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Do Modifiable Cardiovascular Risk Factors Differ By Rural Classification in Women Who Enroll in a Weight Loss Intervention?

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Abstract

Purpose: If clinicians and researchers are aware of specific cardiovascular risks associated with women's rural status, whether it be large or small/isolated rural areas, it may help in developing more relevant rural resources. The purpose of this study was to examine whether there were differences in modifiable cardiovascular risk factors of overweight and obese rural women living in large or small/isolated rural areas.

Sample: This secondary analysis examined baseline cross-sectional data from the "Web-based Weight Loss and Weight Maintenance Intervention for Older Rural Women" clinical trial.

Analysis included data from 299 rural Midwestern women, ages 40-69 years with a baseline body mass index of 28-45 kg/m^2, who provided rural classification data and were randomized into groups.

Methods: Demographic and biomarker baseline data were used. Chi-square and independent t-tests were used for data analyses.

Findings: There are no significant differences found in overweight and obese women with cardiovascular risk factors when compared to rural classification, with one exception. Total cholesterol was associated with rural classification (p=0.047), where women living in large rural areas were more likely to have elevated total cholesterol levels (≥240 mg/dL) compared to women living in small/isolated areas (18.5% vs. 10.0%, respectively). Demographic characteristics such as age and education demonstrated no significant differences by rural classification; however, the majority of women in this study were of high socioeconomic status.

Conclusions: Although this secondary analysis found that rural women have similar cardiovascular risk factors and demographic characteristics, this study highlights the need for clinicians to carefully consider the rural community characteristics for primary prevention.

Keywords: Cardiovascular risk factors, rural classification, middle-aged and older women.

Do Modifiable Cardiovascular Risk Factors Differ By Rural Classification in Women Who Enroll in a Weight Loss Intervention?

Each year, 55,000 more women than men have a stroke (Mosca et al., 2011), and the number of cardiovascular (CV) deaths among women continues to exceed those of men (Kling et al., 2013). The American Heart Association (AHA) statistics show that coronary heart disease

(CHD) death rates of women in the United States (US) have increased over the past four decades (Mosca et al., 2011). One in every four women died from heart disease (Centers for Disease Control and Prevention [CDC], 2013; however, women are still less aggressively evaluated and treated than men for CV disease (Homko et al., 2010). Major modifiable CV risk factors identified that are associated with CV disease mortality and morbidity include cigarette smoking, hypertension, diabetes, high total cholesterol, physical inactivity, and overweight or obesity. Each additional risk factor can contribute significantly to the overall risk of CHD (Framingham Heart Study, 2013). Consequently, evaluating CV risk factors in middle-aged and older women are warranted.

Rural women are more vulnerable compared to urban women because they have higher incidence of heart disease and diabetes, and their access to preventive health screening and services may be limited (Feresu, Zhang, Puumala, Ullrich, & Anderson, 2008; Hageman, Pullen, Walker, & Boeckner, 2010). Rural America is increasingly more reliant on industrialization of agriculture leading to fewer opportunities for physical activity (Fahs et al., 2013). Limited access and availability of healthcare such as specialty care, are well-documented as a disadvantage for the rural populations (Crouch, Wilson, & Newbury, 2011; Fahs et al. 2013; Kim, Sillah, Boucher, Sidebottom, & Knickelbine, 2013). A large study of women (>10,000) enrolled in the Nebraska WISEWOMAN program revealed rural residence (defined as rural vs. urban) and socioeconomic status were factors related to CV disease risk (Feresu et al., 2008). The authors Jackson, Doescher, Jerant, and Hart (2005) reported that obesity affected some rural residents disproportionately; whereby, the prevalence of obesity was highest in small rural areas while large rural areas' prevalence of obesity was similar to urban areas. Weierbach, Yates, Hertzog, and Pozehl (2013) compared differences in health status and cardiac risk factors

between cardiac patients living in large and small/isolated Midwestern rural areas, with findings that those living in small/isolated rural areas were less likely to participate in regular physical activity compared to those who live in large rural areas. These studies suggest that there may be differences in CV risk among women by rural classification, though the literature on this remains unclear. In addition, rural classification has been defined in these studies using different methods (Feresu et al., 2008).

There are several taxonomies available for defining rural classification. The Rural Urban Commuting Area (RUCA) codes that use zip code health-related data are widely used for policy and research purposes (Hart, Larson, & Lishner, 2005). The RUCA codes are created in part by the U.S. Department of Agriculture's Economic Research Service (Hart, et al., 2005). The four category classification of RUCA defines urban (> 50,000 residents), large rural (10,000-49,000 residents), small rural (2,500- 9,999 residents), or isolated rural (< 2,499 residents) based on the US Census Bureau's definitions of urbanized areas and urban clusters, which in turn rely on complex criteria, including population density and population work commuting patterns (Hart, et al., 2005).

Knowledge about any CV risks associated with women's rural status may help nurses and researchers in developing health resources relevant to their rural patients/clients, whether in large or small/isolated areas. Weierbach et al. (2013) focused on CV risk factors in patients/clients post-cardiac surgery, noting that future research should focus on an appreciation of CV risk characteristics of rural communities for designing appropriate wellness and CV risk reduction program.

The purpose of this study was to examine the frequency of modifiable CV risk factors of overweight or obese women who volunteered for a web-based weight loss intervention by RUCA-defined rural classifications of large rural and small/isolated rural areas.

This study holds the following two aims:

1. To describe CV risk factors of overweight or obese rural women.
2. To examine difference in demographics characteristics (age, marital status, education, household income and insurance) and modifiable CV risk factors (total cholesterol, diabetes, physical activity, cigarette smoking, blood pressure, and overweight/obese) by rural classification, either large and/or small/isolated.

Methods

This secondary analysis used baseline data of overweight/obese rural middle-aged and older women, ages 40-69, who consented to participate in the 30-month "Web-based Weight Loss and Weight Maintenance Intervention for Older Rural Women" clinical trial, (ClinicalTrials.gov Identifier: NCT0130766). Briefly, the clinical trial was a community-based randomized controlled trial designed to evaluate the effectiveness of three theory-based web-delivered interventions for promoting healthy eating and activity among rural middle-aged and older women in sixteen counties in northeast Nebraska, in order to achieve a 5-10% weight loss and weight maintenance over a 30-month period. The rural women in the parent study were randomized into three groups: the interactive website only, interactive website with a peer-led online support group or interactive website with professional weight loss counseling through e-mail. Women were included in the clinical trial if they were overweight/obese with a body mass index (BMI) between 28 and 45, committed to losing weight through dietary changes and physical activity, and capable of walking without any assistive device for one mile. Women

were excluded if they had any physical or medical restrictions to perform moderate physical activity. Exclusion criteria included women who were diagnosed with type I diabetes mellitus or were insulin dependent with type II diabetes mellitus. Further details of the parent study design and population sample of the clinical trial have been presented elsewhere (Hageman, Pullen, Hertzog, Boeckner, & Walker, 2011).

Of 301 women who completed baseline data and were randomized into groups in the clinical trial, 299 women provided information for accurate identification of RUCA codes and were included in this analysis.

Study Variables

Demographic. Demographic information collected from women included age, marital status, education, insurance status, household income, and rural classification. Age was classified into three categories: 40-49 years, 50-59 years, and 60-69 years. Marital status was classified into two groups as married and not married. Education was classified into three categories: high school graduate or less, some college or college graduate, and graduate school or greater (completed some or completed graduate or professional degree). Insurance status was classified as "yes" or "no." Income was classified into five categories, below $39,999, $40,000 to $59,999, $60,000 to $79,999, $80,000 to $99,999, and $100,000 or more (20 women refused to report). Rural status was classified based on the RUCA codes, and were categorized into two groups, either large rural or small/isolated rural for this study (Hart et al., 2005).

Modifiable cardiovascular risk factors. This study examined total cholesterol, diabetes, cigarette smoking, overweight or obesity, high blood pressure, and physical activity, all modifiable CV risk factors for CV disease (Framingham Heart Study, 2013; Go et al., 2013). After a 12 hour fast, blood specimens were collected from women to determine total cholesterol

utilizing the Laboratory Standardization Panel recommendations. Total cholesterol was defined based on the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) as < 200 mg/dL is desirable, between 200 to 239 mg/dL is borderline high and as ≥ 240 mg/dL is high (2002). Diabetes was self-reported by the participants with "yes" or "no" of having diabetes. Smoking status was self-reported by the participants with "yes" or "no" if they are current smokers. Weight and height data were used to determine BMI defined as kg/m^2, where overweight BMI = 25 to 29.9 kg/m^2, obese class I = BMI 30 to 34.9 kg/m^2, obese class II = BMI 35 to 39.9 kg/m^2 and obese class III was ≥ 40 kg/m^2 (Go et al., 2013). Blood pressure was measured after 5 minutes of quiet sitting using a standardized method. A minimum of two blood pressure measurements were obtained and the mean of the two measurements were recorded. Blood pressure was defined as normal (SBP ≤ 120 mm Hg or DBP ≤ 80 mm Hg), prehypertension (SBP between 120-139 mg Hg or DBP between 80 to 89 mm Hg), or hypertensive (SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg) (National Heart, Lung, and Blood Institute, 2004). Women were asked about their participation in physical activity using the Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS consists of a 7-item self-report instrument that determines the women's physical activity participation defined by the U.S. Department of Health and Human Services (CDC, 2011). Using women's responses, physical activity was classified as being active (≥ 500 $MET \cdot min \cdot wk^{-1}$) or not active (< 500 $MET \cdot min \cdot wk^{-1}$) from the BRFSS survey data using the calculation method defined by Morrow, Bain, Frierson, Trudelle-Jackson, and Haskell (2011). The cut score of ≥ 500 $MET \cdot min \cdot wk^{-1}$ was used to distinguish women who were active versus non-active as activity ≥500 $MET \cdot min \cdot wk^{-1}$ has been associated with having substantial health benefits (U.S. Department of Health and Human Services, 2008).

Data Analysis

Descriptive data were summarized by rural classification, either large and/or small/isolated. Since the small and isolated rural were similar in demographic characteristics along with small sample size individually, they were combined for analysis. The comparison of proportions of modifiable CV risk factors (total cholesterol, diabetes, physical activity, cigarette smoking, blood pressure, and overweight/obese) and demographic characteristics (age, marital status, education, household income, and insurance) were all dichotomized by rural status and analyzed with chi-square tests. Independent t-tests were also used to compare mean differences by rural classification with total cholesterol level, blood pressure and age as continuous variables. Data were analyzed using IBM SPSS version 20. The level of significance was established if the p value was < 0.05.

Findings

Key findings are included in Table 1. Of the 299 overweight and obese women in the Weight Loss Study, their mean BMI was 34.8 kg/m^2 with 10.7% overweight and 89.3% obese. The majority of these women were married, had some type of college education, had insurance coverage, had a household income between $40,000 to $79,000, and had a mean age (standard deviation) age of 54 (6.8) years. Demographic characteristics such as age, education, and household income demonstrated no differences between the two rural classification groups; however, marital status ($p = 0.055$) and health insurance ($p = 0.053$) were marginally associated with living in large vs. small/isolated rural for overweight/obese women. Overweight/obese women living in small/isolated area were more likely to be married (89.1% vs. 81.5%) and have health insurance (97.3% vs. 92.1%) compared to overweight/obese women living in large rural area.

Analysis using the chi-square test revealed no significant differences proportions of modifiable CV risk factors between women from large rural and small/isolated rural areas, with one exception. Total cholesterol was associated with rural classification ($p = 0.047$), where women living in large rural areas were more likely to have elevated total cholesterol levels ($\geq$ 240 mg/dL) compared to women living in small/isolated area (18.5% vs. 10.0%, respectively). Few women from either rural classification were diabetic or smokers (< 5%). Analysis of mean differences using independent t-tests showed no differences by rural classification for continuous variables.

When examining the CV risk profile (elevated cholesterol, diabetes, cigarette smoking, hypertension and overweight/obese), of the 299 rural women, 42.1% (n = 125) had one CV risk factor, 48.8% (n = 146) had two CV risk factors, 7.7% (n = 23) had three CV risk factors, and 1.0% (n = 3) had more than four CV risk factors.

Table 1

Demographic Characteristics and CV Risk Factors in Overweight / Obese Women

	Weight Loss Study		
	Large Rural n =189 (%)	Small/Isolated Rural n =110 (%)	p-value
Demographic			
Age			0.672
40-49	55 (29.1%)	28 (25.5%)	
50-59	98 (51.9%)	57 (51.8%)	
60-69	36 (19.0%)	25 (22.7%)	
Marital Status			0.081
Married	154 (81.5%)	98 (89.1%)	
Not Married	35 (18.5%)	12 (10.9%)	
Education			0.853
High School graduate or less	28 (14.8%)	19 (17.3%)	
Some College or College graduate	115 (60.8%)	65 (59.1%)	
Graduate school or greater	46 (24.3%)	26 (23.6%)	
Household Income			0.162
Below $39,999	31 (16.4%)	20 (18.2%)	

$40,000 - $59,999	48 (25.4%)	29 (26.4%)	
$60,000 - $79,999	45 (23.8%)	27 (24.5%)	
$80,000 - $99,999	31 (16.4%)	20 (18.2%)	
$100,000 or more	24 (12.7%)	4 (3.6%)	
Have Insurance			0.053
Yes	174 (92.1%)	107 (97.3%)	
No	15 (7.9%)	3 (2.7%)	
Modifiable CV Risk Factors			
Total Cholesterol			**0.047**
Desirable (<200 mg/dL)	104 (55.0%)	57 (51.8%)	
Borderline (200-239 mg/dL)	50 (26.5%)	41 (37.3%)	
High (≥ 240 mg/dL)	35 (18.5%)	11 (10.0%)	
Diabetes (Yes)	9 (4.8%)	5 (4.5%)	0.932
Physical Activity (Inactive <500 MET·min·wk^{-1})	121 (64.0%)	75 (68.2%)	0.465
Cigarette Smoking (Yes)	8 (4.3%)	4 (3.6%)	0.527
Blood Pressure			0.486
Normal	82 (43.3%)	40 (36.4%)	
Prehypertension	83 (43.9%)	55 (50.0%)	
Hypertension	24 (12.7%)	15 (13.6%)	
Overweight/Obese			0.214
Overweight (BMI 25-29.9)	17 (9.0%)	15 (13.6%)	
Obese Class I (BMI 30-34.9)	86 (45.5%)	56 (50.9%)	
Obese Class II (BMI 35-39.9)	56 (29.6%)	29 (26.4%)	
Obese Class III (BMI over 40)	30 (15.9%)	10 (9.1%)	

Abbreviations: RUCA, Rural Urban Commuting Area; CV, cardiovascular

Discussion

Few studies have examined the frequency of modifiable CV risk factors of healthy overweight or obese women by RUCA-defined rural classifications of large rural and small/isolated rural areas. Findings revealed that there were no differences in modifiable CV risk factors between the two rural classifications among Midwestern women motivated to volunteer for web-based 30-month weight loss and weight maintenance interventions, except in measures of total cholesterol where a higher percentage of women living in large rural areas had an elevated total cholesterol (≥ 240 mg/dL) than women living in small/isolated rural areas. While the results were not significant between groups, women from small/isolated rural areas

were most likely to participate in physical activity compared to women from large rural, 68.2% and 64.0%, respectively. In general, the rural women residing in the two different rural classifications had similar CV risk factors and demographic characteristics. Our findings are consistent with Weierbach et al. (2013) who compared differences in health status and cardiac risk factors between cardiac patients in large and small/isolated RUCA-defined rural areas. Weierbach et al. (2013) noted no differences in smoking, blood pressure, diabetes, or overweight/obese between the large vs. small/isolated rural with the exception that physical activity was higher among residents in large rural areas ($p = 0.05$).

Our study found that more than 50% of the rural women had more than two CV risk factors. Comparison of our findings with those of others is difficult due to the differences in populations, definitions of rural status, and/or methods used. The work of Feresu et al. (2008) examined a population of women ages 40 or older, of which 70% were identified as rural and from a similar geographic area to women in our study. The Nebraska WISEWOMAN findings showed women having higher baseline percentages of total cholesterol ($\geq$ 200 mg/dL), smoking, and diagnosis of diabetes (> 50%, 26%, and 10%, respectively) than women in this study. Our findings on total cholesterol levels in large rural overweight and obese women are similar to Feresu et al. (2008), who found 19.8% had elevated total cholesterol. Differences between the two studies may be attributed to socioeconomic status, as the women volunteers in this study were of high socioeconomic status whereas the women in Nebraska WISEWOMAN had lower socioeconomic status to participate. Possible reasons for our findings that few women smoked might be that smokers may be less likely to volunteer for eating and activity interventions.

Compared to national data, the prevalence of elevated total cholesterol levels in Americans greater than or equal to 240 mg/dL is 13.8%, in contrast, our sample of women from

small/isolated rural had frequency of 10.0%. However, a higher percentage of our women from large rural areas had an elevated total cholesterol compared to the AHA statistics (18.5% vs. 13.8%, respectively) (Go et al., 2013).

Only 36.0% of women from large rural areas and 31.8% from small/isolated rural areas in this study were considered active ($\geq$ 500 MET·min·wk^{-1}). This is in contrast to the work of Morrow et al. (2011), who investigated the physical activity levels of community-living women, who were ages 20 and older, mean age of 68, with findings that 63% engaged in sufficient physical activity ($\geq$500 MET·min·wk^{-1}), and 64.5% of women reporting engaging in this level of activity in BRFSS (U.S. Department of Health and Human Services, 2008). In addition, it was reported by the CDC (2014) that physical inactivity is higher in women compared to men, ages 18 and older, age adjusted, and women were less likely to meet federal physical activity guidelines compared to men (Go et al., 2013).

This secondary analysis has several limitations that should be considered. First, the sample is based from sixteen Nebraska rural communities; therefore, generalizability is limited. Secondly, the rural women participated voluntarily in the web-based weight loss interventions; therefore, they may differ than the general population as they might have been more motivated to lose weight through physical activity and diet modification over a 30 month period. In addition, the overweight and obese rural women in this study were highly educated, they reported a moderate to high household income and reported having health insurance. More than 50% of women citing a household income more than $60,000 per year and more than 80% of women had some type of college education or higher; therefore, these women were not representative of the general populations. Socioeconomic status has been raised as an issue by Feresu et al. (2008), who noted that even among women of low socioeconomic status, those who were at the

lowest end were more likely to have high CV risk and were less likely to return for follow-up screenings or counseling. Lastly, women with diabetes who were insulin dependent were excluded from the parent study, which may explain our findings of low percentages of women with diabetes.

Despite these limitations, this secondary analysis provides follow-up to the recommendations of Weierbach et al. (2013) for the need to investigate demographic characteristics and CV risk factors of women in large vs. small/isolated areas, to address health promotion such as weight loss. In addition, exploring possible factors that may contribute to CV risk factors in overweight and obese women in different rural areas may assist with tailoring specific interventions that are relevant to rural women.

Conclusions and Implications

Both large and small/isolated rural women had similar CV risk factors. Total cholesterol, hypertension, overweight/obesity, and physical activity were in need of risk factor modification among this well-educated group of women. As the women in this study were not representative of the general population of women from large and small/isolated rural areas, whether differences in the classification of rural exist remains inconclusive. This research reinforces the need for researchers and practitioners to assess the characteristics and the needs of a given community, whether rural or urban in order to tailor appropriate and effective interventions for CV risk reduction. In addition to this research, there are still very few studies examining CV risk factors through rural classification. Larger scale research studies are warranted to examine rural women with CV risk factors in different geographic areas with the ability to generalize to the general population as a whole.

Although, there were only few significant findings in our study, it is important to disseminate these results since so little is known in this area. The value of reporting non-significant findings are for the purpose of not wasting the scientific community time and resources repeating the same findings (Matosin, Frank, Engel, Lum & Newell, 2014).

Overall, CV disease remains the number one cause of death for women in the US. Several programs and initiatives such as the Center for Disease Control and Prevention, the Million Hearts, the American Heart Association, and the U.S. Department of Health and Human Services, set priorities to focus on health promotion, prevention, treatment and management of CV disease. Specifically, the *Healthy People 2020* goal is to "improve CV health and quality of life through prevention, detection and treatment of risk factors for heart attack" (U.S. Department of Health and Human Services, Healthy People 2020, 2011). In order to move toward better CV health, vulnerable population from rural areas should be targeted using evidence-based practice. Nurses who practice in rural communities should include CV risk assessment in their routine care and take an active role in CV health promotion and prevention to reduce CV disease.

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