

Obesity in Rural Youth: Looking Beyond Nutrition and Physical Activity

Debra B. Reed, PhD, RD, LD¹; Patti J. Patterson, MD, MPH²; Nicole Wasserman, MPH¹

ABSTRACT

Contributors to excessive obesity in rural youth include well-documented nutrition and physical activity behaviors. However, emerging research suggests that preventing excessive weight gain and smoking during pregnancy, teen pregnancy, and child abuse also could reduce obesity in this vulnerable population. These traditional and emerging, nontraditional factors need to be addressed within the confines of current challenges faced by rural communities. An enhanced ecological model provides a framework for combining traditional and nontraditional factors into a more comprehensive approach that addresses the complexity of the issues contributing to youth obesity.

Key Words: youth, obesity, ecological model (*J Nutr Educ Behav.* 2011;43:401-408.)

INTRODUCTION

The recommendations of state and national government and health groups suggest that obesity prevention strategies for youth, ages 2-19 years, should target 5 behaviors: improve caloric balance/portion control, increase fruit and vegetable intake, increase physical activity to 60 minutes a day, increase breastfeeding, and decrease sedentary activity (reduce screen time including television, computer, and games to < 2 hours a day).¹⁻⁴ (Currently, the Centers for Disease Control and Prevention use the term “overweight” for children with a body mass index [BMI] at or above the 85th percentile but less than the 95th percentile for age and sex, and “obese” for children with a BMI at or above the 95th percentile by age and sex. However, because in the past the Centers for Disease Control and Prevention and other authors have used the terms “at risk of overweight” and “overweight” to refer to children in the 85th to 94th percentile and ≥ 95th percentile, respectively, these terms will be used if referenced studies use them.) In addition, decreasing fast-

food intake^{5,6} and increasing family meals^{7,8} are targeted to reduce calorie intake and increase fruit and vegetable intake. Targeting nutrition and physical activity is still important in preventing youth obesity; however, emerging research highlights other significant factors. Rural youth are particularly vulnerable to obesity, and thus prevention efforts in this population could benefit from a more comprehensive approach that incorporates the diverse range of traditional and emerging contributing factors.

The purpose of this report on obesity prevention among rural youth is twofold: (1) to describe rural-specific prevalence and challenges, and (2) to highlight emerging, nontraditional contributing factors using an enhanced ecological model.

RURAL YOUTH OBESITY—PREVALENCE AND CHALLENGES

Rural populations, defined as people living in nonmetropolitan areas with

fewer than 2,500 residents,⁹ have significantly higher rates of overweight and obesity.¹⁰⁻¹² Using data from the 2003 National Survey of Children's Health, the prevalence of overweight and/or obesity in rural children ages 5-18 years was compared with that of children in metropolitan settings.¹⁰ Overweight or obese children were more likely to live in rural rather than metropolitan areas (odds ratio [OR] = 1.252; 95% confidence interval [CI]: 1.248, 1.256). Tai-Seale and Chandler compared studies of the prevalence of obesity between rural and urban youth in 8 states.¹³ In all studies, the prevalence of obesity was higher among rural children and adolescents. In 2 of the larger studies, the odds of being obese were 50% higher for rural children in North Carolina,¹⁴ and the prevalence of obese adolescents in rural south Texas was twice the national average.¹⁵ Thus, whereas on a national basis, rural children are approximately 25% more likely to be overweight or obese than those from urban areas,¹⁰ there are pockets where this rate may be greatly increased. With approximately 21% of the total United States (US) population living in rural areas,¹⁶ significant numbers of youth are disproportionately affected by the negative consequences of obesity.

The National Advisory Committee on Rural Health and Human Services, in their 2005 Report to the Secretary of the US Department of Health and Human Services,¹⁷ identified the following as contributors to the excessive

¹Department of Nutrition, Hospitality, and Retailing, Texas Tech University, Lubbock, TX

²Department of Pediatrics, Texas Tech University Health Sciences Center, Lubbock, TX
Address for correspondence: Debra B. Reed, PhD, RD, LD, Department of Nutrition, Hospitality, and Retailing, College of Human Sciences; Texas Tech University, Box 41240, Lubbock, TX 79409-1240; Phone: (806) 742-3068; Fax: (806) 742-3042; E-mail: debra.reed@ttu.edu

©2011 SOCIETY FOR NUTRITION EDUCATION
doi:10.1016/j.jneb.2010.12.005

obesity found in rural areas: lack of health services and local public health capacities, changing lifestyles (less physical activity), dependence on Medicare, lack of knowledge or information (consumers and health professionals), lack of coordination of local providers, socioeconomic disadvantage, geographic isolation, provider shortages, and lack of transportation. Rural overweight or obese youth are more likely to live below or slightly above the poverty level; more likely to be uninsured; and less likely to have received preventive health care in the past 12 months.¹⁰

Rural areas face unique challenges that may negatively affect obesity rates, such as lack of nutrition education, limited access to nutritionists and other resources, and fewer physical education classes, sidewalks, and exercise facilities.¹³ In addition, food availability, especially the availability of fruits and vegetables, may be limited in rural areas. A 2006 study in the non-metropolitan South found that 256 of the 873 counties were "food deserts," as defined by 50% of the population experiencing limited access (have to drive more than 10 miles) to a supermarket.¹⁸ In the absence of supermarkets, the presence of fruit and vegetable markets was analyzed as an alternative food source in these food desert counties. However, only 12 of the 256 food desert counties contained a fruit and vegetable market. The impact of food availability is significant. For example, residents in food desert counties in Mississippi were 23.4% less likely to consume the recommended 5 or more servings of fruits and vegetables per day than those in non-food desert counties.¹⁸

ENHANCED ECOLOGICAL MODEL

Youth obesity prevention activities should not only be developmentally appropriate and conducted throughout the life cycle,¹⁹ they also should recognize the complex interplay among youth, family, and community/society. The ecological model encourages this recognition and highlights all the levels of influence that can be addressed to support long-term, healthful lifestyle choices. In 2001, Davison and Birch published

an ecological model showing the contributing factors of childhood obesity focusing on the traditional influences related to nutrition and physical activity behavior.²⁰ However, this model does not include some of the contributing factors that have recently emerged as being related to childhood obesity, such as in utero influences, child abuse, and teenage pregnancy, which may have a greater impact on rural populations. The Figure expands this model to include these emerging, nontraditional factors, thus providing a more comprehensive framework to guide interventions. Research related to these factors is discussed below with implications for rural populations.

Maternal Obesity during Pregnancy

Maternal obesity during pregnancy may contribute to childhood obesity. Catalano postulates that maternal obesity creates a state of increased insulin resistance, inflammation, and increased nutrient availability to the fetus,²¹ which results in increased somatic growth, particularly fetal adipose tissue in late gestation. Thus, this abnormal metabolic milieu may contribute to fetal-neonatal obesity, which may be related to a perpetual cycle of subsequent childhood and adult obesity. This hypothesis is supported by the results of a large study ($n = 8,492$) of low-income children enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children in Ohio who were followed from the first trimester of gestation until 24-59 months of age.²² Maternal obesity in early pregnancy more than doubled the risk of obesity of their children at 2-4 years of age. By 4 years of age, 24.1% of children were obese if their mothers had been obese in the first trimester of pregnancy compared with 9.0% of children whose mothers had been of normal weight.

In a prospective analysis of US women, parity-associated weight gain (ie, weight gain related to number of births) was related to living in a rural area, being African American, having lower income and lower education, and being unmarried.²³ Children who are large for gestational age

at birth and exposed to an intrauterine environment of either diabetes or maternal obesity are at increased risk of developing metabolic syndrome.²⁴

Maternal Smoking during Pregnancy

In addition to the harmful effects of maternal obesity on the obesity risk of offspring, evidence is increasing that the prevalence of obesity in children may be linked to intrauterine exposure to tobacco.²⁵ Although the exact mechanism is not known, it has been hypothesized that exposure to nicotine may decrease neurobehavioral impulse control or alter neuroendocrine metabolic regulation.²⁶ A meta-analysis of observational studies including 84,563 children found that children whose mothers smoked during pregnancy had an increased risk for overweight (OR = 1.50; 95% CI: 1.36, 1.65) at ages 3-33 years.²⁷ These results could not be explained by sociodemographic and behavioral characteristics such as body size, gestational weight gain, infant feeding, and child behaviors. It has been debated whether smoking cessation within the first trimester prevents the later association of overweight and obesity;²⁸⁻³³ however, the strong association between maternal smoking and future childhood overweight and obesity found across all identified studies indicates that smoking cessation should occur before becoming pregnant or as soon as possible thereafter. Based on the levels of smoking among pregnant women in the US and the prevalence of childhood obesity, Oken, Levitan, and Gillman²⁷ estimated that approximately 715,000 children may be overweight because of intrauterine exposure to tobacco. The burden may be greater in rural areas. Available state-level data indicate smoking during pregnancy is higher among rural compared with urban women,^{34,35} although national data are unavailable.

Teen Pregnancy

Adolescents who become pregnant may contribute to their offspring's risk of overweight or obesity through maternal obesity^{21,22,24} and smoking during pregnancy.^{26,27} However, teen pregnancy contributes uniquely

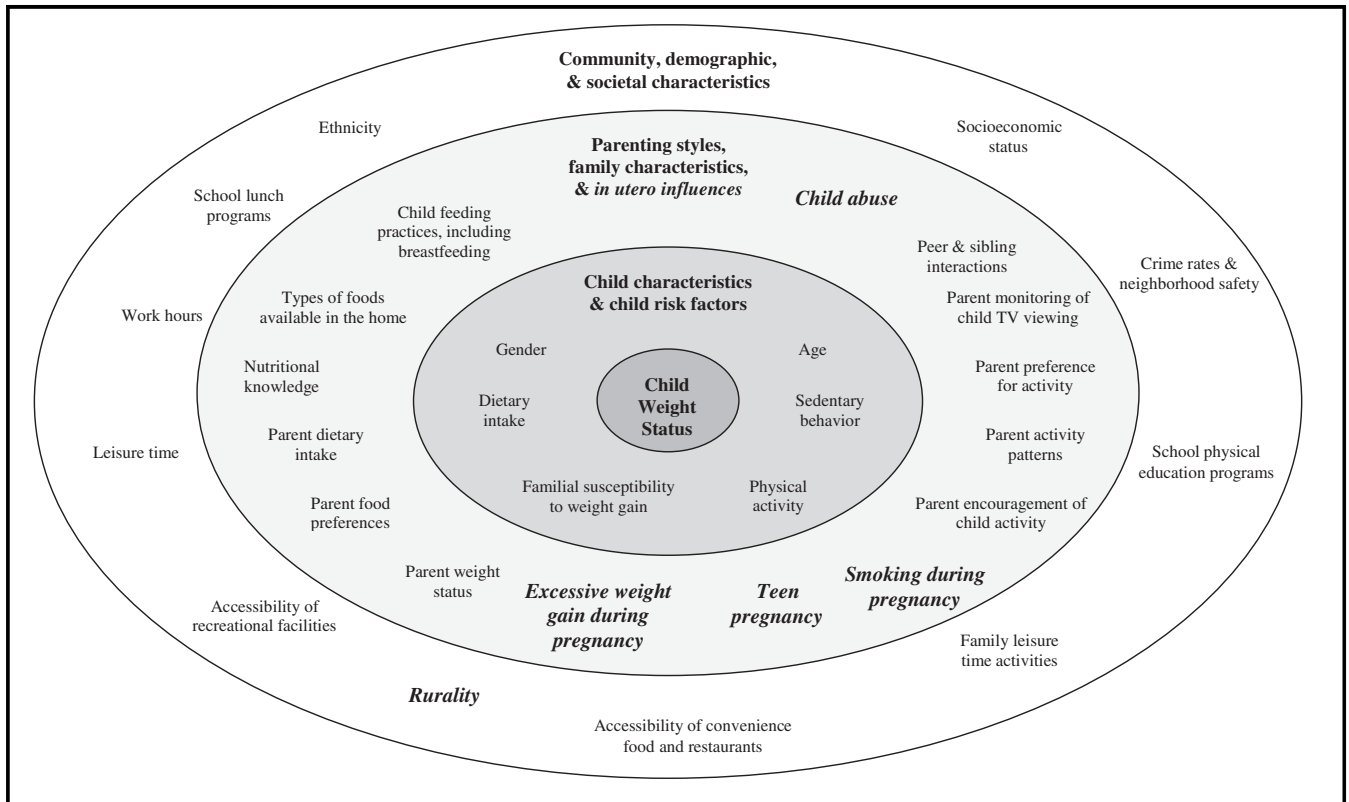


Figure. Expanded version of the Davison and Birch²⁰ ecological model of predictors of childhood overweight. Emerging, non-traditional factors including in utero influences and child abuse are indicated with bold-italics.

to the problem of youth obesity. Teens may increase their own risk of overweight if they become pregnant, as they may be encouraged by health professionals to gain weight at the upper end of recommended ranges.³⁶ However, excessive weight gain does not result in a higher birth weight infant;³⁶ thus, after giving birth, the teens are then overweight and may have difficulty returning to their pre-pregnancy weight. Over 27% of adolescent mothers gained excessive weight during pregnancy, compared with approximately 18% of their older counterparts. This difference was observed in nearly all demographic categories, regardless of parity or race. Because of this risk, adolescents' weight should be monitored during pregnancy by dietetics professionals.³⁷ Recommended weight gain should follow guidelines established by the Institute of Medicine,³⁸ in which recommended weight gain decreases as prepregnancy BMI increases.

Sexually active adolescents in rural areas may be at greater risk for unwanted pregnancy because of de-

creased access to health care and family planning services.³⁹ Once these rural youth become pregnant, the likelihood of receiving adequate preventive or reproductive care is reduced owing to fewer health professionals in rural areas, weaker infrastructures for transportation and information, heightened concerns about confidentiality, low rates of insurance coverage, and reluctance to accept social services.⁴⁰

Childhood Abuse

Abuse during childhood is associated with obesity later in life.⁴¹⁻⁴⁴ The Adverse Childhood Experiences Study found a strong graded relationship between self-reported exposure to 7 categories of abuse (psychological, physical, or sexual, etc.) or household dysfunction during childhood and multiple risk factors for several of the leading causes of death in 9,508 adults.⁴² Controlling for age, sex, race, and educational attainment, persons who had experienced 4 or more categories of childhood exposure, compared with

those who had experienced none, exhibited a 1.4- to 1.6-fold increase in physical inactivity and severe obesity. Physical abuse and verbal abuse were most strongly associated with body weight and obesity. Compared with no physical abuse (55%), being "often hit and injured" (2.5%) had a 4.0-kg (95% CI: 2.4-5.6 kg) greater weight and a 1.4 (1.2-1.6) relative risk of BMI \geq 30. Compared with no verbal abuse (53%), being "often verbally abused" (9.5%) had an relative risk of 1.9 (1.3-2.7) for BMI \geq 40. Obesity risk increased with number of occurrences and severity of each type of abuse. The population-attributable fraction for "any mention" of abuse (67%) was 8% (3.4%-12.3%) for BMI \geq 30 and 17.3% (-1.0% to 32.4%) for BMI \geq 40. Another study by Whitaker and colleagues⁴⁵ also found that neglected children were at greater risk of becoming obese (OR 1.56, 95% CI, 1.14-2.14), after controlling for birth weight, maternal obesity, and multiple economic factors.

National data do not indicate a significant difference in the incidence of physical and emotional abuse

Table. Rural/Urban Comparisons of Traditional and Emerging, Nontraditional Target Behaviors Related to Youth Obesity

	Rural	Urban	Sample	Author/Date	Notes
Nutrition Behaviors					
↓ <i>Breastfeeding</i>					
Exclusive breastfeeding through 3 mo, % (CI)	23.9% (21.8-26.0)	Central city 30.7% (29.0-32.4) Non-central city 32.8% (30.9-34.7)	NIS, 2004	CDC, 2007 ⁵⁹	National sample
Exclusive breastfeeding through 6 mo, % (CI)	8.2% (6.9-9.5)	Central city 11.7% (10.5-12.9) Non-central city 12.1% (10.8-13.4)	NIS, 2004	CDC, 2007 ⁵⁹	National sample
↓ <i>Fruit and vegetable (adult)</i>					
Mean servings (SE)	4.0 (0.09) White 3.6 (0.13) AA	5.0 (0.06) White 4.6 (0.13) AA	1,699 adults Lower MS Delta (rural); 1994-1996, 1998 CSFII (urban)	Champagne et al, 2004 ⁶⁰	Regional sample
Mean servings (SE)	4.6 (0.10)	5.0 (0.10)	1994-1996 CSFII	Krebs-Smith et al, 2001 ⁶¹	National sample
↓ <i>Fruit and vegetable (child)</i>					
Mean servings (SE)	3.3 (0.21) White 4.2 (0.21) AA	4.2 (0.08) White 4.1 (0.11) AA	485 children Lower MS Delta (rural); 1994-1996, 1998 CSFII (urban)	Champagne et al, 2004 ⁶⁰	Regional sample
↑ <i>Caloric imbalance</i>					
↑ Portion sizes	NA				
↑ Sweetened beverages (Mean % total daily energy) ^a	9.4%	8.3%	1994-1996, 1998 Child Supplement CSFII	Adair and Popkin, 2005 ⁶²	National sample
↑ Fast food/↓ family meals (Mean % total daily energy away from home) ^a	37.4%	34.1%	1994-1996, 1998 Child Supplement CSFII	Adair and Popkin, 2005 ⁶²	National sample
Physical Activity Behaviors					
↓ Physical activity ^{a,b,c}	73.1%	68.2%	NHIS 2006	NCHS, 2008 ⁶³	National sample
↑ Sedentary activity ^{a,b}	46.4%	38%	NHIS 2006	NCHS, 2008 ⁶³	National sample
↑ Electronic media use (% TV watching/nonschool computer use >2 h/d [SE])	48.4% (0.7)	47.5% (0.5)	NSCH 2003-2004	Liu et al, 2008 ⁶⁴	National sample

Table. Continued

Emerging, Nontraditional Behaviors	Rural	Urban	Sample	Author/Date	Notes
<i>Pregnancy</i>					
↑ Weight gain during pregnancy	NA				
↑ Smoking during pregnancy	NA				
Teen pregnancy	NA				
<i>Child abuse</i>					
Emotional abuse (incidence rates per 1,000 children)	2.9466 (1.45863)	Major urban 1.8654 (0.26484) Urban 4.2894 (1.29192)	NIS-3, 1996	Sedlak and Broadhurst, 1996 ⁴⁶	National sample
Physical abuse (incidence rates per 1,000 children)	6.6172 (1.95234)	Major urban 3.6356 (0.54246) Urban 7.2198 (1.83442)	NIS-3, 1996	Sedlak and Broadhurst, 1996 ⁴⁶	National sample

AA indicates African American; CDC, Centers for Disease Control and Prevention; CI, confidence interval; MS, Mississippi; NA, data not available; CSFII, Continuing Survey of Food Intakes by Individuals; NHIS, National Health Interview Survey; NIS, National Immunization Survey; NSCH, National Survey of Children's Health.
 Note: All comparisons were significantly different at $P \leq .05$ or less except electronic media use and emotional and physical abuse. Significance not reported for sweetened beverage intake, total daily energy consumed away from home, physical activity, and sedentary activity.
^aStandard error not reported; ^b“Outside MSA” (metropolitan statistical area) considered rural; ^cReversed percentages to determine percentage not getting regular physical activity.

between urban and rural areas;⁴⁶ however, these rates could be affected by limited access to care in rural areas resulting in a reduced likelihood of abuse being identified and reported.⁴⁷ Further, the ability of rural areas to treat and respond to confirmed cases of abuse may exacerbate the problem. Rural counties may be ill equipped to provide mental health services to abused children even when symptoms are chronic,⁴⁸ thereby possibly contributing to obesity in these children.

Rural-Urban Comparison of Traditional and Emerging Nontraditional Factors

The Table provides rural-urban comparisons on the traditional and emerging nontraditional contributors to childhood overweight. Data are included only from national or large regional samples in which differences in urban-rural populations could be evaluated using the same measures and were as representative of the total US as possible. Because data allowing for urban-rural comparisons of children's nutrition and physical activity behaviors are very limited, adult rural data are included if children's data are lacking. Parents are important role models for children; they share the same environment, and their health behaviors are correlated.^{49,50} Collectively, these data indicate that rural youth are at greater risk for obesity.

IMPLICATIONS FOR RESEARCH AND PRACTICE

This report is not meant to be an exhaustive review of the contributing factors to rural childhood obesity and is limited by the availability of data related to the presented emerging topics. Despite these limitations, this report highlights important factors that practitioners need to consider when planning and implementing obesity prevention programs. The Davison and Birch model of childhood obesity²⁰ has been expanded to include emerging, nontraditional factors including prevention of teenage pregnancy, smoking during pregnancy, maternal obesity, and child

abuse. Rural youth are particularly susceptible to both traditional and emerging, nontraditional factors that are linked to obesity. It is unlikely that a rural community would have the resources to initially address all of the issues related to prevention of obesity among youth. However, with recognition of the complex nature of this issue as explored here, factors can be systematically incorporated into existing programs as resources, partners, and opportunities become available so that a comprehensive approach is ultimately achieved.

Practically speaking, it is essential for researchers and communities to take advantage of existing program planning tools, such as *The Community Guide*⁵¹ and *Children and Weight: What Communities Can Do*.⁵² No existing tools, programs, or curricula that include all the traditional and emerging nontraditional factors specified in the enhanced model were found. However, some general tools may be helpful in establishing partnerships and assessing communities.⁵¹⁻⁵⁸ A good first step is to conduct a needs assessment and asset evaluation to determine the extent to which each factor influences a community's childhood obesity rates.⁵⁶ Community-based participatory strategies will ensure that prevention targets and strategies are relevant to each community. For all those involved in youth obesity prevention efforts in rural areas, this report points toward the need for increased awareness and training about the impact of the traditional and emerging nontraditional factors and the need for collaboration among agencies and researchers who are currently addressing each of these issues separately.

REFERENCES

1. Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion. Childhood Overweight and Obesity: Contributing Factors. Centers for Disease Control and Prevention Web site. <http://www.cdc.gov/obesity/childhood/causes.html>. Updated March 3, 2011. Accessed April 8, 2011.
2. Krebs NF, Jacobson MS; for the American Academy of Pediatrics Committee on Nutrition. Prevention of pediatric overweight and obesity. *Pediatrics*. 2003;112:424-430.
3. American Dietetic Association. Position of the American Dietetic Association: individual-, school-, and community-based interventions for pediatric overweight. *J Am Diet Assoc*. 2006;106:925-945.
4. Texas Department of State Health Services. *Strategic Plan for the Prevention of Obesity in Texas: 2005-2010*. Austin, TX: Texas Department of State Health Services; 2006. http://www.dshs.state.tx.us/obesity/pdf/strategic_plan.pdf. Accessed April 8, 2011.
5. Bowman SA, Gortmaker SL, Ebbeling CB, Pereira MA, Ludwig DS. Effects of fast-food consumption on energy intake and diet quality among children in a national household survey. *Pediatrics*. 2004;113:112-118.
6. Guthrie JF, Lin BH, Frazao E. Role of food prepared away from home in the American diet, 1977-78 versus 1994-96: changes and consequences. *J Nutr Educ Behav*. 2002;34:140-150.
7. Burgess-Champoux TL, Larson N, Neumark-Sztainer D, Hannan PJ, Story M. Are family meals patterns associated with overall diet quality during the transition from early to middle adolescence? *J Nutr Educ Behav*. 2009;41:79-86.
8. Nicklas TA, Morales M, Linares A, et al. Children's meal patterns have changed over a 21-year period: the Bogalusa Heart Study. *J Am Diet Assoc*. 2004;104:753-761.
9. Congressional Research Service. *Agriculture: A Glossary of Terms, Programs, and Laws, 2005*. Washington, DC: Congressional Research Service, Library of Congress; 2005. <http://ncseonline.org/nle/crsreports/05jun/97-905.pdf>. Accessed April 8, 2011.
10. Lutfiyya MN, Lipsky MS, Wisdom-Behounek J, Inpanbutr-Martinkus MI. Is rural residency a risk factor for overweight and obesity for U.S. children? *Obesity*. 2007;15:2348-2356.
11. Borders TF, Rohrer JE, Cardarelli KM. Gender-specific disparities in obesity. *J Community Health*. 2006;31:57-68.
12. Jackson JE, Doescher MP, Jerant AF, Hart LG. A national study of obesity prevalence and trends by type of rural county. *J Rural Health*. 2005;21:140-148.
13. Tai-Seale T, Chandler C. Nutrition and overweight concerns in rural areas: a literature review. In: *Rural Healthy People 2010: A Companion Document to Healthy People 2010*. Vol 2. College Station, TX: The Texas A&M University System Health Science Center, School of Rural Public Health, Southwest Rural Health Research Center; 2003.
14. McMurray RG, Harrell JS, Bangdiwala SI, Deng S. Cardiovascular disease risk factors and obesity of rural and urban elementary school children. *J Rural Health*. 1999;15:365-374.
15. Lacar ES, Soto X, Riley WJ. Adolescent obesity in a low-income Mexican American district in South Texas. *Arch Pediatr Adolesc Med*. 2000;154:837-840.
16. Census 2000 Population Statistics. US Department of Transportation, Federal Highway Administration Web site. <http://www.fhwa.dot.gov/planning/census/cps2k.htm>. Updated April 1, 2011. Accessed April 8, 2011.
17. The National Advisory Committee on Rural Health and Human Services. *The 2005 Report to the Secretary: Rural Health and Human Service Issues*. Washington, DC: US Department of Health and Human Services; 2005. <ftp://ftp.hrsa.gov/ruralhealth/NAC2005.pdf>. Accessed April 8, 2011.
18. Blanchard T, Lyson T. *Food Availability and Food Deserts in the Nonmetropolitan South*. Mississippi State, MS: Southern Rural Development Center; 2006. http://srdc.msstate.edu/publications/other/foodassist/2006_04_blanchard.pdf. Accessed April 8, 2011.
19. Johnson DB, Gerstein DE, Evans AE, Woodward-Lopez G. Preventing obesity: a life cycle perspective. *J Am Diet Assoc*. 2006;106:97-102.
20. Davison KK, Birch LL. Childhood overweight: a contextual model and recommendations for future research. *Obes Rev*. 2001;2:159-171.
21. Catalano PM. Obesity and pregnancy—the propagation of a vicious cycle? *J Clin Endocrinol Metab*. 2003;88:3505-3506.
22. Whitaker RC. Predicting preschooler obesity at birth: the role of maternal obesity in early pregnancy. *Pediatrics*. 2004;114:e29-e36.
23. Wolfe WS, Sobal J, Olson CM, Frongillo EA Jr, Williamson DF. Parity-associated weight gain and its modification by sociodemographic and behavioral factors: a prospective analysis in US women. *Int J Obes Relat Metab Disord*. 1997;21:802-810.
24. Boney CM, Verma A, Tucker R, Vohr BR. Metabolic syndrome in childhood: association with birth weight, maternal obesity, and gestational diabetes mellitus. *Pediatrics*. 2005;115:e290-e296.

25. Monasta L, Batty GD, Cattaneo A, et al. Early-life determinants of overweight and obesity: a review of systematic reviews. *Obes Rev.* 2010;11:695-708.
26. Toschke AM, Montgomery SM, Pfeiffer U, von Kries R. Early intra-uterine exposure to tobacco-inhaled products and obesity. *Am J Epidemiol.* 2003;158:1068-1074.
27. Oken E, Levitan EB, Gillman MW. Maternal smoking during pregnancy and child overweight: systematic review and meta-analysis. *Int J Obes (Lond).* 2008;32:201-210.
28. Al Mamun A, Lawlor DA, Alati R, O'Callaghan MJ, Williams GM, Najman JM. Does maternal smoking during pregnancy have a direct effect on future offspring obesity? Evidence from a prospective birth cohort study. *Am J Epidemiol.* 2006;164:317-325.
29. Chen A, Pennell ML, Klebanoff MA, Rogan WJ, Longnecker MP. Maternal smoking during pregnancy in relation to child overweight: follow-up to age 8 years. *Int J Epidemiol.* 2006;35:121-130.
30. Fasting MH, Øien T, Storø O, Nilsen TI, Johnsen R, Vik T. Maternal smoking cessation in early pregnancy and offspring weight status at four years of age. A prospective birth cohort study. *Early Hum Dev.* 2009;85:19-24.
31. Mendez MA, Torrent M, Ferrer C, Ribas-Fitó N, Sunyer J. Maternal smoking very early in pregnancy is related to child overweight at age 5-7 y. *Am J Clin Nutr.* 2008;87:1906-1913.
32. Oken E, Huh SY, Taveras EM, Rich-Edwards JW, Gillman MW. Associations of maternal prenatal smoking with child adiposity and blood pressure. *Obes Res.* 2005;13:2021-2028.
33. Toschke AM, Koletzko B, Slikker W Jr, Hermann M, von Kries R. Childhood obesity is associated with maternal smoking in pregnancy. *Eur J Pediatr.* 2002;161:445-448.
34. Office of Maternal and Child Health. *Maternal and Child Health Assessment.* Olympia, WA: Washington State Department of Health; 2006. http://www.doh.wa.gov/cfh/mch/mch_assessment/mchdatareport/mchdatarepthome.htm. Accessed April 8, 2011.
35. Nebraska Health and Human Services System. *Rural 2010 Health Goals and Objectives for Nebraska.* Lincoln, NE: Nebraska Department of Health and Human Services; 2004. <http://dhhs.ne.gov/pub/oph/docs/Rural-2010.pdf>. Accessed April 8, 2011.
36. Nielsen JN, O'Brien KO, Witter FR, et al. High gestational weight gain does not improve birth weight in a cohort of African American Adolescents. *Am J Clin Nutr.* 2006;84:183-189.
37. Howie LD, Parker JD, Schoendorf KC. Excessive maternal weight gain patterns in adolescents. *J Am Diet Assoc.* 2003;103:1653-1657.
38. Institute of Medicine. *Weight Gain during Pregnancy: Reexamining the Guidelines.* Washington, DC: The National Academies Press; 2009. <http://www.iom.edu/Reports/2009/Weight-Gain-During-Pregnancy-Reexamining-the-Guidelines.aspx>. Accessed April 8, 2011.
39. Eberhardt MS, Ingram DD, Makuc DM, et al. *Urban and Rural Health Chartbook. Health, United States, 2001.* Hyattsville, MD: National Center for Health Statistics; 2001. <http://www.cdc.gov/nchs/data/hus/01.pdf>. Accessed April 8, 2011.
40. Bennett T, Skatrud JD, Guild P, Loda F, Klerman LV. Rural adolescent pregnancy: a view from the South. *Fam Plan Perspect.* 1997;29: 256-260,267.
41. Alvarez J, Pavao J, Baumrind N, Kimerling R. The relationship between child abuse and adult obesity among California women. *Am J Prev Med.* 2007;33:28-33.
42. Felitti VJ, Anda RF, Nordenberg D, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. *Am J Prev Med.* 1998;14:245-258.
43. Greenfield EA, Marks NF. Violence from parents in childhood and obesity in adulthood: using food response to stress as a mediator of risk. *Soc Sci Med.* 2009;68:791-798.
44. Williamson DF, Thompson TJ, Anda RF, Dietz WH, Felitti V. Body weight and obesity in adults and self-reported abuse in childhood. *Int J Obes.* 2002;26:1075-1082.
45. Whitaker RC, Phillips SM, Orzol SM, Burdette HL. The association between maltreatment and obesity among preschool children. *Child Abuse Negl.* 2007;31:1187-1199.
46. Sedlak AJ, Hantman I, Schultz D. *The Third National Incidence Study of Child Abuse and Neglect.* Washington, DC: National Center on Child Abuse and Neglect, Administration on Children, Youth and Families, US Department of Health and Human Services; 1997.
47. The National Advisory Committee on Rural Health and Human Services. *The 2009 Report to the Secretary: Rural Health and Human Services Issues.* Washington, DC: US Department of Health and Human Services; 2009. <http://www.hrsa.gov/advisorycommittees/rural/2009secrpt.pdf>. Accessed April 19, 2011.
48. Anderson RL, Estle G. Predicting level of mental health care among children served in a delivery system in a rural state. *J Rural Health.* 2001;17: 259-265.
49. Scaglioni S, Salvioni M, Galimberti C. Influence of parental attitudes in the development of children eating behavior. *Br J Nutr.* 2008;99(suppl 1):S22-S25.
50. Tibbs T, Haire-Joshu D, Schechtman KB, et al. The relationship between parental modeling, eating patterns, and dietary intake among African-American parents. *J Am Diet Assoc.* 2001;101:535-541.
51. The Guide to Community Preventive Services. Obesity Prevention and Control. The Community Guide Web site. <http://www.thecommunityguide.org/obesity/index.html>. Updated August 30, 2010. Accessed April 8, 2011.
52. University of California Agriculture and Natural Resources. *Children and Weight: What Communities Can Do.* Davis, CA: University of California Agriculture and Natural Resources; 2002. Publication 3422.
53. Centers for Disease Control and Prevention. Guidelines for school and community programs to promote lifelong physical activity among young people. *MMWR.* 1997;46:RR-6. <ftp://ftp.cdc.gov/pub/Publications/mmwr/rr/rr4606.pdf>. Accessed April 8, 2011.
54. Centers for Disease Control and Prevention. Recommended community strategies and measurements to prevent obesity in the United States. *MMWR.* 2009; 58:RR-7. <http://www.cdc.gov/mmwr/pdf/rr/rr5807.pdf>. Accessed April 8, 2011.
55. Keener D, Goodman K, Lowry A, Zaro S, Kettel Khan L. *Recommended Community Strategies and Measurements to Prevent Obesity in the United States: Implementation and Measurement Guide.* Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention; 2009. http://www.cdc.gov/obesity/downloads/community_strategies_guide.pdf. Accessed April 8, 2011.
56. University of Kansas, Work Group for Community Health and Development. The Community Tool Box. Community Tool Box Web site. <http://ctb.ku.edu/en/>. Accessed April 8, 2011.

57. Berg F, Buechner J, Parham E: for the Weight Realities Division of the Society for Nutrition Education. Guidelines for childhood obesity prevention programs: promoting healthy weight in children. *J Nutr Educ Behav.* 2003;35:1-4.
58. United States Department of Health and Human Services. *Healthy People in Healthy Communities. A Community Planning Guide Using Healthy People 2010.* Washington, DC: US Government Printing Office; 2001. <http://www.doh.state.fl.us/COMPASS/documents/HealthyPeopleinHealthyCommunitiesGuide.pdf>. Accessed April 19, 2011.
59. Centers for Disease Control and Prevention. Breastfeeding trends and updated national health objectives for exclusive breastfeeding—United States, birth years 2000–2004. *MMWR.* 2007;56:760-763.
60. Champagne CM, Bogle ML, McGee BB, et al. Dietary intake in the lower Mississippi delta region: results from the Foods of Our Delta Study. *J Am Diet Assoc.* 2004;104:199-207.
61. Krebs-Smith SM, Kantor LS. Choose a variety of fruits and vegetables daily: understanding the complexities. *J Nutr.* 2001;131(2 suppl 1):487S-501S.
62. Adair LS, Popkin BM. Are child eating patterns being transformed globally? *Obes Res.* 2005;13:1281-1299.
63. National Center for Health Statistics. *Leisure-time Physical Activity among Adults 18 Years of Age and over, by Selected Characteristics: United States, 1998, 2005, and 2006.* Hyattsville, MD: National Center for Health Statistics; 2008.
64. Liu J, Bennett KJ, Harun N, Probst JC. Urban-rural differences in overweight status and physical inactivity among US children aged 10–17 years. *J Rural Health.* 2008;24:407-415.

The *Journal of Nutrition Education and Behavior*
welcomes the following new members to the Board of Editors:

✧ James Hersey, PhD ✧
RTI International

✧ G.M. Subba Rao, PhD ✧
National Institute of Nutrition, India

✧ Julie Kennel, PhD, RD, LD ✧
The Ohio State University

✧ Julie Reeder, PhD, MPH, CHES ✧
Oregon Health Authority,
Public Health, WIC Program

✧ Seung-Yeon Lee, PhD ✧
University of Cincinnati

✧ Christopher Alan Taylor, PhD, RD, LD ✧
The Ohio State University
Medical Center

✧ Lisa Nicholson, PhD, RD ✧
California Polytechnic State University