

Characteristics of Self-Rated Health in People with Type 2 Diabetes.

By

Ghislaine Badawi, BSc

Department of Psychiatry

McGill University, Montreal, Quebec

May 2012

A thesis submitted to McGill University in partial fulfillment of the requirements

of the degree of

Master of Science (MSc)

In

Psychiatry

© Ghislaine Badawi, May 2012.

## TABLE OF CONTENTS

Abstract.....	5
Résumé.....	7
Acknowledgements.....	9
Contribution of Authors.....	10
<b>CHAPTER 1. Introduction</b>	
1.1 Self-Rated Health.....	12
1.1.1 Self-Rated Health and mortality.....	13
1.2 Self-rated health, physical and mental functioning.....	14
1.3 Diabetes Mellitus.....	15
1.3.1 Prevalence of diabetes and its complications.....	16
1.3.2 Diabetes and depression.....	17
1.3.3 Diabetes and disability.....	19
1.3.4 Diabetes, depression and disability.....	20
1.4 Self-Rated Health and Diabetes.....	21
1.5 Self-rated health, mortality and morbidity in people with diabetes.....	22
1.6 Limitations in the literature.....	23
1.7 Objectives.....	24
<b>CHAPTER 2- Manuscript 1</b>	
“Indicators of Self-Rated Health in the Canadian Population with Diabetes”	
2.1 Abstract.....	27
2.2 Introduction.....	29
2.3 Participants and Methods.....	30

2.4 Results.....	35
2.5 Discussion.....	37
2.6 References.....	44
2.7 Table 1.....	48
2.8 Table 2.....	49
2.9 Table 3.....	50
2.10 Connecting text.....	51

**CHAPTER 3. Manuscript 2**

“Self-Rated Health; a predictor for the three-year incidence of major depression in individuals with type 2 diabetes”

3.1 Abstract.....	53
3.2 Introduction.....	55
3.3 Methods.....	57
3.4 Results.....	62
3.5 Discussion.....	63
3.6 Conclusion.....	66
3.7 References.....	68
3.8 Table 1.....	72
3.9 Table 2.....	73
3.10 Figure 1.....	74
3.11 Connecting text.....	75

**CHAPTER 4. Manuscript 3**

Self-Rated Health in diabetes: Should the question be the first administered?

4.1 Abstract.....	77
4.2 Introduction.....	78
4.3 Methods.....	79
4.4 Results.....	80
4.5 Discussion.....	81
4.6 References.....	84
4.7 Table 1.....	86
4.8 Table 2.....	87
CHAPTER 5. Conclusion	
5.1 Summary of findings.....	88
5.2 Implications of findings.....	89
5.3 Limitations.....	90
5.4 What is Self-Rated Health?.....	91
5.5 Future Directions.....	95
<b>REFERENCES.....</b>	<b>97</b>
Appendix A.....	109
Appendix B.....	110
Appendix C.....	111
Appendix D.....	112
Appendix E.....	113

## ABSTRACT

**Background:** Self-rated health (SRH) is one of the most widely used measures of general health status in population health research and has received strong support as an independent predictor of mortality and morbidity. Knowledge is limited as to what exactly SRH measures and gaining a better understanding of its characteristics in people with chronic conditions is necessary.

**Objectives:** In a Canadian community sample of people with type 2 diabetes, the aims were to understand the characteristics of SRH, to determine whether SRH was a predictor for the three year incidence of major depression and to study whether placing the question before or after health measures, as organized in a survey, would affect answers to the SRH question.

**Results:** Disability and depression were both associated with SRH in men and women with type 2 diabetes. Fair or poor SRH at baseline was a significant predictor for the three year incidence of major depression and the majority of individuals did not change their ratings when the question was placed either at the beginning or following health-related assessments.

**Conclusion:** Targeting both mental and physical functioning when treating diabetes could be more advantageous. Inserting a brief question, such as SRH, in clinical assessments could aid health-care practitioners in identifying high risk groups. Findings support research comparisons across studies examining SRH in people with diabetes through different surveys. Qualitative and quantitative studies are needed to gain insight into the processes through which characteristics

of SRH are evaluated, to provide evidence for the use of SRH as a screening tool and as a predictor of various outcomes in people with other chronic conditions.

## RÉSUMÉ

**Contexte :** L'auto-évaluation de la santé demande d'évaluer son propre état de santé en général et consiste en l'une des mesures les plus utilisées dans la recherche sur la santé de la population. Cette mesure a reçu de forts soutiens en tant que facteur indépendant prédicteur de mortalité et de morbidité. Nos connaissances demeurent limitées quant à notre compréhension de ce qui est exactement mesuré lorsqu'un individu évalue sa propre santé. Il est nécessaire de comprendre les caractéristiques de cette mesure chez les personnes atteintes de maladies chroniques.

**Objectifs :** Dans un échantillon de la population Canadienne de personnes atteintes de diabète de type 2, les objectifs étaient de comprendre les caractéristiques de l'auto-évaluation de la santé, de déterminer si cette mesure pouvait prévoir l'incidence de la dépression majeure au cours de trois ans et d'évaluer le changement des réponses dépendamment de l'emplacement de la question dans un sondage.

**Résultats :** L'auto-évaluation de la santé était associée à l'incapacité physique et à la dépression chez les hommes et les femmes atteints de diabète de type 2. Une mauvaise évaluation de la santé de base prévoyait significativement l'incidence de la dépression majeure au cours de trois ans. La majorité des individus n'ont pas changé leurs évaluations lorsque la question était placée avant ou suivant des questions objectives liées à la santé.

**Conclusions :** Il pourrait être avantageux de cibler à la fois le fonctionnement mental et physique lors du traitement des personnes atteintes de diabète. Les professionnels de la santé pourraient incorporer une brève mesure telle que l'auto-évaluation de la santé dans les évaluations cliniques pour identifier les individus à risque de complications. Les résultats confirment la possibilité de comparer les résultats portant sur l'auto-évaluation de la santé obtenus à travers différentes enquêtes chez les personnes atteintes de diabète. Des études qualitatives et quantitatives sont nécessaires pour aider à mieux comprendre le processus d'évaluation des caractéristiques sur lesquelles l'auto-évaluation de la santé est basée, pour fournir des preuves quant à l'utilisation cette mesure comme outil de dépistage et comme facteur prédictif de plusieurs résultats de la santé chez des personnes atteintes de différentes maladies chroniques.



## ACKNOWLEDGEMENTS

First and foremost, I would like to thank my supervisor Dr. Norbert Schmitz for his great patience, constant support and dedication throughout my training. I could never fully express my gratitude towards the numerous opportunities he has allowed me to undertake and towards the opportunities that have opened up as a result of my experience as a graduate student under his supervision. I have learned a great deal through his expertise and research insight and will carry this knowledge throughout my career.

I would like to thank my colleagues who have encouraged me and from whom I continue to learn; a very special thanks to Geneviève Gariépy and Veronique Pagé who have been of tremendous support every step of the way.

I also wish to thank all the participants who agreed to take part in this study and without whom this thesis would not have been possible.

I am deeply grateful to the Canadian Institute for Health Research (CIHR) and the Fonds de la Recherche en santé du Québec (FRSQ) for their support of diabetes-related research.

Lastly, I would like to thank my family and friends who encourage me to push forward and who have and continue to support me throughout my academic career.

## CONTRIBUTIONS OF AUTHORS

As the first author of all three studies, I (**Ghislaine Badawi**) have made significant contributions regarding the formulation of hypotheses, the research design and data analysis. I was responsible for writing all three manuscripts.

**Dr. Norbert Schmitz** has provided substantial contributions regarding the research design, interpretation of findings and the structure of the manuscript content and revisions.

**Geneviève Gariépy** has provided substantial input regarding data analysis for the three manuscripts and has contributed to manuscript revisions.

**Véronique Pagé** has provided input regarding the data analysis, the interpretation of findings and the revisions of the first two manuscripts.

**Dr. Kimberley Smith** has contributed to revisions of the second manuscript

**Dr. Ashok Malla** has contributed to revisions of the second manuscript.

**Dr. JianLi Wang** has contributed to revisions of the second manuscript.

**Dr. Richard Boyer** has contributed to revisions of the second manuscript.

**Dr. Irene Strychar** has contributed to revisions of the second manuscript.

**Dr. Alain Lesage** has contributed to revisions of the second manuscript.

# CHAPTER 1

## INTRODUCTION

Would you say that in general your health is excellent, very good, good, fair or poor? The single self-rated health item (SRH) is one of the most widely used measures of health status in epidemiological and population health research. SRH has received great attention in the past decades given its predictive power on survival which has been demonstrated through short and long-term follow up periods (Idler & Benyamini, 1997; Kaplan & Camacho, 1983; Nielsen et al., 2009; Sargent-Cox, Anstey, & Luszcz, 2010; Vuorisalmi, Lintonen, & Jylha, 2005) and has been replicated in a wide range of disease areas (Bosworth & Siegler, 1999; Farkas, Nabb, Zaletel-Kragelj, Cleland, & Lainscak, 2009; Shadbolt, Barresi, & Craft, 2002) and in many languages and cultures around the globe (Appels, Bosma, Grabauskas, Gostautas, & Sturmans, 1996; DeSalvo, Bloser, Reynolds, He, & Muntner, 2006; Heistaro, Jousilahti, Lahelma, Vartiainen, & Puska, 2001). Thus far, several relationships between ratings of health have been established with behavioral, environmental and individuals factors. However, studies repeatedly highlight a deficiency in our understanding of SRH which remains one of the most poorly understood health measures in research; we still have limited knowledge and do not fully understand what it really measures. The generic and non-specific nature of SRH implies a need to study its characteristics in people of the general population and in those with chronic conditions. Given differential physiological states, characteristics of SRH could be very different in different sub-groups of the population. The objective is

to understand characteristics of SRH in a Canadian community sample of people with Type 2 diabetes in an effort to establish the measure as a useful tool for predicting long-term health outcomes in this population. This thesis was supported by a Fonds de la Recherche en santé du Québec (FRSQ) fellowship (FF9-17M).

### **1.1 Self-Rated Health**

SRH is part of the SF-36; a generic multi-purpose short-form health survey yielding a summary of physical and mental measures (Mossey & Shapiro, 1982; Ware & Gandek, 1998). The International Quality of Life Assessment (IQOLA) project chose to develop validated translations of the SF-36 for use in international studies of health (Ware, Gandek, & Iqola Project Group, 1994) given that the SF-36 subscales were identified to be reliable, valid and acceptable measures of general health status (Cleary, Greenfield, & McNeil, 1991; Gelberg & Linn, 1989; Ware, 1993). Today, SRH has been translated for use in more than 60 countries and has been incorporated in some of the world's largest ongoing community health surveys such as the Behavioral Risk Factor Surveillance System and the National Health and Nutrition Examination survey in the United States, the Canadian Community Health survey and the European Health Examination survey (National Center for Health Statistics, 1971; National Institute for Health and Welfare, 1960; Office of Surveillance Epidemiology and Laboratory Services, 1984; Statistics Canada, 2000). SRH has been recommended for use in health monitoring by the World Health Organization, the US centers for

Disease Control, the Institute of Medicine in the United States and the European Commission (De Bruin, Picavet, & Nossikov, 1996; Hennessy, Moriarty, Zack, Scherr, & Brackbill, 1994; Kramers, 2003; Institute of Medicine, 2009). SRH has been used to track health service utilization, to monitor progress towards health goals and to predict future healthcare expenditures in populations around the world (DeSalvo et al., 2009). One of the reasons for the consistent use of the measure relates to persistent findings supporting it as a predictor for subsequent mortality and as a strong indicator of morbidity in both population and clinical samples (Hennessy, Moriarty, Zack, Scherr & Brackbill, 1994; Idler & Benyamini, 1997; Idler, Russell, & Davis, 2000; Mossey & Shapiro, 1982).

### **1.1.1 Self-Rated Health and mortality**

Over the years, longitudinal studies have repeatedly provided support for SRH as a strong predictor for mortality even after accounting for objective health measures and confounding variables in the general population (Franks, Gold, & Fiscella, 2003; Heistaro, et al., 2001; Kaplan & Camacho, 1983; Lee, 2000; Mossey & Shapiro, 1982; Schoenfeld, Malmrose, Blazer, Gold, & Seeman, 1994) and through meta-analyses (DeSalvo, et al., 2006; Idler & Benyamini, 1997). Similar findings were found in clinical populations with individuals suffering from different chronic conditions including coronary artery disease, chronic heart failure, cancer and diabetes (Bosworth, et al., 1999; Farkas, et al., 2009; Shadbolt, et al., 2002). Recent epidemiological research has provided evidence for the predictive value of SRH on 10-year mortality which was shown to be as accurate

and as stable as ten objective health measures including systolic blood pressure, cholesterol, white blood cell count and electrocardiogram readings (Lima-Costa, Cesar, Chor, & Proietti, 2012). In patients with advanced cancer, SRH was shown to be a better predictor of mortality compared to clinical indicators, performance status and health-related quality of life measures (Shadbolt, et al., 2002) and was to predict survival in HIV patients (Dzekedzeke, Siziya, & Fylkesnes, 2008).

### **1.1.2 Self-rated health, physical and mental functioning**

Not only does SRH predict mortality but it also provides unique information to epidemiological data following evidence supporting functional status as an important determinant of self-assessments of health. Physical functioning has been strongly associated with SRH in the general population (Mavaddat, et al., 2011) and in the elderly (Hoeymans, Feskens, Kromhout, & VandenBos, 1997). Valued life activities disability has been shown to play a substantial role in individuals' perceptions of health over and above measures of health status, disease symptoms and physical functioning (Katz et al., 2009). Self-ratings of health have been associated with changes in functional ability over periods of one through six years (Idler & Kasl, 1995) and have been shown to independently predict functional limitations and mortality in adult men and women and in older adults (Idler, et al., 2000; Lee, 2000). In people with chronic health conditions or long-term disability, poor SRH has been associated with both long and short term disability (Cott, Gignac, & Badley, 1999). Lastly, the recovery process following

a major medical event has been shown to be influenced by illness-related changes in health perceptions (Wilcox, Kasl, & Idler, 1996).

In addition to physical health status measure, mental health measures have been suggested as contributors to the SRH concept (Singh-Manoux, et al., 2006). SRH has been associated with depression in the general population through cross-sectional and longitudinal studies (Kosloski, Stull, Kercher, & Van Dussen, 2005; Mavaddat, et al., 2011; Molarius & Janson, 2002; Mulsant, Ganguli, & Seaberg, 1997). The association between depression and SRH has been shown to go beyond the presence of illness as evidenced by a recent meta-analysis indicating poor SRH to be more strongly associated with depression than with the presence of chronic disease (Chang-Quan, et al., 2010). In patients with chronic illnesses such as chronic obstructive pulmonary disease, SRH has been shown to be worse in patients compared to healthy controls and has been associated with depression scores and disease severity (Farkas, et al., 2009). Even though mental and physical functioning have been shown to be unique determinants of SRH, poor SRH coupled with either severe disability or depression has been shown to increase risks of mortality (Van den Brink, et al., 2005). Such findings highlight the importance of examining both physical and mental functioning as determinants of SRH in people with different health conditions.

## **1.2 Diabetes Mellitus**

Diabetes mellitus, referred to as diabetes, is a progressive chronic disease that occurs when the body cannot produce any or enough insulin from the pancreas leading to high levels of sugar in the blood stream. Hyperglycemia can lead to a number of complications particularly for the eyes, kidneys, nerves, heart and blood vessels. There are three main types of diabetes; type 1, type 2 and gestational diabetes. Of interest here is type 2 diabetes resulting from insulin resistance which occurs when cells fail to use insulin properly. Type 2 diabetes was formerly known as noninsulin-dependent diabetes or adult-onset diabetes given that it occurs later in life and is due to mainly lifestyle factors such as being overweight, having a high-caloric diet and leading sedentary lifestyles. Type 2 diabetes is found in nearly all countries and continues to increase in numbers as poorer lifestyle behaviors and unhealthy foods become more common and accessible and as ageing populations continue to increase.

### **1.2.1 Prevalence of diabetes and its complications**

The World Health Organization (WHO) identifies about 346 million people worldwide with diabetes and 3.4 million dying from consequences of high blood sugar levels in 2004. More specifically, 90% of people with diabetes are affected with Type 2 diabetes. One of the main difficulties of living with diabetes relates to the severe complications individuals experience as a result of damage to the heart, blood vessels, eyes, kidneys and nerves. In effect, almost half of people with diabetes die of cardiovascular disease, 10 to 20% die of kidney failure and 50% are affected with neuropathy causing tingling, pain, numbness or weakness in the feet and hands and leading to eventual foot ulcers and limb amputations. Lastly,



retinopathy may cause blindness and visual impairments. Today, diabetes is a major public health concern. The WHO recognizes the economic impact of diabetes and its complications on health care systems in different countries estimating a cost of 558 billion dollars spent between 2006 and 2015 in China due to heart disease, stroke and diabetes (World Health Organization, 2011). The Canadian Diabetes Association (CDA) identifies 9 million Canadians living with diabetes or pre-diabetes and estimates 20 people being diagnosed with the disease every hour of every day (Canadian Diabetes Association, 2012). The International Diabetes Federation (IDF) projected 439 million adults to be affected with diabetes in 2030 increasing by 69% in developing countries and 20% in developed countries (Shaw, Sicree, & Zimmet, 2010). Such figures highlight the importance of preventing and controlling the disease by identifying potential risk factors in people with diabetes.

### **1.2.2 Diabetes and depression**

Observations from the World Health Survey studying adults in 60 countries around the world indicated that the one-year prevalence of depression in the general population was 3.2%. However, an average of 9% to 23% of individuals with one or more chronic conditions has been diagnosed with comorbid depression (Moussavi, et al., 2007). Depression is a serious comorbidity in people with diabetes. According to the CDA, 25% of people affected by the disease suffer from depression (Canadian Diabetes Association, 2012). In general, studies have shown that individuals with diabetes are more likely to have depression

compared to people without diabetes. In fact, diabetes has been shown to double the odds of comorbid depression (Anderson, Freedland, Clouse, & Lustman, 2001). Using data from the 2006 Behavioral Risk Factor Surveillance System (BRFSS); a standardized telephone survey of the adult population in the US, Li et al. found that the rate of depression in people with diabetes was 8.3%, more than double the rate of depression in the general population (Li, Mokdad, Ford, & Strine, 2008; Moussavi, et al, 2007). In a systematic review estimating the prevalence of depression in type 2 diabetes, Ali et al. (2006) found that the rate of depression was 17.6% compared to 9.8% in those without diabetes. Comorbid depression is therefore highly prevalent in this population and has been shown to have serious consequences on all aspects of daily life for individuals affected by the disease. In effect, depression in diabetes has been shown to increase the risk for poor glycemic control and for poor adherence to self-care regimens in particular adherence to medications, diet and exercise regimens (Gonzalez et al., 2008; Gonzalez et al., 2008; Lin et al., 2004; Lustman, et al., 2000). Moreover, comorbid depression has been associated with greater diabetic complications, poor health outcomes, increased odds of disability, decreased work productivity and deterioration in quality of life (Ali, et al., 2010; De Groot, Anderson, Freedland, Clouse, & Lustman, 2001; Egede, 2003; Egede, 2004; Egede, 2004; Eren, Erdi, & Şahin, 2008; Goldney, Phillips, Fisher, & Wilson, 2004; Lin et al., 2010; Moussavi, et al., 2007). Lastly, people with both depression and diabetes exhibit greater health care use and health care expenditures and are at greater risk of mortality (Egede, Zheng, & Simpson, 2002; Katon, et al., 2008; Katon et al.,

2005; Lin et al., 2009). Depression has been identified as a serious comorbid condition given that treatment with antidepressants or cognitive behavioral therapy has been shown to improve glycemic control and medical outcomes in this population (Lustman, et al, 2000; Lustman et al., 1997; Lustman, Griffith, Freedland, Kissel, & Clouse, 1998).

### **1.2.3 Diabetes and disability**

Although depression is a serious comorbidity in people with diabetes, several epidemiological studies have suggested that diabetes is also a major risk factor for disability and functional limitations in middle-aged and older adults (Gregg et al., 2000; Gregg et al., 2002; Kalyani, Saudek, Brancati, & Selvin, 2010; Maggi et al., 2004; Ryerson et al., 2003; Sayer, et al., 2005; Wray, Ofstedal, Langa, & Blaum, 2005; Wu, et al., 2003). In fact, having diabetes has been shown to increase the odds of disability by 2 to 3 times (Kalyani, et al., 2010; Ryerson, et al., 2003). Older diabetic adults have been shown to have a higher number of limitations for activities of daily living (ADL) and for instrumental activities of daily living (IADL) (Gregg, et al., 2000; Maggi, et al., 2004; Wu, et al., 2003). Cross sectional and longitudinal studies have identified diabetes-related complications, depression and common comorbidities as potential causes of disability in people with diabetes (Bruce, Davis, & Davis, 2005; Kalyani, et al., 2010; Von Korff et al., 2005). In older women, diabetes has been associated with a major burden of disability and has been related to a higher prevalence of mobility disability, activities of daily living and severe walking limitations when compared to non-

diabetic women (Volpato, et al., 2002). In general, disability in daily living increases the likelihood for hospitalization, institutionalization and healthcare costs and is an important diabetes-related outcome in older adults (American Diabetes Association, 2003). Work disability, work loss and health-related work limitations have also been shown to be significantly higher among people with diabetes than among those without diabetes, resulting in significant decreases in earnings (Mayfield, Deb, & Whitecotton, 1999; Tunceli, et al., 2005). More specifically, compared to individuals without diabetes, those with diabetes have been found to report more than three times the proportion of work disability and have been shown to be 5 to 6 times more likely to have work limitations (Mayfield, et al., 1999; Tunceli, et al., 2005). Eventually, disability in people with diabetes is likely to substantially impair quality of life in affected individuals and can eventually erode health status (Gregg, et al., 2000; Gregg, et al., 2002).

#### **1.2.4 Diabetes, depression and disability**

Depression and disability are individually major burdens in the diabetic population. However, findings have suggested important implications for the concurrent occurrence of diabetes, depression and disability. Results from the National Health Interview Survey in the US comprising of more than 30 000 adults found that the odds of functional disability was more than 7 times higher among adults with diabetes and major depression compared to individuals with either depression or diabetes alone (Egede, 2004). More specifically, in a Canadian sample of people with diabetes, a joint effect of psychological distress

and activity limitations was documented on short-term disability (Schmitz, Wang, Lesage, Malla, & Strychar, 2008). In fact, depression has been identified as a potential cause and modifiable factor explaining the diabetes-disability relationship (Bruce, et al., 2005; Volpato, et al., 2002; Von Korff, et al., 2005). In summary, the findings suggest that both depression and disability are important comorbidities in diabetes and have serious health-related consequences. Therefore, identifying risk factors for both comorbid depression and disability are important for improving the lives of affected individuals.

### **1.3 Self-Rated health and diabetes**

In general, the prevalence of fair or poor health ratings is more prevalent among people with diabetes. Results from the National Health Study conducted from 1993 to 2003 indicated that the prevalence of fair or poor SRH among adults with diabetes is more than double that of individuals without diabetes and does not vary within 10 years (Jimenez-Garcia, et al., 2008). In addition, findings from the 1996-2005 BRFSS showed fair or poor self-assessed ratings of health to be three times more common among US adults with diabetes than among those without diabetes (Pan, Mukhtar, Geiss, Rivera, Alfaro-Correa & Sniegowski, 2006). The Public Health Agency of Canada indicated nearly 40% of Canadians who reported having diabetes to rate their health as fair or poor in 2009-2010 compared to 10% of the population without diabetes. More specifically, Canadian adults with diabetes aged 30 to 39 were six times more likely to rate their health as fair or poor while the oldest individuals (more than 80 years old) with diabetes

were twice as likely to rate their health as fair or poor (Public Health Agency of Canada, 2011). Lastly, SRH has been related to diabetes characteristics, symptoms of nephropathy, cardiovascular disease and glycosylated hemoglobin in people with diabetes (Klein, Klein, & Moss, 1998).

### **1.3.2. Self-rated health, mortality and morbidity in people with diabetes**

The single SRH question has been identified as an important predictor of mortality in people with diabetes and has been suggested as a tool for identifying individuals with diabetes in need of intensified support. SRH has significantly predicted mortality even after controlling for physical health status (Dasbach, Klein, Klein, & Moss, 1994). In a study of approximately 8.5 years of follow-up, low SRH was associated with mortality even after controlling for age, sex, educational level, body mass index, physical inactivity, smoking, insulin treatment, hypertension, history of myocardial infarction, stroke and cancer (Wennberg et al., 2012). Similarly, in patients with longer duration of diabetes, fair or poor SRH was associated with higher risks of mortality even after adjusting for demographic, socioeconomic and clinical risk factors for mortality (McEwen et al., 2009). Diabetes and stroke together have been strongly associated with poor SRH in older Mexican Americans (Otiniano, Du, Ottenbacher, & Markides, 2003) and better ratings of health have been associated with lower risks of vascular events and with fewer diabetes complications (Hayes, et al., 2008). Depression has been identified as an important comorbidity in people with diabetes and has been associated with lower quality of life scores (Goldney, et al., 2004),

deteriorating quality of life in people with type 2 diabetes (Eren, Erdi & Sahin, 2008). Lastly, worsening SRH has been an independent factor associated with major depressive disorder in people with diabetes (Egede & Zheng, 2003).

#### **1.4 Limitations in the literature**

As discussed previously, poor SRH has been widely identified to be strongly associated with mortality in people with diabetes and has been strongly associated with poor health-related outcomes. However, we still don't know what exactly SRH measures and why it has such a strong association with mortality (Bailis, Segall, & Chipperfield, 2003; Jylha, 2009). It is possible that different aspects of health are taken into account in self-perceptions of health and such aspects might be different for people with different chronic conditions. For example, both depression and disability are highly prevalent in people with diabetes and present a major concern given their impact on health outcomes and diabetic complications. However, it is not clear whether physical functioning or mental functioning is more important when people with diabetes provide self-assessments of health. Given the strong impact of poor SRH on poor health outcomes, it is important to not only study SRH in the general population but to also understand it in people with chronic conditions. We identify an essential need to study characteristics of SRH in a community sample of people with diabetes since most patients are treated in the primary care sector. No other study has attempted to identify determinants of SRH in a community sample of people with type 2 diabetes while accounting for diabetes-related characteristics, socio-demographic

factors, lifestyle-related factors and health-related characteristics. Such results may help identify and target modifiable factors that may improve SRH thus improving health outcomes in this population.

Moreover, depression has been identified as a serious comorbidity in people with diabetes and has been shown to have serious consequences on the progression of the illness. Although an association has been demonstrated between depression and poor SRH, there is a lack of longitudinal studies looking at SRH as a predictor for major depression in people with type 2 diabetes. Therefore, studying SRH as a predictor of major depression may provide support for the use of such a simple and easily administered tool for identifying patients at risk for serious complications and in need of close monitoring.

Lastly, although SRH has been widely used to track health conditions in community-health surveys around the world, the item appears to be administered differently in each survey. People with diabetes are living with a major burden of disease and with poor daily health conditions. Administering the SRH question either before or after objective health measures in surveys could particularly impact ratings of health in this population. There is a lack of studies looking at the effect of the mode of administration on answers given to the SRH question in people with diabetes. Examining such effects is important when determining whether comparisons can be made across studies investigating SRH in people with diabetes through different population surveys.

## **1.5 Objectives**



The present objectives are threefold. Firstly, we aim to study associations between SRH and depression, disability, diabetes related characteristics, socio-demographic factors, social support and lifestyle related behaviors in a community sample of Canadian people with type 2 diabetes. Secondly, we aim to study SRH as a predictor for the three-year incidence of major depression in people with type 2 diabetes while accounting for confounding variables. Thirdly, in a brief report, our goal is to evaluate the effect of the mode of administration of SRH on ratings in people with type 2 diabetes.

## CHAPTER 2. Manuscript 1

### Indicators of Self Rated Health in the Canadian Diabetic Population

G. Badawi<sup>1,2</sup>, G. Gariepy<sup>2,3</sup>, V. Pagé<sup>2</sup>, N. Schmitz<sup>1,2,4</sup>

Diabetic Medicine (2012), 29(8), 1021-1028.

<sup>1</sup> Department of Psychiatry, McGill University, Montreal, Quebec, Canada

<sup>2</sup> Douglas Mental Health University Institute, Montreal, Quebec, Canada

<sup>3</sup> Department of Epidemiology and Biostatistics, McGill University, Montreal, Quebec, Canada

<sup>4</sup> Montreal Diabetes Research Centre, Montreal, Quebec, Canada

Running Title: Self rated health, depression and disability in people with diabetes

#### *Address for Correspondence*

Norbert Schmitz<sup>1</sup>, PhD;  
Douglas Mental Health University Institute  
McGill University  
6875 LaSalle Boulevard  
Montreal, Quebec, Canada  
H4H 1R3

Tel: 1-514-761-6131, ext. 3379  
Fax: 1-514-888-4064  
E-mail: [norbert.schmitz@mcgill.ca](mailto:norbert.schmitz@mcgill.ca)

## **ABSTRACT**

**Aims:** Self rated health (SRH) is a widely used measure of general health assessing risk factors and poor health outcomes in health surveys and clinical settings. The characteristics of SRH may be different in populations with specific chronic conditions such as diabetic populations. This study investigates the characteristics of SRH in a Canadian community sample of people with diabetes.

**Methods:** SRH was obtained from 1837 adults with Type 2 diabetes participating in the Montreal Diabetes Health and Wellbeing Study. Global disability and depression were assessed using the World Health Organization Disability Assessment Schedule II and the Patient Health Questionnaire (PHQ-9) respectively. Logistic regressions studied the association between SRH and depression, disability, diabetes related characteristics, socio-demographic factors, social support and lifestyle related behaviors in both men and women.

**Results:** Participants' answers were dichotomized into excellent/very good/ good (78%) and fair/poor (22%) SRH. Both depression (men: OR 1.9, 95% CI 1.4-2.6; women: OR 1.5, 95% CI 1.2 -1.9) and disability (men: OR 1.7, 95% CI 1.4-1.9; women: OR 1.7, 95% CI 1.5-1.9) were associated with fair/poor SRH. The associations remained unchanged even after controlling for diabetes characteristics. After controlling for confounding variables, chronic conditions were associated with fair/poor SRH in both men and women. Obesity was associated with fair/poor SRH in women only while lifestyle behaviors such as

being physically active and alcohol consumption were associated with good/very good/excellent SRH in men.

**Conclusions:** In men and women, depression and disability are important factors that are associated with SRH in a large sample of individuals with Type 2 diabetes.

Keywords: Self rated health, diabetes, depression, disability, health behaviors.

## INTRODUCTION

Cross sectional and longitudinal data indicate a high prevalence of both reduced physical functioning and impaired mental health in diabetic populations (Anderson, Freedland, Clouse, & Lustman, 2001; Gregg et al., 2000). Given these facts, it is important to continuously track the health status of affected individuals as part of community health surveys.

Self-rated health (SRH) is based on a single item question asking people to rate their health on a scale from excellent to poor. SRH has been shown to be a valid measure predicting subsequent mortality and morbidity in both population and clinical samples even after accounting for socio-demographic and other health characteristics (DeSalvo, Bloser, Reynolds, He, & Muntner, 2006; Han, 2002).

SRH status is among the most frequently assessed health perceptions in epidemiological research (Salomon, Nordhagen, Oza, & Murray, 2009); it has been recommended for use in health monitoring by the World Health Organization, and the European Commission (Salomon, et al., 2009). The Institute of Medicine in the US recommended SRH as one of 8 indicators for tracking the progress of health in the United States (Medicine, 2009). Nevertheless, it is not clear what SRH exactly measures and why it has such a strong association with morbidity and mortality. Evidence indicates that biological, physiological, and psychological factors are major determinants of SRH (Jylha, 2009). As pointed out by Jylha and colleagues (2009), ratings may reflect a subjective summary of all the information people have available about their understanding of health,

including information on physical functioning in everyday life, lifestyle conditions that have adverse effects on health, specific disease characteristics (severity and prognosis) and mood and personality factors such as a weak sense of mastery or fatalism. Therefore, SRH might have a different meaning for people with different health conditions: SRH might be an indicator of general wellbeing for those without chronic conditions but might be an indicator for disease related problems (e.g. complications in diabetes) in those with chronic conditions. More information on the characteristics of SRH in specific populations is needed before this question can be used for tracking health status in clinical samples.

Only a few studies have evaluated SRH in community samples of people with diabetes (Jimenez-Garcia et al., 2008; Pan et al., 2006) and there is a lack of information regarding the association between SRH and diabetes specific problems as well as physical and mental functioning. Using data from the Montreal Diabetes Health and Well Being Study (DHS), the objectives of the present study were to examine the association between SRH and depression, disability, diabetes related characteristics, socio-demographic factors, social support and lifestyle related behaviors in a community sample of Canadian people with type 2 diabetes. We hypothesized that SRH is not only an indicator of physical functioning but also of depression, diabetes related complications and lifestyle behaviors.

## **PARTICIPANTS AND METHODS**

## **Data Source**

This study is based on data from the Montreal Diabetes Health and Well Being Study; a random digit-dialed telephone survey of the non-institutionalized adult population in Quebec, Canada. Participants were recruited between January and April 2008 through random selection of listed phone numbers in Quebec by a recognized polling firm, Bureau d'Intervieweurs Professionnels (Montreal, Quebec, Canada). Adults eligible to participate were 18 to 80 years of age, had a diagnosis of diabetes determined by a physician and could respond to the interview in either French or English. More details have been reported elsewhere (Schmitz et al., 2009) (Appendix A).

## **Measures**

*Self-Rated Health* was assessed with one item 'Would you say that in general your health is...' Participants were asked to answer with a 5-category Likert response scale (Excellent, Very Good, Good, Fair or Poor). This scale has been used in some of the world's largest telephone surveys tracking health conditions and behaviors; the National Health and Nutrition Examination Survey (NHANES), the Canadian Community Health survey (CCHS) and especially the Behavioral Risk Factor Surveillance System (BRFSS) (Ford, Moriarty, Zack, Mokdad, & Chapman, 2001).

*Global disability* was assessed using the 12-item version of the World Health Organization Disability Assessment Schedule II (WHO-DAS-II) consisting of both physical and non-physical dimensions (mobility, understanding and

communication, interpersonal relations, etc.) (Appendix B). Participants estimated the magnitude of the disability during the previous 30 days on a scale from none to extreme/cannot do. The 12 items were summed and transformed to a percent score (0% to 100%) with higher scores reflecting greater disability. More information is included in Appendix A. The 12-item WHO-DAS-II provides a reliable and valid measure of global disability (Chwastiak & Von Korff, 2003) and has been validated and used in diabetes epidemiological studies (Von Korff et al., 2005).

*Depression* was assessed using the Patient Health Questionnaire (PHQ-9) (Kroenke, Spitzer, & Williams, 2001) (Appendix C). Each question was scored from 0 = not at all to 3 = nearly every day) with a resulting range of 0 to 27. The PHQ-9 provides a tentative diagnosis of major and minor depression according to Diagnostic and Statistical Manual, 4th Edition (DSM-IV) criteria and a continuous severity score. The PHQ-9 has been used as an indicator for depression severity in people with diabetes (Katon et al., 2005).

#### *Socio-demographic status*

The DHS collected data on socio-demographic characteristics: age at baseline, sex and marital status (married/common-law; single; divorced/separated/widowed), education (less than high school graduation; high school graduation; post high school graduation) and employment status (employed; unemployed; not working).

#### *Lifestyle related characteristics*

Physical inactivity levels were measured by asking participants to rate the number of days they exercised or participated in sports activity for at least 15 minutes in



the previous month. The response was divided into three categories: inactive (0 days), moderately active (1 to 12 days) and active (more than 12 days).

Smoking behavior was assessed by questions from the Canadian Community Health Survey. Participants were asked whether they currently smoke, had formerly smoked, or had never smoked.

Alcohol consumption was assessed from the first item of the Alcohol Use Disorders Identification Test (AUDIT): 'How often do you have a drink containing alcohol?' (Bush, Kivlahan, McDonell, Fihn & Bradley, 1998).

Answers were categorized into never, less than twice a week and two or more times a week.

#### *Health related characteristics*

Body mass index was calculated based on self-reported weight and height and was categorized according to guidelines from the National Heart, Lung and Blood Institute; underweight ( $<18.5 \text{ kg/m}^2$ ), normal weight ( $18.5\text{-}24.9 \text{ kg/m}^2$ ), overweight ( $25.0\text{-}29.9 \text{ kg/m}^2$ ) and obese ( $\geq 30.0 \text{ kg/m}^2$ ).

Diabetes complications were assessed using the Diabetes Complications Index (DCI) (Fincke et al., 2005). The DCI is a 17-item survey that assesses diabetes complications on the basis of patient self-report (retinopathy, neuropathy, large-vessel atherosclerotic disease, peripheral vascular disease, cerebrovascular disease and foot problems). A summary variable was computed counting the number of complications. Number of chronic conditions was assessed by asking participants whether they suffered from various health conditions diagnosed by a health professional at the time of the interview (asthma, high blood pressure, heart

disease, stomach or intestinal ulcers, arthritis / rheumatism, migraine headaches, cancer, kidney disease, and back problems). Chronic conditions were summarized into 0 to 8 chronic conditions.

Participants' treatment regimen was assessed by asking participants if they took insulin or if they took pills to control their diabetes in the past month.

### *Social support*

Social support was measured using a 9-item version of the Medical Outcomes Study (MOS-SSS) (Appendix D) (Sherbourne & Stewart, 1991) measuring the individual's perception of support along four dimensions: 1) emotional/informational; 2) affectionate; 3) tangible; and 4) positive social interaction.

Participants were asked how often the different types of support were available and responded on a 5-point scale (none of the time to all of the time). A general score was computed (Sherbourne & Stewart, 1991).

### **Statistical Analysis**

Data were analyzed using SPSS software (SPSS Inc., Chicago, IL, USA).

Frequency tables were used to describe the associations between SRH and socio-demographic characteristics, lifestyle related behaviors and health related characteristics. Analyses of variances (ANOVA) were conducted on social support, depression and disability separately, to study the relationship with SRH.

Logistic regression analyses were then conducted to study the association between SRH and disability, depression, socio-demographic characteristics, lifestyle-related behaviors, social support and health related characteristics. SRH was

dichotomized into two categories: fair/poor vs. excellent/very good/good. This classification is often used in epidemiological research. Hierarchical entry was performed by entering variables in blocks in the following order: (1) disability, depression, diabetic complications, chronic conditions, duration of diabetes and treatment regimen; (2) socio-demographic characteristics; (3) social support; and (4) lifestyle-related behaviors. The analyses were stratified by sex since we expected different associations between SRH and depression and disability for men and women.

## **RESULTS**

Of the total 2003 participants in the DHS with self-reported diabetes, 93.6% were classified as having type 2 diabetes (n=1868). Results reported in this paper are for individuals with type 2 diabetes only; participants diagnosed before the age of 30 and using insulin immediately after diagnosis were epidemiologically classified as having type 1 diabetes and were excluded from the analysis. 1% of the sample was underweight and was excluded from the analysis.

Seventy-eight percent of the participants rated their health as excellent/very good/good while 22% rated their health as fair/poor. Nine participants did not answer the PHQ-9, and 6 participants did not answer the WHO-DAS-II. Non-response to the individual survey questions was low (<5%), with two exceptions: 178 participants did not answer all questions to the DCI and 178 participants did not report enough information to calculate their BMI. Participants followed one of three treatment regimens; 25% took insulin as a means of treating their diabetes,

60% were on medication (without insulin) and 15% used neither insulin nor medication.

Associations between SRH and diabetes characteristics, demographic, social support and lifestyle behaviors are presented in Table 1. Self-ratings of health were not significantly associated with neither age, nor duration of diabetes nor smoking status. They were however significantly associated with sex, marital status, employment status, education, physical activity, alcohol consumption, weight categories, diabetic complications and number of chronic conditions ( $p < .05$ ). Men were more likely to rate their health as excellent, while women were more likely to rate their health as good, fair or poor. Individuals with good to excellent SRH were more likely to be currently working, married or living with a partner, to have never smoked or to be a former smoker and to be active or moderately active. Those reporting fair to poor health were more often widowed/divorced/separated, not working, have less than a high school education, be physically inactive, never drink, be obese, have two or more complications and one or more chronic conditions ( $p < 0.05$ ).

Analysis of variance indicated social support to be significantly associated with SRH in the total sample ( $F(4, 1698) = 4.81, p = .001$ ). Individuals with very good and good SRH reported more social support ( $M = 66.17, SD = 28.61$  and  $M = 65.47, SD = 25.97$ , respectively) than those with excellent, fair and poor SRH ( $M = 55.90, SD = 32.31; M = 62.13, SD = 26.55$  and  $M = 60.07, SD = 26.58$ , respectively).

Similarly, SRH was significantly associated with depression and disability ( $F(4, 1823) = 178.67, p < .001; F(4, 1827) = 254.63, p < .001$ ) respectively as shown in

Table 1. The prevalence of major depression was 8.6 %. Individuals reporting excellent and very good health status reported low levels of depression and disability symptoms while individuals reporting fair and poor health reported high levels of depression and disability symptoms.

The results of the logistic regression analyses are presented in tables 2 and 3. Four regression models were tested for both men and women. Depression, disability and number of chronic conditions were associated with SRH in all regression models for both men and women. The odds ratios for depression and disability were similar. In men, the odds ratio for depression was higher than that for disability. The opposite effect was observed in women. The odds ratios changed marginally when socio-demographic characteristics, social support, and lifestyle related behavior were added in the models. Obesity was associated with poorer health status in women while physical activity and alcohol consumption (two or more times a week) were associated with better health status in men only.

## **DISCUSSION**

The way people perceive their health is considered an important indicator of the overall health and wellbeing of a population. The present community-based study of people with diabetes indicates a strong association between SRH and both disability and depression. The strength of association between SRH and disability was similar to that of depression. The associations remained unchanged when we controlled for duration of diabetes, diabetes specific complications, chronic conditions, treatment regimen, social support, socio-demographic characteristics,

and lifestyle-related behaviors. Diabetes complications were strongly associated with SRH in univariate analyses but were no longer associated with SRH in multivariate analyses. These results may indicate that complications affect SRH through their impact on physical functioning.

The association between SRH and physical functioning is well supported in population-based samples. Analyzing the association between SRH and the mental and physical summary scores of the SF-36 in a representative UK cohort, Mavaddat et al. (2011) found that the strength of association between SRH and physical functioning was almost two times higher than the association between SRH and mental functioning. Similarly, physical mobility was one of the strongest predictor for SRH in the British Whitehall II and French Gazel studies (Singh-Manoux et al., 2006). In contrast, our results indicate that depression and disability were equally associated with SRH, suggesting that the association between SRH and mental and physical functioning might be different in people with diabetes. This difference might be explained by a higher prevalence of depressive symptoms in people with diabetes compared with the general population. Prevalence of major depression in our sample was 8.6 %, three times higher than in the general Canadian adult population (2.5-3.3%, as measured by the PHQ-9) (Patten & Schopflocher, 2009). People with diabetes may be taking their mental health status into account when evaluating their overall health status. Further, depression in diabetes is associated with poorer self-care behavior, poorer blood glucose management and more diabetes specific complications (Ciechanowski, Katon, Russo, & Hirsch, 2003; De Groot, Anderson, Freedland,

Clouse, & Lustman, 2001). The negative effect of depression on current health behaviors (e.g., diabetes management) and diabetes outcomes (e.g., complications) may contribute to poor SRH in diabetes. In addition, depressive mood may affect the perception that individuals with diabetes have of their health, independent of their actual health.

Our results indicate that physically inactive individuals, individuals who did not drink and obese individuals were more likely to report fair and poor self-ratings of health. Alcohol consumption consisting of two or more drinks a week was associated with better health status in men in multivariate analyses. Previous research suggests that healthy lifestyle behaviors are associated with good SRH (excellent, very good, good) in adults with diabetes, including regular physical activity, moderate alcohol intake and not currently smoking (Tsai, Ford, Li, Zhao & Balluz, 2010). Univariate analysis suggested that people who did not drink alcohol were more likely to report fair or poor SRH than people who did drink alcohol. Non-drinkers had higher levels of disability, more chronic conditions and more diabetes specific complications than drinkers, suggesting that some of the non-drinkers might have stopped drinking due to health issues and/or medication. Women were less likely to rate their health as excellent compared with men. However, associations between gender and self-rated health remain ambiguous. Men and women may be using different sources of information when making their judgment. Women might base their judgments of health on both threatening and non-threatening life events whereas men might relate them more to serious

illness (Benyamini, Leventhal, & Leventhal, 2000). For these reasons, SRH has been shown to be a weaker predictor of mortality in women compared with men. Obesity was associated with poorer health status in women, whereas physical activity was associated with better health status in men. These results indicate that obesity might be an important dimension of SRH for women with diabetes in addition to depression, disability and information on chronic conditions. Findings from non-diabetic samples support a significant association between obesity and poor SRH particularly in women (Imai, et al., 2008) although sex differences have not been consistently observed (Okosun, Choi, Matamoros, & Dever, 2001). Evidence suggests that women may be more likely to consider obesity a health problem than do men (Gregory, Blanck, Gillespie, Maynard, & Serdula, 2008). Excess weight is also reported to affect the social and psychological health in women more than in men (Puhl & Heuer, 2009). For example, obese women are more often victim of weight discrimination and body disturbances than obese men (Puhl & Heuer, 2009). Conversely, physical activity was an important predictor of better SRH in men, but not in women. This result is closely related to a recent study by Tsai et al. (2010), which found physical activity related to good to excellent SRH in both men and women with diabetes. Men and women may evaluate physical activity differently, particularly in relation to their work and household activities. Severe physical inactivity could therefore be capturing a specific aspect of functioning or health in men but not women.

The strengths of the current study include the population-based design and a large sample of people with diabetes. The study however has some limitations. The data



was cross-sectional analysis and thus no causal inferences can be made. For example, it is possible that a feedback loop exists between depression and a poor rated health status. A brief generic disability score was used as an outcome measure which includes both physical and non-physical dimensions such as interpersonal relations, understanding and communication. Given that disability is a complex phenomenon involving many dimensions, a global score might overlook domain-specific differences in disability. Although we focused on current depression (last 2 weeks) and current disability (last 30 days), it is possible that previous depression or disability had an impact on diabetes severity or health behaviors. Another limitation is that our study variables were self-reported, which could have resulted in misclassifications. Our sampling frame was limited to landline telephones and neither cell-phone-only households nor households without phones were included.

SRH is a widely used instrument and a strong predictor for morbidity and mortality. Our results suggest that depression and disability are important factors that are associated with SRH in diabetes. Other factors such as lifestyle related behaviors are important, but these associations appear to be different for men and women. These results highlight the importance of physical and mental functioning of people with diabetes while rating their health. Clinical implications include the importance of enhancing both mental and physical functioning in people with diabetes. Lastly, to enhance our understanding of the impact of SRH on mortality and morbidity, future research should focus on longitudinal data to study the

association between SRH and the above mentioned factors throughout the years as well as to study the causality between the factors associated with SRH.

### **Competing interests**

Nothing to declare.

### **Acknowledgments**

This research was supported by a grant from Canadian Institute for Health Research (CIHR).

The corresponding author (N.S.) is supported by a Fonds de recherche en santé du Québec (FRSQ) Chercheur-Boursier fellowship. G.G. is supported by a doctoral fellowship from the Bombardier foundation.

## References

- Anderson, R. J., Freedland, K. E., Clouse, R. E., & Lustman, P. J. (2001). The prevalence of comorbid depression in adults with diabetes. *Diabetes Care*, *24*(6), 1069-1078. doi: 10.2337/diacare.24.6.1069.
- Benyamini, Y., Leventhal, E. A., & Leventhal, H. (2000). Gender differences in processing information for making self-assessments of health. *Psychosomatic Medicine*, *62*(3), 354-364.
- Bush, K., Kivlahan, D. R., McDonell, M. B., Fihn, S. D., & Bradley, K. A. (1998). The AUDIT alcohol consumption questions (AUDIT-C) - An effective brief screening test for problem drinking. *Archives of Internal Medicine*, *158*(16), 1789-1795.
- Chwastiak, L. A., & Von Korff, M. (2003). Disability in depression and back pain: Evaluation of the World Health Organization Disability Assessment Schedule (WHO DAS II) in a primary care setting. *Journal of Clinical Epidemiology*, *56*(6), 507-514.
- Ciechanowski, P. S., Katon, W. J., Russo, J. E., & Hirsch, I. B. (2003). The relationship of depressive symptoms to symptom reporting, self-care and glucose control in diabetes. *General Hospital Psychiatry*, *25*(4), 246-252. doi: 10.1016/s0163-8343(03)00055-0
- de Groot, M., Anderson, R., Freedland, K. E., Clouse, R. E., & Lustman, P. J. (2001). Association of depression and diabetes complications: A meta-analysis. *Psychosomatic Medicine*, *63*(4), 619-630.
- DeSalvo, K. B., Bloser, N., Reynolds, K., He, J., & Muntner, P. (2006). Mortality prediction with a single general self-rated health question. *Journal of General Internal Medicine*, *21*(3), 267-275. doi: 10.1111/j.1525-1497.2005.0291.x
- Fincke, B. G., Clark, J. A., Linzer, M., Spiro, A., III, Miller, D. R., Lee, A., & Kazis, L. E. (2005). Assessment of Long-term Complications due to Type 2 Diabetes Using Patient Self-report: The Diabetes Complications Index. *The Journal of Ambulatory Care Management*, *28*(3), 262-273.
- Ford, E. S., Moriarty, D. G., Zack, M. M., Mokdad, A. H., & Chapman, D. P. (2001). Self-reported body mass index and health-related quality of life: Findings from the Behavioral Risk Factor Surveillance System. *Obesity*, *9*(1), 21-31.

- Gregg, E. W., Breckles, G. L. A., Williamson, D. F., Leveille, S. G., Langlois, J. A., Engelgau, M. M., & Narayan, K. M. V. (2000). Diabetes and physical disability among older US adults. *Diabetes Care*, *23*(9), 1272-1277.
- Gregory, C. O., Blanck, H. M., Gillespie, C., Maynard, L. M., & Serdula, M. K. (2008). Perceived health risk of excess body weight among overweight and obese men and women: Differences by sex. *Preventive Medicine*, *47*(1), 46-52. doi: 10.1016/j.ypmed.2008.01.008
- Han, B. (2002). Depressive symptoms and self-rated health in community-dwelling older adults: A longitudinal study. *Journal of the American Geriatrics Society*, *50*(9), 1549-1556.
- Imai, K., Gregg, E. W., Chen, Y. J., Zhang, P., de Rekeneire, N., & Williamson, D. F. (2008). The association of BMI with functional status and self-rated health in US adults. *Obesity*, *16*(2), 402-408.
- Jimenez-Garcia, R., Carrasco-Garrido, P., Jimenez-Trujillo, I., Lopez, A., Hernandez-Barrera, V., & Gil, A. (2008). Ten-year trends in self-rated health among Spanish adults with diabetes, 1993-2003. *Diabetes Care*, *31*(1), 90-92. doi: 10.2337/dc07-1382
- Jylha, M. (2009). What is self-rated health and why does it predict mortality? Towards a unified conceptual model. *Social Science & Medicine*, *69*(3), 307-316. doi: 10.1016/j.socscimed.2009.05.013
- Katon, W. J., Rutter, C., Simon, G., Lin, E. H. B., Ludman, E., Ciechanowski, P., Kinder, L., Young, B., Von Korff, M. (2005). The association of comorbid depression with mortality in patients with type 2 diabetes. *Diabetes Care*, *28*(11), 2668-2672.
- Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9 - Validity of a brief depression severity measure. *Journal of General Internal Medicine*, *16*(9), 606-613.
- Mavaddat, N., Kinmonth, A. L., Sanderson, S., Surtees, P., Bingham, S., & Khaw, K. T. (2011). What determines Self-Rated Health (SRH)? A cross-sectional study of SF-36 health domains in the EPIC-Norfolk cohort. *Journal of Epidemiology and Community Health*, *65*(9), 800-806. doi: 10.1136/jech.2009.090845
- Medicine, I. o. (2009). State of the USA Health Indicators: Letter Report. *Washington, DC: The National Academies Press*.
- Okosun, I. S., Choi, S., Matamoros, T., & Dever, G. E. A. (2001). Obesity is associated with reduced self-rated general health status: Evidence from a

- representative sample of white, black, and hispanic Americans. *Preventive Medicine*, 32(5), 429-436.
- Pan, L., Mukhtar, Q., Geiss, S. L., Rivera, M., Alfaro-Correa, A., & Sniegowski, R. (2006). Self-rated fair or poor health among adults with diabetes - United States, 1996-2005 (Reprinted from MMWR, vol 55, pg 1224-1227, 2006). *Jama-Journal of the American Medical Association*, 296(24), 2919-2920.
- Patten, S. B., & Schopflocher, D. (2009). Longitudinal epidemiology of major depression as assessed by the Brief Patient Health Questionnaire (PHQ-9). *Comprehensive Psychiatry*, 50(1), 26-33. doi: 10.1016/j.comppsy.2008.05.012
- Puhl, R. M., & Heuer, C. A. (2009). The stigma of obesity: A review and update. *Obesity*, 17(5), 941-964.
- Salomon, J. A., Nordhagen, S., Oza, S., & Murray, C. J. L. (2009). Are americans feeling less healthy? The puzzle of trends in self-rated health. *American Journal of Epidemiology*, 170(3), 343-351. doi: 10.1093/aje/kwp144
- Schmitz, N., Boyer, R., Nitka, D., Messier, L., Garipey, G., Strychar, I., Malla, A., LeSage, A., Wang, J. L. (2009). Association between neighborhood-level deprivation and disability in a community sample of people with diabetes. *Diabetes Care*, 32(11), 1998-2004. doi: 10.2337/dc09-0838
- Sherbourne, C. D., & Stewart, A. L. (1991). The Mos Social Support Survey. *Social Science & Medicine*, 32(6), 705-714.
- Singh-Manoux, A., Martikainen, P., Ferrie, J., Zins, M., Marmot, M., & Goldberg, M. (2006). What does self rated health measure? Results from the British Whitehall II and French Gazel cohort studies. *Journal of Epidemiology and Community Health*, 60(4), 364-372. doi: 10.1136/jech.2005.039883
- Tsai, J., Ford, E., Li, C., Zhao, G., & Balluz, L. (2010). Physical activity and optimal self-rated health of adults with and without diabetes. *Bmc Public Health*, 10(1), 365.
- Tsai, J., Ford, E. S., Li, C. Y., Zhao, G. X., Pearson, W. S., & Balluz, L. S. (2010). Multiple healthy behaviors and optimal self-rated health: Findings from the 2007 Behavioral Risk Factor Surveillance System Survey. *Preventive Medicine*, 51(3-4), 268-274. doi: 10.1016/j.ypmed.2010.07.010
- Von Korff, M., Katon, W., Lin, E. H. B., Simon, G., Ludman, E., Ciechanowski, P., Rutter, C., & Bush, T. (2005). Potentially modifiable factors associated

with disability among people with diabetes. *Psychosomatic Medicine*,  
67(2), 233-240. doi: 10.1097/01.psy.0000155662.82621.50

Table 1. Prevalence of demographic and clinical characteristics by self-rated health status

		Self Rated Health										
		Excellent (n=127)		Very Good (n= 333)		Good (n= 979)		Fair (n= 273)		Poor (n= 125)		
		N	%									
Age	18-49	315	15.0	17.7	16.3	19.8	18.4					
	50-64	830	47.2	42.6	46.6	40.7	48.8					
	65-80	692	37.8	39.6	37.1	39.6	32.8					
Sex†	Men	832	56.7	48.6	45.3	42.5	31.2					
	Women	1005	43.3	51.4	54.7	57.5	68.8					
Marital Status†	Married/Living with a partner	1144	65.9	66.5	64.0	56.8	48.0					
	Widowed/Divorced/Separated	475	21.4	22.4	24.9	30.0	38.4					
	Single	214	12.7	11.2	11.0	13.2	13.6					
Employment Status‡	Working (full/part time/student)	617	39.4	38.4	36.0	26.7	12.0					
	Not Working	338	13.4	9.1	17.5	26.0	39.2					
	Retired	879	47.2	52.6	46.5	47.3	48.8					
Education*	Less than high school	787	41.5	37.5	42.9	49.4	53.3					
	High school	510	30.9	28.7	28.4	25.8	27.9					
	More than high school	512	27.6	33.8	28.7	24.7	18.9					
<b>Lifestyle Related Behaviors</b>												
Smoking Status	Never Smoker	675	38.1	40.2	37.2	33.3	31.2					
	Former Smoker	783	43.7	42.3	43.5	41.0	40.0					
	Current Smoker <20cigs/day	376	18.3	17.4	19.3	25.6	28.8					
Physical Activity ‡	Inactive	557	21.5	19.9	28.0	47.1	59.7					
	Moderately Active	645	29.8	43.1	37.8	28.9	25.0					
	Active	589	48.8	37.0	34.2	24.0	15.3					
Alcohol Consumption‡	Never	792	36.8	34.5	40.6	54.8	71.0					
	Less than twice a week	741	43.2	47.9	41.1	36.3	24.2					
	2 or more times a week	291	20.0	17.6	18.3	8.9	4.8					
Weight‡	Normal	334	25.2	25.3	19.0	16.1	14.7					
	Overweight	589	41.2	40.3	36.6	24.6	25.7					
	Obese	755	33.6	34.4	44.4	59.3	59.6					
<b>Health Related Characteristics</b>												
Diabetes Complications‡	No complications	527	50.0	54.0	28.4	16.8	5.4					
	One complication	473	28.3	27.8	31.9	23.1	11.7					
	2 or more complications	671	21.7	18.1	39.6	60.1	82.9					
Number of Chronic Conditions‡	0	341	41.6	27.4	18.3	9.0	5.3					
	one or more	1413	58.4	72.6	81.7	91.0	94.7					
Duration of Diabetes	<1 year	75	6.3	5.5	3.7	4.1	1.6					
	1-9.9 years	950	54.0	54.0	31.8	48.3	46.0					
	More than 10 years	790	39.7	40.5	42.8	47.6	52.4					
			M	SD	M	SD	M	SD	M	SD	M	SD
Depression Score‡		1828	2.14	3.10	2.25	3.03	4.50	4.24	8.85	5.86	12.22	6.65
Disability score‡		1832	5.38	9.46	5.91	8.79	11.69	12.14	25.30	16.09	41.43	18.81

\* p<.05, † p< .01, ‡ p< .001



Table 2. Associations between self rated health status and depression, disability, diabetes specific characteristics, socio-demographic characteristics, social support and lifestyle related variables in 704 women with type 2 diabetes

Model	Self Rated Health (Excellent/Very Good/Good vs. Fair/Poor)							
	1		2		3		4	
	Odds Ratio	95.0% C.I. Lower-Upper	Odds Ratio	95.0% C.I. Lower-Upper	Odds Ratio	95.0% C.I. Lower-Upper	Odds Ratio	95.0% C.I. Lower-Upper
Depression Score <sup>1</sup>	1.53	1.22-1.91	1.42	1.13-1.78	1.43	1.14-1.80	1.43	1.14-1.81
Disability Score <sup>1</sup>	1.69	1.47-1.94	1.75	1.51-2.03	1.77	1.53-2.06	1.73	1.49-2.02
Diabetes Complications	1.04	0.75-1.43	1.04	0.75-1.44	1.03	0.74-1.43	1.01	0.72-1.41
Chronic Conditions	1.23	1.05-1.43	1.28	1.09-1.50	1.27	1.08-1.50	1.26	1.07-1.48
Duration of Diabetes	1.05	0.82-1.36	1.15	0.88-1.50	1.15	0.88-1.51	1.14	0.87-1.51
Treatment Regimen								
Insulin	1.87	0.77-4.55	1.83	0.75-4.45	1.73	0.71-4.22	1.53	0.60-3.89
Pills	1.42	0.64-3.14	1.53	0.68-3.44	1.48	0.66-3.31	1.41	0.61-3.27
<b>Sociodemographic Characteristics</b>								
Age			0.96	0.94-0.99	0.97	0.94-0.99	0.97	0.94-0.99
Education								
Less than High School			1.23	0.72-2.11	1.27	0.74-2.19	1.23	0.70-2.14
More than high School			0.90	0.48-1.68	0.92	0.49-1.70	0.95	0.50-1.79
Employment Status								
Employed			1.20	0.63-2.26	1.21	0.64-2.30	1.26	0.65-2.43
Retired			1.44	0.75-2.75	1.41	0.74-2.71	1.65	0.84-3.25
Marital Status								
Widowed/Divorced/Separated			1.00	0.61-1.64	1.13	0.67-1.92	1.18	0.69-2.04
Single			0.62	0.29-1.34	0.70	0.32-1.54	0.61	0.27-1.37
<b>Social Support</b>								
<b>Lifestyle-related behaviors</b>								
Physical Activity								
Active							0.79	0.45-1.41
Moderately Active							0.77	0.45-1.33
Smoking Status								
Never Smoker							0.74	0.40-1.37
Former Smoker							0.69	0.36-1.30
Alcohol consumption								
1-4 times a month							0.72	0.44-1.19
Alcohol $\geq$ twice a week							0.79	0.30-2.08
Weight Status								
Overweight							1.31	0.62-2.79
Obese							2.73	1.35-5.52

Note 1. WHO-DAS-II and PHQ-9 summary scores were transformed by adding 1 to each score and computing the square root of that score due to skewed distributions

2. Model 1  $R^2 = .26$  (Cox & Snell),  $.40$  (Nagelkerke) Model1  $X^2(7) = 210.13$ , Model 2  $R^2 = .26$  (Cox & Snell),  $.41$  (Nagelkerke) Model 2  $X^2(14) = 218.45$ , Model 3  $R^2 = .27$  (Cox & Snell),  $.41$  (Nagelkerke) Model3  $X^2(15) = 220.642$ , Model 4  $R^2 = .29$  (Cox & Snell),  $.44$  (Nagelkerke) Model4  $X^2(23) = 237.55$ .

3. The sample size is based on participants who had no missing values on the variables included in the regression analysis.

Table 3. Associations between self rated health status and depression, disability, diabetes specific characteristics, socio-demographic characteristics, social support and lifestyle related variables in 607 men with diabetes

Model	Self Rated Health (Fair/Poor vs. Excellent/Very Good/Good )							
	1		2		3		4	
	Odds Ratio	95.0% C.I. Lower-Upper	Odds Ratio	95.0% C.I. Lower-Upper	Odds Ratio	95.0% C.I. Lower-Upper	Odds Ratio	95.0% C.I. Lower-Upper
Depression Score	1.91	1.43-2.57	1.85	1.37-2.49	1.85	1.37-2.50	1.96	1.43-1.96
Disability Score	1.67	1.41-1.97	1.68	1.40-2.00	1.68	1.40-2.01	1.62	1.35-1.96
Diabetes Complications	1.31	0.88-1.95	1.34	0.89-2.03	1.34	0.89-2.02	1.33	0.86-2.05
Chronic Conditions	1.26	1.04-1.54	1.26	1.03-1.54	1.26	1.03-1.54	1.32	1.07-1.63
Duration of Diabetes	0.95	0.69-1.31	1.05	0.75-1.48	1.05	0.75-1.48	1.10	0.76-1.57
Treatment Regimen								
Insulin	2.34	0.61-9.00	2.12	0.55-8.23	2.12	0.55-8.24	1.68	0.41-6.88
Pills	1.65	0.46-5.88	1.54	0.43-5.49	1.54	0.43-5.49	1.23	0.32-4.68
<b>Socio-demographic Characteristics</b>								
Age			0.98	0.94-1.01	0.98	0.94-1.01	0.98	0.94-1.02
Education								
Less than High School			0.66	0.33-1.29	0.65	0.33-1.29	0.74	0.36-1.50
More than high School			0.76	0.37-1.57	0.76	0.37-1.57	1.03	0.47-2.23
Employment Status								
Employed			0.72	0.30-1.71	0.72	0.30-1.71	0.90	0.36-2.21
Retired			0.91	0.34-2.39	0.90	0.34-2.39	1.07	0.38-2.97
Marital Status								
Widowed/Divorced/Separated			1.47	0.71-3.04	1.48	0.71-3.11	1.48	0.68-3.20
Single			1.28	0.55-2.97	1.29	0.53-3.10	1.39	0.57-3.42
<b>Social Support</b>					1.00	0.99-1.01	1.00	0.99-1.01
<b>Lifestyle-related behaviors</b>								
Physical Activity								
Active							0.31	0.14-0.68
Moderately Active							0.84	0.42-1.68
Smoking Status								
Never Smoker							0.72	0.30-1.75
Former Smoker							0.94	0.46-1.94
Alcohol consumption								
1-4 times a month							0.59	0.30-1.16
Alcohol $\geq$ twice a week							0.28	0.12-0.67
Weight Status								
Overweight							0.46	0.19-1.08
Obese							0.63	0.28-1.42

Note 1. WHO-DAS-II and PHQ-9 summary scores were transformed by adding 1 to each score and computing the square root of that score due to skewed distributions

2. Model 1  $R^2 = .30$  (Cox & Snell),  $.50$  (Nagelkerke) Model 1  $X^2(7) = 218.72$ , Model 2  $R^2 = .31$  (Cox & Snell),  $.51$  (Nagelkerke) Model 2  $X^2(14) = 224.29$ , Model 3  $R^2 = .31$  (Cox & Snell),  $.51$  (Nagelkerke) Model 3  $X^2(15) = 224.29$ , Model 4  $R^2 = .33$  (Cox & Snell),  $.56$  (Nagelkerke) Model 4  $X^2(23) = 247.93$ .

3. The sample size is based on participants who had no missing values on the variables included in the regression analysis.

## 2.10 CONNECTING TEXT

As evidenced by the first manuscript, depression and disability were important characteristics of SRH in people with type 2 diabetes. As discussed in the introduction, the prevalence of depression in people with diabetes is more than twice as prevalent as in people without diabetes and is associated with poor SRH. Comorbid depression in diabetes is associated with a variety of serious health outcomes including poor glycemic control which can have a serious impact on the deterioration of the illness. Predicting the incidence of major depression in this population could therefore aid in identifying patients at risk for poor health outcomes and health practitioners would be able to allocate treatment accordingly. The following chapter is aimed at determining whether fair or poor SRH can be used to predict the three-year incidence of major depression in a Canadian community sample of people with type 2 diabetes. Findings could help in supporting the use of SRH as a screening tool for patients risking deteriorating health consequences.

## CHAPTER 3. Manuscript 2

### **Self-rated health: a predictor for the three year incidence of major depression in individuals with Type II diabetes**

Ghislaine Badawi<sup>1,2</sup>, B.Sc.; Véronique Pagé<sup>2</sup>, MSc; Kimberley J Smith<sup>1,2</sup>, PhD; Geneviève Gariépy<sup>2,3</sup>, MSc; Ashok Malla<sup>1,2</sup>, MD; JianLi Wang<sup>5</sup>, PhD; Richard Boyer<sup>6</sup>, PhD; Irene Strychar<sup>4,7</sup>, EDD; Alain Lesage<sup>6</sup>, MD, Norbert Schmitz<sup>1,2,3,4</sup>, PhD

Accepted for publication, *Journal of Affective Disorders*, 2012

<sup>1</sup> Department of Psychiatry, McGill University, Montreal, Quebec, Canada

<sup>2</sup> Douglas Mental Health University Institute, Montreal, Quebec, Canada

<sup>3</sup> Department of Epidemiology and Biostatistics, McGill University, Montreal, Quebec, Canada

<sup>4</sup> Montreal Diabetes Research Centre, Montreal, Quebec, Canada

<sup>5</sup> Departments of Psychiatry and Community Health Sciences, Faculty of Medicine, University of Calgary, Calgary, Canada.

<sup>6</sup> Centre de Recherche Fernand Seguin, Hôpital Louis-H. Lafontaine, University of Montreal, Montreal, QC Canada

<sup>7</sup> Department of Nutrition, Faculty of Medicine, University of Montreal, and the Centre de Recherche du Centre Hospitalier de l'Université de Montréal (CRCHUM), Montreal, QC, Canada

Running title. *Health ratings predict depression in diabetes.*

#### *Address for Correspondence*

Norbert Schmitz<sup>1</sup>, PhD;  
Douglas Mental Health University Institute  
McGill University  
6875 LaSalle Boulevard  
Montreal, Quebec, Canada  
H4H 1R3  
Tel: 1-514-761-6131, ext. 3379  
Fax: 1-514-888-4064  
E-mail: norbert.schmitz@mcgill.ca

## **ABSTRACT**

**Background:** To determine whether self-rated health was a predictor for the three year incidence of major depression in people with type 2 diabetes.

**Methods:** Data was collected as part a population-based telephone survey of adults with diabetes, in Québec, Canada (2008-2011). 1265 adults with type 2 diabetes did not have major depression at baseline and were assessed at three follow-up interviews conducted 12, 24 and 36 months after baseline. Depression was assessed using the Patient Health Questionnaire (PHQ-9). Self-rated health status was determined by asking participants to rate their health on a scale from excellent to poor.

**Results:** Thirty six percent of individuals who had developed major depression at follow up rated their health as fair or poor at baseline compared to 14.4% of those who had not developed major depression. Logistic regression analyses indicated fair or poor self-rated health at baseline to be predictive of a twofold increased risk for major depression at follow-up, even after adjusting for socio-demographic characteristics, lifestyle-related behaviors, disability and diabetes characteristics (OR= 2.05, 95%CI 1.20-3.48).

**Limitations:** We have focused on current depression (last two weeks) and we have used a questionnaire (PHQ-9) rather than a clinical interview for the assessment of depression.

**Conclusions:** Self-rated health status might be a predictor for developing major depression in people with diabetes in addition to well established risk factors.

Key words: Self-rated health, health ratings, depression, diabetes, predictor, longitudinal.

## INTRODUCTION

With increasingly sedentary lifestyles, exceedingly rich diets and obesity, the diabetes epidemic has become one of the main concerns threatening human health in the 21<sup>st</sup> century. A recent study estimated the prevalence of diabetes to be 6.4% in 2010 and the figure is projected to dramatically rise to 7.7% in 2030 potentially affecting 439 million adults (Shaw, Sicree, & Zimmet, 2010).

Depression is an important comorbidity in diabetes (Katon et al., 2008); it has been associated with poor adherence to the recommended diabetes self-care regimens, poorer lifestyle behaviors, higher risks of micro- and macro-vascular complications, more diabetes complications and higher mortality rates (Black, Markides, & Ray, 2003; Katon et al., 2004; Katon et al., 2005; Lin et al., 2004; Lustman et al., 2000).

Various risk factors have been identified to increase the likelihood of developing depression in people with diabetes. These factors include demographic characteristics such as younger age, female sex, less education, being unmarried, lower income, functional impairments, lifestyle characteristics such as obesity and smoking and diabetes characteristics such as diabetes complications and treatment regimen, specifically treatment with insulin (Blazer, Moody-Ayers, Craft-Morgan, & Burchett, 2002; Egede & Zheng, 2003; Katon et al., 2004).

Self-rated health (SRH) status is among the most frequently assessed health perceptions in epidemiological research (Salomon, Nordhagen, Oza, & Murray, 2009); it has been recommended for use in health monitoring by the World Health Organization, and the European Commission (Salomon, et al., 2009). SRH is a

single item measure repeatedly shown to be a strong predictor of mortality in both population and clinical samples (Idler & Benyamini, 1997). As pointed out by Jylha and colleagues (2009), ratings may reflect a subjective summary of all the information people have available about their understanding of health; including information on physical functioning in everyday life, lifestyle conditions that have adverse effects on health, specific disease characteristics (severity and prognosis), mood and personality factors. SRH has been demonstrated to be a reliable predictor of mortality and morbidity around the world and in a wide range of conditions, including cancer and cardiovascular disease, independent of socio-economic, physical and biological characteristics (Bosworth et al., 1999; Idler & Benyamini, 1997; Shadbolt, Barresi, & Craft, 2002). In a recent large population-based cohort study, Mavaddat & al. (2011) found mental health to be associated with fair or poor SRH. SRH was also found to be longitudinally associated with depression in older adults of the general population (Kosloski, Stull, Kercher, & Van Dussen, 2005). Lastly, in clinical samples, part of the association between depressive symptoms and cardiovascular mortality was explained by SRH (Kamphuis, et al., 2009).

Recently, we have shown that SRH was strongly associated with depression in a cross-sectional community sample of people with diabetes even after accounting for socio-economic factors, lifestyle-related behaviors, social support and diabetes related characteristics (Badawi, Garipey, Page & Schmitz, 2012). Although SRH has been associated with depression, there is a lack of information concerning SRH as a predictor for depression in people with diabetes. We hypothesize that



SRH is not only associated with depression in diabetes but that SRH is a risk factor for depression, possibly capturing an aspect of health not accounted for by objective health measures.

Given the high incidence of comorbid depression in people with diabetes and the strong association between SRH and depression in this population, the present study is aimed at determining whether SRH is a predictor for the three year incidence of major depression in a sample of people with type 2 diabetes. This study constitutes an effort to potentially improve the mental wellbeing of individuals identified with poor SRH while detecting those at risk for poor mental health.

## **METHODS**

For the objective of this analysis, data from the Montreal Diabetes Health and Well Being Study (DHS) were used. The DHS was a random digit-dialed telephone survey of the non-institutionalized adult population in Quebec, Canada. Participants were recruited between January and April 2008 through random selection of listed phone numbers in Quebec by a recognized polling firm, Bureau d'Intervieweurs Professionnels (Montreal, Quebec, Canada) (Schmitz et al., 2009). Adults eligible to participate were 18 to 80 years of age at baseline, had a diagnosis of diabetes determined by a physician and could respond to the interview in either French or English. Three follow-up interviews were conducted approximately 12, 24 and 36 months after baseline. Participants were asked

whether they would be interested to participate in the follow-up study and only those who agreed were contacted.

*SRH* at baseline was assessed by asking participants ‘Would you say that in general your health is...’ Participants were asked to answer with a 5-category Likert response scale (Excellent, Very Good, Good, Fair or Poor). This scale has been used in some of the world’s largest telephone surveys tracking health conditions and behaviors, such as the National Health and Nutrition Examination Survey (NHANES), the Canadian Community Health Survey (CCHS) and especially the Behavioral Risk Factor Surveillance System (BRFSS) (Ford, Moriarty, Zack, Mokdad, & Chapman, 2001).

*Depression* at baseline and at each follow-up was assessed using the Patient Health Questionnaire (PHQ-9) (Appendix C) (Kroenke, Spitzer, & Williams, 2001). The PHQ-9 provides a tentative diagnosis of major depression according to Diagnostic and Statistical Manual, 4th Edition (DSM-IV) criteria and a continuous severity score. The criteria for *major depression* required the patient to have, for at least 2 weeks, five or more depressive symptoms present for more than half of the days with at least one of these symptoms being either depressed mood or anhedonia. Participants who did not have major depression at baseline were evaluated for the presence or absence of major depression during at least one of the follow-ups.

The DHS collected data on socio-demographic characteristics: age at baseline, sex and marital status (married/common-law, single, divorced/separated/widowed), education level (less than high school graduation, high school graduation, post

high school attendance or graduation) and employment status (Working full time/part time/Student, Retired, not working).

*Baseline lifestyle related characteristics-* Physical inactivity levels were measured by asking participants to rate the number of days they exercised or participated in sports activity for at least 15 minutes in the previous month. The response was collapsed into three categories: inactive (0 days), moderately active (1 to 12 days) and active (more than 12 days).

Smoking behavior was assessed by questions from the Canadian Community Health Survey. Participants were asked whether they currently smoked, had formerly smoked, or had never smoked. Answers were dichotomized into yes or no smoking status. Alcohol consumption was assessed from the first item of the Alcohol Use Disorders Identification Test (AUDIT): ‘How often do you have a drink containing alcohol?’(Bush et al., 1998). Answers were categorized into never, less than twice a week and two or more times a week.

*Global disability* was assessed using the 12-item version of the World Health Organization Disability Assessment Schedule II (WHO-DAS-II) (Appendix B) which consists of both physical and non-physical dimensions (mobility, understanding and communication, interpersonal relations, etc.). Participants were asked to estimate the magnitude of the disability during the previous 30 days on a scale from none to extreme/cannot do. The 12 items were summed and transformed to a percent score (0% to 100%) with higher scores indicating greater disability. The 12-item WHO-DAS-II has been confirmed as a reliable and valid measure of global disability (Chwastiak & Von Korff, 2003) and has been

validated and used in diabetes epidemiological studies (Von Korff et al., 2005). Based on available normative data, we classified a WHO-DAS-II score of 45 or greater as indicating severe disability (Von Korff, et al., 2005).

*Baseline health related characteristics*-Baseline body mass index (BMI) was calculated based on self-reported weight and height and was categorized according to guidelines from the National Heart, Lung and Blood Institute; underweight ( $<18.5 \text{ kg/m}^2$ ), normal weight ( $18.5\text{-}24.9 \text{ kg/m}^2$ ), overweight ( $25.0\text{-}29.9 \text{ kg/m}^2$ ) and obese ( $\geq 30.0 \text{ kg/m}^2$ ). Diabetes complications were assessed using the Diabetes Complications Index (DCI) (Fincke et al., 2005). The DCI is a 17-item survey that assesses diabetes complications on the basis of patient self-report (retinopathy, neuropathy, large-vessel atherosclerotic disease, peripheral vascular disease, cerebrovascular disease and foot problems). A summary variable was computed counting the number of complications. Number of chronic conditions was assessed by asking participants whether they suffered from various health conditions diagnosed by a health professional at the time of the interview (asthma, high blood pressure, heart disease, stomach or intestinal ulcers, arthritis / rheumatism, migraine headaches, cancer, kidney disease, and back problems). Chronic conditions were summarized into 0 to 8 chronic conditions and categorized into 0 conditions versus one versus two or more chronic conditions. Duration of diabetes was calculated in years based on the age at which participants were first diagnosed with diabetes. The duration was categorized into less than one year, one to 9.9 years and at least 10 years. Participants' treatment

regimen was assessed by asking participants if they took insulin or if they took pills to control their diabetes in the past month.

### **Statistical Analysis**

Data were analyzed using SPSS software. Frequency tables were designed to describe the associations between major depression status at follow-up and SRH, socio-demographic characteristics, lifestyle related behaviors, disability and diabetes specific characteristics.

Logistic regression analyses were then conducted to study the association between depression status at follow-up (major vs. no major depression) and SRH, socio-demographic characteristics, lifestyle-related behaviors, and diabetes specific characteristics. SRH was dichotomized into two categories: excellent/very good/good vs. fair/poor while age and BMI were inserted as continuous variables into the model. The classification of SRH into a dichotomous variable is often used in epidemiological research. Hierarchical entry was performed by entering variables in blocks in the following order: (1) SRH (2) socio-demographic characteristics; (3) lifestyle-related behaviors (4) disability; and (5) diabetes-related characteristics. We also conducted two sensitivity analyses. The first one included individuals who did not have major depression at baseline and who had participated in all three follow ups. The second included those who did not have major depression at baseline but excluded those who had undergone at least thirty minutes of psychotherapy or who were prescribed antidepressants for a minimum of thirty days in the past year.

## RESULTS

As presented in figure 1, of the total 2003 individuals who participated in the DHS at baseline, 1464 agreed to participate in the follow up, had type 2 diabetes, did not have major depression at baseline and were not underweight. We excluded 16 participants who were underweight because lower than normal BMIs may reflect disordered eating behaviors. Of those participants, 139 developed major depression during the follow-up period. The final sample consisted of 1265 participants with Type 2 diabetes who did not have major depression at baseline and were assessed to have a depression status during at least one of the follow-ups.

Non-response to the individual survey questions was low (<5%), with two exceptions: 68 (5.4%) participants in the final sample did not answer all questions to the DCI and 98 (7.7%) participants did not report enough information to calculate their BMI. The sample consisted of 94% Caucasians, 53% of females, the mean age was 59.76,  $SD= 10.77$ , and the mean BMI was 30.33,  $SD= 6.27$ . The prevalence of fair/poor health status at baseline was 16.8% while the three years incidence of major depression among those participants who had at least one follow up assessment was 11.0%.

Associations between depression status at follow up with baseline SRH, socio-demographic characteristics, lifestyle behaviors, disability and diabetes specific characteristics are presented in Table 1. Depression status at follow-up was significantly associated with SRH, age, education level, marital status,

employment status, physical activity, BMI categories, disability and diabetes-related complications ( $p < .05$ ). Thirty six percent of individuals who had developed major depression at follow up rated their health as fair or poor compared to 14.4% of those who had not developed major depression. Participants with major depression at follow up were more likely to be physically inactive, obese, to have more severe disability and to have 2 or more complications related to their diabetes.

Logistic regression results are presented in Table 2. Individuals who rated their health as fair or poor at baseline were twice more likely to develop major depression during a three year follow up (OR=2.05, 95% CI: 1.20-3.48), even after accounting for socio-demographic characteristics, lifestyle related behaviors, disability and diabetes related characteristics. In all 5 models, older age, lower education and higher disability scores were significantly associated with major depression at follow up. Lastly, in both sensitivity analyses, individuals with fair or poor SRH remained about twice as likely to suffer from major depression at follow up (OR= 1.91, 95% CI: .93-3.95,  $p = .08$ ) when only including participants who had participated in all three follow ups and (OR= 2.21, 95% CI: 1.19-4.11) when excluding individuals who had received psychotherapy or who had taken anti-depressants. The lower significance level in the first sensitivity analysis could be attributed to the loss of power due to a smaller sample size of 588.

## **DISCUSSION**

Our objective in the present study was to determine whether fair or poor SRH at baseline predicted the three year incidence of major depression in a community sample of people with Type 2 diabetes and in the absence of major depression at baseline. Our data showed that fair /poor SRH was associated with a twofold increased risk of developing major depression over a 3-year period compared to individuals who reported excellent/very good/good SRH. The association remained significant after accounting for socio-demographic characteristics, lifestyle-related behaviors, disability and diabetes related characteristics and after conducting sensitivity analyses.

In the past two decades, an interest in factors associated with SRH has grown. Strong relationships have been established linking SRH to both physical and psychological outcomes (Mavaddat, et al., 2011). SRH has also been repeatedly linked to mortality in both cross sectional and longitudinal studies (DeSalvo, Bloser, Reynolds, He, & Muntner, 2006; Heistaro, Jousilahti, Lahelma, Vartiainen, & Puska, 2001; Mulsant, Ganguli, & Seaberg, 1997; Vuorisalmi, Lintonen, & Jylha, 2005) and in people with a wide range of diseases such as cancer and heart disease (Møller, Kristensen, & Hollnagel, 1996; Shadbolt, et al., 2002). Depression in diabetes has been associated with higher rates of chronic conditions, poorer functioning, increased mental health service use and poor glycemic control (Black, 1999). Furthermore, both depression and SRH have been associated with increased risk of mortality in people with diabetes (Dasbach, Klein, Klein, & Moss, 1994; Katon, et al., 2008; Katon, et al., 2005). Evidence has revealed SRH to have a consistent effect on depressive symptoms in the older



general population. Kosloki et al. (2005) found an effect of self-rated on depressive symptoms during a five waves longitudinal study. Poor SRH at baseline was also shown to predict depressive symptoms in older adults living in rural areas (St. John, Blandford, & Strain, 2009). Our study constitutes a useful addition to the literature in a group at risk for serious complications, demonstrating the predictive effect of SRH on the three-year occurrence of major depression in people with diabetes. The single item measure SRH seems to be capturing an aspect of health for people with diabetes apart from other established risk factors.

Based on our findings, health professionals should be conscious of the fact that subjective statements of health on behalf of the patient have important clinical implications. Although commonly seen as manifestations of depressed affect, SRH seems to be predictive of subsequent mental health outcomes. Our results highlight the clinical importance of asking patients with diabetes how they would rate their own health. Individuals with fair or poor SRH may be identified as a risk group for further complications such as, in this case, developing major depression, putting them in need of more clinical attention. Our study clearly demonstrates an effect of self-assessed health on depression aside from illness related complications, chronic conditions and disability.

The study has several limitations. We focused on current depression (last two weeks), and did not have information inquiring about whether individuals suffered from depression during their life. Given the episodic nature of major depression, we could not account for past depression in our model. It is possible that previous

depression had an impact on diabetes severity, SRH and/or health behaviors. Another limitation is that our study variables were self-reported, which could have results in misclassifications. Our sampling frame was limited to landline telephones and neither cell-phone-only households nor households without phones were included. Finally, some participants without major depression at baseline refused to participate in one or more follow-up interview. As such, the incidence of major depression could have been under estimated. If those who were lost to follow-up were more likely to develop major depression, the observed association between SRH and major depression could have been under estimated as well. Lastly, we used a brief generic instrument for the assessment of major depression; the PHQ-9. Although there's general high agreement between a PHQ-9 diagnosis of depression and a diagnosis based on structured clinical interviews (Spitzer, Kroenke, & Williams, 1999), there could be either over or underestimation of depression in the sample.

Although the study had some limitations, it also had its strengths. This is one of the first studies to look at the longitudinal effect of SRH on depression in this specific population of individuals with type 2 diabetes prone to complications; a population in which the prevalence of depression is very high.

## **CONCLUSIONS**

The present findings suggest a meaningful effect of baseline SRH on the occurrence of major depression over time in people with diabetes. In a population suffering from chronic daily complications, our study has important clinical implications. Our results give SRH a prognostic power making it a useful tool for

identifying high risk individuals that could require close monitoring. Also SRH could be employed for planning and allocating treatment, in an effort to target and decrease mental health difficulties frequently experienced by individuals suffering from diabetes.

## References

- Badawi, G., Garipey, G., Pagé, V., & Schmitz, N. (2012). Indicators of self-rated health in the Canadian population with diabetes. *Diabetic Medicine*, *29*(8), 1021-1028. doi: 10.1111/j.1464-5491.2012.03571.x
- Black, S. A., Markides, K. S., & Ray, L. A. (2003). Depression predicts increased incidence of adverse health outcomes in older Mexican Americans with type 2 diabetes. *Diabetes Care*, *26*(10), 2822-2828. doi: 10.2337/diacare.26.10.2822
- Black, S. A. S. (1999). Increased health burden associated with comorbid depression in older diabetic Mexican Americans. Results from the Hispanic Established Population for the Epidemiologic Study of the Elderly survey. *Diabetes Care*, *22*(1), 56-56-64.
- Blazer, D. G., Moody-Ayers, S., Craft-Morgan, J., & Burchett, B. (2002). Depression in diabetes and obesity: Racial/ethnic/gender issues in older adults. *Journal of Psychosomatic Research*, *53*(4), 913-916.
- Bosworth, H. B., Siegler, I. C., Brummett, B. H., Barefoot, J. C., Williams, R. B., Clapp-Channing, N. E., & Mark, D. B. (1999). The association between self-rated health and mortality in a well-characterized sample of coronary artery disease patients. *Medical Care*, *37*(12), 1226-1236. doi: 10.1097/00005650-199912000-00006
- Bush, K., Kivlahan, D. R., McDonell, M. B., Fihn, S. D., Bradley, K. A., & Ambulatory Care Quality Improvement, P. (1998). The AUDIT alcohol consumption questions (AUDIT-C) - An effective brief screening test for problem drinking. *Archives of Internal Medicine*, *158*(16), 1789-1795. doi: 10.1001/archinte.158.16.1789
- Chwastiak, L. A., & Von Korff, M. (2003). Disability in depression and back pain: Evaluation of the World Health Organization Disability Assessment Schedule (WHO DAS II) in a primary care setting. *Journal of Clinical Epidemiology*, *56*(6), 507-514.
- Dasbach, E. J., Klein, R., Klein, B. E. K., & Moss, S. E. (1994). Self-rated health and mortality in people with diabetes. *American Journal of Public Health*, *84*(11), 1775-1779.
- DeSalvo, K. B., Bloser, N., Reynolds, K., He, J., & Muntner, P. (2006). Mortality prediction with a single general self-rated health question. *Journal of General Internal Medicine*, *21*(3), 267-275. doi: 10.1111/j.1525-1497.2005.0291.x

- Egede, L. E., & Zheng, D. (2003). Independent factors associated with major depressive disorder in a national sample of individuals with diabetes. *Diabetes Care*, 26(1), 104-111. doi: 10.2337/diacare.26.1.104
- Fincke, B. G., Clark, J. A., Linzer, M., Spiro, A., III, Miller, D. R., Lee, A., & Kazis, L. E. (2005). Assessment of long-term complications due to type 2 diabetes using patient self-report: The Diabetes Complications Index. *The Journal of Ambulatory Care Management*, 28(3), 262-273.
- Ford, E. S., Moriarty, D. G., Zack, M. M., Mokdad, A. H., & Chapman, D. P. (2001). Self-reported body mass index and health-related quality of life: Findings from the behavioral risk factor surveillance system. *Obesity Research*, 9(1), 21-31.
- Heistaro, S., Jousilahti, P., Lahelma, E., Vartiainen, E., & Puska, P. (2001). Self rated health and mortality: a long term prospective study in eastern Finland. *Journal of Epidemiology and Community Health*, 55(4), 227-232.
- Idler, E. L., & Benyamini, Y. (1997). Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health and Social Behavior*, 38(1), 21-37.
- Jylha, M. (2009). What is self-rated health and why does it predict mortality? Towards a unified conceptual model. *Social Science & Medicine*, 69(3), 307-316. doi: 10.1016/j.socscimed.2009.05.013
- Kamphuis, M. H., Geerlings, M. I., Giampaoli, S., Nissinen, A., Grobbee, D. E., & Kromhout, D. (2009). The association of depression with cardiovascular mortality is partly explained by health status. The FINE Study. *Journal of Affective Disorders*, 114(1-3), 184-192. doi: 10.1016/j.jad.2008.07.005
- Katon, W., Fan, M.-Y., Unützer, J., Taylor, J., Pincus, H., & Schoenbaum, M. (2008). Depression and diabetes: A potentially lethal combination. *Journal of General Internal Medicine*, 23(10), 1571-1575. doi: 10.1007/s11606-008-0731-9
- Katon, W., Von Korff, M., Ciechanowski, P., Russo, J., Lin, E., Simon, G., Ludman, E., Walker, E., Bush, T., & Young, B. (2004). Behavioral and clinical factors associated with depression among individuals with diabetes. *Diabetes Care*, 27(4), 914-920. doi: 10.2337/diacare.27.4.914
- Katon, W. J., Lin, E. H. B., Russo, J., Von Korff, M., Ciechanowski, P., Simon, G., Ludman, E., Bush, T., & Young, B. (2004). Cardiac risk factors in patients with Diabetes Mellitus and major depression. *Journal of General Internal Medicine*, 19(12), 1192-1199. doi: 10.1111/j.1525-1497.2004.30405.x

- Katon, W. J., Rutter, C., Simon, G., Lin, E. H. B., Ludman, E., Ciechanowski, P., Kinder, L., Young, B., Von Korff, M. (2005). The association of comorbid depression with mortality in patients with type 2 diabetes. *Diabetes Care*, 28(11), 2668-2672. doi: 10.2337/diacare.28.11.2668
- Kosloski, K., Stull, D. E., Kercher, K., & Van Dussen, D. J. (2005). Longitudinal analysis of the reciprocal effects of self-assessed global health and depressive symptoms. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences*, 60(6), 296-303.
- Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9 - Validity of a brief depression severity measure. *Journal of General Internal Medicine*, 16(9), 606-613.
- Lin, E. H. B., Katon, W., Von Korff, M., Rutter, C., Simon, G. E., Oliver, M., Ciechanowski, P., Ludman, E., Bush, T., & Young, B. (2004). Relationship of depression and diabetes self-care, medication adherence, and preventive care. *Diabetes Care*, 27(9), 2154-2160. doi: 10.2337/diacare.27.9.2154
- Lustman, P. J., Anderson, R. J., Freedland, K. E., de Groot, M., Carney, R. M., & Clouse, R. E. (2000). Depression and poor glycemic control: a meta-analytic review of the literature. *Diabetes Care*, 23(7), 934-942. doi: 10.2337/diacare.23.7.934
- Mavaddat, N., Kinmonth, A. L., Sanderson, S., Surtees, P., Bingham, S., & Khaw, K. T. (2011). What determines Self-Rated Health (SRH)? A cross-sectional study of SF-36 health domains in the EPIC-Norfolk cohort. *Journal of Epidemiology and Community Health*, 65(9), 800-806. doi: 10.1136/jech.2009.090845
- Møller, L., Kristensen, T. S., & Hollnagel, H. (1996). Self rated health as a predictor of coronary heart disease in Copenhagen, Denmark. *Journal of Epidemiology and Community Health*, 50(4), 423-428. doi: 10.1136/jech.50.4.423
- Mulsant, B. H., Ganguli, M., & Seaberg, E. C. (1997). The relationship between self-rated health and depressive symptoms in an epidemiological sample of community-dwelling older adults. *Journal of the American Geriatrics Society*, 45(8), 954-958.
- Salomon, J. A., Nordhagen, S., Oza, S., & Murray, C. J. L. (2009). Are Americans feeling less healthy? The Puzzle of Trends in Self-rated Health. *American Journal of Epidemiology*, 170(3), 343-351. doi: 10.1093/aje/kwp144

- Schmitz, N., Boyer, R., Nitka, D., Messier, L., Gariepy, G., Strychar, I., Malla, A., LeSage, A., Wang, J. L. (2009). Association between neighborhood-level deprivation and disability in a community sample of people with diabetes. *Diabetes Care*, 32(11), 1998-2004. doi: 10.2337/dc09-0838
- Shadbolt, B., Barresi, J., & Craft, P. (2002). Self-rated health as a predictor of survival among patients with advanced cancer. *Journal of Clinical Oncology*, 20(10), 2514-2519. doi: 10.1200/jco.2002.08.060
- Shaw, J. E., Sicree, R. A., & Zimmet, P. Z. (2010). Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Research and Clinical Practice*, 87(1), 4-14. doi: 10.1016/j.diabres.2009.10.007
- Spitzer, R. L., Kroenke, K., & Williams, J. B. W. (1999). Validation and utility of a self-report version of PRIME-MD - The PHQ primary care study. *Jama - Journal of the American Medical Association*, 282(18), 1737-1744.
- St. John, P. D., Blandford, A. A., & Strain, L. A. (2009). Does a rural residence predict the development of depressive symptoms in older adults? *Canadian Journal of Rural Medicine*, 14(4), 150-156.
- Von Korff, M., Katon, W., Lin, E. H. B., Simon, G., Ludman, E., Ciechanowski, P., Rutter, C., & Bush, T. (2005). Potentially modifiable factors associated with disability among people with diabetes. *Psychosomatic Medicine*, 67(2), 233-240. doi: 10.1097/01.psy.0000155662.82621.50
- Vuorisalmi, M., Lintonen, T., & Jylha, M. (2005). Global self-rated health data from a longitudinal study predicted mortality better than comparative self-rated health in old age. *Journal of Clinical Epidemiology*, 58(7), 680-687. doi: 10.1016/j.jclinepi.2004.11.025

Table 1. Prevalence of baseline demographic and clinical characteristics by Major depression status at follow-up in DHS participants (n = 1265), Quebec, Canada (2008-2011)

		Major Depression at follow up		
		n	No (%)	Yes (%)
SRH <sup>‡</sup>	Excellent	91	7.8	2.9
	Very Good	253	21.5	8.8
	Good	702	56.3	52.2
	Fair	159	11.4	22.8
	Poor	52	3.0	13.2
<b>Socio-Demographic Characteristics</b>				
Age <sup>*</sup>	18-49	216	16.2	24.5
	50-64	606	48.1	46.0
	65-80	443	35.7	29.5
Sex	Female	671	52.8	54.7
	Male	594	47.2	45.3
Education level <sup>*</sup>	Less than high school	508	39.5	50.4
	High school graduation	339	28.0	20.9
	Post-secondary school attendance/graduation	400	32.5	28.8
Marital Status <sup>*</sup>	Married/Partner	809	65.1	56.1
	Widowed/Divorced/Separated	308	24.3	25.2
	Single	145	10.6	18.7
Employment Status <sup>†</sup>	Working Full time/part time/student	461	37.2	30.9
	Not working	202	14.7	26.6
	Retired	600	48.1	42.4
<b>Lifestyle-related behaviors</b>				
Smoking Status	Never Smoker	471	37.5	35.3
	Former Smoker	559	44.5	42.4
	Current Smoker	233	18	22.3
Alcohol Consumption	None	496	38.9	43.5
	Less than twice a week	549	43.9	41.3
	Two or more times a week	213	17.1	15.2
Physical Activity <sup>†</sup>	Inactive	324	24.7	38.1
	Moderately active	483	39.9	32.1
	Active	431	35.4	29.9
BMI <sup>†</sup>	Normal	224	20.1	11.8
	Overweight	415	36.2	30.7
	Obese	528	43.8	57.5
Disability <sup>‡</sup>	No severe Disability	1219	97.4	88.5
	Severe Disability	45	2.6	11.5
<b>Diabetes Specific characteristics</b>				
Diabetes Complications <sup>‡</sup>	0 complications	378	33.0	19.5
	1 complication	355	30.6	21.9
	2 or more complications	464	36.4	58.6
Duration of diabetes	Less than 1 year	51	3.9	5.1
	1-9.9 years	676	54.1	51.8
	At least 10 years	528	41.9	43.1
Treatment of Diabetes	Insulin	284	22.2	25.2
	Pills	890	71.1	66.2
	No insulin and no pills	88	6.8	8.6
Number of chronic conditions	0 conditions	244	20.7	14.2
	1 or more conditions	976	79.3	85.8

\* p<.05, † p< .01, ‡ p< .001

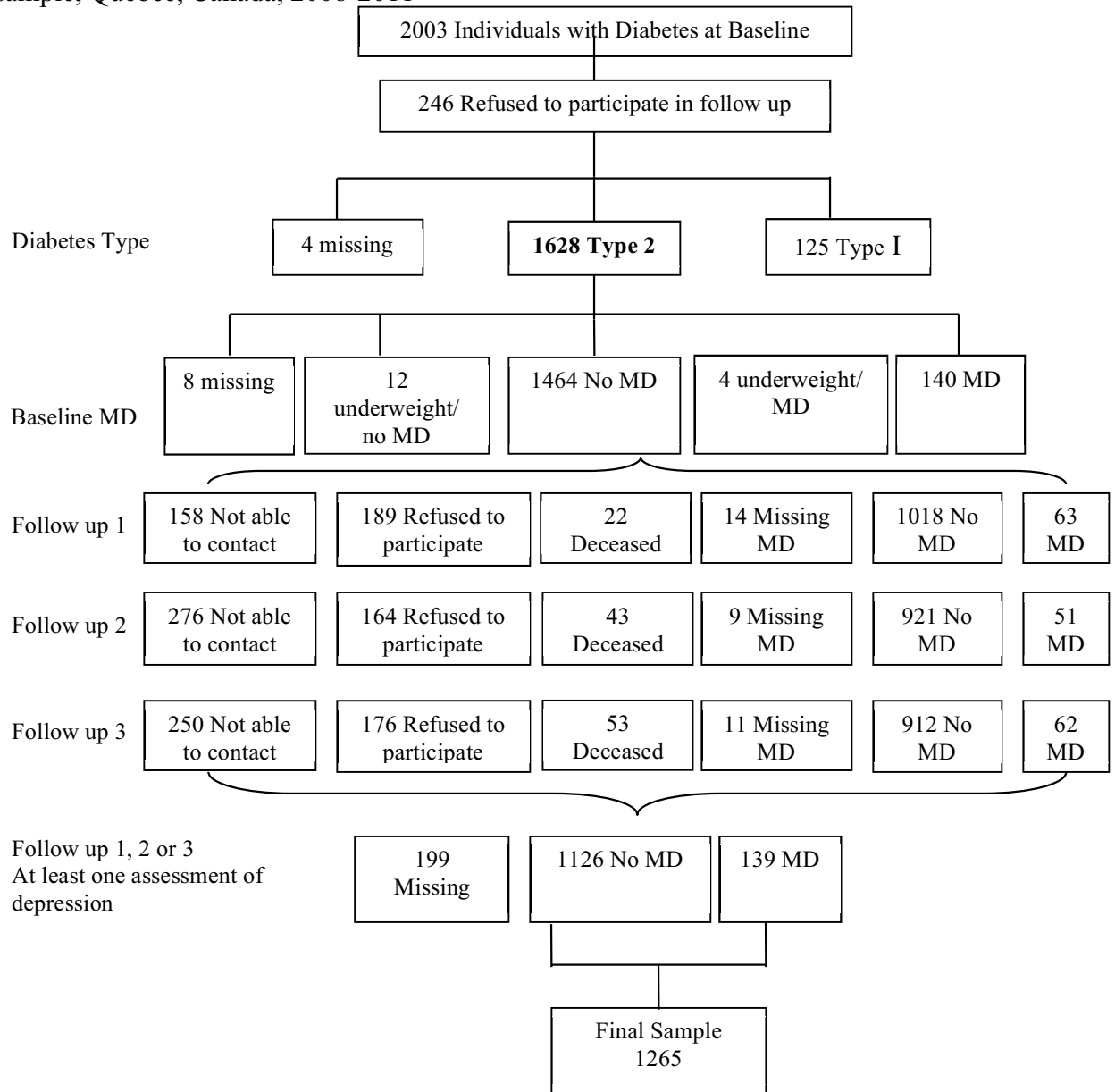


Table 2. Associations between depression status at follow-up and SRH, socio-demographic characteristics, lifestyle behaviors, disability and diabetes characteristics in 1049 individuals with type 2 diabetes, Quebec, 2008-2011

	Depression Status at follow up (Major Depression vs. no Major Depression)									
	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR	95% C.I.	OR	95% C.I.	OR	95% C.I.	OR	95% C.I.	OR	95% C.I.
SRH	3.10	1.98-4.88	2.97	1.85-4.75	2.76	1.70-4.49	2.41	1.44-4.00	2.05	1.20-3.48
Age			.97	.94-.99	.97	.94-1.00	.97	.94-.99	.97	.94-.99
Sex: Male vs. Female			1.14	.74-1.74	1.11	.71-1.74	1.10	.70-1.72	1.16	.73-1.86
Marital Status										
Married/Partner										
Wid/Divorced/Separated			1.05	.62-1.77	1.02	.60-1.72	.97	.57-1.66	.94	.55-1.62
Single			1.54	.84-2.83	1.41	.75-2.62	1.43	.76-2.68	1.31	.69-2.47
Education										
High School graduation										
Less than high school			2.11	1.19-3.75	2.00	1.11-3.56	1.96	1.10-3.51	1.91	1.06-3.44
More than high School			1.69	.93-3.10	1.65	.90-3.03	1.55	.84-2.86	1.51	.81-2.81
Employment Status										
Not working										
Working/Student			.78	.43-1.42	.80	.43-1.47	.83	.45-1.54	.85	.45-1.59
Retired			1.01	.50-2.03	.99	.49-2.01	1.03	.51-2.09	1.00	.49-2.05
Smoking Status (yes vs. no)					1.07	.63-1.82	1.04	.61-1.77	1.02	.59-1.76
Physical Activity										
Inactive										
Active					.75	.44-1.27	.79	.46-1.35	.82	.47-1.41
Moderately Active					.85	.50-1.46	.89	.51-1.54	.92	.53-1.61
Alcohol consumption										
None										
Less than twice a week					1.06	.66-1.72	1.08	.66-1.76	1.05	.64-1.73
2 or more times a week					1.32	.69-2.53	1.36	.71-2.62	1.39	.71-2.70
BMI					1.03	1.00-1.06	1.02	.99-1.06	1.02	.99-1.06
Disability (Severe vs. No severe Disability)							3.20	1.34-7.65	3.25	1.34-7.83
Diabetes Complications										
0 complications										
1 complication								1.13	.61-2.09	
2 or more complications								1.69	.95-3.02	
Chronic Conditions										
0 Conditions										
One condition								.94	.46-1.89	
2 or more conditions								1.40	.73-2.70	
Treatment Regimen										
No Insulin/No Pills										
Insulin								.43	.17-1.07	
Pills								.72	.33-1.56	
Duration of Diabetes										
Less than 1 year										
1-9.9 years								.89	.29-2.73	
At least 10 years								1.10	.34-3.52	

<sup>1</sup> OR: Odds ratio, CI: Confidence Interval. <sup>2</sup> WHO-DAS-II scores dichotomized due to skewed distribution. Model 1  $R^2 = .02$  (Cox & Snell), .04 (Nagelkerke) Model 1  $X^2(1) = 21.70$ , Model 2  $R^2 = .04$  (Cox & Snell), .08 (Nagelkerke) Model 2  $X^2(9) = 37.97$ , Model 3  $R^2 = .04$  (Cox & Snell), .09 (Nagelkerke) Model 3  $X^2(15) = 42.60$ , Model 4  $R^2 = .05$  (Cox & Snell), .10 (Nagelkerke) Model 4  $X^2(16) = 48.88$ , Model 5  $R^2 = .06$  (Cox & Snell), .12 (Nagelkerke) Model 5  $X^2(24) = 60.19$ .<sup>3</sup> Sample size based on participants with no missing values on variables included in the regression analysis.

Figure 1. Baseline and follow up Major Depression (MD) leading to the final sample, Quebec, Canada, 2008-2011



### 3.11 CONNECTING TEXT

We have demonstrated that SRH was a significant predictor of major depression in a Canadian community sample of people with type 2 diabetes. Our findings provide evidence for the use of SRH to screen for individuals at risk for poor mental health outcomes. Individuals at risk for developing major depression could also be at risk for poor diabetes-related consequences given the strong association between depression and poor health outcomes. Although we have demonstrated the usefulness of this brief measure in people with type 2 diabetes, it is important to determine whether the placement of the SRH question in population health surveys might affect responses to the item. SRH is placed in a different order in epidemiological surveys, for example it is the first question administered in the BRFSS while administered following objective health measures in the Canadian Community Health Survey. In order to compare findings across studies, the fourth chapter is aimed at identifying question order effects on self-assessed ratings of health in people with type 2 diabetes; a population whose ratings might be particularly affected by earlier assessed health measures.

## CHAPTER 4. Manuscript 3

### Self-Rated Health in diabetes: Should the question be the first administered?

**Ghislaine Badawi<sup>1,2</sup>, B.Sc, Genevieve Gariepy<sup>2,3</sup>, M.Sc, Norbert Schmitz<sup>1,2,4</sup>,  
PhD.**

Accepted for publication, *Diabetes Research and Clinical Practice*, 2012.

<sup>1</sup> Department of Psychiatry, McGill University, Montreal, Quebec, Canada

<sup>2</sup> Douglas Mental Health University Institute, Montreal, Quebec, Canada

<sup>3</sup> Department of Epidemiology and Biostatistics, McGill University, Montreal, Quebec, Canada

<sup>4</sup> Montreal Diabetes Research Centre, Montreal, Quebec, Canada

#### *Address for Correspondence*

Norbert Schmitz<sup>1</sup>, PhD;  
Douglas Mental Health University Institute  
McGill University  
6875 LaSalle Boulevard  
Montreal, Quebec, Canada  
H4H 1R3

Tel: 1-514-761-6131, ext. 3379

Fax: 1-514-888-4064

E-mail: [norbert.schmitz@mcgill.ca](mailto:norbert.schmitz@mcgill.ca)

## **ABSTRACT**

In 599 individuals with Type 2 diabetes, mode of administration of self-rated health did not affect ratings when the item was placed before or after health-related questions. 85% of individuals had stable ratings providing support for comparisons across studies using the measure in this population.

## INTRODUCTION

Self-rated health (SRH); a strong predictor of mortality and morbidity in general and clinical populations, asks individuals to rate their health on a scale from excellent to poor (Dasbach, Klein, Klein, & Moss, 1994; Idler & Benyamini, 1997; Idler, Russell, & Davis, 2000). We have shown that SRH is strongly associated with both depression and disability in a community sample of people with diabetes (Badawi, Gariepy, Pagé, & Schmitz, 2012). SRH has been widely used to track changes in population health but has been differentially placed in epidemiological surveys; administered either before or after questions about health and functioning (Hennessy, Moriarty, Zack, Scherr, & Brackbill, 1994; Kramers, 2003; Pan et al., 2006; Smith, Glazier, & Sibley, 2010). Before comparing research findings, it is important to know if the placement order of the question affects self-ratings of health.

Context effects have been reported on self-reported general questions (Schwarz, 1999). Some studies have found SRH to be rated more positively when asked after health-related questions (Bowling & Windsor, 2008; Crossley & Kennedy, 2002) while others have reported absence of such effects (Lee & Grant, 2009).

Study populations have been limited to the general population and to older individuals. Results may not be generalizable for people with diabetes.

To better interpret SRH and to make valid comparisons between studies, we investigated administration mode effects on SRH in people with Type 2 diabetes.

Individuals participated in two surveys: one where the item was placed following

socio-demographic and perceived health measures and the other where it was placed first.

## **METHODS**

### **Data Sources**

We used data from the Montreal Diabetes Health Study (DHS), a random digit-dialling telephone survey of non-institutionalized adults with diabetes from Quebec, Canada (Schmitz et al., 2009). The baseline survey was conducted in 2008 with annual follow-ups. In 2011, participants from the DHS annual follow-up interested in participating in a supplementary survey 2-3 months later were recruited as a sub-sample, in order to add missing information on diet, physical exercise and the environment to the DHS in people with Type 2 diabetes. The present study consists of 599 participants who participated in the 2011 follow-up DHS interview (January-February) and the DHS sub-study two to three months later (March-April), and who had information on SRH at both time points.

### **Self-rated health**

SRH was measured by asking “Would you say that in general your health is: excellent, very good, good, fair, or poor?” following questions on socio-demographic variables, diabetes characteristics, diabetes-related behaviours and functional problems in the DHS (Appendix E) while asked first in the sub-study. We analyzed SRH using both 5-category and dichotomized versions (excellent/very good/good vs. fair/poor). We conducted a four category consistency rating: Stable positive: ratings remained excellent/very good/good, Stable Negative: ratings remained fair/poor, Upgraded rating: ratings changed

from fair/poor to excellent/very good/good and Downgraded rating: ratings changed from excellent/very good/good to fair/poor.

### **Socio-demographic characteristics**

Sex, age and education level were collected at baseline. Marital status and employment status were collected at the 2011 DHS follow-up.

**Depression** was assessed using the Patient Health Questionnaire (PHQ-9) (Kroenke, Spitzer, & Williams, 2001).

### **Statistical Analysis**

Data was analyzed using SAS. We compiled a table comparing SRH at the second interview with SRH at the first interview for the 5-category and dichotomized measures and calculated un-weighted and weighted Kappa statistics. We conducted subgroup analyses by socio-demographic variables.

## **RESULTS**

SRH across interviews were comparable (table 1) with moderate agreement between the 5-category SRH (weighted kappa of 0.43) and the dichotomized SRH (kappa of 0.48), 85% of participants did not change between dichotomized ratings of SRH across surveys. 9% of the sample upgraded their rating and 6% downgraded it when the question was asked first.

Cross-tabulation analyses showed significant associations of rating consistency with marital and employment status ( $p < .01$ ) (table 3). Partnered and working



individuals had more stable SRH. Individuals who upgraded their rating at the second survey had lower mean depression scores.

## **DISCUSSION**

There was no evidence that SRH was influenced by administration mode in a large community sample of people with Type 2 diabetes using data from two surveys administered about 3 months apart. The majority (85%) of participants did not change their ratings and Kappa statistics indicated a moderate level of consistency. Such findings are not surprising; we have previously shown that SRH in this population includes mental health, physical health and factors that might change within three months (Badawi, et al., 2012). Some of the changes in ratings were attributed to lower depression scores at the second survey.

Similar moderate kappa coefficients have been found for SRH (Zajacova & Dowd, 2011). In general, our findings are in line with previous work reporting a minority of participants changing their ratings when the question is first administered (Crossley & Kennedy, 2002; Lee & Grant, 2009). We found some associations between changes in SRH and certain socio-demographic characteristics. Partnered individuals with diabetes had more stable ratings highlighting the importance of social support in score stability for people living with a high burden of disease (Eller, Holle, Landgraf, & Mielck, 2008).

Individuals not working had less stable health ratings; they may be experiencing serious impairments making SRH more likely to change over time.

This is the first report examining administration mode effects on SRH in people with diabetes. The sample size was large and unlike previous work, SRH was administered under the same conditions in both surveys. Limitations include self-reported data, a three months interval between surveys and the lack of information measuring changes in objective health measures.

In conclusion, we found no administration mode effects on SRH in Canadian adults with Type 2 diabetes, providing support for the comparison across studies of SRH in this population.

## **Acknowledgements**

This work was supported by a grant from the Canadian Institutes of Health Research (CIHR) and by a grant from the Canadian Diabetes Association.

G.B. is supported by a Masters fellowship from the Fonds de la Recherche en Santé du Québec (FRSQ) and G.G. is supported by a doctoral fellowship from the Canadian Institute for Health Research (CIHR).

## References

- Badawi, G., Garipey, G., Pagé, V., & Schmitz, N. (2012). Indicators of self-rated health in the Canadian population with diabetes. *Diabetic Medicine*, 29(8), 1021-1028. doi: 10.1111/j.1464-5491.2012.03571.x
- Bowling, A., & Windsor, J. (2008). The effects of question order and response-choice on self-rated health status in the English Longitudinal Study of Ageing (ELSA). *Journal of Epidemiology and Community Health*, 62(1), 81-85. doi: 10.1136/jech.2006.058214
- Crossley, T. F., & Kennedy, S. (2002). The reliability of self-assessed health status. *Journal of Health Economics*, 21(4), 643-658.
- Dasbach, E. J., Klein, R., Klein, B. E. K., & Moss, S. E. (1994). Self-rated health and mortality in people with diabetes. *American Journal of Public Health*, 84(11), 1775-1779.
- Eller, M., Holle, R., Landgraf, R., & Mielck, A. (2008). Social network effect on self-rated health in type 2 diabetic patients - results from a longitudinal population-based study. *International Journal of Public Health*, 53(4), 188-194. doi: 10.1007/s00038-008-7091-4
- Hennessy, C. H., Moriarty, D. G., Zack, M. M., Scherr, P. A., & Brackbill, R. (1994). Measuring health-related quality of life for public-health surveillance. *Public Health Reports*, 109(5), 665-672.
- Idler, E. L., & Benyamini, Y. (1997). Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health and Social Behavior*, 38(1), 21-37.
- Idler, E. L., Russell, L. B., & Davis, D. (2000). Survival, functional limitations, and self-rated health in the NHANES I epidemiologic follow-up study, 1992. *American Journal of Epidemiology*, 152(9), 874-883. doi: 10.1093/aje/152.9.874
- Kramers, P. G. N. (2003). The ECHI project - Health indicators for the European community. *European Journal of Public Health*, 13, 101-106.
- Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9 - Validity of a brief depression severity measure. *Journal of General Internal Medicine*, 16(9), 606-613.

- Lee, S., & Grant, D. (2009). The effect of question order on self-rated general health status in a multilingual survey context. *American Journal of Epidemiology*, 169(12), 1525-1530. doi: 10.1093/aje/kwp070
- Pan, L., Mukhtar, Q., Geiss, S. L., Rivera, M., Alfaro-Correa, A., & Sniegowski, R. (2006). Self-rated fair or poor health among adults with diabetes - United States, 1996-2005. *Jama-Journal of the American Medical Association*, 296(24), 2919-2920.
- Schmitz, N., Nitka, D., Gariepy, G., Malla, A., Wang, J., Boyer, R., Malla, A., & Lesage, A. (2009). Association between neighborhood-level deprivation and disability in a community sample of people with diabetes. *Diabetes Care*, 32(11), 1998-2004. doi: 10.2337/dc09-0838
- Schwarz, N. (1999). Self-reports - How the questions shape the answers. *American Psychologist*, 54(2), 93-105.
- Smith, P. M., Glazier, R. H., & Sibley, L. M. (2010) The predictors of self-rated health and the relationship between self-rated health and health service needs are similar across socioeconomic groups in Canada. *Journal of Clinical Epidemiology*, 63(4), 412-421. doi: 10.1016/j.jclinepi.2009.08.015
- Zajacova, A., & Dowd, J. B. (2011) Reliability of self-rated health in US adults. *American Journal of Epidemiology*, 174(8), 977-983. doi: 10.1093/aje/kwr204

**Table 1.** Dichotomized SRH at the second interview compared to dichotomized SRH at the first interview

		DHS		
		Excellent/ very good/good	Fair/Poor	Total (N)
		%		
DHS – sub-study	Excellent/very good/good	75.1	9	504
	Fair/Poor	6	9.8	95
	Total (N)	486	113	599

**Table 2.** Association between consistency in self ratings across surveys with socio-demographic characteristics

			Stable Positive	Stable negative	Up-graded rating	Down-graded rating	Kappa	Weighted Kappa	Kappa if dichotomized
		N	%						
Age	< 49	86	83.7	4.7	7.0	4.7	0.33	0.54	0.38
	50-64	273	70.3	13.9	10.3	5.5	0.34	0.45	0.54
	65-83	240	77.5	7.1	8.3	7.1	0.33	0.36	0.39
Sex	Female	322	73.9	9.6	8.4	8.1	0.38	0.45	0.44
	Male	277	76.5	10.1	9.7	3.6	0.31	0.38	0.53
Marital status†	Married/Partner	361	79.8	8.6	5.8	5.8	0.38	0.45	0.53
	Wid/Div/Separated	159	70.4	12.6	10.7	6.3	0.31	0.38	0.49
	Single	78	62.8	10.3	20.5	6.4	-	-	0.28
Employment Status‡	Working/ student	193	84.5	6.2	4.7	4.7	0.38	0.48	0.52
	Not working	99	52.5	22.2	19.2	6.1	0.31	0.40	0.45
	Retired	306	76.5	8.2	8.5	6.9	0.34	0.39	0.42
Education level	Less than high school	228	69.3	11.8	11.8	7.0	0.34	0.39	0.44
	High school graduation	166	76.5	9.0	10.2	4.2	0.30	0.40	0.47
	More than high school	197	80.2	8.6	5.1	6.1	0.41	0.51	0.54
			M (SD)						
DHS PHQ-9 Summary Score		599	3.50 (3.75)	11.1 (6.35)	9.21 (7.05)	7.77 (6.14)	-	-	-
Sub-study PHQ-9 Summary Score		598	3.76 (4.33)	10.77 (7.23)	6.49 (5.08)	8.08 (5.04)	-	-	-

† p < .01, ‡ p < .001. Note. Kappa and weighted Kappa statistics could not be computed using the 5-category SRH for single individuals given that none rated their health as poor .

## CONCLUSION

### 5.1 Summary of findings

Fair or poor SRH has been two to three times more common in people with diabetes than in people without diabetes (Jimenez-Garcia, et al., 2008; Pan, et al., 2006) and has been strongly associated with mortality and morbidity in this population (Gregg, et al., 2002; Otiniano, Du, Ottenbacher & Markides, 2003; Wennberg, et al., 2012). Meanwhile, comorbid depression has been established to be a serious condition that impacts the progression of the disease, increases the risk of all-cause mortality, health care use and expenditures (Egede, et al., 2002; Katon, et al., 2008) and predicts poor outcomes, poor self-care behaviors, treatment non-adherence and poor glycemic control (Gonzalez, et al., 2008; Gonzalez, et al., 2008). The aims of the present studies were to understand characteristics of SRH in people with diabetes, to determine whether SRH could predict the occurrence of major depression in a longitudinal study and to lastly briefly determine whether placing the SRH item at the beginning of a survey, so that respondents are uninfluenced by later items, or in the middle would influence answers to the SRH question. Our results have shed light on the unique characteristics of SRH in a population at risk for serious complications, providing insight into the understanding of self-rated health in people with diabetes. Our results have established that both mental and physical functioning might be important indicators of SRH in men and women with Type 2 diabetes and have identified SRH to be a significant predictor of the three-year incidence of major



depression in this population. Our results suggested that the positioning of the SRH item generally does not affect answers to the SRH question for people with diabetes.

## **5.2 Implications of findings**

SRH is a non-time consuming brief instrument that asks individuals a single question. Such a question, as evidenced by our results could be a useful measure of health status in clinical settings for people with type 2 diabetes. In the first manuscript, mental and physical functioning constituted important characteristics of SRH. Such findings highlight the importance of promoting not only physical functioning but also of mental functioning by health practitioners when treating individuals with diabetes who usually are at high risk for life-threatening complications. Improving mental and physical functioning by clinicians and raising awareness as to the importance of such factors in this population could therefore enhance SRH. Given the role of SRH as a predictor of mortality and of a wide range of clinical outcomes (Emmelin, et al., 2003), health-care professionals could target changes towards more positive self-assessments of health to help enhance outcomes in people with type 2 diabetes. The second manuscript identified the predictive power of SRH on the three-year incidence of major depression indicating that poor SRH, in particular, warrants further attention. Such findings are extremely important given the negative impact of major depression on health outcomes in the population. Firstly, they support the use of a brief question, SRH, as a screening tool for high risk groups as part of a

routine clinical assessment. Secondly they support SRH as a valuable tool for allocating treatment and identifying individuals with diabetes in need of intensified support and clinical attention. As such, we have provided support for the use of SRH as a useful and convenient complementary outcome measure in clinical practice for people with type 2 diabetes. Such a tool may enhance the doctor-patient relationship by allowing the patient to provide a genuine perspective of his or her own perceived health status. In the third manuscript, we provided evidence to show that SRH was unaffected by contextual effects supporting its use in people with diabetes. Given that SRH is used in more than 60 countries around the world as part of the SF-36, our findings support comparisons across surveys that include SRH and that use it as a measure of health status in people with type 2 diabetes.

### **5.3 Limitations**

Some of the major limitations of all three manuscripts relate to the fact that variables, other than SRH, were self-reported. Self-reported information may have resulted in misclassifications. Moreover, we were limited to contact individuals who had landline telephones therefore cell-phone-only households and households without phones were not included in the studies. We used the PHQ-9; a brief generic instrument for the assessment of major depression however general high agreement between a PHQ-9 diagnosis of depression and a diagnosis based on structured clinical interviews has been established (Spitzer, Kroenke, & Williams, 1999). Using the PHQ-9 could have resulted in either over or

underestimation of depression in the sample. In the first manuscript, we used cross-sectional data to study SRH in people with Type 2 diabetes and thus we cannot make any causal inferences between depression, disability and SRH. We also used a brief generic disability score as an outcome measure. Given that disability is a complex phenomenon involving many dimensions, using such a measure might have overlooked domain-specific differences in disability. We also focused on current depression in the past two weeks and on current disability in the last 30 days, which may have overlooked any impact of previous depression or disability on disease severity or health behaviors. In the second manuscript, we focused on current depression as reported in the last two weeks. As previously discussed, we did not have any information regarding lifetime prevalence of depression and therefore we were not able to account for past lifetime depression in our analyses. Moreover, some participants who did not have major depression at baseline did not agree to participate in follow-up interviews which could have resulted in an underestimation of major depression at follow-up. It is possible that some of those individuals were more likely to develop major depression which could have therefore underestimated the relationship between SRH and major depression. For the third manuscript, the surveys were administered three months apart, we could therefore not account for changes in objective health status or health-related behaviors between both interviews.

#### **5.4 What is Self-Rated Health?**

In 1972, Tissue defined SRH as a “summary statement about the way in which numerous aspects of health, both subjective and objective are combined within the perceptual framework of the individual respondent” (Tissue, 1972). Although there is widespread agreements that this global SRH question provides a summary of how patients perceive their overall health, a small number of qualitative studies have been conducted to gain insight into the meaning of ratings of health where people are asked to explain what exactly went through their mind when they answered the SRH question (Borawski, Kinney, & Kahana, 1996; Idler, Hudson, & Leventhal, 1999; Krause & Jay, 1994; Simon, De Boer, Joung, Bosma, & Mackenbach, 2005; Van Dalen, Williams, & Gudex, 1994) or to rate how important some factors were when rating their health (Benyamini, Leventhal, & Leventhal, 2003). Results have been consistent with findings from quantitative studies indicating that SRH is underlined by aspects of objective health relating to physical functioning, physical aspects of health and objective measures of health (Benyamini, et al., 2003; Krause & Jay, 1994; Simon, et al., 2005). In a conceptual framework, Jylha (2009) explained components of “health” to include direct knowledge received from the physician about medical diagnoses and diagnostic labels and indirect information of conditions such as prescribed medication, treatments, health-care utilization, sick leaves or disability pensions. Information about medical conditions also includes subjective knowledge of symptoms observed by the individual such as functional status and disabilities in addition to various internal sensations comprising of fatigue, dizziness, pains and aches (Jylha, 2009). The latter symptoms, which also contribute to signs of

clinical depression as defined by the DSM-IV-TR (American Psychiatric Association, 2000), have been shown to be significant predictors of poor self-rated health in the general population and in people with chronic diseases (Mitchell & Adkins, 2009; Molarius & Janson, 2002) including in individuals with type 2 diabetes (Badawi, et al., 2012) and in cancer patients (Liavaag, Dorum, Fossa, Trope, & Dahl, 2009). Components of health also include information about the time-line of health problems, consequences, course and controllability of different conditions (Knäuper & Turner, 2003).

Qualitative studies have highlighted the diverse way by which these factors are selected by different individuals and the diverse way through which relevant factors of health are considered in the context of an individual's own health status and in the context of his or her past and present health history. Understanding components of health and how they are taken into account may be a key step in understanding ratings of health in people with chronic conditions. For example, as we have found both physical and mental functioning constitute important indicators of SRH for people with Type 2 diabetes which has not been the case for people with chronic obstructive pulmonary disease or for those with mild Alzheimer's disease (Farkas, et al., 2009; Waldorff, Nielsen, & Waldemar, 2010). Moreover, individuals with type 2 diabetes will likely take the diagnosis into account when rating their health while someone who has never been diagnosed with diabetes will not take it into account. Such differences could explain higher rates of fair and poor SRH in people with diabetes compared to the general population. On the other hand, an unhealthy individual suffering from a chronic

condition who receives a supplemental diagnosis of diabetes may not rate their health as poorly as a healthy individual who receives a diagnosis of diabetes. Such differences highlight the role of adaptation in health assessments (Heller, Ahern, Pringle, & Brown, 2009) and explain variability in ratings of health in people with diabetes.

Culture has also been suggested to provide a framework of evaluation in health ratings. Immigrant populations in Sweden have been shown to be at higher risks of poor SRH, Italians to rate their health worse than French people (Desesquelles, Egidi, & Salvatore, 2009) and Lithuanian men to rate their health worse than Dutch men (Appels, et al., 1996). In Colorado, Hispanics rated their health more negatively than non-Hispanic whites (Shetterly, Baxter, Mason, & Hamman, 1996) and Arabs rated that health better than Jewish people in Israel despite similar objective health measures (Baron-Epel, et al., 2005). Cultural differences in self-assessments of health may reflect differences in people's willingness to display positive or negative images of themselves as a result of social norms (Baron-Epel, et al., 2005; Kaplan & Baron-Epel, 2003).

Lastly, personality and individual differences can also impact health evaluations. Health optimists make more positive health attributions based on positive attitudes and behaviors, while health pessimists reference physical health aspects and are less likely to make reference to positive attitudes or behaviors. Health pessimists have thus been found to be at a greater risk of dying despite sharing similar objective health as health optimists (Borawski, et al., 1996).

## 5.5 Future directions

Most empirical studies looking at SRH come from epidemiological data studying statistical associations of variables, leaving us with unanswered questions about the meaning of SRH. Although much information is readily available on which relevant aspects of health are taken into account when an individual is asked to assess his or her health, there is a need to determine which aspects are relevant in specific populations, as we have applied in this case for people with diabetes. Although it is important to identify which factors are taken into account, there is also an urgent need to understand how exactly such factors are evaluated when self-assessments of health are made. In order to arrive to such valuable information, it is necessary to utilize qualitative approaches. Such studies would aim at understanding peoples' underlying reasoning processes when they evaluate different aspects of their health enabling them to arrive to an answer to the SRH question. Such underlying processes of reasoning in different population groups could help bring light into our understanding of how such factors could be targeted in clinical settings.

SRH has been proposed to have a biological basis and has been shown to be a sensitive barometer to physiological states. For instance, relationships between hemoglobin and white blood cell counts with SRH have been established even after adjusting for coronary heart disease, stroke, diabetes, cancer, blood pressure, other biomarkers and socio-demographic characteristics (Jylhä, Volpato, & Guralnik, 2006). In an effort to better understand biological bases of SRH in

people with chronic conditions, studying its association with biomarkers (inflammatory, psycho-endocrinological and psycho-neuro-immunological) could help gain insight into our understanding of SRH. Also, bodily sensations such as pain, fatigue and dizziness have been implicated in assessments of health; SRH may capture aspects of subjective experiences not measured nor diagnosed in clinical practice which may explain the relationship between SRH and mortality (Jylha, 2009). Qualitative studies could ask people to describe these sensations and to relate them to their assessments of health. People could also be asked to rate the relevance of such symptoms when evaluating their health and associations with SRH could be analyzed through quantitative approaches. Also, in an effort to get more detailed information, questions about physical and mental SRH at the time of the interview, in the last month and in the last year should be assessed. Qualitative studies could focus on understanding the bases on individuals' changes of health ratings. Such studies could provide new factors that could underlie and help us better understand the measure.

In conclusion, improving both mental and physical functioning could target better clinical outcomes in people with Type 2 diabetes. SRH should be used as part of clinical assessments to identify patients at risk for poor mental health outcomes and serious complications. SRH is a multidimensional concept that we do not fully comprehend. Qualitative research is necessary to gain insight into unidentified factors of SRH in both the general and clinical populations. Understanding the evaluation framework underlying health ratings could explain the variety of concepts elicited by different individuals.



## REFERENCES

- Ali, S., Stone, M., Skinner, T. C., Robertson, N., Davies, M., & Khunti, K. (2010). The association between depression and health-related quality of life in people with type 2 diabetes: a systematic literature review. *Diabetes/Metabolism Research and Reviews*, *26*(2), 75-89. doi: 10.1002/dmrr.1065
- 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. doi: 10.1111/j.1464-5491.2006.01943.x
- American Diabetes Association. (2003). Economic costs of diabetes in the U.S. in 2002. *Diabetes Care*, *26*(3), 917-932. doi: 10.2337/diacare.26.3.917
- American Psychiatric Association. (2000). Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision. *Washington, DC, American Psychiatric Association*.
- 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), 1069-1078.
- Appels, A., Bosma, H., Grabauskas, V., Gostautas, A., & Sturmans, F. (1996). Self-rated health and mortality in a Lithuanian and a Dutch population. *Social Science & Medicine*, *42*(5), 681-689.
- Badawi, G., Garipey, G., Pagé, V., & Schmitz, N. (2012). Indicators of self-rated health in the Canadian population with diabetes. *Diabetic Medicine*, *29*(8), 1021-1028. doi: 10.1111/j.1464-5491.2012.03571.x
- Bailis, D. S., Segall, A., & Chipperfield, J. G. (2003). Two views of self-rated general health status. *Social Science & Medicine*, *56*(2), 203-217.
- Baron-Epel, O., Kaplan, G., Haviv-Messika, A., Tarabeia, J., Green, M. S., & Nitzan Kaluski, D. (2005). Self-reported health as a cultural health determinant in Arab and Jewish Israelis: MABAT—National Health and Nutrition Survey 1999–2001. *Social Science & Medicine*, *61*(6), 1256-1266. doi: 10.1016/j.socscimed.2005.01.022
- Benyamini, Y., Leventhal, E. A., & Leventhal, H. (2003). Elderly people's ratings of the importance of health-related factors to their self-assessments of health. *Social Science & Medicine*, *56*(8), 1661-1667.

- Borawski, E. A., Kinney, J. M., & Kahana, E. (1996). The meaning of older adults' health appraisals: Congruence with health status and determinant of mortality. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 51B(3), S157-S170. doi: 10.1093/geronb/51B.3.S157
- Bosworth, H. B., Siegler, I. C., Brummett, B. H., Barefoot, J. C., Williams, R. B., Clapp-Channing, N. E., & Mark, D. B. (1999). The association between self-rated health and mortality in a well-characterized sample of coronary artery disease patients. *Medical Care*, 37(12), 1226-1236. doi: 10.1097/00005650-199912000-00006
- Bruce, D. G., Davis, W. A., & Davis, T. M. E. (2005). Longitudinal predictors of reduced mobility and physical disability in patients with type 2 diabetes - The Fremantle Diabetes Study. *Diabetes Care*, 28(10), 2441-2447.
- Canadian Diabetes Association. (2012), from <http://www.diabetes.ca/>
- Chang-Quan, H., Xue-Mei, Z., Bi-Rong, D., Zhen-Chan, L., Ji-Rong, Y., & Qing-Xiu, L. (2010). Health status and risk for depression among the elderly: a meta-analysis of published literature. *Age and Ageing*, 39(1), 23-30. doi: 10.1093/ageing/afp187
- Cleary, P. D., Greenfield, S., & McNeil, B. J. (1991). Assessing quality of life after surgery. *Controlled Clinical Trials*, 12(4), 189-203. doi: 10.1016/s0197-2456(05)80023-6
- Cott, C. A., Gignac, M. A. M., & Badley, E. M. (1999). Determinants of self rated health for Canadians with chronic disease and disability. *Journal of Epidemiology and Community Health*, 53(11), 731-736.
- Dasbach, E. J., Klein, R., Klein, B. E. K., & Moss, S. E. (1994). Self-rated health and mortality in people with diabetes. *American Journal of Public Health*, 84(11), 1775-1779.
- De Bruin, A., Picavet, H. S., & Nossikov, A. (1996). Health interview surveys. Towards international harmonization of methods and instruments. *WHO regional publications. European series*, 58, i-xiii, 1-161.
- De Groot, M., Anderson, R., Freedland, K. E., Clouse, R. E., & Lustman, P. J. (2001). Association of depression and diabetes complications: A meta-analysis. *Psychosomatic Medicine*, 63(4), 619-630.
- DeSalvo, K. B., Bloser, N., Reynolds, K., He, J., & Muntner, P. (2006). Mortality prediction with a single general self-rated health question. *Journal of General Internal Medicine*, 21(3), 267-275. doi: 10.1111/j.1525-1497.2005.0291.x

- DeSalvo, K. B., Jones, T. M., Peabody, J., McDonald, J., Fihn, S., Fan, V., He, J., Muntner, P. (2009). Health care expenditure prediction with a single item, self-rated health measure. *Medical Care*, 47(4), 440-447.
- Desesquelles, A. F., Egidi, V., & Salvatore, M. A. (2009). Why do Italian people rate their health worse than French people do? An exploration of cross-country differentials of self-rated health. *Social Science & Medicine*, 68(6), 1124-1128. doi: 10.1016/j.socscimed.2008.12.037
- Dzekedzeke, K., Siziya, S., & Fylkesnes, K. (2008). The impact of HIV infection on adult mortality in some communities in Zambia: a cohort study. *Tropical Medicine & International Health*, 13(2), 152-161. doi: 10.1111/j.1365-3156.2007.01985.x
- Egede, L. (2003). Effect of major depression on functional disability in a national sample of adults with diabetes. *Diabetes*, 52, 412.
- Egede, L. E. (2004). Diabetes, major depression, and functional disability among US adults. *Diabetes Care*, 27(2), 421-428.
- Egede, L. E. (2004). Effects of depression on work loss and disability bed days in individuals with diabetes. *Diabetes Care*, 27(7), 1751-1753. doi: 10.2337/diacare.27.7.1751
- Egede, L. E., & Zheng, D. (2003). Independent factors associated with major depressive disorder in a national sample of individuals with diabetes. *Diabetes Care*, 26(1), 104-111. doi: 10.2337/diacare.26.1.104
- Egede, L. E., Zheng, D., & Simpson, K. (2002). Comorbid depression is associated with increased health care use and expenditures in individuals with diabetes. *Diabetes Care*, 25(3), 464-470. doi: 10.2337/diacare.25.3.464
- Emmelin, M., Weinehall, L., Stegmayr, B., Dahlgren, L., Stenlund, H., & Wall, S. (2003). Self-rated ill-health strengthens the effect of biomedical risk factors in predicting stroke, especially for men - an incident case referent study. *Journal of Hypertension*, 21(5), 887-896.
- Eren, İ., Erdi, Ö., & Şahin, M. (2008). The effect of depression on quality of life of patients with type II diabetes mellitus. *Depression and Anxiety*, 25(2), 98-106. doi: 10.1002/da.20288
- Farkas, J., Kosnik, M., Zaletel-Kragelj, L., Flezar, M., Suskovic, S., & Lainscak, M. (2009). Distribution of self-rated health and association with clinical parameters in patients with chronic obstructive pulmonary disease. *Wiener*

*Klinische Wochenschrift*, 121(9-10), 297-302. doi: 10.1007/s00508-009-1170-2

- Farkas, J., Nabb, S., Zaletel-Kragelj, L., Cleland, J. G. F., & Lainscak, M. (2009). Self-rated health and mortality in patients with chronic heart failure. *European Journal of Heart Failure*, 11(5), 518-524. doi: 10.1093/eurjhf/hfp038
- Franks, P., Gold, M. R., & Fiscella, K. (2003). Sociodemographics, self-rated health, and mortality in the US. *Social Science & Medicine*, 56(12), 2505-2514.
- Gelberg, L., & Linn, L. S. (1989). Psychological distress among homeless adults. *Journal of Nervous and Mental Disease*, 177(5), 291-295. doi: 10.1097/00005053-198905000-00007
- Goldney, R. D., Phillips, P. J., Fisher, L. J., & Wilson, D. H. (2004). Diabetes, depression, and quality of life - A population study. *Diabetes Care*, 27(5), 1066-1070.
- Gonzalez, J. S., Peyrot, M., McCarl, L. A., Collins, E. M., Serpa, L., Mimiaga, M. J., & Safren, S. A. (2008). Depression and diabetes treatment nonadherence: A Meta-Analysis. *Diabetes Care*, 31(12), 2398-2403. doi: 10.2337/dc08-1341
- Gonzalez, J. S., Safren, S. A., Delahanty, L. M., Cagliero, E., Wexler, D. J., Meigs, J. B., & Grant, R. W. (2008). Symptoms of depression prospectively predict poorer self-care in patients with Type 2 diabetes. *Diabetic Medicine*, 25(9), 1102-1107. doi: 10.1111/j.1464-5491.2008.02535.x
- Gregg, E. W., Breckles, G. L. A., Williamson, D. F., Leveille, S. G., Langlois, J. A., Engelgau, M. M., & Narayan, K. M. V. (2000). Diabetes and physical disability among older US adults. *Diabetes Care*, 23(9), 1272-1277.
- Gregg, E. W., Mangione, C. M., Cauley, J. A., Thompson, T. J., Schwartz, A. V., Ensrud, K. E., & Nevitt, M. C. (2002). Diabetes and Incidence of Functional Disability in Older Women. *Diabetes Care*, 25(1), 61-67. doi: 10.2337/diacare.25.1.61
- Hayes, A. J., Clarke, P. M., Glasziou, P. G., Simes, R. J., Drury, P. L., & Keech, A. C. (2008). Can self-rated health scores be used for risk prediction in patients with type 2 diabetes? *Diabetes Care*, 31(4), 795-797. doi: 10.2337/dc07-1391

- Heistaro, S., Jousilahti, P., Lahelma, E., Vartiainen, E., & Puska, P. (2001). Self-rated health and mortality: a long term prospective study in eastern Finland. *Journal of Epidemiology and Community Health, 55*(4), 227-232.
- Heller, D. A., Ahern, F. M., Pringle, K. E., & Brown, T. V. (2009). Among older adults, the responsiveness of self-rated health to changes in Charlson comorbidity was moderated by age and baseline comorbidity. *Journal of Clinical Epidemiology, 62*(2), 177-187. doi: 10.1016/j.jclinepi.2008.05.009
- Hennessy, C. H., Moriarty, D. G., Zack, M. M., Scherr, P. A., & Brackbill, R. (1994). Measuring health-related quality of life for public-health surveillance. *Public Health Reports, 109*(5), 665-672.
- Hoeymans, N., Feskens, E. J. M., Kromhout, D., & VandenBos, G. A. M. (1997). Ageing and the relationship between functional status and self-rated health in elderly men. *Social Science & Medicine, 45*(10), 1527-1536.
- Idler, E. L., & Benyamini, Y. (1997). Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health and Social Behavior, 38*(1), 21-37.
- Idler, E. L., Hudson, S. V., & Leventhal, H. (1999). The meanings of self-ratings of health - A qualitative and quantitative approach. *Research on Aging, 21*(3), 458-476.
- Idler, E. L., & Kasl, S. V. (1995). Self-ratings of health- Do they also predict change in functional ability. *Journals of Gerontology Series B- Psychological Sciences and Social Sciences, 50*(6), 344-353.
- Idler, E. L., Russell, L. B., & Davis, D. (2000). Survival, Functional Limitations, and Self-rated Health in the NHANES I Epidemiologic Follow-up Study, 1992. *American Journal of Epidemiology, 152*(9), 874-883. doi: 10.1093/aje/152.9.874
- J.E Ware, K. K. S., M Kosinski, B Gandek., (1993). *SF-36 Health Survey Manual and Interpretation Guide*. Boston, MA New England Medical Center, The Health Institute.
- Jimenez-Garcia, R., Carrasco-Garrido, P., Jimenez-Trujillo, I., Lopez, A., Hernandez-Barrera, V., & Gil, A. (2008). Ten-year trends in self-rated health among Spanish adults with diabetes, 1993-2003. *Diabetes Care, 31*(1), 90-92. doi: 10.2337/dc07-1382

- Jylha, M. (2009). What is self-rated health and why does it predict mortality? Towards a unified conceptual model. *Social Science & Medicine*, 69(3), 307-316. doi: 10.1016/j.socscimed.2009.05.013
- Jylhä, M., Volpato, S., & Guralnik, J. M. (2006). Self-rated health showed a graded association with frequently used biomarkers in a large population sample. *Journal of Clinical Epidemiology*, 59(5), 465-471. doi: 10.1016/j.jclinepi.2005.12.004
- Kalyani, R. R., Saudek, C. D., Brancati, F. L., & Selvin, E. (2010). Association of diabetes, comorbidities, and A1C with functional disability in older adults results from the National Health and Nutrition Examination Survey (NHANES), 1999-2006. *Diabetes Care*, 33(5), 1055-1060. doi: 10.2337/dc09-1597
- Kaplan, G., & Baron-Epel, O. (2003). What lies behind the subjective evaluation of health status? *Social Science & Medicine*, 56(8), 1669-1676. doi: 10.1016/s0277-9536(02)00179-x
- Kaplan, G. A., & Camacho, T. (1983). Perceived health and mortality- A 9-year follow-up of the human-population laboratory cohort. *American Journal of Epidemiology*, 117(3), 292-304.
- Katon, W., Fan, M.-Y., Unützer, J., Taylor, J., Pincus, H., & Schoenbaum, M. (2008). Depression and diabetes: A potentially lethal combination. *Journal of General Internal Medicine*, 23(10), 1571-1575. doi: 10.1007/s11606-008-0731-9
- Katon, W. J., Rutter, C., Simon, G., Lin, E. H. B., Ludman, E., Ciechanowski, P., Kinder, L., Yougn, B., & Von Korff, M. (2005). The association of comorbid depression with mortality in patients with type 2 diabetes. *Diabetes Care*, 28(11), 2668-2672. doi: 10.2337/diacare.28.11.2668
- Katz, P., Morris, A., Gregorich, S., Yazdany, J., Eisner, M., Yelin, E., & Blanc, P. (2009). Valued life activity disability played a significant role in self-rated health among adults with chronic health conditions. *Journal of Clinical Epidemiology*, 62(2), 158-166. doi: 10.1016/j.jclinepi.2008.06.002
- Klein, B. E. K., Klein, R., & Moss, S. E. (1998). Self-rated health and diabetes of long duration - The Wisconsin Epidemiologic Study of Diabetic Retinopathy. *Diabetes Care*, 21(2), 236-240.
- Knäuper, B., & Turner, P. A. (2003). Measuring health: Improving the validity of health assessments. *Quality of Life Research*, 12(0), 81-89. doi: 10.1023/a:1023589907955

- Kosloski, K., Stull, D. E., Kercher, K., & Van Dussen, D. J. (2005). Longitudinal analysis of the reciprocal effects of self-assessed global health and depressive symptoms. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences*, 60(6), 296-303.
- Kramers, P. G. N. (2003). The ECHI project - Health indicators for the European community. *European Journal of Public Health*, 13, 101-106.
- Krause, N. M., & Jay, G. M. (1994). What do global self-rated health items measure. *Medical Care*, 32(9), 930-942.
- Lee, Y. (2000). The predictive value of self assessed general, physical, and mental health on functional decline and mortality in older adults. *Journal of Epidemiology and Community Health*, 54(2), 123-129.
- Li, C. Y., Mokdad, A. H., Ford, E. S., & Strine, T. W. (2008). Prevalence of depression among US adults with diabetes - Findings from the 2006 behavioral risk factor surveillance system. *Diabetes Care*, 31(1), 105-107. doi: 10.2337/dc07-1154
- Liavaag, A. H., Dorum, A., Fossa, S. D., Trope, C., & Dahl, A. A. (2009). Morbidity associated with "self-rated health" in epithelial ovarian cancer survivors. *Bmc Cancer*, 9, 11. doi: 2 10.1186/1471-2407-9-2
- Lima-Costa, M. F., Cesar, C. C., Chor, D., & Proietti, F. A. (2012). Self-rated health compared with objectively measured health status as a tool for mortality risk screening in older adults: 10-year follow-up of the Bambuí Cohort Study of Aging. *American Journal of Epidemiology*, 175(3), 228-235. doi: 10.1093/aje/kwr290
- Lin, E. H. B., Heckbert, S. R., Rutter, C. M., Katon, W. J., Ciechanowski, P., Ludman, E. J., Olivier, M., Young, B.A., McCulloch, D.K., & Von Korff, M. (2009). Depression and increased mortality in diabetes: Unexpected causes of death. *Annals of Family Medicine*, 7(5), 414-421. doi: 10.1370/afm.998
- Lin, E. H. B., Katon, W., Von Korff, M., Rutter, C., Simon, G. E., Oliver, M., . . . Young, B. (2004). Relationship of depression and diabetes self-care, medication adherence, and preventive care. *Diabetes Care*, 27(9), 2154-2160. doi: 10.2337/diacare.27.9.2154
- Lin, E. H. B., Rutter, C. M., Katon, W., Heckbert, S. R., Ciechanowski, P., Oliver, M. M., Ludman, E.J., Young, B.A., Williams, L.H., McCulloch, D.K., & Von Korff, M. (2010). Depression and advanced complications of diabetes - A prospective cohort study. *Diabetes Care*, 33(2), 264-269. doi: 10.2337/dc09-1068

- Lustman, P. J., Anderson, R. J., Freedland, K. E., de Groot, M., Carney, R. M., & Clouse, R. E. (2000). Depression and poor glycemic control: a meta-analytic review of the literature. *Diabetes Care*, *23*(7), 934-942. doi: 10.2337/diacare.23.7.934
- Lustman, P. J., Freedland, K. E., Griffith, L. S., & Clouse, R. E. (2000). Fluoxetine for depression in diabetes: a randomized double-blind placebo-controlled trial. *Diabetes Care*, *23*(5), 618-623. doi: 10.2337/diacare.23.5.618
- Lustman, P. J., Griffith, L. S., Clouse, R. E., Freedland, K. E., Eisen, S. A., Rubin, E. H., Carney, R.M., & McGill, J. B. (1997). Effects of nortriptyline on depression and glycemic control in diabetes: results of a double-blind, placebo-controlled trial. *Psychosomatic Medicine*, *59*(3), 241-250.
- Lustman, P. J., Griffith, L. S., Freedland, K. E., Kissel, S. S., & Clouse, R. E. (1998). Cognitive behavior therapy for depression in type 2 Diabetes Mellitus. *Annals of Internal Medicine*, *129*(8), 613-621.
- Maggi, S., Noale, M., Gallina, P., Marzari, C., Bianchi, D., Limongi, F., Crepaldi, G., & Group, f. t. I. (2004). Physical disability among older Italians with diabetes. The ILSA Study. *Diabetologia*, *47*(11), 1957-1962. doi: 10.1007/s00125-004-1555-8
- Mavaddat, N., Kinmonth, A. L., Sanderson, S., Surtees, P., Bingham, S., & Khaw, K. T. (2011). What determines Self-Rated Health (SRH)? A cross-sectional study of SF-36 health domains in the EPIC-Norfolk cohort. *Journal of Epidemiology and Community Health*, *65*(9), 800-806. doi: 10.1136/jech.2009.090845
- Mayfield, J. A., Deb, P., & Whitecotton, L. (1999). Work disability and diabetes. *Diabetes Care*, *22*(7), 1105-1109. doi: 10.2337/diacare.22.7.1105
- McEwen, L. N., Kim, C., Haan, M. N., Ghosh, D., Lantz, P. M., Thompson, T. J., & Herman, W. H. (2009). Are health-related quality-of-life and self-rated health associated with mortality? Insights from Translating Research Into Action for Diabetes (TRIAD). *Primary Care Diabetes*, *3*(1), 37-42. doi: 10.1016/j.pcd.2009.01.001
- Medicine, I. o. (2009). State of the USA Health Indicators: Letter Report. *Washington, DC: The National Academies Press.*
- Mitchell, J. M., & Adkins, R. H. (2009). Differences in predictors of self-rated health among people with and without a disability. *Journal of Rehabilitation*, *75*(4), 45-52.



- Molarius, A., & Janson, S. (2002). Self-rated health, chronic diseases, and symptoms among middle-aged and elderly men and women. *Journal of Clinical Epidemiology*, 55(4), 364-370.
- Mossey, J. M., & Shapiro, E. (1982). Self-rated health- A predictor of mortality among the elderly. *American Journal of Public Health*, 72(8), 800-808.
- Moussavi, S., Chatterji, S., Verdes, E., Tandon, A., Patel, V., & Ustun, B. (2007). Depression, chronic diseases, and decrements in health: results from the World Health Surveys. *The Lancet*, 370(9590), 851-858. doi: 10.1016/s0140-6736(07)61415-9
- Mulsant, B. H., Ganguli, M., & Seaberg, E. C. (1997). The relationship between self-rated health and depressive symptoms in an epidemiological sample of community-dwelling older adults. *Journal of the American Geriatrics Society*, 45(8), 954-958.
- National Center for Health Statistics. (1971). National Health and Nutrition Examination Survey 2012, from <http://www.cdc.gov/nchs/nhanes.htm>
- National Institute for Health and Welfare. (1960). European Health Examination Survey, 2012, from <http://www.ehes.info/index.html>
- Nielsen, A. B. S., Siersma, V., Kreiner, S., Hiort, L. C., Drivsholm, T., Eplöv, L. F., & Hollnagel, H. (2009). The impact of changes in self-rated general health on 28-year mortality among middle-aged Danes. *Scandinavian Journal of Primary Health Care*, 27(3), 160-U110. doi: 10.1080/02813430903020446
- Office of Surveillance Epidemiology and Laboratory Services. (1984). Behavioral Risk Factor Surveillance System, 2012, from <http://www.cdc.gov/brfss/>
- Otiniano, M. E., Du, X. L. L., Ottenbacher, K., & Markides, K. S. (2003). The effect of diabetes combined with stroke on disability, self-rated health, and mortality in older Mexican Americans: Results from the Hispanic EPESE. *Archives of Physical Medicine and Rehabilitation*, 84(5), 725-730. doi: 10.1016/s0003-9993(03)04941-9
- Pan, L., Mukhtar, Q., Geiss, S. L., Rivera, M., Alfaro-Correa, A., & Sniegowski, R. (2006). Self-rated fair or poor health among adults with diabetes - United States, 1996-2005. *Jama-Journal of the American Medical Association*, 296(24), 2919-2920.
- Public Health Agency of Canada. (2011). Diabetes in Canada: Facts and figures from a public health perspective.

- Ryerson, B., Tierney, E. F., Thompson, T. J., Engelgau, M. M., Wang, J., Gregg, E. W., & Geiss, L. S. (2003). Excess physical limitations among adults with diabetes in the U.S. population, 1997–1999. *Diabetes Care*, *26*(1), 206-210. doi: 10.2337/diacare.26.1.206
- Sargent-Cox, K., Anstey, K., & Luszcz, M. The choice of self-rated health measures matter when predicting mortality: evidence from 10 years follow-up of the Australian longitudinal study of ageing. *BMC Geriatrics*, *10*(1), 18.
- Sayer, A. A., Dennison, E. M., Syddall, H. E., Gilbody, H. J., Phillips, D. I. W., & Cooper, C. (2005). Type 2 diabetes, muscle strength, and impaired physical function. *Diabetes Care*, *28*(10), 2541-2542. doi: 10.2337/diacare.28.10.2541
- Schmitz, N., Wang, J., Lesage, A., Malla, A., & Strychar, I. (2008). Psychological distress and short-term disability in people with diabetes: Results from the Canadian Community Health Survey. *Journal of Psychosomatic Research*, *65*(2), 165-172. doi: 10.1016/j.jpsychores.2008.03.004
- Schoenfeld, D. E., Malmrose, L. C., Blazer, D. G., Gold, D. T., & Seeman, T. E. (1994). Self-rated health and mortality in the high-functioning elderly- A closer look at healthy individuals- Macarthur Field-Study of Successful Aging *Journals of Gerontology*, *49*(3), M109-M115.
- Shadbolt, B., Barresi, J., & Craft, P. (2002). Self-rated health as a predictor of survival among patients with advanced cancer. *Journal of Clinical Oncology*, *20*(10), 2514-2519. doi: 10.1200/jco.2002.08.060
- Shaw, J. E., Sicree, R. A., & Zimmet, P. Z. (2010). Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Research and Clinical Practice*, *87*(1), 4-14. doi: 10.1016/j.diabres.2009.10.007
- Shetterly, S. M., Baxter, J., Mason, L. D., & Hamman, R. F. (1996). Self-rated health among Hispanic vs non-Hispanic white adults: The San Luis Valley Health and Aging study. *American Journal of Public Health*, *86*(12), 1798-1801.
- Simon, J. G., De Boer, J. B., Joung, I. M. A., Bosma, H., & Mackenbach, J. P. (2005). How is your health in general? A qualitative study on self-assessed health. *The European Journal of Public Health*, *15*(2), 200-208. doi: 10.1093/eurpub/cki102
- Singh-Manoux, A., Martikainen, P., Ferrie, J., Zins, M., Marmot, M., & Goldberg, M. (2006). What does self rated health measure? Results from the British

- Whitehall II and French Gazel cohort studies. *Journal of Epidemiology and Community Health*, 60(4), 364-372. doi: 10.1136/jech.2005.039883
- Spitzer, R. L., Kroenke, K., & Williams, J. B. W. (1999). Validation and utility of a self-report version of PRIME-MD - The PHQ primary care study. *Jama - Journal of the American Medical Association*, 282(18), 1737-1744.
- Statistics Canada. (2000). Canadian Community Health Survey (CCHS) - Cycle 1.1, 2012, from <http://www.statcan.gc.ca/concepts/health-sante/index-eng.htm>
- Tissue, T. (1972). Another look at self-rated health among the elderly. *Journal of Gerontology*, 27(1), 91-94.
- Tunceli, K., Bradley, C. J., Nerenz, D., Williams, L. K., Pladevall, M., & Elston Lafata, J. (2005). The impact of diabetes on employment and work productivity. *Diabetes Care*, 28(11), 2662-2667. doi: 10.2337/diacare.28.11.2662
- van Dalen, H., Williams, A., & Gudex, C. (1994). Lay people's evaluations of health: are there variations between different subgroups? *Journal of Epidemiology and Community Health*, 48(3), 248-253. doi: 10.1136/jech.48.3.248
- van den Brink, C. L., Tjihuis, M., van den Bos, G. A. M., Giampaoli, S., Nissinen, A., & Kromhout, D. (2005). The contribution of self-rated health and depressive symptoms to disability severity as a predictor of 10-year mortality in European elderly men. *American Journal of Public Health*, 95(11), 2029-2034. doi: 10.2105/ajph.2004.050914
- Volpato, S., Blaum, C., Resnick, H., Ferrucci, L., Fried, L. P., & Guralnik, J. M. (2002). Comorbidities and impairments explaining the association between diabetes and lower extremity disability. *Diabetes Care*, 25(4), 678-683. doi: 10.2337/diacare.25.4.678
- Von Korff, M., Katon, W., Lin, E. H. B., Simon, G., Ludman, E., Ciechanowski, P., Rutter, C., & Bush, T. (2005). Potentially modifiable factors associated with disability among people with diabetes. *Psychosomatic Medicine*, 67(2), 233-240. doi: 10.1097/01.psy.0000155662.82621.50
- Vuorisalmi, M., Lintonen, T., & Jylha, M. (2005). Global self-rated health data from a longitudinal study predicted mortality better than comparative self-rated health in old age. *Journal of Clinical Epidemiology*, 58(7), 680-687. doi: 10.1016/j.jclinepi.2004.11.025

- Waldorff, F. B., Nielsen, A. B. S., & Waldemar, G. Self-rated health in patients with mild Alzheimer's disease: Baseline data from the Danish Alzheimer Intervention Study. *Archives of Gerontology and Geriatrics*, 50(1), 1-5. doi: 10.1016/j.archger.2008.12.010
- Ware, J. E., Gandek, B., & Group, I. P. (1994). The SF-36 Health Survey: Development and use in mental health research and the IQOLA Project. *International Journal of Mental Health*, 23(2), 49-73.
- Ware Jr, J. E., & Gandek, B. (1998). Overview of the SF-36 Health Survey and the International Quality of Life Assessment (IQOLA) Project. *Journal of Clinical Epidemiology*, 51(11), 903-912. doi: 10.1016/s0895-4356(98)00081-x
- Wennberg, P., Rolandsson, O., Jerdén, L., Boeing, H., Sluik, D., Kaaks, R., Teucher, B., Spijkerman, A., De Mesquita, B. B., Dethlefsen, C., Nilsson, P., & Nöthlings, U. (2012). Self-rated health and mortality in individuals with diabetes mellitus: prospective cohort study. *BMJ Open*, 2(1). doi: 10.1136/bmjopen-2011-000760
- Wilcox, V. L., Kasl, S. V., & Idler, E. L. (1996). Self-rated health and physical disability in elderly survivors of a major medical event. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences*, 51(2), S96-S104.
- World Health Organization. (2011). Diabetes, Facts sheet N°312.
- 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. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 60(9), 1206-1211. doi: 10.1093/gerona/60.9.1206
- Wu, J. H., Haan, M. N., Liang, J., Ghosh, D., Gonzalez, H. M., & Herman, W. H. (2003). Diabetes as a predictor of change in functional status among older Mexican Americans. *Diabetes Care*, 26(2), 314-319. doi: 10.2337/diacare.26.2.314

## APPENDIX A

### **Data Source (continued)**

Trained professional interviewers conducted a 30-minute interview using a computer-assisted telephone interview system; 86,486 phone calls were made, 62,439 people were reached, 54,930 people accepted to be interviewed, 3,221 people were eligible for the interview, and 2,003 people completed the interview. Telephone monitoring occurred throughout data collection. Informed consent was obtained from each participant. Participants received \$20 for each completed interview. The protocol was approved by the Research Ethics Committee of the Douglas Mental Health University Institute, McGill University, Montreal, Canada.

## APPENDIX B

### Functioning and Disability: WHO DAS II (12 items)

In the last 30 days how much difficulty did you have in:

- Standing for long periods such as 30 minutes?
- Taking care of your household responsibilities?
- Learning a new task, for example, learning how to get to a new place?
- How much of a problem did you have joining in community activities (for example, festivities, religious or other activities) in the same way as anyone else can?
- How much have you been emotionally affected by your health problems?
- Concentrating on doing something for ten minutes?
- Walking a long distance such as a kilometre?
- Washing your whole body?
- Getting dressed?
- Dealing with people you do not know?
- Maintaining a friendship?
- Your day to day work?

**Response categories:** None (1) Mild (2) Moderate (3) Severe (4) Extreme/Cannot

Do (5)

## APPENDIX C

### PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems?  
(Use "✓" to indicate your answer)

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

For office use only: 0 + \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_  
=Total Score: \_\_\_\_\_

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Developed by Drs. Robert L. Spitzer, Janet B.W. Williams, Kurt Kroenke and colleagues, with an educational grant from Pfizer Inc. No permission required to reproduce, translate, display or distribute.

## APPENDIX D

### **Social support MOS-SSS: (9 items)**

People sometimes look to others for companionship, assistance, or other types of support. How often is each of the following kinds of support available to you if you need it? Circle one number on each line.

- Someone to help you if you were confined to bed
- Someone to take you to the doctor if you needed it
- Someone who shows you love and affection
- Someone to confide in or talk to about yourself or your problems
- Someone who hugs you
- Someone to get together with for relaxation
- Someone to help with daily chores if you were sick
- Someone to turn to for suggestions about how to deal with a personal problem
- Someone to love and make you feel wanted

### **Response categories:**

None of the time (1) A little of the time (2) Some of the time (3) Most of the time (4) All of the time (5)



## APPENDIX E

### Questions preceding the SRH question in the Diabetes Health Study (DHS).

- Which one of the following best describes your current marital status? Are you married, living as married, never married, divorced or separated, widowed?
- What is your current work status? Working full time, working part time, not working, retired, student
- How many people live in your household, including yourself
- Total income of all persons in your household over the past year
- Ethnic origin or cultural group
- How old were you when your diabetes was first diagnosed?
- In the past month, did you take insulin?
- When you were first diagnosed with diabetes, how long was it before you were started on insulin?
- In the past month, did you take pills to control your diabetes?
- In the past month, did you follow a diet to control your diabetes?
- In the past month, would you say that the control of your diabetes was: excellent, very good, good , fair or poor?
- In the past month, would you say your blood glucose levels were: excellent, very good, good , fair or bad?
- Think back over the last 30 days and answer these questions thinking about how much difficulty you had doing the following activities.

Answer on the following scale: none, mild, moderate, extreme, severe/cannot do

1. Difficulty doing: Standing for long periods such as 30 minutes

2. Difficulty doing: Taking care of your household responsibilities?
3. Difficulty doing: Learning a new task, for example, learning how to get to a new place?
4. Difficulty doing: How much of a problem did you have joining in community activities
5. Difficulty doing: How much have you been emotionally affected by your health problems
6. Difficulty doing: Concentrating on doing something for ten minutes?
7. Difficulty doing: Walking a long distance such as a kilometer
8. Difficulty doing: Washing your whole body?
9. Difficulty doing: Getting dressed?
10. Difficulty doing: Dealing with people you do not know?
11. Difficulty doing: Maintaining a friendship?

- In the last 30 days how much difficulty did you have in doing your day to day work? None, mild, moderate, extreme, severe/cannot do.
- During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups? Not at all, slightly, moderately, quite a bit, extremely.
- During the past 4 weeks, how much of the time have your physical or emotional health problems interfered with your social activities with friends? All of the time, most of the time, some of the time, a little of the time, none of the time
- Would you say that in general your health is excellent, very good, good fair or poor.