Projecting the Impact of Obesity on a Cohort of School-Aged Hispanic Children

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Abstract

Over the past 30 years, the prevalence of childhood obesity has tripled in the United States. Hispanics face a significantly greater risk of becoming obese; 24% of Hispanic children aged 6-11 are obese compared to 17% of the general population. Excess obesity among Hispanics could lead to two significant changes. First, given that obesity is associated with a number of chronic conditions and an increased risk of premature death, the higher prevalence of obesity among Hispanic youth may serve to undo the historic US Hispanic health and mortality advantage. Second, a disproportionate increase in obesity prevalence among Hispanics could compromise their ability to accumulate human capital. Using a number of rich, nationally representative data sources, this paper seeks to: measure trends in Hispanic obesity, ascertain the effects of obesity on human capital development, and determine how changing the projected obesity prevalence will affect human capital.

The Problem

Over the past 30 years, the prevalence of childhood obesity has tripled in the United States. While the likelihood of becoming obese has increased for all youth, Hispanics face a significantly greater risk: 24% of Hispanic children aged 6-11 are obese compared to 17% of the general population[1]. Excess obesity among Hispanics could lead to two significant changes. First, given that obesity is associated with a number of chronic conditions and an increased risk of premature death, the higher prevalence of obesity among Hispanic youth relative to white populations may serve to undo the historic US Hispanic health and mortality advantage, the "Hispanic Paradox". To the extent that early obesity compromises scholastic achievement, a disproportionate increase in obesity prevalence among Hispanics could compromise their ability to accumulate human capital. Obesity may directly affect youth behaviors and the early acquisition of strategic traits through stigmatization and discrimination, by exposing individuals to excess health risks that impair school attendance and school performance, and by lowering both parental and teachers' expectations [2]. This paper will explore how current obesity prevalence and projected risks of obesity for the Hispanic cohort aged 5 to 14 may affect their future prevalence of obesity and their educational attainment. The paper has three distinct aims:

a. To estimate current and projected short-term trends in obesity in a set of cohorts of Hispanic youth.

b. To identify the effects of obesity on scholastic achievement, including early cognitive measures and the probability of graduating from high school in the same cohorts.

c. To compute alternative scenarios and demonstrate the influence that current prevalence and risks of obesity among Hispanic youths may have both on the risk of early adult obesity and on scholastic performance and educational attainment.

Estimation

a.General Strategy

We first project obesity prevalence rates for a cohort of Hispanic youth aged 5 to 14 at the onset of the projection period with characteristics similar to the Hispanic population living in the United States. We adopt a relatively crisp classification that distinguishes Mexican-origin-US born, Mexican-origin-Mexico born, Non Mexican Hispanic-origin-foreign and US born, and all other Hispanics (including Puerto Ricans and Cubans). The projection uses a multistate life table approach based on estimated age-specific conditional probabilities that those who start out as obese will remain obese, the conditional probability that those who are non-obese will become obese at some point before age 20 and, finally, the conditional probability of starting out obese and becoming non obese. The latter is a quantity subject to some noise since it represents a rare event. The associated transition rates into obesity will be calculated using trends in obesity within suitable age intervals derived from the BRFSS and NHANES data sets, and rates of children who remain obese will be calculated using the NLSY 79, NLSY 97, and ECLS-K (see below). We use multiple data sets to maximize the window of time within which rates are estimated to increase robustness of both past and current estimates of transition rates and forecasted values.

Second, we estimate the effects of obesity on early scholastic achievement as measured by scores on various cognitive tests, including math and verbal ability as well as on the probability of graduating from high school (conditional on past scholastic performance). To obtain robust estimates of the effects of obesity we utilize a structural equation model that includes three stages: the first is at the time and age when children were administered these cognitive tests, the second is at the time of high school graduation, and the third is at the time when children are expected to enter college. The resulting estimates will reflect the impact that past obesity has on the ultimate probability of entering college (see **Models and Measures** below).

Third, and finally, we link together (a) the values of forecasted obesity prevalence rates from ages 5 to 25 for the period 2010-2020 and (b) the estimates of the effects of obesity on the probability of attaining a high school degree and being admitted to college. Thus we can predict the influence of past, current and forecasted obesity trends on aggregate Hispanic high school attainment and college admission. Altering

initial conditions, either those representing obesity trends or those capturing the effects of obesity, we will produce different scenarios to assess the degree to which future Hispanic educational attainment is already locked in past and current trends.

b. Methods and Measures

The effect of obesity in early childhood on later educational attainment is largely indirect. Obesity in early childhood could affect later child weight and health, cognition, and behaviors which in turn affect ultimate educational attainment. Obesity will be measured according to CDC guidelines with children in the top five percent of height and weight for age being considered obese. Health status will be measured according to whether the child has a health limitation or is reported to be in poor or fair health. Cognition will be measured as a standardized score on the Peabody Individual Achievement Test. We will also investigate the role of non-cognitive traits using an index of a child's behavior problems; behavioral problems have been highlighted as a salient feature of obese children which ultimately impact their school performance and chances of completing secondary education.

To estimate effects we will pose a structural equation model (SEM) where the dependent variables will be the scores in the cognitive tests (either in continuous or discrete form) at ages 10-12 approximately, the probability of graduating from high school (age 18 approximately), and the probability of making it to college (age 25). The overall effects of initial obesity as well as obesity at other points in the life course can be calculated using standard SEM procedures.

Data

Estimates of the prevalence of obesity and risks of becoming obese amongst Hispanic youth will be estimated using data from the Behavioral Risk Factor Surveillance System (BRFSS) and will be complemented by using estimates of obesity obtained from the NHANES. The BRFSS is a telephone survey that interviews a nationally representative sample of individuals living in the United States. The BRFSS is used as the workhorse for this part of the paper because it offers the most current data on the prevalence of obesity among Hispanic youth and its sample size is much larger than the ones for the other surveys with the requisite information. This will enable us to estimate obesity prevalence within a relatively narrow age interval and for the Hispanic subgroups previously defined. Calculated estimates of the prevalence of obesity will be compared with estimates from the NHANES as a robustness check.

The connections between obesity and scholastic performance and high school graduation will be estimated using data from three sources. To estimate the association between obesity, cognition, and high school graduation, we will use data from the NLSY-C 1979, NLSY 1997, and ECLS-K First, the National Longitudinal Survey of Youth-Children 1979 (NLSY-C 1979), will be used because it allows for a long period of follow-up on the implications of early child obesity on this cohort's health, cognitive capacity, and behaviors during adolescence as well as the likelihood of completing high school and entering college. The NLSY-C 1979 is a nationally representative survey of children born to the 1979 cohort of youth which has conducted interviews of these children from 1986-2010. Because some information from the NLSY-C 1979 is dated, information from the more recent National Longitudinal Survey of Youth (1997) will be used to supplement estimates and check the robustness of obesity's effect on cognitive skills and high school attainment. Like the NLSY-C (1979) the NLSY (1997) is a nationally representative sample. The survey first interviews 12 to 16 year old adolescents and has followed them through the present. The NLSY 1997 does not have extensive information on early childhood characteristics, but these estimates too can be checked using information from the Early Child Longitudinal Study-Kindergarten. The ECLS-K study began in 1998 and is nationally representative of kindergarteners born in 1998. This will provide data on the effects of obesity for more recent cohorts.

Preliminary Results

Two key assumptions are made in projecting forward the effects of obesity. The first, that the prevalence of obesity is increasing, is well established. The second, that obesity in childhood may affect other aspects of child growth and well-being is less so. To support this claim, results from some regressions using non-imputed data from the NLSY-C are shown in Table 1. Due to both the comparatively low prevalence of obesity when the NLSY-C was conducted and the small sample of Hispanic children, these estimates are pooled for all races. Updates to these models will compare trends when the sample is restricted to only Hispanics. Results across these models show that while obesity does not have a direct effect on educational attainment, it does negatively affect both cognition and health, important predictors of educational attainment. Being obese at or around age 4, makes a child 1.4 times more likely to experience a health limitation at or around age 8 and 5.3 times more likely to be obese at age 8. It also lowers a child's expected cognition scores by about a 10th of a standard deviation. Experiencing obesity at age 8 again lowers cognitive score at or around age 13 by a 10th of a standard deviation and makes children 15.82 times more likely to be obese at age 13. These results suggest a significant effect of obesity on various aspects of child well-being and development. If trends in obesity continue and the consequences of becoming obese are similar to what was found in the NLSY-C, there may be serious deleterious consequences for this cohort of Hispanic youth.

Implications

The primary outcomes in this study will be the expected number of Hispanic high school graduates among the cohort of children now entering kindergarten, the expected number of Hispanic youth who will enter college, and the number of youths expected to be obese around age 25. These endpoints are chosen because educational attainment is key for predicting labor market success and health later in life, and obesity at young adulthood has important implications for later health. The combination of strong effects of obesity on cognitive and non-cognitive traits, on educational achievement and a growing and earlier incidence of obesity among the Hispanic youth could have ominous consequences for this group's accession, economic success, social mobility as well as their adult health status.

References

[1] Center for Disease Control, http://www.cdc.gov/obesity/data/trends.HTML. *Center for Disease Control*, February 2012.

[2] C. MacCann and RD Roberts. Just as smart but not as successful: obese students obtain lower school grades but equivalent test scores to nonobese students. *International Journal of Obesity*, 2012.

	(1) health 7 to 9	(2) obesity 7 to 9	(3) behavior 7 to 9	(4) cognition 7 to 9	(5) cognition 12 to 14	(6) health 12 to 14	(7) behavior 7 to 9	(8) obesity 12 to 14	(9) HS equivalence	(10) College Entry
Obesity 3 to 5	1.450**	5.307***	1.267	-0.108*	-0.0565	0.906	0.876	1.358	0.739	0.820
	(2.68)	(13.45)	(1.43)	(-2.14)	(-1.07)	(-0.50)	(-0.57)	(1.43)	(-1.04)	(-0.90)
Income Quart	0.978	1.145	1.734***	-0.388***	-0.237***	1.049	1.267	1.174	0.797	0.870
	(-0.18)	(1.06)	(4.03)	(-7.91)	(-6.08)	(0.35)	(1.56)	(0.89)	(-1.11)	(-0.91)
Obesity 7 to 9					-0.105*	0.944	1.209	15.82***	1.809	1.414
					(-2.20)	(-0.33)	(0.93)	(16.19)	(1.59)	(1.60)
Health 7 to 9					-0.0881	9.177***	2.090***	1.706*	0.909	0.995
					(-1.79)	(18.18)	(4.39)	(2.38)	(-0.35)	(-0.03)
Cognition 7 to 9					0.576***	1.027	0.761***	0.783**	1.248*	1.452***
					(35.16)	(0.49)	(-4.24)	(-3.23)	(2.19)	(5.72)
Behavior 7 to 9					-0.0869	1.324	5.982***	1.132	0.860	0.685
					(-1.81)	(1.61)	(11.19)	(0.50)	(-0.63)	(-1.65)
Obesity 12 to 14									0.965	1.073
									(-0.13)	(0.37)
Health 12 to 14									0.789	0.961
									(-1.00)	(-0.23)
Cognition 12 to 14									2.597***	1.827***
									(8.69)	(8.58)
Behavior 12 to 14									0.505***	0.437***
				0.0983***	0.133***				(-3.33)	(-3.73)
Constant				(4.55)	(7.05)					
N	4946	4324	4658	4586	3071	3239	3137	2243	1864	1661

Exponentiated coefficients; t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1: Effects of Obesity in Childhood and Adolescenc