



Food insecurity and physical activity insecurity among rural Oregon families[☆]

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ABSTRACT

Among rural families, rates of both child obesity and household food insecurity (FI) are higher compared to non-rural families. These disparities result from a complex interplay of social and environmental conditions that influence behavior. The Transtheoretical Model suggests individual readiness to change underlies success in modifying obesity-preventing behaviors; however, whether an association between readiness to change obesity-related behaviors and FI status among rural families exists is unknown. We examined the association between readiness to change family-level nutrition and physical activity (PA) behaviors that predict child obesity and family FI status within a sample of rural families to better understand these relationships. Families ($n = 144$) were recruited from six rural Oregon communities in 2013. Families completed a FI screener and the Family Stage of Change Survey (FSOC), a measure of readiness to change family-level nutrition and PA behaviors associated with obesity. Demographic differences by FI status were explored, and regression was applied to examine relationships between FI and FSOC scores, adjusting for relevant covariates. Among FI families (40.2%), more were non-white (77.8% vs. 22.2%; $p = 0.036$) and had lower adult education (30.4% vs. 11.8% with > high school degree; $p = 0.015$) compared to non-FI families. After adjusting for education, race, ethnicity, and eligibility for federal meal programs, readiness to provide opportunities for PA was lower among FI families ($p = 0.002$). These data highlight a need to further investigate how food insecurity and low readiness to provide PA opportunities, i.e. “physical activity insecurity” may be contributing to the higher obesity rates observed among rural children and families.

1. Introduction

Children living in rural areas are known to have higher risk for obesity compared to their urban counterparts (Johnson and Johnson, 2015). This disparity is likely influenced by numerous factors, including individual diet and physical activity (PA) behaviors. While the behavioral correlates of obesity may be similar for rural and non-rural children, the ability to enact these behaviors is impacted by socio-economic and cultural factors that may vary considerably between rural and non-rural settings (Gamm et al., 2010). Family-level factors, such as higher poverty and lower education levels among rural households, and environmental-level factors, such as distance to resources, result in less access to safe, healthy, affordable food and opportunities for physical activity (U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, 2013; Institute of Medicine and National Research Council, 2009). These differences make it challenging for rural families to

provide the necessary supports children need to eat healthfully and be physically active outside of school hours and likely contribute to rural-urban disparities in obesity prevalence.

Families in rural areas also are more likely to be food insecure (FI) than non-rural families (Coleman-Jensen et al., 2016). The relationship between FI and obesity is not completely understood, but data suggest food insecure households experience higher rates of obesity (Metallinos-Katsaras et al., 2012; Franklin et al., 2012), and rural households in the United States (US) experience higher rates of both food insecurity and obesity compared to non-rural families in the US (Piontak and Schulman, 2014). While the higher rates of poverty in rural compared to non-rural households (DeNavas-Walt and Proctor, 2014) likely play a role in both outcomes, there may be additional factors unique to rural environments that elevate FI and obesity risk for rural families. To date, little research has examined the relationships between FI and behavioral risk factors for obesity among children (Metallinos-Katsaras et al., 2012; Hanson and Connor, 2014; Fram

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et al., 2015). While it is clear that excess calories and insufficient PA contribute to weight gain, low PA consistently emerges as a stronger predictor of overweight than poor diet among children identified as food insecure (Hanson and Connor, 2014; Fram et al., 2015). However, the relationships between poor diet and low PA among rural, food insecure children and families have not been examined.

Because children have limited control over the factors that enable them to enact healthy behaviors, child obesity prevention strategies have shifted toward environmental approaches, with most of the current research focused on school settings (Institute of Medicine, 2012). Though the importance of the family-home environment on children's risk for obesity is evident (Maitland et al., 2013; Appelhans et al., 2014), how family-level obesity-preventing policies, practices, and behaviors relate to family FI status is not known. A better understanding of these phenomena and their theoretical underpinnings among rural families, who disparately experience both obesity and FI, may be crucial for extending obesity prevention efforts into the family home environment.

The Transtheoretical Model (TTM) is a comprehensive, integrative model describing intentional behavior change that can be applied to a variety of behaviors, populations, and settings (DiClemente et al., 1991). Current behaviors and behavioral intent are categorized along a continuum represented by five distinct stages of change (SOC) that reflect readiness to change targeted behaviors: precontemplation, contemplation, preparation, action, and maintenance. The further along the continuum, the higher the “readiness to change”, and the more likely change will occur from undesired toward desired behaviors in response to stage-targeted intervention strategies.

Understanding the interplay between families' readiness to change family-level policies and practices that influence child obesity and household FI status may provide insights as to why rural children are at higher risk for both obesity and FI compared to non-rural children. The objective of this study was to evaluate associations between family FI status and readiness to change family-level diet and PA behaviors associated with child obesity among a sample of rural Oregon households with elementary-age children.

2. Methods

2.1. Study design and participants

This study was conducted as part of a larger collaborative research effort funded by the United States Department of Agriculture examining the influence of rural family home, school, and community environments on child obesity, Generating Rural Options for Weight-Healthy Kids & Communities (John et al., 2016). Schools served as the hub for recruitment and data collection activities and were selected based on the following criteria: 1.) Located in a community designated as a rural place by the US Census (U.S. Department of Agriculture (USDA), 2012), 2.) $\geq 50\%$ of school families eligible for free and reduced meals, 3.) Oregon State University Health Extension county faculty were available to lead community-based research efforts. The cross-sectional data presented in this paper were collected in Fall 2013 from rural families with elementary-age children (grades k–6) recruited from the six participating schools. All families with children enrolled in selected schools were eligible to participate, and all families received similar recruitment strategies and opportunities to enroll in the study.

This study was reviewed and approved by the Oregon State University Institutional Review Board.

2.2. Survey measures

Data for this study include survey responses about family FI, family stages of change, and demographics. After consenting, surveys were mailed to participants or distributed online via the survey hosting website Qualtrics (Qualtrics, Provo, UT) based on participant

preference. Participants who chose to fill out paper surveys were provided business reply envelopes at no cost. Survey data were scored and double entered into a data management system by trained research assistants.

2.2.1. Food insecurity

Families were identified as at-risk (food insecure) or not at-risk (food secure) for FI (FI or FS, respectively) using a two-item FI-screener that has been validated among low-income families with young children (Hager et al., 2010). Families were classified as FI if they responded “Sometimes True” or “Often True” to either of the two statements: 1) *Within the past 12 months we worried if our food would run out before we got money to buy more* and 2) *Within the past 12 months the food we bought just didn't last and we didn't have money to get more*. If participants responded with “Never True” to both questions, they were categorized as FS.

2.2.2. Family stage of change (FSOC)

The FSOC was developed and validated (Gunter et al., 2014) to specifically address readiness to make obesity related behavior change within the family home environment. The FSOC items were derived from the Family Nutrition and Physical Activity (FNPA) screening tool, which has been shown to predict children's risk for obesity (Ihmels et al., 2009). The specific family-level health behaviors surveyed include eating behaviors (items 1–6; Nutrition Domain) and PA, sleep, and screen time behaviors (items 7–12; PA Domain). Each FSOC item was scored by applying a value of 1 (precontemplation) through 5 (maintenance) based on respondents' answers for that item.

2.2.3. Covariates

Information provided by adult respondents included sex, race, ethnicity, education level (grade 12 or less, 1–3 years college, 4 years or more college), and family eligibility for free or reduced-cost school meals (yes, no).

2.3. Statistical analysis

Descriptive statistics were examined for all variables. Data were collapsed to create a dichotomous variable with categories of “white” and “non-white” due to low responses among non-white categories. Chi-square and Fisher's exact tests were used to examine whether FI was associated with demographics. To test for differences in mean FSOC domain and item scores by FI risk, we conducted independent *t*-tests on FSOC continuous variables. We used linear regression to examine the association between being at-risk for FI and FSOC scores, adjusted for relevant demographic variables (race, adult education, and school meal eligibility). All data analyses were performed using Stata (version 13, 2013, StataCorp). Statistical significance was set at $\alpha = 0.05$.

3. Results

3.1. Demographics

The Final sample included 144 families. Respondents primarily identified as white (94%) and non-Hispanic (87%). Most (55%) completed 1–3 years of college, 26% completed four or more years of college, and 19% had obtained a high school diploma or less. Approximately 40% of families were at-risk for FI. When stratified by FI status (Table 1), FI families were more likely to be non-white (78% versus 22%; $p = 0.027$) and have lower adult education (30% versus 12%; \geq high school degree; $p = 0.015$) compared to FS families.

3.2. FSOC scores by FI risk

No differences by FI status were observed on individual nutrition items or Nutrition Domain scores. In the PA Domain, FI families

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