Correlates and Select Quality of Life Measures Among Individuals with Schizophrenia and Comorbid Diabetes Compared to Individuals with Schizophrenia Only

by

Sean Griffith

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Public Health

Lakehead University
September 2008

Your file Votre référence
ISBN: 978-0-494-43422-2
Our file Notre référence
ISBN: 978-0-494-43422-2

ABSTRACT

Individuals with schizophrenia are at an increased risk for developing diabetes and experience rates of diabetes two to five times higher than the general population. The limited number of studies that have been conducted in the area of schizophrenia and comorbid diabetes have been inconsistent in demonstrating whether individuals with schizophrenia and comorbid diabetes differ significantly in terms of personal factors, functional and clinical characteristics, social involvement and service utilization. Nor have these studies consistently shown the impact of comorbid schizophrenia and diabetes on quality of life. An examination of the various measures that differentiate individuals with schizophrenia and comorbid diabetes from those without diabetes were explored.

The prevalence of diabetes among persons with schizophrenia was 4.75%. Persons with comorbid diabetes differed on a number of personal factors, functional and clinical characteristics, social involvement and service utilization. Of note, individuals with comorbid diabetes were more likely to be female, have a BMI in the obese/overweight range, were more likely to be married/partnered and more likely to be unemployed. They were also more likely to experience cognitive deficits, impaired self-care, fewer positive symptoms, a greater number of physical health problems and medical co-morbidities than individuals without diabetes. Individuals with diabetes were more likely to experience more lifetime psychiatric admissions and were admitted for longer periods of time. With respect to quality of life, individuals with diabetes were more likely to have poor-self rated health (OR=1.61), more likely to report having a confidant (1.27) and more likely to be unemployed (OR=2.64).

The low prevalence of diabetes is consistent with under-detection of diabetes among individuals with schizophrenia and must be investigated and remedied. Addressing diabetes before full on-set through lifestyle interventions and pharmacotherapy should be further explored. The underlying reasons for the disparities (i.e. poor self-rated health, service utilization, reduced self-care abilities) found should be the focus of future research to determine methods to reduce the impact of diabetes on individuals with schizophrenia.

ACKNOWLEDGMENTS

I am ever thankful for the support I received from my family and friends throughout the process of conducting this research and the endless days of writing. My family has been there when I needed a place to escape and write, when I needed to discuss my thoughts out loud or for a quick proof read. To Arran, for putting up with the long days, nights, lost weekends and reading over my work, even when you were truly too busy.

I would also like to extend thanks to Dr. Lynn Martin, my graduate supervisor who was always available, responded to every question and worked through her vacation to ensure that revisions and corrections were completed on time. Her guidance in every aspect of this research project has been truly invaluable and her dedication has been imperative in completing this project in a timely manner. Thank you also to Dr. Mike Stones for offering up your suggestions and aiding in improving the rigor of this research study.

TABLE OF CONTENTS

ABSTRACT ii

ACKNOWLEDGMENTS iv

TABLE OF CONTENTS v

LIST OF TABLES vii

Chapter 1: INTRODUCTION AND LITERATURE REVIEW 1
- INTRODUCTION 1
- LITERATURE REVIEW 3
  - Part 1: Epidemiology and Prevalence of Diabetes 3
    - Overview of Diabetes 3
    - Prevalence of Diabetes 4
    - Prevalence of Diabetes among Individuals with Schizophrenia 5
    - Underdiagnosis of Diabetes among Individuals with Schizophrenia 7
  - Part 2: Characteristics of Individuals with Diabetes and Schizophrenia 8
    - Characteristics of Individuals with Diabetes Alone 8
    - Characteristics of Individuals with Schizophrenia and Comorbid Diabetes 11
  - Part 3: Quality of Life 13
    - Quality of Life in Individuals with Schizophrenia 15
    - Quality of Life in Individuals with Diabetes 19
    - Quality of Life in Individuals with Schizophrenia and Comorbid Diabetes 21
  - Study Rational 22
  - Study Objectives 23

Chapter 2: METHOD 24
- Participants 24
- Instrument 24
- Measures 26
  - Schizophrenia 26
  - Diabetes 26
  - Personal Characteristics 27
  - Functional Characteristics 29
  - Clinical Characteristics 30
  - Social Characteristics 32
  - Medication Adherence 33
  - Service Utilization 34
- Quality of Life 34
- Analysis 35

Chapter 3: RESULTS 37
Comparison of Personal Characteristics 37
Comparison of Functional Characteristics 39
Comparison of Clinical Characteristics 40
Comparison of Social Characteristics/Involvement 46
Comparison of Medication Adherence 48
Comparison of Service Utilization History 49
Quality of Life 53
Chapter 4: DISCUSSION 57
Personal Characteristics 57
Functional Characteristics 60
Clinical Characteristics 61
Social Characteristics/ Involvement 63
Service Utilization History (Past and Present) 64
Quality of Life 65
Limitations 68
Implications for Public Health 71
Conclusion 74
REFERENCES 76
APPENDIX A: ICD-10 Coding for Medical Diagnosis 89

LIST OF TABLES

Table 3.1 Comparison of Personal Characteristics 38
Table 3.2 Test for Normality, Functional Characteristics 40
Table 3.3 Wilcoxon-Mann-Whitney Sign Rank Test, Functional Characteristics 40
Table 3.4 Test for Normality, Mental Health Characteristics 41
Table 3.5 Wilcoxon-Mann-Whitney Sign Rank Test, Mental Health Characteristics 41
Table 3.6 Comparison of Clinical Characteristics, Health Conditions 42
Table 3.7 Comparison of Clinical Characteristics, Physical Health 44
Table 3.8 Comparison of Medical Diagnoses 46
Table 3.9 Comparison of Social Characteristics and Involvement 47
Table 3.10 Comparison of Medication Use and Adherence 49
Table 3.11 Comparison of Past and Present Service Utilization 50
Table 3.12 Comparison of Major Focus of Interventions 51
Table 3.13 Comparison of Number of Days of Formal Care 52
Table 3.14 Bivariate Logistic Regression, Quality of Life Indicators 53
Table 3.15 Multivariate Logistic Regression, Self-Rated Health 54
Table 3.16 Multivariate Logistic Regression, Presence of Confidant 55
Table 3.17 Multivariate Logistic Regression, Visit from Long-Standing Social Relation 55
Table 3.18 Multivariate Logistic Regression, Unemployment 56

Chapter 1: INTRODUCTION AND LITERATURE REVIEW

INTRODUCTION

In 2004, the number of individuals in Canada affected by schizophrenia was estimated to be approximately 234,305 (Goeree et al., 2005). This condition most often has an onset in early adulthood, and is believe to be the result of a combination of genetic and environmental factors (Tsuang, Stone & Faraone, 2001). The effects of schizophrenia have been described on a spectrum, from mild to severe symptoms, from single to multiple to chronic episodes, and from episodes with few lasting effects to those that impact across the lifetime. The majority of affected individuals experience more chronic symptoms that have a lasting effect and increase in severity over time (Kendler, Neale & Walsh, 1995; Goeree et al., 2005), including impaired functioning, social dysfunction, and financial and vocational problems (Hirsch & Weinberger, 2003). Though some individuals may experience periods of remission between episodes, many do not (Dunayevich, Sethuramen, Enerson, Taylor & Lin, 2006).

People with schizophrenia are affected by a number of comorbid diseases at higher rates than the general population (Carney, Jones & Woolson, 2006). Of particular interest is type 2 diabetes, which has been shown to be two to five times higher among persons with schizophrenia (Dixon et al., 2000; Suvisaari et al., 2007). Although the cause for this remains unclear, there has been a significant increase in research in the area, in particular since the introduction of second generation or atypical antipsychotics (which have been implicated in the increased risk of developing diabetes) (Citrome, Jaffe, Levine, Allingham & Robinson, 2004; Holt, Bushe & Citrome, 2005). In addition, the interaction between a

variety of traditional risk factors (e.g., age, sex, ethnic background and family history of diabetes) and increased genetic susceptibility may play a role in the high rate of diabetes among persons with schizophrenia. For example, a pathophysiological link between schizophrenia, lifestyle (e.g., diet high in saturated fat, increased smoking, and sedentary lifestyle) and diabetes is well recognized (Brown, Birtwhistle & Thompson, 1999; Citrome, Jaffe, Levine & Martello, 2006; Dixon et al., 2000).

Diabetes among the general population has been shown to impact many domains of quality of life and is associated with reduced life expectancy (Gu, Cowie & Harris, 1998). Schizophrenia has been termed a 'life shortening disease' as individuals often live 9-12 years fewer than the general population (Lambert, Velakoulis & Pantelis, 2003). Few studies have examined the interaction between diabetes and schizophrenia and the potential impact on quality of life.

The purpose of this study is to better understand the characteristics and needs of persons with schizophrenia and comorbid diabetes receiving inpatient psychiatric care. The personal, functional, clinical and social characteristics, and service utilization of persons with the comorbid conditions will be compared to persons with schizophrenia only. In addition, the impact of a diagnosis of diabetes on select measures of quality of life among persons with schizophrenia will be explored. It is hoped that the results of this study will provide a framework whereby persons with comorbid schizophrenia and diabetes would receive a more holistic plan of support services.

The first section of this literature review will focus on the epidemiology and prevalence of diabetes in the general population as well as among persons with

schizophrenia. The second section will describe the known characteristics of individuals with diabetes, again among both the general population and persons with schizophrenia. Third, current literature examining quality of life among persons with the comorbid conditions will be reviewed.

LITERATURE REVIEW

Part 1: Epidemiology and Prevalence of Diabetes

Overview of Diabetes

The World Health Organization (WHO) has described diabetes as "a condition primarily defined by the level of hyperglycemia giving rise to risk of microvascluar damage..." (WHO, 2006a, p.5), though it can also be described as "a failure to maintain a stable level of blood glucose in the face of the normal fluctuations of supply and demand" (Surridege & Nath, 2001, p.781). There are two primary forms of chronic diabetes, type I and type 2, where the pathogenesis of the two forms of diabetes is drastically different. There are two common factors related to the origin of type 2 diabetes, including a marked reduction in insulin secretion by the ß-cells of the pancreas as well as decreased insulin action (insulin resistance) by tissues of the body (DeFronzo, 1992). The progression to type 2 diabetes in individuals experiencing both insulin resistance and insulin secretion deficiencies has recently been confirmed in a cohort of Japanese individuals (Tokuyama, Ishizuka, Matsui, Egashira &Kanatsuka, 2008). The onset of type 2 diabetes occurs over the course of a number of years, and it is yet unknown the relative contribution of ß-cell dysfunction and insulin resistance; however, by the time hyperglycemia and frank diabetes occurs, both insulin resistance and impaired insulin secretion are present and detectable.

The onset of type 2 diabetes may occur 9-12 years before a diagnosis leading to a vast amount of macrovascular and microvascular degeneration and complications over this period of time (Harris, Klein, Welborn & Knuiman, 1992). Macrovascular damage occurs to the large blood vessels, such as the heart and aorta, and commonly leads to cardiovascular disease such as heart attacks, strokes and insufficient blood flow to the legs (WHO, n.d.). Microvascular damage occurs in the small blood vessels and commonly leads to complications including retinopathy (damage to the eyes, including blindness), nephropathy (damage to kidneys and renal failure), and neuropathy (damage to nerves leading to impotence and foot disorders) (WHO, n.d.). More recently, Nichols, Hillier and Brown (2007) found that the progression from impaired fasting glucose (IFG), a 'prediabetes' state, to diabetes occurs over the course of 3-6 years. Although IFG is detectable during this period before full onset, underdiagnosis occurs at phenomenal rates due to the lack of overt symptoms of type 2 diabetes, and thus a lack of screening (Botas, Delgado, Castano, 2003; Glaser, 1997; Jesudason, Leong, Dunstan & Wittert, 2003).

As current literature suggests that individuals with schizophrenia are affected by type 2 diabetes at rates two to five times that of the general population and diabetes has been demonstrated to negatively impact quality of life in the general population, the focus of this review will be on type 2 diabetes only. As the remainder of the paper will focus solely on type 2 diabetes, the term "diabetes" will henceforth refer to type 2 diabetes.

Prevalence of Diabetes

The prevalence of diagnosed diabetes in Canada in 1999/2000 was 5.1%, where approximately 90% have type 2 diabetes (Health Canada, 2003). Worldwide prevalence

rates of diabetes in 2000 were approximately 171 million for adults over the age of 20 (Wild, Roglic, Green, Sicree & King, 2004) and accounted for 5.2% of worldwide mortality (Roglic, Unwin, Bennett, Mathers & Toumilehto, 2005). Assuming age specific prevalence rates remain stable, Wild et al. (2004) project an estimated 366 million individuals worldwide will have diagnosed diabetes by the year 2030.

Prevalence rates of diabetes are particularly high in developed countries, with mortality rates due to diabetes reaching more than 8% in Canada and the US; while in developing countries, excess mortality rates are between 2 and 3% (Roglic et al., 2005). Type 2 diabetes is differentially expressed in a number of populations, who are considered to be at increased risk due to both increased genetic susceptibility as well as environmental risk factors. Caucasian individuals experience much lower prevalence rates of diabetes compared to individuals of Asian, African-American, Hispanic/Latino or Native American ethnicity; each of which are between 1.5 and 2 times more likely to be affected (Brancati, Kao, Folsom, Watson, & Szklo, 2000; McNeely & Boyko, 2004). Aside from ethnicity, the Canadian Diabetes Association (2003) recognizes individuals with schizophrenia and polycystic ovary syndrome to be at an increased risk of developing diabetes, regardless of the presence of traditional risk factors.

Prevalence of Diabetes among Individuals with Schizophrenia

Since as early as 1879 there has been a recognized increase in glucose abnormalities (including diabetes) among individuals with schizophrenia (Maudsley, 1879, as cited in Krosnick & Wilson, 2005). Sir Henry Maudsley commented in the 'Pathology of the Mind', that "[d]iabetes is a disease which often shows itself in families in which insanity prevails"

(Maudsley, 1879, as cited in Krosnick & Wilson, 2005, p. 320). Early studies confirmed the increased prevalence of diabetes and glucose abnormalities among individuals with schizophrenia; however, research methodologies were severely flawed in many cases with no use of controls, small samples and the utilization of retrospective data (Bushe & Holt, 2004). The definition of diabetes and schizophrenia were non-standardized and thus patient groups were not consistent between studies. The standardized criteria in the definition of both diabetes and schizophrenia has allowed for greater consistency between studies in recent years (Bushe & Holt, 2004).

Recent studies suggest a prevalence rate of diabetes among persons with schizophrenia that is between two and five times that of the general population (Mukherjee, Decina, Bocola, Saraceni, & Scapicchio, 1996; Dixon et al., 2000; Sernyak, Leslie, Alarcon, Losonczy & Rosenheck, 2002; Subramaniam, Chong, & Pek, 2003). The association between diabetes and schizophrenia has not been fully elucidated (Holt et al., 2005). The mechanism by which the increased prevalence occurs is multifactorial, with a mix of both genetic and environmental factors (Bellivier, 2005; Rouillon & Sorbara, 2005). Genetic susceptibility has been suggested as more than 30% of individuals with diabetes and schizophrenia have a family history of diabetes (Mukherjee, Schnur & Reddy, 1989). A recent study by Mathur, Law, Megson and Wei (2008) found a gene interaction in medicated patients with schizophrenia that leads to increased insulin resistance and may contribute to the development of diabetes. Environmental factors such as an unhealthy lifestyle, including poor diet, increased rates of smoking and little exercise (Brown et al., 1999) may also contribute to the increased rates of diabetes. There is a possible increased risk in individuals taking antipsychotic medications; however, the literature is inconsistent

as to the specific interaction between antipsychotics and diabetes. Cohen, Dekker, Peen & Gispen-de Wied, (2006) found that, irrespective of the type of antipsychotic (typical or atypical), individuals with schizophrenia were at a significantly increased risk of developing diabetes while others have found increased risk associated with particular types of atypical antipsychotics only (Citrome et al., 2004).

A recent study by Ryan, Collins and Thakore (2003) suggests an independent link between diabetes and schizophrenia. They found that a cohort of drug naïve, first episode persons with schizophrenia had increased insulin resistance and impaired fasting glucose tolerance with a prevalence of 15% compared to healthy controls that had no insulin resistance or impaired fasting glucose tolerance. These results have been replicated in a recent study involving a larger number of participants using randomized, double blind, controlled prospective methodology (Saddichha, Manjunatha, Ameen, & Akhtar, 2008).

Underdiagnosis of Diabetes among Individuals with Schizophrenia

In spite of a known increase in risk, diabetes often goes undetected among persons with schizophrenia. In a study conducted by Cohen, Stolk, Grobbee & Gispen-de Wied (2006) examining prevalence of diabetes among persons with schizophrenia receiving inpatient and outpatient care, 8% had previously known diabetes, while another 6.5% had undiagnosed diabetes, giving a total prevalence of 14.5% in the sample. Subramaniam et al. (2003) report that in a chart review of patients with schizophrenia in a long-stay facility, the prevalence of confirmed diabetes was 4.9%, while active screening revealed an overall prevalence rate of 16%. In a study examining the guidelines set by the American Diabetes Association for the diagnosis of diabetes in persons with schizophrenia, van Winkel et al.

(2006) found that less than half of the individuals with diabetes were successfully identified. Using a more thorough 2-step method proposed by the World Health Organization, 96.2% of individuals were successfully diagnosed.

Factors leading to the under recognition of diabetes in this population include a lack of knowledge by health care professionals, lack of consistent medical care, and the fact that persons with schizophrenia are often unable or unwilling to communicate symptoms of diabetes (Voruganti et al., 2007; Goldman, 1999).

Part 2: Characteristics of Individuals with Diabetes and Schizophrenia

Characteristics of Individuals with Diabetes Alone

The vast majority of studies to date have examined demographic and personal characteristics of individuals with diabetes. A set of 'traditional risk factors', including obesity, physical inactivity, unhealthy diet, cigarette smoking, family history of diabetes and age, have been recognized by the World Health Organization & International Diabetes Federation (2004) and the Canadian Diabetes Association (2003). The impact of these common characteristics, or risk factors, present in individuals with diabetes can have serious effects on functioning and quality of life. A number of studies have investigated characteristics of diabetes beyond the established demographic characteristics and risk factors, and include reports of psychosocial and social support.

Glasgow, Ruggiero, Eakin, Dryfoos & Chobanian (1997) conducted a large national study of characteristics of individuals with diabetes, including demographic, social and emotional factors. With a sample of 2,056 participants living in the US, the authors

examined the impact of these characteristics on three measures of quality of life: physical functioning, social functioning and mental health. They found that: females reported poorer overall quality of life than males; younger individuals reported less impairment in physical and social functioning, but greater impairments on mental health measures compared to older individuals; persons with lower educational attainment and lower income reported poorer health status; persons living alone reported poorer health status when compared to individuals living with at least one other person; and those with private insurance coverage had greater quality of life compared to persons with Medicare, Medicaid or no coverage. Glasgow et al. (1997) found that longer time since diagnosis of diabetes was associated with poorer physical and social functioning; and individuals reporting more complications, comorbid conditions (other than diabetes) and who had been hospitalized in the last year had lower quality of life. In an examination of the impact of self-management behaviours on quality of life scores, the authors found that healthier diet, more physical exercise and blood glucose testing improved mental health scores. Increased physical activity was also related to higher scores on physical and social functioning.

Kumari, Head and Marmot (2004) found that lower grades of employment were related to increased risk of developing diabetes, even after controlling for the traditional risk factors (BMI, smoking, family history of diabetes, ethnicity, exercise). Overweight, obesity, and lifestyle factors (e.g., poor diet, decreased physical activity) were associated with increased incidence of diabetes; smoking and social support was not found to affect diabetes. Tillotson and Smith (1996) found that, post diagnosis, increasing levels of social support predicted better diabetes regimen adherence and more favourable outcomes.

Maddigan, Feeny and Johnson (2005) found that individuals with diabetes were at increased risk for experiencing greater amounts of medical comorbidities. The number of medical comorbidities was significantly associated with lower quality of life in individuals with diabetes. They specifically examined the impact of heart disease, stroke and arthritis on quality of life in individuals with diabetes. They found that individuals with diabetes alone experienced lower quality of life compared to the general population and the combination of any of the comorbid conditions further impacted quality of life.

Peyrot et al. (2005) report on the results from an international study, with participants in 13 countries worldwide, on psychosocial problems that affect care in individuals with diabetes. They note the presence of psychological problems (depression, anxiety, stress and burnout) in the majority (61-72%) of persons with diabetes, while only 9-12% of individuals had received treatment for psychological problems over the last 5 years. The majority of individuals (41%) also report poor psychological well-being.

Depression has been highlighted as a significant issue in individuals with diabetes. Two meta-analyses examining clinically relevant depression among individuals with diabetes have been conducted and found that individuals with diabetes were 1.5-2 times as likely to experience depression than non-diabetic controls (Anderson, Freedland, Clouse & Lustman, 2001; Ali, Stone, Peters, Davies, & Khunti, 2006). Women with diabetes were found to experience significantly higher rates of depression (28%) than men (18%) (Anderson et al., 2001). Depression is shown to increase rates of morbidity and mortality, independent of health status (Wulsin, Vaillant, & Wells, 1999). It is also associated with overall reduced quality of life, and physical and social functioning (Egede, 2004). The link

between diabetes and depression is yet unknown. Talbot & Nouwen (2000) suggest that depression may in fact be a risk factor in the development of diabetes as depression often precedes the development of diabetes by a number of years.

Characteristics of Individuals with Schizophrenia and Comorbid Diabetes

Few studies have focused on the characteristics of individuals with schizophrenia and comorbid diabetes. The majority of studies that have been conducted have centered on the association between antipsychotics and diabetes (Bushe & Leonard, 2004; Citrome et al., 2004; Mackin, Watkinson & Young, 2005; Saddichha et al., 2008), and have been methodologically flawed; few have utilized case control methods to determine differences between individuals with the comorbid conditions and those with schizophrenia alone.

Of particular interest is a study conducted by Ascher-Svanum, Zhu, Ernst, Faries & Jacobson (2007) that examined the clinical and functional characteristics of individuals with the comorbid conditions and those of persons with schizophrenia only. The study, conducted over a three-year period, sought to determine whether the course of schizophrenia was affected by a diagnosis of diabetes. The study used a prospective naturalistic methodology and captured data from 6 locations across the United States, from a variety of treatment centers (i.e. community mental health center, university health care systems, community and state hospitals, and Department of Veterans Affairs (VA) Health Services). The total sample included 594 participants, with 76 individuals (12.8%) reporting a diagnosis of diabetes at study enrollment. The number of complications differed significantly, with 79 % of participating individuals with the comorbid conditions reporting at least 1 other comorbid condition, compared to 50% of individuals with

schizophrenia only. Only two functional and clinical outcomes differed significantly between the 2 groups over the course of 3 years; higher number of contacts with (non-psychiatrist) physicians and poorer overall health among those with the comorbid conditions. No differences were found in use of psychiatric services, severity of depressive or psychotic symptoms, quality of life and relationships.

In a large US national study examining data collected by the Schizophrenia Patient Outcomes Research Team (PORT) in 1991, Dixon et al. (2000) investigated the prevalence and correlates of diabetes in 14,182 persons with a diagnosis of schizophrenia. The rate of lifetime diabetes was 14.9% in this sample. Unlike the general population, where the prevalence of diabetes is higher in men, women were 2.1 times as likely to have diabetes. Ethnicity (i.e., African American or 'other'), increased age, lower educational attainment and marital status (i.e., ever having been married) were significantly associated with increased risk of lifetime diabetes. Subramaniam et al. (2003) report a prevalence rate of diabetes of 16% in persons with schizophrenia; however, they found no effect of sex, ethnicity or other clinical variables on the likelihood of developing diabetes.

Cohen et al. (2006) found that the age of onset of diabetes among a cohort of individuals with schizophrenia was significantly younger than is seen amongst the general population. The rate of previously known diabetes (8%) in individuals in the study, with a mean age of 41 years, is normally seen in individuals between the ages of 60 to 65 years in the general population. This suggests that there may be an early onset or aging effect that occurs in individuals with schizophrenia.

Medication adherence to both antipsychotic and hypoglycemic medication was measured in a cohort of individuals with schizophrenia and comorbid diabetes. Individuals were more likely to be non-adherent to hypoglycemic medication than antipsychotic medications (Piette, Heisler, Ganoczy, McCarthy, & Valenstein, 2007); there was only a moderate correlation between adherence to antipsychotic and hypoglycemic medications. As the principal focus of the study was not to measure differential medication adherence between individuals with and without diabetes, no control group (i.e., schizophrenia only) was utilized. However, in previous studies, non-adherence with antipsychotic medication has been associated with poor overall outcomes and higher risk for hospitalization (Law, Soumerai, Ross-Degnan, & Adams, 2008). Similarly, not adhering to diabetic medication has been associated with poorer overall outcomes, higher service utilization costs and increased rates of depression (Lin, Katon, Von Korff, et al., 2004; Balkrishnan, Rajagopalan, Camacho, et al., 2004).

Many studies, including those previously discussed (Ascher-Svanum et al., 2007; Dixon et al., 2000), have utilized self-report as a means to identify individuals with diabetes as screening is a time consuming and expensive process. It has been shown that diabetes goes seriously undiagnosed in individuals with schizophrenia and thus there may be individuals with diabetes in non-diabetes groups, resulting in inaccurate findings (Voruganti et al., 2007).

Part 3: Quality of Life

Measures of quality of life (QOL) have become increasingly important in aiding care planners in developing effective treatment strategies for individuals with schizophrenia

(Ruggeri et al., 2005). Although there is no standardized definition for QOL as it applies to individuals with serious mental illness, including individuals with schizophrenia, Lehman (1988) proposed quality of life (QOL) indicators be divided into two categories: (1) subjective, which measures a person's satisfaction with particular life domains or aspects of their well-being; and (2) objective or functional, which are comprised of observations of living conditions, functioning in daily living, participation in meaningful activities and interpersonal relationships (Hofer et al., 2004). Subjective measures of quality of life are commonly measured through self-report measures on life satisfaction (Voruganti, Heslegrave, Awad & Seeman, 1998). Positive, negative and depressive symptoms are associated with worse outcomes on subjective quality of life, as are certain socio-demographic factors including gender, age, educational attainment, employment status and living conditions (Caron, Mercier, Diaz & Martin, 2005; Narvaez, Twamley, McKibbin, Heaton & Patterson, 2008). No standard definition for positive and negative symptoms of schizophrenia exists; however, positive symptoms include delusions, hallucinations, and disorganized speech, while negative symptoms include flattened affect, alogia and avolition (Andreasen, Nopoulos, Schultz & Miller, 1994). Positive symptoms may be indicators of schizophrenia and contribute to initial hospitalization while negative symptoms contribute to psychosocial morbidity (Andreasen, Nopoulos, Schultz & Miller, 1994). Objective measures of quality of life may also be assessed via self-report, but are distinct from measures of life satisfaction and typically include measures of social involvement and activities, relationships, marital status, employment status, and living situation (Narvaez, Twamley, McKibbin, Heaton, & Patterson, 2008). Severity of psychiatric symptoms,

cognitive performance and functional capacity are often found to be correlated with objective measures of quality of life (Hofer et al., 2005; Palmer et al., 2002).

Watson, Clark and Tellegan (1988) proposed the use of positive and negative affect as indicators in measuring quality of life and subsequently developed the Positive and Negative Affect Schedule (PANAS) based on two, 10 point scales (Positive and Negative Affect). The authors found that Positive Affect (PA), or the extent to which a person feels enthusiastic, happy and active, was correlated with high self-reported life satisfaction whereas Negative Affect (NA) was associated with self-reported stress and poor coping (Watson, Clark and Tellegan, 1988). The inclusion of scales that incorporate measures of positive and negative affect is increasingly common in measuring quality of life among individuals with schizophrenia (Gaite et al., 2000).

Quality of life in individuals with schizophrenia or diabetes is lower when compared to the general population. Few measures of quality life have been consistently measured between individuals with schizophrenia and individuals with diabetes.

Quality of Life in Individuals with Schizophrenia

The quality of life of individuals with schizophrenia is impacted through the course of the disease itself as well as through many extraneous factors. Major determinants of quality of life in schizophrenia have been described as demographics, symptom severity, level of psychosocial functioning and the presence of medication side effects (Awad & Hogan, 1994). These are briefly described below.

Demographic Information

Browne et al. (1996) report that increasing age, which is often related to length of illness, is inversely related to scores on quality of life (i.e. older adults have poorer QOL scores). Although they report that gender was not significantly associated with General Well Being (GWB) scores, Norman, Malla, McLean, Voruganti, Cortese et al (2000) found that women had significantly higher scores on quality of life measures than did men. Norman et al. (2000) also report that individuals who were married scored higher on quality of life measures than those who were separated/divorced or who were never married; and that individuals living on their own or with family reported higher quality of life than those living in group or boarding homes.

Psychosocial Functioning

Ho et al. (1998) examined two overall measures of psychosocial functioning, levels of social adjustment and the Global Assessment Scale (GAS) as well as six other measures of psychosocial functioning in a two-year prospective study of persons with first episode schizophrenia. Nearly 60% of individuals experienced prominent to severe impairment of overall social adjustment, and nearly 50% of individuals met criteria for poor outcome based on GAS scores. Furthermore, individuals experienced difficulties with relationships with friends, were less likely to be employed, lost motivation to complete daily tasks and no longer enjoyed participating in recreational activities. Gainful employment was also associated with higher life satisfaction and self-esteem. A study conducted by Caron, Lecomte, Stip and Renaud (2005) found that levels of social support and quality of life measured were significantly related.

Symptom Severity

In a review of the literature on quality of life and schizophrenia, Pinikahana, Happell, Hope and Keks (2002) found that both the severity of symptoms and the type of symptom, negative, psychotic or disorganized, have been found to impact quality of life. Negative symptoms, as compared to positive or psychotic symptoms, are shown to have a more severe impact on quality of life (Hofer et al, 2004; Ho et al., 1998). Ho et al (1998) examined the relative impact on quality of life based on the presentation of psychotic, negative, or disorganized symptoms and found that negative symptoms were significantly associated with greater impact on quality of life at two-year follow up, with severity of the negative symptoms being correlated with a more severe impact on quality of life.

Medication Side Effects

Antipsychotics have proven to be effective in managing the symptoms of schizophrenia and are recommended as a first line of defense in the treatment of schizophrenia (Davis, Chen & Glick, 2003; Lehman et al., 2004). Second generation antipsychotics have been associated with fewer detrimental side effects and increasing quality of life over first generation antipsychotics (Awad & Voruganti, 2004). Lima et al. (2005) examined differences in quality of life between individuals taking first generation antipsychotics and olanzapine, a second generation antipsychotic, and found that patients taking olanzapine showed greater improvements in negative symptomatology and general psychopathology. However, there remain a number of side effects that significantly impact the quality of life of individuals with schizophrenia including: weight gain, metabolic abnormalities (insulin resistance, hyperglycemia, type 2 diabetes), and increased risk of

cardiovascular disease (Newcomer, 2007). Antipsychotics have also been associated with depression, sedation and diminished sexual desire, which are negatively correlated with quality of life (Hofer et al., 2004).

Weight gain is consistently reported in individuals taking antipsychotics, even over a short period of time (Hofer et al., 2004; Henderson, 2007). Allison, Mackell and McDonnell (2003) reported on the first large-scale study examining the association of weight gain and quality of life in people with schizophrenia. They found that nearly half the participants gained weight, with 25% of participants gaining a minimum of 10 pounds in the six months prior to the study. Greater amounts of weight gain were associated with lower quality of life scores, particularly poorer psychological well-being and self-reported general health.

The metabolic syndrome (characterized by the presence of three or more of the following risk factors: hypertension, dyslipidemia, impaired glucose tolerance, obesity, and insulin resistance/hyperinsulinemia) is a group of risk factors that have been identified in the development of cardiovascular disease (National Cholesterol Education Program Expert Panel, 2002). Atypical antipsychotics have been shown to increase the risk of developing the metabolic syndrome, a condition that often precedes the development of type 2 diabetes and cardiovascular disease (Newcomer, 2007; Saddichha et al., 2008). Saddichha et al. (2008) report prevalence rates of the metabolic syndrome up to 5 times higher in first episode schizophrenia patients compared to matched, healthy controls. Individuals with the metabolic syndrome are more likely to report fair or poor quality of

life, have a higher number of physically unhealthy days, mentally unhealthy days, and activity limited days in the 30 days prior to measurement (Ford & Li, 2008).

Quality of Life in Individuals with Diabetes

Improving the quality of life of individuals with diabetes has been recognized as a major public health initiative (Health Canada, 2002) as people with diabetes have a poorer quality of life compared to individuals without chronic disease (Rubin & Peyrot, 1999). In both the United States and Spain, studies have been conducted to determine trends in quality of life (Jiménez-Garcia, Jiménez-Trujilo, Hernanadez-Barrera,Carrasco-Garrido, Lopez, et al, 2008; Centers for Disease Control and Prevention (CDC), 2006). Over the course of 10 years, quality of life did not improve in the US or Spain for people with type 2 diabetes; two to three times as many individuals with diabetes report fair or poor overall quality of life when compared to the general population.

A number of determinants of quality of life have been identified in the literature and include: demographic information, psychosocial factors, and complications.

Demographic Information

Several studies have identified associations between demographic variables and quality of life in individuals with diabetes. Obesity (Wexler et al, 2006; Koopmanschap, 2002), older age (Wexler et al, 2006; Ghanbari, Yekta, Roushan, & Lakeh, 2005; Koopmanshap, 2002), smoking (CDC, 2006) and low socioeconomic status (Wexler, 2006) is consistently associated with lower quality of life. Higher educational attainment has

been shown to be associated with increased quality of life (CDC, 2006; Jimenez-Garcia et al., 2008).

The most consistently reported demographic factor associated with quality of life has been gender. Women with diabetes consistently report poorer quality of life than men (Jimenez-Garcia et al, 2008; Ghanbari, Yekta, Roushan, & Lakeh, 2005; Koopmanschap, 2002; Wexler et al, 2006). Goz, Karaoz, Goz, Ekz and Cetn (2005) report that men have self perceived higher levels of social support, which is correlated with improved quality of life. Rubin and Peyrot (1998) found that men reported lower burden of illness and greater treatment satisfaction than women.

Psychosocial Functioning

Rubin and Peyrot (1999) indicate that the most significant psychosocial determinants of quality of life were whether individuals felt more socially competent, received more practical support for diabetes management, and used active coping strategies. Higher levels of social support, self-efficacy, better social relations and fewer arguments with family were also found to increase quality of life for individuals with diabetes (Rubin and Peyrot, 1999).

Wexler et al. (2006) found that other than complications, depression was most strongly associated with reduced quality of life in persons with diabetes. This is particularly disconcerting, as individuals with diabetes have been identified as a high-risk group for depression (Anderson, Freedland, Clouse & Lustman, 2001). In a review of current literature on diabetes and quality of life, Rubin and Peyrot (1999) found that the number of complications was associated with higher rates of depression and anxiety.

Social support has been shown to exert a significant effect on quality of life (Goz et al., 2007). The presence of greater social support may subsequently improve metabolic control, self-management and psychosocial adjustment to diabetes (Goz et al., 2007). Low levels of social support are associated with poor physical functioning and emotional well-being.

Complications

The most severe impact on quality of life for individuals with diabetes is the presence of complications (Coffey et al., 2002). Blindness, dialysis, symptomatic neuropathy, foot ulcers, amputation, stroke, and congestive heart failure were associated with more substantial reductions in quality of life (Coffey et al, 2002). Both microvascular and macrovascular complications are associated with poorer quality of life; however, some studies report macrovascular complications are associated with even lower scores on indices of quality of life (Koopmanschap, 2002; U.K. Prospective Diabetes Study Group, 1999). The presence of both microvascular and macrovascular complications appears to compound the effects to reduce quality of life further (Koopmanschap, 2002).

Quality of Life in Individuals with Schizophrenia and Comorbid Diabetes

Quality of life of persons with schizophrenia and comorbid diabetes has been examined in a limited number of studies. Dixon et al. (2000) used a series of questions that examined self-rated physical health status, satisfaction with physical health, and overall satisfaction with life 'as a whole'. Individuals with diabetes that were not being treated reported the poorest health status, while persons with managed diabetes and those with

lifetime, but no current diabetes, rated health status marginally better. Individuals with schizophrenia and no diabetes reported the best physical health status.

Quality of life and physical health status is often associated with the presence of physical illnesses. Dixon et al (2000) report that individuals with schizophrenia and diabetes report a significantly higher number of comorbid conditions than those with schizophrenia and no diabetes. The conditions most commonly reported in individuals with diabetes and schizophrenia are: hypertension, heart problems, seizures, hearing problems, and vision problems. Coffey et al. (2002) previously reported that the presence of comorbid conditions in individuals with diabetes is a significant predictor of poorer quality of life.

Study Rationale

Diabetes has been shown to significantly impact quality of life in the general population (Glasgow et al., 1997), and its prevalence among persons with schizophrenia is two to five times higher than in the general population (Muhkerjee et al., 1996; Dixon et al., 2000; Sernyak et al., 2002; Subramaniam et al., 2003), though the prevalence is thought to be much higher (Cohen et al., 2006). The limited number of studies that have been conducted in this area have been inconsistent in demonstrating whether individuals with schizophrenia and comorbid diabetes differ significantly in terms of personal factors, functional and clinical characteristics, social involvement and service utilization. Nor have these studies consistently shown the impact of comorbid schizophrenia and diabetes on quality of life.

The quality of life of individuals with schizophrenia is already impacted through the course of the disease and given that a diagnosis of diabetes may further impact an individual's quality of life, further investigation is warranted. An examination of the various measures that differentiate individuals with schizophrenia and comorbid diabetes from those without diabetes may reveal areas in which clinicians could target in developing a more holistic plan of care. Determining specific areas that require greater focus in care planning may lead to improved quality of life for individuals with the comorbid conditions.

Study Objectives

1. To examine the personal factors, functional and clinical characteristics, social involvement and service utilization of individuals with a diagnosis of schizophrenia and comorbid diabetes compared to individuals with schizophrenia and no diabetes.
2. To determine the impact of a diagnosis of diabetes on select measures of quality of life among persons with schizophrenia.

Chapter 2: METHOD

Participants

In October 2005, the Ontario Ministry of Health and Long-term Care (MOHLTC) mandated the use of the Resident Assessment Instrument – Mental Health (RAI-MH) for all persons admitted to an inpatient psychiatric facility or designated mental health bed in a general hospital in Ontario, Canada. At that time, the MOHLTC also mandated the submission of all RAI-MH data to the Canadian Institute of Health Information's (CIHI) Ontario Mental Health Reporting System (OMHRS). The current analyses are based on RAI-MH admission assessments of all adults aged 18 years or more admitted to an inpatient psychiatric facility/bed between October of 2005 and June 2007 (N=39,724).

Access to the OMHRS dataset was provided through a data-sharing agreement between the Canadian Institute of Health Information (CIHI) and inter*RAI*. The Lakehead University Office of Research has provided ethics approval for secondary analyses of the anonymised dataset (REB Project #:016 07-08).

Instrument

inter*RAI*, a not for profit research network, has been instrumental in the creation of a number of RAI instruments that are currently being used in Canada and throughout the world in long-term, acute, and palliative care as well a number of other areas of clinical relevance where instruments are currently being developed and implemented (Steel et al., 2003; Hawes, Fries, James & Guihan, 2007). A consortium of individuals and stakeholders, including the JPPC Psychiatric Working Group (PWG) (a group of Ontario based

researchers) and inter*RAI* researchers from 5 countries completed development of the Resident Assessment Instrument–Mental Health (RAI-MH). The exhaustive process included: an extensive literature review; examination of previous RAI instruments as well as other applicable assessment instruments; consultations with front-line staff including psychiatrists, physicians, and nurses; expert working groups; and focus groups (Hirdes et al., 2002). The RAI-MH is an instrument designed to support care planning, quality improvement, outcome measurement and case-mix based payment systems (Hirdes et al., 2001).

The RAI-MH instrument was developed in accordance with previous RAI instruments, but was designed to specifically meet the needs of individuals over the age of 18 in a variety of psychiatric settings. The instrument is designed to provide a multitude of information to providers, stakeholders, researchers and policy developers and has been developed to assess function, physical and mental health, social supports and service use (Hirdes et al., 2001).

Through previous validity and reliability trials with other RAI instruments, criterion validity was established for scales embedded within the RAI-MH (Hirdes et al., 2002). Inter-rater reliability of the RAI-MH was completed in a trial whereby independent assessors, trained in the usage of the assessment instrument, twice evaluated a large sample of psychiatric inpatients in a variety of inpatient mental health settings across Ontario (Hirdes et al., 2002). Upon completion of the validity and reliability trials, a number of items were deleted or modified to increase simplicity and reduce coding complications. All items retained for the final version (2.0) of the RAI-MH demonstrate at least acceptable

levels of inter-rater reliability ($k \geq 0.40$), with many items demonstrating excellent validity with kappa values in excess of 0.70 (Hirdes et al., 2002). After the completion of a second reliability trial, the instrument was deemed ready for implementation for all inpatient psychiatry beds in Ontario beginning in October of 2005 (interRAI).

Clinical staff, trained in the usage of the Resident Assessment Instrument – Mental Health (RAI-MH), assess all individuals in an inpatient psychiatry bed in Ontario within 72 hours of admission.

Measures

Schizophrenia In the RAI-MH, the psychiatrist or attending physician provides a provisional diagnosis upon initial assessment utilizing the RAI-MH. Therefore, a diagnosis of schizophrenia was ascertained under the section 'psychiatric diagnostic information' within the diagnostic category 'Schizophrenia and other psychotic disorders'. The clinician completing the RAI-MH would rank up to three DSM-IV provisional diagnoses contributing to the individual's admission. Individuals who had a diagnosis of schizophrenia in any of these positions (one, two or three) were considered to have schizophrenia.

Diabetes In the RAI-MH diabetes is coded in the 'Health Conditions and Possible Medication Side Effects' section. Clinical assessors are asked to "code for all medical diagnoses that are currently subject to active treatment or monitoring" and are directed to the person's medical records or ICD-10-CA manual for the appropriate codes. Medical conditions are coded as either primary medical condition or other medical condition.

Developed by the World Health Organization, the International Statistical Classification of Diseases and Related Health Problems (10th revision) is a standard used in the coding and reporting of clinical diagnoses. The ICD-10-CA is a version of the coding system developed by the Canadian Institute for Health Information (CIHI), in consultation with a number of high profile physicians and over 100 reviewers, for the classification of morbidity tailored to the Canadian population (CIHI, 2001).

Diabetes is coded under the 'Endocrine, Nutritional and Metabolic Diseases'. As several versions of the ICD-10 manuals were used throughout the period of data collection, all codes for diabetes (E10-E14) were utilized to ascertain a diagnosis of diabetes (CIHI, 2003; WHO, 2007). Although this may include individuals with type 1 diabetes, rates of type 1 diabetes are typically below 10%, and even lower among individuals with schizophrenia (WHO, 2006a). A diagnosis of diabetes under the primary medical diagnosis or other relevant diagnosis categories was considered sufficient to be included in the diabetes group.

Personal Characteristics Personal characteristics examined include: age; sex; body mass index (BMI); marital status; employment status; economic trade-offs; educational attainment; prior living arrangement and residential status. Data for individuals under the age of 18 (n=105) were excluded from data analysis. To facilitate data interpretation, age was divided into categories: 18-34 years, 35-64 years and 65 years and older. *Body mass index* (BMI) was calculated by dividing the individuals body weight by the square of their height, giving a unit measure of kg/m^2 (Brown & Miller, 2006). A number of possible outliers were detected through review of the data on height, weight and BMI values.

Biologically implausible values for weight (less than 50lbs.) (n=23) and height (greater than 400 or less than 22 centimeters) (n=22) were set as missing. As recommended by the World Health Organization (WHO) Expert Committee on Physical Status (1995), cut-off values for BMI were set at 4 z-scores below the mean and 5 z-scores above the mean with extreme values set as missing. BMI was then divided into 4 categories to facilitate interpretation: BMI less than 20, between 20 and 25, between 25 and 30, and greater than 30. *Marital status* was combined to form two variables: individuals with a partner (married, partner/significant other) or no partner (never married, widowed, separated, divorced). *Employment status* was combined into two variables, employed or unemployed, with current employment status of 'other' or 'unknown', as coded in the RAI-MH, set as missing. *Economic trade-offs*, measured over the month prior to admission, include not purchasing medications, home heat, necessary health care or adequate food due to limited funds and was measured as no economic trade-offs in the 30 days prior to admission or individual made economic trade-offs in 30 days prior to admission. *Educational attainment* was grouped according to number of years of formal education: 0-8 years, 9-13 years and 14 or more years. *Living arrangement* prior to admission was grouped to form four categories: lived alone, lived with family, lived with others (not family) and lived in a group setting. *Prior residential status* was coded during assessment into one of twelve groups: private home/apartment, rented room, board and care/assisted living/group home/mental health residence, facility for those with intellectual disability, psychiatric hospital or unit, homeless (with or without shelter), long-term care facility (nursing home), rehabilitation unit/hospital, hospice, acute unit/hospital, correctional facility, and other.

Functional Characteristics Functional characteristics include cognitive status and self-care skills. *Cognitive functioning* is determined through an embedded scale – the Cognitive Performance Scale (CPS), which is based on short-term memory/recall abilities, daily-decision making skills, expression and self-performance in eating (Morris et al., 1994). Scores of cognitive performance are measured on a 7-point scale; from intact (0) and borderline intact (1), to mild (2), moderate (3), and moderate-severe impairment (4), to severe (5) and very severe impairment (6). *Self-care* is measured using the Activities of Daily Living (ADL) Self-Performance Hierarchy Scale as well as the Instrumental Activities of Daily Living (IADL) Summary Index. The Activities of Daily Living measured include: personal hygiene (ie. combing hair, brushing teeth, and shaving); walking; use of wheelchair; toilet use; and eating habits. The ADL-Hierarchy Scale aims to reflect the disablement process by differentiating early loss items (i.e. personal hygiene) from late loss items (i.e. eating) (Morris, Fries & Morris, 1999). An algorithm is used to compute a 7-point scale that differentially accounts for early loss items, which receive a lesser score, than late loss items. The scale computed based on the 4 items ranges from: the ability to perform the task independently (0), to supervision (1), to limited assistance (2), to extensive assistance 1 (3), to extensive assistance 2 (4) to dependent (5) and total dependence (6). The Instrumental Activities of Daily Living (IADL) Summary Index includes items on: meal preparation; performing ordinary housework; managing medications; transportation (ability to use public transportation, arrange other transportation or drives self); financial management; shopping; and use of telephone. Scores based on IADL activities are summative and range from 0 to 42, with higher scores reflecting greater difficulty in performing IADLs.

Clinical Characteristics Clinical characteristics examined include those related to both mental health and physical health. *Mental health* variables measured include; mental state indicators (including depression, positive and negative symptoms); behaviour disturbance; and Global Assessment of Functioning (GAF) scores. The Depression Rating Scale (DRS) is a summative scale, based on the presence of 7 items (negative statements, persistent anger, expressions of unrealistic fears, repetitive health complaints, repetitive anxious complaints, facial expression and crying or tearfulness), and is a clinical indicator of possible depression (Burrows, Morris, Simon, Hirdes & Phillips, 2000). Scores on the DRS range from 0 to 14, with scores of 3 or more indicating possible depression (Burrows et al., 2000). The Positive Symptoms Scale (PSS) is a summative scale that provides information on psychosis based on the presence of 4 items (hallucinations, command hallucinations and abnormal thought process/form) over the three day period prior to assessment. The scores on the PSS range between 0 and 8, with higher scores being representative of elevated levels of positive symptoms. The Negative Symptom Scale (NSS) is a summative scale that similarly provides information on withdrawal based on 4 items (anhedonia, loss of interest, lack of motivation, and reduced interaction) over the three days prior to assessment. The scores on the NSS range from 0 to 8, with higher scores representing elevated levels of negative symptomatology. Behavioural disturbances are measured based on the aggressive behaviour scale (ABS). Scores on the ABS are based on the occurrence of 4 items: verbal abuse, physical abuse, socially disruptive behaviour and resistance of care. The summative scores range from 0-12, where higher scores represent increased behaviour disturbance. Scores of 1 to 4 are indicative of mild to moderate aggressive behaviour, with scores of 5 or more indicating more severe aggressive behaviour. The

Global Assessment of Functioning (GAF) score ranges from 0-100, with lower scores representing decreased social, occupational and psychological functioning (DSM-IV-TR), and has been demonstrated to be a good measure of symptoms and social functioning in individuals with schizophrenia (Startup, Jackson and Bendix, 2002).

Physical health variables examined include: presence of various health conditions over the last 3 days (i.e. headache, dizziness or lightheadedness; shortness of breath; chest pain; blurred vision; dry mouth; increase or decrease in appetitive; urinary problems; nausea; vomiting; constipation; daytime drowsiness/sedation; fatigue/weakness; impaired balance; emergent conditions (i.e. fever, itch or rash); and edema); physical activity; vision; nutritional problems; extra pyramidal symptoms (i.e increase/decrease in motor activity and muscle contractions); sexual dysfunction; skin or food problems; pain; and presence of other medical diagnosis. Health conditions are measured on a 3-point scale ranging from indicator not exhibited in last 3 days (0) to exhibited on 1-2 of last 3 days (1) to exhibited on each of last 3 days (2). To facilitate data analysis, health conditions were collapsed into a dichotomous variable and recorded as exhibited in last three days (1 and 2) and not exhibited on any of the last 3 days (0). Data on physical activity, or stamina, was measured over the 3 days prior to assessment and was scored as: more than 2 hours (0), 1-2 hours (1), less than 1 hours (2) and none (3). Vision was scored on a five-point scale from adequate (0) to impaired (1), moderately impaired (2), highly impaired (3) and severely impaired (4). Vision ratings are conducted with the person utilizing normal aides (i.e., glasses, hearing aid, or other appliance). Vision was dichotomized to form two categories, adequate vision (0) and impaired vision (1-4). The presence of nutritional problems were assessed as: weight loss of 5% or more in the last 30 days or 10% or more in the last 180

days; weight gain of 5% or more in the last 30 days or 10% or more in the last 180 days; insufficient fluid, less than 1,000 cc per day; and noticeable decrease in the amount of food patient usually eats or fluid usually consumed in the last 3 days and coded as either no (0) or yes (1). Extra pyramidal symptoms were measured as either being present in the last 3 days (1) or not present during the last 3 days (0). Sexual dysfunction was measured as either being present (1) or not (0) through the person's report of persistent difficulty in sexual functioning in the past 30 days. Whether the person has experienced any skin or foot conditions over the past 30 days was recorded as no (0) or yes (1). The embedded Pain Scale (PS) utilizes two measures, frequency and intensity of pain over the previous 3 days, to derive a score ranging from 0-3 (Fries, Simon, Morris, Flodstrom & Bookstein, 2001). Scale scores indicate no pain (0), to less than daily pain (1), to daily pain but not severe (2), to severe daily pain (3). Presence of medical conditions currently subject to active treatment and monitoring were coded utilizing the ICD-10-CA standard. Medical conditions were combined into groups including: cardiopulmonary, neurological, musculoskeletal, gastrointestinal, infections and other conditions (see Appendix A). Summing the number of medical diagnoses was also completed to gauge the total number of medical conditions an individual had. Categories were formed for the number of medical diagnoses as no medical diagnosis, 1-2 medical diagnoses, and greater than 3 medical diagnosis.

Social Characteristics Social characteristics examined include: relationship with immediate family and presence of social supports (family/friends). Whether the person's *relationship with immediate family* members is disturbed or dysfunctional is scored as no belief that relationships are disturbed (0), only patient believes (1), family, friends and

others believe relationships are dysfunctional (2) or both patient and family/friends/others believe that relationships are dysfunctional. Presence of problems with social relationships is scored as either no problems (0) or problems (1). Whether the person has *social supports* (family/friends) who are willing to provide assistance with a number of activities including help with child care or dependents, supervision for personal safety, crisis support and support with ADLs or IADLS is examined. The presence of social supports is scored as being not needed (0), regular support (1), occasional support (2), or no support (3).

Medication Adherence Medication use and adherence data includes: history of adherence to medication; refusal to take prescribed medications; stopping psychotropic medication due to side effects; and use of acute control medications. *History of medication adherence* is measured over the month prior to admission and is scored as always adherent (0), adherent 80% of the time or more (1), adherent less than 80% of the time including failure to purchase prescribed medications (2), no medications prescribed (3) or unknown status (8). Records with unknown medication status or where individuals were not taking any medication were excluded. *Refusal to take some or all prescribed medication* was measured over the previous 3 days and was scored as no, did not refuse to take medication, (0) or yes, refused to take medications (1). Whether a patient *stopped taking psychotropic medication due to side effects* or intentionally misused medications (prescription or over-the-counter) in the previous 3 months was scored as no (0) or yes (1). The use of *acute control medications to prevent harm to self or others* was coded based on the number of times it had occurred over the previous 3 days. Therefore, if psychotropic dugs were used

as an immediate intervention 3 times, a code of 3 was entered. If medications were utilized more than 9 times in an acute manner, a code of 9 was entered.

Service Utilization Mental health service utilization was also assessed as part of the data analysis and included: number of recent and lifetime psychiatric admissions; time since last discharge; amount of time hospitalized (in a psychiatric unit in the past 2 years); time since last contact with community mental health agency or professional; and age at first hospitalization. Present service utilization will also be examined. This includes number of days having contact (of at least 15 minutes) over the previous 7 days or since admission with: psychiatrist, nurse practitioner or MD (non psychiatrist), social worker, psychologist or psychometrist, occupational therapist, recreation therapist, addiction counselor or dietician. In addition, the focus of interventions being provided to patients will be explored. The types of interventions measured include community reintegration, social/family functioning, psychological rehabilitation, detoxification, alcohol/drug treatment or smoking cessation, vocational counseling, anger management, eating disorder, behavioural management, post traumatic stress, pain management and alternative/non-traditional therapy.

Quality of Life

A number of select subjective and objective indicators of quality of life are found in the RAI-MH and include: self-rated health, quality of social relationships, social contacts and participation in meaningful activities. *Self-rated health*, a subjective indicator of quality of life, is assessed by asking the individual if he/she has poor health. The subsequent indicators are considered objective measures of quality of life. Measures of *quality of social*

relationships include: whether the person has a confidant; person is hostile or critical of family/friends; person is hostile or critical of other patients/staff; family/friends are hostile or critical of the person. *The presence of potential problems with social relationships* were measured as present (1) or not present (0). Two measures of *social contact* with family/friends are measured and include: visit by long standing social relation/family member and telephone or e-mail contact with long-standing social relation/family member. The length of time since a visit or telephone/e-mail is used to score contact with social relationships. The scores range from occurred within last 3 days (0), to occurred within last week (1), to occurred within last month (2), and to last occurred more than a month ago. *Participation in social activities of long standing interest* was measured and scored as above, utilizing length of time since last participation as an indicator of participation. A second meaningful activity considered in the RAI-MH is current employment status and is scored as employed (0), unemployed but seeking employment (1), unemployed and not seeking employment (2), other (3), or employment status unknown (4).

The Depression Rating Scale (DRS) includes many items (i.e. negative statements, persistent anger, expressions of unrealistic fears, repetitive health complaints, and repetitive anxious complaints) found in measures of Negative Affect (NA) and thus served as a proxy for Negative Affect.

Analysis

All individuals meeting inclusion criteria were profiled using descriptive statistics to provide a basic overview and features of the patient population. Characteristics of persons

with the comorbid conditions were compared to persons with schizophrenia and no diabetes using chi-square analysis and unpaired t-tests. Tests of normality were performed to determine whether ordinal and continuous data was normally distributed based on the Kolmogrov-Smirnov and Cramer-von Mises tests for normality. Data that was determined to be non-normal was analyzed using the Wilcoxon-Mann-Whitney test to compare groups.

Bivariate regression analyses were performed to examine the impact of diabetes on select measures of quality of life. Select variables that have been previously associated with a diagnosis of diabetes and those that were significant ($p<0.05$) were then entered into a multivariate logistic model that evaluated the impact of diabetes after controlling for potential confounders. Variables entered into the model included: age, gender, depression, positive symptoms, negative symptoms, marital status, number of health problems, physical activity and pain.

All tests were performed using a 2-sided α level of 0.05. This level of significance was used to ensure that the results were powerful given the large number of comparisons made while not excluding potentially significant results, which may occur with a lower α level. All data analysis was generated using SAS software, Version 9.1.3 Service Pack 2 of the SAS System for Windows. Only significant results ($p<0.05$) will be reported in the text.

Chapter 3: RESULTS

The entire data set consisted of 39,233 observations, of which 13,088 individuals (33.35%) had a diagnosis of schizophrenia or other psychotic disorder and 1863 individuals (4.75%) had a diagnosis of diabetes. Of persons with a diagnosis of schizophrenia, 630 individuals (4.81%) had a comorbid diagnosis of diabetes. Only records with a diagnosis of schizophrenia were retained for data analysis. Overall, individuals with schizophrenia consisted largely persons who were male (58.5%), single (83.1%), with a mean age of 42.1 years (± 15.3 years) and 9 to 13 years of education (56.1%).

Comparison of Personal Characteristics

As summarized in table 3.1, individuals with the comorbid conditions, as compared to individuals with no diabetes, were more often female (χ^2 [1] = 18.9; p<0.0001), over 35 years of age (χ^2 [2] = 278.0; p<0.0001), have a BMI greater than 25 (χ^2 [2] = 191.8; p<0.0001), be married/have a partner (χ^2 [1] = 9.9; p<0.01), unemployed (χ^2 [1] = 31.8; p<0.0001), have fewer years of formal education (χ^2 [2] = 39.3; p<0.0001), live in a group setting, but less likely to live with others (not family) (χ^2 [3] = 73.5; p<0.0001), and have resided in long-term care, acute unit/hospital, or board and care/assisted living/group home/mental health residence prior to admission (χ^2 [11] = 101.8; p<0.0001).

Table 3.1 *Comparison of Personal Characteristics between Individuals With and Without Diabetes, Percent Within Group (N)*

Characteristic	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Age, years					278.09 [2]	<0.0001
18-34	6.35	(40)	36.19	(4509)		
35-64	69.52	(438)	53.06	(6610)		
>64	24.13	(152)	10.75	(1339)		
Gender					18.88 [1]	<0.0001
Male	50.16	(316)	58.90	(7338)		
Female	49.84	(314)	41.10	(5120)		
BMI					191.83 [3]	<0.0001
<20	4.92	(31)	10.64	(1326)		
20-24	15.40	(97)	34.89	(4346)		
25-29	33.33	(210)	29.28	(3648)		
>30	46.35	(292)	25.29	(3138)		
Marital status					9.88 [1]	0.0017
Married/ partner/significant other	21.43	(135)	16.62	(2071)		
Single/widowed/separated/divorced	78.57	(495)	83.38	(10387)		
Employment status					31.80 [1]	<0.0001
Employed	5.63	(26)	15.14	(1501)		
Unemployed	94.37	(436)	84.86	(8416)		
Economic trade-offs					3.06[1]	ns
No trade off in last 30 days	95.40	(601)	93.67	(11669)		
Trade off in last 30 days	4.60	(29)	6.33	(789)		
Education, years					39.30 [2]	<0.0001
0-8	21.75	(117)	12.75	(1365)		
9-13	54.28	(292)	56.72	(6074)		
>14	23.98	(129)	30.53	(3269)		
Living arrangements					73.53 [3]	<0.0001
Lived alone	35.24	(222)	34.49	(4297)		
Lived with family	20.32	(128)	17.47	(2176)		
Lived with others (not family)	16.35	(103)	29.99	(3736)		
Lived in group setting	28.10	(177)	18.05	(2249)		

(table continues)

Characteristic	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Prior Residential Status					101.75[11]	<0.0001
Private home/apartment	59.52	(375)	68.78	(8569)		
Rented room	3.02	(19)	4.82	(600)		
Board and care/assisted living/group home/mental health residence	13.65	(86)	8.69	(1082)		
Facility for intellectual disability	0.48	(3)	0.26	(32)		
Psychiatric hospital of unit	4.29	(27)	3.13	(390)		
Homeless (with or without shelter)	3.49	(22)	4.93	(614)		
Long-term care facility	4.92	(31)	1.37	(171)		
Rehabilitation unit/hospital	0.00	(0)	0.08	(10)		
Hospice	0.00	(0)	0.10	(12)		
Acute unit/hospital	7.62	(48)	4.17	(519)		
Correctional facility	1.27	(8)	1.73	(216)		
Other	1.75	(11)	1.95	(243)		

Note: The employment status variable excludes records that identified as 'other' or 'unknown' employment status (diabetes = 168 (26.7%), no diabetes = 2,541 (20.4%)).

Comparison of Functional Characteristics

The Kolmogorov-Smirnov (KS) and Cramer-von Mises (CS) tests for normality (table 3.2) indicate that the Cognitive Performance Scale (CPS), the Activities of Daily Living (ADL) Hierarchy and Instrumental Activities of Daily Living (IADL) Summary Index are not normally distributed and thus the Wilcoxon-Mann-Whitney sign rank test was used to analyze these variables. The Wilcoxon-Mann-Whitney test (table 3.3) indicates that scores differ significantly between individuals with diabetes and without diabetes on the CPS (W = 4.75, p<0.0001), ADL (W = 4.95, p<0.0001) and the IADL (W = 7.92, p<0.0001). Individuals with the comorbid conditions had higher scores on the CPS, ADL and IADL scales when compared to individuals with no diabetes.

Table 3.2 *Test for Normality, Functional Characteristics*

	Kolmogorov-Smirnov		Cramer-von Mises	
Characteristic	Test Statistic	*P*-value	Test Statistic	*P*-value
Cognitive Performance Scale	0.274	<0.0100	213.31	<0.0050
Activities of Daily Living	0.455	<0.0100	597.88	<0.0050
Instrumental Activities of Daily Living	0.227	<0.0100	194.48	<0.0050

Table 3.3 *Wilcoxon-Mann-Whitney Sign Rank Test Examining Between Group (Diabetes, No Diabetes) Differences for Non-Normal Functional Characteristics*

			Wilcoxon-Mann-Whitney Test	
Characteristic	Diabetes (N=630)	No Diabetes (N=12,458)	Test statistic (*z*)	*P*-value
Cognitive Performance Scale			4.75	<0.0001
0-3	92.54 (583)	95.05 (11841)		
> 4	7.46 (47)	4.95 (617)		
Activities of Daily Living			4.95	<0.0001
0-2	90.48 (570)	93.22 (11613)		
>3	9.52 (60)	6.78 (845)		
Instrumental Activities of Daily Living			7.92	<0.0001
Mean (SD)	8.05 (8.73)	5.79 (7.83)		

Comparison of Clinical Characteristics

Mental Health Tests for normality indicate that measures of mental health, including the Depression Rating Scale (DRS), Positive Symptom Scale (PSS), Negative Symptom Scale (NSS), Aggressive Behaviour Scale (ABS), and the Global Assessment of Functioning (GAF) are not normally distributed (table 3.4). The Wilcoxon-Mann-Whitney test was therefore utilized and the results are presented in table 3.5, which indicates that scores on the Positive Symptom Scale (PSS) differ between individuals with and without diabetes ($W = -2.23$, $p<0.05$) and that individuals with diabetes experience lower levels of psychosis.

Table 3.4 *Test for Normality, Mental Health Characteristics*

	Kolmogorov-Smirnov		Cramer-von Mises	
Characteristic	Test Statistic	*P*-value	Test Statistic	*P*-value
Depression Rating Scale	0.176	<0.0100	65.3	<0.0050
Positive Symptom Scale	0.114	<0.0100	34.79	<0.0050
Negative Symptom Scale	0.222	<0.0100	120.9	<0.0050
Aggressive Behaviour Scale	0.323	<0.0100	273.63	<0.0050
Global Assessment of Functioning (GAF)	0.0937	<0.0100	15.14	<0.0050

Table 3.5 *Wilcoxon-Mann-Whitney Sign Rank Test Examining Between Group (Diabetes, No Diabetes) Differences of Select Mental Health Characteristics*

			Wilcoxon-Mann-Whitney Test	
Characteristic	Diabetes (N=630)	No Diabetes (N=12,458)	Test statistic (*z*)	*P*-value
Depression Rating Scale			-0.963	ns
0-2	58.25 (367)	55.86 (6959)		
>3	41.75 (263)	44.12 (5499)		
Positive Symptom Scale			-2.23	0.0255
0	26.51 (167)	21.96 (2736)		
>1	73.49 (463)	78.04 (9722)		
Negative Symptom Scale			-0.107	ns
0	41.11 (259)	40.18 (5006)		
>1	58.89 (371)	59.82 (7452)		
Aggressive Behaviour Scale			-0.346	ns
0	58.89 (371)	57.74 (7193)		
1-4	26.51 (167)	28.81 (3589)		
>5	14.60 (92)	13.45 (1676)		
Global Assessment of Functioning (GAF)			-0.37	ns
Mean (SD)	36.68 (14.91)	37.04 (15.85)		

Physical Health Table 3.6 provides statistics related to health conditions and indicates that individuals with diabetes are more likely to experience shortness of breath (χ^2 [1] = 26.65; p<0.0001), chest pain/pressure (χ^2 [1] = 4.32; p<0.05), blurred vision (χ^2 [1] = 4.61; p<0.05), difficulty urinating/frequent urination (χ^2 [1] = 10.74; p<0.01), impaired balance/ataxia (χ^2 [1] = 4.74; p<0.05) and edema (χ^2 [1] = 13.34; p<0.01).

Table 3.6 *Health Conditions Experienced by Individuals With and Without Diabetes in the Three Days Prior to Assessment, Percent Within Group (N)*

Health Condition	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Headache					0.091 [1]	ns
Not exhibited in last 3 days	90.16	(568)	90.52	(11277)		
Exhibited in last 3 days	9.84	(62)	9.48	(1181)		
Dizziness/vertigo or lightheadedness					2.98 [1]	ns
Not exhibited in last 3 days	91.59	(577)	93.35	(11630)		
Exhibited in last 3 days	8.41	(53)	6.65	(828)		
Shortness of breath					26.65 [1]	<0.0001
Not exhibited in last 3 days	92.70	(584)	96.61	(12036)		
Exhibited in last 3 days	7.30	(46)	3.39	(422)		
Chest pain/pressure					4.32 [1]	0.0377
Not exhibited in last 3 days	96.98	(611)	98.15	(12227)		
Exhibited in last 3 days	3.02	(19)	1.85	(231)		
Blurred Vision					4.61 [1]	0.0318
Not exhibited in last 3 days	95.71	(603)	97.18	(12107)		
Exhibited in last 3 days	4.29	(27)	2.82	(351)		
Dry mouth					0.36 [1]	ns
Not exhibited in last 3 days	90.48	(570)	89.79	(11179)		
Exhibited in last 3 days	9.52	(60)	10.21	(1279)		
Increase/decrease in normal appetite					2.47 [1]	ns
Not exhibited in last 3 days	88.73	(559)	86.55	(10782)		
Exhibited in last 3 days	11.27	(71)	13.45	(1676)		
Difficulty urinating/frequent urination					10.74 [1]	0.001
Not exhibited in last 3 days	95.40	(601)	97.52	(12149)		
Exhibited in last 3 days	4.60	(29)	2.48	(309)		
Nausea					0.076 [1]	ns
Not exhibited in last 3 days	96.51	(608)	96.71	(12048)		
Exhibited in last 3 days	3.49	(22)	3.29	(410)		
Vomiting					0.24 [1]	ns
Not exhibited in last 3 days	97.94	(617)	98.20	(12234)		
Exhibited in last 3 days	2.06	(13)	1.80	(224)		
Constipation					3.80 [1]	ns
Not exhibited in last 3 days	93.17	(587)	94.93	(11827)		
Exhibited in last 3 days	6.83	(43)	5.07	(631)		
Diarrhea					2.75 [1]	ns
Not exhibited in last 3 days	96.98	(611)	97.95	(12203)		
Exhibited in last 3 days	3.02	(19)	2.05	(255)		
Daytime drowsiness/sedation					1.97 [1]	ns
Not exhibited in last 3 days	84.44	(532)	82.26	(10248)		
Exhibited in last 3 days	15.56	(98)	17.74	(2210)		

(table continues)

Characteristic	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Fatigue/weakness					2.58 [1]	ns
Not exhibited in last 3 days	82.22	(518)	84.6	(10539)		
Exhibited in last 3 days	17.78	(112)	15.4	(1919)		
Impaired balance/ataxia					4.74 [1]	0.0294
Not exhibited in last 3 days	92.22	(581)	94.30	(11748)		
Exhibited in last 3 days	7.78	(49)	5.70	(710)		
Emergent conditions					0.43 [1]	ns
Not exhibited in last 3 days	97.30	(613)	97.70	(12172)		
Exhibited in last 3 days	2.70	(17)	2.30	(286)		
Edema					13.34 [1]	0.0003
Not exhibited in last 3 days	96.03	(605)	98.11	(12223)		
Exhibited in last 3 days	3.97	(25)	1.89	(235)		

Information on physical activity, vision, nutritional problems, extra pyramidal signs/symptoms, sexual functioning, skin or foot problems and pain are presented in table 3.7 and provide comparisons between individuals with diabetes and those without diabetes. Individuals with diabetes were more likely to engage in fewer than 2 hours of physical activity in the previous 3 days (χ^2 [3] = 25.38; p<0.0001), have impaired vision (χ^2 [1] = 32.31; p<0.0001), experience skin or foot problems (χ^2 [1] = 18.68; p<0.0001), and experience higher rates of pain ([3] = 16.06; p<0.01). Individuals with diabetes were also more likely to demonstrate decreased motor activity in the form of slow, shuffling gait (χ^2 [1] = 12.37; p<0.0001).

Table 3.7 *Analysis of Clinical Characteristics Related to Physical Health Comparing Individuals With and Without Diabetes, Percent Within Group (N)*

Characteristic	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Physical activity					25.38 [3]	<0.0001
More than 2 hours	38.41	(242)	48.47	(6039)		
1-2 hours	23.17	(146)	20.64	(2571)		
Less than 1 hour	22.22	(140)	17.81	(2219)		
None	16.19	(102)	13.08	(1629)		
Vision					32.31 [1]	<0.0001
Adequate	88.41	(557)	94.03	(11714)		
Impaired	11.59	(73)	5.97	(744)		
Nutritional Problems						
Weight Loss					0.29 [1]	ns
No	4.32	(564)	88.83	(11067)		
Yes	10.48	(66)	11.17	(1391)		
Weight Gain					0.74 [1]	ns
No	4.61	(603)	96.37	(12006)		
Yes	4.29	(27)	3.63	(452)		
Insufficient Fluids					1.30 [1]	ns
No	96.83	(610)	95.91	(11948)		
Yes	3.17	(20)	4.09	(510)		
Decrease in Food					3.48 [1]	ns
No	94.60	(596)	92.62	(11539)		
Yes	5.40	(34)	7.38	(919)		
Extra pyramidal symptoms						
Akathasia					0.078 [1]	ns
No	95.08	(588)	95.32	(11875)		
Yes	4.92	(31)	4.68	(583)		
Dyskinesia					3.58 [1]	ns
No	96.83	(610)	97.94	(12201)		
Yes	3.17	(20)	2.06	(257)		
Tremor					3.29 [1]	ns
No	94.29	(594)	95.79	(11933)		
Yes	5.71	(36)	4.21	(525)		
Rigidity					0.0005 [1]	ns
No	98.25	(619)	98.24	(12239)		
Yes	1.75	(11)	1.76	(219)		
Slow Shuffling Gait					12.37 [1]	0.0004
No	93.65	(590)	96.38	(12007)		
Yes	6.35	(40)	3.62	(451)		
Bradykinesia					0.52 [1]	ns
No	96.83	(610)	97.30	(12122)		
Yes	3.17	(20)	2.70	(336)		
Dystonia					0.16 [1]	ns
No	99.05	(624)	98.88	(12318)		
Yes	0.95	(6)	1.12	(140)		

(table continues)

Characteristic	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Sexual Functioning (last 30 days)					0.86 [1]	ns
No dysfunction	96.35	(607)	97.00	(12084)		
Dysfunction	3.65	(23)	3.00	(374)		
Skin or Foot Problems					18.68 [1]	<0.0001
No	86.67	(546)	91.62	(11414)		
Yes	13.33	(84)	8.38	(1044)		
Pain Scale (PS)					16.06 [3]	0.0011
No pain	80.48	(507)	85.12	(10604)		
Less than daily pain	8.89	(56)	8.07	(1005)		
Daily pain, not severe	9.37	(59)	5.68	(707)		
Severe daily pain	1.27	(8)	1.14	(142)		

Table 3.8 provides information on categories of medical conditions (see Appendix A). In comparison to individuals without diabetes, individuals with diabetes more often had a cardiopulmonary condition (χ^2 [1] = 414.02; p<0.0001), neurological condition (χ^2 [1] = 14.71; p<0.01), musculoskeletal condition (χ^2 [1] = 36.71; p<0.0001), gastrointestinal condition (χ^2 [1] = 12.49; p<0.01), or other condition (χ^2 [1] = 194.48; p<0.0001). Individuals with the comorbid conditions were also more likely to have a multitude of medical diagnoses than were individuals with schizophrenia only (χ^2 [2] = 332.76; p<0.0001).

Table 3.8 *Medical Diagnoses in Individuals With and Without Diabetes, Percent Within Group (N)*

Medical Diagnosis	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Cardiopulmonary	24.41	(179)	6.60	(822)	414.02 [1]	<0.0001
Neurological	4.44	(28)	2.13	(265)	14.71 [1]	0.0001
Musculoskeletal	5.40	(34)	1.89	(235)	36.71 [1]	<0.0001
Gastrointestinal	4.13	(26)	2.04	(254)	12.49 [1]	0.0004
Infection	0.95	(6)	1.58	(197)	1.55 [1]	0.213
Other	23.97	(151)	7.92	(987)	194.48 [1]	<0.0001
Total number of medical diagnoses					332.76 [2]	<0.0001
0	53.97	(340)	82.62	(10293)		
1-2	42.70	(269)	16.60	(2068)		
>3	3.33	(21)	0.78	(97)		

Comparison of Social Characteristics/Involvement

Table 3.9 provides information pertaining to social characteristics and involvement comparing individuals with diabetes to individuals without diabetes. With respect to social relationships, individuals with the comorbid conditions were more likely to report having a confidant (χ^2 [1] = 4.85; p<0.05). Friends/family of individuals with the comorbid conditions were less likely to report feeling overwhelmed by the patient's illness (χ^2 [1] = 7.94; p<0.01). In regards to the availability of social supports, individuals with diabetes are more likely to need supervision for personal safety, while having support occasionally (χ^2 [1] = 12.34; p<0.01), and need support with ADLs or IADLs, while having support occasionally (χ^2 [1] = 35.59; p<0.0001).

Table 3.9 *Social Characteristics and Involvement of Individuals With and Without Diabetes, Percent Within Group (N)*

Characteristic	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Family Roles					7.73 [3]	ns
Belief not present	69.34	(440)	65.41	(8149)		
Only Patient Believes	10.63	(67)	12.2	(1520)		
Family/friends/others believe	8.73	(55)	8.32	(1037)		
Both patient and others believe	10.79	(68)	14.06	(1752)		
Social Relationships						
Patient reports having no confidant					4.85 [1]	0.0280
No	84.44	(532)	80.92	(10081)		
Yes	15.56	(98)	19.08	(2377)		
Family/friends overwhelmed by patients illness					7.94 [1]	0.0048
No	65.4	(412)	59.76	(7445)		
Yes	34.6	(218)	40.24	(5013)		
Patient is hostile/critical towards family/friends					1.31 [1]	ns
No	84.13	(530)	82.35	(10259)		
Yes	15.87	(100)	17.65	(2199)		
Patient is hostile/critical towards other patients/staff					0.67 [1]	ns
No	88.57	(558)	89.6	(11162)		
Yes	11.43	(72)	10.4	(1296)		
Family/friends are hostile toward/critical of patient					0.050 [1]	ns
No	96.03	(605)	95.85	(11941)		
Yes	3.97	(25)	4.15	(517)		
Staff reports frustration in dealing with patient					0.898 [1]	ns
No	90.95	(573)	92.01	(11462)		
Yes	9.05	(57)	7.99	(996)		
Family/friends require unusual amount of facility/staff time					0.0022 [1]	ns
No	96.67	(609)	96.7	(12047)		
Yes	3.33	(21)	3.3	(411)		

(table continues)

Characteristic	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Available Social Supports						
Help with child care, other dependents					5.59 [1]	ns
Not needed	91.27	(575)	89.96	(11207)		
Occasional	3.02	(19)	4.83	(602)		
Regular	1.27	(8)	1.55	(193)		
No	4.44	(28)	3.66	(456)		
Supervision for personal safety					12.34 [1]	0.0063
Not needed	33.97	(214)	39.57	(4930)		
Occasional	29.52	(186)	25.18	(3137)		
Regular	22.86	(144)	23.91	(2979)		
No	13.65	(86)	11.33	(1412)		
Crisis support					5.83 [1]	ns
Not needed	25.08	(158)	24.71	(3078)		
Occasional	25.56	(161)	27.24	(3394)		
Regular	34.6	(218)	36.33	(4526)		
No	14.76	(93)	11.72	(1460)		
Support with ADLs or IADLs					35.59 [1]	<0.0001
Not needed	46.51	(293)	57.99	(7225)		
Occasional	22.22	(140)	15.61	(1945)		
Regular	18.1	(114)	15.39	(1917)		
No	13.17	(83)	11	(1371)		

Comparison of Medication Adherence

Table 3.10 provides information on medication adherence. Individuals with diabetes, compared to individuals with no diabetes, were less likely to have had psychotropic drugs used as an acute intervention over the 3 days prior to assessment (χ^2 [3] = 8.85; $p<0.05$).

Table 3.10 *History of Medication Use and Adherence Comparing Individuals With and Without Diabetes, Percent Within Group (N)*

Characteristic	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
History of medication adherence					1.28 [2]	ns
Always adherent	29.18	(164)	31.17	(3108)		
Adherent 80% of time or more	26.16	(147)	24.50	(2443)		
Adherent less than 80% of time	44.66	(251)	44.33	(4420)		
Medication refusal, last 3 days					0.023 [1]	ns
No, did not refuse medications	77.62	(489)	77.88	(9702)		
Yes, refused medications	22.38	(141)	22.12	(2756)		
Stopped taking psychotropics due to side effects, last 3 months					0.054 [1]	ns
No	82.70	(521)	83.06	(10347)		
Yes	17.30	(109)	16.94	(2111)		
Misused medication, last 3 months					2.15 [1]	ns
No, did not misuse medications	93.02	(586)	91.34	(11379)		
Yes, misused medications	6.98	(44)	8.66	(1079)		
Psychotropic medication used for acute control, last 3 days					8.85 [3]	0.031
0	81.90	(516)	76.80	(9568)		
1-5	15.71	(99)	20.03	(2495)		
6-8	1.43	(9)	1.92	(239)		
> 9	0.95	(6)	1.25	(156)		

Comparison of Service Utilization History

Data regarding past and present service utilization is presented in table 3.11. Persons with diabetes, in contrast to individuals without diabetes, were more likely to have experienced more than 6 lifetime psychiatric admissions (χ^2 [3] = 82.84; p<0.0001), had longer periods of time (χ^2 [4] = 33.33; p<0.0001), and had been admitted for longer periods of time (greater than 31 days) in the previous 2 years (χ^2 [3] =8.47; p<0.05). They were also more likely to have had contact with community mental health in the 30 days prior to admission (χ^2 [1] = 26.34; p<0.0001) and were more likely to be over the age of 25 at the time of their first overnight hospitalization in a psychiatric unit/hospital (χ^2 [2] = 73.74; p<0.0001).

Table 3.11 *Comparison of Past and Present Service Utilization History between Individuals With and Without Diabetes, Percent Within Group (N)*

Characteristic	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Number of recent psychiatric admissions, last 2 years					1.20 [2]	ns
0	44.44	(28)	45.51	(5670)		
1-2	38.25	(241)	36.18	(4507)		
>3	17.30	(109)	18.32	(2281)		
Number of psychiatric admissions, lifetime					82.84 [3]	<0.0001
0	14.13	(89)	23.29	(2914)		
1-3	30.00	(189)	33.75	(4204)		
4-5	14.92	(94)	17.48	(2178)		
>6	40.95	(258)	25.38	(3162)		
Time since last mental health admission					33.33 [4]	<0.0001
> 1 year	48.57	(306)	40.68	(5068)		
31 days - 1 year	29.21	(184)	26.91	(3352)		
< 30 days (from other facility)	4.76	(30)	5.47	(681)		
< 30 days (from same facility)	3.33	(21)	3.56	(443)		
Not applicable	14.13	(89)	23.39	(2914)		
Amount of time in psychiatric unit/hospital, last 2 years					8.47 [3]	0.0373
No admission in last 2 years	44.44	(280)	43.32	(5670)		
< 30 days	23.81	(150)	26.25	(3435)		
31 days - 1 year	26.67	(168)	21.36	(2796)		
> 1 year	5.08	(32)	4.26	(557)		
Time sine last contact with community mental health, last year					26.34 [2]	<0.0001
No contact in last year	30.95	(195)	41.11	(5121)		
31 days or more	21.75	(137)	19.62	(2444)		
30 days or less	47.3	(298)	39.28	(4893)		
Age at first overnight hospitalization in psychiatric unit/hospital					73.74 [2]	<0.0001
0-24	33.81	(213)	47.53	(5921)		
25-64	58.73	(370)	49.56	(6174)		
65+	7.46	(47)	2.91	(363)		

Table 3.12 provides information on the focus of intervention over the 7 days prior to assessment or since admission. Individuals with diabetes were less likely to have received interventions that focused on detoxification (χ^2 [1] = 7.39; p<0.01) and behavioural management (χ^2 [1] = 5.06; p<0.05), but were more likely to have received pain management (χ^2 [1] = 4.78; p<0.05) than individuals without diabetes.

Table 3.12 *Comparison of Major Focus of Interventions, in Seven Days Prior to Assessment or Since Admission if Less Than Seven Days, between Individuals With and Without Diabetes, Percent Within Group (N)*

Characteristic	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Community reintegration					0.101 [1]	ns
Not received	53.81	(339)	54.45	(6784)		
Received	46.19	(291)	45.55	(5674)		
Social/family functioning					0.878 [1]	ns
Not received	64.29	(405)	62.43	(7778)		
Received	35.71	(225)	37.57	(4680)		
Psychological rehabilitation					0.779 [1]	ns
Not received	57.94	(365)	59.70	(7438)		
Received	42.06	(265)	40.30	(5020)		
Detoxification						
Not received	97.78	(616)	95.50	(11898)	7.39 [1]	0.0066
Received	2.22	(14)	4.50	(560)		
Alcohol/smoking/drug treatment						
Not received	92.22	(581)	89.82	(11190)	3.82 [1]	ns
Received	7.78	(49)	10.18	(1268)		
Vocational counseling					0.359 [1]	ns
Not received	97.30	(613)	96.88	(12069)		
Received	2.70	(17)	3.12	(389)		
Anger management						
Not received	91.27	(575)	89.80	(11187)	1.43 [1]	ns
Received	8.73	(55)	10.20	(1271)		
Eating disorder					0.549 [1]	ns
Not received	98.73	(622)	98.35	(12252)		
Received	1.27	(8)	1.65	(206)		
Behavioural management					5.06 [1	0.0245
Not received	81.75	(515)	77.95	(9711)		
Received	18.25	(115)	22.05	(2747)		
Post-traumatic stress					0.163 [1]	ns
Not received	98.41	(620)	98.19	(12233)		
Received	1.59	(10)	1.81	(225)		
Pain management					4.78 [1]	0.0288
Not received	91.90	(579)	94.04	(11715)		
Received	8.10	(51)	5.96	(743)		
Alternative/non-traditional therapy					1.64 [1]	ns
Not received	97.30	(613)	98.03	(12213)		
Received	2.70	(17)	1.97	(245)		

Results of information collected on contact with formal care are presented in table 3.13. Individuals with the comorbid conditions, compared to individuals with schizophrenia only, were more likely to have had contact with a nurse practitioner or MD (non-psychiatrist) (χ^2 [2] = 32.77; p<0.0001), occupational therapist (χ^2 [2] = 7.75; p<0.05), recreational therapist (χ^2 [2] = 7.17; p<0.05) and dietician (χ^2 [2] = 55.06; p<0.0001).

Table 3.13 *Comparison of Number of Days of Formal Care, in Seven Days Prior to Assessment or Since Admission, between Individuals With and Without Diabetes, Percent Within Group (N)*

Characteristic	Diabetes (N=630)		No Diabetes (N=12,458)		χ^2 [df]	*P*-value
Psychiatrist					2.16 [2]	ns
0	5.87	(37)	5.25	(654)		
1-4	79.05	(498)	81.39	(10139)		
5-7	15.08	(95)	13.36	(1665)		
Nurse Practitioner of MD					32.77 [2]	<0.0001
0	41.11	(259)	52.66	(6560)		
1-4	55.56	(350)	44.17	(5503)		
5-7	3.33	(21)	3.17	(395)		
Social Worker					0.993 [2]	ns
0	48.41	(305)	50.19	(6253)		
1-4	47.30	(298)	46.03	(5734)		
5-7	4.29	(27)	3.78	(471)		
Psychologist or Psychometrist					0.0331 [2]	ns
0	93.97	(592)	93.93	(11702)		
1-4	5.56	(35)	5.54	(690)		
5-7	0.48	(2)	0.53	(66)		
Occupational Therapist					7.75 [2]	0.021
0	80.00	(504)	82.81	(10316)		
1-4	18.10	(114)	16.27	(2027)		
5-7	1.90	(12)	0.92	(115)		
Recreation Therapist					7.17 [2]	0.028
0	70.79	(446)	75.36	(9388)		
1-4	25.71	(162)	22.07	(2749)		
5-7	3.49	(22)	2.58	(321)		
Addiction Counselor					0.041 [2]	ns
0	98.25	(619)	98.15	(12227)		
1-4	1.59	(10)	1.69	(211)		
5-7	0.16	(1)	0.16	(20)		
Dietician					55.06 [2]	<0.0001
0	88.57	(558)	95.12	(11850)		
1-4	10.79	(68)	4.74	(590)		
5-7	0.63	(4)	0.14	(18)		

Quality of Life

Bivariate logistic regression was performed to assess the impact of diabetes on select quality of life indicators (table 3.14). On its own, diabetes was significantly related to: poor self-rated health (OR = 1.97, p <0.0001), having a confidant (OR: 0.78, p < 0.05), no visit from long standing social relation/family member in 30 days prior to assessment (OR: 1.34, p <0.01) and unemployment (OR: 2.99, p<0.0001).

Table 3.14 *Bivariate Logistic Regression of Quality of Life Indicators with Diabetes as Independent Predictor*

Quality of life indicator	β (SE)	Adjusted OR (95% CI)	*P*-value
Poor self-rated health	0.68 (0.099)	1.97 (1.63-2.40)	<0.0001
Patient reports having no confidant	-0.26 (0.11)	0.78 (0.63-0.97)	0.028
Patient is hostile towards family/friends	-0.13(0.11)	0.88 (0.71-1.1)	ns
Patient is hostile towards other patients/staff	0.11(0.13)	1.11 (0.86-1.43)	ns
Family/friends are hostile toward patient	-0.046 (0.21)	0.96 (0.63-1.44)	ns
No visit from social relation/family (last 30 days)	0.30 (0.097)	1.34 (1.11-1.62)	0.0023
No telephone or e-mail from social relation/family (last 30 days)	0.096 (0.11)	1.10 (0.89-1.36)	ns
Employment status (unemployed)	1.09 (0.20)	2.99 (2.00-4.46)	<0.0001
Depressive symptoms (Negative Affect)	-0.097 (0.083)	0.91 (0.77-1.07)	ns

Multivariate logistic regression was then performed for each of those four quality of life indicators while including possible confounding variables (i.e. age, gender, depression, positive symptoms (PSS), negative symptoms (NSS), marital status, number of physical health problems, amount of physical activity and pain). The results appear in tables 3.15 through 3.18.

Diabetes remained significantly related to poor self-rated health (OR: 1.61, p <0.001) when controlling for possible confounders (table 3.15). Covariates of poor self-rated health, along with diabetes, included: advanced age category (OR: 1.47, p <0.0001),

depression (OR: 1.63, p<0.0001), negative symptomatology (OR: 1.15, p <0.05), greater number of physical health problems (OR: 1.27, p<0.0001), lower amounts of physical activity (OR: 1.15, p<0.0001) and higher scores on the pain scale (OR: 1.94, p<0.0001).

Table 3.15 *Multivariate Logistic Regression Examining Independent Contribution of Diabetes on Self-Rated Health, Controlling for Possible Confounders*

Predictors	β (SE)	Wald's χ^2	*P*-value	Odds Ratio
Diabetes (0=no diabetes, 1=diabetes)	0.48 (0.11)	18.95	<0.0001	1.61
Age	0.38 (0.045)	72.59	<0.0001	1.47
Gender (0=female, 1=male)	0.011 (0.058)	0.03	ns	1.01
Depression (0-2, >3)	0.49 (0.060)	65.89	<0.0001	1.63
Positive Symptoms (0-5, >6)	-0.060 (0.059)	1.04	ns	0.94
Negative Symptoms (0-5, >6)	0.14 (0.060)	5.03	0.0248	1.15
Marital Status (0=single, 1=partner)	0.082 (0.073)	1.27	ns	1.09
Number of Health Problems	0.24 (0.014)	298.38	<0.0001	1.27
Physical Activity	0.14 (0.025)	30.99	<0.0001	1.15
Pain	0.66 (0.036)	346.05	<0.0001	1.94

Individuals with diabetes were significantly more likely to report having a confidant (OR: 1.27, p<0.05) than were individuals without diabetes (table 3.16). A number of other factors were also associated with individuals reporting having no confidant, including: depression (OR: 1.30, p<0.0001), positive symptomatology (OR: 1.16, p<0.01), negative symptomatology (OR: 1.34, p<0.0001), being married/partnered (OR: 1.53, p<0.0001), greater number of health problems (OR: 1.05, p<0.0001) and higher scores on the pain scale (OR: 1.09, p<0.05).

Table 3.16 *Multivariate Logistic Regression Examining Independent Contribution of Diabetes on Patients Report of Having a Confidant, Controlling for Possible Confounders*

Predictors	β (SE)	Wald's χ^2	*P*-value	Odds Ratio
Diabetes (0=no diabetes, 1=diabetes)	-0.24 (0.11)	4.34	0.0371	0.79
Age	0.014 (0.037)	0.15	ns	1.01
Gender (0=female, 1=male)	0.067 (0.048)	1.96	ns	1.07
Depression (0-2, >3)	0.27 (0.049)	29.89	<0.0001	1.30
Positive Symptoms (0-5, >6)	0.15 (0.047)	10.11	0.0015	1.16
Negative Symptoms (0-5, >6)	0.29 (0.049)	35.88	<0.0001	1.34
Marital Status (0=single, 1=partner)	0.43 (0.067)	39.97	<0.0001	1.53
Number of Health Problems	0.052 (0.013)	15.34	<0.0001	1.05
Physical Activity	-0.012 (0.013)	0.30	ns	0.99
Pain	0.088 (0.034)	5.69	0.0171	1.09

When controlling for possible confounders the association between diabetes and visit from a long-standing social relation/family member, the independent association between and having no visit in the 30 days prior to assessment was lost (table 3.17).

Table 3.17 *Multivariate Logistic Regression Examining Independent Contribution of Diabetes on Social Relationship as Measured by Visit from Long-standing Social Relation/Family Member (No Visit in Past 30 Days), Controlling for Possible Confounders*

Predictors	β (SE)	Wald's χ^2	*P*-value	Odds Ratio
Diabetes (0=no diabetes, 1=diabetes)	0.13 (0.10)	1.77	ns	1.14
Age	0.46 (0.037)	154.64	<0.0001	1.59
Gender (0=female, 1=male)	0.36 (0.050)	53.16	<0.0001	1.44
Depression (0-2, >3)	-0.22 (0.050)	20.12	<0.0001	0.80
Positive Symptoms (0-5, >6)	0.042 (0.049)	0.74	ns	1.04
Negative Symptoms (0-5, >6)	0.022 (0.052)	0.18	ns	1.02
Marital Status (0=single, 1=partner)	0.89 (0.076)	134.93	<0.0001	2.43
Number of Health Problems	-0.029 (0.015)	3.40	ns	0.97
Physical Activity	0.18 (0.021)	73.23	<0.0001	1.19
Pain	0.068 (0.039)	3.08	ns	1.07

Diabetes retained a significant association with unemployment (table 3.18) (OR:2.64, p<0.0001) when controlling for possible confounders. Age (OR: 1.52, p<0.0001), gender (being male) (OR: 0.85, p<0.01), depression (OR:0.87, p<0.05), marital status (OR:

3.21, p<0.0001), number of health problems (OR: 0.96, p<0.05) and physical activity (OR: 1.12, p<0.0001) were also significantly associated with unemployment.

Tables 3.18 *Multivariate Logistic Regression Examining Independent Contribution of Diabetes on Unemployment, Controlling for Possible Confounders*

Predictors	β (SE)	Wald's χ^2	*P*-value	Odds Ratio
Diabetes (0=no diabetes, 1=diabetes)	0.97 (0.21)	21.99	<0.0001	2.64
Age	0.42 (0.051)	68.43	<0.0001	1.52
Gender (0=female, 1=male)	-0.16 (0.062)	6.66	0.0098	0.85
Depression (0-2, >3)	-0.14 (0.061)	5.31	0.0211	0.87
Positive Symptoms (0-5, >6)	0.026 (0.061)	0.18	ns	1.03
Negative Symptoms (0-5, >6)	0.082 (0.065)	1.61	ns	1.09
Marital Status (0=single, 1=partner)	1.17 (0.068)	290.18	<0.0001	3.21
Number of Health Problems	-0.037 (0.018)	4.41	0.0358	0.96
Physical Activity	0.11 (0.027)	17.24	<0.0001	1.12
Pain	0.096 (0.054)	3.20	ns	1.1

Chapter 4: DISCUSSION

The purpose of this study was to determine whether individuals with schizophrenia and comorbid diabetes differ in terms of personal factors, functional and clinical characteristics, social involvement and service utilization from individuals with schizophrenia only. Among individuals with schizophrenia, comorbid diabetes had a prevalence rate of 4.75%, which is much lower than has been previously reported. For example, Muhkerjee, Decina, Bocola, Saraceni & Scapicchio (1996) report a rate of 15.8% among an inpatient population in Italy, while Dixon et al. (2000) report rates of between 9 and 15% among individuals in usual care. In the RAI-MH, diabetes is coded under 'Medical diagnosis relevant to patient's status', and is intended to capture information on medical diseases that are relevant to the persons stay or to their self-care status. However, only conditions that are subject to active treatment are recorded in this section. It is possible that a diagnosis of diabetes, if not currently subject to active treatment via medication, may be overlooked and thus not recorded leading to lower than expected prevalence. Also, no screening was performed to detect a diagnosis of diabetes beyond what was captured in the RAI-MH and thus many individuals may have diabetes that is undetected (Cohen et al., 2006).

Personal Characteristics

A number of personal characteristics were found to be more prevalent among persons with a comorbid diagnosis of diabetes. Persons with comorbid diabetes, as compared to persons without diabetes, were more often female, which is consistent with previous findings among individuals with schizophrenia (Dixon et al., 2000; Narayan,

Boyle, Thompson, Sorensen, & Williamson, 2003). Individuals in the diabetes group were more likely to be over the age of 35, which is also consistent with the later onset of type 2 diabetes (Koopman, Mainous, Diaz, & Geesey, 2005). Individuals with diabetes were significantly more likely to have a BMI in the overweight/or obese category (based on WHO (2006b) recommendations for the classification of BMI). Although individuals with schizophrenia or diabetes alone are at an increased risk for being overweight/obese, the compounding effects of the co-morbid conditions, through lifestyle and clinical symptoms, may contribute to excess body weight and the increased rates of overweight/obesity (Coodin, 2001; Schienkiewitz, Schulze, Hoffmann, Kroke, & Boeing, 2006). Care-planners should ensure that individuals with diabetes are receiving appropriate interventions to aid in weight loss as they are at greater risk for a number of poor outcomes, such as reduced physical and mental health quality of life (Dickerson et al., 2008) and poorer self-rated health status (Dixon et al., 2000).

In concordance with results of a study by Ascher-Scanum et al. (2007), individuals with diabetes were less likely to identify as being single. The reasons as to why individuals with the comorbid conditions are more likely to have a partner were not studied within the contexts of this paper. However, women were over-represented among individuals with the co-morbid conditions and onset of schizophrenia generally occurs later among women, while symptoms among women with early onset schizophrenia are commonly less severe (Dickerson, 2007). The possibility of later onset or less severe symptoms of schizophrenia in early life among women may explain the increased rates of marriage and partnerships among individuals with comorbid diabetes. Furthermore, individuals with comorbid

diabetes were found to experience lower levels of psychosis (positive symptoms), which may allow them to function more easily in social settings or with a partner.

Unemployment rates among individuals with the comorbid conditions were significantly higher than among individuals without diabetes, with nearly 95% of persons with diabetes being unemployed. A number of possible explanations exist which may explain the lower rates of employment, including the older age of the diabetes group, poorer cognitive functioning, impaired self-care and the higher number of medical comorbidities experienced by these individuals (Von Korff et al., 2005). Persons with comorbid diabetes were more likely to have seen an occupational therapist, but were only equally as likely as individuals without diabetes to have received vocational counseling. Future research should focus on whether increased rates of vocational counseling for individuals with schizophrenia and comorbid diabetes can help these individuals return to work.

It was somewhat surprising that individuals with diabetes had fewer years of formal education as type 2 diabetes does not generally onset until after the time when individuals would have completed their education (Koopman, Mainous, Diaz & Geesey, 2005). The lower number of years of education may be associated with risk factors for diabetes, such as lower socio-economic status, smoking and a general unhealthy lifestyle, which are associated with fewer years of educational attainment (Robbins, Vaccarino, Zhang, & Kasl 2005). Persons with diabetes were less likely to reside in a private home or apartment and were more likely to live in a group home/mental health residence/assisted living facility or

long-term care facility. This may be due to the older age of individuals with diabetes and their need for care with daily activities.

Functional Characteristics

Individuals with diabetes were more likely to score higher (poorer functioning) on the Cognitive Performance Scale (CPS). Literature on the association of diabetes and cognitive functioning suggests a link between poorer overall cognitive functioning and a diagnosis of diabetes (Cukierman, Gerstein, & Williamson, 2005). It has also been suggested that comorbid conditions, insulin resistance, and hyper/hypoglycaemia play a role in deleterious scores on cognitive functioning in individuals with diabetes (Kodl, & Seaquist, 2008). Research suggests that maintaining tight control over blood glucose levels and insulin levels, through diet, exercise and pharmacological interventions, can improve cognitive functioning in individuals with type 2 diabetes (Ryan et al., 2006).

Lower cognitive performance has been linked to impairments in physical functioning such as activities of daily living or instrumental activities of daily living so it is not surprising that the comorbid group had greater levels of dependence on the Activities of Daily Living Hierarchy Scale and the Instrumental Activities of Daily Living Summary Index (Rosano et al., 2005). Reduced functioning on these scales may also be attributed to greater amounts of medical comorbidities, such as cardiopulmonary or musculoskeletal disorders which can reduce functioning and are more prevalent in individuals with diabetes (Wray, Ofstedal, Langa, & Blaum, 2005). Addressing medical comorbidities, through treatment and prevention strategies may aid in both the cognitive and physical functioning of individuals with diabetes.

Clinical Characteristics

Mental Health Of the mental health characteristics examined, only measures on the Positive Symptom Scale differed between individuals with and without diabetes. Individuals with diabetes experienced fewer positive symptoms in the days prior to assessment. Schultz, Miller, Oliver, Arndt, Flaum and Andreasen, (1997) found that age was negatively associated with severity of positive symptoms but not associated with severity of negative symptoms. The older age of individuals with diabetes and schizophrenia may explain the difference in positive symptoms compared to those with schizophrenia alone, who tend to be significantly younger. Future analyses that consider the role of age in this relationship are needed.

Physical Health In the 3 days prior to assessment, individuals with diabetes were more likely to experience a number of health problems such as shortness of breath, chest pain, blurred vision and vision problems, skin or foot problems and frequent urination. Many of these symptoms may be attributed to diabetes itself, and are common among individuals with diabetes alone in the general population (Clark, Fox, & Grandy, 2007). Along with signs and symptoms of physical health problems, individuals with diabetes were more likely to have a diagnosed cardiopulmonary, musculoskeletal, neurological, gastrointestinal or other medical condition. This is consistent with the PORT study conducted by Dixon et al. (2000) and Ascher-Svanum et al. (2007) who found individuals with diabetes had a greater number of health conditions than did individuals with schizophrenia alone. These conditions are largely attributable to the disease course of diabetes, which can contribute to both microvascular and macrovascular diseases that

include the above-mentioned conditions and may in turn contribute to the signs and symptoms of health problems (WHO, n.d.). The presence of any medical comorbidity has an impact on the quality of life of individuals with diabetes in the general population, and when multiple complications are present, quality of life is impacted even further (Coffey et al., 2002; Koopmanschap, 2002). The rate of medical comorbidities is significantly higher among individuals with diabetes, with 46.03% having at least one medical diagnosis other than diabetes, while only 17.38% of individuals with schizophrenia had one or more medical diagnosis. Although it is not feasible to suggest the reduction of medical comorbidities after they occur, proper treatment and care upon admission may aid in reducing further complications. It is encouraging to note that individuals with the comorbid conditions were more likely to see a nurse practitioner or MD (other than psychiatrist) in the 7 days prior to assessment, which may be an indication that their physical health status, including diabetes, is being monitored. Preventive measures should be further investigated among this population as research suggests that early detection of diabetes is highly treatable, even reversible, and significantly reduces the chances of developing medical complications (De Hert et al., 2006).

Individuals with diabetes were more likely than individuals without diabetes to exhibit signs of decreased motor activity in the form of slow shuffling gait. Diabetes has been previously associated with gait disturbances in the general population and has been associated with other symptoms of diabetes such as issues with feet and ankles as well as neuropathy (Arvanitakis, 2004; Mueller, Minor, Sahrmann, Schaff & Strube, 1994). Individuals who exhibit signs of gait disturbance are more likely to injure themselves while performing simple tasks such as walking, standing and sitting (Mueller, Minor, Sahrmann,

Schaff & Strube, 1994). Again, preventing, addressing and treating symptoms of diabetes may aid in reducing the possibility of injury and also the autonomy of individuals in performing ADLs and IADLs by reducing the incidence of decreased motor activity among individuals with diabetes.

Krein, Heisler, Piette, Makki and Kerr (2005) found that nearly 60% of individuals with diabetes report chronic pain. Although the present study found lower rates of pain (approximately 19.5%), individuals with diabetes experienced pain more frequently/severely than did individuals without diabetes. Experiencing pain is associated with poorer self-management of diabetes, difficulty following an exercise routine and eating plan, all of which contributes to increased risk of developing diabetic complications (Krein et al., 2005). The comorbid group was also less likely to have performed physical activity in the days prior to assessment. It is encouraging to note, however, that individuals with diabetes were more likely to have received pain management and more days of contact with a recreation therapist and dietician since admission. These intervention strategies may aid in reducing the effects of pain on diabetes self-management, increase the amount of time performing physical activity and aid individuals in eating a healthy, balanced diet leading to a lower chance of individuals developing health complications.

Social Characteristics/ Involvement

In this study, the family and/or friends of persons with diabetes were less likely to feel overwhelmed by the patient's illness. This is somewhat surprising given the extra care required by individuals with diabetes, as patients with diabetes also identify as requiring supervision with personal safety and support with ADLs and IADLs. The question,

however, refers to the patient's 'illness', which may have been taken to refer to schizophrenia rather than diabetes. Individuals with the comorbid conditions tend to have fewer positive symptoms, which may translate into easier interactions with the individual.

Service Utilization History (Past and Present)

Individuals with comorbid diabetes were older than those without diabetes during their first overnight hospitalization in a psychiatric unit but experienced more lifetime psychiatric admissions and were admitted for more time in the past 2 years compared to persons without diabetes. However, they generally experienced longer times between admissions than did people without diabetes. Although no data was available on the reason for each previous admission, it is somewhat surprising that individuals with diabetes would have a greater number of psychiatric admissions, as they appear to experience less severe symptoms of schizophrenia, which may explain the longer times between admissions. As individuals with diabetes were older and experienced more medical complications, the likelihood of an individual in this group being hospitalized is independently increased. This group did, however, experience more cognitive impairments and reduced ability to perform self-care skills which may impact their ability to care for themselves in the community, even with only mild mental health symptoms.

Individuals with diabetes were more likely to have had recent contact with community mental health. This may be a by-product of having a partner and more extensive social network that could remind them of scheduled meetings with community mental health workers. It may also stem from the increased comorbidity and complexity of their illness, which may require additional follow-up.

The focus of interventions for individuals with the comorbid conditions differed in three domains. Individuals with diabetes were less likely to have received detoxification, behavioural management and were more likely to have received pain management. This suggests that individuals with diabetes and schizophrenia are less likely to experience or be admitted for problems concerning drugs or alcohol as compared to individuals with schizophrenia only. Although scores on the aggressive behaviour scale (ABS) showed no significant difference, reasons for the increased number of interventions in this domain among individuals with schizophrenia may be due to increased severity of psychotic symptoms and validated by the increased use of antipsychotics as acute control measures among individuals with schizophrenia only. Differences in the administration of pain management have been previously addressed.

As discussed earlier, seeing a nurse practitioner or MD was significantly associated with membership in the comorbid group; Ascher-Svanum et al. (2007) reported similar findings. This is most likely attributed to either the diagnosis of diabetes itself or with complications (i.e. cardiopulmonary, neurological or other conditions) arising from a diagnosis of diabetes.

Quality of Life

In the RAI-MH only one measure of subjective quality of life is incorporated and consists of the individual's self-rated health. Individuals with diabetes were found to be 1.6 times more likely to rate their own health as being poor compared to individuals without diabetes, even after controlling for possible confounding variables. The findings here are consistent with the small amount of research that has been conducted on quality of life in

individuals with comorbid diabetes and schizophrenia, and more specifically self-rated health (Dixon et al., 2000).

Previous research also suggests that rating physical health status as poor is linked to greater amounts of medical comorbidities (Ascher-Svanum et al., 2007; Dixon et al., 2000). This is in agreement with the present results that found that individuals with diabetes were more likely have cardiopulmonary, neurological, musculoskeletal, gastrointestinal and other medical diagnosis. Individuals with diabetes were also more likely to report a number of physical health problems upon admission including: shortness of breath, chest pain, difficulty or frequent urination, edema and skin or foot problems, all of which may contribute to lower self-rated health.

Addressing issues related to physical health status upon admission should be considered a priority for individuals with comorbid diabetes. Women are more likely to have diabetes among this population and research has shown that women with diabetes are more likely to report a greater burden of illness and lower treatment satisfaction (Rubin & Peyrot, 1998). Every effort should be made to address potential physical health problems to maintain a high-level of treatment satisfaction, in regards to both an individuals psychiatric diagnosis as well as other medical conditions, for all individuals, especially women, in an effort to increase their perceived health status and quality of life.

When examining objective measures of quality of life, initially three measures were significant in the bivariate analysis. However, after controlling for possible confounders, the impact of diabetes on whether an individual had received a visit in the last 30 days from a long-standing social relation or family member lost significance. Two objective

quality of life indicators remained significant after adjusting for potentially biasing variables. Individuals with diabetes were more likely to report having a confidant and were nearly three times as likely to be unemployed compared to individuals with schizophrenia only.

Individuals with diabetes may be more likely to report having a confidant, as they are also more likely to identify as being married or having a partner, an individual who may act as a confidant. Rosenfeld and Wenzel (1997) found that whether an individual reports having a confidant or not, as well as the strength of their social relationships has a significant impact on the quality of life of individuals with serious mental illness. In this respect, it appears that individuals with diabetes, through reasons that are largely unknown, are more likely to have someone within their social network who they consider a confidant and thus an increased sense of quality of life relative to this measure of social relationships. As no global scale of quality of life was available in the RAI-MH, it is impossible to tell the relative contribution of having a confidant to overall measures of quality of life.

It is not surprising that individuals with diabetes experience significantly higher rates of unemployment given that previous studies have shown that, among the general population, individuals with diabetes are more likely to be unemployed or experience greater amounts of lost productive time when employed (Stewart, Ricci, Chee, Hirsch, & Brandenburg, 2007). Individuals who exhibit common symptoms of diabetes are more likely to report unemployment status than those with diabetes without symptoms (Stewart et al., 2007). As diabetes is significantly associated with greater numbers of physical health

problems in this population, the association with unemployment seems very plausible. However, the association between unemployment and an individual having both diabetes and schizophrenia is particularly strong. As symptoms of diabetes may be exacerbated by a diagnosis of schizophrenia, the possibility exists that a compounding effect exists in individuals with the comorbid conditions as both diabetes and schizophrenia are independently associated with greater risks of unemployment among the general population (Ho et al., 1998; Stewart et al., 2007).

Gainful employment has been associated with increased quality of life among individuals with diabetes and also among individuals with schizophrenia (Ho et al., 1998; Wexler et al., 2006). Individuals with diabetes were more likely to have had contact with an occupational therapist since admission; however, the actual difference between those with and without diabetes was small and neither group received much contact with an occupational therapist. As has been previously discussed, individuals with comorbid diabetes, compared to individuals with no diabetes, were only equally as likely to have received vocational rehabilitation although the staggeringly high rates of unemployment among this group suggests they are more in need of vocational interventions. Given the association of unemployment with detriments to quality of life, individuals with diabetes should be considered priority candidates for occupational therapy and vocational rehabilitation upon successful stabilization of symptoms related to admission.

Limitations

There are several limitations to this research study. Similar to many previous studies (Asher-Svanum et al., 2007; Dixon et al., 2000) a diagnosis of diabetes was

ascertained through medical records or self-report. No further testing was conducted to determine whether an individual had diabetes or not. As such a low prevalence rate of diabetes was observed in this population, individuals with undiagnosed diabetes may have been incorporated into the 'no diabetes' or schizophrenia only group, thus biasing the comparison results. Further, due to the nature of the coding for diabetes within the RAI-MH, with only conditions subject to current active treatment or that are relevant to the patients stay being coded, only diabetes of the more severe forms may have been coded. This would reduce the power of the diabetes group, as it may not be representative of the true population of individuals with diabetes receiving inpatient care, rather it may be representative of individuals with more severe forms of diabetes.

A great interest in the possible effects of second-generation anti-psychotics on the development of diabetes has been aroused since their widespread use began in the 1990's (Bushe & Leonard, 2004; Citrome et al., 2004). Although a medication section is present within the RAI-MH, its use was not mandated upon initial implementation of the instrument in 2005. As such, no investigation of the association of second-generation anti-psychotics within this inpatient population was possible.

In the present research study, no comparison was completed between the general psychiatric population or individuals with diabetes and no mental illness. As such, it is impossible to determine whether the findings are unique to individuals with diabetes and schizophrenia. It is also impossible to determine the relative impact of diabetes among individuals with schizophrenia, compared to diabetes in combination with other mental illnesses. Although the inclusion of a control group (schizophrenia only) is a significant

advantage over previous findings, future studies should include a group of individuals with diabetes only and with diabetes among the general psychiatric population.

Although the RAI-MH provides a substantial amount of information that is useful in care planning, quality improvement and many other domains of health care support, the present study was limited by the information contained within the instrument. Examining quality of life among individuals with comorbid schizophrenia and diabetes was identified as an objective of the present study; however, few measures of quality of life are present within the instrument and none have been validated for use as quality of life indicators. That said, there are measures within the RAI-MH that are strikingly similar to measures that have been identified previously (Hofer et al., 2004; Watson, Clark and Tellegan, 1988) as indicators of quality of life. It would be pertinent to investigate the development of a valid and reliable quality of life scale based on the inclusion of items within the RAI-MH.

The RAI-MH also did not include information on age of diagnosis, for either schizophrenia or diabetes. As length of time since diagnosis for either condition may affect both severity of symptoms and probability of complications, knowing the age of onset would be useful in establishing length of time with the respective disease. Knowing the age at onset for both diseases would allow for the investigation of time course; whether a diagnosis of diabetes preceded a diagnosis of schizophrenia or vice versa among this population.

Although no service utilization costs were analyzed in this study due to a lack of data available in the RAI-MH, Dixon et al. (2000) report that service utilization costs were significantly higher among individuals with co-occurring diabetes and schizophrenia. It is

conceivable that health care costs associated with diabetes among this group would also be considerably higher due to the number of lifetime hospitalizations, the length of time hospitalized, and treatment of medical complications while hospitalized. Future studies should focus on determining the service utilization costs and means to address disparities in these costs among individuals with schizophrenia and co-morbid diabetes, as the costs would appear to be significantly higher.

The present research has identified many personal factors, clinical and functional characteristics, areas of social involvement and service utilization history in which individuals with schizophrenia and comorbid diabetes differ from individuals with schizophrenia only. It is possible, through the extensive number of variables examined that by chance a difference between groups was observed when in fact there was no difference. However, this should not significantly impact the many striking differences that have been identified through this study.

Implications for Public Health

The health of individuals is significantly compromised by a diagnosis of schizophrenia and is further impacted by a diagnosis of diabetes as has been demonstrated through the present research study. The prevalence rates of comorbid diabetes among individuals with schizophrenia are known to be two to five times higher than the general population; however, the current study found rates comparable to rates among the general population. Changes must occur in a number of core areas to ensure that the prevalence of diabetes is reduced in individuals with schizophrenia and that the quality of life is

improved and the impact of a diagnosis of diabetes is lessened in individuals who do develop diabetes.

The Canadian Diabetes Association (CDA) (2003) has included schizophrenia as a risk factor for developing diabetes in its current clinical practice. The website of the CDA has sections specifically devoted to understanding and managing diabetes for Aboriginal individuals (CDA, 2008); however, no information is targeted to individuals with mental illness, a group afflicted with similarly high rates of diabetes. An increase in resources, for individuals with mental illness, and more specifically schizophrenia, should be investigated. For instance, a section devoted to individuals with mental illness on the CDA website may aid in calling attention to the increased risk, the unique risk factors, methods for managing these risk factors, and resources (i.e. support groups, exercise classes, dieticians) available to individuals with mental illness.

The rates of under-detection of diabetes in individuals with schizophrenia are extremely high (Voruganti et al., 2007). The present study suggests rates of less than 5%, while some studies suggest rates of up to 19% among individuals with schizophrenia (Mukherjee et al., 1996; Subramaniam, Chong & Pek, 2003). The identification of pre-diabetes, or heightened risk for the development of diabetes is crucial in this population as full diabetes may be preventable, or even reversible (De Hert et al., 2006). Screening for diabetes and pre-diabetes should therefore be a priority among individuals with schizophrenia. Educating physicians and clinicians about the increased risk for diabetes and the potential benefits to screening is thus highly recommended.

Future research needs to be done in a number of areas to determine the best ways in which diabetes can be prevented and managed in this population. For instance, the reasons as to why individuals with diabetes experience more hospitalizations with longer stays may reveal areas in which care planners could focus their efforts to reduce the burden of comorbid diabetes among individuals with schizophrenia. Second, conventional interventions for diabetes do not necessarily meet the needs of individuals with mental illness. A number of studies suggest that diabetes can be prevented or delayed for individuals in the general population in the pre-diabetes state by making lifestyle interventions in combination with pharmacotherapy, such as metformin or insulin resistance inhibitors (Padwal, Majumdar, Johnson, Varney & McAlister, 2005;Yamaoka & Tango, 2005); however, research is only now beginning on methods for preventing the progression to diabetes in individuals with schizophrenia.

The *Diabetes Prevention Program in Schizophrenia* (n.d.), a program being investigated through a five-year prospective, controlled trial sponsored in part by Hamilton Health Sciences and McMaster Univerity, seeks to extend current diabetes prevention strategies to meet the needs of individuals with schizophrenia. The program includes early interventions such as healthy eating habits, regular moderate exercise and pharmacotherapy targeted to individuals with schizophrenia who are in the pre-diabetes stage and at high risk for developing frank diabetes. The aim of the program is to impact modifiable risk factors in an effort to reduce overall incidence of diabetes. As individuals with the comorbid conditions suffer from poorer overall outcomes and poorer self-rated health, targeting diabetes before full onset would appear to be the most effective way in improving outcomes for individuals with schizophrenia who are at risk for developing

diabetes. The results of the *Diabetes Prevention Program in Schizophrenia,* in combination with further research, may indicate the most effective intervention methods for reducing incidence of diabetes among persons with schizophrenia.

Conclusion

Overall, individuals with comorbid diabetes and schizophrenia share many common characteristics of individuals with diabetes among the general population. Care-planners for persons with diabetes entering a mental health facility/bed should ensure that normal practices for managing diabetes among the general population are not over looked during treatment of their psychiatric diagnosis. Practices such as close monitoring of the individuals blood glucose levels, ensuring they are getting ample amounts of exercise, are eating a healthy balanced diet, pain management techniques are being implemented and ensuring that any complications are being closely monitored to ensure the severity of the physical health problems do not worsen are all extremely important in managing diabetes. Individuals with diabetes should also be seen by a physician regularly while being treated, see an occupational and recreation therapist and be offered vocational rehabilitation to guide the individual in engaging in meaningful activities such as employment and physical activity. In combination, these recommendations will aid in improving the quality of life of individuals living with schizophrenia and co-morbid diabetes. Care planners should be particularly attentive to the needs of individuals with schizophrenia entering a psychiatric facility or mental health bed who have a diagnosis of diabetes as the comorbid conditions may have a cumulative effect which may compound the effects of diabetes with those of schizophrenia.

Beyond monitoring individuals who initially identify with diabetes, a movement towards intensive screening for diabetes among individuals with schizophrenia must be made due to the overwhelming amount of literature which suggests a link between diabetes and schizophrenia which may lead to the substantially increased rates of diabetes among individuals with schizophrenia. Early detection of diabetes is essential to proper treatment and may help to reduce the many disparities identified in the present study, especially concerning the high number of co-morbid conditions and lower subjective and objective quality of life experienced by individuals with comorbid diabetes.

REFERENCES

Ali, S., Stone, M. A., Peters, J. L., Davies, M. J., & Khunti, K. (2006). The prevalence of co-morbid depression in adults with Type 2 diabetes: a systematic review and meta-analysis. *Diabetic Medicine, 23*(11), 1165-1173.

Allison, D. B., Mackell, J. A., & McDonnell, D. D. (2003). The impact of weight gain on quality of life among persons with schizophrenia. *Psychiatric Services,54*, 565-567.

Andreasen, N. C., Nopoulos, P., Schultz, S., & Miller, D. (1994). Positive and negative symptoms of schizophrenia: past, present, and future. *Acta Psychiatrica Scandinavic,. 90*(*Supp* 384), 51-59.

Anderson, R.J., Freedland, K.E., Clouse, R.E., & Lustman, P.J. (2001). The prevalence of comorbid depression in adults with diabetes: a meta-analysis. *Diabetes Care, 24*(6), 1069-78.

Arvanitakis, Z., Wilson, R. S., Schneider, J. A., Bienias, J. L., Evans, D. A., & Bennett, D. A. (2004). Diabetes mellitus and progression of rigidity and gait disturbance in older persons. *Neurology, 63*(6), 996-1001.

Ascher-Svanum, H., Zhu, B., Ernst, F. R., Faries, D. E., Jacobson, J. G., & Doebbeling, C. C. (2007). The 3-year clinical and functional course of schizophrenia among individuals with and without diabetes at study entry. *The Journal Of Clinical Psychiatry, 9*(2), 122-128.

Awad, A. G., & Voruganti, L. N. P. (2004). New antipsychotics, compliance, quality of life, and subjective tolerability-are patients better off? *Canadian Journal Of Psychiatry, 49*, 297-302.

Awad, A.G., & Hogan, T.P. (1994). Subjective response to neuroleptics and quality of life: implications for treatment outcome. *Acta Psychiatrica Scandanavia, 89*(Supp 380), 27-31.

Balkrishnan, R., Rajagopalan, R., Camacho, F. T., Huston, S. A., Murray, F. T., & Anderson, R. T. (2003). Predictors of medication adherence and associated health care costs in an older population with type 2 diabetes mellitus: A longitudinal cohort study. *Clinical Therapeutics, 25*(11), 2958-2971.

Bellivier, F. (2005). Schizophrenia, antipsychotics and diabetes: Genetic aspects. *European Psychiatry, 20*, S335-S339.

Berren, M.R., Santiago, J.M., Zent, M.R., & Carbone, C.P. (1999). Health care utilization by persons with severe and persistent mental illness. *Psychiatric Services, 50*(4), 559-560.

Botas, P., Delgado, E., Castano, G., Diaz de Grenu, C., Prieto, J., & Diaz-Cadorniga, F. J. (2003). Comparison of the diagnostic criteria for diabetes mellitus, WHO-1985, ADA-1997 and WHO-1999 in the adult population of Asturias (Spain). *Diabetic Medicine, 20,* 904–908

Brancati, F. L., Kao, W. H., Folsom, A. R., Watson, R. L., & Szklo, M. (2000). Incident type 2 diabetes mellitus in african american and white adults: the atherosclerosis risk in communities study. *Journal of the American Medical Association, 283,* 2253-2259.

Brown, S., Birtwistle, J., Roe, L., & Thompson, C. (1999). The unhealthy lifestyle of people with schizophrenia. *Psychological Medicine, 29*(3), 697-701.

Brown, S., & Miller, C. (2006). *Exercise physiology: Basis of human movement in health and disease.* United States: Lippincott Williams & Wilkins.

Brown, S., Roe, M., Lane, A., Gervin, M., Morris, M., Kinsella, A., et al. (1996). Quality of life in schizophrenia: relationship to sociodemographic factors, symptomatology and tardive dyskinesia. *Acta Psychiatrica Scandinavica, 94*(2), 118-124.

Burrows, A. B., Morris, J. N., Simon, S. E., Hirdes, J. P., & Phillips, C. (2000). Development of a Minimum Data Set-based depression rating scale for use in nursing homes. *Age and Ageing, 29,* 165-172.

Bushe, C. & Leonard, B. (2004). Association between atypical antipsychotic agents and type 2 diabetes: review of prospective clinical data. *The British Journal of Psychiatry - Supplement, 47,* 87-93.

Canadian Diabetes Association (CDA) (2003). Canadian Diabetes Association 2003 clinical practice guidelines for the prevention and management of diabetes in Canada. *Canadian Journal of Diabetes, 27*(2), S1-S153.

Canadian Diabetes Association (CDA). (2008). *Aboriginal Information.* Retrieved July 14, 2008, from http://www.diabetes.ca/aboriginal/index.asp

Canadian Institute for Health Information (CIHI). (2001). *Final report: the Canadian enhancement of ICD-10.* Ottawa: Canadian Institute for Health Information.

Canadian Institute for Health Information (CIHI). (2003). *International Statistical Classification of Diseases and Health Related Problems, 10th Revision, ICD-10-CA.* Ottawa: Canadian Institute for Health Information.

Caron, J., Lecomte, Y., Stip, E., & Renaud, S. (2005). Predictors of quality of life in schizophrenia. *Community Mental Health Journal, 4* (4), 399-417.

Caron, J., Mercier, C. l., Diaz, P., & Martin, A. (2005). Socio-demographic and clinical predictors of quality of life in patients with schizophrenia or schizo-affective disorder. *Psychiatry Research. 137*(3), 203-213.

Centers for Disease Control and Prevention (CDC). (2006). Self-rated fair or poor health among adults with diabetes-United States, 1996-2005. *Morbidity and Mortality Weekly Report, 55*(45), 1224-7.

Citrome, L., Jaffe, A., Levine, J., Allingham, B., & Robinson, J. (2004). Relationship between antipsychotic medication treatment and new cases of diabetes among psychiatric inpatients. *Psychiatric Services, 55*(9), 1006-1013.

Clark, N. G., Fox, K. M., & Grandy, S. (2007). Symptoms of diabetes and their association with the risk and presence of diabetes: findings from the study to help improve early evaluation and management of risk factors leading to diabetes (SHIELD). *Diabetes Care. 30*(11), 2868.

Coffey, J.T., Brandle, M., Zhou, H., Marriott, D., Burke, R., Tabaei, B.P., et al. (2002). Valuing health-related quality of life in diabetes. *Diabetes Care, 25*(12), 2238-43.

Cohen, D., Dekker, J. J., Peen, J., & Gispen-de Wied, C. C. (2006). Prevalence of diabetes mellitus in chronic schizophrenic inpatients in relation to long-term antipsychotic treatment. *European Neuropsychopharmacology, 16*(3), 187-194.

Cohen, D., Stolk, R.P., Grobbee, D.E., & Gispen-de Wied, C.C. (2006). Hyperglycemia and diabetes in patients with schizophrenia or schizoaffective disorders. *Diabetes Care, 29*(4), 786-91.

Coodin, S. (2001). Body mass index in persons with schizophrenia. *Canadian Journal of Psychiatry, 46*(6), 549-555.

Cukierman, T., Gerstein, H. C., & Williamson, J. D. (2005). Cognitive decline and dementia in diabetes - systematic overview of prospective observational studies. *Diabetologia, 48*(12), 2460-2469.

Davis, J. M., Chen, N., & Glick, I. D. (2003). A meta-analysis of the efficacy of second-generation antipsychotics. *Archives Of General Psychiatry, 60*, 553-564.

De Hert, M., Hanssens, L., van Winkel, R., et al. (2006). Reversibility of antipsychotic treatment–related diabetes in patients with schizophrenia. *Diabetes Care, 29*, 2329-2330.

DeFronzo, R.A. (1992). Pathogenesis of type 2 (non-insulin-dependent) diabetes mellitus: a balanced overview. *Diabetologia, 35*, 389-397.

Dickerson, F. B. (2007). Women, Aging, and Schizophrenia. *Journal of Women and Aging. 19*(1/2), 49-62.

Dickerson, F., Brown, C. H., Fang, L., Goldberg, R. W., Kreyenbuhl, J., Wohlheiter, K., et al. (2008). Quality of life in individuals with serious mental illness and type 2 diabetes. *Psychosomatics, 49*(2), 109.

Diabetes Prevention Program in Schizophrenia [DPPS] (n.d.). *Diabetes prevention program in schizophrenia.* Retrieved July 14, 2008, from http://www.dpps.info/index.php

Dixon, L., Weiden, P., Delahanty, J., Goldberg, R., Postrado, L., Lucksted, A., et al. (2000). Prevalence and correlates of diabetes in national schizophrenia samples. *Schizophrenia Bulletin, 26*(4), 903-12.

Egede, L.E. (2004). Diabetes, major depression, and functional disability among U.S. adults. *Diabetes Care, 27*(2), 421-8.

Fries, B. E., Simon, S. E., Morris, J. N., Flodstrom, C., & Bookstein, F. L. (2001). Pain in U.S. nursing homes: Validating a pain scale for the Minimum Data Set. *Gerontologist, 41*, 173-179.

Ford, E. S., & Li, C. (2008). Metabolic Syndrome and health-related quality of life among U.S. adults. *Annals of Epidemiology, 18*(3), 165.

Gaite, L., Vazquez-Barquero, J. L., Arrizabalaga, A. A., Schene, A. H., Welcher, B., Thornicroft, G., et al. (2000). Quality of life in schizophrenia: development, reliability and internal consistency of the Lancashire Quality of Life Profile - European Version. *The British Journal of Psychiatry, 177*, s49-s54.

Ghanbari, A., Yekta, Z. P., Roushan, Z. A., & Lakeh, N. M. (2005). Assessment of factors affecting quality of life in diabetic patients in Iran. *Public Health Nursing, 22*(4), 311-322.

Glaser, N. S. (1997). Non-insulin-dependent diabetes mellitus in childhood and adolescence. *Pediatric Clinics Of North America, 44*(2), 307-338.

Glasgow, R.E., Ruggiero, L., Eakin, E.G., Dryfoos, J., & Chobanian, L. (1997). Quality of life and associated characteristics in a large national sample of adults with diabetes. *Diabetes Care, 20*(4), 562-7.

Goeree, R., Farahati, F., Burke, N., Blackhouse, G., O'Reilly, D., Pyne, J., et al. (2005). The economic burden of schizophrenia in Canada in 2004. *Current Medical Research and Opinion, 21*(12), 2017-2028.

Goldman, L.S. (1999). Medical illness in patients with schizophrenia. *The Journal of Clinical Psychiatry, 60*, 10-5.

Goz, F., Karaoz, S., Goz, M., Ekz, S., & Cetn, I. (2007). Effects of the diabetic patients' perceived social support on their quality-of-life. *Journal Of Clinical Nursing, 16*(7), 1353-1360.

Gu, K., Cowie, C.C., & Harris, M.I. (1998). Mortality in adults with and without diabetes in a national cohort of the U.S. population, 1971-1993. *Diabetes Care, 21*(7), 1138-45.

Harris, M.I., Klein, R., Welborn, T.A., & Knuiman, M.W. (1992). Onset of NIDDM occurs at least 4-7 yr before clinical diagnosis. *Diabetes Care, 15*(7), 815-9.

Hawes, C., Fries, B. E., James, M. L., &Guihan, M. (2007). Prospects and pitfalls: Use of the RAI-HC assessment by the Department of Veterans Affairs for home care clients. *Gerontologist, 47*(3), 378-387.

Health Canada (2002). *Diabetes in Canada.* Retrieved Mar 20, 2008, from http://www.phac-aspc.gc.ca/publicat/dic-dac2/pdf/dic-dac2_en.pdf

Health Canada (2003). *Responding to the challenge of diabetes in Canada* (Cat. N° H39-4/21-2003E). Ottawa, ON: Health Canada.

Henderson, D. C. (2007). Weight gain with atypical antipsychotics: Evidence and insights. *Journal Of Clinical Psychiatry, 68*, 18-26.

Hirdes, J.P., Marhaba, M., Smith, T.F., Clyburn, L., Mitchell, L., Lemick, R.A., et al. (2001). Development of the Resident Assessment Instrument-Mental Health (RAI-MH). *Hospital Quarterly, 4*(2), 2000-2001.

Hirdes, J.P., Smith, T.F., Rabinowitz, T., Yamauchi, K., Puerez, E., Telegdi, N.C., et al. (2002). The Resident Assessment Instrument-Mental Health (RAI-MH): Inter-rater reliability and convergent validity. *The Journal of Behavioral Health Services & Research, 29*(4), 419-32.

Hirsch, S.R., & Weinberger, D.R. (Ed.). (2003). *Schizophrenia.* Oxford, UK: Blackwell Science Ltd.

Ho, B.C., Nopoulos, P., Flaum, M., Arndt, S., & Andreasen, N. C. (1998). Two-year outcome in first-episode schizophrenia: Predictive value of symptoms for quality of life. *American Journal Of Psychiatry, 155*(9), 1196-1201.

Hofer, A., Kemmler, G., Eder, U., Edlinger, M., Hummer, M., & Fleischhacker, W. W. (2004). Quality of life in schizophrenia: the impact of psychopathology, attitude toward medication, and side effects. *Journal Of Clinical Psychiatry, 65*, 932-939.

Hofer, A., Baumgartner, S., Edlinger, M., Hummer, M., Kemmler, G., Rettenbacher, M. A., et al. (2005). Patient outcomes in schizophrenia I: correlates with sociodemographic variables, psychopathology, and side effects. *Journal of the Association of European Psychiatrists. 20*(5), 386.

Holt, R.I., Bushe, C., & Citrome, L. (2005). Diabetes and schizophrenia 2005: are we any closer to understanding the link? *Journal of Psychopharmacology, 19*(6), 56-65.

Jacobson, A. M., De Groot, M., & Samson, J. A. (1994). The evaluation of two measures of quality of life in patients with type I and type II diabetes. *Diabetes Care. 17*(4), 267.

Jesudason, D.R., Dunstan, K., Leong, D., & Wittert, G.A. (2003). Macrovascular risk and diagnostic criteria for type 2 diabetes: Implications for the use of FPG and HbA(1c) for cost-effective screening. *Diabetes Care, 26*(2), 485-90.

Jiménez-Garcia, R., Jiménez-Trujilo, I., Hernanadez-Barrera, V., Carrasco-Garrido, P., Lopez, A., et al (2008). Ten-year trends in self-rated health among Spanish adults with diabetes, 1993 2003. *Diabetes Care, 31*(1):90-2.

Kodl, C. T., & Seaquist, E. R. (2008). Cognitive Dysfunction and Diabetes Mellitus. *Endocrine Reviews. 29*(4), 494.

Koopman, R. J., Mainous, A. G., Diaz, V. A., & Geesey, M. E. (2005). Changes in Age at Diagnosis of Type 2 Diabetes Mellitus in the United States, 1988 to 2000. *Annals of Family Medicine. 3*(1), 60-63.

Koopmanschap, M. (2002). Coping with type II diabetes: the patient's perspective. *Diabetologia, 45*(7), 18-22.

Krein, S.L., Heisler, M., Piette J.D., Makki, F., & Kerr, E.A. (2005). The effect of chronic pain on diabetes patients' self-management. *Diabetes Care. 28*(1), 65-70.

Krosnick, A. & Wilson, M.G. (2005). A retrospective chart review of the clinical effects of atypical antipsychotic drugs on glycemic control in institutionalized patients with schizophrenia and comorbid diabetes mellitus. *Clinical Therapeutics, 27*(3), 320-6.

Kumari, M., Head, J., & Marmot, M. (2004). Prospective study of social and other risk factors for incidence of type 2 diabetes in the Whitehall II study. *Archives Of Internal Medicine, 164*(17), 1873-1880.

Law, M. R., Soumerai, S. B., Ross-Degnan, D., & Adams, A. S. (2008). A longitudinal study of medication nonadherence and hospitalization risk in schizophrenia. *The Journal of Clinical Psychiatry, 69*(1), 47.

Lehman, A.F., (1988). A quality of life interview for the chronically mentally ill. *Evaluation of Program Planning, 11*(1), 51–62.

Lehman, A.F., Kreyenbuhl, J., Buchanan, R.W., Dickerson, F.B., Dixon, L.B., Goldberg, R., et al. (2004). The Schizophrenia Patient Outcomes Research Team (PORT): Updated treatment recommendations 2003. *Schizophrenia Bulletin, 30*(2), 193-217.

Lima, M. S. d., Mari, J. d. J., Breier, A., Costa, A. M., Sena, E. P. d., & Hotopf, M. (2005). quality of life in schizophrenia: a multicenter, randomized, naturalistic, controlled trial comparing olanzapine to first-generation antipsychotics. *The Journal of Clinical Psychiatry, 66*(7), 831.

Lin, E.H., Katon, W., Von Korff, M., Rutter, C., Simon, G.E., Oliver, M., et al. (2004). Relationship of depression and diabetes self-care, medication adherence, and preventive care. *Diabetes Care, 27*(9), 2154-60.

Mackin, P., Watkinson, H. M., & Young, A. H. (2005). Prevalence of obesity, glucose homeostasis disorders and metabolic syndrome in psychiatric patients taking typical or atypical antipsychotic drugs: a cross-sectional study. *Diabetologia, 48*(2), 215-221.

Maddigan, S. L., Feeny, D. H., & Johnson, J. A. (2005). Health-related quality of life deficits associated with diabetes and comorbidities in a Canadian National Population Health Survey. *Quality Of Life Research, 14*(5), 1311-1320.

Manuel, D.G. & Schultz, S.E. (2004). Health-related quality of life and health-adjusted life expectancy of people with diabetes in Ontario, Canada, 1996-1997. *Diabetes Care, 27*(2), 407-14.

Mathur, A., Law, M. H., Megson, I. L., & Wei, J. (2008). A study of the genetic association between schizophrenia and type-2 diabetes mellitus. *Schizophrenia Research, 98*, 148.

McNeely, M.J., & Boyko, E.J. (2004). Type 2 diabetes prevalence in Asian Americans: results of a national health survey. *Diabetes Care, 27*(1), 66-9.

Mokdad, A.H., Ford, E.S., Bowman, B.A., Dietz, W.H., Vinicor, F., Bales, V.S., et al. (2003). Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. *Journal of the American Medical Association. 289*(1), 76-79.

Morris, J.N., Fries, B.E., Mehr, D.R., Hawes, C., Phillips, C., Mor, V., et al. (1994). MDS Cognitive Performance Scale. *Journal of Gerontology, 49*(4), 174-82.

Morris, J.N., Fries, B.E., & Morris, S.A. (1999). Scaling ADLs within the MDS. *The Journals of Gerontology, 54*(11), 546-53.

Mukherjee, S., Decina, P., Bocola, V., Saraceni, F., & Scapicchio, P.L. (1996). Diabetes mellitus in schizophrenic patients. *Comprehensive Psychiatry, 37*(1), 68-73.

Mukherjee, S., Schnur, D.B., & Reddy, R. (1989). Family history of type 2 diabetes in schizophrenic patients. *Lancet,* (8636), 495.

Mueller, M.J., Minor, S.D., Sahrmann, S.A., Schaaf, J.A., & Strube, M.J. (1994). Differences in the gait characteristics of patients with diabetes and peripheral neuropathy compared with age-matched controls. *Physical Therapy. 74*(4), 299-308.

Musselman, D. L., Betan, E., Larsen, H., & Phillips, L. S. (2003). Relationship of depression to diabetes types 1 and 2: epidemiology, biology, and treatment. *Biological Psychiatry, 54*(3), 317-329.

National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). (2002). Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation, 106*(25), 3143-421.

Narayan, K. M. V., Boyle, J. P., Thompson, T. J., Sorensen, S. W., & Williamson, D. F. (2003). Lifetime Risk for Diabetes Mellitus in the United States. *Journal of the American Medical Association, 290*(14), 1884-1890.

Narvaez, J. M., Twamley, E. W., McKibbin, C. L., Heaton, R. K., & Patterson, T. L. (2008). Subjective and objective quality of life in schizophrenia. *Schizophrenia Research,* 98(1-3), 201-208.

Newcomer, J. W. (2007). Metabolic considerations in the use of antipsychotic medications: a review of recent evidence. *Journal Of Clinical Psychiatry, 68*(S1), 20-27.

Norman, R. M. G., Malla, A. K., McLean, T., Voruganti, L. P. N., Cortese, L., McIntosh, E., et al. (2000). The relationship of symptoms and level of functioning in schizophrenia to

general wellbeing and the Quality of Life Scale. *Acta Psychiatrica Scandinavica, 102*, 303-309.

Nichols, G. A., Hillier, T. A., & Brown, J. B. (2007). Progression from newly acquired impaired fasting glucose to type 2 diabetes: Response to Dinneen and Rizza. *Diabetes Care, 30*(7), e80.

Padwal, R., Majumdar, S.R., Johnson, J.A., Varney, J., & McAlister, F.A. (2005). A systematic review of drug therapy to delay or prevent type 2 diabetes. *Diabetes Care, 28*(3), 736-44.

Palmer, B. W., Heaton, R. K., Gladsjo, J. A., Evans, J. D., Patterson, T. L., Golshan, S., et al. (2002). Heterogeneity in functional status among older outpatients with schizophrenia: employment history, living situation, and driving. *Schizophrenia Research, 55*(3), 205-215.

Peyrot, M., Rubin, R. R., Lauritzen, T., Snoek, F. J., Matthews, D. R., & Skovlund, S. E. (2005). Psychosocial problems and barriers to improved diabetes management: results of the Cross-National Diabetes Attitudes, Wishes and Needs (DAWN) Study. *Diabetic Medicine, 22*(10), 1379-1385.

Piette, J. D., Heisler, M., Ganoczy, D., McCarthy, J. F., & Valenstein, M. (2007). Differential medication adherence among patients with schizophrenia and comorbid diabetes and hypertension. *Psychiatric Services, 58*(2), 207-212.

Robbins, J. M., Vaccarino, V., Zhang, H., & Kasl, S. V. (2005). Socioeconomic status and diagnosed diabetes incidence. *Diabetes Research And Clinical Practice, 68*(3), 230-236.

Roglic G, Unwin N, Bennett PH, Mathers C, Tuomilehto J, Nag S, et al. (2005). The burden of mortality attributable to diabetes: realistic estimates for the year 2000. *Diabetes Care, 28*(9), 2130-5.

Rosano, C., Simonsick, E. M., Harris, T. B., Kritchevsky, S. B., Brach, J., Visser, M., et al. (2005). Association between physical and cognitive function in healthy elderly: the health, aging and body composition study. *Neuroepidemiology, 24*(1-2), 8-14.

Rosenfield, S., & Wenzel, S. (1997). Social networks and chronic mental illness: a test of four perspectives. *Social Problems, 44*(2), 200-216.

Rouillon, F., & Sorbara, F. (2005). Schizophrenia and diabetes: Epidemiological data. *European Psychiatry, 20*, S345-S348.

Rubin, R.R., Peyrot, M. (1998). Men and diabetes: psychosocial and behavioral issues. *Diabetes Spectrum, 11*, 81– 87.

Rubin, R.R., & Peyrot, M. (1999). Quality of life and diabetes. *Diabetes/Metabolism Research and Reviews, 15*(3), 205-218.

Ruggeri, M., Nose, M., Bonetto, C., Cristofalo, D., Lasalvia, A., Salvi, G., et al. (2005). Changes and predictors of change in objective and subjective quality of life: multiwave follow-up study in community psychiatric practice. *The British Journal of Psychiatry: the Journal of Mental Science, 187*(2), 121-30.

Ryan, C.M., Freed, M.I., Rood, J.A., Cobitz, A.R., Waterhouse, B.R., & Strachan, M.W. (2006). Improving metabolic control leads to better working memory in adults with type 2 diabetes. *Diabetes Care. 29*(2), 345-51.

Ryan, M. C. M., Collins, P., & Thakore, J. H. (2003). Impaired Fasting Glucose Tolerance in first-episode, drug-naive patients with schizophrenia. *American Journal Of Psychiatry, 160*, 284-289.

Saddichha, S., Manjunatha, N., Ameen, S., & Akhtar, S. (2008). Diabetes and schizophrenia - effect of disease or drug? Results from a randomized, double-blind, controlled prospective study in first-episode schizophrenia. *Acta Psychiatr Scand, Feb 26* (E-pub ahead of print), 1-6.

Saddichha, S., Manjunatha, N., Ameen, S., & Akhtar, S. (2008). Metabolic syndrome in first episode schizophrenia — A randomized double-blind controlled, short-term prospective study. *Schizophrenia Research*, E-Pub ahead of print (doi:10.1016/j.schres.2008.01.004).

Schienkiewitz, A., Schulze, M. B., Hoffmann, K., Kroke, A., & Boeing, H. (2006). Body mass index history and risk of type 2 diabetes: results from the European Prospective Investigation into Cancer and Nutrition (EPIC)-Potsdam Study. *American Journal of Clinical Nutrition, 84*(2), 427-433.

Schmitz, N., Kruse, J., & Kugler, J. (2003). Disabilities, quality of life, and mental disorders associated with smoking and nicotine dependence. *The American Journal of Psychiatry, 160*(9), 1670-6.

Sernyak, M.J., Leslie, D.L., Alarcon, R.D., Losonczy, M.F., & Rosenheck, R. (2002). Association of diabetes mellitus with use of atypical neuroleptics in the treatment of schizophrenia. *The American Journal of Psychiatry, 159*(4), 561-6.

Steel, K., Ljunggren, G., Topinkova, E., Morris, J. N., Vitale, C., Parzuchowski, J., et al. (2003). The RAI-PC: An assessment instrument for palliative care in all settings. *American Journal of Hospice and Palliative Care, 20*, 211-220.

Stewart, W.F., Ricci, J.A., Chee, E., Hirsch, A.G., & Brandenburg, N.A. (2007). Lost productive time and costs due to diabetes and diabetic neuropathic pain in the US workforce. *Journal of Occupational and Environmental Medicine, 49*(6), 672-9.

Strachan, M.W., Deary, I.J., Ewing, F.M., & Frier, B.M. (1997). Is type II diabetes associated with an increased risk of cognitive dysfunction? A critical review of published studies. *Diabetes Care, 20*(3), 438-45.

Subramaniam, M., Chong, S.-A., & Pek, E. (2003). Diabetes mellitus and impaired glucose tolerance in patients with schizophrenia. *Canadian Journal Of Psychiatry, 48*, 345-347.

Surridge, C. & Nath, D. (2001). Insight: Diabetes. *Nature, 414*(13), 781.

Suvisaari, J., Perala, J., Saarni, S.I., Harkanen, T., Pirkola, S., Joukamaa, M., et al. (2007). Type 2 diabetes among persons with schizophrenia and other psychotic disorders in a general population survey. *European Archives of Psychiatry and Clinical Neuroscience,* (E-pub ahead of print). Retrieved Feb 3rd, 2008, from SprinerLink database.

Talbot, F., & Nouwen, A. (2000). A review of the relationship between depression and diabetes in adults: is there a link? *Diabetes Care, 23*(10), 1556-62.

Tillotson, L. M., & Smith, M. S. (1996). Locus of control, social support, and adherence to the diabetes regimen. *Diabetes Educator, 22*(2), 133-139.

Tokuyama, Y., Ishizuka, T., Matsui, K., Egashira, T., & Kanatsuka, A. (2008). Predictors of glycemic control in Japanese subjects with type 2 diabetes mellitus. *Metabolism, Clinical and Experimental, 57*(4), 453.

Tsuang, M. T., Stone, W. S., & Faraone, S. V. (2001). Genes, environment and schizophrenia. *The British Journal of Psychiatry, 178*(S40), s18-s24.

U.K. Prospective Diabetes Study Group (1999). Quality of life in type 2 diabetic patients is affected by complications but not by intensive policies to improve blood glucose or blood pressure control (UKPDS 37). *Diabetes Care, 22*(7), 1125-36.

van Winkel, R., De Hert, M., Van Eyck, D., Hanssens, L., Wampers, M., Scheen, A., et al. (2006). Screening for diabetes and other metabolic abnormalities in patients with

schizophrenia and schizoaffective disorder: Evaluation of incidence and screening methods. *Journal of Clinical Psychiatry, 67*(10), 1493-1500.

Von Korff, M., Katon, W., Lin, E.H., Simon, G., Ciechanowski, P., Ludman, E., et al. (2005). Work disability among individuals with diabetes. *Diabetes Care, 28* (6), 1326-32.

Voruganti, L., Heslegrave, R., Awad, A. G., & Seeman, M. V. (1998). Quality of life measurement in schizophrenia: reconciling the quest for subjectivity with the question of reliability. *Psychological Medicine, 28* (1), 165-172.

Voruganti, L. P., Punthakee, Z., Van Lieshout, R. J., MacCrimmon, D., Parker, G., Awad, A. G., et al. (2007). Dysglycemia in a community sample of people treated for schizophrenia: The Diabetes in Schizophrenia in Central-south Ontario (DiSCO) study. *Schizophrenia Research, 96*(1-3), 215-222.

Wannamethee, S.G., Shaper, A.G., & Perry, I.J. (2001). Smoking as a modifiable risk factor for type 2 diabetes in middle-aged men. *Diabetes Care, 24*(9), 1590-5.

Watson, D., Clark, L.A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063-70.

Wexler, D. J., Grant, R. W., Wittenberg, E., Bosch, J. L., Cagliero, E., Delahanty, L., et al. (2006). Correlates of health-related quality of life in type 2 diabetes. *Diabetologia, 49*(7), 1489-1497.

Wild, S., Roglic, G., Green, A., Sicree, R., & King, H. (2004). Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care, 27*(5), 1047-53.

World Health Organization (WHO) (n.d.). *About diabetes.* Retrieved April 8, 2008, from http://www.who.int/diabetesactiononline/diabetes/basics/en/index3.html

World Health Organization (WHO) Expert Committee on Physical Status. (1995). Physical status: the use and interpretation of anthropometry: report of a WHO Expert Committee. Geneva: World Health Organization.

World Health Organization (2006a). *Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia: report of a WHO/IDF consultation.* Geneva: World Health Organization.

World Health Organization (WHO). (2006b). *Fact sheet No. 311: Obesity and overweight.* Retrieved July 3, 2008, from http://www.who.int/mediacentre/factsheets/fs311/en/index.html.

World Health Organization (WHO). (2007). *International classification of diseases* (ICD). Geneva: World Health Organization. Retrieved June 2, 2008 from, http://www.who.int/classifications/apps/icd/icd10online/

World Health Organization & International Diabetes Federation (2004). *Diabetes action now: an initiative of the World Health Organization and the International Diabetes Federation.* Geneva: World Health Organization.

Wray, L. A., Ofstedal, M. B., Langa, K. M., & Blaum, C. S. (2005). The effect of diabetes on disability in middle-aged and older adults. *Journals Of Gerontology Series A. 60* (9), 1206-1211.

Wulsin, L. H., Vaillant, G. E., & Wells, V. E. (1999). A Systematic Review of the Mortality of Depression. *Psychosomatic Medicine, 61*(1), 6-17.

Yamaoka K, & Tango T. (2005). Efficacy of lifestyle education to prevent type 2 diabetes: a meta-analysis of randomized controlled trials. *Diabetes Care. 28* (11), 2780-6.

APPENDIX A: ICD-10 Coding for Medical Diagnosis

Cardiopulmonary:	Circulatory	I00-I99
	Respiratory	J00-J99
Neurological:	Nervous system	G00-G99
Musculoskeletal:	Musculoskeletal and connective tissue	M00-M99
Gastrointestinal:	Digestive system	K00-K93
Infection:	Certain infectious and parasitic diseases	A00-B99
Other:	Neoplasm	C00-D48
	Diseases of blood/blood-forming organs/immune mechanism	D50-D89
	Endocrine/nutritional/metabolic (excluding diabetes)	E00-E07
		E15-E90
	Eye and adnexa	H00-H59
	Ear and mastoid process	H60-H95
	Skin and subcutaneous tissue	L00-L99
	Genitourinary	N00-N99

Adapted from:

World Health Organization. (2007). *International classification of diseases* (ICD). Geneva: World Health Organization. Retrieved June 2, 2008 from, http://www.who.int/classifications/apps/icd/icd10online/