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Weight Loss Success of Participants Residing in Rural and Urban Areas

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Abstract

Purpose—Rural residents are significantly more likely to be overweight and obese than are urban residents. However, few data have compared weight control program responses in these population groups. Therefore, the primary aim of this study was to evaluate the weight loss outcomes of participants in a multi-site, on-line behavioral intervention by residential location (rural vs. urban) and, secondly, assess any possible differences in adherence to treatment goals.

Methods—492 adult participants (Mean BMI = 35.7 kg/m²; 90 % Female; 24% Minority) were categorized based on their home zip code and the 2010 US Census Urban and Rural Classification criteria (58.3% Rural; 41.7% Urban). Weight (kg) was measured in-person at baseline and 6 months after participating in a behavioral weight control intervention. Adherence to physical activity and calorie and fat intake goals was assessed based on weekly self-monitoring journals. Weekly online chat attendance and completion of weekly online self-monitoring journals were recorded. Presence of obesogenic foods in the home was self-reported at baseline and 6 months.

Findings—There were no statistically significant differences in weight loss between rural and urban participants (−6.1 kg vs. −5.3 kg, $P = .16$), nor were there differences in chat attendance, self-monitoring journals, self-reported physical activity, calorie intake or obesogenic foods reported in the household.

Conclusions—Overall, there was no difference in weight loss and adherence to treatment goals for rural and urban participants. Further research on rural and urban residents is necessary to explore the factors responsible for the disparity in obesity prevalence.

Keywords

Weight loss; Adherence; Online intervention; Home food inventory; Diet and exercise

More than one third of U.S adults are obese (BMI >30).¹ Behavioral weight loss interventions are the gold standard for treatment because of the success in promoting weight loss and maintenance through adaptations of lifestyle behaviors². According to data from the LookAHEAD trial, 50.3% of participants reach the goal of losing 5% of their total weight and 26.9% of individuals lose 10%.³ However, these averages do not represent the marked variability in weight loss among individuals. Some individuals fail to produce clinically meaningful weight loss, which can be associated with early, lack of adherence to treatment goals such as self-monitoring.^{3,4} To our knowledge, residential location has never been assessed as a potential factor influencing weight loss outcomes.

Many studies have evaluated the prevalence of obesity in different populations and found a higher percentage of people with obesity in rural areas compared to urban areas.⁵⁻⁷ The data on why rural populations may have higher rates of obesity are equivocal. For example, while some studies have found that rural adults are less likely to meet physical activity recommendations,^{6,7} others have failed to find a difference in rates of achieving physical activity recommendations based on residence.⁵ Moreover, the relationship between dietary intake and rurality is also mixed, with some studies suggesting no difference⁵ and others finding more obesogenic dietary patterns in rural residents.⁷ The underlying etiology of increased obesity rates in rural populations is likely complex and multifactorial. Even less is known however, about differences in weight loss outcomes based on residence. Therefore, the primary aim of this study is to evaluate the weight loss outcomes of participants in an online behavioral intervention study by residential location and, secondly, assess any possible differences in adherence to treatment goals.

Methods

Study Population and Sampling Design

This study was part of a larger study designed to evaluate the benefit of adding motivational interviewing to an online behavioral weight loss intervention. The treatment intervention and outcomes have been described previously.⁸ Briefly, participants were recruited from research sites in Vermont and Arkansas using community based resources (newspaper ads, radio notices, television), targeted emails, and recruitment materials in primary care offices. Individuals were included if they were at least 18 years old, had a BMI ≥ 25 (kg/m²), had no major medical problems, were not taking medications that may have interfered with their ability to lose weight, not currently pregnant or lactating, or enrolled in another weight loss program. All participants were required to have access to a computer, either at home or work. Eligible and consented participants were randomized to one of two treatment arms (Internet alone and Internet+Motivational Interviewing) by the University of Vermont College of Medicine Bioinformatics Facility Interactive Voice Response system. Because early adherence predicts later weight loss success^{3,4} data from the first 6 months of this 18-month intervention were used for the current analysis.

The first 6 months of intervention consisted of 24 weekly “group meetings” in the form of synchronous chat sessions led by an interventionist that were designed to help facilitate sustained changes in dietary and physical activity habits. All participants engaged in diet and activity self-monitoring, received weekly feedback from their interventionist to assist them

in meeting their calorie, fat, physical activity and weight loss goals, and learned stimulus control, problem solving, relapse prevention and goal setting skills. Weekly sessions and all self-monitoring were conducted on a secure, password-protected online platform. Because there were no significant differences in weight loss between the Internet Alone vs. Internet +Motivational Interviewing conditions,⁸ data have been combined for the purposes of this analysis. This study was approved by the Committee for Human Subjects Research in the Behavioral Sciences at the University of Vermont and the Institutional Review Board at the University of Arkansas for Medical Sciences.

Measures—All measures were obtained in-person at each respective research site at baseline and 6 months unless specified otherwise. Questionnaire measures (including demographic data) were collected on-line.

Body Mass Index: Weight was measured in kilograms (kg) on a calibrated digital scale in light clothing without shoes (Tanita Corporation, Tokyo, Japan). Height was measured in centimeters at baseline using a wall-mounted stadiometer (Seca Corporation, Chino, California). BMI was calculated as weight (kg)/height (m²). Changes in weight were expressed as kilograms and % of baseline body weight lost as well as the percent of participants losing at least 5% of baseline weight.

Rural-urban residence: Each participant was classified as rural or urban based on home zip code. The 2010 US Census Urban and Rural Classification Criteria were used to determine rural and urban areas.⁹ The US Census classifies urban areas as those with greater than 2,500 residents or more. Rural areas are areas with fewer than 2,500 residents.

Household Food Inventory: Participants were instructed to complete the Home Food Inventory Questionnaire.¹⁰ The complete HFI contains 190 items; however, to assess overall obesogenic home food availability, a summative score, created by Fulkerson, et al. was used. This subscale contains 71 foods which are high in calories, including regular fat versions of cheese, milk, yogurt, other dairy, frozen desserts, prepared deserts, savory snacks, added fats, regular sugared beverages, processed meats, high fat quick microwavable foods, and candy. Participants self-reported whether they have access to these foods in their refrigerator or kitchen. The obesogenic HFI score has been found to be significantly and positively associated with self-reported energy intake.¹⁰

Dietary Intake: Each participant was given a daily calorie intake goal based on individual needs with a fat gram intake goal equivalent to 25% of total prescribed energy intake. Participants recorded their daily calorie and fat intake using an online dietary monitoring system which provided caloric values and fat grams derived from the USDA Compendium. Compliance with calorie and fat intake goals was recorded by interventionists as 1= met weekly goal or 0 =did not meet weekly goal.

Physical Activity: Participants were given a goal of 175 minutes/week of physical activity, with graded increases in the initial weeks until the target was reached. Participants self-monitored minutes of physical activity online. Group interventionists recorded if they met

their weekly goal for minutes of physical activity (1=met weekly goal; 0 =did not meet weekly goal).

Treatment Adherence measures: Interventionists recorded attendance at group chats as well as whether participants submitted weekly self-monitoring journals (1=attended chat; submitted journal; 0 =did not attend chat; did not submit journal).

Statistical Analysis: Kernel method tests and Q-Q plots were used to test for normality for dichotomous outcomes. T-tests were run to compare weight loss and adherence goals between rural and urban participants. Two-way analysis of variance (ANOVA) was used to evaluate possible interactions between state and residence. Chi-squared (X^2) tests were run to assess differences in the percent of participants achieving a 5% weight loss by residence and state. For analyzing the Home Food Inventory, paired t-tests were used to indicate changes from baseline to 6-months and repeated measures ANOVA assessed any residence by time associations. To address any possible confounding or bias based on the distribution of minority participants, all tests were additionally run with minority participants removed. Data analysis was conducted with SAS (v9, SAS Institute, Inc., Cary, NC 2003). Statistical significance was defined as $P < .05$ (two-tailed).

Results

Four hundred and ninety-two participants were randomized to the weight loss trial. Half of the sample came from Vermont (50.8%) and half from Arkansas (49.2%) with 24% of the total sample identifying as a racial minority. Four hundred forty-four subjects (90.2%) completed a 6-month weigh-in; 353 (71.7%) completed the Home Food Inventory measure at baseline and 6 months. There was no difference in rates of completion by rurality. Table 1 describes the distribution of rural and urban residents. Significantly more rural participants lived in Vermont with more urban residents in Arkansas. Average age, gender distribution, education and BMI were not significantly different at baseline by residence.

Table 2 shows the rural-urban differences between weight loss and treatment adherence measures for the overall sample, Vermont only, and Arkansas only. There was no statistically significant difference between rural and urban residents regarding weight loss in terms of kilograms of weight loss or percent weight loss. For the proportion achieving 5% or greater weight loss, there was a non-significant trend ($P = 0.06$) with rural participants (61.4%) being higher than urban (38.6%). Additionally, there was no difference in adherence to meeting weekly physical activity, calorie and fat intake goals, self-monitoring journals submitted, and attendance at weekly group meetings over the 6-month period. The rural-urban proportional differences were also evaluated on an individual state-level and showed no statistically significant differences between rural and urban participants within both Arkansas and Vermont for weight loss and adherence to treatment goals. In a sensitivity analysis, we removed participants identifying as a racial minority since all were in one site (Arkansas); there were also no statistically significant differences for weight loss and adherence to treatment goals when comparing urban and rural residents for the overall sample.

Rural and urban comparisons of baseline, 6-month and change during treatment in obesogenic HFI scores (Table 3) revealed no significant difference between rural and urban participants. However, t-tests evaluating the change from baseline to 6-months separately for each residential location, revealed a significant decrease in obesogenic food score for both rural and urban residents ($P<.0001$).

Discussion

The aim of this study was to determine if residence (i.e., rural versus urban), was related to weight loss success in a structured behavioral program. Unlike previous research,⁵⁻⁷ there was no difference in BMI for rural and urban individuals at baseline for this treatment seeking sample. The main finding was that while there was a trend toward more weight loss in rural areas, results were not statistically significant due to the high variability in weight losses achieved. However, this is an interesting finding and one that warrants further investigation. Particularly in light of the fact that, there were additionally no significant differences in adherence to treatment goals. This is the first study to investigate rural or urban residence as a possible predictor of weight loss outcomes in individuals with obesity.

While some studies have found that rural adults report more sedentary behaviors, less leisure-time physical activity, and poorer dietary habits than urban participants,⁷ available diet and physical activity data are equivocal.¹¹ This may be due to the different methods used to evaluate diet and physical activity in different studies. Additionally, many studies do not include physical activity related to work or transportation, which may represent an area in which rural and urban residents may differ. The classification of rural and urban residency has varied among studies thus allowing for further discrepancy in results.¹² Finally, one suggestion for rural/ urban differences may be education level discrepancies.¹¹ Lack of observed differences in our study may therefore, have been partially attributed to the fact that our study sample was highly educated with almost 3/4ths having attended college or graduate/professional school (Table 1).

Investigations into how access to grocery stores and supermarkets may differ among low-density populations has suggested that disparities in food access are far more apparent in rural areas.¹² However, in this study both rural and urban residents were able to make similar, favorable changes in their obesogenic food scores suggesting that food access and availability was not an insurmountable barrier for our rural participants. We also failed to find an association between the home food environment and weight loss. Krukowski and colleagues¹³ similarly found a lack of association between weight loss and home environment changes during the course of a behavioral weight loss program, when using a different measure of the home food environment in a similarly well-educated sample¹⁴. The combination of this previous research and the current results indicates that further investigation may be necessary into how to explain higher obesity rates among rural populations.

This online behavioral weight loss program did not find differences in weight loss based on residence, suggesting that people residing in rural areas are not adversely impacted by their geographic location in on-line behavioral weight loss programs. Weight loss trials for rural

breast cancer survivors showed similar successful outcomes with phone counseling intervention strategies.¹⁵ The use of online and distance-accessible interventions allows for the comparison of residences that may be restricted from study participation due to necessary travel. This is the first study to evaluate rural and urban participants engaged in the same behavioral intervention, therefore highlighting the importance of this study design in enrolling otherwise isolated participants. Further research should continue to evaluate the causes of obesity disparity by residence to further inform effective prevention and treatment methods.

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References

1. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA*. 2014; 311(8):806–814. [PubMed: 24570244]
2. Burke LE, Wang J, Sevick MA. Self-monitoring in weight loss: a systematic review of the literature. *J Am Diet Assoc*. 2011; 111(1):92–102. [PubMed: 21185970]
3. The Look AHEAD Research Group. Eight-Year Weight Losses with an Intensive Lifestyle Intervention: The Look AHEAD Study. *Obesity*. 2014; 22(1):5–13. [PubMed: 24307184]
4. Krukowski RA, Harvey-Berino J, Bursac Z, Ashikaga T, West DS. Patterns of Success: Online Self-Monitoring in a Web-Based Behavioral Weight Control Program. *Health Psychology*. 2013; 32(2): 164–170. [PubMed: 22545978]
5. Befort CA, Nazir N, Perri MG. Prevalence of obesity among adults from rural and urban areas of the United States: findings from NHANES (2005-2008). *J Rural Health* May. 2012; 28(4):392–397.
6. Patterson PD, Moore CG, Probst JC, Shinogle JA. Obesity and physical inactivity in rural America. *J Rural Health*. 2004; 20(2):151–159. [PubMed: 15085629]
7. Trivedi T, Liu J, Probst J, Merchant A, Jhones S, Martin AB. Obesity and obesity-related behaviors among rural and urban adults in the USA. *Rural Remote Health*. 2015; 15(4):3267. [PubMed: 26458564]
8. West DS, Harvey JR, Krukowski RA, Prewitt TE, Priest J, Ashikaga T. Does the addition of individual online motivational interviewing chat sessions enhance weight loss in a group-based online weight control program? *Obesity*. 2016; 11:2334–2340. Blinded for review.
9. Krukowski RA, DiLillo V, Ingle K, Harvey J, West DS. Design and methods of a synchronous online motivational interviewing intervention for weight management. *JMIR Res Protoc*. 2016; 5(2):e69. Blinded for review. [PubMed: 27095604]
10. United States Census Bureau. Census urban and rural classification and urban area criteria. 2010. Feb. 9, 2015. Available at: <https://www.census.gov/geo/reference/ua/urban-rural-2010.html>. Accessed June 28, 2017
11. Fulkerson JA, Nelson MC, Lytle L, Moe S, Heitzler C, Pasch KE. The validation of a home food inventory. *Int J Behav Nutr Phys Act*. 2008; 5:55–60. [PubMed: 18983668]
12. McCormack LA, Meendering J. Diet and Physical Activity in Rural vs Urban Children and Adolescents in the United States: A Narrative Review. *J Acad Nutr Diet*. 2016; 116(3):467–480. [PubMed: 26685123]
13. Richardson AS, Boone-Heinonen J, Popkin BM, Gordon-Larsen P. Are neighbourhood food resources distributed inequitably by income and race in the USA? Epidemiological findings across the urban spectrum. *BMJ Open*. 2012; 2(2):e000698.
14. Krukowski RA, Harvey-Berino J, West DS. Differences in home food availability of high- and low-fat foods after a behavioral weight control program are regional not racial. *Int J Behav Nutr Phys Act*. 2010; 7:69–75. [PubMed: 20868503]

15. Raynor HA, Polley BA, Wing RR, Jeffery RW. Is dietary fat intake related to liking or household availability of high- and low-fat foods? *Obes Res.* 2004; 12(5):816–823. [PubMed: 15166302]
16. Befort CA, Klemp JR, Sullivan DK, et al. Weight loss maintenance strategies among rural breast cancer survivors: The rural women connecting for better health trial. *Obesity.* 2016; 24(10):2070–2077. [PubMed: 27581328]

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Table 1

Subject Characteristics at Baseline

	Rural (n= 287)	Urban (n= 205)
Age (years) ¹	49.0 (0.61)	47.8 (0.72)
Gender (%Female)	89.5	90.2
Minority (%)	13.6	43.4 *
Education (%)		
High school/vocational	7	8.5
Some college	22.1	14.6
College degree	37.1	40.2
Graduate/professional	33.2	36.7
BMI (kg/m ²) ²	35.1 (0.34)	36.6 (0.42)
Residence (%)		
Arkansas	38.8 *	61.2 *
Vermont	77.2 *	22.8 *
Combined	58.3 *	41.7 *

¹Year ± SE²BMI ± SE* $P < .0001$

Table 2

Weight Loss and Adherence to Treatment Goals from Baseline to Six Months by Residence for the Overall Sample, Vermont Only and Arkansas Only (% $\pm$ SE)

Overall Sample	Rural (n=261)	Urban (n=183)
Weight loss (kg) [/]	-6.1 (0.4)	-5.3 (0.5)
Weight loss (%)	-6.5 (0.3)	-5.5 (0.4)
Calorie goal met (% of weeks)	29.0 (1.6)	29.2 (2.0)
Fat goal met (% of weeks)	20.7 (1.5)	17.1 (1.5)
Activity goal met (% of weeks)	31.8 (1.6)	27.4 (1.8)
Weekly chat attendance (%)	67.8 (1.6)	63.4 (1.9)
Weekly self-monitoring journals (%)	72.6 (2.0)	68.5 (3.6)
Individuals losing 5% baseline weight (%)	61.4	38.6
Vermont	Rural (n=177)	Urban (n=53)
Weight loss (kg) [/]	-6.8 (0.4)	-5.9 (0.9)
Weight loss (%)	-7.3 (0.4)	-6.4 (0.9)
Calorie goal met (%)	30.7 (2.0)	30.4 (4.0)
Fat goal met (%)	22.6 (1.9)	20.4 (3.3)
Activity goal met (%)	35.6 (1.9)	34.9 (3.7)
Weekly group attendance (%)	70.8 (1.8)	68.9 (3.3)
Weekly self-monitoring journals (%)	76.9 (2.0)	74.9 (3.7)
Individuals losing 5% total weight (%)	79.4	20.6
Arkansas	Rural (n=84)	Urban (n=130)
Weight loss (kg) [/]	-4.8 (0.6)	-5.1 (0.5)
Weight loss (%)	-4.8 (0.6)	-5.1 (0.5)
Calorie goal met (%)	29.0 (1.6)	29.2 (2.0)
Fat goal met (%)	16.9 (2.5)	15.9 (1.7)
Activity goal met (%)	23.7 (2.5)	24.5 (2.0)
Weekly group attendance (%)	59.1 (3.1)	61.3 (2.3)
Weekly self-monitoring journals (%)	63.8 (3.4)	66.0 (2.6)
Individuals losing 5% baseline weight (%)	36.7	63.3

[/] Mean $\pm$ (SE)

Table 3Home Food Inventory Score at Baseline and Six Months by Residence (Mean $\pm$ SD)

Residence	Baseline	6 Months	Change Baseline-6 Mo.
Rural (n=287)	24.5 $\pm$ 9.5	20.0 $\pm$ 8.5	4.2 $\pm$ 6.7 *
Urban (n=205)	24.7 $\pm$ 9.7	20.4 $\pm$ 10.1	4.4 $\pm$ 6.9 *

*
p .0001 for baseline to 6 month change