



## Health Related Quality of Life in Patients with Metabolic Syndrome

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### Authors' contributions

This work was carried out in collaboration between all authors. Authors AP and WWI designed the study and wrote the first draft of the manuscript. Authors OD, KB, APH, GD and BB managed the literature searches and performed the data analysis. All authors read and approved the final manuscript.

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### ABSTRACT

**Purpose:** The metabolic syndrome (MetS) is characterized by obesity, dyslipidemia (high triglycerides and low HDL cholesterol), hyperglycemia, and hypertension. With the constantly increasing epidemic of metabolic syndrome in the US population, our purpose is to review the impact of metabolic syndrome on health related quality of life (HRQOL).

**Methods:** A literature search was conducted on articles in the English language on the Ovid MEDLINE, PubMed, and Cochrane databases from 2002 to 2011. The abstracts of 622 relevant articles were reviewed for accordance with our criteria, resulting in 80 selections that broadly addressed MetS or the involved disorders. Twenty-one papers with studies using HRQOL measurement were selected for inclusion in this review.

**Results:** Metabolic syndrome negatively impacts health related quality of life. Two of the

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conditions comprising metabolic syndrome, obesity and hyperglycemia, have the most negative effects on HRQOL. The consequences are most prevalent in the physical component of HRQOL.

**Conclusions:** The negative impact of metabolic syndrome on HRQOL affects a large proportion of the population. Further research is needed to guide in the prevention and proper treatment of MetS in order to improve patients' HRQOL.

*Keywords: Metabolic syndrome; quality of life; health-related quality of life.*

## 1. INTRODUCTION

Metabolic Syndrome (MetS) is a disorder afflicting approximately 47 million US residents nationwide and presents with a constellation of symptoms. These symptoms include abdominal obesity, increased triglycerides, decreased HDL cholesterol, increased blood glucose, increased blood pressure, and pro-thrombotic and inflammatory states [1]. The Adult Treatment Panel III (ATP III) of the National Cholesterol Education Program (NCEP) is a commonly referenced evidence based measure for identifying MetS. [2] This ATP III criteria requires 3 out of the 5 following factors: abdominal obesity (waist circumference), elevated triglycerides (150mg/dl or higher), decreased HDL cholesterol (less than 40 mg/dl in men and 50mg/dl in women), increased fasting glucose levels (110mg/dl or higher), and high systolic blood pressure (130mm Hg or higher) [1] as shown in Table 1. There are several severe health complications associated with MetS. Most notably, MetS increases the risk of diabetes, cardiovascular events and increases overall mortality [3].

**Table 1. Criteria for diagnosis of metabolic syndrome**

	<b>Waist Circumference</b>	<b>Triglycerides</b>	<b>HDL-C</b>	<b>Blood Pressure</b>	<b>Glucose</b>
WHO	BMI >30kg/m <sup>2</sup>	≥150 mg/dl	<35 mg/dl in men, <39 mg/dl in women	≥140/90 mm Hg	IGT, IFG, or T2D Microalb.
ATPIII	≥40in in men ≥35in in women	Same as WHO	<40 mg/dl in men, <50 mg/dl in women	≥130/85 mm Hg	Fasting >110 mg/dl
AHA/NHLBI	Same as ATPIII	Same as WHO	Same as ATPIII	Same as ATPIII	Fasting ≥100 mg/dl

*Abbreviations: AHA: American Heart Association, ATPIII: National Institute of Health Adult Treatment Panel 3, IFG: Impaired Fasting Glucose, IGT: Impaired Glucose Tolerance, Microalb.: Mircoalbuminuria  
NHLBI: National Heart, Lung, and Blood Institute, T2D: Type 2 Diabetes*

Health-related quality of life (HRQOL) refers to an individual's overall sense of wellbeing, based on subjective physical, social, and psychological functioning [4]. These three domains are measured utilizing patient-reported instruments such as the SF-36, EQ-5D, and the HRQOL-4 [5]. When examining patients with medical conditions such as MetS, it is important to analyze the perceived effect a medical condition has on an individual's physical and mental health in order to determine HRQOL [6]. As the prevalence of MetS increases, many groups have looked into its association with HRQOL. Our objective is to present a review of the published literature with respect to the association between MetS, and its constituents,

with HRQOL. Due to the complexity of MetS, we also wanted to examine the impact of the combined effect of the syndrome as well as its individual components on HRQOL.

## **2. METHODS**

### **2.1 Search Strategy**

A literature search was conducted on articles in the English language on the Ovid MEDLINE, PubMed, and Cochrane databases from 2002 to 2011. The keywords used for the search were “metabolic syndrome” and “quality of life”. We also reviewed the reference list of review articles for additional studies. This strategy identified 622 relevant articles.

### **2.2 Study Selection Criteria and Methodology**

Two reviewers examined the abstracts of the 622 studies independently using the following inclusion criteria: 1. Articles in English or with an available published English translation; 2. Publication in a peer-reviewed journal; 3. Studies performed on adults; 4. Studies (of any design) that focused on MetS; and 5. Studies that measured HRQOL. Eighty articles met the above criteria. Both reviewers then conducted, independently, a focused review using the full text articles of studies that met the above criteria. The quality of the studies were evaluated by assessing sample size, outcome measures, patient selection methods, study group comparison, and statistical analysis, as guided by the criteria adapted from Lohr and Carey [7] by the Agency for Healthcare Research and Quality [8].

The reviewers then reached a consensus on the studies to include in this review.

### **2.3 Data Extraction and Yield**

The study selection process described above yielded twenty-one articles. Research methodology and key findings were derived from the full text and tables of the selected studies. Study design and findings are detailed in the tables provided in this review.

## **3. RESULTS**

### **3.1 The impact of MetS on HRQOL**

The negative impact of MetS on HRQOL was remarkable. The findings from the reviewed studies are depicted in Table 2.

A variety of studies we reviewed found that MetS was associated with decreased HRQOL, [1,9,10] but there also was an array of papers that paralleled the outcome to the presence of obesity and/or hyperglycemia [6,11-16]. Some studies attempted to control for certain conditions [1] while others admitted the overlap was a limitation of their study [11,13,14]. Others found that the sequelae of MetS (depression and disease burden) negatively impacted HRQOL, but the syndrome itself did not [17]. Although it would be academically rewarding to discern the exact cause of decreased HRQOL in MetS, clinically any patient with obesity and/or hyperglycemia is advised to lose weight and control glucose levels, respectively to improve HRQOL. Likewise, dyslipidemia, which has been found to have the lowest association with HRQOL [11], is targeted in both obese and diabetic patients [6]. While treatment of MetS may focus first on hyperglycemia or obesity, the overall approach remains multi-dimensional.

**Table 2. The Impact of the Metabolic Syndrome on HRQOL**

Author	N	Population and setting	QOL Measurement Tool	Design	Finding	P value
Amiri et al. 2010 [9]	950	Iranian adults	SF-36 (Iranian Version)	Cross Sectional	HRQOL was lower in participants with MetS and in women when compared to men.	P<.001
Brown et al. 2003 [6]	37,054	American adults 50 and over	HRQOL-4	Cross Sectional	Those with DM have lower HRQOL than those without, report 5 days of impaired physical or mental health and were 64% more likely to report 14 more unhealthy days in the most recent 30 days.	P=.04
Chedraui et al. 2006 [22]	325	Ecuadorian post menopausal women	MENQOL (Menopause-Specific Quality of Life Questionnaire)	Cross Sectional	Abdominal obesity increased the risk of having vasomotor, psychosocial and physical scores above the median. Hypertension and hyperglycemia increased the risk for higher scores within the psychosocial and sexual domain respectively.	P<.05
Dixon and O'Brien 2007 [32]	459	Severely obese patients	SF-36	Cross Sectional	Patients had lower scores compared with community normal values for all 8 aspects of QOL measured, especially the physical health scores. LAP-BAND surgery provided a dramatic and sustained improvement in all measures of the SF-36. Improvement was greater in those with more preoperative disability, and the extent of weight loss was not a good predictor of improved QOL. Mean scores returned to those of community normal values by 1 year after surgery and remained in the normal range throughout the 4 years of the study.	
Ford & Li, 2008 [1]	1,859	American men and women 20 and older	HRQOL-4	Cross Sectional	U.S. adults with the metabolic syndrome experience worse health-related quality of life than adults without this syndrome. People with	P=.002 P=.010

Frisman & Kristenson, 2009 [18]	1,007	Swedish men and women	SF-36 (Swedish Standard Version)	Cross Sectional	MetS have more mentally unhealthy days than people without. Men and women with MetS reported lower levels of physical activity, lower scores on physical and social dimensions of SF-36.	P<.05
Gardner & Montgomery, 2008 [13]	423	American adults with peripheral artery disease	SF-36	Cross Sectional	Patients with peripheral artery disease and those with a greater number of factors contributing to metabolic syndrome showed poor cardiopulmonary fitness. Abdominal obesity and elevated fasting glucose are the metabolic syndrome components that are most predictive of these outcome measures. Abdominal obesity was the predictor of exercise performance during the treadmill and 6-minute walk tests, as well as physical activity. Elevated fasting glucose was a predictor of peripheral vascular measures, self-perceived walking ability and health, and health-related quality of life.	P<.05
Hjellset et al. 2010 [10]	198	Pakistani immigrant women in Oslo, Norway.	SF-36	Cross sectional	Woman with MetS had significantly lower general health (P<.04), physical function (P<.012), and more bodily pain (P<.007) than those without MetS. No differences were found with regard to mental health.	P<.04
Huang et al. 2010 [20]	140	Men and women from the cardiovascular department at a major hospital	SF-36	Cross sectional	MetS was not found to correlate with HRQOL scores.	
Kasteng et al. 2011 [28]	410	Patients taking either aripiprazole or olanzapine without MetS at baseline	EQ-5D	Pooled analysis of three randomized clinical	A Markov health-state transition model was developed to assess the risk of developing MetS after one year of aripiprazole or olanzapine. Aripiprazole was associated with lower rates of	P<.0055

				trials	MetS, overall treatment costs, and improved quality of life.	
Liu, 2010 [34]	11	Australian men and women	SF-36	Prospective	Participants attended Tai Chi and Qigong exercise classes 3x/week and had statistically significant improvements in general health (P<.01), mental health (P<.01), and MCS (P<.05 domains of HRQOL.	P<.01
Mokhlesi, 2010 [31]		Review: American men and women	SF-36	Review	Patients with OHS have a lower quality of life, with increased healthcare expenses, and are at higher risk of developing pulmonary hypertension and early mortality, compared to eucapnic patients with sleep-disordered breathing.	
Miettola et al. 2008 [11]	480	Finnish men and women	EQ-5D	Cross sectional	MetS was significantly associated with impaired HRQOL. In a logistic regression analysis, a significant association persisted between MetS and impaired HRQOL (OR = 1.9). MetS seems to be associated closely with perceived HRQOL at the community level. Therefore, reduction of risk factors of MetS may improve HRQOL.	P<.001
Oh et al. 2010 [10]	52	Korean men and women	SF-36	Randomized controlled trial	The treatment group underwent a 6-month lifestyle intervention consisting of exercise, diet, counseling, and education, which resulted in a greater decrease in MetS than the control group, although statistical significance was not achieved.	
Park et al. 2010 [14]	4463	Korean men and women	EQ-5D	Survey	Differences were found between men and women with the effect of MetS causing greater decreases in EQ-5D scores in women. More factors contributing to MetS also caused lower scores. Lower family income, education, and marital status, also played a role in the prevalence of	P<.05

Scholtz et al. 2007	1212	Elderly American men and women	SF-36	Cross-sectional	MetS. The results indicate that insulin resistance is associated with poor HRQOL in domains of physical health, but not in domains of mental health.	
Thompson et al. 2010	104	Overweight women with polycystic Ovarian Syndrome	PCOSQ (Specific PCOS QOL measure)	Randomized Clinical Trial	This study demonstrated that dietary restriction alone and combined with exercise had similar benefits for improving depression and HRQOL scores in overweight and obese women with PCOS. At baseline the emotion score correlated with glucose showing that higher glucose levels were related to worse domain scores. All groups experienced significant improvements in PCOSQ domain scores by week 20 (P<.001),	P<.001
Tsai et al. 2008 [12]	361	American obese men and women	SF-36	Randomized Clinical Trial	MetS was associated with lower scores on the physical function and general health subscales of the SF-36 and on the physical component summary (PCS) score. Individuals with MetS reported lower HRQOL. This appeared to be an effect of increased weight, rather than a unique effect of MetS. Individuals with MetS had significantly lower scores on two of the eight subscales of the SF-36. These were, physical functioning (P = .021) and general health (P = .007). Participants with MetS also scored significantly lower on the physical component summary (PCS) score (P<.013).	P<.05 .021 P<.01 .007 P<.05 0.013
Tung et al. 2011 [3]	104	Taiwanese men and women	SF-36 (Taiwanese form)	Cross Sectional	The results indicated that patients who ate fruit more frequently tended to have a better quality of life, while the intake of fried food was more frequently	

					associated with a poor quality of life. Frequent intake of fried food was negatively associated with physical function, mental health, and PCS ( $r=-.266$ , $p=.006$ ; $r=-.235$ , $p=.016$ ; $r=-.294$ , $p=.002$ ), and more frequent intake of fruit was positively associated with general health and MCS ( $r=-.275$ , $p=.005$ ; $r=-.235$ , $p=.016$ ). The results also showed that eating more vegetables was associated with lower diastolic pressure ( $r=-.218$ , $p=.032$ ). Among the category of eggs, seafood, beans, and meat, fish was significantly negatively associated with waist size ( $r=-.265$ , $p=.007$ ).	
Tziallas et al. 2012 [24]	359	Greek men and women	SF-36	Cross sectional	MetS was strongly associated with decreased MCS, showing increased anxiety and depressive symptoms. Patients with MetS also had lower scores on PCS.	P<.001
Vetter et al. 2011 [17]	390	Obese men and women with at least one additional criteria for MetS	SF-12 and EQ-5D	Cross sectional	MetS was not associated with HRQOL. Univariate analysis of depression, disease burden and employment status in participants was associated with decreased HRQOL.	

Abbreviations: HRQOL = Health Related Quality of Life,  
 MetS = Metabolic Syndrome, PCS = Physical Component Summary of the SF-36,  
 MCS = Mental Component Summary of the SF-36



In their evaluation of the National Health and Nutrition Examination Survey, Ford and Li [1] found that participants with MetS had a significantly worse perception of their own health. They also had a greater number of self-reported mentally “unhealthy” and “activity limited” days as compared to those without the syndrome. Their study utilized the CDC tool, HRQOL-4, and adjusted for age, sex, ethnicity, educational and smoking status. Additionally, when all five components of MetS were used in a logistic regression model, none were found to be independently associated with physically or mentally unhealthy days. The exclusion of participants with diabetes or cardiovascular disease only weakened the association with perceived health but did not impact the number of physically unhealthy, mentally unhealthy, or activity limited days. Metabolic syndrome patients with more inclusion comorbidities had lower HRQOL scores and also showed gender differences with decreased physical HRQOL in the dimensions of physical activity, bodily pain and social functioning in women. These findings suggest that the impact of MetS as a constellation of conditions has a greater impact on HRQOL than the individual disorders.

A more sedentary lifestyle, as a consequence of MetS, leads to decreased HRQOL [18]. A study of a middle-aged Swedish population with MetS showed lower perceived HRQOL in the physical and social domains when compared with controls, but the measured differences were lost when controlling for lifestyle factors, including smoking, food habits and physical activity [18]. Another study attributed depressed HRQOL to an inactive lifestyle in MetS patients [19]. Although the sequelae of inactivity are outside the scope of this review, it appears to be prevalent among people with MetS and negatively impacts their HRQOL.

Cultural differences result in dissimilar perceptions of HRQOL. Studies of populations from regions other than North America have failed to find an association between HRQOL and MetS [20]. However, a study of populations using a culturally modified HRQOL tool, showed impaired quality of life among patients with MetS [9,14,18]. In the future, when assessing HRQOL in international populations, culturally sensitive tools should be used.

Although different tools have been implemented to gauge the effect MetS has on quality of life, most studies have concluded that HRQOL is decreased in individuals with MetS [1,9,11,14]. Studies that expanded on both the specific aspects of MetS and the domains of HRQOL, allowed us to evaluate MetS on a variety of levels. In one study utilizing the 15D instrument, MetS was linked to overall lower HRQOL particularly with respect to mobility, hearing, breathing, usual activities, discomfort and symptoms, vitality and sexual activity [11]. MetS has also been associated with an increased risk of fungal infections and prolonged wound healing [21]. Other reports have found that among patients with peripheral artery disease, those with a greater number of factors contributing to MetS showed poorer cardiopulmonary fitness [13]. Additionally, many characteristics of MetS emerge during menopause and cause decreased quality of life compared to menopausal women without the syndrome [22]. This data suggests that with few exceptions, the amalgamation of comorbidities in MetS has its own effect on quality of life.

### **3.1.1 The physical aspects of HRQOL in patients with MetS**

Physical health is a broad category with many contributing factors. MetS can severely inhibit many of the normal physical functions that a healthy adult would have. Patients with MetS have increased subjective health complaints of musculoskeletal, neurological, and gastrointestinal pains [10]. The increased risk for cardiovascular disease [14] and the increased prevalence of obesity and hyperglycemia in patients requiring coronary artery bypass grafting (CABG) allow for the assumption that MetS negatively impacts physical

health [3]. Gardner and Montgomery [13] assessed that patients with MetS and peripheral artery disease had decreased claudication distances, physical function, and HRQOL. The impact of MetS also extends to sexual health and is an independent risk factor for sexual dysfunction [23]. An impairment of circulation underlies all of these conditions, and results in pain with physical activity, promoting a sedentary lifestyle and a debilitating cycle ensues. In addition, obesity increases the work of the heart by requiring a greater area of perfusion while consistently increased insulin levels have macro and micro vascular complications inciting discomfort caused by decreased circulation. Waist-hip ratio, fasting insulin, triglycerides and HDL-cholesterol alone were associated with a decline in physical functioning [14]. Thus, when these conditions are combined in MetS, the consequences can be assumed to be cumulative. MetS has a strong negative impact on the physical domain of HRQOL.

### **3.1.2 The psychological aspects of HRQOL in MetS**

The impact of MetS on mental health remains unclear. Anxiety, depressive disorders, distress, and hostility are among some of the mental health problems experienced by this population [1,24]. Cognitive stressors such as these cause alterations in inflammatory states, namely increased interleukin 6 (IL-6) levels which lead to cardiovascular disease, infections, difficulties in wound healing, and type 2 diabetes [25].

In the study by Ford and Li, it was observed that those suffering from MetS were more likely to report having mentally unhealthy days compared to those without MetS [1]. A possible flaw of this study was the neglect of other circumstances and events in the lives of the subjects that could possibly affect whether or not they have a healthy day. On the contrary, Tsai et al. failed to find a correlation between MetS and the mental health domains in the SF-36 questionnaire. Using the same HRQOL tool for a Pakistani population, Hjellset did not find an association between quality of life and MetS. An association between MetS and psychosocial health was once again non-contributory in the study of an Asian population [14]. It is of note that the latter study used a culturally adjusted tool and found decreases in all non-mental HRQOL aspects. Nonetheless, some ethnicities may be more reserved in reporting mental health complaints than others.

Studies have shown that MetS is present in 40% of bipolar disorder and 32% of schizophrenia patients; a prevalence that increased by 8%-9.4% at 6 months follow-up [26]. People with schizophrenia are prone to developing MetS due to medication side effects that result in weight gain. A team of Spanish researchers looked at the effects of MetS on quality of life in 136 people with schizophrenia, 49 of who had MetS. They found a positive correlation between number of years taking antipsychotic psychotic medications, age, and metabolic syndrome [27]. Several groups have found that second-generation antipsychotics can increase the risk of metabolic abnormalities in patients with schizophrenia and bipolar disorder [28, 29]. The level of risk varies among antipsychotic medications with weight gain data for second-generation antipsychotics indicating differences in the gain liability, and clozapine and olanzapine being associated with the greatest weight gain over 1 year [28, 29]. In an elderly population, MetS was related to greater disability secondary to marked decline in cognition [30]. Further research on the outcomes of MetS on mental health is warranted.

### **3.1.3 The social aspects of HRQOL in patients with MetS**

Metabolic Syndrome can bring about depression and feelings of inferiority. Perceptions of beauty influenced by the media often-lead patients with abdominal obesity to feel less

attractive and experience increased self-consciousness. Even conditions that are invisible to the naked eye can lead to feelings of guilt. For example, a patient with elevated blood pressure may experience guilt for being unable to control or prevent the MetS components. Although the interaction between MetS and the social domain of HRQOL is still being developed, it remains an important aspect of lowering HRQOL.

### **3.2 The Impact of Specific Components of MetS on HRQOL**

The MetS components examined in the reviewed HRQOL studies are summarized in Table 3.

#### **3.2.1 The impact of the obesity component of MetS on HRQOL**

Although most studies found that MetS generally decreased HRQOL, many attributed the results to obesity or increased BMI, with one study demonstrating lowered HRQOL in more obese individuals [11] and another losing statistical significance when controlling for BMI [12]. Likewise, domains including exercise performance [13], physical activity [14], and perceived poor health [1], were negatively affected by obesity, thereby resulting in a lower perceived quality of life. Obese women also reported reduced vasomotor, psycho-social and physical scores [22]. In patients with hypercapnia, those with concomitant obesity hypoventilation syndrome had a lower quality of life [31]. One study found that HRQOL endorsements returned to normal approximately one year after obese patients underwent the LAP-BAND procedure [32]. As most patients with obesity have degrees of insulin resistance and dyslipidemia, these findings suggest that associated conditions may have an additive impact on HRQOL in obese patients.

#### **3.2.2 The impact of the hyperglycemia component of MetS on HRQOL**

As previously mentioned, hyperglycemia is a component of MetS that is frequently found to play an important role in the observed decline in quality of life. Some studies have found that hyperglycemia strengthened the association of MetS with poorly perceived health [1], worse physical health [14], more unhealthy days [6], and inferior peripheral circulation and walking ability [13]. These conclusions were present even when controlling for possible confounding variables such as BMI, lifestyle factors, and diseases in men [15]. The aforementioned findings are expected, as management of hyperglycemia requires dietary and lifestyle changes that result in a pessimistic outlook on quality of life [6]. High glucose levels also create a fertile environment for organisms to thrive, making diabetics more prone to fungal infections and decreasing quality of life [21]. In menopausal women with MetS, those with hyperglycemia suffered in the sexual dimension [22]. The role of insulin resistance on mental health is less convincing [15] and may depend on whether the patient uses insulin, the duration and intensity of the disease, and associated complications.

**Table 3. Metabolic syndrome components examined in the reviewed studies regarding the impact on HRQOL**

Authors	Dyslipidemia	Blood Pressure	Abdominal Obesity	Hyperglycemia	Metabolic Syndrome Total
Amiri et al. 2010 [9]	X		X		X
Brown et al., 2003 [6]					X
Chedraui et al. 2006 [22]		X	X	X	
Dixon & O'Brien, 2007 [32]			X		
Esposito & Giugliano, 2005 [32]			X		
Ford & Li, 2008 [1,6]					X
Frisman & Kristenson, 2009 [18]			X		X
Gardner & Montgomery, 2008	X		X		
Han et. al., 2009 [13]			X		X
Huang et al. 2009 [20]	X	X	X	X	X
Hjellset et al. 2011 [10]			X	X	X
Kasteng et al. 2011 [28]				X	X
Mokhlesi, 2010 [31]					
Miettola et. al. 2008 [11]					X
Park et al. 2011	X	X	X	X	X
Scholtz et al. 2007				X	
Thompson et al. 2010			X		
Tsai et al. 2008 [12]					X
Tung et al. 2011 [3]					X
Tziallas et al. 2012 [24]	X	X	X	X	X
Vetter et al. 2011 [17]	X	X	X	X	X

**3.2.3 The impact of MetS treatment on HRQOL**

Metabolic syndrome is concerned with abnormalities in metabolism, making diet an important factor in development and mitigation. Lifestyle intervention with low-calorie diets lessens the incidence and prevalence of MetS [33]. Certain dietary changes such as increased fruit intake and fish consumption are related to better general health and are inversely associated with waist size. A large intake of fried foods reduces scores on the physical domain of HRQOL [3]. Greater attention to energy balance may greatly impact MetS.

Exercise has also been shown to increase HRQOL in those suffering from MetS [30]. In people with exercise intolerance less taxing practices such as Tai Chi and Qigong showed clinical improvement in conditions associated with MetS and consequently HRQOL [34]. Multi-dimensional programs like the one conducted and reported by Oh et al., [35], used a 6-month therapeutic lifestyle intervention of counseling, health monitoring, health education, diet and exercise to lessen the prevalence of MetS. Although the results were not statistically significant, considerable reduction in waist circumference and body weight was achieved,

decreasing the prevalence of MetS after just four weeks [36]. HRQOL in this intervention group showed significant positive interactions with physical functioning, general health, vitality and mental health.

Pharmaceuticals including oral anti-glycemics, anti-hypertensives and lipid lowering medications also worked to thwart MetS [30]. However, Emili et al. [37] found that behavior change was more effective in treating MetS than trials of metformin or placebo. Educational status also has implications, as impaired HRQOL was associated with a low vocational education level and unemployment [11,16,24]. Teaching patients and their communities about healthy lifestyle habits may be an effective way to slow the increasing rate of MetS.

Most recently, O'Conner and his colleagues tested the effects of intensive and standard blood pressure control on patients with type 2 diabetes, in the Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial, in order to determine if one method was more effective than the other in improving HRQOL. After four years of observation, it was concluded from this study that there was no major clinical difference between intensive and standard blood pressure control [38]. Dixon and O'Brien, however, noted dramatic changes especially in the physical domain in their study on the effects of the LAP-BAND on HRQOL [32]. It should be noted that in their study only the patients of two highly experienced surgeons were examined and therefore it is possible for the frequency of adverse effects from the surgery to be higher with less experienced surgeons.

#### **4. DISCUSSION**

Metabolic syndrome is a unique condition with negative HRQOL sequelae associate with the combined effect of the syndrome as well as its individual components. In treating MetS, the physician's goal is to mitigate the combination of symptoms associated with the disorder and hopefully to ameliorate the patient's HRQOL. Each of the comprising disease states also has a negative impact on HRQOL [6,11-15]. In the study by Chedraui and colleagues it was concluded that hypertension has an impact on the psychosocial domains while abdominal obesity is correlated with the psychosocial domain as well as the physical domain. Hyperglycemia was not found to have any major impact on the psychosocial domain but it did affect the sexual domain [22]. Although some groups found that MetS was not associated with decreased HRQOL [17] it was related to decreased physical health and disease burden, which in fact does weigh on HRQOL.

Current HRQOL questionnaires evaluate aspects of the physical and mental health domains. With respect to the physical domain, the perception of physical health was most commonly negatively affected [1,3,9,13,14]. More specifically, decreased mobility, labored breathing, and sexual activity [11] increased fungal infections and delayed wound healing [21], peripheral artery disease and decreased cardiopulmonary fitness have all been implicated in causing this negative perception [14]. Using a culturally sensitive assessment tool was also shown to be important in generating valid results [9,14,18,20] and should be used in the future evaluation of HRQOL and MetS.

The ramifications on mental health have been less conclusive. However, since negative affect secondary to MetS can increase inflammation via IL-6 [25] and thus lead to cardiovascular associated disability, further exploration on the relationship between mental health, negative affect and HRQOL is warranted. Malhotra et al. showed that MetS is prevalent in 40% of patients with bipolar disorder and 32% of patients with schizophrenia, and more importantly this prevalence increased by 8%-9.4% at 6 months follow-up [26].

Patients with bipolar disorder and schizophrenia have a higher prevalence of MetS often as a side effect of psychotropic medications [27]. This finding is especially prominent with second-generation antipsychotics such as olanzapine and as suggested by Kasteng [28]. The use of aripiprazole is associated with lower risk of MetS.

The treatment of MetS involves a number of approaches including changes in diet, [33] increased exercise, [30,34,35] patient education, [11] and pharmacological interventions [30]. These techniques are also applied in the treatment of obesity and hyperglycemia. Additionally, the management of hypertension and hyperlipidemia are within most obesity and hyperglycemia protocols.

## 5. CONCLUSIONS

Metabolic syndrome increases the risk of cardiovascular incidents and mortality while decreasing health related quality of life. After examining the studies in this literature review it is safe to conclude that whether as a constellation of symptoms or secondary to one of the comprising ailments, MetS has a negative association with quality of life. Although MetS includes five components as highlighted above, most research studies show that hyperglycemia and obesity play a pivotal role in MetS' effect on quality of life especially the physical component of HRQOL. The creation of a MetS-specific HRQOL tool, to objectively assess the direct consequences of MetS and its components on HRQOL, might have the potential of improving measurement precision. Treatment of the MetS by addressing each of the components according to evidence-based practices has the potential to improve HRQOL in patients with MetS. Further research is needed to guide in the prevention and proper treatment of MetS in order to improve patients' HRQOL.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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