

An Investigation of the Incidence of PTSD in Patients Who Have Type II Diabetes or Metabolic Syndrome

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Abstract

The purpose of this archival study is to investigate the incidence of posttraumatic stress disorder (PTSD) in patients who have Type II Diabetes or Metabolic Syndrome and were seen at a local medical office in the last 10 years. Participants were collected through medical records of all the patients 18 and older with Type II diabetes or metabolic syndrome seen by the clinical psychologist at the practice between 2004 and 2012. Medical charts were reviewed to collect demographic data, medical diagnoses, and presence of PTSD. Medical diagnoses were the basis for inclusion in the study and examining the relations between medical diagnosis and PTSD. The hypothesis that the incidence of PTSD is higher in this sample than the general public was supported by a chi-square goodness of fit test. Findings may serve to reveal a bi-directional link between traumatic events, PTSD, and the development of endocrine disorders later in life.

Keywords: diabetes, metabolic syndrome, PTSD, insomnia, comorbidity

Trauma experience and posttraumatic stress disorder are implicated in many compromising health issues and patient outcomes. With the rise in Type II diabetes and metabolic syndrome, it is important to establish and further explore the relations between Type II diabetes and metabolic syndrome and posttraumatic stress disorder (PTSD) to improve intervention and prevention treatments for individuals. Studies have found that those with Type II diabetes and/or metabolic syndrome have a higher incidence rate of psychiatric disorders, including PTSD (Maia, Braga, Brouwers, Nardi, & Oliveira, 2012; Jimenez-Garcia et al., 2012; Goodwin & Davidson, 2005; Singh & Mattoo, 2008). In similar studies, presence of PTSD specifically increases the risk for obesity, dyslipidemia, hypertension, Type II diabetes, and cardiovascular disease (Levine, Levine, & Levine, 2013). A growing body of research has indicated the cascading effects of risk; that is, risk factors often lead to other risks and maladaptive outcomes. However, this body of research also indicates that these cycles of risk can be interrupted to reduce risk and promote greater health outcomes through establishing and identifying those factors that most contribute to poor health outcomes (Masten, 2014). The present archival study aims to further establish if the incidence rate of PTSD among those with Type II diabetes or metabolic syndrome is higher than in the general population. The present study also furthers the research by examining the relations between Type II diabetes and/or metabolic syndrome and health risk factors including insomnia, physical comorbidity, and presence of PTSD and associated trauma.

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Posttraumatic Stress Disorder

PTSD is defined as a psychiatric disorder following the experience of a traumatic event that persists for more than one month and includes symptoms such as intrusion, avoiding possible triggers related to the traumatic event, numbing oneself to alleviate the emotional stress of the event, negative alterations in cognitions and mood, and changes in arousal and reactivity (American Psychiatric Association, 2013). PTSD is the result of traumatic events such as physical, emotional, and sexual abuse, military combat, natural disasters, and serious accidents and impacts approximately 9.7% of the population (American Psychiatric Association, 2013; Siqueland, Hussain, Lindstrøm, Ruud, & Hauff, 2017). PTSD is frequently comorbid with other psychological disorders and compromised health functioning overall including a relation to metabolic syndrome and Type II diabetes (e.g., Dedert, Calhoun, Watkins, Sherwood, & Beckham, 2010). The current study examines compromised health functioning in an at-risk sample of individuals with poorly regulated Type II diabetes and/or metabolic syndrome, including those suffering from PTSD.

Higher trauma frequency and severity exposure in individuals with PTSD is associated with more health problems, increased body mass index, poorer stress-response immune system function, and increased utilization of health services (Clark, Thatcher, & Martin, 2010; Dedert et al., 2010). Dedert et al. (2010) found that those suffering from PTSD tend to have a higher resting heart rate, are more likely to have an increased heart rate in response to trauma cues, have higher blood pressure, elevated cholesterol, low-density lipoproteins and triglycerides, and decreased high-density lipoproteins. In this same study, it was also noted that the maladaptive health behaviors of those with PTSD may contribute to the poorer health functioning of individuals with PTSD (2010). Those with PTSD have a higher incidence rate of somatic disorders, especially Type II diabetes and cardiovascular disorders, compared to the general population without PTSD (Levine et al., 2013; Singh & Mattoo, 2008). For example, in one study, women with PTSD had a considerable increased risk for developing Type II diabetes when compared to their counterparts with no trauma exposure. In this same study, those with more severe PTSD symptoms had a twofold increased risk for developing Type II diabetes (Roberts et al., 2015). The importance of this lies in developing knowledge to target improvements in overall health outcomes by better understanding the relations between PTSD and metabolic disruptions.

Traumatic events and adversities experienced in childhood often have lasting effects on health functioning and development and act as predictors of later PTSD (Goodwin & Stein, 2004; Norman et al., 2012; Romans, Belaise, Martin, Morris, & Raffi, 2002; Thomas, Hypponen, & Power, 2008). For example, childhood physical, emotional, and sexual abuse has been associated with an increased risk for lung disease, cardiac disease, increased BMI values later in life, chronic fatigue, headaches/migraines, and autoimmune disorders (Goodwin & Stein, 2004; Rich-Edwards et al., 2010). The current study included the developmental stage, that is, childhood or adulthood, of the trauma that led to later symptoms of PTSD.

PTSD and traumatic events have been linked to decreased health functioning, an increased risk for psychological disorders, and poorer lifestyle decisions (Cloutier et al., 2002; Dedert et al., 2010; Trief, Ouimette, Wade, Shanahan, & Weinstock, 2006; Vidovic et al., 2011). Illuminating and addressing trauma may facilitate the prevention and/or treatment of the long-term effects of trauma and PTSD. By intervening after traumatic experiences occur, it may be possible to promote more adaptive health behaviors resulting in a lower risk for Type II diabetes and metabolic syndrome. Based on research indicating that Type II diabetes and metabolic syndrome increase risk for comorbid disorders, more targeted interventions may reduce the cascading risks of PTSD and maladaptive health.

Type II Diabetes

Diabetes mellitus, commonly referred to as diabetes, is defined as a chronic disease characterized by an insufficient production of insulin from the pancreas, and subsequently, hyperglycemia (high blood sugar). Uncontrolled diabetes can cause an array of serious health complications such as heart disease, blindness, kidney failure, and lower-extremity amputations (Centers for Disease Control and Prevention [CDC], 2015). Type II diabetes, also known as adult-onset diabetes, accounts for approximately 95% of all diagnosed cases of diabetes (CDC, 2015). Risk factors for Type II diabetes are well established and include older age, obesity, family history of diabetes, prior history of gestational diabetes, impaired glucose tolerance, and lack of physical activity (CDC, 2015). However, risk factors involving psychological comorbidities have not yet been fully established and are examined in the current study.

Diabetics often have co-morbid physical and psychological disorders. Type II diabetes is often associated with an increased risk for coronary heart disease, retinopathy, nephropathy, and neuropathy (Pouwer, Kupper, & Adriaanse, 2010). Diabetics are also at an increased risk for psychiatric disorders, most commonly generalized anxiety disorder, social phobia, depression, panic disorder, risk of suicide, PTSD, and impulse control disorders (de Jonge et al., 2014; Maia et al., 2012; Jimenez-Garcia et al., 2012). Diabetes is also considerably higher among individuals with psychiatric disorders (Myers & Edwards, 2010). As diabetes appears to be related to psychological well-being, there is likely a relation between PTSD and Type II Diabetes.

Psychological disorders may increase the risk for developing Type II diabetes. Eriksson et al. (2008) found psychological distress increases the risk of pre-diabetes and Type II diabetes among men, but not women. A comparative meta-analysis conducted by Vancampfort et al. (2016) revealed that those with PTSD have an approximately 50% higher risk of developing Type II diabetes compared to individuals without PTSD. Research has also indicated that depression, general emotional stress, anxiety, anger/hostility, and sleeping problems may result in an increased risk for Type II diabetes (Pouwer et al., 2010). With strong support that physical and psychological disorders are associated with Type II Diabetes, the complex relation between PTSD and Type II Diabetes merits further investigation. Research further establishing the relation between PTSD and Type II Diabetes, as well as mechanisms of this association, may help in developing improved interventions to reduce the impact of PTSD and trauma on Type II diabetes.

Metabolic Syndrome

Metabolic syndrome is defined as meeting three or more of the following criteria: abdominal obesity, atherogenic dyslipidemia (elevated triglyceride, small LDL particles, low HDL cholesterol), raised blood pressure, insulin resistance, proinflammatory state, or prothrombotic state putting one at an increased risk of thrombosis (Ervin, 2009). Abdominal obesity, hypertension, and hyperglycemia are the most common risk factors for developing metabolic syndrome. Being overweight or obese is often positively associated with metabolic syndrome, with the risk of metabolic syndrome increasing as BMI increases (Ervin, 2009). Furthering our understanding of the risk factors for developing metabolic syndrome may represent an important step in the prevention of other long-term health risks, including Type II diabetes. By better understanding the risk factors for metabolic syndrome, actions can be taken to prevent the further development of metabolic syndrome symptoms and progression.

Metabolic syndrome is associated with an increased risk of developing Type II Diabetes and cardiovascular disease. Those with metabolic syndrome have a 30%-40% chance of developing Type II Diabetes and/or cardiovascular disease within 20 years (Kumar, 2011). Individuals with severe mental illness tend to have a high prevalence of metabolic syndrome, which may be a result of the mental illness itself or the medication to control the mental illness (Singh & Mattoo, 2008). In other words, the high prevalence of metabolic syndrome among those with severe mental illness may be accounted for by medication side effects or maladaptive health behaviors. Although metabolic syndrome poses serious health issues if uncontrolled, it is controllable and preventable by lifestyle modifications and pharmacotherapy (Kumar, 2011). Given that those with PTSD tend to have more health complications and a higher likelihood of an increased BMI (Clark et al., 2010; Dedert et al., 2010), there may be a strong relation between metabolic syndrome and PTSD.

Insomnia's Role in Diabetes and Metabolic Syndrome

Insomnia is broadly defined as a problem with falling or staying asleep or getting restorative sleep. It is estimated to affect around 30% of the general population (American Psychiatric Association, 2013; Roth, 2007). Despite being a relatively common disorder, insomnia has far-reaching consequences. Insomnia has been shown to disrupt many areas of physical well-being, such as hormone regulation, glucose metabolism, insulin resistance, inflammation processes, pain perception, and immune function (Carpenter, 2012). There is a high incidence rate of comorbid medical and psychiatric disorders among those with insomnia as well as an increased risk for depression and hypertension (Morin & Benca, 2012).

Insomnia may increase the risk for Type II Diabetes, metabolic syndrome, and obesity (Broussard et al., 2012; Buxton et al., 2012; Carpenter, 2013). Supporting this claim, sleep restriction results in changes in appetite regulation, food intake, hunger, blood sugar, metabolism, and blood pressure control (Knutson, 2012). Broussard et al. (2012) found that lack of sleep resulted in a person's fat cells being 30% less responsive to insulin, resulting in higher blood glucose levels. Similarly, Matthews et al. (2012) found that if teens who regularly got six hours of sleep could manage to get one more hour, their insulin resistance decreased by 9%. Further evidence that insomnia may

increase the risk of developing Type II Diabetes and metabolic syndrome lies in the literature. In light of this research and the effects of insomnia, the current study considers these findings when examining the association between PTSD, trauma, Type II Diabetes, and metabolic syndrome.

The Role of PTSD in Type II Diabetes and Metabolic Syndrome

PTSD may be a risk factor for metabolic disorders such as metabolic syndrome and Type II diabetes (Ahmadi, Arora, Vaidya, Yehuda, Ebrahimi, 2013; Heppner et al., 2009; Weiss et al., 2011). More severe PTSD is associated with a higher risk of metabolic syndrome (Heppner et al., 2009; Ciocca et al., 2015). Because PTSD has been linked to hyperarousal, sympathetic nervous system hyperactivity, irritability, and disturbed circadian rhythms, these factors may make the individual more susceptible to metabolic syndrome and/or Type II diabetes (Singh & Mattoo, 2008). Given that symptoms and associated maladaptive behaviors of PTSD have been shown to increase the risks of developing metabolic syndrome or Type II diabetes, a better understanding of the pathways of these risk factors may inform improved treatment modalities and outcomes.

The increased risk of Type II diabetes and metabolic syndrome due to PTSD and abuse is complex and may be explained via multiple factors. PTSD and abuse have been linked to higher BMIs and obesity, which often contribute to Type II diabetes and metabolic syndrome (Norman et al., 2012; Thomas et al., 2008). First, the dysregulation and disruption of the hypothalamic-pituitary-adrenal (HPA) axis due to prolonged activation in response to trauma or danger may increase vulnerability to chronic diseases (Tulloch, Greenman, & Tasse, 2015). The HPA dysregulation and disruption that occurs in PTSD has been linked to higher rates of weight gain (van der Berk-Clark et al., 2018). Second, those with PTSD tend to make more maladaptive health choices that contribute to poorer health in general, such as higher caloric intake, less physical activity, and less effective self-care (Dedert et al., 2010). Three, PTSD is often accompanied by insomnia, which has a large impact on metabolic functioning and hormone regulation (Broussard et al., 2012; Buxton et al., 2012; Carpenter, 2013; Matthews et al., 2012), indicating that insomnia, and subsequently PTSD, may contribute to Type II diabetes and/or metabolic syndrome. Beyond the research reviewed thus far, other research has shown a weak or inconsistent relation between PTSD and metabolic syndrome (e.g. Goodwin & Davidson, 2005; Muhtz et al., 2011; Tamayo et al., 2010), indicating a need for further investigation of the connections between PTSD and metabolic disorders.

The Present Study

A myriad of research has shown relations between PTSD, abuse, insomnia, Type II diabetes, and metabolic syndrome (e.g., Dedert et al., 2010). According to Heppner et al. (2009), “there is accumulating evidence...that chronic posttraumatic stress disorder may moderate the link between trauma and secondary negative health outcomes such as cardiovascular, metabolic, and autoimmune conditions” (p. 1). For example, PTSD and abuse have been found to be associated with an increased risk for Type II diabetes (Dedert et al., 2010; Masters Pedersen et al., 2015; Huffhines, Noser, & Patton, 2016). Adults who reported some kind of childhood trauma were at a 60% higher risk for developing Type II diabetes. Further, those who reported moderate to severe physical abuse were at a 26% to 54% higher risk, those who reported unwanted sexual touching in childhood or adolescence had a 16% higher risk, and those who reported sexual assault had a 34% to 69% higher risk for developing Type II diabetes than those who were not sexually abused (Rich-Edwards et al., 2010). Similarly, Masters Pederson et al. (2015) found that children who experience multiple major life events or trauma are at a 69% higher risk of developing Type II diabetes later in life. Abuse increased the risk of obesity, and consequently the risk for metabolic syndrome and Type II diabetes, by 20-40% (Thomas et al., 2008). Due to the growing research that links PTSD, abuse, Type II diabetes, and metabolic syndrome to one another, further research is warranted.

The present study used archival data from the past ten years to determine the incidence of PTSD among those with Type II diabetes or metabolic syndrome. In this study, PTSD was operationally defined as the consequences of a traumatic event persisting for more than one month and the presence of PTSD symptoms resulting in clinically significant distress and/or impairment (e.g., re-experiencing/re-living the traumatic event, avoidance, numbing, negative alterations in cognitions and mood, and alterations in arousal and reactivity). Type II diabetes and metabolic syndrome were operationally defined as clinically diagnosed cases of Type II diabetes and metabolic syndrome. The hypotheses were as follows: (1) The incidence of PTSD among diabetics and those with metabolic syndrome would be higher than in the general population, (2) the current sample would have a higher incidence of insomnia than in the general population, (3) PTSD would be related to physical comorbidity and insomnia, and (4) insomnia would be related to physical comorbidity and PTSD.

Method

Participants

Because this was an archival study, there was no participant interaction and informed consent was not required. Data were gathered from medical records at a local medical office. All patients with metabolic syndrome or Type II diabetes who had been seen by the clinical psychologist at the practice between 2004 and 2012 were included. Inclusion criteria consisted of medical diagnoses of metabolic syndrome and/or Type II diabetes and a history of having seen the clinical psychologist. Exclusion criteria consisted of anyone without the diagnosis of metabolic syndrome or Type II diabetes and under 18 years old. There were 128 participants ($N = 128$). Of these, 96 were female and 32 were male. The range of patient ages was 20 to 87 years ($M = 56.45$). The sample consisted of 50% Caucasian, 18% African American, and 0.8% Latino; 10.9% chose not to answer.

Assessments and Measures

The present study was an archival study to investigate the incidence of PTSD among those with metabolic syndrome and/or Type II diabetes. Patient charts were reviewed to collect demographic data, medical diagnosis, comorbid disorders, and BMI. Medical diagnosis was determined by International Classification of Diseases (ICD) codes and collected as inclusion criteria for the study. Demographic data that were collected consisted of age, gender, marital status, and ethnicity. The investigators reviewed the patient charts and input data to conduct statistical analyses. To ensure patient anonymity the clinical psychologist at the practice reviewed the charts while the co-investigator input data.

PTSD and Comorbidity

Presence of PTSD was determined by the DSM-V diagnostic criteria being met in an unstructured, clinical interview by the same clinical psychologist for all patients. Trauma that the person experienced was collected from the clinical psychologist.

Co-morbid disorders were collected to investigate any other possible relations among diagnoses and PTSD. Physical comorbidity was defined as a diagnosis of a physical disorder in addition to Type II diabetes or metabolic syndrome (e.g. hyperlipidemia, hypertension, hypothyroidism, etc.). Comorbid disorders were recorded as indicated by the ICD code in the medical chart. The most common co-morbid disorders were hyperlipidemia (73.4%), insomnia (65.6%), hypertension (57%), and vitamin D deficiency (40.6%).

Medical Diagnoses

Medical diagnosis of Type II diabetes or metabolic syndrome was recorded as indicated in the medical chart by ICD code. The current sample consisted of 76.6% with Type II diabetes and 23.4% with metabolic syndrome. BMI was collected to assess if PTSD was associated with BMI. The subject's BMI value that was collected was the most recent BMI in the patient chart.

Results

Descriptive Statistics

Of the 98 Type II diabetics in this archival study, 27.6% ($n = 27$) had presence of PTSD and of the 30 with metabolic syndrome, 33.3% ($n = 10$) had presence of PTSD. The most common types of trauma associated with the presence of PTSD were childhood sexual abuse, traumatic life event, and childhood physical abuse. Of the 28.9% with presence of PTSD, childhood traumatic experiences accounted for 54.1% of the current sample with presence of PTSD, while adult traumatic experiences accounted for 45.9%. All hypotheses examined below are inferential in nature due to the use of an archival dataset.

Incidence Rates of PTSD, Insomnia, and Psychological Disorders

Hypothesis 1. The incidence rate of PTSD among the current sample with Type II diabetes or metabolic syndrome was 28.9%, compared with the general population incidence rate of 9.7% (Siqueland et al., 2017). A chi-square goodness of fit test indicated that the incidence of PTSD among the current sample was significantly different from the incidence of PTSD among the general population, $\chi^2(1, N = 128) = 53.91, p < .001, w = 0.65$. This finding indicates a large effect size and that there was a significantly higher incidence rate of PTSD among the sample with Type II diabetes or metabolic syndrome compared to the general population.

Hypothesis 2. The incidence rate of insomnia among the current sample with Type II diabetes or metabolic syndrome was 65.6%, compared with the general population incidence rate of 30%. A chi-square goodness of fit test indicated that the incidence rates of insomnia among the two groups were significantly different, $\chi^2(1, N = 128) = 77.36, p < .001, w = 0.78$. This finding indicates a large effect size and that the incidence rate of insomnia among the current sample was higher than that of the general population.

Hypothesis 3. A chi-square test of independence indicated a significant relation between insomnia and PTSD, $\chi^2(1, N = 128) = 23.14, p < .001$, Cramer's $V = .43$, indicating a moderate effect size. Individuals with PTSD were much more likely to have insomnia (97.3% of individuals with PTSD also had insomnia). However, there was no significant relation between PTSD and physical comorbidity, $\chi^2(1, N = 128) = 1.29, p = .26$ or between insomnia and physical comorbidity, $\chi^2(1, N = 128) = .11, p = .74$. Individuals with PTSD or insomnia were not more likely to have physical comorbidity, unlike past research findings have suggested (e.g., Dedert et al., 2010; Morin & Benca, 2012).

Exploratory Analyses. To assess the potential for increased risk associated with various demographic factors, exploratory analyses were run on gender and age. A chi-square test of independence indicated a significant relation between insomnia and gender, $\chi^2(1, N = 128) = 9.05, p < .05$, Cramer's $V = .27$, indicating a small effect size. Women were more likely to have insomnia than men. However, there was no increased vulnerability to PTSD or comorbidity by gender. Age was positively related to comorbidity, $r_s(128) = .20, p < .05$ with a small effect size indicating that as you age you are more likely to have a comorbid disorder. However, no other variables were associated with age of participants and no other demographic characteristics indicated differences in risk of these varied outcomes.

Discussion

The results support the hypothesis that the incidence rate of PTSD is higher among those with Type II diabetes and metabolic syndrome than the general population. Being overweight and/or obese are some of the leading risk factors for Type II diabetes and metabolic syndrome (American Diabetes Association [ADA], 2015), and it has been suggested that the increased BMI as a result of PTSD may cause a reduction in metabolic efficiency, and subsequently, metabolic syndrome or Type II diabetes (Heppner et al., 2009). Maladaptive health behaviors of those with PTSD may also help to explain the association between PTSD and Type II diabetes and metabolic syndrome. For example, lack of exercise, increased caloric intake, and smoking (Dedert et al., 2010) may directly alter metabolic functioning and increase the risk for Type II diabetes or metabolic syndrome.

The strong association between PTSD and insomnia and the significantly higher incidence of insomnia in the current sample may illustrate how PTSD may increase the risk for the development of Type II diabetes or metabolic syndrome. Insomnia has been associated with more caloric intake (i.e., especially with fatty foods), reduced ability to respond to insulin, more insulin resistance, and increased BMI (Broussard et al., 2012; Carpenter, 2013; Matthews et al., 2012), which stands to offer an explanation for poor health functioning in those with PTSD. Insomnia contributes to reduced ability to respond to insulin and increased BMI, subsequently insomnia may increase the risk of the development of Type II diabetes and metabolic syndrome. Some research indicates that medical treatment for insomnia mitigates the ramifications of inefficient sleep (e.g., insulin resistance, poorer food choices, and increased caloric intake) on the development of Type II diabetes and metabolic syndrome, which leads to a decreased risk of developing such conditions (Carpenter, 2013; Matthews et al., 2012).

Furthermore, the finding that presence of physical comorbidity is strongly associated with the presence of PTSD is consistent with other studies indicating that PTSD is associated with compromised health functioning, such as high cholesterol, hypertension, and elevated triglycerides (Clark et al., 2010; Cloutier et al., 2002; Dedert et al., 2010; Trief et al., 2006). This specific finding is interesting as it would be reasonable to assume that if the PTSD and accompanying symptoms are treated or better controlled, then it may help to reduce the risk of developing physical disorders or comorbidities.

Findings in this study are consistent with other studies that examine the relations between PTSD, diabetes and/or metabolic syndrome, insomnia, and abuse (e.g., Clark et al., 2010; Dedert et al., 2010; Levine et al., 2013). However, it is interesting to note that in the current study BMI did not have significant relations with PTSD, physical comorbidity, or insomnia as found in previous studies. Given this finding, BMI may not be as reliable of an indicator as previously thought. Consequently, these findings contribute to the previous literature and further strengthen the generalizability and prevalence of this association between various health risks across diverse samples. The importance of replicating studies and establishing previously found results contributes to the more solid foundation of knowledge about variables and interactions, particularly in establishing those variables that hold the most potential for improving health outcomes in at risk populations. Although this study is a conceptual replication as opposed to exact replication, it strengthens the findings that there are clear relations between PTSD, abuse, insomnia, and diabetes and/or metabolic syndrome.

Limitations

This study was limited in that it was an archival study that is, PTSD diagnosis was previously determined by the clinical psychologist as indicated in the patient chart and as such is preliminary. An archival study poses as a limitation due to the nature of archival studies limiting the amount of information that could be gathered and lack of self-report from each patient. The sample may have been skewed as these participants were referred to the clinical psychologist by the medical doctor at the practice due to concern regarding the health functioning and efficacy of treatments for those patients. However, this same limitation of having a sample that was referred to the clinical psychologist due to health disparities raising concern, may also be a strength because the current study was exploring a particularly at risk sample (i.e., poorly regulated). Additionally, the medical office that the archival data was pulled from was near one of the largest army bases, possibly resulting in a higher incidence rate of PTSD.

Future Directions

Future research on the subject would benefit from a longitudinal study to better evaluate the pathways between PTSD, Type II diabetes, and metabolic syndrome. Given that the current study is archival and data is inferential, future studies would benefit from both a prospective and longitudinal design. Prospective studies could use a more stringent measure to determine presence of PTSD, such as a combination of self-report measures and an additional, structured clinical interview incorporating the DSM-V diagnostic criteria. Future studies would benefit from looking at a sample that included people who had not previously seen a clinical psychologist and people who were not already diagnosed with Type II diabetes or metabolic syndrome. Research could also examine the type of trauma or abuse in regards to the risk and association of Type II diabetes or metabolic syndrome given that findings indicate that traumatic events experienced in childhood seem to have a lasting negative impact on a person's health functioning and development (Masters Pederson et al., 2015; Goodwin & Stein, 2004; Norman et al., 2012; Rich-Edwards et al., 2010; Tamayo et al., 2010; Thomas et al., 2008). Future studies could also look further into the timing of trauma in relation to diagnosis of Type II diabetes to better understand the direction and reason for the higher incidence of Type II diabetes and metabolic syndrome in those with PTSD as compared to the general population without PTSD. It is important to examine this relation in order to work towards prevention and treatment of the health disparities of those who have experienced trauma in childhood.

Despite there being an increasing amount of research done in this area in recent years, it has been noted by van den Berk-Clark et al. (2018) that a systematic review of PTSD and varied health behaviors that impact or increase diabetes and metabolic disruptions is still needed. Prospective study designs are needed to further investigate the relations and/or causal pathways between PTSD and Type II diabetes and metabolic syndrome to determine if PTSD and trauma increase the risk for developing Type II diabetes and/or metabolic syndrome. By determining the link, those who have experienced trauma may be able to better combat the effects and work towards lessening these risks later in life.

Implications

Research regarding PTSD, Type II diabetes, and metabolic syndrome may benefit war veterans. If PTSD is in fact a risk factor for developing Type II diabetes and/or metabolic syndrome, it would be especially important for those who have engaged in military combat as they would be at a heightened risk for the development of metabolic issues in the future. By better understanding the relations between PTSD and insomnia experienced by these

soldiers, applied practitioners could provide intervention and treatment better suited to reducing their risk for developing metabolic disorders.

Similarly, understanding the relation between PTSD, Type II diabetes, and/or metabolic syndrome may also benefit those that have experienced childhood trauma. As indicated in a wealth of research childhood trauma has a lasting effect on sufferers in adulthood (e.g., Norman et al., 2012). Learning how to manage and/or intervene with PTSD symptoms early may reduce the development of metabolic disorders later in life.

Research in this area would be beneficial for the rising cost in healthcare associated with the growing Type II diabetes and obesity epidemic. It is estimated that the total costs of Type II diabetes is \$245 billion a year (ADA, 2013) and the total costs of obesity is \$147 billion per year (Finkelstein, Trogon, Cohen, & Dietz, 2009). These numbers are expected to continue increasing as the incidence rates of Type II diabetes and obesity continue to increase. The cost in healthcare due to Type II diabetes and obesity could be slowed to an extent if individuals with PTSD seek treatment to combat the possible future risk of developing disorders associated with PTSD, such as Type II diabetes, metabolic syndrome, and obesity. Ultimately, if someone who has experienced a traumatic event seeks treatment for possible PTSD, the treatment may help alleviate the often times accompanying insomnia and its direct effect on health functioning, as well as other PTSD related issues that may contribute to the development of Type II diabetes and metabolic syndrome.

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