain underlying processes, cognitive and physical operation, and emotional repercussions may vary between genders, in the context of patients of comorbid diseases specifically on schizophrenia and diabetes. The findings support the self-regulation theory in relation to the claim that people differ in their basic abilities and styles of self-control, which manifest as different outcomes among individuals based on their levels of self-control, adherence, lifestyle choices, behavioral functions, and inherent practices. However, the

findings of this study only partial supports the moderating effect of gender between comorbid disease and length of stay which existed among patients with schizophrenia and diabetes, but not with patients with both comorbid diseases. The conclusions could also be used by healthcare practitioners to develop specific interventions for reducing healthcare costs and improving outcomes for this patient population by taking gender-differences into consideration.

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CHAPTER 1

INTRODUCTION

Schizophrenia is a mental health disorder that shortens life spans (Davis, Starkstein, Bruce, & Davis, 2015; Hjorthoj, Sturup, McGrath, & Nordentoft, 2017; Suvisaari, Keinänen, Eskelinen, & Mantere, 2016). The prevalence of diabetes and obesity is significantly higher in patients diagnosed with schizophrenia than those without schizophrenia, and the increased risk of death is six-fold for patients diagnosed with both schizophrenia and diabetes mellitus, compared to those only with schizophrenia (Annamalai, Kosir, & Tek, 2017; Davis et al., 2015; Suvisaari et al., 2016). Moreover, researchers have shown that patients' gender is an understudied factor that influences diagnosis, treatment, treatment outcomes, and healthcare costs for people living with schizophrenia and diabetes (Gabilondo, Alonso-Moran, Nuño-Solinis, Orueta, & Iruin, 2017; Sainz, Prieto, & Crespo-Facorro, 2019; Schwartz et al., 2015; Zhang et al., 2015).

Both mental and physical health are critical factors for patient care in healthcare organizations. Among people living with schizophrenia and diabetes, there is an increased risk for hospitalization for diabetes-related complications and suicide attempts compared to people who only had diabetes (Goueslard et al., 2018). The American Diabetes Association (2012) has reported that inpatient care (hospitalizations) constitutes the highest proportion of medical expenditures for diabetes care. Several scholars have also confirmed that there are significant gender-based differences in terms of symptoms, prevalence, and treatment needs and outcomes for patients living with schizophrenia and diabetes (Barker, Kurdyak, Jacob, & Vigod, 2018; Davis et al., 2015; Gabilondo et al., 2017; Krall et al., 2017; Lange, Mueller, Leweke, & Bumb, 2017; R. Li, Ma, Wang,

Yang, & Wang, 2016; Nsiah, Shang, Boateng, & Mensah, 2015; Schwartz et al., 2015; Zhang et al., 2015). For example, female patients are more likely to have additional comorbidities in addition to schizophrenia and diabetes compared to male patients yet are less likely to be represented in the literature (Gabilondo et al., 2017; Zhang et al., 2015).

Mental health conditions should be addressed appropriately whether a co-morbidity is present or not present. Additionally, differences in gender should be considered in targeted patient care and research to lessen healthcare costs, improve patients' quality of life, and avoid further increases in the burden of schizophrenia and diabetes (Gabilondo et al., 2017; Laursen, Nordentoft, & Mortensen, 2014). In this study, the researcher focused on exploring the relationship between the dual diagnosis of schizophrenia and diabetes, and the length of hospital stay, with patient's gender as a moderator. Through this knowledge, the researcher aimed to fill a gap in the literature by uncovering differences in healthcare costs related to schizophrenia and diabetes, and how these are moderated by the gender of the patient. The results support planning and decision-making in resource allocation for male versus female patients who are diagnosed with schizophrenia and type II diabetes and become hospitalized. This chapter includes the background of the problem, statement of the problem, purpose of the study, theoretical framework, nature of the study, term definitions, research questions, assumptions, the need for the study, and a chapter summary.

Background of the Problem

Mental health is an ongoing problem with affected individuals suffering and in need of appropriate healthcare. Diabetes and obesity are more common among patients with schizophrenia than in the general population (American Diabetes Association, 2012;

Annamalai et al., 2017). Additionally, gender differences can influence diagnosis, treatment, treatment outcomes, and healthcare costs for SCZ/T2D patients (Gabilondo et al., 2017; Sainz et al., 2019; Schwartz et al., 2015).

The effects of mental illness differ by gender. For example, men have more negative symptoms than women in terms of neurological functioning (Han et al., 2012; Mendrek & Mancini-Marie, 2016). Furthermore, women are more likely to have comorbidities in addition to SCZ/T2D than men (Gabilondo et al., 2017; Zhang et al., 2015). The predisposition of anxiety and psychological thoughts, as well as low self-esteem in women have been shown to add to the amplified susceptibility to anxiety when hardship is present, which is common among adult women (Gabilondo et al., 2017).

For treatment of SCZ/T2D, Barker et al. (2018) found that women are in need of higher quality patient care compared to men. Researchers have observed differences in the effectiveness of dosages and anti-psychotic medication between the two genders as well. Several authors found that women metabolize drugs differently, resulting in side effects occurring more commonly in contrast to men (Krall et al., 2017; Lange et al., 2017). This means that women may need additional medical assistance, electrocardiograms, or bone density scans as well as diabetes, metabolic diseases, and cardiovascular workups throughout their anti-psychotic treatments (Krall et al., 2017; Lange et al., 2017). Other researchers have concluded that female schizophrenic patients have worse lipid metabolic dysfunction than male schizophrenic patients, which is associated with anti-psychotic treatments (R. Li et al., 2016; Lucca, Ramesh, & Ram, 2016).

Several studies have reported that women tend to have higher percentages of comorbidities than men, with and without schizophrenia (Gabilondo et al., 2017; Nsiah et al., 2015). Nsiah et al. argued that women with schizophrenia are at more risk than men in terms of developing other metabolic issues or health problems in contrast to men with schizophrenia. Kucerova, Babinska, Horska, and Kotolova (2015) underlined that women with schizophrenia/depression are more vulnerable to metabolic syndrome development.

Many authors have called for gender-specific treatment methods and research in the context of schizophrenia and diabetes to lessen healthcare costs related to patient care of schizophrenia and/or diabetes. Laursen et al. (2014), Gabilondo et al. (2017), and Gorczynski et al. (2017) argued that unless significant gender-specific treatment methods are developed and implemented, the burden of disease would increase, and more patients with mental and chronic illnesses would be subject to healthcare costs related to the care of schizophrenia and diabetes (Schwartz et al., 2015).

Despite the prevalence of diabetes and obesity being significantly higher in patients diagnosed with schizophrenia than those without (Annamalai et al., 2017), and the gender-specific needs among SCZ/T2D patients (Davis et al., 2015), knowledge for this comorbidity by patients' gender is scarce, especially in diagnosis, treatment, treatment outcomes, and healthcare costs for people living with SCZ/T2D (Gabilondo et al., 2017; Schwartz et al., 2015; Zhang et al., 2015; Zhou, Xiao, Yang, Yuan, & Liu, 2015). Understanding how patient gender moderates healthcare costs among SCZ/T2D patients is key to making targeted care decisions to effectively support these patients in a healthcare organization (Zhang et al., 2015).

Statement of the Problem

Schizophrenia among diabetes patients increases the risk of death and its associated healthcare costs (Annamalai et al., 2017). Differences in diagnosis, treatment, and treatment outcomes by gender may result in differences in healthcare costs between male and female SCZ/T2D patients. Recent scholars have shown that schizophrenia is common among patients with diabetes and that it shortens the lifespan of patients significantly by 10 to 20 years (Annamalai et al., 2017; Davis et al., 2015; Holt & Peveler, 2010; Laursen et al., 2014). Previous researchers have illustrated differences between male and female SCZ/T2D patients (Gabilondo et al., 2017; Schwartz et al., 2015; Zhang et al., 2015; Zhou et al., 2015). These differences by gender are likely to influence healthcare costs differently as well.

Previous authors have identified gender as a factor influencing schizophrenia and diabetes in various ways, as well as the need for further exploration. Limited researchers, however, have addressed the effect of patients' gender as a moderator to the healthcare costs associated with hospitalizations related to schizophrenia and diabetes (American Diabetes Association, 2012, Gabilondo et al., 2017; Goueslard et al., 2018; Zhang et al., 2015; Zhou et al., 2015). Understanding the moderating effects of gender could inform decision-makers at hospitals to find differentiated and targeted interventions to increase efficiency and effectiveness for SCZ/T2D patient care.

Purpose of the Study

The current researcher performed quantitative correlational analysis using data from the Healthcare Cost and Utilization Project (HCUP). The HCUP includes the largest collection of longitudinal hospital care data in the United States (The Healthcare Cost and

Utilization Project, 2019). The researcher used data from HCUP to explore the relationships between schizophrenia, diabetes, patients' gender, and length of hospital stay. The dependent variable was length of hospital stay, the independent variables of interest were schizophrenia and diabetes, the moderator of the relationships was patients' gender, and the covariates for the analyses were age, race, and other common comorbidities (i.e., depression and heart disease). The researcher determined the sample size using Tabachnick and Fidell's (2018) method. The researcher used a medium effect size in the power analysis so that it would not be either strict or lenient. The researcher conducted an a priori power analysis considering the statistical test of a two-tailed correlational analysis, a statistical power of 0.8, a medium effect size of 0.30 for a correlational analysis, and a level of significance of 0.05.

Theoretical Framework

According to the literature, a patient's gender may have an effect on diagnosis, treatment, and treatment outcomes for schizophrenia patients who also have diabetes. Thus, patient's gender may also influence healthcare costs associated with healthcare for these patients. Hospitalization is one of the highest costs associated with having diabetes. This study hypothesizes that patient's gender is a moderator for the relationships between (a) schizophrenia and length of hospital stay, (b) diabetes and length of hospital stay, and (c) schizophrenia and diabetes comorbidity and length of hospital stay (Figure 1). Further details on the development of the hypotheses are present in Chapter 2.

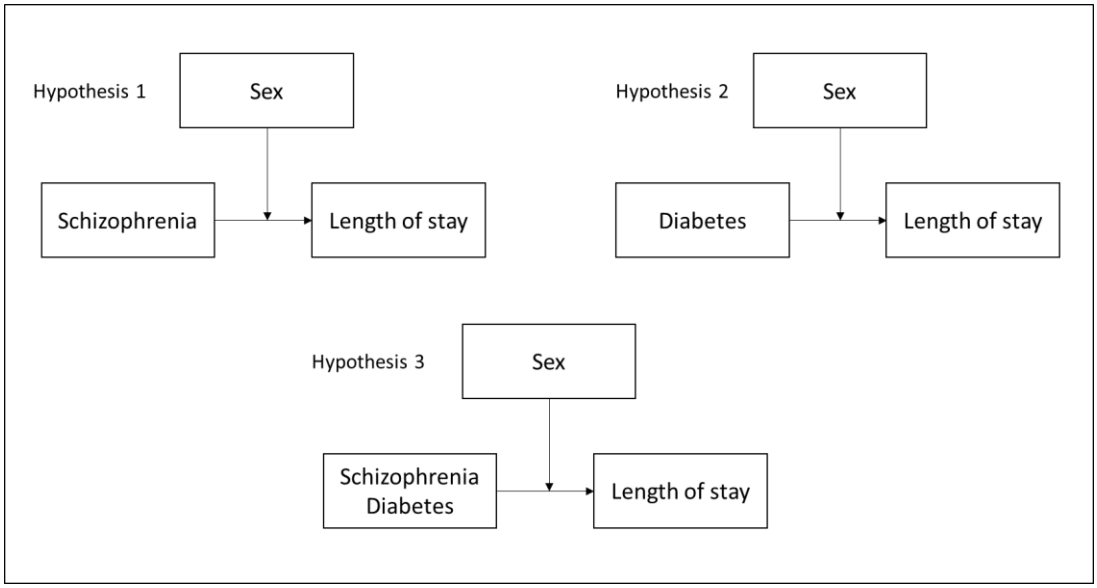

Figure 1. Illustration of the study's hypothesis with patient's gender as the moderator for the relationship between schizophrenia/diabetes and length of hospital stay.

Nature of the Study

This study included a quantitative correlational research design. The purpose of the study was to examine the relationships between SCZ/T2D and length of hospital stay with patient's gender as their moderator. A moderator is a third variable in a correlation that affects the strength of the relationship between a dependent and independent variable (Hayes, 2013). Correlational research designs are commonly used by researchers to explore relationships among variables that are not or cannot be manipulated (Fitzgerald, Rumrill, & Schenker, 2004). A correlational design was suitable for this study because the researcher aimed to establish whether and to what extent a correlation exists among the four main variables mentioned above.

The goal of quantitative methodologies is to examine relationships between variables measured numerically (Babbie, 2012). Quantitative researchers test theories that are objective by investigating the association between variables and attempt to form a relationship that is statistically significant and is suitable for correlational design

(Moxham, 2012; Polit & Hungler, 2013). The research questions of the present study asked whether there is a significant relationship between SCZ/T2D and length of hospital stay, with patient's gender as the moderator. In quantitative studies, the research questions ask about possible relationships between variables, which mandates a quantitative correlational approach (Moxham 2012; Polit & Hungler, 2013).

The researcher obtained and extracted data from the HCUP. The data included the four main variables of interest (i.e. schizophrenia, diabetes, length of hospital stay, and patient's gender), as well as the control variables (i.e. age, race, depression, and heart disease). The years that the researcher accessed for these variables were 2015 and 2016, when ICD-9-CM diagnosis codes were available to identify schizophrenic patients within HCUP. The researcher conducted all descriptive and quantitative analyses using Stata software.

Definitions

The researcher used the following variables in this data analysis to answer the research questions and test the hypotheses. The researcher extracted all data from the HCUP database and adhered to the definitions listed in their website (The Healthcare Cost and Utilization Project, 2019).

Length of hospital stay (LOS). This was the dependent (continuous) variable, which the researcher measured in days. The researcher calculated LOS by subtracting the admission date from the discharge date of a patient. Same-day stays were considered 0 days.

Schizophrenia (SCZ). This was a main independent (binary) variables of interest. The ICD-9 code for schizophrenia is 295.9. A patient either had a diagnosis of schizophrenia at the time of hospitalization or not.

Diabetes (T2D). This was a main independent (binary) variables of interest. The ICD-9 code for diabetes is 250.0x-250.9x. A patient either had a diagnosis of diabetes at the time of hospitalization or not.

Patient's gender. This was the moderator (binary) variable for the hypotheses referring to the patient's sex as documented in the hospital's medical records: female or male.

Age. This was a continuous covariate indicating the age of the patient at admission to the hospital. Only adults aged 18 years old and older were included in this study.

Race. This was a categorical covariate indicating the race and ethnicity of the patient who is admitted to the hospital. The categories include White, Black, Hispanic, Asian or Pacific Islander, Native American, and Other.

Depression. This was a binary covariate indicating whether an admitted patient had a comorbidity of depression at the time of admission to the hospital.

Heart disease. This was a binary covariate indicating whether an admitted patient had a comorbidity of heart disease (congestive heart failure) at the time of admission to the hospital.

Research Questions and Hypotheses

The following are the three research questions, null hypotheses, and alternative hypotheses for this study:

RQ1: Does the effect of having schizophrenia on length of hospital stay vary by patient's gender? The researcher used hospital stay in days as the dependent variable, schizophrenia as the binary key independent variable, patient's gender (male/female) as the moderator, and age, race, depression, and heart disease as the covariates.

H_{o1}: The patient's gender moderates the effect of having schizophrenia on length of hospital stay, holding other variables constant.

H_{a1}: The effect of having schizophrenia on length of hospital stay does not vary by patient's gender, holding other variables constant.

RQ2: Does the effect of having diabetes on length of hospital stay vary by patient's gender? The researcher used hospital stay in days as the dependent variable, having diabetes as the binary key independent variable, patient's gender (male/female) as the moderator, and age, race, depression, and heart disease as the covariates.

H_{o2}: The patient's gender moderates the effect of having diabetes on length of hospital stay, holding other variables constant.

H_{a2}: The effect of having diabetes on length of hospital stay does not vary by patient's gender, holding other variables constant.

RQ3: Does the combined effect of having schizophrenia and diabetes on length of hospital stay vary by patient's gender? The researcher used hospital stay in days as the dependent variable, having schizophrenia and diabetes as the binary key independent variable, patient's gender (male/female) as the moderator, and age, race, depression, and heart disease as the covariates.

H_{o3}: The patient's gender moderates the effect of having schizophrenia and diabetes on length of hospital stay, holding other variables constant.

H_{a3}: The effect of having schizophrenia and diabetes on length of hospital stay does not vary by patient's gender, holding other variables constant.

Assumptions

This researcher made several assumptions regarding the data extracted from HCUP. HCUP is the largest collection of longitudinal hospital care data in the United States, including a wide variety of databases at state- and national-levels; therefore, the researcher assumed that the data available were representative of the U.S. population for the time period selected. This was necessary in order to link the results of this study with the wider population of the U.S. Another assumption was that the results of the analysis using data from 2015 quarters 1-3 would still be applicable to current hospital organizations' decision-making. This assumption was necessary because HCUP transitioned from ICD-9-CM to ICD-10-CM/PCS codes on October 1, 2015; in this study, the researcher used only ICD-9-CM codes for consistency. Lastly, the researcher assumed that based on the literature review, the selected covariates were appropriate for the hypothesis testing in this study.

Need for the Study

The researcher designed this study to fill a knowledge gap in the literature for SCZ/T2D healthcare costs in healthcare organizations and how patients' gender may moderate these costs (R. Li et al., 2016; Sainz et al., 2019; Schwartz et al., 2015). SCZ/T2D patients need healthcare services such as diagnosis, treatment, and support at healthcare organizations. These services should be resourced and implemented to reflect the actual needs of patients with SCZ/T2D. Through this study, the researcher aimed to promote further research on the topic and inform decision-makers on appropriate

resource allocation based on individual patient's comorbidities and personal characteristics such as gender.

The gap in research also includes the specific challenges that women with schizophrenia and/or diabetes face in contrast to men, which is vital to address given that women are more likely to have additional comorbidities in addition to schizophrenia and diabetes than men (Gabilondo et al., 2017; Zhang et al., 2015). These important characteristics of risk factors by women patients with schizophrenia and/or diabetes, as well as the identification of their needs and treatment methods, were found to be part of the least explored of the constructs in the literature (Gabilondo et al., 2017). As such, there is a need for supported and informed planning and decision-making in resource allocation for male versus female SCZ/T2D patients who are hospitalized (Zhang et al., 2015).

Summary

The aim of this study was to identify the association between mental health disorders, chronic illness, and patient's gender on inpatient stay. Chapter 1 included this study's background of the problem, statement of the problem, purpose of the study, theoretical framework, nature of the study, term definitions, research questions, assumptions, the need for the study, and a chapter summary. In this study, the researcher explored the need for differentiated resource allocation and targeted interventions to care for female versus male patients who have a dual diagnosis for schizophrenia and diabetes.

In Chapter 2, the researcher provides a robust literature review of the historical and current state of hospitalizations and hospitalization costs due to schizophrenia and diabetes, and patient's gender as a factor influencing these relationships. In Chapter 3, the

researcher provides a thorough discussion of the research methodology, design, and data collection procedures. The research methodology was quantitative, the design was correlational, and the researcher extracted data from HCUP. In Chapter 4, the researcher summarizes the findings. In Chapter 5, the researcher presents an interpretation of the results, discusses its relevance to existing literature research, and provides recommendations for future research based on the findings.

CHAPTER 2

LITERATURE REVIEW

Introduction

Major mental health disorders such as schizophrenia are known to shorten life spans amongst patients (Hjorthoj et al., 2017). People with severe mental illness (SMI) experience a reduction in life expectancy of 15–20 years (Das-Munshi et al., 2016). Additionally, the prevalence of diabetes and obesity is also significantly higher in patients diagnosed with schizophrenia than those without (Annamalai et al., 2017). In fact, studies report that people with schizophrenia have 2- to 5-fold higher risk of diabetes than the general population (Suvisaari et al., 2016). Further, the risk of death in people living with schizophrenia and diabetes is 6-fold compared to patients living with only schizophrenia (Davis et al., 2015). Despite these staggering statistics and risk factors related to schizophrenia and diabetes, researches related to gender-specific interventions is understudied, especially factors that influence diagnosis, treatment, and treatment outcomes for people living with schizophrenia and diabetes (SCZ/T2D; Gabilondo et al., 2017; Schwartz et al., 2015; Zhang et al., 2015; Zhou et al., 2015).

Among people living with schizophrenia and diabetes, various reports have noted that specific genders have an increased risk for certain symptoms. For example, men have been reported to have more negative symptoms than women in terms of neurological functioning (Han et al., 2012; Mendrek & Mancini-Marie, 2016). Another study indicated that women have a higher prevalence of any lifetime internalizing disorder such as schizophrenia than men (Boyd et al., 2015). Additionally, a meta-analysis concluded that the risk factors associated with SCZ/T2D included being 40 years old or older,

overweight, and a woman (Zhou et al., 2015). Furthermore, studies show that women are more likely to have comorbidities in addition to SCZ/T2D than men (Gabilondo et al., 2017; Zhang et al., 2015). Despite these gender differences in the context of SCZ/T2D, gender-specific research regarding the prevalence, symptoms, and treatment of SCZ/T2D are less likely to be found in existing literature (Gabilondo et al., 2017; Zhang et al., 2015).

As such, mental health conditions such as schizophrenia should be addressed appropriately, especially with the elevated risk of diabetes. Unaddressed needs of patients with T2D or SCZ/T2D diminishes quality of life and thus significantly increases healthcare costs related to SCZ/T2D patient care in hospitals (Gabilondo et al., 2017). In the current study, the researcher focused on exploring the relationship between SCZ/T2D and LOS, with gender as the moderator. The researcher hoped to obtain knowledge that would bridge a gap in the literature by uncovering differences in healthcare costs related to SCZ/T2D and how these are moderated by the gender of the patient. The results support planning and decision-making in resource allocation for male versus female patients staying at hospitals with SCZ/T2D.

The problem that the current researcher addressed was the lack of exploration of the differences by patient's gender in healthcare costs among schizophrenia and/or diabetes patient care in hospitals (Davis et al., 2015). In addition, researchers have called for more effective support for schizophrenia/diabetes patients through targeted interventions (Davis et al., 2015; Zhang et al., 2015). Having this set of effective support and targeted interventions is important, given that the development of care plans

decreases the burden of disease and provides appropriate care to patients with mental illnesses and chronic illnesses (Schwartz et al., 2015).

Other chronic illnesses that require medical attention have been identified, including heart disease, cancer, and diabetes, which are found to be the leading causes of death and disability in the United States (Hippisley-Cox, Vinogradova, Coupland, Langford, & Parker, 2006). Although such chronic illnesses are not the direct cause of one's death, chronic illnesses can have an impact on mental illness (Hippisley-Cox et al., 2006). Additionally, studies have shown that people with schizophrenia have excess morbidity and mortality leading to a reduced lifespan of 20 to 25 years in contrast to the general population (Annamalai et al., 2017). Hayes, Marston, Walters, King, and Osborn (2017) concurred, noting that excess morbidity and mortality are not due to factors that are directly associated with psychiatric illnesses such as suicide or homicide. In fact, excess morbidity and mortality of people with schizophrenia are largely due to factors such as physical illness, metabolic abnormalities, and cardiovascular disease (Annamalai et al., 2017; Mangurian, Newcomer, Modlin, & Schillinger, 2016). This is vital to address given that people living with serious mental illness like schizophrenia, bipolar disorder, and severe depression are at particular risk for metabolic disorders (Sajatovic et al., 2015). A number of factors contribute to this situation, such as anti-psychotic drugs and especially second-generation anti-psychotics, including other external factors such as unhealthy behaviors, reduced physical activities, lack of exercise, and poor diet. These factors predispose people with serious mental illness, such as schizophrenia, to diabetes (Bailey, Sharpe, Ringel, & Zeeshan, 2018; Sajatovic et al., 2015). An understanding of the link between healthcare for the mind and for the body is therefore critical for patients'

outcomes. Investigation into healthcare for both the mind and the body is therefore integral and could actually help to inform the ways in which patients' quality of life could be enhanced (Gabilondo et al., 2017).

The effects of mental illness differ by gender. Risk factors in women experiencing depression and various anxiety disorders, such as panic disorder, social anxiety disorder, and generalized anxiety disorder are higher than in men (Gabilondo et al., 2017). Critically analyzing the mental health illness' effects by gender is important because it can lead to more targeted interventions and thus better patient outcomes (R. Li et al., 2016; Riecher-Rössler, 2016; Riecher-Rössler, Butler, & Kulkarni, 2018). Additional scholars have acknowledged that the predisposition of anxiety and psychological thoughts, as well as low self-esteem in women, add to the amplified susceptibility to anxiety when hardship is present, which is common among adult women (Gabilondo et al., 2017). Researchers have also shown a need to investigate the influence of patients' gender as a moderator to schizophrenia and/or diabetes healthcare costs (Goueslard et al., 2018). This is vital to address, as schizophrenia among diabetes patients increases the risk of death and its associated healthcare costs (Annamalai et al., 2017). These results indicate a need for more investigation into the differences in diagnosis, treatment, and treatment outcomes by gender among these patients, which could correlate to differences in healthcare costs between male and female patients (Annamalai et al., 2017). A clear distinction of gender-differences and the moderating effects of gender could inform decision makers at hospitals to find differentiated and targeted interventions to increase efficiency and effectiveness for patients with schizophrenia and diabetes care.

The objectives of this quantitative correlational research study are to identify the associations between mental health disorders, chronic illness, and gender on inpatient stay. Providing and understanding the link between the mind and body allows providers to develop strategies to reduce the incidence of comorbidities and assists patients living with mental illness and chronic physical conditions (Gabilondo et al., 2017; Zhang et al., 2015). The study also aims to contribute to the medical field by highlighting the need for differentiated resource allocation and targeted interventions to care for female versus male patients who have dual diagnosis for schizophrenia and diabetes (R. Li et al., 2016). This includes identifying the moderating effects of gender to the healthcare costs associated with hospitalizations related to schizophrenia and diabetes. This could, in turn, help inform decision makers at hospitals to find differentiated and targeted interventions that increase efficiency and effectiveness for patients with schizophrenia and diabetes care (Goueslard et al., 2018). The findings of this study could aid in enhancing quality of life for patients who are diagnosed with diabetes and/or schizophrenia, and significantly decrease healthcare costs related to the care and management of diabetes and/or schizophrenia.

With the objective of building the literature review, the following online databases and search engines were used: Google Scholar, Educational Resource Information Center (ERIC), Global Health, Ingenta Connect, JSTOR, EBSCOhost Online Research Databases, and Journal Seek. The key search terms and combination of search terms that were included the following: *challenges for women with chronic illness, diabetes, diabetes among women, self-regulation theory, schizophrenia, schizophrenia among women, medical interventions for women with diabetes,* and *medical interventions*

for women with schizophrenia. These key terms and combination of search terms were used to find studies that were correlated to the topic of the study, the problem presented in the previous chapter, and the respective research questions that are to be focused on for the current study.

The majority of the literature included in the review was published between 2015 and 2019, specifically in terms of clinical interventions for women with diabetes and schizophrenia, and the differences between men and women regarding medical intervention needed for treating and/or managing diabetes and schizophrenia. Recent findings were crucial in order to keep the study as updated as possible. It is worth noting that in the course of this study, older studies were included as part of the references (published before 2015), such as the self-regulation framework theory. The research articles that were chosen for inclusion in the study addressed topics regarding gender differences in medical interventions needed for illnesses such as diabetes and schizophrenia, self-regulation theory, and available gender-specific interventions for treating and/or managing diabetes and schizophrenia.

In order to address the research problem and questions presented in the previous chapter, the researcher expands on the background of the study, as well as the process of identification of literature search and strategy, and consequently, how the literature review was built. In the second section, the researcher focuses on the theoretical framework of the study. In the third section, the researcher discusses the details of the framework used, which is centered on patient's gender and its effect on diagnosis, treatment, and treatment outcomes for patients with schizophrenia and diabetes, and studies in which discussions centered on the differences between men and women

regarding medical aid when diagnosed with diabetes and schizophrenia follows. A section on the gender-differences between men and women in terms of symptoms, treatments, and occurrence of schizophrenia and diabetes occurs thereafter. Lastly, the fourth section includes a summary and synthesis of findings, in which the researcher presents the conclusion of the literature review section and the key points to consider in the context of the current study.

Self-Regulation Theory

The current researcher used self-regulation theory as a theoretical foundation for the study in understanding the differences by patient's gender in healthcare costs among schizophrenia/diabetes patient care in hospitals. Self-regulation theory is an approach that promotes a system of conscious personal management, involving the process of guiding one's own thoughts, behaviors, and feelings to reach goals (Baumeister & Vohs, 2004). Additionally, self-regulation theory is an approach concerned with how the self is put together (Baumeister & Vohs, 2004). One of the principles of self-regulation theory is that there are certain underlying processes, cognitive and physical operation, and emotional repercussions that may vary between genders (Baumeister & Vohs, 2004). Another principle of self-regulation theory is that people differ in their basic abilities and styles of self-control, which also include how people are adherent to certain prescriptions. Because of this, outcomes differ among individuals based on their levels of self-control, adherence, lifestyle choices, behavioral functions, and inherent practices (Baumeister & Vohs, 2004).

Fenton-O'Creevy, Nicholson, Soane, and Willman (2003) and Muraven, Tice, and Baumeister (1998) further delved into to self-regulation theory. The authors indicated that

self-regulation has to be understood and/or explored in three different facets, as a knowledge structure, strength, or skill, in order to explain its cognitive accessibility (Fenton-O'Creevy et al., 2003; Muraven et al., 2000). The authors further noted that strength and willpower are limited resources; as such, there is a limited amount of self-regulation that can occur (Fenton-O'Creevy et al., 2003; Muraven et al., 2000).

Self-regulation theory has also been used in social science and in understanding various perspectives relating to social situations, personal health management, impulse control, sickness behavior, and health outcomes (Cameron & Leventhal, 2003; DeWall, Baumeister, Gailliot, & Maner, 2008; Fenton-O'Creevy et al., 2003). According to Cameron and Leventhal (2003), there is an increasing number of scholars who are familiar with self-regulation theory, finding it a robust alternative to the medical and psychological perspectives. The authors argued that self-regulation theory focuses on the ways in which individuals direct and monitor their activities and emotions in order to attain their goals, which serves as a fruitful resource for carving out new paths for health psychology research (Cameron & Leventhal, 2003). Horne (2012) added to this by stating that researchers should consider using self-regulation theory, delineating emotional processes of various individuals along with varying cognitive mechanisms, which yields a more robust study relating to medical and psychological studies.

As it relates to the gender-related differences in schizophrenia and/or diabetes in hospital, this theory provides additional understanding from a gender-based perspective, as well as how individuals of different genders approach treatment care methods offered by hospitals (Cameron & Leventhal, 2003). As such, self-regulation theory provides insights on what the gender differences are in terms of healthcare, specifically

schizophrenia/diabetes patient care in hospitals (Davis et al., 2015). From a theoretical perspective, self-regulation theory serves as guidance in understanding the differences of patient's gender in healthcare costs among schizophrenia/diabetes patient care in hospitals. This framework also serves a backbone to the literature in building relevant studies or tools that meet the gender-specific needs of the patient's schizophrenia/diabetes in hospitals. This framework could also provide additional empirical evidence on the different impacts and treatment methods that are gender-specific and relevant to prevention for schizophrenia/diabetes patients. Understanding how gender-specific methods and mechanisms within schizophrenia/diabetes care can affect outcomes for patients is important for the comprehension of the significance of the purposed study. Thus, identifying the gender differences of schizophrenia/diabetes care in hospitals is vital in the objective of the healthcare organizations to bring down healthcare costs related to schizophrenia/diabetes.

The findings of this study may serve as an extension of scientific knowledge relative to that of bringing awareness to gender differences of medical interventions needed when diagnosed with schizophrenia and/or diabetes, and addressing the management and/or treatment needs amongst patients with schizophrenia and/or diabetes with respect to gender. As such, the researcher places all of this information within the conceptual framework of self-regulation theory. This theory was both a way to conceptualized and categorize this study, as well as a method for designing the quantitative method and analysis that the researcher employed.

Review of the Literature

With a focus on understanding the differences by patient's gender in healthcare costs among schizophrenia/diabetes patient care in hospitals, the current researcher reviews and outlines past literature on schizophrenia and/or diabetes prevalence and patient care amongst men and women, highlighting the specific gender-related differences in terms of symptoms, prevalence, and treatment methods related to schizophrenia and/or diabetes patient care and illness management. The researcher outlines self-regulation theory and its relevance as a framework in understanding the differences by patient's gender in healthcare costs among schizophrenia/diabetes patient care in hospitals. The researcher first explores a definition of schizophrenia and/or diabetes, followed by a review of schizophrenia and/or diabetes prevalence, links of having schizophrenia and/or diabetes illness as well as the incidence of comorbidities and its impact on both men and women patients who have schizophrenia and/or diabetes. Interventions and treatments, such as drug doses that men and women patients who have schizophrenia and/or diabetes, are discussed to identify the most effective treatment methods or programs available in literature; this section bridges the gap in different resource allocation and targeted interventions to care for female versus male patients who have dual diagnosis for schizophrenia and diabetes. These differentiated factors are important focus points in order to grasp and clearly understand how to develop strategies to reduce the incidence of comorbidities and assist patients living with mental illness and chronic physical conditions. This understanding may lead to the development of care plans to decrease the burden of disease and provide appropriate care to patients with mental illnesses and chronic illnesses.

With this objective, the researcher now delves into studies that aid in gender-specific needs and underlining factors that influence how women respond differently to men in terms of treatment for schizophrenia and/or diabetes, which also aid in highlighting the importance of having targeted measures and programs established to support both men and women in treating/preventing schizophrenia and/or diabetes. In the following sections, the researcher examines these specific gender differences in symptoms, prevalence, treatment, and health care needs by outlining previous research that is validated and peer-reviewed. The researcher then discusses the related literature available in examining treatment methods and drug medications for people living with schizophrenia and/or diabetes, identifying whether or not there are gender differences in its effectiveness among this population. The researcher then compares and contrasts these findings and determines their respective relevance to this study.

Schizophrenia and/or Diabetes

Schizophrenia, which is a mental health disorder, is identified as a life-shortening disease (Manjunatha et al., 2019) and individuals with mental health disorders have an amplified risk of untimely demise and a condensed lifespan (Hayes et al., 2017; Walker, McGee, & Druss, 2015). The potential lifespan for an individual suffering from mental illness is 10 to 20 years less than the individuals not suffering with mental illness (Henderson et al., 2015; Manjunatha et al., 2019). Further studies concurred and reported that individuals with mental illness have an increased mortality rate than individuals not suffering from mental illness (Walker et al., 2015). Even though mental illnesses contribute to mortality rates, chronic illness in conjunction with mental illness also leads to mortality contributed by a number of diseases such as cardiovascular disease (Hayes et

al., 2017). Henderson et al. (2015) added to this, noting that shorter lifespan of individuals with schizophrenia than peers without schizophrenia is mainly due to premature cardiovascular disease, suicide, and cancer. That is, patients with severe mental illness are at increased risk for cardiovascular disease related to increased incidence of diabetes, hypertension, smoking, poor diet, obesity, dyslipidemia, metabolic syndrome, low physical activity, and side-effects of anti-psychotic drugs (Henderson et al., 2015). This body of findings could provide initial context regarding the mental health disorder that is schizophrenia and how it negatively impacts the quality of life amongst individuals who are diagnosed with schizophrenia (Henderson et al., 2015; Manjunatha et al., 2019; Walker et al., 2015).

Schizophrenia patients also suffering with chronic illnesses experienced increased mortality rates in hospitals (Hayes et al., 2017). The chronic illnesses that are in conjunction with mental health illnesses are diabetes along with obesity-related diseases, hypertension, cardiovascular disease, respiratory illness, and metabolic syndrome (Bouza, López-Cuadrado, & Amate, 2010; Henderson et al., 2015). Brink et al. (2019) delved into this topic further and examined medical comorbidity and mortality across the lifespan in schizophrenia. The authors of the study noted that people with schizophrenia tend to have undetected medical disorders, leaving them untreated (Brink et al., 2019). Inadequate treatment of medical disorders leaves these patients with schizophrenia vulnerable to premature death. The findings of Brink et al. underlined that cases of cardiovascular disease (CVD), chronic obstructive pulmonary disease (COPD), cancer, and diabetes, as well as mortality due to these diseases, are higher among the lifespan of patients with schizophrenia. This body of findings could provide an empirical conclusion that major

mental health illnesses such as schizophrenia are left vulnerable to premature death, in addition to undetected medical disorders such as cancer and diabetes, which are all life-threatening.

Several other reports have shown that individuals with mental illness experience chronic illnesses and other mortality rate at greater levels than individuals who don't suffer from mental illness. Furthermore, chronic illness within individuals that have a mental illness occurs commonly at an earlier age (Hayes et al., 2017). Furthermore, according to Hayes et al. and Hippisley-Cox et al. (2006), the mortality rate is higher among individuals with mental illness as opposed to individuals who do not have mental illnesses such as schizophrenia. This body of findings could provide empirical justification regarding the need to address the medical support required by individuals who have mental illnesses, especially given that this population is linked to increased mortality rates in hospitals, in addition to a number of chronic illnesses (Bouza et al., 2010; Hippisley-Cox et al., 2006).

Figure 1 shows that there is a higher prevalence of chronic illnesses among individuals that have a mental illness such as schizophrenia under the age 55 compared to individuals without a mental illness (Hippisley-Cox et al., 2006). That is, 31% of patients under the age of 55 are diagnosed with both schizophrenia and coronary heart disease as opposed to 18% of the general population diagnosed with coronary heart disease alone. Also, there is 41% of patients under the age of 55 diagnosed with both schizophrenia and diabetes as opposed to 18% of the general population diagnosed with diabetes alone. Another statistic is that 21% of patients under the age of 55 are diagnosed with both schizophrenia and stroke as opposed to 11% of the general population diagnosed with

stroke alone. Moreover, there is 23% of patients under the age of 55 diagnosed with both schizophrenia and respiratory disease as opposed to 17% of the general population diagnosed with respiratory disease alone (Hippisley-Cox et al., 2006).

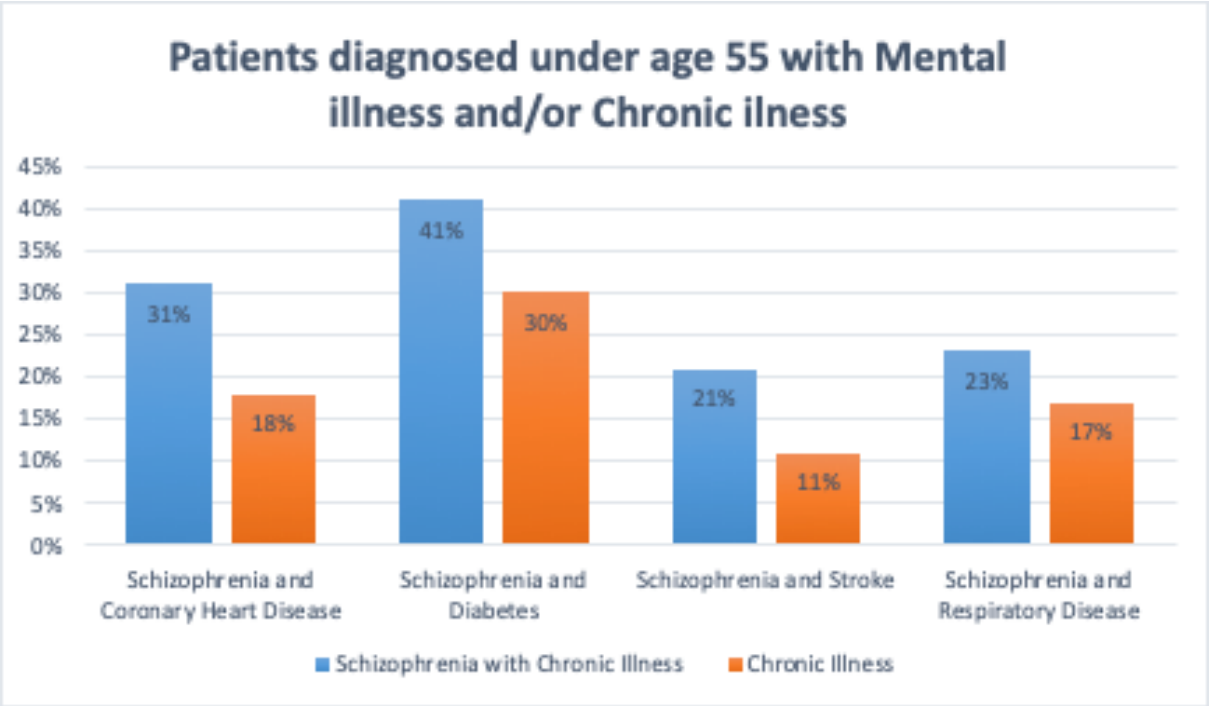

Figure 2. Chronic illnesses among individuals that have mental illness under the age 55 compared to individuals without a mental illness (Hippisley-Cox et al., 2006).

It is important to understand the nature and types of diabetes that is prevalent amongst individuals in order to treat and manage it effectively. According to several researchers, diabetes mellitus is a chronic disease of diminished carbohydrate, protein, and fat breakdown due to inadequate secretion of insulin or to target tissue insulin resistance (Balaji et al., 2019; Vancampfort et al., 2016; Zaccardi, Webb, Yates, & Davies, 2016). Diabetes mellitus occurs in two forms, Type 1 Diabetes Mellitus and Type 2 Diabetes Mellitus (Sajatovic et al., 2015; Zaccardi et al., 2016). Type 1 Diabetes is a chronic illness in which the pancreas produces little or no insulin, which is a hormone needed to allow sugar to enter the cells to produce energy (Zaccardi et al., 2016). Type 2

Diabetes happens when the body becomes resistant to insulin or does not make enough insulin (Zaccardi et al., 2016). For both types of diabetes, monitoring glucose levels is important for diabetes control, and is a vital step in proactively managing diabetes among high-risk individuals. This body of literature could provide empirical information regarding the nature and types of diabetes that high-risk individuals are prone to having. Understanding diabetes itself is vital in order to proactively treat and manage the disease, especially amongst patients with schizophrenia given that they are more prone to the disease (Balaji et al., 2019; Vancampfort et al., 2016; Zaccardi et al., 2016). This body of findings could provide substantial information regarding the medical illness of diabetes, which clinicians with patients who have schizophrenia should be mindful of preventing through proactive treatment measures.

Prevalence of Diabetes and/or Schizophrenia

Individuals with schizophrenia are more prone to develop diabetes in their lifetime. In fact, diabetes is three times higher in individuals with schizophrenia than the overall population (Vancampfort et al., 2016). According to several studies, diabetes is diagnosed within 15% of people who have schizophrenia (Holt, 2015; Vancampfort et al., 2016). Several authors have delved further into this topic and found that majority of people who have diabetes are unaware and the occurrence of diabetes within individuals who have schizophrenia is miscalculated (Poudel et al., 2019; Sharma & Joshi, 2017). This is vital to address given that, as discussed, 41% of patients under the age of 55 are diagnosed with both schizophrenia and diabetes as opposed to 18% of the general population diagnosed with diabetes alone (Hippisley-Cox et al., 2006). Also, with the prevalence of both schizophrenia and diabetes, individuals are at higher risk of shorter

life spans than the average individual (Reininghaus et al., 2015). This body of findings could provide empirical knowledge with regards to the high prevalence of having both schizophrenia and diabetes amongst patients.

People with schizophrenia are more likely to develop diabetes than people in the general population. In fact, research has shown that people with schizophrenia have a two to three times higher risk for premature death than the general population (Reininghaus et al., 2015). A more recent study also reported similarly noting that people with schizophrenia have 2- to 5-fold higher risk of diabetes than the general population (Suvisaari et al., 2016). This was further delved into by Sajatovic et al. (2015). The authors of the study noted that diabetes is a prevalent comorbidity in people with serious mental illness. With measures of depressive symptoms, global psychopathology severity, and diabetes markers taken into account, the authors indicated that there is a correlation between diabetes and serious mental illness such as schizophrenia; that is, more symptoms of depression and a longer span of diabetes are related to poorer diabetes control (Sajatovic et al., 2015). Further, it was also found empirically that the global psychiatric severity levels are related to worsened diabetes control. This could be due to the overall low psychosis and mania levels experienced by the patients in the study. This body of findings could provide more in-depth evidence regarding the correlation between diabetes and schizophrenia such that diabetes control is essential in mitigating the risks of psychiatric severity and mania symptoms. As such, proper management of diabetes such as diabetes control is vital to address given that people with schizophrenia have a two to three times higher risk for premature death than the general population (Reininghaus et al., 2015; Sajatovic et al., 2015).

Other studies concurred and indicated that diabetes mellitus is, in fact, highly predictive of cardiovascular diseases, as well as deleterious health impacts in people with severe mental illness or schizophrenia (Luo et al., 2019; Mangurian et al., 2016; Vancamfort et al., 2016). Further studies have indicated that traditional risk factors for diabetes are, in fact, common in people with schizophrenia already early in the course of illness (Suvisaari et al., 2016). This body of knowledge could provide initial knowledge regarding the risk factors associated with schizophrenia, even in the early stages (Suvisaari et al., 2016). Such risk factors have detrimental impacts on people with schizophrenia, which could exacerbate their illness. As such, this pool of findings could provide justification regarding the need to address the needs of this population as they are at elevated risk in developing diabetes and/or schizophrenia, which could result to negative outcomes in the individual's quality of life, physically and mentally (Vancamfort et al., 2016).

There are several reasons that account for the prevalence of having both schizophrenia and/or diabetes. According to several studies, family history is a critical risk factor when it comes to diabetes as well as a meager nutritional regimen and dormancy (Farahvar et al., 2019; Nsiah et al., 2015). Nsiah et al. noted that diabetic patients are also prone to metabolic syndrome, which predicts cardiovascular disease, aside from type 2 diabetes mellitus, amongst individuals. The authors further noted that the speeding up of the acquisition of the metabolic syndrome is due to family history (Nsiah et al., 2015). Farahvar et al. (2019) added to this finding and noted that type 2 diabetes mellitus, metabolic syndrome, cardiovascular morbidity, malignancies, ophthalmic, psychiatric, and renal disease are illnesses that are strongly linked to family

history. These findings are in line with past studies, such as that of Mukherjee, Schnur, and Reddy (1989), whose findings indicated that the family history of patients with type 2 diabetes accounts for up to 50% of people who suffer with schizophrenia. This body of findings could provide initial empirical knowledge regarding the contributing factors that cause schizophrenia and/or diabetes amongst patients (Mukherjee et al., 1989).

Indeed, having a family history of schizophrenia and/or diabetes presents a potential risk factor for the development of the diseases. Further studies have noted the factor of family history as a contributing factor of schizophrenia and/or diabetes amongst patients (Hackinger et al., 2018; Mamakou et al., 2018). Hackinger et al. (2018) delved into this topic further and noted that there is an epidemiologic link between schizophrenia (SCZ) and type 2 diabetes (T2D) that should be given more attention. With the analysis of three patient groups (SCZ only (n = 924), T2D only (n = 822), comorbid SCZ and T2D (n = 505), the authors revealed for the first time that patients with comorbid SCZ and T2D have a higher genetic predisposition to both disorders (Hackinger et al., 2018). More importantly, Hackinger et al. revealed that there are 29 genes associated with both T2D and SCZ, which were outlined in their study. Out of these 29 genes, several of them have been implicated in biological processes relevant to these disorders. Another study by Lencz et al. (2014) delved into this topic and provided further evidence of molecular confirmation related to the genetic overlap between SCZ and general cognitive ability. The authors recognized and underscored the fact that genetics play a significant factor on deficits in cognitive ability and schizophrenia, evident before full illness onset and independent of medication and/or treatment (Lencz et al., 2014). This body of findings by Lencz et al. (2014) and Hackinger et al. (2018) could provide substantial insight into the

pathophysiology of the disorder of schizophrenia and/or diabetes, providing empirical evidence that these illnesses are contributed by the genetic factor.

Patients with schizophrenia are commonly at elevated risk of developing diabetes due to a number of other reasons that are explored chemically. Pillinger et al. (2017) delved into this topic further and examined whether schizophrenia confers an inherent risk for glucose dysregulation in the absence of the effects of chronic illness and long-term treatment. With a sample including 731 patients and 614 case control studies, the findings of the study showed that diabetes indicators such as fasting plasma glucose, plasma glucose post-OGTT, fasting plasma insulin, and insulin resistance were all significantly elevated in patients with schizophrenia (Pillinger et al., 2017). This body of findings could provide empirical knowledge and evidence that glucose homeostasis is altered from illness onset in schizophrenia, which means that chemically, patients with schizophrenia are at elevated risk of developing diabetes. Another study by Petrikis et al. (2015) stated similar findings wherein the authors noted that patients with schizophrenia are prone to insulin resistance even prior to starting anti-psychotic therapy. Further, the authors noted that patients with psychosis taking anti-psychotic drugs are more insulin resistant (Petrikis et al., 2015). This means that patients with schizophrenia are, indeed, at a high risk for developing diabetes. Furthermore, this body of findings could provide initial evidence of the high prevalence of diabetes development amongst patients with schizophrenia. This pool of knowledge could, therefore, merit the need for more attention to be placed on patients with schizophrenia in terms of monitoring and treatment choice.

Other studies have shown that prevalence of diabetes and SCZ can be due to unfavorable drug combinations (Mamakou et al., 2018). Mamakou et al. understood this

and delved further into this topic by conducting a study regarding combination therapy, assessing it a potential risk factor for the development of type 2 diabetes in patients with schizophrenia and assessing the effect of pharmacological, anthropometric, lifestyle and clinical measurements. The results of the study indicated that through regression analysis, patients with schizophrenia on a combination of at least three different classes of psychiatric drugs had a higher risk of diabetes (Mamakou et al., 2018). Further results revealed that first-generation anti-psychotic drug treatment had a lower risk of developing diabetes among patients with schizophrenia (Mamakou et al., 2018). Luo et al. (2019) concluded similarly, noting that metabolic dysfunctions frequently occur in patients receiving anti-psychotics, especially in the prescription of second-generation anti-psychotics. More specifically, Luo et al. (2019) noted that the treatment of anti-psychotics for schizophrenia and metformin for diabetes amongst patients have adverse effects on the gut microbiota and the brain. As such, these effects brought about by second-generation anti-psychotics could decrease patient compliance and increase health costs. Therefore, this body of findings could provide empirical knowledge regarding the medical implications of prescribing psychiatric drugs for patients with schizophrenia given that there are certain drug combinations that could place patients at even more risk for developing diabetes.

Other risk factors related to drugs for diabetes and/or schizophrenia management and treatment include developing other chronic illness. Pillinger et al. (2017) delved into this topic, examining the cardiac structure and function in patients with schizophrenia taking anti-psychotic drugs. Pillinger et al. noted that cardiovascular disease is a major cause of excess mortality in schizophrenia. As such, the authors aimed to find evidence

whether cardiac fibrosis and/or inflammation are found using cardiac MRI in medicated patients with schizophrenia who are taking anti-psychotic medicine (Pillinger et al., 2019). The results of the study found that native myocardial T1 was significantly longer in patients with schizophrenia compared to those patients not taking anti-psychotic medicine (Pillinger et al., 2019). Further, the authors indicated that myocardial fibrosis should be studied further given that it predicts cardiovascular and all-cause mortality (Pillinger et al., 2019). Shinoda et al. (2016) concluded similarly as the authors found that anti-psychotics induce interstitial and endocardial fibrosis, as well as myolysis and other changes seen in dilated cardiomyopathy. The authors specifically studied Haloperidol, which is an anti-psychotic drug that inhibits the dopamine D2 receptor, and how it impacts patients with schizophrenia (Shinoda et al., 2016). This indicates a high risk of cardiovascular disease amongst patients with schizophrenia taking anti-psychotic drug medications. This body of findings could, therefore, provide empirical information regarding the adverse effects of anti-psychotic drug medications such that is could induce other illnesses such as cardiovascular disease, which contribute to high mortality amongst this population. As such, this could call out for more research on more effective treatment and drug medications to mitigate anti-psychotics-related (such as haloperidol-relate) adverse effects in schizophrenia patients (Pillinger et al., 2019; Shinoda et al., 2016).

Lifestyle changes associated with diabetes can be difficult and can have unfavorable impacts on individuals. Several authors have outlined the negative impact that changes due to diabetes and/or schizophrenia can bring to patients, which is due to several factors such as nutrition regimens, interventions and specific routines that must be followed in order to manage the chronic illness (Evert et al., 2019; Knyahnytska,

Williams, Dale, & Webster, 2018). Psychologically and physically, this lifestyle change significantly impacts an individual, and, in turn, mental illness negatively impacts diabetes (Knyahnytska et al., 2018). Furthermore, the surge in heart disease, stroke, and kidney disease continues to escalate due to the lack of abiding by the lifestyle required to manage diabetes when dealing with a mental illness (Evert et al., 2019; Knyahnytska et al., 2018). Sajatovic et al. (2015) concluded similarly and further underscored that people with serious mental illness need help in managing their illnesses, not just for schizophrenia. The authors further noted that people living with schizophrenia and diabetes have multiple challenges, which, along with severe depression, may impede diabetes self-management (Sajatovic et al., 2015). This body of findings could provide initial evidence regarding the need for more effective lifestyles support and/or interventions for patients with schizophrenia and diabetes; doing so could enhance their quality of life, as well as mitigate risk factors of developing other chronic illnesses (Evert et al., 2019; Knyahnytska et al., 2018).

The specific needs of patients living with schizophrenia and diabetes include having support and adjustments in treatment methods (specifically in dealing with lifestyle changes). These specified needs are vital to address, especially given that current interventions such as anti-psychotic drugs for patients with diabetes and/or schizophrenia are still not well understood (Sajatovic et al., 2015). Bailey et al. (2018) similarly underscored this conclusion, stating that researchers need more understanding about the relationship between type 2 diabetes mellitus and anti-psychotic use by schizophrenia patients. This body of literature could provide empirical knowledge regarding the need to further delve into the study of diabetes mellitus and schizophrenia, how its currently

being treated, and its overall impact on patients and the quality of life; how they are dealing with schizophrenia and diabetes, and the challenges of living with these diseases such as lifestyle changes (Bailey et al., 2018; Evert et al., 2019; Sajatovic et al., 2015).

There is a growing impact of diabetes and/or schizophrenia in the United States. In a study by Boyle et al. (2010), the authors underscored the impact that diabetes will have on the U.S. population wherein the authors pointed out that as individuals in the U.S age, the likelihood of diabetes developing increases (Boyle et al., 2010). Thus, designing interventions to address factors contributing to mental illness and to the development of diabetes are necessary preventative measures. This body of literature could provide empirical evidence regarding the need for more effective measures for patients with diabetes and/or schizophrenia. As such, this could prove to be a call out for further research to study further the relationship between type 2 diabetes mellitus and anti-psychotic use by schizophrenia patients in order to treat it effectively and proactively among the U.S. population.

Treatment of Diabetes and/or Schizophrenia

The most optimal treatment option for schizophrenia is the use of long-term anti-psychotic drugs. However, patients with schizophrenia who have been prescribed with anti-psychotics are at a high risk of developing diabetes. Several other researchers have delved into this area of study and the association between diabetic patients and being prescribed with anti-psychotics for treatment of schizophrenia (Foley et al., 2016; Perry et al., 2017). For example, Wani et al. (2015) indicated that treatment with anti-psychotics increases the risk of developing diabetes in patients of schizophrenia. In Wani et al.'s (2015) study, 50 patients (32 males and 18 females) diagnosed with schizophrenia

were assessed for glucose dysregulation using oral glucose tolerance test. Wani et al. (2015) conducted tests and evaluated glucose tolerance amongst patients before and after anti-psychotic treatment to test whether there is an independent association between schizophrenia and diabetes. The results of the study indicated that anti-psychotic treatment of non-diabetic schizophrenia patients resulted in adverse effects on glucose regulation, which led the non-diabetic schizophrenia patients to develop high risk for diabetes diagnosis (Wani et al., 2015). As such, this could provide evidence to medical practitioners that drug-naïve, first-episode patients with schizophrenia are more insulin resistant compared to those without schizophrenia (Petrikis et al., 2015; Wani et al., 2015).

Other researchers have reported similar findings and have provided evidence that patients with schizophrenia are at a high risk of diabetes due to anti-psychotic drugs related to the treatment of schizophrenia (Perry et al., 2017; Wani et al., 2015). Vancamfort et al. (2016) agreed to this body of findings and found that diabetes prevalence was overall higher in patients prescribed anti-psychotics. This means that people with schizophrenia prescribed with anti-psychotics are at high risk of developing diabetes and should, therefore, be closely monitored. As such, various authors have underscored the need for routine screening and multidisciplinary management of diabetes and/or schizophrenia (Vancamfort et al., 2016). This body of findings could provide initial evidence of developing diabetes and schizophrenia at the same time due to reasons such as anti-psychotic treatments (Wani et al., 2015). As such, this could provide notice to those in the medical field to be wary of the risks of diabetes amongst schizophrenia

patients and to provide effective preventive measures to avoid this comorbidity (Foley et al., 2016; Perry et al., 2017).

Anti-psychotic drugs are indeed proven to be correlated to diabetes amongst patients who take them. However, more attention is needed on how anti-psychotic drugs impact the prevalence of diabetes, and what medicinal alternatives are needed to treat patients with schizophrenia without elevating their risk of diabetes. As such, researchers have studied the reason why anti-psychotic medications increase the risk of diabetes (Marni, Bahagia Loebis, Effendy, & Nasution, 2019; Suvisaari et al., 2016). Suvisaari et al. found that obesity, poor diet, and sedentary lifestyle are common in people with schizophrenia and diabetes. The authors noted that people with schizophrenia have risk factors such as obesity, poor diet, and sedentary lifestyle is because of the fact that patients with schizophrenia often have low socioeconomic status and income. This demographic status impacts their lifestyle choices (Suvisaari et al., 2016). As such, this has a negative impact on the individuals with diabetes and/or schizophrenia, which could exacerbate the disease or even result to other chronic illnesses such as cardiovascular illness (Evert et al., 2019). This body of findings could provide empirical knowledge related to the risk factors that are associated with diabetes and/or schizophrenia, which could underscore the need for more effective alternative solutions in treating the illness without exacerbating the disease (Evert et al., 2019).

Also, patients with schizophrenia who are prescribed and are taking regular anti-psychotic drugs induces insulin sensitivity, which indirectly results to weight gain (Suvisaari et al., 2016; Whicher, Price, & Holt, 2018). In another study, Marni et al. (2019) examined the use of anti-psychotic drugs and their effects on glucose intolerance

and high blood glucose amongst patients. The authors conducted an experimental study, unpaired numerical comparative analytic with non-probability consecutive sampling by recruiting 50 research subjects of men with male patients with schizophrenia. In their study, two groups were given different anti-psychotic treatment for schizophrenia: one group received aripiprazole treatment while another group received risperidone treatment (Marni et al., 2019). Using unpaired *t*-test in the two groups, the quantitative results of the study showed a significant difference in fasting blood sugar levels for men with schizophrenia in the group receiving aripiprazole treatment and the group receiving risperidone treatment at the end of an 8-week treatment duration (Marni et al., 2019). That is, the treatment using risperidone can significantly increase the fasting blood sugar level compared to the aripiprazole treatment (Marni et al., 2019). This body of literature could provide initial empirical justification that alternative treatments are available and proven by existing literature, promoting lifestyle modification interventions and certain drugs, which are needed for the effective management and prevention of diabetes given the risk factors involved (Marni et al., 2019).

As such, lifestyle modification interventions should be an integral part of the treatment of patients with schizophrenia. This is especially because schizophrenia patients (especially women) who are taking anti-psychotic drugs are at uniquely high risk for metabolic dysfunction and future adverse cardiovascular outcomes (Mangurian et al., 2016; Suvisaari et al., 2016). Krall et al. (2017) further underscored this and added that women who are taking clozapine or olanzapine are prone to obesity and thus warrant close monitoring in order to prevent worsening of metabolic risk. This body of findings could be used by medical providers to provide communication and collaboration between

medical care and psychiatric treatment providers, as well as proper monitoring and interventions, which are needed in the effective treatment of patients with schizophrenia (Krall et al., 2017; Suvisaari et al., 2016). Furthermore, these findings provide empirical results regarding medicinal anti-psychotic treatments that are best given to patients with schizophrenia, which is risperidone treatment, especially for women with schizophrenia (Marni et al., 2019; Suvisaari et al., 2016). This body of literature could be used as an initial reference on the possible alternatives to anti-psychotic treatments that would not increase the risk of diabetes amongst patients with schizophrenia.

However, elevated risk for diabetes in people with schizophrenia is not simply due to the prevalence of anti-psychotic medication. Several researchers have found that the occurrence of diabetes and schizophrenia is due to familial risk factors (Foley et al., 2016). Foley et al. (2016) found reported in their study that there is strong evidence for familial comorbidity between diabetes and schizophrenia. In fact, the authors of the study found that the significance of the relationship was different in those with an affective versus non-affective psychosis (Foley et al., 2016). That is, a positive family history of diabetes was associated with a positive family history of schizophrenia in those with a psychotic disorder. Further, the results of the study revealed familial comorbidity was significant only in those with schizophrenia, which is non-affective psychosis (Foley et al., 2016). Darcin, Cavus, Dilbaz, Kaya, and Dogan (2015) examined metabolic disturbances in people with schizophrenia exist as a part of the schizophrenic syndrome, even when the anti-psychotic drug effect is eliminated. The authors included 172 patients with schizophrenia (drug-naïve or drug-free), 64 siblings and 70 age-matched healthy subjects in their case-control study (Darcin et al., 2015). The results of the study showed

that metabolic disturbances were found to be significantly more frequent in patients with schizophrenia and their siblings than individuals without schizophrenia (Darcin et al., 2015). This body of findings could provide further contexts regarding the comorbidity diabetes and schizophrenia, which is not only due to anti-psychotic medication.

As such, this pool of literature could provide more evidence that patients with schizophrenia are more at risk in developing diabetes than the general population due to familial risk factors (Darcin et al., 2015; Foley et al., 2016). That is, patients with schizophrenia (including their siblings) are already at a high risk for metabolic syndrome even without the anti-psychotic drug effect (Darcin et al., 2015). Garcia-Rizo, Kirkpatrick, Fernandez-Egea, Oliveira, and Bernardo (2016) stated similar findings as the authors found that patients with serious mental illnesses present an abnormal glycemic state at the onset. The authors of the study revealed further that there is an abnormal metabolic pathway at the beginning of mental illness diagnosis, even before any pharmacological treatment or other confounding factors take place (Garcia-Rizo et al., 2016). This body of literature could provide empirical evidence on the early risk of diabetes even before any treatment for schizophrenia, which underscores the subsequent need of primary and secondary prevention strategies for diabetes amongst those with schizophrenia (Darcin et al., 2015; Garcia-Rizo et al., 2016). Further, this merits the need for more attention to be given to patients with schizophrenia and their families as they are at high risk in developing metabolic disturbances and diabetes.

Notwithstanding the cause, the increased risk of diabetes in patients with schizophrenia is vital to address. The long-term outcome of patients with both diabetes and schizophrenia have been found to have increased risks of other complications, which

may result in early death (Wu, Lai, & Gau, 2018). Wu et al. delved into this topic and aimed to explore whether having schizophrenia increases the risk of advanced complications and mortality in people with diabetes. The authors involved 11,247 participants with diabetes and schizophrenia and 11,247 participants with diabetes but not schizophrenia (Wu et al., 2018). The findings of the study showed that patients with both diabetes and schizophrenia had an increased risk of macrovascular complications and all-cause mortality (Wu et al., 2018). Moreover, the increased risk of macrovascular complications and all-cause mortality was higher amongst patients with both diabetes and schizophrenia than patients with only one of the two diagnoses (diabetes and/or schizophrenia; Wu et al., 2018). Given the elevated risk of having both diabetes and schizophrenia among patients, it is vital to acknowledge and provide the needs of this population as leaving it unaddressed could lead to adverse consequences such as advanced complications and mortality (Wu et al., 2018).

Diabetes and/or Schizophrenia by Gender

There are varying perspectives regarding the prevalence of schizophrenia amongst men and women. Certain studies have shown that women have certain advantages over men in that women's schizophrenia illness starts at a later age and that their symptoms respond more quickly and more completely to available treatments in contrast to men (Riecher-Rössler, 2016; Riecher-Rössler et al., 2018; Seeman, 2019). Rietschel et al. (2016), Riecher-Rössler (2016), and Riecher-Rössler et al. (2018) stated similar findings noting that men are typically diagnosed with schizophrenia earlier than women. R. Li et al. (2016) concluded similarly, noting that in terms of the prevalence of schizophrenia, female onset is typically 3 to 5 years later than males. Other scholars have revealed that

women have been known to develop and be diagnosed with schizophrenia later in life than men counterparts (Kelly et al., 2016; Rietschel et al., 2016; Seeman, 2019). This body of findings could provide empirical contexts regarding the knowledge available concerning the prevalence of developing schizophrenia at the onset when gender is taken into consideration. As such, this could call out the need for more gender-based interventions that are proactive in nature, which should be targeted for the male population who are at risk in developing schizophrenia earlier than women.

The benefits that women have regarding schizophrenia is not long-term. Seeman (2019) delved further into this topic and noted that even though women have advantages in terms of developing schizophrenia later men, the benefits for women only appear at the outset of illness and then dissipate over time (Seeman, 2019); however, women have other benefits in the diagnosis of schizophrenia. This area of study is explored in a study by Kelly et al. (2016) wherein the authors analyzed the prevalence of childhood physical abuse in a cohort of men and women with schizophrenia and schizoaffective disorder. The authors reported that amongst individuals with trauma, aside from the fact that women are diagnosed at a later age, women also tend to have more affective symptoms and more social support (Kelly et al., 2016). On the other hand, men tend to have poorer premorbid function, more negative symptoms, and lower social functioning than women with schizophrenia (Rietschel et al., 2016). Rietschel et al. (2016) further reported higher impairment in specific symptoms observed amongst male schizophrenia patients in comparison to women schizophrenia patients. Women, in the case of schizophrenic symptoms, have more benefits in comparison to men with schizophrenia. Thus, this body of findings could provide empirical literature that women who are diagnosed with

schizophrenia have several benefits such as the rate of development of the illness and symptoms of schizophrenia (Kelly et al., 2016; Rietschel et al., 2016). Also, this pool of literature could provide initial evidence that though women have advantages in terms of developing schizophrenia, these advantages dissipate over time.

It has been established in medical research that men and women are different in terms of symptoms of schizophrenia. However, there are conflicting conclusions regarding who has more severe symptoms in the development of schizophrenia. For example, there are researchers who have concluded that women are prone to develop more severe symptoms of schizophrenia (Lindamer, Lohr, Harris, McAdams, & Jeste, 1999; Polachek et al., 2017). Lindamer et al. (1999) delved into a study concerning gender-related clinical differences in older patients with schizophrenia. The authors assessed clinical characteristics of women and men with early-onset schizophrenia and late-onset schizophrenia (Lindamer et al., 1999). The results of the study showed that a significantly greater proportion of women had late-onset schizophrenia (Lindamer et al., 1999). However, the results of the study found that women overall had more severe positive psychotic symptoms in contrast to men with schizophrenia (Lindamer et al., 1999). This means that overall, women after age 45 develop and experience more severe positive symptoms than men. This body of findings is in line with that of Polachek et al. (2017). The authors here aimed to evaluate the association between gender and hospitalization characteristics in psychotic disorders. The results of the study revelated that women older than 55 years had higher proportions of hospitalizations than men with psychotic disorders (Polachek et al., 2017). This pool of findings could provide empirical information that women (especially at the age of 45 and above) need more clinical

interventions as support in treating and managing their schizophrenia and its symptoms (Lindamer et al., 1999; Polachek et al., 2017). Gender differences in outcome thus vary depending on the age of the patient (Seeman, 2019). Further, the factor of age should be taken into account by future researchers in assessing the severity of symptoms by gender, given that some studies showed that women older than 55 years have more severe psychotic symptoms than men (Polachek et al., 2017; Seeman, 2019).

The level of impact on certain functions due to schizophrenia is also different between men and women. Men with schizophrenia are prone to have more negative symptoms in brain morphology and neurocognitive function (Han et al., 2012; Mendrek & Mancini-Marie, 2016). Mendrek and Mancini-Marie (2016) and Han et al. (2012) delved further into this topic and focused on gender/gender differences in the brain and cognition in schizophrenia. The authors found male schizophrenic patients had more serious cognitive deficits than female patients in immediate and delayed memory (Han et al., 2012). Mendrek and Mancini-Marie (2016) concluded similar findings and went further to explain that these male schizophrenic patients have more serious cognitive deficits due to the brain asymmetry and specific corticolimbic structures that are different based on gender. As such, in terms of brain morphology and neurocognitive function, male schizophrenic patients have more serious and severe levels of symptoms than women with schizophrenia (Han et al., 2012; Mendrek & Mancini-Marie, 2016). This body of findings offers knowledge regarding gender differences of symptoms in brain morphology and neurocognitive function amongst patients with schizophrenia, which means that interventions catering to neurocognitive function should be more proactive towards men than women.

Further studies reported that men who have both diabetes and schizophrenia are more prone to more severe symptoms than women who have both diabetes and schizophrenia. Zhang et al. (2015) delved into this topic and investigated the gender differences in cognitive deficits in schizophrenia with and without diabetes. The authors of the study assessed 263 individuals with schizophrenia with age range (40–68): 67 males and 34 females with schizophrenia with diabetes; and 125 males and 37 females with schizophrenia without diabetes. The results of the study indicated that male individuals performed worse on most cognitive tasks, especially attention, in schizophrenia with than without diabetes (Zhang et al., 2015). Conversely, the results were different for the women respondents with and without diabetes; that is, women patients did not have as adverse of effects in cognition domains than male patients. As such, among patients with only schizophrenia, it was found that males had worse performances in immediate and delayed memory than females (Zhang et al., 2015). That is, overall results showed that in those with schizophrenia and diabetes, males have significantly worse cognition than females in all cognitive domains, which is in line with the findings of Han et al. (2012) and Mendrek and Mancini-Marie (2016). As such, in terms of cognitive function, men with schizophrenia are more prone to experience adverse effects than women with schizophrenia, with or without diabetes.

Researchers have investigated gender differences in psychosis in terms of symptoms, and the results have contributed to a better understanding of the disease. As such, other studies that have delved further into the gender differences on how diabetes and/or schizophrenia affect men and women include the study of Thorup et al. (2014). The authors of the study aimed to investigate the gender differences at the onset of

psychosis in its development during the first five years of treatment (Thorup et al., 2014). The authors selected 578 patients with first-episode psychosis in the schizophrenia spectrum and obtained data that indicated significant gender differences throughout the first five years of treatment (Thorup et al., 2014). The findings revealed that males with schizophrenia have significantly higher levels of negative symptoms at all times and are more likely to live alone and suffer from substance abuse (Thorup et al., 2014). Barajas, Ochoa, Obiols, and Lalucat-Jo (2015) similarly concluded that different patterns of clinical, social, and cognitive functioning among men and women with schizophrenia. That is, men were found to more severe negative symptoms, worse social functioning, and longer duration of untreated illness than women (Barajas et al., 2015). This body of findings could provide empirical information regarding the need for gender-specific interventions that cater to the needs of men in terms of managing and/or mitigating their negative symptoms, especially where social functioning is concerned (Barajas et al., 2015; Thorup et al., 2014).

On the other hand, females have been found to have better chances in attaining higher levels of social functioning, as well as a greater tendency to be employed or in education than males at follow-up (Thorup et al., 2014). Thara and Kamath (2015) stated similarly, noting that most studies have shown better premorbid functioning and social adjustment for women compared with men. This finding might be due to the fact that women are more compliant with medication for schizophrenia after their first-episode psychosis than men (Thorup et al., 2014). This body of findings could provide more in-depth information regarding the gender differences of patients with schizophrenia even after treatment. That is, both genders show different symptomatology and different levels

of social functioning, as indicated in the studies of Thorup et al. (2014) and Barajas et al. (2015). As such, future researchers should plan for gender-sensitive mental health services targeting the special needs of patients with schizophrenia in relation to their gender-specific needs.

Men and women are also different in the likelihood of developing schizophrenia. Due to the risk of developing diabetes and schizophrenia, Vancamfort et al. (2016) conducted a systematic review and large-scale meta-analysis concerning diabetes mellitus in people with schizophrenia, bipolar disorder, and major depressive disorder. The results of the study indicated higher diabetes prevalence among women with severe mental illness such as schizophrenia compared to men (Vancamfort et al., 2016). Boyd et al. (2015) reported similar findings, stating that women have a higher prevalence of any lifetime internalizing disorder such as schizophrenia than men (Boyd et al., 2015). That is, the findings of the study showed that women are more prone to developing schizophrenia in general than their male counterparts (Boyd et al., 2015). Boyd et al. evaluated gender differences in mental disorders and suicidality, specifically between European countries. The findings of the study indicated that women have consistently higher odds than men in developing mental health disorders such as schizophrenia than men in Europe (Boyd et al., 2015). This body of findings could provide empirical evidence regarding the high risk of developing both diabetes and schizophrenia among women in contrast to men, which could merit the need for more proactive measures and/or medical assistance given to women with diabetes and/or schizophrenia.

Women have been reported to have higher percentages of comorbidities than men, with and/or without schizophrenia. A number of researchers have concluded that women

with schizophrenia are at more risk than men in terms of developing other metabolic issues or health problem in contrast to men with schizophrenia (Gabilondo et al., 2017). Gabilondo et al. found that women with schizophrenia had a cluster of respiratory diseases wherein men with schizophrenia had none. In another study, Nsiah et al. (2015) studied the prevalence of metabolic syndrome in type 2 diabetes mellitus patients, including participants who were prone to mental health illness. In their study, the findings indicated that risk factors were more prevalent in women, compared to men; women were 3 times more likely to have metabolic syndrome (Nsiah et al., 2015). The results also revealed that hypertension, followed by central obesity, low HDL-C and hypertriglyceridemia were experienced by women more than men (Nsiah et al., 2015). This body of knowledge could provide further evidence regarding the need for a more comprehensive, gender-oriented approach to health care in schizophrenia, especially for women who are at risk in developing other complications such as hypertension, central obesity, low HDL-C and hypertriglyceridemia, aside from schizophrenia (Gabilondo et al., 2017).

Gender Differences of Diabetes and/or Schizophrenia Treatment

There are gender differences when it comes to treating diabetes and/or schizophrenia. Understanding gender differences in treating diabetes and/or schizophrenia is important because it provides insight on the gender-specific characterizes of the diseases' onsets and symptoms, as well as an opportunity to deliver gender-specific treatments and care for diabetes and/or schizophrenia patients (Q. Li et al., 2016). Barker et al. (2018) understood this and aimed to explore quality care for diabetic individuals with comorbid chronic psychotic illness with respect to gender

differences. Findings showed that the treatment of diabetes and/or schizophrenia is different among men and women. Additionally, the authors of the study found that quality of diabetes care and monitoring is similarly poor in both women and men; in fact, women with diabetes and/or schizophrenia received only marginally more optimal monitoring than men (Barker et al., 2018). This finding is vital to underscore to health care practitioners given that quality of care for patients with diabetes and/or schizophrenia differs from patterns in the general population. As such, there is more room for improvement when it comes to developing and implementing interventions to improve diabetes and/or psychotic illness care in women and men, which could lead to better patient outcomes (Barker et al., 2018; Q. Li et al., 2016).

In terms of treatment, the effectiveness of dosages and anti-psychotic medication differ significantly between the genders. Several authors have delved further into this area (Krall et al., 2017; Lange et al., 2017). Women metabolize drugs differently, resulting in side effects occurring more commonly in contrast to men (Lange et al., 2017). This means that women tend to need additional medical assistance electrocardiograms or bone density scans as well as diabetes and cardiovascular workups throughout the duration of their intake of anti-psychotic medication (Lange et al., 2017). Krall et al. (2017) indicated similar findings and noted that female schizophrenia patients reportedly are diagnosed with metabolic diseases at higher rates than males. Further, the findings of the study showed that female schizophrenia patients taking clozapine or olanzapine are at uniquely high risks for metabolic dysfunction and future adverse cardiovascular outcomes in contrast to men schizophrenia patients. This body of findings by Krall et al. (2017) and Lange et al. (2017) means that women have specific metabolic

needs with respect to anti-psychotic drugs and/or diabetic drugs. This should, therefore, be taken into account by medical practitioners when dealing with female schizophrenia patients, as their needs warrant close monitoring to prevent worsening of metabolic risk through proper monitoring and interventions (Krall et al., 2017; Lange et al., 2017). As such, a gender-specific approach may be more effective for the treatment and prevention of diabetes and/or schizophrenia (Kucerova et al., 2015).

There are several factors of gender differences associated with anti-psychotics treatment. Researchers have concluded this in their studies, noting that this is due to biological and chemical differences between men and women (Q. Li et al., 2016; Sainz et al., 2019). Q. Li et al. (2016) discussed this further in a study that compared gender difference the effects of anti-psychotics and related risk factors on obesity and body mass index (BMI) in Chinese patients with schizophrenia. The findings of the study showed that there are significant gender differences in bodyweight and obesity in chronically-medicated patients with schizophrenia, with the prevalence of obesity in female patients approximately double that of male patients with schizophrenia (Q. Li et al., 2016). Further, the results of the study revealed that female schizophrenic patients had worse lipid metabolic dysfunction than male schizophrenic patients, which is associated with the anti-psychotic treatment (Q. Li et al., 2016). Lucca et al. (2016) reported similar findings in examining the gender-related differences in the occurrences and pattern of adverse drug reactions in psychiatric patients. The authors of the study argued that female gender suffers from more adverse drug reactions than the male gender (Lucca et al., 2016). Specifically, the results of the study revealed that the incidence of adverse drug reactions in male and females is 33.6% and 45.9%, respectively. Women receiving more

drugs are at higher risk of developing adverse drug reactions than males with schizophrenia (Lucca et al., 2016). This body of knowledge could provide initial references on the several factors of gender differences related to the treatment of diabetes and/or schizophrenia (Q. Li et al., 2016). This could also underscore the need for the development and adjustment of anti-psychotic drug treatments adjusted to age, number of prescriptions, and drug classes with respect to gender differences (Lucca et al., 2016).

This is vital to address given that induced weight gain due to anti-psychotic drugs contributes significantly to reduced quality of life, drug compliance, and increased mortality (R. Li et al., 2016; Sainz et al., 2019; Whicher et al., 2018). Crawford and DeLisi (2016) noted that the many potential gender differences in efficacy and doses of medications for schizophrenia should be addressed, as well as other gender-specific considerations. The authors delved further into this topic and found that female patients respond to lower doses of anti-psychotic medications than males and that side-effect profiles vary between the genders (Crawford & DeLisi, 2016). Further, the authors also found that changes in hormone production occurring at multiple stages throughout a women's life (such as during pregnancy, breastfeeding, menopause, and postmenopausal) should be considered in the treatment of diabetes and mental health issues, which merits more careful treatment for women in contrast to men with schizophrenia (Crawford & DeLisi, 2016). Whicher et al. (2018) and Sainz et al. (2019) also concluded that in females, there are genes related to obesity traits and metabolic syndrome, which indicates that females are more prone to induced weight gain due to anti-psychotics than male counterparts. This body of findings could provide empirical information regarding the gender-related differences associated with anti-psychotics treatment, which should be

taken into account by medical practitioners dealing with diabetic and/or schizophrenic patients in order to yield more positive outcomes for effective treatment of the patient.

Drug doses for diabetes and/or schizophrenia patients are different among men and women. This is due to the fact that men and women have different metabolic capabilities and functioning, influenced by various factors such as gender hormones, dimorphism of the brain, metabolic differences, and social factors (Kucerova et al., 2015; Lange et al., 2017). Lange et al. delved further into this topic and indicated that doses of anti-psychotics should be altered for women with respect to their menstrual cycle. Further, the authors revealed that certain precautions should be taken when prescribing anti-psychotic drugs to women based on their age and body condition (Lange et al., 2017). For example, first-generation anti-psychotics, drugs that are known to increase prolactin levels should be avoided in postmenopausal female patients (Lange et al., 2017). Kucerova et al. (2015) also examined the metabolic syndrome among schizophrenia and diabetic patients. The authors of the study found that women with schizophrenia/depression are more vulnerable to MetS development, meriting the need for different treatment and drug dosage for women with schizophrenia compared to men with schizophrenia (Kucerova et al., 2015). This pool of knowledge could provide empirical evidence regarding the need for treatment methods and/or drug dosages that consider gender-differences, which is needed for the effectiveness of treating diabetes and/or schizophrenia in both men and women patients.

This body of findings suggests that there should be more clinical objectives that aim to improve treatment and care for men and women by offering gender-specific approaches (R. Li et al., 2016; Riecher-Rössler, 2016; Riecher-Rössler et al., 2018). In

particular, researchers have indicated that there is a need to specifically address appropriate adjustments in psychopharmacologic treatment for specific for female patients given their hormonal changes, especially during pregnancy and during stages of postmenopausal (Crawford & DeLisi, 2016). Women have more specific needs in treatment in comparison to men. Another example is the need for breastfeeding women with diabetes and/or schizophrenia with objectives to better manage their symptoms for their offspring a long-term (Crawford & DeLisi, 2016). As such, this body of knowledge underscores the import of studying the specific needs of men and women patients with diabetes and schizophrenia in order to yield optimal patient outcomes for both genders, which could aid alleviate the burden of diabetes and/or schizophrenia in hospitals, as well as healthcare costs related to diabetes and/or schizophrenia patient care.

Conclusion and Summary of Findings

In this literature review, the researcher discussed the factors that affect differences in patient's gender in healthcare costs among schizophrenia and/or diabetes patient care in hospitals in order to identify the association between mental health disorders, chronic illness, and gender on inpatient stay. Providing and understanding the link between the mind and body might allow providers to develop strategies to reduce the incidence of comorbidities, and may assist patients living with mental illness and chronic physical conditions (Davis et al., 2015; Gabilondo et al., 2017; Zhang et al., 2015). Self-regulation theory served as a theoretical foundation for the study to help understand the differences by patient's gender in healthcare costs among schizophrenia/diabetes patient care in hospitals. Self-regulation theory is an approach that promotes systems of conscious

personal management, which involve the process of guiding one's own thoughts, behaviors, and feelings to reach goals (Baumeister & Vohs, 2004).

Despite the prevalence of diabetes and obesity being significantly higher in patients diagnosed with schizophrenia than those without (Annamalai et al., 2017), and the gender-specific needs among diabetes and schizophrenia patients (Davis et al., 2015), research related to gender-specific interventions remains understudied, especially the factors that influence diagnosis, treatment, and treatment outcomes for people living with schizophrenia and diabetes (SCZ/T2D; Gabilondo et al., 2017; Schwartz et al., 2015; Zhang et al., 2015; Zhou et al., 2015).

Several researchers have delved further into the study of schizophrenia and diabetes patient care and found that there are significant differences between male and female patients in terms of symptoms, prevalence, and treatment needs **(**Gabilondo et al., 2017; Schwartz et al., 2015; Zhang et al., 2015). Specifically, there are gender differences when it comes to treating diabetes and/or schizophrenia. Barker et al. (2018) found that women are in need of higher quality patient care for diabetes and/or schizophrenia, while Rietschel et al. (2016) argued that there is higher impairment in specific symptoms observed amongst male schizophrenia patients in comparison to women schizophrenia patients. In terms of treatment, there are differences observed in the effectiveness of dosages and anti-psychotic medication between the two genders as well. Several authors have further examined this area (Krall et al., 2017; Lange et al., 2017) and found that women metabolize drugs differently, resulting in side effects occurring more commonly in contrast to men (Lange et al., 2017). This means that women tend to need additional medical assistance electrocardiograms or bone density scans as well as diabetes,

metabolic diseases, and cardiovascular workups throughout the duration of their intake of anti-psychotic medication (Krall et al., 2017; Lange et al., 2017). Other researchers concluded that female schizophrenic patients have worse lipid metabolic dysfunction than male schizophrenic patients, which is associated with the anti-psychotic treatments (Q. Li et al., 2016; Lucca et al., 2016). This could merit the need for more research on effective anti-psychotic treatments that have fewer adverse effects on patients with diabetes and/or schizophrenia.

Given the differences in males and females in schizophrenia and diabetes patient care, treatment, and symptoms, several researchers have reported that women tend to have higher percentages of comorbidities than men, with and/or without schizophrenia (Gabilondo et al., 2017; Nsiah et al., 2015). Nsiah et al. argued that women with schizophrenia are at more risk than men in terms of developing other metabolic issues or health problem in contrast to men with schizophrenia, while Kucerova et al. (2015) underlined that women with schizophrenia/depression are more vulnerable to metabolic syndrome development. This body of work indicates the need for gender-specific approaches and treatment for people living with schizophrenia and diabetes (Gabilondo et al., 2017; Zhang et al., 2015).

Many authors have underlined the need for promoting gender-specific treatment methods and research in the context of schizophrenia and diabetes to lessen healthcare costs related to patient care of schizophrenia and/or diabetes. Laursen et al. (2014), Gabilondo et al. (2017), and Gorczynski et al. (2017) all argued that unless significant gender-specific treatment methods are developed and implemented, the burden of disease would increase and more patients with mental and chronic illnesses would be subject to

healthcare costs related to the care of schizophrenia and/or diabetes (Schwartz et al., 2015). Therefore, health care organizations and clinicians should ensure there is appropriately planned and targeted decision-making in resource allocation for male and female patients staying at hospitals with SCZ/T2D (R. Li et al., 2016; Zhang et al., 2015).

Gap in Literature

Despite the existence of literature on diabetes and/or schizophrenia, gender-related differences in terms of treatment and symptoms of diabetes, and/or schizophrenia, there have been several constraints in terms of available and reliable literature for the use of this study in terms of gender differences, as well as gender-specific treatment of diabetes and/or schizophrenia. Resultingly, there is a gap in the literature regarding gender-differences of effective treatment of diabetes and/or schizophrenia among men and women (Q. Li et al., 2016; Sainz et al., 2019; Schwartz et al., 2015). That is, focus on gender-specific treatment methods for diabetes and/or schizophrenia have rarely been explored by existing literature and there are few effective ways to manage and/or prevent diabetes and/or schizophrenia in both genders. Also, support programs that reflect the needs of patients with diabetes and/or schizophrenia, particularly women, have not been discussed in detail by existing research.

This is vital to address through future research. Health care practitioners and clinicians can refer to such work in order to provide needed support for women patients with diabetes and/or schizophrenia. It is also noted that gender differences in schizophrenia and/or diabetes have been well-recognized. Gender differences in chronic illness associated with anti-psychotic drugs have received little systematic study (Q. Li et al., 2016; Sainz et al., 2019). Moreover, there is a lack of research on the specific

challenges that women with diabetes and/or schizophrenia face in contrast to men, which is vital to address given that women are more likely to have additional comorbidities in addition to schizophrenia and diabetes than men (Gabilondo et al., 2017; Zhang et al., 2015). These important characteristics of risk factors by women patients with diabetes and/or schizophrenia, as well as the identification of their needs and treatment methods, were the least commonly explored of the constructs in the literature (Gabilondo et al., 2017).

Moreover, there is a limited amount of empirical studies, either quantitative or qualitative, that have examined the need for more effective treatment methods and programs to assist with eradicating and preventing comorbidities amongst patients (specifically women) with diabetes and/or schizophrenia. Previous researchers focused on examining the impacts of drugs prescribed to this population (anti-psychotics) and its impact; some have concluded that certain medication results in adverse side-effects and even other chronic illnesses such as cardiovascular disease. There is limited research, however, exploring alternative ways and/or mechanisms to treat and manage symptoms of diabetes and/or schizophrenia (Bent-Ennakhil et al., 2018; Brink et al., 2019). Moreover, researchers have examined the side-effects of anti-psychotics treatments (e.g., increasing the risks of patients developing other chronic illnesses such as diabetes and cardiovascular disease; Galling et al., 2016; Pillinger et al., 2019), but few have focused on providing alternatives to anti-psychotics treatments that cater to the need of patients living with diabetes and/or schizophrenia taking into account gender-specific needs. This is important since there is an existing gap related to differences in healthcare costs related to schizophrenia and diabetes and how these are moderated by the gender of the patient.

As such, there is a prevalent need to support planning and decision-making in resource allocation for male versus female schizophrenia/diabetes patients who are hospitalized (Zhang et al., 2015). Some previous studies have underscored that if healthcare for diabetes patients simultaneously targets their mental health condition, this ultimately results in a significant improvement of patient outcomes and prevailing lower healthcare costs related to schizophrenia and/or diabetes (Gabilondo et al., 2017; Goueslard et al., 2018).

In Chapter 3, the researcher discusses the quantitative methodology and the systematic steps that the researcher employed to address the research questions on this topic. The researcher then outlines the correlational research design used, which coincides with the purpose of the study, the research population, and the sampling method that the researcher utilized in order to ensure a randomized, balanced set of unbiased data. The researcher then discusses the methodology of the study and provides a concrete outline of its steps, including recruitment procedures, participation in data collection, and concerns regarding the validity of the results.

CHAPTER 3

METHODOLOGY

Introduction

The researcher's aim in this study was to explore the relationship between schizophrenia and type II diabetes and the length of hospital stay, with patient's gender as the moderator. In Chapter 3, the researcher outlines the methodology by discussing the overall approach used in conducting this study. The sections in this chapter include the research design and rationale, methodology, and data analysis. This chapter also includes a discussion of the research questions and hypotheses, data collection process, variables, validity and reliability, limitations, delimitations, ethical considerations, and a chapter summary.

Research Design and Rationale

In this quantitative correlational study, the researcher used multiple regression analysis to examine the relationships among the dependent and independent variables listed in each of the study's hypotheses (length of hospital stay, schizophrenia, and diabetes) and the moderating effect of patient's gender, while controlling for demographic variables (age, race, and comorbidities). The researcher determined that moderation occurred when the strength or direction of the effect of an independent variable on a dependent variable varied as a function of the values of the moderator (Hayes, 2013; Marsh, Hau, Wen, Nagengast, & Morin, 2013). The analysis focused on the marginal effects of the key independent variables, dependent variables, and moderator, while holding covariates constant and using a standard significance level of $p<0.05$ (Wooldridge, 2012).

The researcher estimated the models for the multiple linear regressions using the Ordinary Least Squares (OLS) method. This method is a standard regression estimation process, in which a regression line is found for the coefficient estimates working to minimize the value of the squares of the residuals (Wooldridge, 2012). The main purpose of the research design was to provide methods that allow the examination of the independent variables and how they may predict the dependent variable. The researcher exported statistical computations to Stata software (StataCorp. 2017).

The researcher selected quantitative methods for this study after reviewing existing literature in-depth. The goal of quantitative methodologies is to examine relationships between variables measured numerically (Babbie, 2012). A quantitative methodology was appropriate for the present study because the purpose of the research was to understand the relationship between length of hospital stay and schizophrenia/diabetes with patient's gender as the moderator in the general U.S. population. Quantitative methodologies are more desirable when a researcher is examining the strength of the relationship between the variables of the study. Quantitative researchers objectively test theories by investigating the association between variables and attempts to form a relationship that is statistically significant and is suitable for correlational design (Moxham, 2012; Polit & Hungler, 2013).

Methodology

Subjects

HCUP is a family of health care databases bringing together the data collection efforts of state data organizations, hospital associations, private data organizations, and the federal government to create a national information resource of patient discharge-

level health care data (The Healthcare Cost and Utilization Project, 2019). The target population for this study included patients whose data are included in the HCUP databases and come from all U.S. states. The databases cover hospital inpatient care, outpatient emergency department care, and ambulatory surgery from hospital-owned facilities.

The researcher obtained and extracted data from the HCUP. The data that the researcher accessed for these variables came from 2015 Q1, Q2, and Q3 (prior to HCUP's transition from ICD-9-CM to ICD-10-CM/PCS). The researcher purchased HCUP data of interest online through the HCUP Central Distributor. The researcher was required to complete the online Data User Agreement (DUA) training and create a HCUP account prior to purchasing data. The DUA online training included information on the rules and restrictions while using HCUP data. Once purchased, data were available for download for 30 days.

Operationalization of Constructs

Length of hospital stay (LOS). This is the dependent (continuous) variable that the researcher measured in days. The researcher calculated this by subtracting the admission date from the discharge date of a patient. Same-day stays were considered 0 days.

Schizophrenia (SCZ). This is a main independent (binary) variables of interest. The ICD-9 code for schizophrenia is 295.x. A patient either had a diagnosis of schizophrenia as principal or secondary diagnosis at the time of hospitalization discharge or not.

Diabetes (T2D). This is a main independent (binary) variables of interest. The ICD-9 code for type II diabetes without reported complications is 250.x. A patient either had a diagnosis of T2D without complications as principal or secondary diagnosis at the time of hospitalization discharge or not.

Patient's gender. This is the moderator (binary) variable for the hypotheses referring to the patient's sex as documented in hospitals' medical records: female or male.

SCZ*GENDER. This is an interactive term where the values for schizophrenia and patient's gender are multiplied together to be used as the moderating effect in the regression analysis model.

T2D*GENDER. This is an interactive term where the values for diabetes and patient's gender are multiplied together to be used as the moderating effect in the regression analysis model.

SCZ*T2D*GENDER. This is an interactive term where the values for schizophrenia, diabetes, and patient's gender are multiplied together to be used as the moderating effect in the regression analysis model.

Age. This is a continuous covariate indicating the age of the patient at admission to the hospital. Only adults aged 18 years old and older were included in this study.

Race. This is a categorical covariate indicating the race and ethnicity of the patient who is admitted to the hospital. The categories include White, Black, Hispanic, Asian or Pacific Islander, Native American, and Other.

Comorbidities. This is a proxy continuous covariate representing the total number of comorbidities, extracted from the reported number of ICD-9-CM diagnoses counted per discharge as reported in the HCUP dataset.

Validity and Reliability

There are internal and external validity threats. Internal validity relates to the methodology and tools used to conduct the research. Included in internal validity are threats that may discredit the research, including the research tools chosen to conduct the study (Twycross & Shields, 2004). In this study, using regression analysis provided the flexibility to include all the desired independent variables. The sample size was large due to the use of national-level data, lending credibility to the results. The validity of the HCUP dataset is high, as those variables are a result of years of collaborative work across healthcare organizations locally and nationally. Regardless of how many times the regression is run, if the same variables are chosen, the resulting data extracted would be the same. Thus, the validity and reliability of data collection and import into Stata software did not vary.

Because the sample came from a nationwide dataset, external validity was not considered a problem. Generalization should be possible with other similar datasets collected from healthcare organizations that are not part of the HCUP database. As for internal validity, the researcher only analyzed 2015 data from Q1-Q3, which may not be comparable to data available in the future from more recent years.

The researcher took several steps to ensure the validity of this research. The statistical methods selected for examining relationships between predictive variables helped the researcher the nature of the relationships among variables; however, the

researcher ensured that analysis remained focused on potential predictive relationships and not on the causality of these relationships. This reinforced the alignment of the research questions and purpose of the study with the selected research methods (Creswell, 2014). Additionally, the researcher consulted the perspectives of other expert researchers in the field and previously published studies that use the HCUP data to ensure alignment between essential facets of the study and the selected research methods (Creswell, 2014).

Sampling and Sampling Procedures

Sampling has already taken place by HCUP's collaborators (The Healthcare Cost and Utilization Project, 2019). The dataset that the researcher analyzed in this study already exists and was completely accessible to the researcher for analysis. The researcher accessed data via HCUP and cleaned the data prior to analysis. Inclusion criteria included adult patients whose medical records show a hospitalization in 2015 Q1-Q3 and medical billing show T2D or SCZ as the principal or secondary diagnosis at discharge. Exclusion criteria included patients under the age of 18 years, having a condition other than T2D or SCZ listed as principal diagnosis at hospital discharge, and missing gender data.

For this study's research questions, the researcher used a $p>.05$ significance level, selected an 80% power of the test, and applied it to the more restrictive multivariate multiple regression for the statistical technique (compared to *t*-test; Morgan & Van Voorhis, 2007). The researcher used Green's (1991) approach to perform the power analysis calculations for this study. To test the model overall, the recommended minimum sample size is 50 + 8k (k is the number of predictors, 8), or 114. To test the

individual predictors, the minimum sample size should be 104 + k, or 112. Taking the larger number, the minimal sample size for this study was 114.

Data Analysis

The data analysis for this study included descriptive and cross-sectional quantitative analytical approaches. Creswell (2014) defined quantitative research as "an approach for testing objective theories by examining the relationship among variables" (p. 4). The researcher chose this research design to determine the association between two or more predictor variables. The methodology for this research was split into two distinct phases: the first phase involved the exploration of descriptive statistics for all variables and t-tests between patient groups by variable value (i.e. schizophrenia [0/1], diabetes [0/1], female [0/1]), while the second phase was an exploration of the relationships among these variables via regression analyses.

In the first phase, the researcher used descriptive statistic of mean and standard deviations, and categorical responses counts and frequency for the dependent variable (length of hospital stay) and key independent variables (schizophrenia, diabetes, patient's gender), as well as the covariates (age, race, comorbidities). In the second phase of the study, the researcher explored the relationships among the dependent variable and key independent variables of interest. To determine the association between the independent variables and the dependent variable, the researcher used Pearson's correlations, *t*-tests, and multivariate multiple regression analyses (Wooldridge, 2012). First, the researcher used *t*-tests to test whether the differences between patient groups by variables are significant (for example, testing the difference between female and male patients). Then, the researcher used Pearson's correlations to test binary relationships among all variables.

Finally, the researcher conducted multiple regressions to estimate the relationships between the dependent and key independent variables with the moderator (as interaction terms) and without, holding covariates constant and using a significance level of $p<0.05$. The main purpose of the research design was to provide methods that allow the examination of the independent variables and the moderator, and their quantitative relationship to the dependent variable. The researcher conducted all data analysis using Stata software (StataCorp, 2017).

For regression analyses including a moderator, there are two steps to confirm a moderation effect (Hayes, 2013). Using RQ1 as an example, first, a regression model predicting the dependent variable (length of hospital stay) from the key independent variable (schizophrenia) and moderator (patient's gender) is run, holding all else constant. Both effects and the model in general should be significant. Then the same model is run adding the interaction term (schizophrenia*patient's gender) and if the model and the interaction term are significant, then the researcher concludes that the moderation is occurring. According to Shieh (2013), "The sample squared multiple correlation coefficient R^2 is a prevailing strength of association effect size measure for the population squared multiple correlation coefficient ρ^2 between the criterion variable and the set of predictor variables" (pp. 402-403). The researcher repeated the same steps for RQ2 and RQ3.

The researcher performed all inferential tests using survey data analysis and taking into account the variable DISCWT from the HCUP database. This variable is a weight variable used to make the sample more representative of national estimates. Weighting of survey data is required in order to "map the sample back to an unbiased

representation of the population" (Heeringa, West, & Berglund, 2010). The researcher describes the assumptions for a multiple regression model below.

Existence. For each combination of independent variables, the response observations are a random variable that has a finite mean and variance and a particular probability distribution.

Independence. The response observations are independent of one another.

Normality. The researcher checked the distribution of each continuous independent variable for substantial skewedness or outliers using kurtosis and a goodness-of-fit test such as the Kolmogorov-Smirnov test. The researcher analyzed a histogram, normal probability plot, and a residual plot to determine normality as well. Central Limit Theorem also states that if *N* is greater than or equal to 30, the sampling distribution of the sample mean is approximately normal, regardless of the shape of the population distribution. If there was an issue with normality, the researcher would have transformed the data to meet this condition.

Linearity. The researcher analyzed bivariate relationships among continuous independent variables and the dependent variable to check for linearity. The researcher studied scatterplots, correlations, and residual plots. Other methods that the researcher used to detect outliers were leverage points and Cook's distance. The leverage point was supposed to be greater than (2(k+1))/n. If there was an issue with linearity, the researcher would have transformed the data to meet this condition.

Homoscedasticity. The researcher analyzed a residual jackknife plot for the full regression model to assess homoscedasticity. If the variance appeared to increase with the outcome variable, then there was a violation of the homoscedasticity assumption and the

researcher transformed the data or used a weighted least-squares analysis to address this issue. The researcher analyzed residual plots for each continuous independent variable as well.

Multicollinearity. The researcher checked for multicollinearity between the continuous independent variables. The researcher examined bivariate scatterplots and correlations to determine whether independent variables over correlate with one another along with the collinearity statistic (R^2) in the coefficient table. The Variance Inflation Factor (VIF) should be small, or tolerance should be high. Another way to check collinearity is to compute the eigenvalues of the independent variable correlation matrix. As an eigenvalue approaches zero, collinearity among other independent variables is indicated.

The data set may violate certain assumptions such as normality, linearity, and homoscedasticity. In this situation, the researcher may eliminate independent variables, may transform the data, or linearized the regression model. The most common types of transformations used are the log, square root, and square. The three research questions, null hypotheses, and alternative hypotheses for this study were as follows.

RQ1: Does the effect of having schizophrenia on length of hospital stay vary by patient's gender?

H_{o1}: The patient's gender moderates the effect of having schizophrenia on length of hospital stay, holding other variables.

H_{a1}: The effect of having schizophrenia on length of hospital stay does not vary by patient's gender, holding other variables constant.

RQ2: Does the effect of having type II diabetes on length of hospital stay vary by patient's gender?

H_{o2}: The patient's gender moderates the effect of having type II diabetes on length of hospital stay, holding other variables constant.

H_{a2}: The effect of having type II diabetes on length of hospital stay does not vary by patient's gender, holding other variables constant.

RQ3: Does the combined effect of having schizophrenia and type II diabetes on length of hospital stay vary by patient's gender?

H_{o3}: The patient's gender moderates the effect of having schizophrenia and type II diabetes on length of hospital stay, holding other variables constant.

H_{a3}: The effect of having schizophrenia and type II diabetes on length of hospital stay does not vary by patient's gender, holding other variables constant.

Limitations

It is expected for research studies to have a set of limitations and delimitations (Ellis & Levy, 2009). Limitations refer to the threats that are uncontrollable to the internal validity of the study while delimitations impact the external validity in regard to the result of the study (Ellis & Levy, 2009). The researcher assumed that there were limitations and delimitations related to the generalizability of the study. Although limitations and delimitations are foreseeable in researcher studies, it is vital for a researcher to acknowledge them to boost the trustworthiness of the study (Price & Murnan, 2004).

The following are some of the limitations that the researcher anticipated for this study.

1. There was a possibility patients' data may not be a true representation of the U.S. population. This may prevent the results from being generalizable to the larger population of interest.
2. The dataset was limited to the years 2014 - 2015, which may not be applicable to the current healthcare context.
3. Sampling was not randomized at the patient-level, which means that there may be characteristics about the place where patients were hospitalized that determine what patients' data are more likely to end up in HCUP than others, and it is possible that these characteristics are also correlated to the dependent variable. This could bias the results to be representative of only that subpopulation hospitalized in participating entities and not to the larger population of interest.

Ethical Procedures

Ethical guidelines for research include protecting participant privacy, confidentiality, and anonymity, as well as ensuring that participants are exposed to minimal risk as a result of being part of the study (Miller, 2003). The safety and confidentiality of the data are also paramount (Miller, 2003). The researcher anticipated no ethical problems related to this study because the risk to participants were minimal, per IRB standards. There was an understanding that if ethical issues arose, the researcher would address them in a manner that was consistent with the Belmont principles (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1978). The researcher obtained ethical approval to conduct the study from the university's IRB before data collection.

According to HCUP (2019), “The HCUP databases are consistent with the definition of limited data sets under the HIPAA Privacy Rule and contain no direct patient identifiers. HCUP Data Use Agreement (DUA) training and a signed DUA are required to purchase and/or use the HCUP databases.” There was no interaction with respondents by the researcher. Electronic data purchased from HCUP were password-protected and stored electronically on the researcher’s personal file space on the university server. Three years after the completion of the study, the researcher will destroy the physical data and permanently erase the electronic data.

Summary

In this chapter, the researcher explained the research methodology for this quantitative, correlation design to examine the relationships among length of hospital stay, schizophrenia, diabetes, and patient’s gender for adult patients in the United States. The researcher discussed the chosen methodology for the study, explored the data collection and analysis procedures, and explained the limitations and delimitations of the study. In addition, the researcher explained the ethical guidelines for this research, including protecting participant privacy, confidentiality, and anonymity. In Chapter 4, the researcher outlines an in-depth report of the assumption test, findings, and analyses of the 2014 and 2015 HCUP data.

CHAPTER 4

RESULTS

Introduction

Schizophrenia is a mental health disorder that shortens life spans (Davis et al., 2015; Hjorthoj et al., 2017; Suvisaari et al., 2016). Researchers have shown that patients' gender is an understudied factor that influences diagnosis, treatment, treatment outcomes, and healthcare costs for people living with SCZ and type II diabetes (Gabilondo et al., 2017; Sainz et al., 2019; Schwartz et al., 2015; Zhang et al., 2015). The aim of this study was to explore the relationships among SCZ, type II diabetes, and the length of hospital stay, with patient's gender as the moderator. In Chapter 4, the researcher outlines the results of this study by describing the data and analyses conducted. The sections in this chapter include data collection, description of the data, the analyses conducted, and a chapter summary.

Data Collection

The current researcher used 2015 data from the Healthcare Cost and Utilization Project database (The Healthcare Cost and Utilization Project, 2019). The HCUP is a family of health care databases bringing together the data collection efforts of state data organizations, hospital associations, private data organizations, and the federal government to create a national information resource of patient discharge-level health care data. The unit of analysis for this study were hospital discharge records in the HCUP databases from all U.S. states. The original HCUP dataset has over 7 million data points per year, which weighted represent national estimates of roughly 40 million hospital discharge records in the United States.

The researcher obtained and extracted data from the HCUP during the month of November 2019. The data accessed for the study's variables came from the year 2015 Q1, Q2, and Q3, which are the quarters prior to HCUP's transition from ICD-9-CM to ICD-10-CM/PCS coding system. The researcher purchased these data online through the HCUP Central Distributor. The researcher completed the online Data User Agreement (DUA) training and created a HCUP account prior to purchasing data. The DUA online training included information on the rules and restrictions while using HCUP data.

The researcher accessed the dataset compiled by HCUP via their website and cleaned the data prior to analysis. The HCUP data contains the Nationwide Inpatient Sample (NIS). The NIS contains data on more than seven million hospital stays each year. The NIS is sampled from the State Inpatient Database (SID), which contains all inpatient data that are currently contributed to HCUP. NIS depends on the hospitals to ensure accuracy, completeness, and consistency of the data. The validity and reliability of the data from the hospitals to HCUP was out of this study's researcher's realm of control.

The inclusion criteria for subset of 2015 data included adult patients (18 years old and older) whose medical records show a hospital discharge in 2015 Q1-Q3 and medical billing show schizophrenia or type II diabetes without complications as the principal or secondary diagnosis at the time of discharge. Exclusion criteria include patients under the age of 18 years, a condition other than schizophrenia or type II diabetes without complications listed as principal or secondary diagnosis at the time of hospital discharge, observations that were missing gender data, and discharge records reporting the death of a patient during the hospital stay.

The researcher performed all inferential tests using survey data analysis, which takes into account the variable DISCWT from the HCUP's NIS Core database. Weighting of survey data is required in order to map the sample back to an unbiased representation of the population. Th DISCWT variable is a weight variable which is used to make the sample more representative of national estimates. To answer the study's research questions, the researcher followed a retrospective, quantitative, correlational design, used a $p > .05$ significance level, and obtained a minimum sample size of 114, according to the calculations in Chapter 3. The researcher conducted all data analysis using Stata software (StataCorp, 2017).

2015 Results

The subsample extracted from HCUP based on the criteria listed above resulted in a sample size of 50,129 hospital discharge records. The age of the sample ranged between 18 and 90 years old, with a mean of 43.9 years old (Table 1). Among females, the mean age was higher at 47.3 years old than the male average of 41.8 years old. The average number of total comorbidities reported at hospital discharge was 7.6 (range: 1-30), which was slightly higher among females (mean=8.2) compared to males (mean=7.3). The mean number of days of stay at the hospital was 10.8, and ranged from 0 to 355 days. For females, the LOS was higher at 11.5 days, compared to males' 10.4 days.

Table 1

Descriptive Statistics for the Continuous Independent Variables

	Gender					
	Female (*n*=19,319)		Male (*n*=30,810)		Total (*n*=50,129)	
Variable	Mean	SE	Mean	SE	Mean	SE
Age	47.3 [18-90]	.21	41.8 [18-90]	.18	43.9 [18-90]	.18
Comorbidities	8.2 [1-30]	.10	7.3 [1-30]	.09	7.6 [1-30]	.09
LOS	11.5 [0-300]	.24	10.4 [0-355]	.25	10.8 [0-355]	.23

*LOS=length of stay at hospital in days; Comorbidities=total number of diagnoses reported at time of hospital discharge.

In the sample, 47,475 discharge records reported a diagnosis of SCZ (94.7%), 10,213 (20.4%) reported a diagnosis of T2D without complication, and 7,558 (15.1%) records showed diagnoses with both SCZ and T2D (Table 2). Among females, SCZ diagnosis was lower than males (38% vs. 62%, respectively). Differences between females and males were smaller for T2D (48.5% vs. 51.5%, respectively) and SCZ/T2D (48.8% vs. 51.2%, respectively). Out of the sample of 50,129 hospital discharge records, 39,916 (79.6%) had a diagnosis of SCZ, but no T2D, whereas 2,655 (5.3%) had a diagnosis of T2D, but no SCZ. A higher number of males than females were diagnosed with SCZ, but no T2D (82.9% vs. 74.4%, respectively), whereas the opposite was true for diagnoses of T2D and no SCZ (4.5% vs. 6.6%).

White was the predominant race in this sample with 45.5%, followed by Black (36.1%), Hispanic (12.2%), other (3.4%), Asian or Pacific Islander (2.1%) and Native American (0.7%; see Table 2). There more females reported as White and Asian or Pacific Islander than males (48.7 vs. 43.5% and 2.4% vs. 1.9%, respectively), more males reported as Black, Hispanic, and other (36.9% vs. 34.7%, 13.3% vs. 10.5%, and 3.7% vs.

3.0%, respectively), and Native Americans were equally represented in both genders at 0.7% each.

Table 2

Descriptive Statistics for the Categorical Dependent and Independent Variables

		Gender					
		Female (*n*=19,319)		Male (*n*=30,810)		Total (*n*=50,129)	
Variable	Category	*Freq.*	*%*	*Freq.*	*%*	*Freq.*	*%*
SCZ, all		18,052	38.0	29,422	62.0	47,474	94.7
SCZ, no T2D		14,366	74.4	25,550	82.9	39,916	79.6
T2D, all		4,952	48.5	5,260	51.5	10,212	20.4
T2D, no SCZ		1,267	6.6	1,388	4.5	2,655	5.3
SCZ/T2D		3,686	48.8	3,872	51.2	7,558	15.1
Race	White	8,926	48.7	12,718	43.5	21,644	45.5
	Black	6,360	34.7	10,790	36.9	17,151	36.1
	Hispanic	1,922	10.5	3,877	13.3	5,799	12.2
	Asian/P.I.	439	2.4	565	1.9	1,004	2.1
	Native Am.	133	0.7	205	0.7	338	0.7
	Other	546	3.0	1,068	3.7	1,614	3.4

*Asian/P.I.=Asian and Pacific Islander; Native Am.=Native American; SCZ=schizophrenia; T2D=type II diabetes without complications; SCZ/T2D=schizophrenia and type II diabetes without complications.

Prior to conducting the analysis, the researcher checked the distribution of each continuous variable for normality. The researcher graphed histograms of the LOS, age, and comorbidities variables to visualize normality (Graphs 1a-1c). In all three variables, data were right-skewed, especially for the dependent variable, of LOS. The Central Limit Theorem states that if *N* is greater than or equal to 30, the sampling distribution of the sample mean is approximately normal, regardless of the shape of the population distribution. The sample size in this case was very large at over 50,000 observations, so there was no need to transform the data to meet the normality assumption (Lumley, Diehr, Emerson, & Chen, 2002).

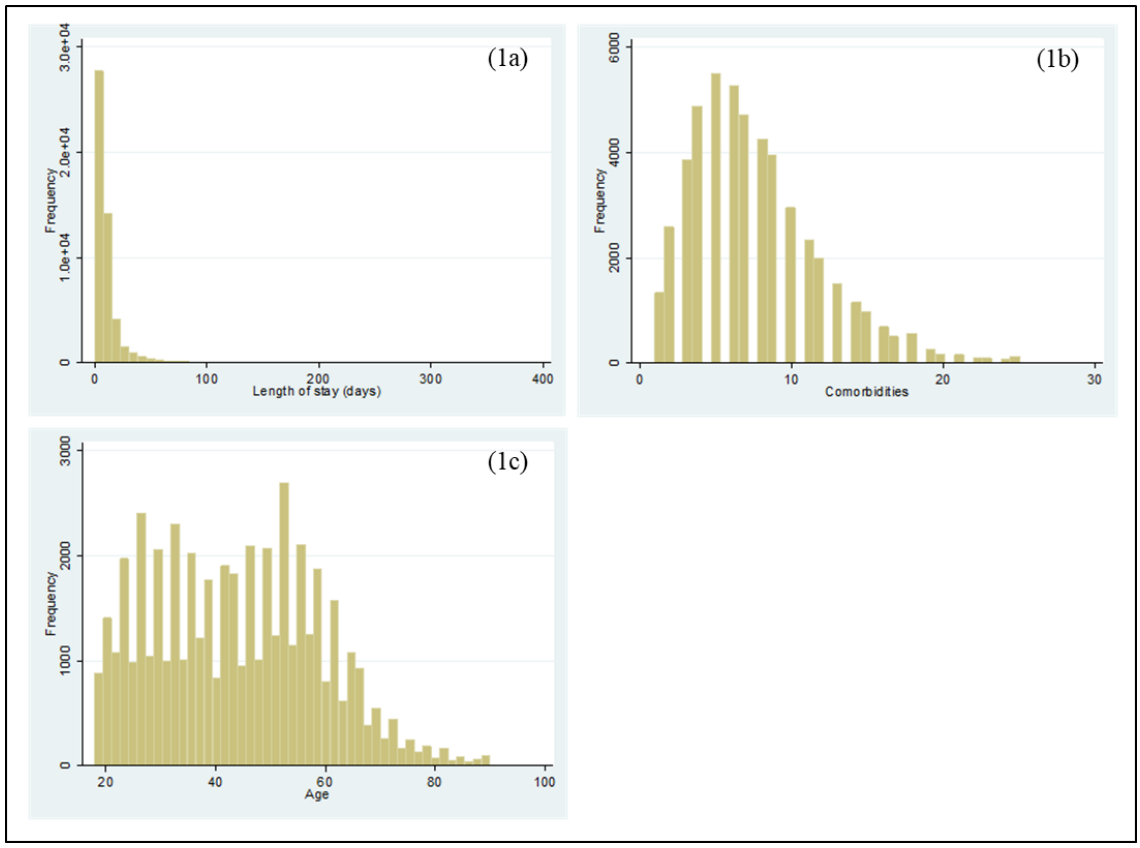

Figure 3. Histograms for the continuous variables LOS, age, and comorbidities.

The dependent variable, LOS, had a number of real zeros (341 discharge records had 0 days of hospitalization) and an overdispersion of data. These characteristics led to the use of negative binomial regressions for the analysis. Researchers prefer negative binomial regressions over OLS for over-dispersed count data—that is, when the conditional variance exceeds the conditional mean (Wooldridge, 2002). Using an OLS regression with a count dependent variable that has been log-transformed can cause many issues, including loss of data due to undefined values generated by taking the log of zero (which is undefined), as well as the lack of capacity to model the dispersion. Negative binomial regressions can be considered as a generalization of the Poisson regression because it has the same mean structure and it has an extra parameter to model the over-dispersion. If the conditional distribution of the outcome variable is over-dispersed, the

confidence intervals for the negative binomial regression are likely to be narrower as compared to those from a Poisson regression model.

The researcher conducted univariate analyses using negative binomial regressions, accounting for survey design weights, with LOS as the dependent variable and SCZ, T2D, SCZ/T2D, gender, age, rage, and comorbidities as the predictor variables (Table 3). All predictors, except T2D and race, had positive statistically significant relationships with LOS of $p \leq .009$. For example, the variable age had a coefficient of .006, which is statistically significant. In negative binomial regressions, this means that for each one-unit increase on age, the expected log count of LOS (days in the hospital) increases by 0.006. The T2D (no SCZ) binary predictor had a statistically significant relationship with LOS, but it was negative ($\beta = -.709$, $p < .001$). This coefficient can be interpreted as the expected difference in log count between T2D, no SCZ, and the reference group (T2D and SCZ or other comorbidities). The expected log count for T2D, no SCZ, was .709 lower than the expected log count for T2D and SCZ or other comorbidities.

In the case of race, with White as the reference category, Black and Hispanic races had negative statistically significant differences in log count ($\beta = -.094$, $p = .002$ vs. $\beta = -.152$, $p < .001$, respectively; see Table 3). The races of Asian or Pacific Islander, on the other hand, had a positive statistical significant difference in log count ($\beta = .212$, $p = .002$). At the univariate analysis level, the researcher included all variables of interest in the multiple negative binomial regressions.

Table 3

Univariate Negative binomial Regression Analyses for Variables Predicting Hospital Length of Stay in Days

						95% CI	
Predictor	*n*	*β*	*SE*	*T*	*p*	Upper	Lower
SCZ, no T2D	50,113	.050	.019	2.61	.009	.012	.088
T2D, no SCZ	50,113	-.709	.044	-15.99	.000	-.795	-.622
SCZ/T2D	50,113	.135	.020	6.71	.000	.095	.174
Gender	50,113	.106	.015	6.88	.000	.076	.136
Age	50,113	.006	.001	10.17	.000	.005	.007
Race	47,533						
Black		-.094	.031	-3.06	.002	-.154	-.034
Hispanic		-.152	.035	-4.28	.000	-.222	-.082
Asian/P.I.		.212	.069	3.06	.002	.076	.347
Native Am.		-.156	.092	-1.70	.089	-.336	.024
Other		.092	.060	1.54	.123	-.025	.209
Comorbidities	50,113	.024	.003	7.46	.000	.018	.031

Note. *B*: Regression Coefficient; *SE*: Standard Error; *t*: t-test statistic. Asian/P.I.=Asian and Pacific Islander; Native Am.=Native American; SCZ=schizophrenia; T2D=type II diabetes without complications; SCZ/T2D=schizophrenia and type II diabetes without complications. For all categorical variables (*), the reference group is not having the condition(s) or reporting race as white.

In the next phase of the analysis, the researcher explored the relationships among the dependent variable, independent variables, and hypothesized moderator of gender. To determine the relationships among these variables, the researcher performed *t*-tests, Pearson's correlations, and multiple negative binomial regression analyses (Wooldridge, 2012). First, the researcher used *t*-tests to test whether the differences between gender groups were significant by testing the differences between females and males in all the continuous and count variables of interest. Then, the researcher used Pearson's correlations to test binary relationships among gender and the rest of the categorical variables.

For the dependent variable of LOS (*diff.* = -1.16, *95% CI*: .88, -1.44) and the predictor variables of age (*diff.* = -5.45, *95% CI*: -5.18, -5.72) and comorbidities (*diff.* = -

.918, *95% CI*: -.840, -.995), the differences between means for females and make were statistically significant at $p < .001$ (Table 4). Tables 5, 6, 7, and 8 illustrate the Chi-squared test results for binary and categorical variables SCZ, T2D, SCZ/T2D, and race. All binary and categorical variables showed statistically significant differences between females and males.

Table 4

Differences between Female and Male Group Using t-tests

Predictor	Mean female	Mean male	Diff.	*SE*	95% CI	
					Upper	Lower
LOS	11.5	10.4	-1.16***	.141	-1.44	-.88
Age	47.3	41.8	-5.45***	.136	-5.72	-5.18
Comorbidities	8.19	7.27	-.918***	.040	-.995	-.840

Note. ***$p < .001$. *SE*: Standard Error; LOS=hospital length of stay in days.

Table 5

Crosstabulation of Gender and Schizophrenia with Corresponding Chi-Squared Test Result

	Gender		
SCZ, no T2D	Female	Male	χ^2
Yes	14,366	25,550	
No	4,953	5,260	537.01***

Note. ***= $p < .001$.

Table 6

Crosstabulation of Gender and Diabetes with Corresponding Chi-Squared Test Result

	Gender		
T2D, no SCZ	Female	Male	χ^2
Yes	1,267	1,388	
No	18,052	29,422	99.80***

Note. ***= $p < .001$.

Table 7

Crosstabulation of Gender and Schizophrenia/Diabetes with Corresponding Chi-Squared Test Result

	Gender		
SCZ/T2D	Female	Male	χ^2
Yes	3,686	3,872	
No	15,633	26,938	393.29***

Note. ***= $p < .001$.

Table 8

Crosstabulation of Gender and Race with Corresponding Chi-Squared Test Result

	Gender		
Race	Female	Male	χ^2
White	8,926	12,718	
Black	6,360	10,790	
Hispanic	1,922	3,877	
Asian/P.I.	439	565	179.86***
Native Am.	133	205	
Other	546	1,068	

Note. ***= $p < .001$.

Finally, the researcher used multiple negative binomial regressions to estimate the relationships between the dependent and independent variables with the moderator (as interaction terms) and without, holding covariates constant and using a significance level of $p < 0.05$. This next phase of the analysis requires two steps to confirm a moderation effect per research question (Hayes, 2013). First, the researcher ran a regression model predicting the dependent variable (LOS) from the key independent variable (SCZ for RQ1, T2D for RQ2, and SCZ/T2D for RQ3) and moderator (gender), holding all else constant. Both effects and the model in general should be significant. Then, the researcher ran the same model after adding the interaction term (for example, SCZ*gender in RQ1); if the model and the interaction term were significant, the

researcher conclude that moderation was occurring. The researcher followed the same steps for the three research questions.

For RQ1, the question was whether the effect of having SCZ on LOS varies by gender, with the null hypothesis stating that the patient's gender moderates the effect of having SCZ on LOS, holding other variables constant. First, the researcher ran a regression model (Model 1) predicting LOS from the key independent variable SCZ and the hypothesized moderator variable of gender, while holding age, comorbidity, and race constant (Table 9). The required SCZ, gender, and overall model were all statistically significant. The key variable SCZ and moderator had a positive regression coefficient ($\beta = .181$, $p < .001$, and $\beta = .070$, $p < .001$, respectively). The overall model F-statistic was also positive ($F = 25.65$) and statistically significant ($p < .001$).

Next, the researcher ran the same model with the added interaction term, SCZ*gender (Model 2; Table 9). Again, the required SCZ, gender, and overall model were all statistically significant. The key variable SCZ and moderator had a positive regression coefficient ($\beta = .213$, $p < .001$, and $\beta = .122$, $p < .001$, respectively). The overall model F-statistic was also positive ($F = 23.08$) and statistically significant ($p < .001$). Additionally, the interaction term SCZ*gender was statistically significant ($\beta = -.068$, $p = .041$) and negative. Thus, the researcher failed to reject the first null hypothesis.

Table 9

Multiple Negative Binomial Regression Analyses for Q1 Variables Predicting Hospital Length of Stay in Days

	Model 1			Model 2		
Predictor	*β*	*SE*	*t*	*β*	*SE*	*t*
SCZ	.181***	.021	8.65	.213***	.026	8.05
Gender	.070***	.015	4.60	.122***	.030	4.09
SCZ*gender	-	-	-	-.068*	.033	-2.05
Age	.005***	.001	7.48	.005***	.001	7.55
Comorbidities	.022***	.004	5.96	.022***	.004	5.96
Race						
Black	-.038	.031	-1.23	-.038	.031	-1.24
Hispanic	-.084*	.034	-2.44	-.083*	.034	-2.43
Asian/P.I.	.277***	.069	3.97	.277***	.070	3.98
Native Am.	-.131	.074	-1.76	-.131	.074	-1.76
Other	.165**	.061	2.70	.165**	.061	2.71
Constant	1.82***	.048	38.3	1.79***	.050	35.54
n	47,533				47,533	
F	25.65***				23.08***	

Note. *$p < .05$. **$p < .01$. ***$p < .001$

For RQ2, the question was whether the effect of T2D on LOS varies by gender, with the null hypothesis that the patient's gender moderates the effect of having T2D on LOS, holding other variables constant. First, the researcher ran a regression model (Model 1) predicting LOS from the key independent variable T2D and the hypothesized moderator variable, gender, holding age, comorbidity, and race constant (Table 10). The required T2D, gender, and overall model were all statistically significant. The key variable T2D had a negative regression coefficient and the moderator had a positive regression coefficient (β = -.883, $p < .001$, and β = .064, $p < .001$, respectively). The overall model F-statistic was also positive (F = 85.30) and statistically significant ($p < .001$).

Table 10

Multiple Negative Binomial Regression Analyses for Q2 Variables Predicting Hospital Length of Stay in Days

	Model 1			Model 2		
Predictor	*β*	*SE*	*t*	*β*	*SE*	*t*
T2D	-.883***	.042	-21.0	-.957***	.047	-20.36
Gender	.064***	.015	4.27	.056***	.015	3.64
T2D*gender	-	-	-	.150*	.066	2.27
Age	.006***	.001	924	.006***	.001	9.26
Comorbidities	.021***	.004	5.88	.021***	.004	5.89
Race						
Black	-.052	.030	-1.72	-.052	.030	-1.72
Hispanic	-.087*	.034	-2.58	-.087*	.034	-2.58
Asian/P.I.	.265***	.069	3.86	.265***	.069	3.86
Native Am.	-.142*	.072	-1.97	-.142	.072	-1.96
Other	.161**	.060	2.67	.161**	.060	2.68
Constant	1.97***	.036	54.72	1.97***	.036	54.64
n		47,533			47,533	
F		85.30***			85.10***	

Note. *p < .05. **p < .01. ***p < .001

Next, the researcher ran the same model with the added interaction term, T2D*gender (Model 2; Table 10). Again, the required T2D, gender, and overall model were all statistically significant. The key variable T2D had a negative regression coefficient and the moderator had a positive regression coefficient (β = -.957, p < .001, and β = .056, p < .001, respectively). The overall model F-statistic was also positive (F = 85.10) and statistically significant (p < .001). Additionally, the interaction term T2D*gender was statistically significant (β = .150, p = .023) and positive. Thus, the researcher failed to reject the second null hypothesis.

Lastly, for RQ3, the question was whether the combined effect of having SCZ/T2D on LOS varies by gender, with the null hypothesis that the patient's gender moderates the effect of having SCZ/T2D on LOS, holding other variables constant. First, the researcher ran a regression model (Model 1) predicting LOS from the key

independent variable SCZ/T2D and the hypothesized moderator variable, gender, holding age, comorbidity, and race constant (Table 11). The required SCZ/T2D, gender, and overall model were all statistically significant. The key variable SCZ/T2D and moderator had a positive regression coefficient (β = .044, p = .035, and β = .062, p < .001, respectively). The overall model F-statistic was also positive (F = 22.47) and statistically significant (p < .001).

Next, the researcher ran the same model with the added interaction term, SCZ/T2D*gender (Model 2; Table 11). This time, gender and the overall model were positive and statistically significant (β = .053, p = .002, and F = 20.26, p < .001, respectively); however, SCZ/T2D (β = .019, p = .493) and the moderator (β = .052, p = .133) were not statistically significant. Thus, the researcher rejected the null hypothesis for RQ3.

Table 11

Multiple Negative Binomial Regression Analyses for Q3 Variables Predicting Hospital Length of Stay in Days

	Model 1			Model 2		
Predictor	*β*	*SE*	*t*	*β*	*SE*	*t*
SCZ/T2D	.044*	.021	2.11	.019	.027	0.69
Gender	.062***	.015	4.01	.053**	.017	3.17
SCZ/T2D*gender	-	-	-	.052	.035	1.50
Age	.004***	.001	5.46	.004***	.001	5.50
Comorbidities	.018***	.004	4.97	.018***	.004	4.97
Race						
Black	-.051	.030	-1.67	-.051	.030	-1.68
Hispanic	-.100**	.034	-2.93	-.099**	.034	-2.92
Asian/P.I.	.256***	.069	3.70	.255***	.069	3.71
Native Am.	-.135	.079	-1.72	-.135	.079	-1.72
Other	.153*	.061	2.53	.154*	.061	2.54
Constant	2.06***	.038	54.72	2.06***	.038	54.90
n		47,533			47,533	
F		22.47***			20.26***	

Note. *p < .05. **p < .01. ***p < .001

2014 Results

The subsample extracted from 2014 HCUP based on the same criteria resulted in a sample size of 105,244 hospital discharge records. The age of the sample ranged between 18 and 90 years old, with a mean of 61.45 years old (Table 12). Females had a higher mean age of 62.53 years as compared to males, with an average of 60.39 years. The average number of total comorbidities reported at hospital discharge was 8.88 (range: 1-30) and was slightly higher among females (mean=9.07) compared to males (mean=8.68). The mean number of days of stay at the hospital (LOS) was 3.76, and ranged from 0 to 330 days. Males had a slightly higher length of stay of 3.81 days, compared to females' 3.71 days.

Table 12

Descriptive Statistics for the Numeric Variables

	Gender					
	Female (*n*=53,031)		Male (*n*=52,231)		Total (*n*=105,244)	
Variable	Mean	SE	Mean	SE	Mean	SE
Age	62.53 [18-90]	0.074	60.39 [18-90]	0.071	61.45 [18-90]	0.051
Comorbidities	9.07 [1-30]	0.019	8.68 [1-30]	0.019	8.88 [1-30]	0.013
LOS	3.71 [0-300]	0.024	3.81 [0-355]	0.027	3.76 [0-355]	0.019

*LOS=length of stay at hospital in days; Comorbidities=total number of diagnoses reported at time of hospital discharge.

Table 13 contains frequencies and percentages of occurrences of all categorical variables considered in this analysis. This includes variables pertaining to the research questions, as well as covariates accounted for that may influence LOS. The sample included 8,864 discharge records with a diagnosis of SCZ (8.4%), 97,954 (93.1%) that

reported a diagnosis of T2D without complication, and 1,574 (1.5 %) with diagnoses with both SCZ/T2D (see Table 13). Among females, SCZ diagnosis was lower than males (6.2% vs. 10.7%, respectively). However, females were more likely to be diagnosed for T2D (95.2% vs. 89.5%, respectively). Both males and females were approximately equally likely to be diagnosed SCZ/T2D (1.5% vs. 1.5% for males and females respectively). Out of the sample of 105,244 hospital discharge records, 7,290 (6.9%) had a diagnosis of SCZ, but not T2D, whereas 96,380 (5.3%) had a diagnosis of T2D, but not SCZ. Proportions of males and females diagnosed with either SCZ or T2D (but not both) were similar to those for patients diagnosed with SCZ or T2D including both diagnoses. A higher percentage of males was reported with SCZ but not T2D (9.1% vs. 4.7% for males and females respectively) and a higher proportion of females was reported with T2D but not SCZ (89.3% vs. 93.8% for males and females respectively).

White was the predominant race in this sample with 58.4%, followed by Black (17.8%), Hispanic (12.5%), missing race (4.5%), other (3.4%), Asian or Pacific Islander (2.8%) and Native American (0.6%; see Table 2). There were more males reported as White than females (60.7% vs. 55.9% respectively), and more females reported as Black or Hispanic (19.4% vs. 16.0% for Black, and 13.3% vs. 11.7% for Hispanic, respectively). Proportions of males and females identifying as Native Americans, Asian / P.I., other, or missing race were approximately equal.

Table 13

Descriptive Statistics for Categorical Variables

	Gender		
	Female (n=53,013)	Male (n=52,231)	Total (n=105,244)

Variable	Category	*Freq.*	*%*	*Freq.*	*%*	*Freq.*	*%*
SCZ, all		3,286	6.2	5,578	10.7	8,864	8.4
SCZ, no T2D		2,509	4.7	4,781	9.1	7,290	6.9
T2D, all		50,504	95.2	47,450	89.5	97,954	93.1
T2D, no SCZ		49,727	93.8	46,653	89.3	96,380	5.3
SCZ/T2D		777	1.5	797	1.5	1,574	1.5
Race	White	29,656	55.9	31,756	60.7	61,412	58.4
	Black	10,325	19.4	8,371	16.0	18,696	17.8
	Hispanic	7,098	13.3	6,095	11.7	13,193	12.5
	Asian/P.I.	1,540	2.9	1,433	2.7	2,973	2.8
	Native Am.	332	0.6	348	0.7	680	0.6
	Other	1,730	3.3	1,829	3.5	3,559	3.4
	Missing	2,399	4.5	2,332	4.5	4,731	4.5

*Asian/P.I.=Asian and Pacific Islander; Native Am.=Native American; SCZ=schizophrenia; T2D=type II diabetes without complications; SCZ/T2D=schizophrenia and type II diabetes without complications.

Prior to conducting the analysis, the researcher checked the distribution of each continuous variable for normality. The researcher graphed histograms of the LOS, age, and comorbidities variables to visualize normality (Figure 4). Data for LOS and number of comorbidities were right-skewed, especially for the dependent variable LOS. The distribution for Age is lightly left skewed, with higher proportions patients being above 60 years old. The Central Limit Theorem states that if *N* is greater than or equal to 30, the sampling distribution of the sample mean is approximately normal, regardless of the shape of the population distribution. The sample size in this case was very large at over 100,000 observations, so there was no need to transform the data to meet the normality assumption (Lumley, Diehr, Emerson, & Chen, 2002).

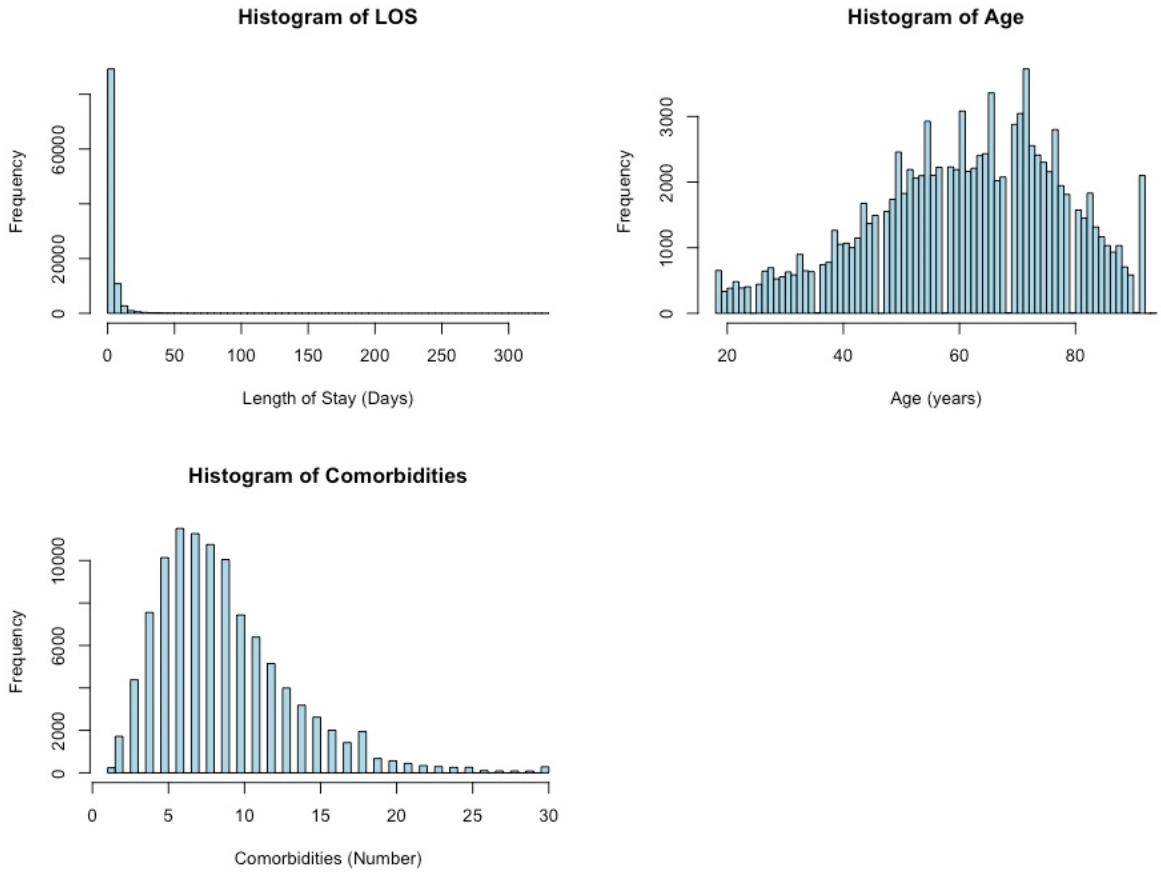

Figure 4. Histograms for the numeric variables LOS, age, and number of comorbidities.

The dependent variable in each research question, LOS, had a number of real zeros (2,769 discharge records had 0 days of hospitalization). Furthermore, while most patients had a LOS of less than 10 days, some had much larger values (up to 330) resulting in overly dispersed data. These characteristics led to the use of negative binomial regressions for the analysis. Researchers prefer negative binomial regressions over OLS for over-dispersed count data—that is, when the conditional variance exceeds the conditional mean (Wooldridge, 2002). Using an OLS regression with a count dependent variable that has been log-transformed can cause many issues, including loss of data due to undefined values generated by taking the log of zero (which is undefined),

as well as the lack of capacity to model the dispersion. Negative binomial regressions can be considered as a generalization of the Poisson regression because it has the same mean structure and it has an extra parameter to model the over-dispersion. If the conditional distribution of the outcome variable is over-dispersed, the confidence intervals for the negative binomial regression are likely to be narrower as compared to those from a Poisson regression model.

The researcher conducted univariate analyses using negative binomial regressions, accounting for survey design weights, with LOS as the dependent variable and SCZ, T2D, SCZ/T2D, gender, age, race, and comorbidities as the predictor variables (Table 14). All predictors, with the exception of Hispanic patients, had statistically significant relationships with LOS at a 0.05 significance level. In negative binomial regressions, the estimated coefficient for a variable indicates the expected log count of LOS (days in the hospital) increases or decreases. Estimated coefficients that are positive indicate longer LOS and estimated coefficients that are negative indicate shorter LOS as compared to the reference group (patients with only SCZ were the reference group). Groups of patients with T2D (both with and without SCZ) had lower average LOS as compared to patients with only SCZ (β = -1.040, $p < 0.001$ for patients with only T2D and β = -0.245, $p < 0.001$ for patients with both SCZ and T2D). Average LOS was lowest for patients with only T2D. The expected log count for T2D, no SCZ, was 1.040 lower than the expected log count for SCZ. The log counts for patients with both SCZ/T2D was 0.245 lower than for patients with only SCZ.

In the case of race, patients missing race were considered reference category for which to compare other races. All races except Hispanic patients had statistically

significant relationships with LOS. Black and Asian / P.I. and others races had positive statistically significant differences in log count (β = 0.107, p < 0.001 and β = 0.094, p < .001, respectively; see Table 3). The races of White or Native Americans had a negative statistically significant difference in log count (β = -0.040 p < .001 and β = -0.055 p < .001, respectively). At the univariate analysis level, the researcher included all variables of interest in the multiple negative binomial regressions. Gender had a positive statistically significant relationship with LOS indicating that female patients spend longer on average (β = 0.036; p < .001). Finally, patient's age was negatively associated with LOS indicating that older patients had shorter LOS than younger patients. However, this effect was relatively small. The estimated coefficient for age was -0.002 (p < 0.001) meaning that for each year a patient's age increases, the log count of years decreased by 0.002 on average.

Table 14

Univariate negative binomial regression analyses for variables predicting hospital length of stay in days

	N	Estimate	Std. Error	t	*p*
SCZ, no T2D	105,244				
(Intercept)		2.024	0.007	278.492	0.000
T2D, no SCZ	105,244	-1.040	0.004	-239.734	0.000
SCZ/T2D	105,244	-0.245	0.009	-26.859	0.000
Gender	105,244	0.036	0.002	15.411	0.000
AGE	105,244	-0.002	0.000	-28.708	0.000
RACE	105,244				
White		-0.040	0.006	-7.117	0.000
Black		0.107	0.006	17.756	0.000
Hispanic		0.012	0.006	1.931	0.054
Asian/P.I.		0.094	0.009	10.798	0.000
Native Am.		-0.055	0.016	-3.530	0.000
Other		0.073	0.008	8.863	0.000
Comorbidities	105,244	0.035	0.000	133.746	0.000

Note. β: Regression Coefficient; *SE*: Standard Error; *t*: t-test statistic. Asian/P.I.=Asian and Pacific Islander; Native Am.=Native American; SCZ=schizophrenia; T2D=type II diabetes without complications; SCZ/T2D=schizophrenia and type II diabetes without complications. For all categorical variables (*), the reference group is not having the condition(s) or reporting race as white.

In the next phase of the analysis, the researcher explored the relationships among the dependent variable, independent variables, and hypothesized moderator of gender. To determine the relationships among these variables, the researcher performed *t*-tests, Pearson's correlations wioth chi-squared tests, and multiple negative binomial regression analyses (Wooldridge, 2012). First, the researcher used *t*-tests to test whether there were differences in the average values for each numeric variable between gender. Significance was evaluated at a 0.5 significance level and significant findings indicate that the mean of a numeric variable as statistically different between males and females. Next, Pearson's correlations were used to test binary relationships among gender and each variable.

For the dependent variable LOS (*diff.* = -0.016, *95% CI*: -0.164, -0.024, p = 0.008) and the predictor variables of age (*diff.* = -2.18, *95% CI*: -2.385, -1.982, $p < 0.001$) and comorbidities (*diff.* = -.390, *95% CI*: -0.439, -0.330, $p < 0.001$), the differences in mean values between males and females were statistically significant at a 0.05 significance level (Table 15). The average age for females was high than males. However, LOS and number of comorbidities were higher in male patients than female patients. Tables 16, 17, 18, and 19 illustrate the chi-squared test results for binary and categorical variables SCZ, T2D, SCZ/T2D, and race. All binary and categorical variables showed statistically significant differences between females and males.

Table 15

Differences between female and male group using t-tests

Predictor	*Mean female*	*Mean male*	*Diff.*	*SE*	*95% CI*	
					Lower	*Upper*
LOS	3.717	3.811	-0.016**	0.02	-0.164	-0.024
Age	62.533	60.349	2.18***	0.71	1.982	2.385
Comorbidities	8.685	9.070	-0.39***	0.19	-0.439	-0.330

Note. ***$p < .001$.

Table 16

Crosstabulation of gender and schizophrenia with corresponding Chi-squared test result

	Gender			
SCZ, no T2D	Females	Males	χ^2	*p*
Yes	2509	4781		
No	50504	47450	123.34	0.000***

Note. ***= $p < .001$.

Table 17

Crosstabulation of gender and diabetes with corresponding Chi-squared test result

	Gender			
T2D, no SCZ	Females	Males	χ^2	*p*
Yes	3286	5578		
No	49727	46653	684.34	0.000***

Note. ***= $p < .001$.

Table 18

Crosstabulation of gender and diabetes with corresponding Chi-squared test result

	Gender			
T2D/SCZ	Females	Males	χ^2	*p*
Yes	777	779		
No	52236	51434	0.607	0.435

Table 19

Crosstabulation of gender and race with corresponding Chi-squared test result

Race	Gender		χ^2	*p*
	Females	Males		
White	29656	31756		
Black	10325	8371		
Hispanic	7098	6095		
Asian/P.I.	1540	1433	352.12	0.000***
Native Am.	332	348		
Other	1730	1829		
None	2332	2399		

Note. *** = $p < .001$

To test hypotheses associated with each research question, multiple negative binomial regressions were fit to estimate the relationships between the dependent and independent variables with the moderator (as interaction terms) and without, holding covariates constant and using a significance level of $p < 0.05$. This next phase of the analysis requires two steps to confirm a moderation effect per research question (Hayes, 2013). First, the researcher ran a regression model predicting the dependent variable (LOS) from the key independent variable (SCZ for RQ1, T2D for RQ2, and SCZ/T2D for RQ3) and moderator (gender), holding all else constant. Based on previous models, it is expected that significant relationships will be identified between diagnoses of T2D and SCZ and LOS, as well as overall model significance based on an *F*-test. Next, the researcher fit a similar model by adding an interaction term (for example, SCZ*gender in RQ1). Significance of this interaction and an *F*-test comparing the model with the interaction term to the model fit without it will be used to evaluate whether the effect of SCZ or T2d on LOS change by gender, and thus, whether gender is a moderator for each diagnosis.

Research Question 1 inquired whether the relationship between a patient having SCZ and their LOS varies by gender, with the null hypothesis stating that the patient's

gender does not moderate the effect of having SCZ on LOS, holding other variables constant. First, the researcher ran a regression model (Model 1) predicting LOS from the key independent variable SCZ and the hypothesized moderator variable of gender, while controlling for age, comorbidity, and race (Table 20). The independent variables SCZ and gender were statistically significant at a 0.05 significance level (β = .996, p < .001, and β = .0.034, p < .001, respectively). The key variable SCZ was positively related to LOS, with the log count of LOS increasing by 0.996 for patients diagnosed with SCZ. Gender was also positively related to LOS with female patients staying longer than male patients on average. The overall F-statistic for the model was 2556, indicating the independent variables and covariates explain a significant portion of variability in LOS (p < .001).

A similar model was fit by incorporating an interaction term, SCZ*gender (Model 2; Table 20). Again, the main effects for SCZ and gender were statistically significant with estimated coefficients similar to the estimated coefficients in Model 1. The key variable SCZ and gender had a positive regression coefficient (β 1.009, p < .001, and β = .037, p < .001, respectively). The interaction term SCZ*gender was statistically significant (β = -.031, p < .001. This indicates that while LOS was longer on average for women based on coefficient estimates in Model 1, this effect was reduced for patients diagnosed with SCZ as compared to males with SCZ. The F-statistic comparing Model 2 to Model 1 was 25.38 (p = 0.012), indicating that this interaction indeed explained a significant portion of variation. Thus, the relationship between patients having SCZ and their LOS varies between females and males.

Table 20

Multiple negative binomial regression analyses for Q1 variables predicting hospital length of stay in days

	Model 1				Model 2			
Predictor	*β*	*SE*	*t*	*p*	*β*	*SE*	*t*	*p*
SCZ	0.996	0.004	250.43	0.000	1.009	0.005	202.492	0.000
Gender	0.034	0.002	14.580	0.000	0.037	0.002	15.117	0.000
SCZ*gender	-	-	-	-	-0.031	0.008	-4.123	0.000
Age	-0.002	0.000	-30.560	0.000	-0.002	0.000	-30.327	0.000
Comorbidities	0.034	0.000	132.317	0.000	0.034	0.000	132.337	0.000
Race								
White	-0.041	0.006	-7.244	0.000	-0.04	0.006	-7.233	0.000
Black	0.104	0.006	17.274	0.000	0.104	0.006	17.269	0.000
Hispanic	0.009	0.006	1.492	0.136	0.009	0.006	1.475	0.14
Asian / PI	0.092	0.009	10.619	0.000	0.092	0.009	10.619	0.000
Native Amer.	-0.057	0.016	-3.649	0.000	-0.057	0.016	-3.655	0.000
Other	0.072	0.008	8.787	0.000	0.072	0.008	8.79	0.000
Constant	0.999	0.007	136.342	0.000	0.996	0.007	135.417	0.000
n	105,244					105,244		

Note. SE and *p*-values less than 0.001 are represented as 0.000.

Research Question 2 compares the relationship between a patient having T2D and their LOS by gender, with the null hypothesis stating that the patient's gender does not moderate the effect of having T2D on a patient's LOS, after controlling for demographics. A negative binomial regression model (Model 1) was fit predicting LOS

from the independent variable T2D and the indicator variable of gender, while controlling for age, comorbidity, and race (Table 21). The independent variables T2D and gender were all statistically significant at a 0.05 significance level (β = -1.001 $p < .001$, and β = 0.035, $p < .001$, respectively). The key variable T2D was negatively related to LOS, with the log count of LOS decreasing by 1.001 for patients diagnosed with T2D. Gender was positively related to LOS with female patients staying slightly longer than male patients on average. The overall model *F*-statistic was 1839, indicating the independent variables and covariates explain a significant portion of variability in LOS ($p < .001$).

A new model was fit with an interaction term, T2D*gender (Model 2; Table 21). Again, the variables T2D was statistically significant with estimated coefficients similar to the estimated coefficients in Model 1 (β = -1.006, $p < .001$. Gender was also significant, although the positive effect was reduced slightly (β = 0.024, p = .003). The interaction term SCZ*gender was not statistically significant (β = 0.012, p =0.155) at a 0.05 significance level. The *F*-statistic comparing Model 2 to Model 1 was 0.42 (p = 0.842), indicating that this interaction term did not explain a significant portion of variation LOS than Model 1. Thus, the relationship between patients having SCZ and their LOS does not vary between females and males and there is no evidence to suggest that gender is a moderator for T2D and patient's LOS.

Table 21

Multiple negative binomial regression analyses for Q2 variables predicting hospital length of stay in days

	Model 1				Model 2			
Predictor	β	*SE*	*t*	*p*	β	*SE*	*t*	*p*

T2D	-1.001	0.004	-229.30	0.000	-1.006	0.005	-188.01	0.000
Gender	0.035	0.002	14.821	0.000	0.024	0.008	2.95	0.003
T2D*gender	-	-	-	-	0.012	0.008	1.421	0.155
Age	-0.003	0.000	-38.782	0.000	-0.003	0.000	-38.696	0.000
Comorbidities	0.036	0.000	136.461	0.000	0.036	0.000	136.463	0.000
Race								
White	-0.043	0.006	-7.686	0.000	-0.043	0.006	-7.684	0.000
Black	0.128	0.006	21.093	0.000	0.128	0.006	21.085	0.000
Hispanic	0.009	0.006	1.468	0.142	0.009	0.006	1.459	0.144
Asian / PI	0.096	0.009	10.956	0.000	0.096	0.009	10.955	0.000
Native Amer.	-0.06	0.016	-3.859	0.000	-0.06	0.016	-3.865	0.000
Other	0.073	0.008	8.851	0.000	0.073	0.008	8.853	0.000
Constant	2.044	0.007	279.187	0.000	2.048	0.008	264.183	0.000
n	105,244					105,244		

Note. SE and *p*-values less than 0.001 are represented as 0.000.

Research Question 3 aims to compare the relationship between a patient having both T2D and SCZ (SCZ/T2D) and their LOS by gender, to determine whether the LOS for a patient with both diagnoses is different among men and women. A negative binomial regression model (Model 1) was first fit predicting LOS from the independent variable SCZ/T2D and the indicator variable of gender, while controlling for age, comorbidity, and race (Table 22). Independent variables SCZ/T2D and gender were all statistically significant at a 0.05 significance level ($\beta =$ 0.607, $p < .001$, and $\beta = -0.011$, p

< .001, respectively). Patients with SCZ/T2D had increased LOS on average, with the log count of LOS increasing by 0.607 for patients diagnosed both conditions. Gender was negatively related to LOS, with female patients staying slightly less time than male patients on average. The overall model *F*-statistic was 726, indicating the independent variables and covariates explain a significant portion of variability in LOS ($p < .001$).

A second regression model was fit with an interaction term, SCZ/T2D*gender (Model 2; Table 10) allowing the effect of SCZ/T2D to vary by between males and females. The variables main effect SCZ/T2D was statistically significant with estimated coefficients slightly lower than the estimated coefficient in Model 1 ($\beta = 0.561$, $p < .001$. Gender was also significant, although the positive effect was reduced slightly ($\beta = -0.013$, $p < 0.001$). The interaction term SCZ/T2D*gender was statistically significant ($\beta = 0.092$, $p < 0.001$) at a 0.05 significance level. The *F*-statistic comparing Model 2 to Model 1 was 22.84 ($p = 0.007$), indicating that this interaction explained a significant portion of variation LOS as compared to Model 1. Thus, the relationship between patients having SCZ/T2D and their LOS significantly varies between females and males, with LOS increasing among females with both diagnoses.

Table 22

Multiple negative binomial regression analyses for Q3 variables predicting hospital length of stay in days

	Model 1				Model 2			
Predictor	*β*	*SE*	*t*	*p*	*β*	*SE*	*t*	*p*
T2D	0.607	0.009	67.906	0.000	0.561	0.013	44.606	0.000
Gender	-0.011	0.002	-4.531	0.000	-0.013	0.002	-5.187	0.000
T2D*gender	-	-	-	-	0.092	0.018	5.163	0.000

Age	-0.009	0.000	-118.47	0.000	-0.009	0.000	-118.48	0.000
Comorbidities	0.03	0.000	109.109	0.000	0.03	0.000	109.143	0.000
Race								
White	-0.072	0.006	-12.349	0.000	-0.072	0.006	-12.361	0.000
Black	0.144	0.006	22.896	0.000	0.143	0.006	22.872	0.000
Hispanic	-0.062	0.007	-9.484	0.000	-0.062	0.007	-9.477	0.000
Asian / PI	0.069	0.009	7.687	0.000	0.069	0.009	7.688	0.000
Native Amer.	-0.123	0.016	-7.612	0.000	-0.123	0.016	-7.634	0.000
Other	0.064	0.009	7.496	0.000	0.064	0.009	7.508	0.000
Constant	1.602	0.007	219.211	0.000	1.603	0.007	219.256	0.000
n	105,244					105,244		

Note. SE and *p*-values less than 0.001 are represented as 0.000.

Based on 2014 data, the researcher rejected the null hypotheses for RQ1 and RQ3, and failed to reject the null hypothesis for RQ2. The evidence in this study supports the statement that the effect diagnoses of SCZ or SCZ/T2D have on LOS varies between male and females; however, there is no evidence supporting that the relationship between having T2D and LOS differs between male and female patients. This is evidence that a diagnosis of SCZ effects patient's LOS differently between males and females. Chapter 5 includes a discussion of the findings in the context of the relevant literature and the study's conclusions.

Summary

The purpose of this study was to explore the relationships among SCZ, T2D, and the LOS, with patient's gender as the moderator. In this chapter, the researcher outlined the results of this study by describing the data collection process, data used, and analyses conducted. This study had three research questions: (a) Does the effect of having SCZ on LOS vary by patient's gender?; (b) Does the effect of having T2D on LOS vary by patient's gender?; and, (c) Does the combined effect of having SCZ/T2D on LOS vary by patient's gender? The researcher failed to reject the null hypotheses for RQ1 and RQ2, and rejected the null hypothesis for RQ3. The evidence in this study supports the statement that patient's gender is a moderator for the effect of having SCZ or having T2D on LOS; however, there is no evidence supporting that it is also a moderator for the effect of having both SCZ and T2D on the LOS. Chapter 5 includes a discussion of the findings in the context of the relevant literature and the study's conclusions.

CHAPTER 5

DISCUSSION

Introduction

Major mental health disorders such as schizophrenia shorten life spans amongst patients (Hjorthoj et al., 2017). People with severe mental illness experience a reduction in life expectancy of 15 to 20 years (Das-Munshi et al., 2016). Additionally, the prevalence of diabetes and obesity is also significantly higher in patients diagnosed with schizophrenia than those without (Annamalai et al., 2017). The risk of death in people living with schizophrenia and diabetes is six-fold compared to patients living with only schizophrenia (Davis et al., 2015). Through a review of literature, the current researcher concluded that despite these staggering statistics and risk factors related to schizophrenia and diabetes, the topic of gender-specific interventions was understudied, especially relating to factors that influence diagnosis, treatment, and treatment outcomes for people living with schizophrenia and diabetes (Gabilondo et al., 2017; Schwartz et al., 2015; Zhang et al., 2015; Zhou et al., 2015). The research problem was that although scholars have identified gender as a factor that could influence schizophrenia and diabetes, there was a lack of studies on the effect of patients' gender as a moderator to the healthcare costs associated with hospitalizations related to schizophrenia and diabetes (Gabilondo et al., 2017; Goueslard et al., 2018).

The research gap that the researcher addressed in the current study also included the specific challenges that women with schizophrenia and/or diabetes face in contrast to men. This was vital to address, given the fact that women have a higher likelihood of having additional comorbidities in addition to schizophrenia and diabetes than men

(Gabilondo et al., 2017; Zhang et al., 2015). The additional risk factors faced by women patients with schizophrenia and/or diabetes, in addition to the need for the identification of their needs and treatment methods, had received limited previous attention in the literature (Gabilondo et al., 2017). The purpose of this quantitative correlational study was to explore the relationships between schizophrenia, type II diabetes, and the length of hospital stay, with patient's gender as the moderator. Understanding the moderating effects of gender can inform decision-makers at hospitals to find differentiated and targeted interventions to increase efficiency and effectiveness for SCZ/T2D patient care.

The dependent variable in the study consisted of the length of hospital stay, while the independent variables of interest included schizophrenia and diabetes. The moderator of the relationships was patients' gender, and the covariates for the analyses included age, race, and other common comorbidities (i.e., depression and heart disease). The researcher selected a quantitative correlational design and 2015 data from the Healthcare Cost and Utilization Project database (The Healthcare Cost and Utilization Project, 2019) for analysis in the current study. HCUP, which is a family of health care databases bringing together the data collection efforts of state data organizations, hospital associations, private data organizations, and the federal government in order to create a national information resource of patient discharge-level health care data, is the largest collection of longitudinal hospital care data in the United States (The Healthcare Cost and Utilization Project, 2019). Hospital discharge records in the HCUP databases from all U.S. states formed the unit of analysis for this study. Data collection from the HCUP took place during the month of November 2019. The data included for the study's variables came from Q1, Q2, and Q3 of the year 2015, and the subsample extracted from HCUP

resulted in a sample size of 50,129 hospital discharge records. The researcher analyzed data through descriptive and cross-sectional quantitative analytical approaches. The findings from the analysis supported the statement that patient's gender is a moderator for the effect of having SCZ or having T2D on LOS; however, there was no evidence supporting that it is also a moderator for the effect of having both SCZ and T2D on LOS.

In Chapter 5, the researcher discusses the findings of the data analysis in detail. The researcher presents a summary of the key findings, followed by an interpretation of the findings in relation to the review of literature conducted in Chapter 2. Finally, the researcher discusses the limitations emerging from the research in relation to the limitations identified initially in Chapter 3.

Summary of Key Findings

Three research questions guided the current study, which the researcher developed based on the research variables, purpose, and design. The dependent variable in this study consisted of the length of hospital stay, while the independent variables of interest included schizophrenia and diabetes. The purpose was to explore the relationships between SCZ, T2D, and the LOS, with patient's gender as the moderator. In this subsection, the researcher describes the findings associated with the three research questions and their corresponding hypotheses using 2014 and 2015 data.

Research Question 1

The first research question developed in the current study focused on answering whether the effect of having schizophrenia on length of hospital stay varies by patient's gender. For this research question, the LOS in days was the dependent variable, having schizophrenia was the binary key independent variable, patient's gender was the

moderator, and age, race, depression, and heart disease were the covariates. The null hypothesis for the first research question stated that the patient's gender moderates the effect of having schizophrenia on length of hospital stay, holding other variables constant. The alternative hypothesis for the first research question stated that the effect of having schizophrenia on length of hospital stay does not vary by patient's gender, holding other variables constant. For analysis, the researcher ran Model 1 predicting LOS from the key independent variable SCZ and the hypothesized moderator variable of gender while holding age, comorbidity, and race constant. The findings using 2015 data showed that key variable SCZ and moderator had a positive regression coefficient (β = .181, p < .001, and β = .070, p < .001, respectively), and the overall model F-statistic was also positive (F = 25.65) and statistically significant (p < .001). The researcher ran Model 2 with the added interaction term, SCZ*gender, and the findings showed that the key variable SCZ and moderator had a positive regression coefficient (β = .213, p < .001, and β = .122, p < .001, respectively). Additionally, the researcher determined that the interaction term SCZ*gender was statistically significant (β = -.068, p < .05) and negative. The results are similar when the 2014 data were used: SCZ (β = .996, p < .001) and gender (β = .034, p < .001) in Model 1 were positively significant and the interaction term SCZ*gender was negatively significant (β = -.031, p < .05) in Model 2. As a result, the researcher did not reject the null hypothesis for the first research question.

Research Question 2

The second research question focused on answering whether the effect of having diabetes on length of hospital stay varies by patient's gender. For this research question, LOS in days was the dependent variable, having diabetes was the binary key independent

variable, patient's gender was the moderator, and age, race, depression, and heart disease were the covariates. The null hypothesis for the second research question stated that the patient's gender moderates the effect of having diabetes on length of hospital stay, holding other variables constant. The alternative hypothesis for the second research question stated that the effect of having diabetes on length of hospital stay does not vary by patient's gender, holding other variables constant. For analysis, the researcher ran Model 1 predicting LOS from the key independent variable T2D and the hypothesized moderator variable, namely gender, holding age, comorbidity, and race constant. The findings using 2015 data showed that key variable T2D had a negative regression coefficient and the moderator had a positive regression coefficient (β = -.883, p < .001, and β = .064, p < .001, respectively), the and overall model F-statistic was also positive (F = 85.30) and statistically significant (p < .001). The researcher ran Model 2 with the added interaction term, T2D*gender; the findings showed that the key variable of T2D had a negative regression coefficient and the moderator had a positive regression coefficient (β = -.957, p < .001, and β = .056, p < .001, respectively). Additionally, the interaction term T2D*gender was statistically significant (β = .150, p < .05) and positive. The results are partially similar when the 2014 data were used: T2D (β = -1.001, p < .001) and gender (β = .035, p < .001) were negatively and positively significant in Model 1, respectively; and the interaction term SCZ*gender was insignificant (β = -.012, p = .155) in Model 2. The insignificance of the interaction term using 2015 data maybe due to the fact that only three quarters worth of data were used as compared to the four quarters of 2014. As a result, the researcher did not reject the second null hypothesis.

Research Question 3

The third research question focused on answering whether the combined effect of having schizophrenia and diabetes on length of hospital stay varies by patient's gender. For this research question, LOS measured in days was the dependent variable, having schizophrenia and diabetes was the binary key independent variable, patient's gender was the moderator, and age, race, depression, and heart disease were the covariates. The null hypothesis for the third research question stated that the patient's gender moderates the effect of having schizophrenia and diabetes on length of hospital stay, holding other variables constant. The alternative hypothesis for the third research question stated that the effect of having schizophrenia and diabetes on length of hospital stay does not vary by patient's gender, holding other variables constant. The researcher ran Model 1 predicting LOS from the key independent variable SCZ/T2D and the hypothesized moderator variable of gender, while holding age, comorbidity, and race constant. The findings suing 2015 data showed that key variable SCZ/T2D and moderator had a positive regression coefficient (β = .044, p = .035, and β = .062, p < .001, respectively), and the overall model F-statistic was also positive (F = 22.47) and statistically significant (p < .001). The researcher ran Model 2 with the added interaction term, SCZ/T2D*gender; the findings showed that gender and the overall model were positive and statistically significant (β = .053, p = .002, and F = 20.26, p < .001, respectively); however, SCZ/T2D (β = .019, p = .493) and the moderator (β = .052, p = .133) were not statistically significant. The results are partially similar when the 2014 data were used: SCZ/T2D (β = .607, p < .001) and gender (β = -.011, p < .001) were positively and negatively significant in Model 1, respectively; and the interaction term SCZ*gender was

insignificant ($\beta = 0.092$, $p < .05$) in Model 2. The significance of the interaction term using 2015 data may due to the fact that only three quarters worth of data were used as compared to the four quarters of 2014. As a result, for the third research question, the researcher rejected the null hypothesis.

Interpretation of the Findings

The theoretical framework of the current study was based on self-regulation theory. In the review of literature, the researcher noted that one of the principles of self-regulation theory is the claim that certain underlying processes, cognitive and physical operation, and emotional repercussions that may vary between genders (Baumeister & Vohs, 2004). Other factors that affect individual differences, which may or may not be associated with gender, include their basic abilities and styles of self-control (Baumeister & Vohs, 2004). It is because of these differences that outcomes differ among individuals based on their levels of self-control, adherence, lifestyle choices, behavioral functions, and inherent practices (Baumeister & Vohs, 2004). The findings of the current study show differences between individuals in terms of their LOS in relation to the conditions that they were affected by. Further, the current researcher found gender-based differences in LOS. While gender had a statistically significant role as a moderator in having SCZ or T2D on length of hospital stay, while holding other variables constant, the researcher found no evidence for the moderating role of gender with respect to having both SCZ and T2D. The findings provide complete support to the self-regulation theory in relation to the claim that people differ in their basic abilities and styles of self-control, which manifest as different outcomes among individuals based on their levels of self-control, adherence, lifestyle choices, behavioral functions, and inherent practices (Baumeister &

Vohs, 2004). With respect to the claim of the self-regulation theory that there are certain underlying processes, cognitive and physical operation, and emotional repercussions that may vary between genders (Baumeister & Vohs, 2004), the researcher found only partial support within the findings of the current study, as the moderating effect of gender—which existed among patients with SCZ or T2D—did not exist among patients with both SCZ and T2D.

Previous researchers have noted that women have certain advantages over men because women's SCZ starts at a later age and their symptoms respond more quickly and more completely to available treatments in contrast to men (Riecher-Rössler, 2016; Riecher-Rössler et al., 2018; Seeman, 2019). The findings of the study did not reject these reports, as the researcher found gender to moderate LOS among patients with SCZ. The conclusion drawn from these findings in the literature—namely, the need for more gender-based interventions that are proactive in nature targeted for the male population who are at risk in developing schizophrenia earlier than women—was thus retained. Other findings relevant to LOS have suggested gender differences in relation to SCZ, such as those of Kelly et al. (2016), who reported that regarding childhood physical abuse and SCZ among men and women, women tend to have more affective symptoms and more social support. In addition, Rietschel et al. (2016) found that men tend to have poorer premorbid function, more negative symptoms, and lower social functioning than women with SCZ; this conclusion was not contradictory to the findings of the current study, which highlighted that gender did have a moderating role on LOS among patients with SCZ.

Multiple researchers have found differences based on gender among SCZ patients regarding factors relevant to their LOS. For instance, some researchers found that women are prone to develop more severe symptoms of SCZ (Polachek et al., 2017), while others found that men with SCZ are prone to have more negative symptoms in brain morphology and neurocognitive function (Mendrek & Mancini-Marie, 2016). Barajas et al. (2015) also found different patterns of clinical, social, and cognitive functioning among men and women with SCZ, with men having more severe negative symptoms, worse social functioning, and longer duration of untreated illness than women (Barajas et al., 2015). Thara and Kamath (2015) similarly noted that most studies have shown better premorbid functioning and social adjustment for women compared with men. Researchers have also indicated differences in outcomes due to biological and chemical differences between men and women (Crawford & DeLisi, 2016; R. Li et al., 2016; Lucca et al., 2016; Sainz et al., 2019). None of these findings contradict with the findings of the current study, which provided evidence to the moderating role of gender among SCZ patients on LOS.

The findings of the current study are not in alignment with the literature with respect to treatment. For instance, Krall et al. (2017) found female SCZ patients to be diagnosed with metabolic diseases at higher rates than males, and female SCZ patients taking clozapine or olanzapine to be at uniquely high risks for metabolic dysfunction and future adverse cardiovascular outcomes in contrast to male SCZ patients. Others have noted similar findings (Kucerova et al., 2015; Lange et al., 2017; Whicher et al., 2018). To the extent that this represents LOS outcomes, the findings of the current study did not support these conclusions.

In relation to factors that could affect LOS among patients with SCZ and T2D, one risk found in the literature was of developing other metabolic issues or health problem. In this regard, Gabilondo et al. (2017) found that women with schizophrenia had a cluster of respiratory diseases wherein men with schizophrenia had none. Nsiah et al. (2015) found that among those with T2D, women were three times more likely to have metabolic syndrome, and women also experienced hypertension, followed by central obesity, low HDL-C, and hypertriglyceridemia more often than men (Nsiah et al., 2015).

With respect to patients with both diabetes and SCZ, the current findings showed that men are more prone to more severe symptoms than women who have both diabetes and SCZ (Zhang et al., 2015). These findings of Zhang et al., which showed that male individuals performed worse on most cognitive tasks, especially attention, in SCZ with than without diabetes, were not supported by the findings of the current study. In the current study, there was no evidence to support the moderating role of gender among patients with both SCZ and T2D on LOS. Thus, the finding did not align with research showing gender's moderating role among the characteristics relevant to LOS of patients with both SCZ and diabetes.

In the literature, based on a systematic review and large-scale meta-analysis regarding diabetes mellitus in people with SCZ, bipolar disorder, and major depressive disorder, Vancamfort et al. (2016) reported that higher diabetes prevalence existed among women with severe mental illness such as SCZ compared to men, which contradicted the findings of the current study. Boyd et al. (2015) also concluded the existence of gender differences, stating that women have a higher prevalence of any lifetime internalizing disorder such as SCZ than men (Boyd et al., 2015), which, as far as it represented a factor

relevant to LOS, contradicted the findings of the current study, which showed no evidence of a moderating role of gender among patients with both SCZ and T2D on LOS. With respect to treatment, an important factor in relation to LOS, Barker et al. (2018) found that the treatment of diabetes and/or schizophrenia is different among men and women, which was partially support and partially rejected by the findings of the current study, as only when patients had T2D or SCZ did gender appear as a moderating variable on LOS, and not when patients had both T2D and SCZ.

Limitations of the Study

The current researcher noted a number of limitations of the study prior to commencing the data collection process. Further, the researcher identified new limitations while conducting the data collection process and analyzing the results. With respect to the limitations noted prior to commencing the data collection process, the researcher was concerned mostly with the data collection method and sample. Although new limitations were identified later, the new limitations were also concerned with the data collection method and sample. Due to the reliance on secondary data source in the current study, the researcher encountered a number of challenges.

In the current study, the researcher collected data from the 2015 data from the HCUP database (The Healthcare Cost and Utilization Project, 2019). HCUP is the largest collection of longitudinal hospital care data in the United States (The Healthcare Cost and Utilization Project, 2019). As a family of health care databases, it brings together the data collection efforts of State data organizations, hospital associations, private data organizations, and the Federal government with the purpose of generating a national information resource of patient discharge-level health care data. Despite its scope, which

cover a nationwide sample, it was possible that the data regarding the patients did not provide an exhaustive or accurate representation of the U.S. population. If that is the case, then the findings of the study may be limited in terms of generalizability, as a sample than does not represent the U.S. in its entirety could not yield findings that could be generalized to the entire U.S. population. Further, the findings of the study could also be limited due to the fact that, for females the mean number of LOS in the sample was higher at 11.5 days compared to males' 10.4 days.

Despite this limitation, however, the sample is still notable in terms of its scope and diversity. The sample extracted for the study from HCUP consisted of 50,129 hospital discharge records. Additionally, the age of the sample ranged between 18 and 90 years old with a mean of 43.9 years old. The sample was also diverse in terms of race. Although White was the predominant race in the sample with 45.5%, the sample also included Black (36.1%), Hispanic (12.2%), other (3.4%), Asian or Pacific Islander (2.1%), and Native American (0.7%). Finally, among females, SCZ diagnosis was lower than males (38% vs. 62%, respectively), and differences between females and males were smaller for T2D (48.5% vs. 51.5%, respectively) and SCZ/T2D (48.8% vs. 51.2%, respectively). As a result, the researcher noted that the sample was not driven by researcher bias and represented data as they were found in the defined period, namely Q1, Q2, and Q3 of the year 2015, from HCUP. Further, limiting the dataset to the year 2015 gave access to the most recent data, although it did limit the scope of the findings to three quarters of a specific year. It may be possible that the specific patterns of the selected year may not be representative of the general patterns across a longer period of time.

An important limitation identified initially, and which remained a part of the study, was due to the secondary source of data used in the current study. As the researcher collected the data from the HCUP database, which brings together data collection efforts of state data organizations, hospital associations, private data organizations, and the federal government, the researcher had limited control over sample selection. While the purpose of the study was to explore the relationships between SCZ, T2D, and the LOS, with patient's gender as the moderator, the factors that determined the findings of the study may not be limited to the variables considered, and those variables may have been influenced by other factors themselves, which were not considered. For instance, it is possible that there were characteristics specific to the place where patients were hospitalized and chose to be part of the HCUP coalition that determined that some of patients' data were more likely to end up in HCUP than others. It is also possible that these characteristics were also correlated to the dependent variable of LOS. In that case, the results of the study may be biased, as the data would represent only that subpopulation which was hospitalized in participating entities and not to the larger population of interest. The fact that the sample was not randomized at the patient-level was a limitation of the study, and was an unavoidable outcome associated with the use of secondary data source in the current study.

CHAPTER 6

SUMMARY AND CONCLUSIONS

Recommendations

Based on the study results and the interpretation of the findings, the researcher has developed the following recommendations for further research. First, future researchers should consider utilizing primary sources for data collection in order to explore the relationships between SCZ, T2D, and LOS, with patient gender as the moderator. The use of primary sources would allow future researchers in the future more flexibility regarding the recruitment of participants, thereby enabling a more diverse and representative sample. In the current study, due to the reliance on hospital discharge records in the HCUP databases for data, the researcher discovered a limitation suggesting that some patients' data were more likely to end up in HCUP than others, which could have introduced bias in the findings, as the data would represent only that subpopulation which was hospitalized in participating entities and not the larger population of interest. By collecting primary data and recruiting their own participants randomly, future researchers could avoid these limitations.

Future researchers could also access the hospital discharge records in the HCUP databases for data through different and more expansive timeframes than that employed in the current study. In the current study, the researcher collected data from the HCUP databases from a specific period within a year—namely, Q1, Q2, and Q3 in 2015. Future researchers could expand the period over multiple years in order to avoid the possibility of limiting the findings to the specific patterns of one selected year, which may not be representative of the general patterns across a longer period of time. Future researchers

could also consider utilizing more recent periods in accessing data from the HCUP to be used for their research.

Future researchers could consider examining the relationships between the independent variables of SCZ and T2D with a new dependent variable than the LOS, with patient's gender as the moderator. It is possible that focusing on the variable of the LOS may not have uncovered all the relevant insights regarding the independent variables of SCZ and T2D, with gender as a variable. In addition, the findings from the literature review provided support to the presence of gender-based differences related to SCZ and T2D. These findings were partially supported in the current study with respect to patients with SCZ or T2D, but not for patients with both SCZ and T2D. Future researchers could consider developing studies that focus on ways to minimize these differences, especially with respect to outcomes for SCZ and T2D.

Future researchers could also consider utilizing the qualitative research method to explore and compare the perceptions of male and female patients in order to understand the relationship between SCZ, T2D, and the LOS. In relation to the theoretical framework of the study, the researcher noted that one of the principles of self-regulation theory is the claim that certain underlying processes, cognitive and physical operations, and emotional repercussions may vary between genders (Baumeister & Vohs, 2004). Comparing the perceptions of male and female patients could provide important insights regarding these factors and the overall experiences with SCZ, T2D, and the LOS that may not be possible to capture through quantitative data alone.

Implications for Practice

In this section, the researcher discusses the implications of the findings of the study. First, the researcher provides the implications of the study for positive social change. Next, the researcher delineates the theoretical implications of the current study. Finally, the researcher explains the practical implications of the findings.

Implications for Positive Social Change

The findings of the current study could assist in realizing positive social change through its contribution in showing the moderating role of gender in SCZ, T2D, and the LOS. Specifically, the findings showed that gender did play a moderating role for patients with SCZ or T2D on the LOS. These findings highlighted the need for gender-based interventions that could improve the outcomes of patients with SCZ and T2D. The findings did not contradict the existing literature that showed the need for more gender-based interventions that are proactive in nature for population more at risk in developing SCZ or T2D. The findings also did not contradict those of previous research showing that women with SCZ had more affective symptoms (Kelly et al., 2016) and were prone to develop more severe symptoms of SCZ (Polachek et al., 2017). Previous scholars have suggested differences in SCZ or T2D outcomes due to biological and chemical differences between men and women (Crawford & DeLisi, 2016; R. Li et al., 2016; Lucca et al., 2016; Sainz et al., 2019), which the findings of the current study did not contradict. Thus, the need for more gender-based interventions was reinforced by the findings of the current study, which supported the moderating role of gender in patients with SCZ and T2D on the LOS.

Through the introduction of gender-based interventions, it is possible to affect the LOS of patients with SCZ or T2D, which has the potential of improving the overall outcomes of such patients while reducing the cost of treatment. Gender-based challenges for patients with SCZ or T2D must be recognized and taken into consideration in order to ensure adequate treatment. Given the limited focus in the existing literature on the moderating role of gender on patients with SCZ or T2D on the LOS, the current findings provided new insights that could be incorporated into practice. Further, the lack of support for the moderating role of gender on SCZ or T2D patients' LOS is another significant factor to consider in improving practice. Through informed interventions that promote better practices, it would be possible to address the specific problems and challenges faced by patients with SCZ or T2D, especially with respect to treatment outcomes and LOS. This would have implications for the broader society by affecting not only patients and families of those with SCZ or T2D or both, but also public health expenditure.

Theoretical Implications

The findings of the study address gaps that researchers have identified in the existing literature prior to commencing the study. Additionally, the findings also expand the body of literature on self-regulation theory. With respect to the theoretical framework, the implications of the research include the expansion of the use of the self-regulation theory in the context of SCZ and T2D patients. The application of the self-regulation theory in the current study was found to be adequate, as it helped understand the moderating role of gender. Initially, the researcher noted that one of the principles of self-regulation theory is the claim that certain underlying processes, cognitive and physical

operation, and emotional repercussions that may vary between genders (Baumeister & Vohs, 2004), and that it is due to these differences that outcomes differ among individuals. The current researcher also noted gender-based differences in LOS, although the existence of gender-based differences was found to be among only patients with SCZ or T2D and not those with both SCZ and T2D. Further, in alignment with the self-regulation theory, the findings of the current study showed differences between individuals in terms of their LOS in relation to the conditions that they were affected by. As a result, the findings of the study expanded the scope of the literature on the self-regulation theory by expanding it in the context of patients with SCZ and T2D.

The current researcher hypothesized that self-regulation theory would provide insights on what the gender differences are in terms of healthcare, specifically SCZ and T2D patient care in hospitals (Davis et al., 2015). The hypotheses were confirmed, as gender was found to play a moderating role in patients with SCZ or T2D but not with SCZ/T2D. As such, the findings supported the use of self-regulation theory in the context of patients with SCZ, T2D, both SCZ and T2D, and LOS, further expanding the literature in which it has been used in social science, personal health management, impulse control, sickness behavior, and health outcomes (Cameron & Leventhal, 2003; DeWall et al., 2008; Fenton-O'Creevy et al., 2003).

Practical Implications

The research findings also have practical implications for the field of healthcare. If the results of the study are replicated, they would indicate the role of gender as a moderator in patients with SCZ or T2D—but not both SCZ and T2D—on the LOS. Gender-based differences have implications for targeted patient care in the field of

healthcare in order to decrease healthcare costs, improve patients' quality of life, and avoid further increases in the burden associated with SCZ and T2D (Laursen et al., 2014; Gabilondo et al., 2017). As LOS is directed related to healthcare costs, the findings of the study showed the role of gender in increasing or decreasing healthcare costs for patients with SCZ or T2D, but not those with both SCZ and T2D. Healthcare practitioners could use these insights to develop specific interventions for reducing healthcare costs and improving patient outcomes for SCZ and T2D in which gender-differences are taken into consideration. Additionally, because the findings did not show gender to be a moderator in patients with both SCZ and T2D in relation to the LOS, this insight could also be incorporated in practical interventions to help patients with both SCZ and T2D by not targeting gender differences among such patients as relevant variable. SCZ and T2D patients require healthcare services such as diagnosis, treatment, and support at healthcare organizations. Based on the insights from the study, such services could be resourced and implemented to reflect the actual needs of these patients, which, as the current results showed, differ based on gender for patients with SCZ and those with T2D—but not those with both. The findings may provide decision-makers with insights regarding the moderating role of gender among patients with SCZ, T2D, and SCZ/T2D to ensure appropriate resource allocation for individual patients based on their comorbidities and gender.

Conclusion

The risk of death in patients living with schizophrenia and diabetes is six-fold compared to patients living with only schizophrenia (Davis et al., 2015). In the existing literature, the topic of gender-specific interventions was understudied, especially relating

to factors that influence diagnosis, treatment, and treatment outcomes for people living with SCZ and T2D (Gabilondo et al., 2017; Schwartz et al., 2015; Zhang et al., 2015; Zhou et al., 2015). The purpose of this quantitative correlational study was to explore the relationships between schizophrenia, type II diabetes, and the length of hospital stay, with patient's gender as the moderator. With the dependent variable of the LOS, and the independent variables of SCZ and T2D, the researcher conducted this quantitative correlational design using 50,129 hospital discharge records from the 2015 data from the Healthcare Cost and Utilization Project. The researcher developed three research questions and corresponding hypotheses to guide the study. Based on the results of the descriptive and cross-sectional quantitative analytical approaches, the researcher did not reject the first null hypothesis, which stated that the patient's gender moderates the effect of having schizophrenia on length of hospital stay, holding other variables constant. The researcher also did not reject the second null hypothesis, which stated that the patient's gender moderates the effect of having diabetes on length of hospital stay, holding other variables constant. The researcher did reject the null hypothesis for the third research question, which stated that the patient's gender moderates the effect of having schizophrenia and diabetes on length of hospital stay, holding other variables constant.

An interpretation of the findings against the existing literature showed that the findings of the study provided complete support to the self-regulation theory in relation to the claim that people differ in their basic abilities and styles of self-control, which manifest as different outcomes among individuals based on their levels of self-control, adherence, lifestyle choices, behavioral functions, and inherent practices (Baumeister & Vohs, 2004), but only partial support to the claim that there are certain underlying

processes, cognitive and physical operation, and emotional repercussions that may vary between genders (Baumeister & Vohs, 2004). The findings did not contradict the conclusions of previous researchers showing gender differences in the outcomes of SCZ patients and T2D patients (Kelly et al., 2016; Riecher-Rössler, 2016; Riecher-Rössler et al., 2018; Rietschel et al., 2016; Seeman, 2019). The findings of the current study, however, were not in alignment with the literature with respect to treatment (Kucerova et al., 2015; Lange et al., 2017; Whicher et al., 2018). The findings of the current study also did not align with the literature showing gender-differences regarding patients with both SCZ and T2D (Zhang et al., 2015).

The researcher identified several limitations of the study, and developed corresponding recommendations for future research. These included limitations regarding HCUP, which, despite covering a nationwide sample, did not provide an exhaustive or accurate representation of the U.S. population regarding the patients. Data were also limited to the year 2015. The use of a secondary data source did not give the research flexibility regarding sample selection. In turn, the researcher recommended that future researchers consider utilizing primary sources for data collection to explore the relationships between SCZ, T2D, and LOS, with patient's gender as the moderator. Future researchers using HCUP databases could also expand the period from which data were accessed. Including diverse variables and a qualitative research method were other recommendations for future researchers.

The researcher discussed the implications of the findings across three spheres: positive social change, theory, and practice. Regarding social change, the researcher noted that through interventions that promote better practices based on the findings of the

current study, the specific problems and challenges faced by patients with SCZ or T2D, could be addressed, which would have implications for the broader society by affecting public health expenditure. Regarding theoretical implications, the findings of the study supported the use of self-regulation theory in the context of patients with SCZ, T2D, both SCZ and T2D, and LOS, further expanding the literature in which it has been used. Finally, regarding practical implications, the findings of the study could be used by practitioners in healthcare to develop specific interventions for reducing healthcare costs and improving patient outcomes for SCZ and T2D in which gender-differences are taken into consideration. Through these findings, the researcher attained the purpose of the quantitative correlational study, which was to explore the relationships between SCZ, T2D, and the LOS, with patient's gender as the moderator. The results provide evidence supporting that patient gender is a moderator for the effect of having SCZ or having T2D on LOS, but no evidence supporting that it is also a moderator for the effect of having both SCZ and T2D on LOS. The study is hereby concluded.

REFERENCES

American Diabetes Association. (2012). Standards of medical care in diabetes—2012. *Diabetes Care, 35*(Supplement 1), S11–S63.

Annamalai, A., Kosir, U., & Tek, C. (2017). Prevalence of obesity and diabetes in patients with schizophrenia. *World Journal of Diabetes*, *8*(8), 390–396.

Babbie, E. R. (2012). *The practice of social research.* Boston, MA: Cengage Learning.

Bailey, R. K., Sharpe, D. K., Ringel, M., & Zeeshan, A. (2018). Early combination therapy for type 2 diabetes mellitus and common comorbid mental disorders. *Focus, 16*(1), 48-53. doi:10.1176/appi.focus.20160048

Balaji, R., Duraisamy, R., & Kumar, M. P. (2019). Complications of diabetes mellitus: A review. *Drug Invention Today, 12*(1). Retrieved from https://www.sciencedirect.com/journal/drug-invention-today

Barajas, A., Ochoa, S., Obiols, J. E., & Lalucat-Jo, L. (2015). Gender differences in individuals at high-risk of psychosis: A comprehensive literature review. *The Scientific World Journal, 2015*, 430735. doi:10.1155/2015/430735.

Barker, L. C., Kurdyak, P., Jacob, B., & Vigod, S. N. (2018). Quality of diabetes care for individuals with comorbid chronic psychotic illness: A gender-based analysis. *Journal of Women's Health, 27*(3), 290-296. doi:10.1089/jwh.2017.6490

Baumeister, R. F., & Vohs, K. D. (Eds.). (2004). *Handbook of self-regulation: Research, theory, and applications.* New York, NY: Guilford Press.

Bent-Ennakhil, N., Cécile Périer, M., Sobocki, P., Gothefors, D., Johansson, G., Milea, D., & Empana, J.-P. (2018). Incidence of cardiovascular diseases and type-2-diabetes mellitus in patients with psychiatric disorders. *Nordic Journal of Psychiatry*, *72*(7), 455–461.

Bouza, C., López-Cuadrado, T., & Amate, J. M. (2010). Hospital admissions due to physical disease in people with schizophrenia: A national population-based study. *General Hospital Psychiatry*, *32*(2), 156–163.

Boyd, A., Van de Velde, S., Vilagut, G., De Graaf, R., Florescu, S., Alonso, J., Kovess-Masfety, V., & EU-WMH Investigators. (2015). Gender differences in mental disorders and suicidality in Europe: Results from a large cross-sectional population-based study. *Journal of Affective Disorders, 173*, 245-254. doi:10.1016/j.jad.2014.11.002

Boyle, J. P., Thompson, T. J., Gregg, E. W., Barker, L. E., & Williamson, D. F. (2010). Projection of the year 2050 burden of diabetes in the US adult population: Dynamic modeling of incidence, mortality, and prediabetes prevalence. *Population Health Metrics, 8*, Article 29.

Brink, M., Green, A., Bojesen, A. B., Lamberti, J. S., Conwell, Y., & Andersen, K. (2019). Excess medical comorbidity and mortality across the lifespan in schizophrenia.: A nationwide Danish register study. *Schizophrenia Research, 206*, 347–354.

Cameron, L. D., & Leventhal, H. (Eds.). (2003). *The self-regulation of health and illness behaviour*. London, England: Psychology Press.

Crawford, M. B., & DeLisi, L. E. (2016). Issues related to gender differences in antipsychotic treatment. *Current Opinion in Psychiatry, 29*(3), 211-217. doi:10.1097/YCO.0000000000000243

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: SAGE.

Darcin, A. E., Cavus, S. Y., Dilbaz, N., Kaya, H., & Dogan, E. (2015). Metabolic syndrome in drug-naïve and drug-free patients with schizophrenia and in their siblings. *Schizophrenia Research, 166*(1-3), 201-206. doi:10.1016/j.schres.2015.05.004.

Das-Munshi, J., Stewart, R., Morgan, C., Nazroo, J., Thornicroft, G., & Prince, M. (2016). Reviving the 'double jeopardy' hypothesis: Physical health inequalities, ethnicity and severe mental illness. *The British Journal of Psychiatry, 209*(3), 183-185. Retrieved from https://www.cambridge.org/core/journals/the-british-journal-of-psychiatry

Davis, W. A., Starkstein, S. E., Bruce, D. G., & Davis, T. M. E. (2015). The interactive effects of type 2 diabetes mellitus and schizophrenia on all-cause mortality: The Fremantle Diabetes Study. *Journal of Diabetes and Its Complications, 29*(8), 1320–1322.

DeWall, C. N., Baumeister, R. F., Gailliot, M. T., & Maner, J. K. (2008). Depletion makes the heart grow less helpful: Helping as a function of self-regulatory energy and genetic relatedness. *Personality and Social Psychology Bulletin, 34*(12), 1653-1662. doi:10.1177/0146167208323981

Ellis, T., & Levy, Y. (2009). Towards a guide for novice researchers on research methodology: Review and proposed methods. *Issues in Informing Science and Information Technology, 6*, 323–337.

Evert, A. B., Dennison, M., Gardner, C. D., Garvey, W. T., Lau, K. H. K., MacLeod, J., Mitri, J.,…Yancy Jr., W. (2019). Nutrition therapy for adults with diabetes or prediabetes: A consensus report. *Diabetes Care, 42*(5), 731-754. doi:10.2337/dci19-0014

Farahvar, S., Walfisch, A., & Sheiner, E. (2019). Gestational diabetes risk factors and long-term consequences for both mother and offspring: A literature review. *Expert Review of Endocrinology & Metabolism, 14*(1), 63-74. doi:10.1080/17446651.2018.1476135

Fenton-O'Creevy, M., Nicholson, N., Soane, E., & Willman, P. (2003). Trading on illusions: Unrealistic perceptions of control and trading performance. *Journal of Occupational and Organizational Psychology, 76*(1), 53-68. doi:10.1348/096317903321208880

Fitzgerald, S. M., Rumrill, P. D., Jr., & Schenker, J. D. (2004). Correlational designs in rehabilitation research. *Journal of Vocational Rehabilitation, 20*(2), 143–150.

Foley, D. L., Mackinnon, A., Morgan, V. A., Watts, G. F., Castle, D. J., Waterreus, A., & Galletly, C. A. (2016). Common familial risk factors for schizophrenia and diabetes mellitus. *Australian & New Zealand Journal of Psychiatry, 50*(5), 488-494. doi:10.1177/0004867415595715

Gabilondo, A., Alonso-Moran, E., Nuño-Solinis, R., Orueta, J. F., & Iruin, A. (2017). Comorbidities with chronic physical conditions and gender profiles of illness in schizophrenia: Results from PREST, a new health dataset. *Journal of Psychosomatic Research*, *93*, 102–109.

Galling, B., Roldán, A., Nielsen, R. E., Nielsen, J., Gerhard, T., Carbon, M., ... & Kahl, K. G. (2016). Type 2 diabetes mellitus in youth exposed to antipsychotics: A systematic review and meta-analysis. *JAMA Psychiatry*, *73*(3), 247-259. doi:10.1001/jamapsychiatry.2015.2923.

Garcia-Rizo, C., Kirkpatrick, B., Fernandez-Egea, E., Oliveira, C., & Bernardo, M. (2016). Abnormal glycemic homeostasis at the onset of serious mental illnesses: A common pathway. *Psychoneuroendocrinology*, *67*, 70-75. doi:10.1016/j.psyneuen.2016.02.001

Goueslard, K., Petit, J.-M., Cottenet, J., Chauvet-Gelinier, J.-C., Jollant, F., & Quantin, C. (2018). Increased risk of rehospitalization for acute diabetes complications and suicide attempts in patients with type 1 diabetes and comorbid schizophrenia. *Diabetes Care*, *41*(11), 2316–2321. doi:10.2337/dc18-0657.

Green, S. B. (1991). How many subjects does it take to do a regression analysis? *Multivariate Behavioral Research*, *26*(3), 499–510.

Hackinger, S., Prins, B., Mamakou, V., Zengini, E., Marouli, E., Brčić, L.,…Gonidakis, F. (2018). Evidence for genetic contribution to the increased risk of type 2 diabetes in schizophrenia. *Translational Psychiatry*, *8*(1), 252. doi:10.1038/s41398-018-0304-6

Han, M., Huang, X. F., Xiu, M. H., Hui, L., Liu, H., Kosten, T. R., & Zhang, X. Y. (2012). Gender differences in cognitive function of patients with chronic schizophrenia. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 39*(2), 358-363. doi:10.1016/j.pnpbp.2012.07.010

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Press.

Hayes, J. F., Marston, L., Walters, K., King, M. B., & Osborn, D. P. (2017). Mortality gap for people with bipolar disorder and schizophrenia: UK-based cohort study 2000–2014. *British Journal of Psychiatry, 211*(3), 175-181. doi:10.1192/bjp.bp.117.202606

Heeringa, S. G., West, B. T., & Berglund, P. A. (2010). *Applied survey data analysis.* Boca Raton, FL: Chapman and Hall/CRC.

Henderson, D. C., Vincenzi, B., Andrea, N. V., Ulloa, M., & Copeland, P. M. (2015). Pathophysiological mechanisms of increased cardiometabolic risk in people with schizophrenia and other severe mental illnesses. *The Lancet Psychiatry, 2*(5), 452-464. doi:10.1016/S2215-0366(15)00115-7

Hippisley-Cox, J., Vinogradova, Y., Coupland, C., Langford, G., & Parker, C. (2006). *A comparison of survival rates for people with mental health problems and the remaining population with specific conditions*. London, England: Disability Rights UK.

Hjorthoj, C., Sturup, A. E., McGrath, J. J., & Nordentoft, M. (2017). Nordentoft M. Years of potential life lost and life expectancy in schizophrenia: A systematic review and meta-analysis. *The Lancet Psychiatry, 4*(9), 295-301. doi:10.1016/S2215-0366(17)30078-0

Holt, R. I. G. (2015). The prevention of diabetes and cardiovascular disease in people with schizophrenia. *Acta Psychiatrica Scandinavica, 132*(2), 86-96. doi:10.1111/acps.12443

Holt, R. I. G., & Peveler, R. C. (2010). Diabetes and cardiovascular risk in severe mental illness: A missed opportunity and challenge for the future. *Practical Diabetes International, 27*(2), 79–84.

Horne, R. B. R. (2012). Treatment perceptions and self-regulation. In *The self-regulation of health and illness behaviour* (pp. 152-168). London, England: Routledge.

Kelly, D. L., Rowland, L. M., Patchan, K. M., Sullivan, K., Earl, A., Raley, H., Liu, F., Feldman, S., & McMahon, R. P. (2016). Schizophrenia clinical symptom differences in women vs. men with and without a history of childhood physical abuse. *Child and Adolescent Psychiatry and Mental Health, 10*(1), 5. doi:10.1186/s13034-016-0092-9

Knyahnytska, Y., Williams, C., Dale, C., & Webster, F. (2018). Changing the conversation: Diabetes management in adults with severe mental illnesses and type 2 diabetes. *Canadian Journal of Diabetes, 42*(6), 595-602. doi:10.1016/j.jcjd.2018.02.001

Krall, J., Durdock, K., Johnson, P., Kanter, J., Koshinsky, J., Thearle, M., & Siminerio, L. (2017). Exploring approaches to facilitate diabetes therapy intensification in primary care. *Clinical Diabetes, 35*(2), 100-105.

Kucerova, J., Babinska, Z., Horska, K., & Kotolova, H. (2015). The common pathophysiology underlying the metabolic syndrome, schizophrenia and depression. A review. *Biomedical Papers of the Medical Faculty of Palacky University in Olomouc, 159*(2). Retrieved from www.biomed.papers.upol.cz/pdfs/bio/2015/02/07.pdf/

Lange, B., Mueller, J. K., Leweke, F. M., & Bumb, J. M. (2017). How gender affects the pharmacotherapeutic approach to treating psychosis: A systematic review. *Expert Opinion on Pharmacotherapy, 18*(4), 351-362. doi:10.1080/14656566.2017.1288722

Laursen, T. M., Nordentoft, M., & Mortensen, P. B. (2014). Excess early mortality in schizophrenia. *Annual Review of Clinical Psychology*, *10*, 425–448. doi:10.1146/annurev-clinpsy-032813-153657

Lencz, T., Knowles, E., Davies, G., Guha, S., Liewald, D. C., Starr, J. M., ... & Reinvang, I. (2014). Molecular genetic evidence for overlap between general cognitive ability and risk for schizophrenia: A report from the Cognitive Genomics consorTium (COGENT). *Molecular Psychiatry, 19*(2), 168. doi:10.1038/mp.2013.166

Li, Q., Chen, D., Liu, T., Walss-Bass, C., De Quevedo, J. L., Soares, J. C., Jair, C., Zhao, J., & Zhang, X. Y. (2016). Gender differences in body mass index and obesity in Chinese patients with chronic schizophrenia. *Journal of Clinical Psychopharmacology, 36*(6), 643-648. doi:10.1097/JCP.000000000000059

Li, R., Ma, X., Wang, G., Yang, J., & Wang, C. (2016). Why gender differences in schizophrenia? *Journal of Translational Neuroscience, 1*(1), 37. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5688947/

Lindamer, L. A., Lohr, J. B., Harris, M. J., McAdams, L. A., & Jeste, D. V. (1999). Gender-related clinical differences in older patients with schizophrenia. *The Journal of Clinical Psychiatry, 60*(1), 61-7. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/10074884/

Lucca, J. M., Ramesh, M., & Ram, D. (2017). Gender differences in the occurrences and pattern of adverse drug reactions in psychiatric patients: A prospective observational study. *Tropical Journal of Medical Research, 20*(1), 84. doi:10.4103/1119-0388.198134

Lumley, T., Diehr, P., Emerson, S., & Chen, L. (2002). The importance of the normality assumption in large public health data sets. *Annual Review of Public Health, 23*, 151–169.

Luo, C., Wang, X., Huang, H. X., Mao, X. Y., Hao, Z. H., & Liu, Z. Q. (2019). Effect of metformin on antipsychotic-induced metabolic dysfunction: the potential role of gut-brain axis. *Frontiers in Pharmacology, 10*, 371. doi:10.3389/fphar.2019.00371

Mamakou, V., Hackinger, S., Zengini, E., Tsompanaki, E., Marouli, E., Serafetinidis, I., … Zeggini, E. (2018). Combination therapy as a potential risk factor for the development of type 2 diabetes in patients with schizophrenia: The GOMAP study. *BMC Psychiatry, 18*(1), 249. doi:10.1186/s12888-018-1826-4

Mangurian, C., Newcomer, J. W., Modlin, C., & Schillinger, D. (2016). Diabetes and cardiovascular care among people with severe mental illness: A literature review. *Journal of General Internal Medicine, 31*(9), 1083-1091. doi:10.1007/s11606-016-3712-4

Manjunatha, N., Kumar, C. N., Thirthalli, J., Suresha, K. K., Harisha, D. M., & Arunachala, U. (2019). Mortality in schizophrenia: A study of verbal autopsy from cohorts of two rural communities of South India. *Indian Journal of Psychiatry, 61*(3), 238. doi:10.4103/psychiatry.IndianJPsychiatry_135_19

Marni, T., Bahagia Loebis, V. C., Effendy, E., & Nasution, N. M. (2019). The difference of fasting blood sugar of male patients with schizophrenia treated with flexible dose between aripiprazole and risperidone in Medan, Indonesia. *Macedonian Journal of Medical Sciences, 7*(9), 1446. doi:10.3889/oamjms.2019.324

Marsh, H. W., Hau, K.-T., Wen, Z., Nagengast, B., & Morin, A. J. S. (2013). Moderation. In *The Oxford handbook of quantitative methods: Statistical analysis* (Vol. 2, pp. 361–386). New York, NY: Oxford University Press.

Mendrek, A., & Mancini-Marie, A. (2016). Gender/gender differences in the brain and cognition in schizophrenia. *Neuroscience & Biobehavioral Reviews, 67*, 57-78. doi:10.1016/j.neubiorev.2015.10.013

Miller, R. L. (2008). Ethical issues in psychological research with human participants. In S. F. Davis (Ed.), *Handbook of research methods in experimental psychology* (pp. 127–150).

Morgan, B. L., & Voorhis, C. R. W. V. (2007). Understanding power and rules of thumb for determining sample sizes. *Tutorials in Quantitative Methods, 3*(2), 43-50.

Moxham, L. (2012). Nurse education: Research and evidence-based practice. In A. Berman, S. J. Snyder, T. Levett-Jones, M. Hales, N. Harvey, Y. Luxford, L. Moxham, T. Park, B. Parker, K. Reid-Searl and D. Stanley (Eds.), *Kozier and Erb's Fundamentals of Nursing* (2nd ed., Vol. 1). Frenchs Forest, Sydney: Pearson Australia.

Mukherjee, S., Schnur, D., & Reddy, R. (1989). Family history of type 2 diabetes in schizophrenic patients. *The Lancet, 333*(8636), 495. doi:10.1016/S0140-6736(89)91392-5

Muraven, M., Tice, D., & Baumeister, R. (1998). Self-control as limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology, 74*(3), 774–89. doi:10.1037/0022-3514.74.3.774

National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1978). *The Belmont report: Ethical principles and guidelines for the protection of human subjects of research*. Bethesda, MD: Author.

Nsiah, K., Shang, V. O., Boateng, K. A., & Mensah, F. O. (2015). Prevalence of metabolic syndrome in type 2 diabetes mellitus patients. *International Journal of Applied and Basic Medical Research, 5*(2), 133. doi:10.4103/2229-516X.157170

Perry, B. I., Salimkumar, D., Green, D., Meakin, A., Gibson, A., Mahajan, D., Tahir, T., & Singh, S. P. (2017). Associated illness severity in schizophrenia and diabetes mellitus: A systematic review. *Psychiatry Research, 256*, 102-110. doi:10.1016/j.psychres.2017.06.027

Petrikis, P., Tigas, S., Tzallas, A. T., Papadopoulos, I., Skapinakis, P., & Mavreas, V. (2015). Parameters of glucose and lipid metabolism at the fasted state in drug-naive first-episode patients with psychosis: Evidence for insulin resistance. *Psychiatry Research, 229*(3), 901-904. doi:10.1016/j.psychres.2015.07.041

Pillinger, T., Beck, K., Gobjila, C., Donocik, J. G., Jauhar, S., & Howes, O. D. (2017). Impaired glucose homeostasis in first-episode schizophrenia: A systematic review and meta-analysis. *JAMA Psychiatry, 74*(3), 261-269. doi:10.1001/jamapsychiatry.2016.3803

Polachek, I. S., Manor, A., Baumfeld, Y., Bagadia, A., Polachek, A., Strous, R. D., & Dolev, Z. (2017). Gender differences in psychiatric hospitalizations of individuals with psychotic disorders. *Journal of Nervous and Mental Disease, 205*(4), 313-317. doi:10.1097/NMD.0000000000000645

Polit, D. F., & Hungler, B. P. (2013). *Essentials of nursing research: Methods, appraisal, utilization* (8th ed.). Philadelphia, PA: Wolters Kluwer/Lippincott Williams and Wilkins.

Price, J. H., & Murnan, J. (2004). Research limitations and the necessity of reporting them. *American Journal of Health Education, 35*(2), 66–67.

Reininghaus, U., Dutta, R., Dazzan, P., Doody, G. A., Fearon, P., Lappin, J., Heslin, M.,…Jones, P. (2015). Mortality in schizophrenia and other psychoses: A 10-year follow-up of the ÆSOP first-episode cohort. *Schizophrenia Bulletin, 41*(3), 664-673. Retrieved from https://academic.oup.com/schizophreniabulletin

Riecher-Rössler, A. (2016). Prospects for the classification of mental disorders in women. *European Psychiatry, 25*(4), 189-196. doi:10.1016/j.eurpsy.2009.03.002

Riecher-Rössler, A., Butler, S., & Kulkarni, J. (2018). Gender and gender differences in schizophrenic psychoses: A critical review. *Archives of Women's Mental Health, 21*(6), 627-648. doi:10.1007/s00737-018-0847-9

Sainz, J., Prieto, C., & Crespo-Facorro, B. (2019). Gender differences in gene expression related to antipsychotic induced weight gain. *PloS One, 14*(4), e0215477. doi:10.1371/journal.pone.0215477

Sajatovic, M., Gunzler, D., Einstadter, D., Thomas, C., McCormick, R. A., Perzynski, A. T.,…Dawson, N. V. (2015). Clinical characteristics of individuals with serious mental illness and type 2 diabetes. *Psychiatric Services, 66*(2), 197–199. doi:10.1176/appi.ps.201300538

Schwartz, E., Charlotte, M., Slade, E., Medoff, D., Li, L., Dixon, L.,…Kreyenbuhl, J. (2015). Gender differences in antipsychotics prescribed to veterans with serious mental illness. *General Hospital Psychiatry, 37*(4), 347–351. doi:10.1016/j.genhosppsych.2015.03.018

Seeman, M. V. (2019). Does gender influence outcome in schizophrenia? *Psychiatric Quarterly, 90*(1), 173-184. doi:10.1007/s11126-018-9619-y

Shieh, G. (2013). Sample size requirements for interval estimation of the strength of association effect sizes in multiple regression analysis. *Psicothema, 25*, 402-407.

Shinoda, Y., Tagashira, H., Bhuiyan, M. S., Hasegawa, H., Kanai, H., & Fukunaga, K. (2016). Haloperidol aggravates transverse aortic constriction-induced heart failure via mitochondrial dysfunction. *Journal of Pharmacological Sciences, 131*(3), 172-183. doi:10.1016/j.jphs.2016.05.012

StataCorp. (2017). *Stata Statistical Software: Release 15.* College Station, TX: StataCorp LLC.

Suvisaari, J., Keinänen, J., Eskelinen, S., & Mantere, O. (2016). Diabetes and schizophrenia. *Current Diabetes Reports, 16*(2), 16. doi:10.1007/s11892-015-0704-4.

Tabachnick, B. G., & Fidell, L. S. (2018). *Using multivariate statistics* (7th edition). Boston, MA: Pearson.

Thara, R., & Kamath, S. (2015). Women and schizophrenia. *Indian Journal of Psychiatry, 57*(Suppl 2), S246-S251. doi:10.4103/0019-5545.161487

The Healthcare Cost and Utilization Project. (2019). *Home page.* Retrieved from https://www.hcup-us.ahrq.gov/

Thorup, A., Albert, N., Bertelsen, M., Petersen, L., Jeppesen, P., Le Quack, P., Krarup, G., Jorgensen, P., & Nordentoft, M. (2014). Gender differences in first-episode psychosis at 5-year follow-up–two different courses of disease? Results from the OPUS study at 5-year follow-up. *European Psychiatry, 29*(1), 44-51. doi:10.1016/j.eurpsy.2012.11.005

Vancampfort, D., Correll, C. U., Galling, B., Probst, M., De Hert, M., Ward, P. B., Rosenbaum, S.,…Stubbs, B. (2016). Diabetes mellitus in people with schizophrenia, bipolar disorder and major depressive disorder: A systematic review and large scale meta-analysis. *World Psychiatry, 15*(2), 166-174. doi:10.1002/wps.20309

Walker, E. R., McGee, R. E., & Druss, B. G. (2015). Mortality in mental disorders and global disease burden implications: A systematic review and meta-analysis. *JAMA Psychiatry, 72*(4), 334-341. doi:10.1001/jamapsychiatry.2014.2502

Wani, R. A., Dar, M. A., Margoob, M. A., Rather, Y. H., Haq, I., & Shah, M. S. (2015). Diabetes mellitus and impaired glucose tolerance in patients with schizophrenia, before and after antipsychotic treatment. *Journal of Neurosciences in Rural Practice, 6*(1), 17. doi:10.4103/0976-3147.143182

Whicher, C. A., Price, H. C., & Holt, R. I. (2018). Mechanisms in endocrinology: Antipsychotic medication and type 2 diabetes and impaired glucose regulation. *European Journal of Endocrinology, 178*(6), R245-R258. Retrieved from https://eje.bioscientifica.com/view/journals/eje

Wooldridge, J. M. (2012). *Introductory econometrics: A modern approach* (5th edition). Boston, MA: Cengage Learning.

Wu, C. S., Lai, M. S., & Gau, S. S. F. (2015). Complications and mortality in patients with schizophrenia and diabetes: Population-based cohort study. *British Journal of Psychiatry, 207*(5), 450-457. doi:10.1192/bjp.bp.113.143925

Zaccardi, F., Webb, D. R., Yates, T., & Davies, M. J. (2016). Pathophysiology of type 1 and type 2 diabetes mellitus: A 90-year perspective. *Postgraduate Medical Journal*, *92*(1084), 63-69. Retrieved from https://pmj.bmj.com/

Zhang, B. H., Han, M., Zhang, X. Y., Hui, L., Jiang, S. R., Yang, F. D., … Huang, X. F. (2015). Gender differences in cognitive deficits in schizophrenia with and without diabetes. *Comprehensive Psychiatry*, *63*, 1–9.

Zhou, M., Xiao, C., Yang, M., Yuan, P., & Liu, Y. (2015). Risk factors for schizophrenia patients with type 2 diabetes: A meta-analysis. *Journal of Central South University – Medical Sciences*, *40*(3), 241–249.