Chapter 57
Enabling Healthy Living:
Spatiotemporal Patterns of Prevalence of Overweight and Obesity among Youths in the United States

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ABSTRACT

The increasing burden of overweight and obesity in the United States (U.S.) demands a better understanding of its local and regional spatial patterns and trends. The study examines the hypothesis that there are spatial differences in the prevalence of overweight and obesity in U.S. youths at regional and local levels. It used spatial, statistical, and spatiotemporal analyses and a synthesis of regionally and locally relevant data from a cohort of large, nationally representative, longitudinal data sets, the National Longitudinal Survey of Youth (NLSY`97) to analyze overweight and obesity prevalence. Specifically, the methods used included the spatial Generalized Linear Mixed Model (GLMM), spatial interpolation techniques (Inverse Distance Weighting – IDW), and Kulldorf's scan space-time analysis. The paper analyzed 12 waves (1997–2008) of data from the NLSY data sets. Its findings revealed there is an upward trend both in males and in females in obesity prevalence in US youths during the twelve-year period. Youth obesity prevalence was also higher among females than among males. The cohort shows evidence of increase in overweight and obesity prevalence. There are mixed trends in youth obesity prevalence patterns in rural and urban areas. Counties identified as consistently experiencing higher prevalence of obesity and with the potential of becoming an obesogenic environment are Copiah, Holmes, and Hinds in Mississippi; Harris and Chamber, Texas; Oklahoma and McCain, Oklahoma; Jefferson, Louisiana; and Chicot and Jefferson, Arkansas. The twelve-year study indicated spatial variation in obesity and overweight prevalence among U.S. youths, with pockets of clustered prevalence. This information can guide programs, policies, and initiatives for obesity prevention at regional and local levels.

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1. INTRODUCTION

The prevalence of obesity has reached epidemic proportions and has become a serious public health problem for Americans of all ages, genders, and races (Flegal, 2010; Mokdad et al., 1999; Nelson et al., 2006; Plantinga & Bernel, 2005; Wang et al., 2012). Among the challenges of planning for obesity prevention is the dearth of regional and local data (Brener et al., 2004, Merchant et al., 2011). Risk factors for obesity and overweight vary considerably at regional, local, and neighborhood levels, but there is little data for program planning available at the county level (Doak et al., 2006; Merchant et al., 2007). A proven technology, geographic information systems (GIS) and their related technologies facilitate the measurement, management, mapping, and analysis of the real world at different geographic levels (de Smith et al., 2011; Longley et al., 2011). Notwithstanding the fact that GIS and related analyses may not be a panacea, the integrative nature of its links with spatial statistical analysis offers an important means of better understanding the most pressing problems of our generation. GIS and spatial statistical analyses provide valuable tools for researchers and policy makers (Matthews, 2009). The availability of geospatial data, enhanced visualization tools, and advanced spatial analysis methods have led to the promotion of myriad applications of spatial methods in health-related research (Cromley & McLafferty, 2011; Matthews, 2009).

Current studies employing spatial analytic tools and geospatial data on people and places undoubtedly span several academic fields (Boone-Heinonen & Gordon-Larsen, 2012; Frank et al., 2012; Frazer et al., 2012; Rainham et al., 2012; Wall et al., 2012). Undoubtedly, spatial analysis is essential for the advancement of research in overweight and obesity to uncover the connection between social and geographic factors (Chaix, 2009).The results indicate that a spatial analysis and spatial-temporal perspective can be an incubator for interdisciplinary research (Goodchild & Janelle, 2004). Until recently, most research lack the spatial analysis component of analyzing youth obesity and overweight prevalence. This paper bridges the gap using a combination of spatial, spatiotemporal, and temporal techniques to analyze youth obesity prevalence using a cohort of national longitudinal data sets. Even though modern data-collection techniques and methods allow geographic units such as ZIP code, census tract, address, and even latitude/longitude coordinates, it is often either inappropriate or ineffective to use the default geographic units to perform spatial analysis. In addition, the use of geographic units at the atomic level often results in unstable pattern estimates or incorrect conclusions due to the small base population among units. As a result it is imperative in certain cases to aggregate small units into sufficiently large and homogeneous areas to achieve stable estimates and uncover hidden patterns (Guo and Wang, 2011). Specifically when health data is involved, it is crucial to impose restrictions on the analysis and mapping of high-resolution levels to protect confidentiality and to respect privacy concerns.

Planning obesity prevention in the United States has become a challenge, mainly due to the dearth of regional and local data as well as cross-sectional data problems. To effectively prevent and reduce overweight and obesity through healthy living, it is essential to understand the spatial dynamics over time. However, most neighborhood environmental research is cross-sectional, focuses on adults, and is often carried out in small geographic areas. Cross-sectional neighborhood environmental studies tend to be problematic because neighborhoods and individuals evolve over time through complex and interrelated processes (Auchcloss et al., 2011; Bhat & Guo, 2007; Boone-Heinonen et al., 2011; Mokhtarian & Cao, 2008; Platenga & Bernell, 2005; Samadi, 2010; Sampson & Sharkey, 2008). With cohort of longitudinal data, it is possible to address individual characteristics that may contribute to these temporal and spatial interrelationships (Boone-Heinonen & Gordon-Larsen, 2012). The use of longitudinal data