Recognizing Intersectionality

The Effect of Gender and Race on Obesity in Rural America

By

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Approved by:

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First Reader

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Second Reader
Abstract

Objectives: This research project investigates the intersectionality of rurality, gender, and race/ethnicity on BMI status.

Methods: Secondary data analysis of Remote Area Medical data (RAM), 2014, (N=4,369) was undertaken to determine the relationship between rurality and BMI status. Multivariate logistic regression was used to estimate this association and to test gender and race/ethnicity as moderators, controlling for confounders.

Results: Gender, but not race/ethnicity, affected the relationship between living rural and having a high BMI. Rural women had 1.63 times the odds of a high BMI compared to urban women (95% CI: 1.06, 2.10), but rurality did not appear to affect the odds of a high BMI among men. African Americans and Latinos had greater odds of high BMI than Caucasians and Asian/Pacific Islanders.

Conclusions: Analyzing RAM data demonstrates that women living in rural or remote areas of the US may be particularly vulnerable to high BMI.

Keywords: Obesity, Rural, Gender, Race, Intersectionality
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Introduction

Obesity within the United States (US) is a significant public health problem affecting 34.9% of the adult population.\textsuperscript{1} Short and long term impacts associated with being overweight or obese are significant. Every year the country expends $147 billion on medical costs for obesity, equating to about $1,429 more for obese individuals than the normal weight referent group.\textsuperscript{2,3} Obesity is a known risk factor for heart disease, diabetes, cancer and stroke.\textsuperscript{4} Additionally, obesity has been linked to a reduced quality of life due to depression, poor self-image, an increased risk of disability through injury, lung disease and other breathing disorders such as asthma and sleep apnoea.\textsuperscript{2,5}

Overweight and obese status is largely determined at the population level by Body Mass Index (BMI). Inconsistencies in body fat across sex and race makes measuring BMI across populations problematic, however BMI continues to be used because it is a standardized, non-invasive, inexpensive and easy to calculate tool requiring no clinical expertise.

Living Rural

Living outside of urban centers decreases access to a healthy diet, exercise and medical services and the rates of overweight and obesity across the country reflect this.\textsuperscript{6} In 2014, the national prevalence for being overweight was 35.2% and obese was 28.9% according to the Centers for Disease Control.\textsuperscript{7} These rates were higher still for rural populations, who experienced 1.19 times
the odds of experiencing a BMI categorized as obese (Crude OR 1.25, 95% CI 1.06–1.34).\textsuperscript{7}

Recent community-based participatory research conducted by Hill, You, and Zoellner in the rural Dan River region of Virginia and North Carolina demonstrated BMI rates higher than the national average of 25.\textsuperscript{8} In their particular study, a random digit dial telephone survey of 784 respondents found that 72% of respondents were overweight or obese.\textsuperscript{8} Interestingly, the heaviest respondents were actually within the urban subpopulation despite the fact that rural respondents had overall higher rates of being either overweight or obese. The authors’ also noted that after controlling for covariates (urban/rural residency, gender, race, employment status, education level) African Americans experienced a higher mean BMI compared to Caucasians, regardless of urban or rural status.\textsuperscript{11}

\textit{Rurality and Race}

Within many similar Appalachian regions like Dan River above, only around 5% of the population is African American and little is known about their health status.\textsuperscript{9} This is also the case for the growing number of Latino migrant workers who are even less likely to access services for a myriad of reasons including language barriers, cultural considerations and immigration concerns.\textsuperscript{10} Understanding their physical and socioeconomic determinants of health, particularly within this uniquely rural setting is worth exploring further if genuine progress is to be made at reducing disparities within this region.
**Gender and Obesity**

Although men demonstrate a higher prevalence of being overweight or obese compared to women, the increasing association between elevated BMI and type 2 diabetes mellitus (T2DM) is concerning for those working to improve maternal and child health outcomes within the rural and remote US. This is particularly of interest when considering the generational effects of obesity as babies born to overweight and obese mothers, especially mothers with T2DM or gestational diabetes mellitus are at increased risk for excessive birth weight, complications associated with preterm delivery such as respiratory distress syndrome, hypoglycemia and T2DM later in life. Unsurprisingly, rural women are significantly more likely to experience obese BMIs compared to their urban counterparts yet data examining this is lacking.

**Intersectionality**

Despite the fact that women and minorities living in rural and remote settings have been shown to have a higher prevalence of obesity, data focused on the intersection of all these factors remain scant. Weber and Parra-Medina define intersectionality as one approach to problematizing “the processes generating and maintaining the macro social structures of race, class, gender, and sexuality” whilst seeking “to identify their relationships to individual and collective identities, behaviors, and health statuses.” Though there is a small though growing body of literature on intersectionality few publications exist in
relation to the intersection of rural health, gender and race specifically and these are predominantly based upon studies and programs from Canada.13,14,15

**Objectives**

This study aims to investigate the impact that the intersectionality of living rural, being a women or being from a minority group has on health outcomes. Specifically this study seeks to understand the relationship that living rural or remote has on BMI status when adjusting for confounders like age and employment status, which is used as a proxy for socioeconomic standing in this instance (see Conceptual Model in 1). This study hypothesizes that rurality increases the odds of having a BMI≥25. It also hypothesizes that this relationship is moderated by gender and race. For example, we expect that the relationship between rurality and BMI to differ for males and females, as well as by race-ethnicity. To address these study aims, we used data collected by Remote Area Medical.

**Remote Area Medical**

Remote Area Medical (RAM) was created in an attempt to bridge the gap in health care experienced by the one in five Americans who live rural or remotely and who disproportionately lack access to insurance which covers basic medical, dental or vision care.16,17 RAM travels the US, setting up “pop up” clinics in hard-to-reach areas, targeting underserved populations including the
uninsured, the homeless, veterans, African Americans, American Indians and people living with disabilities.\textsuperscript{13} In 2014, RAM offered free medical, dental and vision services to 29,210 people in an effort to improve access to quality healthcare services within rural and remote parts of the country and for communities from traditionally underserved backgrounds.\textsuperscript{18}

Due to the mobile nature of RAM’s work, the organization is able to reach communities that are not only demographically and geographically diverse, but also demonstrate some of the poorest health outcomes in the country. Many of the people attending RAM clinics have grown up in communities with limited access to health coverage or preventive and sustainable models of healthy decision-making. A key focus area for RAM is the central and southern Appalachian region of the US, where their main headquarters are based.

Figure 1: Conceptual Model for Relationship Between Rurality and High BMI
Methods

Design

A secondary data analysis was undertaken of patient records collected using convenience sampling from four of the 44 RAM clinics held across the United States in 2014. Specifically, data from clinics held in Grundy, Virginia; Reno, Nevada; Seattle, Washington; and East St. Louis, Illinois were used to ensure geographic and demographic diversity. These data were accessed with permission and de-identified, except for zip codes at RAM headquarters, before being transferred from the organization’s clinic database in May 2015. Zip codes were recoded as either urban or rural according to online county-level population size. Rural counties were those that had 2,500 people or less.

Sample

Although RAM sees patients of all ages, the sample dataset was restricted to persons 18 and older. The original sample size for the four clinics used was 6,171. 345 people under 18 years of age were removed and a further 1,457 observations with missing data (zip code, BMI status, gender, race/ethnicity, age or employment status) were dropped, leaving a final sample size of n=4,369.

Data Collection

Patient data were collected at RAM clinics held throughout the US during 2014. Clinics are open to everyone, but target those who cannot access regular
medical, dental or vision services due to cost, insurance coverage or distance. Clinics are held over 2-5 days in rural and remote regions as well as major cities. Patients camp outside clinics for up to 3 or 4 days in advance as RAM operates on a ‘first come, first served’ numbered ticket basis. Registration usually begins around 0600hr on the first clinic day with a cap on numbers depending on the amount of care providers and time available. Patients are escorted to a registration desk where a volunteer collects their name and contact details, self-reported age, height and weight, marital and employment status. Insurance status is never asked at any RAM clinic.

**Measures**

The outcome variable, BMI status, was dichotomized into BMI <25 and BMI ≥25 categories and was calculated ex post facto by RAM staff based on self-reported weight and height measurements.

During the data cleaning process, men and women with a score of 25-29.9kg/m² (BMI≥25) were categorized as having an overweight BMI and those with a score equal to or greater than 30kg/m² (BMI≥30) were considered obese. Whilst national surveillance categorizes overweight and obese BMIs separately, a considerable amount of the literature focuses solely on those with BMIs in the latter range. This study combined these BMI groupings and labelled them as "high BMI" in an attempt to report not only on those already at extreme risk, but also on those with increased risk of poor health outcomes due to increased weight.
The exposure variable, rurality, was dichotomized as urban or rural and based upon zip codes collected at patient registration. Gender was dichotomized as male or female. Race/ethnicity was categorized as Caucasian, African American, Asian/Pacific Islander, Hispanic/Latino or ‘Other including American Indian’. Control variables included age and employment status. Age was categorized into three groups (18-39 years, 40-59 years and ≥ 60 years), which reflects the current literature regarding age and risk level for obesity. Employment status was categorized as ‘Employed’ (either full or part time), ‘Unemployed’ or ‘Other’, which included college students, retirees and persons living with disability. IRB approval was sought and was deemed exempt by UNC Office of Human Research Ethics for all analyses.

**Analysis**

Data were cleaned using Microsoft Excel; analysis was undertaken using StataSE 14 software (Stata Corp, College Station, Texas, USA). Sample characteristics were examined for the total dataset and by the main outcome (BMI status) and presented with Pearson chi square tests in Table 1. Interaction terms were created for the rural-female variable and for all rural-race dummy variables to test whether these acted as moderators of the rurality/high BMI relationship. This interaction term was run within a logistic regression model and kept in the final multivariate model if the Wald test p-value on the interaction term had an a priori significance level of less than 0.10. Multivariate logistic regression was used to estimate measures of association including the crude and adjusted
odds ratio (OR) and the 95% confidence interval (CI) between rurality and BMI status controlling for confounders.

Results

Table 1 demonstrates that almost 68% of the sample had a high BMI. Slightly more than 80% of the participants were urban dwelling, 46% were male and over one third were Caucasian. Almost one third of the sample was aged between 18-39 years and only one third were employed in any capacity. People who lived in rural counties within this sample were more likely to have a high BMI at 73.0% compared to their urban counterparts of 66.7%.

African Americans and those of Hispanic/Latino ethnicity had an overweight prevalence of 71.9% and 72.1%, respectively. Asian/Pacific Islander background appeared to be a protective factor with only 46.2% of the population experiencing high BMIs.
Table 1. Sociodemographic Characteristics and BMI Status of patients at RAM clinics, 2014 (n=4,369)

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Total</th>
<th>BMI&lt;25</th>
<th>BMI≥25</th>
<th>Total %</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>3574</td>
<td>81.8</td>
<td>1191</td>
<td>33.32</td>
<td>66.68</td>
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<tr>
<td>Rural</td>
<td>795</td>
<td>18.2</td>
<td>215</td>
<td>27.04</td>
<td>72.96</td>
</tr>
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<td><strong>Total</strong></td>
<td><strong>4369</strong></td>
<td><strong>100</strong></td>
<td><strong>2383</strong></td>
<td><strong>66.68</strong></td>
<td><strong>100</strong></td>
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<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2019</td>
<td>46.21</td>
<td>643</td>
<td>31.85</td>
<td>68.15</td>
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<tr>
<td>Female</td>
<td>2350</td>
<td>53.79</td>
<td>763</td>
<td>32.47</td>
<td>67.53</td>
</tr>
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<td><strong>Total</strong></td>
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<td><strong>100</strong></td>
<td><strong>1376</strong></td>
<td><strong>68.15</strong></td>
<td><strong>100</strong></td>
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<td>Race/Ethnicity</td>
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<td></td>
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<tr>
<td>Caucasian</td>
<td>1817</td>
<td>41.59</td>
<td>561</td>
<td>30.88</td>
<td>69.12</td>
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<tr>
<td>African American</td>
<td>1162</td>
<td>26.60</td>
<td>326</td>
<td>28.06</td>
<td>71.92</td>
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<tr>
<td>Asian/Pacific Islander</td>
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<td>10.21</td>
<td>240</td>
<td>53.81</td>
<td>46.19</td>
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<td>Hispanic/Latino</td>
<td>777</td>
<td>17.78</td>
<td>217</td>
<td>27.93</td>
<td>72.07</td>
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<tr>
<td>Other including American Indian</td>
<td>167</td>
<td>3.82</td>
<td>62</td>
<td>37.13</td>
<td>62.87</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4369</strong></td>
<td><strong>100</strong></td>
<td><strong>1587</strong></td>
<td><strong>67.53</strong></td>
<td><strong>100</strong></td>
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<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-39</td>
<td>1543</td>
<td>35.32</td>
<td>594</td>
<td>38.50</td>
<td>61.50</td>
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<tr>
<td>40-59</td>
<td>2054</td>
<td>47.01</td>
<td>555</td>
<td>27.02</td>
<td>72.98</td>
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<tr>
<td>≥60</td>
<td>772</td>
<td>17.67</td>
<td>257</td>
<td>33.29</td>
<td>66.71</td>
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<td><strong>Total</strong></td>
<td><strong>4369</strong></td>
<td><strong>100</strong></td>
<td><strong>1499</strong></td>
<td><strong>68.11</strong></td>
<td><strong>100</strong></td>
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<td>Employment Status</td>
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<td>Employed</td>
<td>1499</td>
<td>34.31</td>
<td>478</td>
<td>31.89</td>
<td>68.11</td>
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<tr>
<td>Unemployed</td>
<td>2051</td>
<td>46.94</td>
<td>663</td>
<td>32.33</td>
<td>67.67</td>
</tr>
<tr>
<td>Other^</td>
<td>819</td>
<td>18.75</td>
<td>265</td>
<td>32.36</td>
<td>67.64</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>4369</strong></td>
<td><strong>100</strong></td>
<td><strong>1406</strong></td>
<td><strong>32.18</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

^ Other includes college students, retirees and persons with disability
*≤0.05 **≤0.01 ***≤0.001, Source: Remote Area Medical Clinic Data, 2015

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Table 2 demonstrates that rural residents experience 1.35 times the odds (95% CI: 1.14, 1.60) of having a BMI greater than or equal to 25 compared to urban residents controlling for confounders. Gender was found to moderate the relationship between rurality and high BMI according to the a priori criteria of 0.10 (Wald test p-value = <0.001). Specifically, rural women were found to have 1.63 times the odds of a high BMI compared to their urban counterparts (95% CI: 1.26, 2.10) controlling for confounders. Adjusting for confounders, rural men experienced 1.12 times the odds of a high BMI compared to urban men, however these odds were not found to be significant (95% CI: 0.86, 1.46).

Race/ethnicity was not found to moderate the relationship between rurality and high BMI and therefore was included as a confounder. It was found to be a significant predictor of high BMI however as African Americans experienced 1.26 the odds of having a BMI ≥25 (95% CI: 1.06, 1.51) when compared to Whites controlling for confounders. Hispanic/Latinos had 1.30 times the odds (95% CI: 1.07, 1.58) when compared to Whites controlling for confounders. Those from Asian or Pacific Islander backgrounds experienced an adjusted OR of 0.43 (95% CI: 0.34, 0.53) compared to Whites. Those from the ‘Other including American Indian’ group did not demonstrate significantly different findings from Whites controlling for confounders.
Table 2. Odds ratios and 95% confidence intervals from logistic regression models examining relationship between living rural and BMI≥25

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Crude OR (95% CI)</th>
<th>Crude p-value</th>
<th>Adjusted OR (95% CI)</th>
<th>Adjusted p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban (Referent)</td>
<td>1</td>
<td>**</td>
<td>1</td>
<td>**</td>
</tr>
<tr>
<td>Rural</td>
<td>1.35 (1.14, 1.60)</td>
<td>***</td>
<td>1.63 (1.06, 2.10)</td>
<td>***</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (Referent)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0.97 (0.86, 1.10)</td>
<td></td>
<td>0.83 (0.59, 1.16)</td>
<td></td>
</tr>
<tr>
<td>Interaction Term (Rural x Female)</td>
<td>1.63</td>
<td>***</td>
<td>1.63</td>
<td>***</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian (Referent)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>1.15 (0.97, 1.35)</td>
<td>**</td>
<td>1.26 (1.06, 1.51)</td>
<td>**</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>0.38 (0.31, 0.47)</td>
<td>***</td>
<td>0.43 (0.34, 0.53)</td>
<td>***</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>1.15 (0.96, 1.39)</td>
<td>**</td>
<td>1.30 (1.07, 1.58)</td>
<td>**</td>
</tr>
<tr>
<td>Other including American Indian</td>
<td>0.76 (0.54, 1.05)</td>
<td></td>
<td>0.83 (0.59, 1.16)</td>
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</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-39 (Referent)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
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<tr>
<td>40-59</td>
<td>1.69 (1.47, 1.95)</td>
<td>***</td>
<td>1.71 (1.48, 1.97)</td>
<td>***</td>
</tr>
<tr>
<td>≥60</td>
<td>1.25 (1.05, 1.50)</td>
<td>*</td>
<td>1.42 (1.15, 1.74)</td>
<td>***</td>
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<td>Employment Status</td>
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<td></td>
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<tr>
<td>Employed (Referent)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.98 (0.85, 1.13)</td>
<td></td>
<td>0.95 (0.82, 1.10)</td>
<td></td>
</tr>
<tr>
<td>Other^</td>
<td>0.98 (0.82, 1.17)</td>
<td></td>
<td>0.91 (0.74, 1.12)</td>
<td></td>
</tr>
</tbody>
</table>
Discussion

The overall prevalence for high BMI in this RAM sample was 67.8%. This is almost four percentage points higher than the national average of 64.1% during this same year.\textsuperscript{1} This rate is similar to those reported by the Dan River study in Virginia/North Carolina\textsuperscript{11} and with recent research conducted by Robel’s et al. in West Virginia.\textsuperscript{21} Furthermore, the overall prevalence for rural residents with a high BMI was 72.9% (almost nine percentage points higher than the national average) serving as a stark reminder of the need to take immediate action if the obesity epidemic is to be curbed and lives are to be saved.

In this study, the relationship between rurality and BMI was moderated by gender. Specifically, the association between whether someone resides in a rural area and whether he or she also experiences a BMI greater than or equal to 25 differs depending on biological sex. Rural women experience significantly greater odds of a high BMI than their urban counterparts and this is consistent with previous studies.\textsuperscript{6,22} This study advances previous research on the negative health effects that living rural can have on women specifically.

Whilst the race/ethnicity variable was not found to significantly affect the rural-high BMI relationship, we may not have had enough power in the sample size to detect it. Future research should examine this relationship in a larger sample. African Americans and people of Hispanic/Latino ethnicity in this study were shown to have greater odds of experiencing a high BMI. Likewise for adults between the ages of 40-59 years and those aged 60 and over, which reflects the
current literature on obesity and race as well as that pertaining to rurality and aging.\textsuperscript{15,23,24,25,26,27} RAM may wish to broaden its data collection processes to include more documentation on morbidities associated with elevated weight status such as diabetes, stroke and heart disease amongst others.

This research demonstrates that rural women have increased odds of having a high BMI as do African Americans and Latinos yet there remains a serious lack of data available on the intersectionality of living rural, being a woman and being from a minority group such as these. This is important when addressing health outcomes for African American and Latina women of reproductive age, who are already at an increased risk for high BMI due to their race/ethnicity.\textsuperscript{26} Given the triple vulnerability that women of color in rural areas face, and the lack of research on intersectionality, future research should pursue this question among a nationally representative sample. This would increase the power to examine a three-way interaction between race/ethnicity, gender, and rurality and diversify the racial characteristics of the sample to allow for a more nuanced study of intersectionality and obesity.

This research also has implications for Remote Area Medical. Next steps for RAM could include integrating maternal and child health indicators into data collection, research and programmatic goals, which could also have long-term positive effects on the population RAM seeks to serve. Furthermore, this could serve as a stable entry point for RAM to develop partnerships with state and federal health department funding sources.
Strengths and Limitations

This study’s strength lies in the use of a unique cross-sectional dataset collected recently, over a period of one year, throughout four demographically and geographically diverse locations within the US. This is the first time that RAM data has been analyzed with any kind of public health lens. Research has shown that people from economically disadvantaged, rural or minority backgrounds are less likely to be represented in data due to access and sampling bias.

This study has a number of limitations. Firstly, as no comprehensive list of all zip codes for this sample exists, these were instead categorized as either rural or urban using multiple county and zip code lists, including CDC, US Census and basic online population searches, increasing the potential for exposure misclassification. Secondly, data came from a convenience sample and was not analyzed for trends in missing observations. As one third of the original dataset contained missing data and much of this was from minority groups, sampling bias was potentially introduced. Additionally, using BMI as an indicator of a person or population’s health outcome alone is recognizably flawed. Whilst it has been moderately correlated with other measures of body fatness and metabolic disorders, BMI is a screening tool at best and should not be considered diagnostic. Despite the focus on the intersectionality of race with rurality and gender, almost half the sample identified as White. A greater number of subjects, who identified as non-White may have increased the potential for more accurate and even significant findings or for determining if race/ethnicity did in fact act as a moderator for rurality and high BMI. Likewise, by leaving American Indians within
the dataset despite their small sample size, there is the increased potential of underestimating their true disadvantage by grouping them with ‘Other’.

**Conclusions**

RAM’s access to underserved communities across the country offers a unique opportunity to explore the health outcomes of women and minority groups who do not live near urban centers where health services and positive health messaging are more accessible. This study demonstrates that women living in rural areas are at greater risk of having a high BMI than their urban counterparts. Additionally, African Americans and Latinos also experience greater odds than their White counterparts though race was not found to be a moderator for this relationship. Follow up analysis on rural data, such as that collected by RAM, could help to build upon the knowledge surrounding the intersectionality of being a women, from a minority group and living in a rural area and would help to quantify the seriousness of many rural and remote communities’ poor health outcomes, further legitimating the need for significant healthcare reform within the US. Specifically research that focuses on why rural women are at an increased risk for a high BMI compared to urban women and more importantly, what interventions are working to help improve the health outcomes of this group in particular is greatly needed if this poor health outcome is to be addressed in any meaningful and substantive way.
References


18 Remote Area Medical. Personal conversation with RAM Volunteer Manager, Oriane Leake. November 2015


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