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RESEARCH

Quality of primary care processes for individuals with chronic diseases associated with the metabolic syndrome: a comparative study

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Aim: The aim of this study is to investigate whether individuals diagnosed with chronic diseases associated with the metabolic syndrome (MetS) receive favorable quality of care processes in the primary care setting relative to other individuals with and without chronic diseases. **Background:** Data from the 2010 Brazos Valley Health Status Assessment (BVHSA) ($n = 3964$) were analyzed. Individuals diagnosed with chronic diseases that are collectively associated with a diagnosis of MetS, namely obesity, diabetes, high cholesterol, and hypertension, were characterized as a group (ie, analytic sample, $n = 168$). Clinical guidelines were utilized to identify indicators representing the quality of care processes received by these individuals during visits with their health-care provider. **Method:** Measures of quality of care processes were analyzed relative to a comparator group comprising individuals with no chronic diseases and an alternative test group comprising those diagnosed with other chronic diseases (eg, arthritis, depression, and cancer among others) using multinomial and binary logistic regression. **Findings:** Physician communication of critical issues such as diet, stress, and weight status was statistically more pronounced in the analytic sample relative to the comparator group. However, differences in physician communication about physical activity were not statistically significant relative to the comparator group (OR = 1.26, $P = 0.533$). Differences in testing of cholesterol (OR = 0.94, $P = 0.743$) and blood pressure (OR = 1.16, $P = 0.619$) were also not statistically significant relative to the comparator group. Individuals who may have MetS generally receive favorable quality of care processes from their health-care provider, but opportunities exist to enhance provider communication about physical activity, and to possibly improve frequency of cholesterol and blood pressure testing.

Key words: primary care; process quality; metabolic syndrome; chronic disease

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Introduction

Metabolic syndrome (MetS) is an international health concern with many components that are commonly associated with the obesity epidemic in different countries and ethnicities (Mente *et al*., 2010). In addition to research focused on the American population, studies of MetS have been conducted on a host of other nationalities (Takeuchi *et al*., 2009; Ferguson *et al*., 2010; Nguyen *et al*., 2010; Lee *et al*., 2010a; 2010b). Although this study examines MetS in the United States, its findings are widely applicable to an international audience of researchers.

At least six different health organizations have proposed definitions for MetS, with no universal consensus for all attributes of the condition (Batsis *et al*., 2007). Despite uncertainty in diagnostic criterion worldwide, in the United States primary care providers generally agree that a diagnosis of MetS can be made if three or more of the following conditions are present: obesity, an elevated blood pressure, high glucose levels, low high-density lipoprotein cholesterol (HDL-C) or a high triglyceride level (Grundy *et al*., 2005).

The medical literature on MetS is extensive. Within the United States, research suggests that individuals diagnosed with MetS have a markedly higher incidence of diabetes and also have a higher risk of coronary heart disease, stroke, and peripheral vascular disease (American Heart Association, 2010a). As a result, these individuals have a mortality rate 1.5 times higher than those without diabetes and MetS (Doshi *et al*., 2009). It is estimated that over 50 million Americans have MetS (American Heart Association, 2010a), with prevalence rates increasing with age to 40% for those over 60 years of age (Jiamsripong *et al*., 2008). Individuals with diabetes are especially at high risk for developing MetS, with the overall prevalence rate among this group estimated to be 86% (Jiamsripong *et al*., 2008).

MetS has been described as a 'constellation of metabolic risk factors and physical conditions' (Jiamsripong *et al*., 2008: 155). As such, it is important to recognize the serious aspects of the individual chronic diseases that comprise the majority of MetS diagnoses: obesity, diabetes, dyslipidemia, and hypertension.

More than 26% of American adults are clinically obese (Centers for Disease Control and Prevention, 2010a). Obesity increases the risk for type 2 diabetes mellitus (T2DM), hypertension, dyslipidemia, and can also lead to many other medical problems including cardiovascular disease and certain cancers (National Heart Lung and Blood Institute, 1998; World Health Organization, 2010). The annual economic impact associated with obesity in the United States is estimated to exceed $200 billion (Hammond, Levine, 2010). Obesity is a key risk factor for T2DM (Centers for Disease Control and Prevention, 2010b). This disease affects over 23 million Americans and doubles the risk of premature death relative to those without diabetes (Centers for Disease Control and Prevention, 2007).

High cholesterol impacts one in six American adults, and also nearly doubles the risk of developing heart disease (Centers for Disease Control and Prevention, 2010c). However, a low HDL-C level affects more than one in four adults, is a prevalent risk factor in individuals with diabetes and coronary heart disease, and is one of the diagnostic components of MetS (Singh *et al*., 2007). Coronary heart disease causes one out of every four deaths in America each year (Centers for Disease Control and Prevention, 2010d), and is estimated to have annual economic costs exceeding $316 billion (Centers for Disease Control and Prevention, 2010d). Finally, hypertension affects one out of every three Americans, and is a major risk factor for stroke, congestive heart failure, and kidney disease (Centers for Disease Control and Prevention, 2010e). The primary care setting is a unique opportunity for both preventing and managing chronic diseases associated with and indicative of MetS. Frequent interaction between individuals with chronic disease and a health-care provider creates an ideal setting for chronic disease management (Ely *et al*., 2008). Yet it is estimated that approximately half of chronic disease patient care in primary care settings does not meet optimal standards of care (Harris and Zwar, 2007). Primary care is similarly challenged when dealing with MetS (Miller and Silverstein, 2006). Quality of care for individuals with chronic diseases indicative of MetS is therefore in doubt within the primary care setting, and worthy of further analysis.

Donabedian (1997) provides health services researchers with a seminal framework for evaluating the concept of quality across the medical

care continuum. The assignment of quality indicators to categories of structure, process, and outcome (Donabedian, 1997) provides a method for a better understanding of what is meant by the term quality, and how to measure it. Donabedian (1997) describes quality of process as a measure of how care is delivered to the patient. Clinical guidelines often provide health-care providers with a set of procedures for engaging a patient who presents with a chronic disease. These guidelines include protocols for screening, testing, obtaining family history, and communicating with patients about critical aspects of their lifestyle. Further, such guidelines and standards are considered keys to delivering quality care to individuals with chronic disease (Boyages *et al*., 1999; Gevirtz *et al*., 1999), and can be categorized as indicators of a quality process.

The value of quality of care processes is often contrasted with the value of quality outcomes. As described by Donabedian (1997), quality of outcomes focuses on how medical care impacts the patient's health status. However, such quality is difficult to measure in primary care, and as a result most quality evaluations focus on processes (Gevirtz *et al*., 1999). Despite the difficulty of measurement, quality of outcome should not necessarily be viewed as superior to quality of process. Quality of process itself is often considered key to achieving positive health outcomes and patient satisfaction among individuals with chronic disease (Al-Hussein, 2008). Burge *et al*. (2007) also note the important role of clinical performance measures in achieving quality in primary care for individuals diagnosed with chronic disease such as heart disease. They further argue that patient–provider interaction is critical to achieve this quality clinical performance (Burge *et al*., 2007). Patient–provider communication is often an essential measure of quality of care processes in primary care because of its importance in leveraging the benefits of the Chronic Care Model (Wagner *et al*., 2001), ensuring client-centered care (Cumbie *et al*., 2004), and enabling a supportive environment for chronic disease self-management (Bodenheimer *et al*., 2002).

Recognizing the importance of chronic disease management in MetS and the potential shortcomings of primary care to deliver quality of care processes to individuals with chronic disease (Harris and Zwar, 2007), our study evaluates self-reported quality of care process indicators from individuals with chronic diseases associated with MetS. The purpose of this study is to examine differences in quality of care process indicators in the primary care setting between individuals with chronic diseases associated with MetS, and those without chronic disease or with other chronic diseases living in central Texas.

Methods

The 2010 BVHSA ($n = 3964$) was conducted and funded by the Center for Community Health Development at the Texas A&M Health Science Center, School of Rural Public Health (2010). In conjunction with community health partners, the aim of the survey was to assess the health status and opportunities for community health improvement in the Brazos Valley, an eight-county area in central Texas, through a voluntary questionnaire (Center for Community Health Development, Texas A&M Health Science Center, School of Rural Public Health, 2010). Data were collected using a random sampling of households. The instrument was 32 pages containing items from validated sources (Center for Community Health Development, Texas A&M Health Science Center, School of Rural Public Health, 2010).

Using data from the 2010 BVHSA, we established a sample of respondents with four chronic diseases that form the constellation of metabolic abnormalities indicative of MetS: obesity, diabetes, high cholesterol, and hypertension (ie, analytic sample). Several characteristics of this cohort merit comment. Diagnostic criterion for MetS only requires three of the possible five criteria described above, including an abnormal glucose level and blood pressure, but not necessarily T2DM or hypertension. Therefore, this inclusion criterion is a more stringent definition than is required to meet the medical diagnosis. It should also be noted that the survey instrument only asked respondents whether they had been diagnosed with high cholesterol, not high triglycerides or low HDL-C. As a result, we used positive responses of high cholesterol as a relative proxy for dyslipidemia, recognizing this as a limitation of our study. Further, the survey instrument only asked respondents whether they had been diagnosed with diabetes (excluding gestational diabetes), not whether the diagnosis was type 1 diabetes mellitus or T2DM. As a result,

we used positive responses of diabetes as a relative proxy for T2DM, recognizing this as a limitation of our study. A comparator group was then established consisting of respondents who reported no chronic diseases of any kind. An alternative test group was also established consisting of respondents who reported a chronic disease other than those associated with MetS (eg, arthritis, depression, and cancer among others).

Using the NCEP (Grundy *et al*., 2004) definition of MetS, we included chronic diseases strongly associated with MetS, and examined nine questions from the BVHSA (listed in Table 1), which we believed were most indicative of the quality of care processes used in the management of these chronic diseases in primary care settings. We then examined three descriptive variables (ie, age, sex, and health insurance status) to provide additional context for identified differences between the analytic sample, the comparator group, and the alternative test group. Next, we applied a multinomial logistic regression model to the responses given to the questions in Table 1. The model was used to measure differences between the analytic sample, the comparator group, and the alternative test group regarding common tests provided to individuals with chronic disease and questions to assess health behavior and lifestyle asked by health-care providers of individuals with chronic disease. Multinomial logistic regression was chosen because of its utility in analyzing differences in both continuous and categorical variables among multiple samples simultaneously within the same system of analysis. Binary logistic regression was then used as a technique to confirm the findings of the multinomial logistic regression by analyzing respondent answers exclusively in the context of the analytic sample and the alternative test group. This approach allowed us to enhance the validity of our findings by directly comparing the treatment of those with chronic diseases associated with MetS with those with more generalized chronic diseases not linked to MetS. All statistical analyses were performed using IBM SPSS version 18 (IBM, 2010).

Results

The mean age of BVHSA respondents ($n = 3964$) was 58.5 years, and 71% were women, and 85% were white. Approximately 16% of respondents reported a lapse in health insurance within the previous three years. On the basis of the selection criteria described above, we created an analytic sample of $n = 168$, a comparator group of $n = 349$, and an alternative test group of $n = 288$. As illustrated in Table 1, respondents in the analytic sample (OR = 1.10, $P = 0.000$) and the alternative test group (OR = 1.05, $P = 0.000$) were statistically more likely to be older than those in the comparator group. This is to be expected given that the risk of developing many of these chronic diseases increases with advancing age (Jiamsripong *et al*., 2008; Peace Health, 2008; American Heart Association, 2010b). Sample respondents were also disproportionately female (ie, 68% for the analytic sample and 79% for the alternative test group). The majority of respondents had continuous health insurance coverage for the previous three years (ie, 87% for the analytic sample and 83% for the alternative test group).

Table 1 also reports differences between responses of the analytic sample, the comparator group, and the alternative test group relative to the nine indicators of quality of care processes, using multinomial logistic regression. Model fit statistics were adequate with −2 log likelihood of 1146 ($\chi^2 = 514.85$, $P = 0.000$) and Nagelkerke = 0.537.

Among those in the analytic sample, there was a lack of statistical significance in the likelihood of receiving a different frequency of cholesterol (OR = 0.94, $P = 0.743$) and blood pressure (OR = 1.16, $P = 0.619$) testing relative to the comparator group. Analytic sample respondents were statistically more likely than the comparator group to report that their health-care provider discussed all measures except level of physical activity (OR = 1.26, $P = 0.533$), smoking or tobacco usage (OR = 1.11, $P = 0.807$), and alcohol consumption (OR = 2.30, $P = 0.108$).

Alternative test group respondents displayed a noteworthy lack of statistical significance in the likelihood of their responses being different from the comparator group. Responses were not able to be determined as statistically different from the comparator group on any measure except physician communication of level of stress, which was less likely to be discussed in the comparator group (OR = 0.29, $P = 0.000$).

Table 2 shows the results of the binary logistic regression between the analytic sample relative to the alternative test group. Model fit statistics

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Table 1 Multinomial logistic regression results: Chronic disease test groups versus comparator group with no chronic diseases

Model fit statistics	Comparator group ($n = 349$)	All test results are relative to the comparator group									
		Test group #1 (analytic sample): indicative of the metabolic syndrome ($n = 168$)					Test group #2 (alternative test group): other chronic diseases ($n = 288$)				
−2 log likelihood = 1.146E3, $\chi^2 = 514.85$, sig. = 0.000, pseudo-R^2 (Nagelkerke) = 0.537	Mean	Mean	β	OR	95% CI	*P*	Mean	β	OR	95% CI	*P*
Demographics											
Age	44.52±13.13	60.82±10.49	0.10	1.10	1.08, 1.13	0.000	52.25±14.54	0.05	1.05	1.04, 1.07	0.000
Sex (1 = male, 2 = female)	1.76	1.68	−0.03	0.98	0.52, 1.82	0.936	1.79	−0.26	0.77	0.51, 1.17	0.225
Health insurance past 3 years (1 = yes, 0 = no)	0.76	0.87	0.38	1.46	0.68, 3.17	0.335	0.83	0.05	1.06	0.67, 1.67	0.816
Testing											
When was the last time you received tests for?…											
Cholesterol (1 = past year…5 = five years ago)	2.64	1.16	−0.06	0.94	0.64, 1.38	0.743	2.15	−0.08	0.93	0.82, 1.05	0.227
Blood pressure (1 = past year…5 = five years ago)	1.46	1.08	0.15	1.16	0.64, 2.11	0.619	1.29	−0.13	0.88	0.72, 1.07	0.201
Blood sugar (1 = past year…5 = five years ago)	3.28	1.10	−1.24	0.29	0.17, 0.49	0.000	2.98	0.06	1.06	0.96, 1.17	0.239
Provider communication											
In the last 2 years, has your health-care provider discussed the following with you?…											
Healthy diet and eating (1 = yes, 0 = no)	0.26	0.80	−1.20	0.30	0.15, 0.63	0.001	0.30	0.23	1.26	0.76, 2.09	0.380
Weight status (1 = yes, 0 = no)	0.16	0.80	−2.26	0.11	0.05, 0.21	0.000	0.24	−0.43	0.65	0.38, 1.12	0.118
Level of physical activity (1 = yes, 0 = no)	0.29	0.76	0.23	1.26	0.61, 2.58	0.533	0.38	0.08	1.08	0.67, 1.75	0.750
Stress level (1 = yes, 0 = no)	0.17	0.47	−1.02	0.36	0.19, 0.68	0.001	0.36	−1.25	0.29	0.19, 0.44	0.000
Smoking or tobacco usage (1 = yes, 0 = no)	0.15	0.18	0.10	1.11	0.49, 2.52	0.807	0.16	−0.10	0.91	0.53, 1.57	0.729
Alcohol consumption (1 = yes, 0 = no)	0.09	0.11	0.83	2.30	0.83, 6.35	0.108	0.07	0.66	1.94	0.92, 4.09	0.082

Table 2 Logistic regression results: analytic sample versus alternative test group

All test results are relative to the alternative test group				
Model fit statistics	Test group #1 (analytic sample): indicative of the metabolic syndrome ($n = 168$)			
−2 log likelihood = 331.846, pseudo-R^2 (Nagelkerke) = 0.608	β	OR	95% CI	P
Demographics				
Age	0.05	1.05	1.02, 1.07	0.000
Sex (1 = male, 2 = female)	0.34	1.40	0.73, 2.68	0.312
Health insurance past 3 years? (1 = yes, 0 = no)	0.64	1.90	0.80, 4.50	0.147
Testing				
When was the last time you received tests for?…				
Cholesterol (1 = past year…5 = five years ago)	0.11	1.12	0.69, 1.81	0.658
Blood pressure (1 = past year…5 = five years ago)	0.27	1.32	0.64, 2.70	0.455
Blood sugar (1 = past year…5 = five years ago)	−1.29	0.28	0.15, 0.50	0.000
Provider communication				
In the last 2 years, has your health-care provider discussed the following with you?…				
Healthy diet and eating (1 = yes, 0 = no)	−1.36	0.26	0.13, 0.52	0.000
Weight status (1 = yes, 0 = no)	−1.73	0.18	0.09, 0.35	0.000
Level of physical activity (1 = yes, 0 = no)	0.12	1.13	0.56, 2.28	0.738
Stress level (1 = yes, 0 = no)	0.16	1.17	0.64, 2.14	0.609
Smoking or tobacco usage (1 = yes, 0 = no)	0.05	1.05	0.46, 2.43	0.903
Alcohol consumption (1 = yes, 0 = no)	0.35	1.41	0.49, 4.05	0.521

were adequate with −2 log likelihood of 332 and Nagelkerke = 0.608. There were three quality indicators with statistically significant differences in the likelihood of response between the two groups. Participants in the analytic sample reported significantly more frequent blood sugar testing compared with their counterparts in the alternative test group (OR = 0.28, $P = 0.000$). Similarly, participants in the analytic sample were significantly more likely to report physician communication about diet (OR = 0.26, $P = 0.000$) and weight (OR = 0.18, $P = 0.000$) in the last two years when compared with their alternative test group counterparts.

Discussion

Clinical guidelines (National Heart Lung and Blood Institute, 1998; 2002; 2003) for the chronic diseases analyzed in this study suggest that individuals with chronic diseases associated with MetS should exhibit a statistically significant difference in primary care treatment compared with those who have no chronic disease. The results of our study indicate that individuals with chronic diseases associated with MetS generally receive higher levels of care relative to both the comparator group and the alternative test group in congruence with clinical care guidelines. However, there are key opportunities for improvement in the results. Specifically, we expected to see a more focused patient–provider interaction involving discussions of critical health issues such as physical activity, but also smoking or tobacco use, and alcohol consumption, which would increase the risk of developing cardiovascular disease and other chronic conditions associated with MetS. In addition, we were surprised that the data were unable to yield a statistically significant difference in testing for cholesterol or blood pressure between the comparator group and both the analytic sample and alternative test group.

It is plausible to believe that the health-care providers did not ask the individuals in the analytic sample about their smoking or tobacco usage, or alcohol consumption, because this information was already established during the initial assessment of patient health history, and/or possibly superfluous to other issues such as physical activity and weight management, which are the cornerstones of reducing the problems that lead to a diagnosis of

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MetS. Considering that smoking initiation is most likely to occur in adolescence and young adulthood (Hill and Borland 1991), it may seem inefficient for primary care providers to continually discuss this issue with their patients, assuming that they have previously indicated they do not smoke.

On the other hand, physical activity is critical in the prevention of MetS (Cho *et al*., 2009), and in managing the component metabolic problems (Dragusha *et al*., 2010; Harralson *et al*., 2010). It has even been suggested that interventions pairing patient education and physical activity can reverse MetS (Mujica *et al*., 2010). Given the importance ascribed to physical activity in both preventing and managing MetS, health-care providers are advised to routinely communicate with their patients regarding their level of regular physical activity; recognizing the patient's ability to participate in physical activity may sometimes be problematic given the conditions associated with aging and obesity, as well as access to resources. Although providers may exhibit an occasional sense of fatalism in discussing improved lifestyle choices with their chronic disease patients (Loewe *et al*., 1998), it is still important to raise these issues drawing upon behavioral counseling principles that can best effect awareness and change (Ory *et al*., 2010).

Given the mean scores reported by the respondents in this study, we are somewhat assured by the fact that the analytic sample reported much more frequent levels of testing for cholesterol, blood pressure, and glucose versus the comparator group. In fact, in the case of glucose testing, the results indicate that testing frequency is unlikely (OR = 0.29, $P = 0.000$) to be any lower in the analytic sample relative to the comparator group, presumably because the analytic sample is already performing with near-perfect rates of annual screening (ie, note the mean score of 1.10 in Table 1). However, we note the lack of statistical difference between the analytic sample and the comparator group for cholesterol (OR = 0.94, $P = 0.743$) and blood pressure (OR = 1.16, $P = 0.619$) screening. This is of much concern because much is known about the importance of more frequent testing for individuals with chronic diseases associated with MetS (U.S. Preventive Services Task Force, 2007; American Heart Association, 2010c). We believe that it is important to revisit this finding in future studies.

This study has limitations that should be acknowledged. First, we did not evaluate outcome measures for the respondents. Thus, we have not established a relationship between sub-optimal quality of care processes and subsequently poor health outcomes. Second, we did not examine electronic medical records to review the severity of each chronic disease, or how long each disease had persisted. We relied only on cross-sectional self-reported data, not clinical encounter data. As such, our data may be affected by gender as well as a healthy user bias. Third, patient–provider interactions are often recursive by nature, making it difficult to accurately discern whether an action or state of condition of the patient led to provider behavior, or whether the provider behavior contributed to the state of the patient. Next, the relatively small number of study participants limits the generalizability of the results beyond this sample. Finally, as noted above, we utilized positive responses of high cholesterol and diabetes as a proxy for dyslipidemia and T2DM, respectively. Given the presence of the other diseases in the analytic sample respondents (ie, obesity and hypertension), we believe this is a reasonable proxy.

Conclusion

Recognizing the regional nature of our study, we believe it provides a glimpse into the ability of health-care providers to deliver quality of care processes to individuals with chronic diseases associated with MetS. Despite the relatively high quality in delivering such care, important gaps exist in the patient–provider relationship with regard to aspects of communication, as well as with regard to more frequent levels of cholesterol and blood pressure testing. Further study of these issues could improve the quality of care processes delivered to these individuals. Given how better processes can lead to better outcomes for those with chronic disease (Burge *et al*., 2007; Al-Hussein, 2008), any improvement in quality of care processes can have favorable consequences for those living with these serious chronic conditions.

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