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Childhood obesity continues to be a major public health problem in the United States. If this problem is unresolved, some children will be at risk for disorders such as type 2 diabetes, high blood pressure, and cancer and will become a high economic and social burden for society. Using the National Longitudinal Survey of Youth, Child and Young Adult sample ($N = 6,643$), this study examined the relationship between the effect of pre- and postnatal characteristics and obesity. The findings of this study show that the probability of childhood obesity can be lessened if pregnant women do not smoke and do not gain significant pregnancy-related weight. Moreover, breast feeding and health insurance were also found to be correlated to avoiding childhood obesity.

KEY WORDS: *child welfare; health; obesity; postnatal care; prenatal care*

In 2001, the surgeon general reported that health problems resulting from obesity would rival the number of diseases and deaths resulting from smoking. The report also warned that if this problem remained unabated, many health care achievements made in the 20th century would be undermined (U.S. Department of Health and Human Services [HHS], 2001). In light of this sobering estimate, childhood obesity has become a major public health problem in the United States. Estimating from past and current trajectories, the rate of obesity will continue to increase before it stabilizes. The latest report from the Centers for Disease Control and Prevention (CDC) (2011) shows that the rate of childhood obesity has tripled since the 1980s, with about 12.5 million (approximately 17 percent) obese children ages two to 19. The risk for obesity is particularly high for children who come from low-income or minority families. To make matters worse, Bell et al. (2011) noted that the obesity rate is continuing to increase, and children who already are heavy are getting heavier.

Obesity may have several harmful consequences for children. Obese children are vulnerable to various health risks. For instance, many will likely develop high blood pressure and high cholesterol, which increase the risk for cardiovascular diseases. Obesity is also associated with type 2 diabetes through glucose intolerance and insulin resistance (Bell et al., 2011; Daniels, 2009). Furthermore, obese children could face social stigma, which can lead to discrimination and loss of self-esteem (Vamosi, Heitmann, Thinggaard, & Kyvik, 2011). Financially, the burden associated with obesity for individuals and society can be substantial. Though there are no specific data on the costs of obesity in children alone, when looking at costs for children and adults together (both medical costs and the cost of lost productivity from premature death and restricted labor activities associated with obesity), the total economic cost was $147 billion in 2008 dollars (Finkelstein, Trogdon, Cohen, & Dietz, 2009).

Although the knowledge base on adult and adolescent obesity is increasing and several state and federal policies are in place to manage this problem, studies of early-onset childhood obesity are less common. However, a number of epidemiological studies have indicated that the risk for childhood obesity is highly associated with pre- and postnatal factors such as mother's weight during pregnancy, smoking, breast feeding, and child care—among other factors (Cnattingius, Villamore, Lagerros, Wikeström, & Granath, 2012; Harder, Bergmann, Kallischnigg, & Plagemann, 2005; Ino, Shibuya, Saito, & Inaba, 2011). These and other studies seem to support the premise that the risk for obesity is rooted in prenatal care and continues through various phases of childhood development. As a result, we examined the impact of prenatal and postnatal characteristics on childhood obesity.

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LITERATURE REVIEW

Obesity, like many other health problems, results from a complex interplay of biological, social, and behavioral factors. Biologically, Neel (1962) postulated in his thrifty gene hypothesis that some people are more disposed to gaining weight because evolutionary processes have increased fat stores as a reaction to food scarcity. If that is the case, natural selection may have favored and preserved individuals whose genes are able to minimally metabolize energy over the many cycles of abundance and scarcity. Though studies are still preliminary and genetic mechanisms are not yet fully understood, a number of researchers have identified several common genetic markers they believe might contribute to childhood obesity and various forms of fat storage around major organs (Hamilton et al., 2010; Han, Lawlor, & Kimm, 2010).

Although it seems clear that genetics are linked to adiposity, social and behavioral factors are an equal or even more important element. Lifestyle changes over the past several decades may be one cause of higher obesity rates. Studies have shown that people who eat meals prepared from scratch in the home consume less and get more healthy foods like fruits and vegetables. However, there is increasing evidence that the consumption of high-caloric foods from restaurants is more common because people have less time to prepare food at home than in the past (Brown & Hermann, 2005). Many restaurant foods are less nutritious, less healthy, and more abundant in size than home-cooked meals (Bowman & Vinyard, 2004; Brown & Hermann, 2005; Diliberti, Bordi, Conklin, & Rolls, 2004). The lack of physical exercise and increased time using computers, watching television, and other sedentary activities only compound matters (de Jong et al., 2013; Han et al., 2010; Tucker & Tucker, 2011). Weight gain is likely if someone consumes more calories than his or her body can metabolize (Han et al., 2010; Tucker & Tucker 2011). Poor eating habits and sedentary lifestyles have compromised the body's ability to metabolize unwanted calories.

Although genetics, food intake, and physical activity all have an impact on obesity, there is literature that shows that the progression of obesity begins as early as pregnancy and continues into the postnatal period (Cnattingius et al., 2012). Understanding the process leading to early-onset childhood obesity can be an important way of managing the growing problem of obesity in the United States.

Impact of Prenatal Influence

It has been shown that prenatal behavior has a significant bearing on childhood obesity. For example, women who smoke regularly during pregnancy are at greater risk for having overweight children (Ino et al., 2011; Toschke, Koletzko, Slikker, Hermann, & von Kries, 2002). Similarly, obese pregnant women are susceptible to intrauterine complications and other health problems—especially if they gain excessive weight while pregnant. Although not all factors are understood, Hamilton et al. (2010) found that fetal exposure to changes in the intrauterine function of an obese pregnant woman was an important factor that contributed to the infant's weight gain and increased level of adiposity in the first year of life. In a similar study, Misra, Trudeau, and Perni (2011) found that maternal serum lipid levels in obese women were higher than those in normal-weight women. They believe this increase in lipid levels affected the intrauterine environment and eventual development of the fetus.

Ananth and Wen (2002) argued that unhealthy infant birthweight in the United States and Canada in the last decade can be attributed to women's high body mass index (BMI). Similar patterns have been observed in some parts of Europe (Surkan, Hsieh, Johansson, Dickman, & Cnattingius, 2004). It is interesting that there appears to be an intergenerational relationship between the child's birthweight and the mother's BMI. Cnattingius et al. (2012), using data from the Swedish Medical Birth Registry, reported that there is an intergeneration cycle of obesity between obese pregnant women and their female offspring. Their study shows that girls born of obese mothers tend to develop obesity, and they, in turn, give birth to larger-for-gestational-age offspring.

Impact of Postnatal Influence

Although prenatal care should have a significant impact on childhood obesity, postnatal care should also play an important role. Breast feeding, which has vital health benefits for infants, may be one significant predictor of healthy weight. Recently, HHS (2011) reported that breast feeding reduced common childhood diseases such as diarrhea, ear infections, respiratory infections, and type 2 diabetes, among other health outcomes. In addition to

these benefits, breast feeding has been linked to lower incident rates of obesity among neonates. Kramer (1981) first showed a negative relationship between breast feeding and obesity and children—a finding supported by other researchers (for example, Harder et al., 2005; Owen et al., 2005). Together, these studies show that breast feeding has significant protective effects for children, even after accounting for sociodemographic factors. Yet it is unclear why breast feeding has a protective effect on childhood obesity. Some conjecture that it could be the healthy lifestyle of parents who breast feed, or it may be some biological factor or hormones at work. Although each of these explanations may have merit, no definitive answers are yet available (CDC, 2007).

In addition to breast feeding, it appears that outside child care is also associated with childhood obesity. Unfortunately, there is no definitive evidence indicating such a relationship. However, various researchers and policymakers have suggested that childhood obesity can be diminished through child care facilities that provide nutritious meals, healthy snacks, and time for physical activities (Larson, Ward, Neelon, & Story, 2011; Story, Kaphingst, & French, 2006). A final important postnatal factor associated with childhood obesity is access to health care. With health insurance, parents can more effectively seek medical attention from community services and resources to address combating obesity and better attend to its effects (Whelan, Russell, & Sekhar, 2010).

It is probable that when these pre- and postnatal factors, along with relevant sociodemographic characteristics, are taken into account, a more accurate picture on childhood obesity will emerge (Wen, Simpson, Baur, Rissel, & Flood, 2011). Our study examined the relationship between prevalence of childhood obesity and pre- and postnatal characteristics.

METHOD

We used the National Longitudinal Survey of Youth, 1979 (NLSY79)-Children and Young Adults (henceforth, NLSY-CYA) data to analyze the likelihood of obesity in five- and 10-year-old children. Respondents in the NLSY-CYA data are the children of the women sampled in the NLSY1979 cohort via a separate survey that began in 1986. Like NLSY79, the data are longitudinal, and the survey was administered annually until 1994 and biennially since. Data are available from 1986 to 2010. Data on mothers were first collected in 1979 and are representative of children born to women living in the United States in 1978 who were born between 1957 and 1965. Thus, mothers were between the ages of 43 and 51 years in 2009 and could have been as old as 46 and have a five-year-old child. There are a number of advantages in using the NLSY-CYA data. First, data on the health behaviors of mothers while pregnant are readily available because NLSY79 has a complete and detailed fertility history that has been collected each year from 1979 to 2008. Second, we have information on the prenatal, postnatal, and other health behaviors because of the data's link to a comprehensive survey of the mothers' deliveries. The data in this area are extensive and among the best collected at the ages of interest. Third, we know about childhood experiences from the data, such as child care arrangements.

For our analysis, we took snapshots of obesity at ages five and 10, while still taking advantage of the NLSY-CYA's longitudinal nature. We included respondents with valid responses on height and weight so that we could calculate a child's BMI. Of course, children had to be age five or 10 to be eligible to be in our sample. We also included children from biannual survey years who were five or 10 years of age in a nonsurvey year. Thus, our five-year-old sample could include some six-year-olds and our 10-year-old sample included a limited number of 11-year-olds. Of the nearly 8,500 eligible children in the data set, our sample of five-year-olds had 6,330 respondents, and our sample of 10-year-olds had 6,634 respondents. Of the almost 2,000 respondents in the NLSY-CYA who were not in our study, the majority were either too young or too old to ever be included in our analyses. As a reference, we include a correlation matrix for ages five and 10 in Appendices A and B. Full demographic characteristics of our sample are reported in Table 1.

Dependent Variables

Our dependent measures are dichotomous variables indicating whether the respondent was obese at age five or age 10. To operationalize these measures, we used age-specific cutoffs for obesity as defined by the CDC (Ogden & Flegal, 2010). Age-specific BMI (BMI greater than 20 at age five and BMI greater than 25 at age 10) has been linked

Table 1: Descriptive Statistics for Independent Variables on Obesity Outcomes at Ages Five and 10

			Age Five				Age 10			
	Range		Obese (n = 839)		Not Obese (n = 5,496)		Obese (n = 736)		Not Obese (n = 5,898)	
Variable	Min	Max	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Prenatal care and characteristics										
No prenatal care	0	1	0.012	–	0.011	–	0.014	–	0.012	–
Mother drank alcohol regularly in year before birth	0	1	0.390	–	0.453	–	0.366	–	0.435	–
Mother smoked regularly in year before birth	0	1	0.354	–	0.279	–	0.337	–	0.297	–
Mother used marijuana in year before birth	0	1	0.026	–	0.025	–	0.027	–	0.026	–
Gained 50 pounds or more	0	1	0.136	–	0.112	–	0.153	–	0.111	–
Maintained or lost weight	0	1	0.029	–	0.023	–	0.043	–	0.017	–
Born premature	0	1	0.120	–	0.122	–	0.126	–	0.113	–
Born via cesarean section	0	1	0.230	–	0.241	–	0.238	–	0.217	–
Postnatal care and characteristics										
Breastfed in first year	0	1	0.387	–	0.519	–	0.344	–	0.458	–
Attended day care between age 0 and 3	0	1	0.592	–	0.655	–	0.611	–	0.620	–
Child is insured	0	1	0.641	–	0.727	–	0.636	–	0.723	–
Sociodemographic characteristics										
Non-Hispanic black	0	1	0.338	–	0.270	–	0.435	–	0.303	–
Hispanic	0	1	0.234	–	0.199	–	0.221	–	0.210	–
Female	0	1	0.489	–	0.485	–	0.523	–	0.494	–
Mother high school graduate	0	1	0.393	–	0.384	–	0.376	–	0.379	–
Mother attended college	0	1	0.207	–	0.226	–	0.190	–	0.233	–
Mother college graduate	0	1	0.085	–	0.184	–	0.098	–	0.142	–
Mother's age at birth	14	42	25.688	–	27.260	–	24.882	–	24.875	–
Year born	1974	2001	1985	6.207	1988	4.575	1985	6.069	1985	4.836
Birth order	1	10	1.950	1.193	2.118	1.178	1.939	1.103	1.922	1.072
Obese at age five	0	1					0.244	–	0.138	–

to a number of health outcomes and has greater reliability for measuring obesity than standard BMI measures that do not account for age-related wellness issues (Cole, Bellizzi, Flegal, & Dietz, 2000). This is in contrast to the World Health Organization (WHO) (2012) definitions of obesity, which do not account for age but use a standard cut point of 30. Using WHO's definition would have made 6.59 percent of five-year-olds obese and 4.05 percent of 10-year-olds obese. Using the CDC's age-specific definitions, 13.23 percent of our five-year-old sample and 11.10% of our 10-year-old sample qualified as obese.

Key Independent Variables

We included a number of measures for pre- and postnatal care and characteristics in our models. We included several measures of mother's prenatal health behaviors in our models. These measures were all dichotomous and measured in the nine to 12 months preceding the child's birth and included the following: had no prenatal care prior to birth, regularly consumed alcohol in the year preceding birth, regularly smoked cigarettes in the year before birth, and regularly smoked marijuana in the year before birth. We also included measures for the mother's weight gain during pregnancy through a set of dichotomous variables. These variables indicate whether the mother gained 50 or more pounds during pregnancy, gained one to 49 pounds (excluded as the reference), or either failed to gain or lost weight. Our final prenatal measures indicate whether the child was born prematurely or via cesarean section through dichotomous measures.

Although postnatal measures are less robust, we included three important characteristics in our models. First, we included a measure that indicates whether mothers breast fed their child for at least 12 months (with regular, age-appropriate breast feeding). Second, a dichotomous measure for day care attendance at any time between birth and three years of age was included in our model. Finally, we included a dichotomous variable that measured whether the child was covered by health insurance at age five or age 10. This health insurance could come from either a private (for example, through a parent's employer) or a public (for example, Medicaid) source.

Control Variables

We included a number of important sociodemographic characteristics in our models as control variables. Racial and ethnic background of the child was measured through dichotomous variables indicating whether the respondent was non-Hispanic black, Hispanic, or not black or Hispanic. Although this operationalization of race and ethnicity is far from ideal, we were limited by the data set, which only included these three racial and ethnic categories in the survey. The child's gender was measured through a dichotomous variable: female = 1, male = 0. Obesity is strongly associated with socioeconomic status (SES) (Singh-Manoux et al., 2008), with more disadvantaged individuals having a higher likelihood of unhealthy weight. We included variables that help approximate SES by measuring mother's educational attainment. We operationalized SES in this way because educational attainment is a more stable measure than alternatives such as income or occupational status. Furthermore, education is strongly associated with socioeconomic trajectory. These measures included the following: mother did not graduate from high school (excluded as reference), mother is a high school graduate, mother attended college, and mother is a college graduate. These variables were constructed from a measure in NLSY79 for total years of education. We also included measures for important age and period effects with continuous measures for mother's age at the child's birth and the year in which the child was born. We also included a control for birth order. This variable was measured continuously. Finally, in our models for age 10, we also included a control for obesity at age five.

Analytic Strategy

We used logistic regression to model the impact of pre- and postnatal care and characteristics on our two outcomes: obesity at age five and obesity at age 10. Although logistic regressions produce log odds, these coefficients are easily converted to odds ratios (*OR*s), which indicate the odds of an outcome happening, based on a given characteristic, and range from zero to positive infinity. We converted our log odds to *OR*s for ease of interpretation. These results are reported in Tables 2 and 3. Results above 1 indicate that the variable has a positive effect on the outcome, or in our study, increases the likelihood of being obese, while numbers below 1 indicate that the variable decreases the odds of being obese. *OR*s of 1 indicate equal odds of either being or not being obese.

We applied a nested modeling strategy to understand the impact of pre- and postnatal care and characteristics on obesity in children. Each outcome has five models applied to it. The first model includes our prenatal measures; model 2 includes these variables and our statistical controls. Model 3 is limited to our postnatal measures, and model 4 includes both postnatal measures and our control variables. Finally, model 5 includes all variables in our analysis.

RESULTS

Descriptive Statistics

The descriptive results of obesity at age five and age 10 are reported in Table 1. We report results for each variable by obesity status at a given age. Lack of prenatal care had little effect on obesity at either age, which is not surprising given that some form of prenatal care is nearly universal. Alcohol consumption did not support obesity at either age, but smoking cigarettes did. Children whose mothers smoked were slightly more likely to be obese than not. There was virtually no difference in obesity across marijuana usage. Mothers who gained a significant amount of weight were slightly more likely to have obese 10-year-old children, as were women who maintained or lost weight.

For our postnatal characteristics, breast feeding and insurance decreased the likelihood of obesity in children. Our demographic and control variables show substantial differences in the likelihood of obesity. Non-Hispanic black and Hispanic children were more likely to be obese than not, but

Table 2: Odds Ratios for the Effect of Prenatal and Postnatal Care and Characteristics on the Likelihood of Obesity at Age Five

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Prenatal care and characteristics					
No prenatal care	0.994	0.834			0.808
Mother drank alcohol regularly in year before birth	0.710***	0.795**			0.809*
Mother smoked regularly in year before birth	1.523***	1.279**			1.252*
Mother used marijuana in year before birth	0.995	0.941			0.937
Gained 50 pounds or more during pregnancy	1.231†	1.194			1.196
Gained 1–49 pounds during pregnancy (ref.)	–	–			–
Maintained or lost weight during pregnancy	1.253	1.358			1.317
Born prematurely	0.985	0.981			0.959
Born via cesarean section	0.943	1.046			1.038
Postnatal care and characteristics					
Breast fed in first year			0.614***	0.748**	0.766**
Attended day care between age 0 and 3			0.822*	0.827*	0.833*
Child is insured			0.768**	1.028	1.052
Sociodemographic characteristics					
Non-Hispanic black		1.513***		1.435***	1.429***
Hispanic		1.440***		1.410**	1.447***
Female		1.036		1.039	1.042
Mother did not graduate high school					
Mother high school graduate		0.757**		0.752**	0.782*
Mother attended college		0.765*		0.783*	0.823
Mother college graduate		0.524***		0.526***	0.579**
Mother's age at birth		1.046***		1.049***	1.047***
Year born		0.873***		0.874***	0.875**
Birth order		0.903**		0.885**	0.887**
N	6,330	6,330	6,330	6,330	6,330
-2 log likelihood	44.06	308.94	72.18	308.28	323.44
Pseudo R-squared	0.01	0.06	0.01	0.06	0.07

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$ (two-tailed tests).

there were very small differences by gender. The likelihood of obesity also decreased with mother's education, and older mothers had less obese children than younger mothers, at least at age five. There was a three-year difference in year born between obese and non-obese five-year-olds but no difference at age 10. Birth order had little impact.

Finally, at age 10, we included a control for obesity at age five. Consistent with conventional thinking on the matter, obesity appears to be a much more chronic problem—even in childhood.

Logistic Regression Results—Age Five

*OR*s for the likelihood of obesity at age five are reported in Table 2. Although we used a nested modeling strategy, we focus our discussion on model 5—the full model. Among the prenatal care variables, we found that alcohol consumption reduced the odds of obesity by nearly 20 percent. This may be explained by the association of fetal alcohol syndrome, which is correlated with regular alcohol consumption by pregnant mothers, with low weight in children well into their teenage years (May et al., 2000). Regular smoking among mothers during pregnancy increased the odds of obesity in five-year-olds by 25 percent. No other significant effects for prenatal care were observed. Some of our postnatal variables remain significant, with breast feeding and day care attendance having a significant negative influence on the likelihood of obesity in five-year-olds. Insurance had no significant effect in the full model. Many of our control variables had a strong effect on obesity. Racial and ethnic minority children are much more likely to be obese than are children from other racial and

Table 3: Effect of Prenatal and Postnatal Care and Characteristics on the Likelihood of Obesity at Age 10

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Prenatal care and characteristics					
No prenatal care	1.056	1.026			1.000
Mother drank alcohol regularly in year before birth	0.715***	0.830*			0.836*
Mother smoked regularly in year before birth	1.286**	1.214*			1.188*
Mother used marijuana in year before birth	1.023	0.936			0.926
Gained 50 pounds or more	1.471**	1.430**			1.417**
Gained 1-49 pounds					
Maintained or lost weight	2.693***	2.259***			2.222***
Born prematurely	1.123	1.144			1.132
Born via cesarean section	1.110	1.075			1.067
Postnatal care and characteristics					
Breast fed in first year			0.652***	0.784**	0.807*
Attended day care between age 0 and 3			1.063	1.092	1.097
Child is insured			0.710***	0.834*	0.853†
Sociodemographic characteristics					
Non-Hispanic black		2.018***		1.878***	1.841***
Hispanic		1.425**		1.354**	1.379**
Female		1.118		1.119	1.120
Mother did not graduate high school					
Mother high school graduate		0.742**		0.732**	0.761*
Mother attended college		0.585***		0.581***	0.614***
Mother college graduate		0.554***		0.546***	0.608**
Mother's age at birth		1.031**		1.034**	1.032**
Year born		1.007		1.011	1.010
Birth order		0.902*		0.896*	0.904*
Obese at age five		1.941***		1.952***	1.949***
N	6,634	6,634	6,634	6,634	6,634
-2 log likelihood	53.93	140.2	50.98	120.69	150.38
Pseudo R-squared	0.01	0.03	0.01	0.04	0.03

ethnic groups. Mother's education has a substantial negative effect on childhood obesity. For example, college-educated mothers had 42.1 percent lower odds of having an obese five-year-old than mothers who did not complete high school. Finally, mother's age, year of birth, and birth order remained statistically significant in model 5.

Logistic Regression Results—Age 10

*OR*s for the likelihood of obesity at age 10 are reported in Table 3. Our modeling strategy remained the same, except that we added a control for obesity at age five. Again, we focus our discussion on the full model (model 5). Prenatal care was an important predictor of obesity, even at age 10. Women who drank alcohol were less likely to have obese children, while smokers were more likely. Unlike our model for five-year-olds, we found significant effects for mother's weight gain or loss during pregnancy. Both gaining significant weight and maintaining or losing weight were positively associated with obesity at age 10. Weight maintenance or loss is typically recommended for obese pregnant women, suggesting this effect may be associated with mother's characteristics more than the physical effects on children while in utero. Premature and cesarean section births had no effect on obesity.

Breast feeding during the first year of life continued to show long-term effects on the likelihood of obesity. The child being insured also had a significant negative effect on the odds of being obese. Several control variables, including minority race and ethnicity, mother's education, age at birth, and

obesity at age five were also significant predictors of obesity in 10-year-olds.

DISCUSSION

Our study outcome is generally consistent with previous research findings regarding the relationship between childhood obesity and pre- and postnatal characteristics. To our surprise, prenatal care, use of marijuana, and alcohol use either had no effect on obesity or resulted in an inverse relationship. However, we found that the risk for childhood obesity increased when pregnant women smoked and also when they gained more than 50 pounds during the pregnancy. Though more research is needed, it has been shown that smoking and excessive pregnancy weight may produce changes in intrauterine environments that can lead to unusual development of the fetus. It seems clear that the effect of prenatal variables has unmistakable impact on early childhood obesity and continues into age 10.

How children are cared for after they are born also has noticeable impact on the risk of childhood obesity. Our findings show that the risk of obesity significantly decreases when infants are breast fed in the first year of life. These benefits continue into early childhood and beyond. The reason for the correlation between breast feeding and obesity is largely unknown. Breast milk has been shown to have other beneficial effects on infants, so there may also be some protective factor for obesity. Or, perhaps parents who breast feed their children are more health conscious and have developed a more healthful lifestyle for all family members. In a similar way, the risk for obesity decreases for families with health insurance and for well-cared-for children in day care programs. This should be no surprise. It is reasonable to believe that health insurance affords families timely medical care and counseling for the healthy development of children. Likewise, children would naturally benefit from state-regulated day care programs that provide nutritious meals and snacks and well-planned physical activities.

Limitations

Our study should be tempered by its limitations. First, even though our sample was derived from a longitudinal data set, we were unable to conduct longitudinal analyses because of some data restrictions. The restrictions reduced the strength of our analytical approach. Also, we were unable to account for various characteristics that influence obesity, such as nutritional information, food (in) security, exercise habits, and biological factors. These data are simply unavailable in the NLSY-CYA. Lastly, our sample consisted of the children of mothers born between 1957 and 1965, leaving room for possible cohort effects.

Recommendations

Despite the limitations, we found a number of significant and important effects that provide social workers with opportunities for intervention. Through a well-planned public campaign and advocacy work by social workers, a large number of people can be reached and relevant information disseminated. It is reasonable to believe that when people are supported and have the right information, they will act on it. As a result, we recommend the following actions.

First, campaigns to stop smoking and using any tobacco product should continue, but more focus should be centered on women who are pregnant or those who plan to become pregnant. Ideally, all women who are at a reproductive age should be encouraged to stop or avoid smoking. Second, pregnant women should be encouraged to maintain a gestational weight gain within the Institute of Medicine guideline (Emerson, Huffman, Istwan, Rhea, & Joy, 2011). They should be encouraged to work toward having a healthy diet and getting exercise before and during pregnancy. Third, a public campaign should be launched to encourage mothers to breast feed their babies. The same message should be extended toward health care providers, health care facilities, workplaces, and communities. Fourth, social workers should encourage parents to discuss weight issues and healthy diet with their health care providers. Those in Women, Infants, and Children or other nutrition-oriented programs should be encouraged to seek out similar discussions with their nutritional counselors. Social workers should also encourage low-income families who do not have insurance to obtain insurance for their children through Medicaid, the Children's Health Insurance Program, or other public and community-based insurance programs. Fifth, although our study strongly focused on the mother, primarily because of data limitations, it also is a call to understand the role of father involvement for childhood health. Fathers are often overlooked in any study of childhood outcomes but have a very strong influence on

children, as shown by studies that consider their effect. Finally, social workers, in partnership with parents who use day care services, should lobby state and local governments to create stronger regulations for child care centers to meet a dietary and physical activity standard. SW

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Appendix A: Zero-order Correlations for Obesity at Age Five

	Obese	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. No prenatal	0.00	1.00																			
2. Alcohol	−0.04	−0.03	1.00																		
3. Cigarette	0.06	0.03	0.21	1.00																	
4. Marijuana	0.00	0.05	0.08	0.11	1.00																
5. Gain 50+ pounds	0.03	0.01	0.00	0.04	0.01	1.00															
6. Same or lost weight	0.01	0.01	−0.02	0.00	0.00	−0.05	1.00														
7. Premature	0.00	−0.01	0.01	0.02	0.00	−0.02	0.01	1.00													
8. Cesarean section	−0.01	−0.02	0.02	0.00	0.02	0.08	−0.01	0.07	1.00												
9. Breast fed	−0.09	−0.04	0.08	−0.14	−0.03	−0.02	−0.05	−0.05	−0.01	1.00											
10. Day care	−0.04	−0.05	0.08	−0.05	−0.01	0.03	−0.04	0.00	0.04	0.03	1.00										
11. Insurance	−0.06	−0.07	0.09	−0.13	−0.03	−0.02	−0.07	−0.02	0.04	0.17	0.20	1.00									
12. Non-Hispanic black	0.05	0.01	−0.12	0.00	0.03	0.02	0.06	0.02	−0.01	−0.29	0.03	−0.15	1.00								
13. Hispanic	0.03	0.06	−0.11	−0.14	−0.02	0.00	−0.02	−0.01	0.01	0.03	−0.03	−0.12	−0.31	1.00							
14. Female	0.00	−0.01	−0.02	−0.03	−0.03	−0.02	0.02	−0.01	−0.01	0.02	0.01	0.01	0.01	−0.02	1.00						
15. Mom high school graduate	0.01	0.01	0.01	0.05	0.04	0.03	0.01	0.00	−0.01	−0.10	0.03	0.01	0.00	−0.05	0.02	1.00					
16. Mom some college	−0.02	−0.03	0.01	−0.06	−0.01	0.00	0.00	0.01	0.00	0.08	0.12	0.11	0.06	0.00	−0.01	−0.42	1.00				
17. Mom college grad.	−0.09	−0.04	0.08	−0.19	−0.05	−0.04	−0.04	0.00	0.05	0.24	0.10	0.25	−0.11	−0.12	0.00	−0.36	−0.24	1.00			
18. Mom's age	−0.10	−0.03	0.03	−0.06	−0.02	−0.02	0.02	0.05	0.10	0.18	0.03	0.19	−0.12	−0.02	0.00	−0.12	0.07	0.24	1.00		
19. Birth year	−0.18	−0.02	0.00	−0.12	−0.02	−0.01	0.04	0.04	0.10	0.17	0.05	0.20	−0.06	0.00	0.01	−0.13	0.08	0.27	0.75	1.00	
20. Birth order	−0.05	0.06	−0.09	0.04	0.01	−0.03	0.07	0.00	−0.09	−0.09	−0.23	−0.18	0.13	0.08	0.00	−0.06	−0.06	−0.13	0.22	0.27	1.00

Appendix B: Zero-order Correlations for Obesity at Age 10

	Obese	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. No prenatal	0.00	1.00																				
2. Alcohol	−0.04	−0.04	1.00																			
3. Cigarette	0.03	0.01	0.22	1.00																		
4. Marijuana	0.00	0.02	0.05	0.08	1.00																	
5. Gain 50+ pounds	0.04	0.00	0.02	0.05	0.02	1.00																
6. Same or lost weight	0.06	0.00	−0.04	−0.01	0.00	−0.04	1.00															
7. Premature	0.01	0.02	0.01	0.04	0.00	−0.03	0.00	1.00														
8. Cesarean section	0.01	−0.03	0.02	0.00	0.00	0.06	0.00	0.07	1.00													
9. Breast fed	−0.07	−0.04	0.09	−0.10	−0.04	−0.03	−0.04	−0.06	0.00	1.00												
10. Day care	−0.01	−0.05	0.09	−0.05	0.00	0.02	−0.03	0.00	0.04	0.05	1.00											
11. Insurance	−0.06	−0.06	0.11	−0.10	−0.01	−0.01	−0.04	0.01	0.02	0.16	0.21	1.00										
12. Non-Hispanic black	0.09	0.00	−0.13	−0.01	0.04	0.00	0.07	0.01	−0.02	−0.31	−0.01	−0.16	1.00									
13. Hispanic	0.01	0.05	−0.11	−0.14	−0.02	0.00	−0.02	−0.01	0.03	0.04	−0.02	−0.10	−0.35	1.00								
14. Female	0.02	−0.01	0.00	−0.01	−0.01	−0.01	0.03	−0.02	−0.02	0.01	0.01	0.01	0.01	−0.02	1.00							
15. Mom high school graduate	0.00	0.00	0.01	0.03	0.03	0.01	0.00	0.00	0.01	−0.08	0.03	0.05	0.00	−0.06	0.00	1.00						
16. Mom some college	−0.03	−0.02	0.04	−0.04	0.00	0.00	−0.01	0.00	−0.01	0.07	0.13	0.11	0.04	−0.02	−0.01	−0.42	1.00					
17. Mom college grad.	−0.04	−0.02	0.09	−0.18	−0.04	−0.04	−0.03	0.00	0.04	0.23	0.12	0.21	−0.10	−0.09	0.00	−0.31	−0.22	1.00				
18. Mom's age	0.00	−0.03	0.08	−0.05	−0.03	−0.02	0.03	0.01	0.10	0.19	0.08	0.20	−0.16	−0.03	0.00	−0.06	0.07	0.26	1.00			
19. Birth year	−0.01	−0.06	0.07	−0.10	−0.02	−0.01	0.03	0.00	0.09	0.19	0.11	0.22	−0.10	−0.02	0.00	−0.06	0.08	0.29	0.72	1.00		
20. Birth order	0.01	0.02	−0.06	0.02	−0.02	−0.05	0.04	−0.01	−0.06	−0.05	−0.19	−0.10	0.11	0.06	−0.01	−0.07	−0.03	−0.09	0.27	0.32	1.00	
21. Obese at age five	0.09	0.00	−0.04	0.03	0.00	0.02	0.00	−0.01	−0.02	−0.07	−0.03	−0.06	0.05	0.04	−0.01	0.02	−0.02	−0.08	−0.14	−0.18	−0.03	1.00