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Chapter 1

PROSPECTS FOR WELFARE ALLEVIATION IN AN OBESOGENIC ENVIRONMENT

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Abstract

The poor, like the general population, live in an increasingly obesogenic environment. Furthermore, the prevalence of women's obesity in developed nations tends to increase as socioeconomic status decreases. Consequently, the rapid rise in obesity in the U.S. might be related to welfare programs, especially those in which women make up a large share of the caseload. This paper explores the possible relationships between welfare programs and obesity. We first review the literature examining the causes of obesity and consider whether welfare, food assistance programs in particular, are part of the problem. We then review the literature examining the implications of increased obesity for both cash and in-kind assistance for the poor. Is there evidence that rising obesity (whatever the cause) leads to higher welfare caseloads? Finally, we carry out an original analysis of data from the Third National Health and Nutrition Examination Survey (NHANES III) of the health of Americans. Our analysis

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finds that poverty is related to overweight and obesity, but the relationship is complex. Socioeconomic, "race/ethnic," and food security issues all impinge on the risk for overweight and obesity. We find no evidence that welfare assistance through the Women, Infants, and Children (WIC) program impacts the likelihood of weight problems among children and adults. We also find no evidence that food stamp receipt increases the likelihood of weight problems among children and teens. However, our results do provide evidence that food stamp receipt does raise the chance of overweight and obesity among adults.
By bringing to together the available evidence on how welfare programs impact obesity and, conversely, how obesity impacts welfare programs, this paper provides a more comprehensive and multifaceted understanding of the relationship between these two variables. Where the research provides compelling evidence we discuss the policy implications. Where the evidence is mixed or lacking we suggest avenues for future research needed to fill the gaps in our knowledge.

1 Introduction

The dramatic rise in obesity in the U.S. and the higher prevalence of obesity among lower income women suggests that welfare programs and obesity may be related (Fulwood *et al* 1981, Sobal and Stunkard 1989, Schoenborn *et al* 2002). This paper first considers whether welfare programs contribute to obesity trends. Welfare programs, especially food assistance programs, could contribute to the obesity epidemic by enabling recipients to consume more calories. Indeed, the prevalence of women's obesity in developed nations tends to increase as socioeconomic status decreases. Furthermore, women make up all of the adult recipients in the Women's, Children's and Infants Nutrition program (WIC) and the majority of food stamps recipients are female (USDA 2003). We review the emerging research on the impact of food assistance on the consumption of calories and recipient body weight.

We then consider how rising obesity in the U.S. could impact both cash and in-kind assistance to the poor. Current federal efforts to alleviate dependency on the Temporary Assistance to Needy Families program (TANF) focus on requiring recipients, 90% of whom are women, to work (USDHHS 2001). Policies to encourage marriage as an anti-poverty strategy have also been promoted. Might obesity impede the transition from welfare to work and/or marriage?

Obesity could also impact government health programs for the poor because it is positively associated with a variety of diseases and disability (e.g., Dietz 1998; Must *et al* 1999, Visscher and Seidell 2001). If these relationships are causal, then rising obesity would mean increased costs for the Medicaid and disability programs. Does the available evidence support the hypothesis that obesity leads to higher caseloads and costs in health programs for the poor?

Finally, we analyze data from the Third National Health and Nutrition Examination Survey (NHANES III) of the health of Americans. We present a descriptive analysis of the distributions of BMI for children, teens and prime-aged adults. Then we use regression analysis to determine whether or not welfare participation impacts BMI and the likelihood of overweight and obesity. We find no evidence that receipt of assistance through WIC or food stamps impacts the probability a child or teen is obese. However, there is evidence that adults who receive food stamps face a greater likelihood of overweight or obesity.

By examining the state of knowledge on welfare's impact of the prevalence of obesity and obesity's impact on welfare programs, this paper offers a more comprehensive

understanding of the complex relationship between these two important variables. When the research produces consistent and compelling evidence we discuss the policy implications. When the evidence is inconsistent and weak, we suggest avenues for further research to fill the gaps in our knowledge.

2 Trends in the Prevalence and Costs of Obesity

Obesity is rising across the globe and the U.S. is leading the way (CDC 2004; Komlos and Baur 2003; Popkin and Doak 1998). Adults are considered obese when their Body Mass Index (BMI=kilograms/ meters^2) equals or exceeds 30. The evidence clearly establishes that the prevalence of obesity among adults in the U.S. has risen significantly in the last few decades (Flegal *et al* 1998, 2002; Mokdad *et al* 1999, 2001, 2003). The Centers for Disease Control (CDC) reports that among Americans over age 20, obesity rates rose from 15.1% in the late 1970s to 30.9% in 2000, an increase of nearly 105% (Health, United States 2002). Women's obesity prevalence has consistently exceeded that of men. Among women, those with low income are 50% more likely to be obese than those of higher income (U.S. DHHS, 2000). American children are also increasingly obese (above the 95th percentile of the BMI distribution). The share of obese American children ages 6 to 11 rose from 4% in 1974 to 15% in 1999-2000 (CDC 2002; NCHS 1999; Troiano *et al* 1995, Troiano and Flegal 1998).

The upward surge in obesity carries considerable private and public costs. The obese face stigmatization that impacts their social, psychological, economic, and physical well-being (Enzi 1994; Dietz 1998; Field *et al* 2001; Must *et al* 1999, Puhl and Brownell 2001). In the U.S., obesity has grown to become the second leading cause of preventable death, following tobacco consumption (McGinnis and Foege 1993, U.S. DHHS 2001). Allison *et al* (1999) estimate that between 280,000 and 325,000 Americans die due to obesity related causes each year. The direct health costs associated with treatment of obesity and its related diseases account for between four and nine percent of the nation's total direct health care costs (Allison *et al* 1999; Finkelstein *et al* 2003; Wolfe and Colditz 1998). Sturm (2002) finds evidence that the medical costs of obesity exceed those of smoking. Indirect costs, such as lost productivity, are also substantial. Wolfe and Colditz (1998) estimate a loss of 39.2 million workdays, a productivity loss of approximately $3.9 billion, due to obesity related illness in 1995.

3 Why is Obesity More Prevalent?

Obesity is an excessive accumulation of adipose tissue, or, more commonly, body fat. Such an accumulation occurs when the energy intake of the body exceeds the energy output. The current epidemic of obesity is likely to be a consequence of modern lifestyle, with access to large amounts of palatable, high calorie food and limited opportunities for physical activity. O'Keefe and Cordain (2004) argue for the primacy of environmental change over genetic change as the root of the obesity epidemic:

Our genetic make-up, shaped through millions of years of evolution, determines our nutritional and activity needs. Although the human genome has remained primarily unchanged since the agricultural revolution 10,000 years ago, our diet and lifestyle have

become progressively more divergent from those of our ancient ancestors. Accumulating evidence suggests that this mismatch between our modern diet and lifestyle and our Paleolithic genome is playing a substantial role in the ongoing epidemics of obesity, hypertension, diabetes, and atherosclerotic cardiovascular disease. Until 500 generations ago, all humans consumed only wild and unprocessed food foraged and hunted from their environment... Historical and anthropological studies show hunter-gatherers generally to be healthy, fit, and [generally not overweight or obese] (O'Keefe and Cordain 2004, p. 101).

A small percentage of people in all populations may be at additional risk for obesity due to particular genes. Genes can directly cause obesity in disorders such as Bardet-Biedl syndrome, Prader-Willi syndrome, and a dozen or more other disorders. However, the implication of the above quotation is that all human beings are at risk for obesity due to a genome-lifestyle mismatch. Even if we posit some recent genetic changes promoting obesity, the current worldwide epidemic of obesity cannot be due to genes *per se.* The rise in rates of obesity has taken place faster than is possible for genetic change.

4 Environmental Causes of Obesity: Food Consumption

What are the specific environmental factors contributing to the obesity epidemic and do they have a differential impact on the poor? Changing technology has dramatically lowered the relative price of food (Cutler *et al* 2003; Lakdawlalla and Philipson 2002; Philipson and Posner 1999; Philipson 2001). Tillotson (2003) and Akst (2003) document the remarkable productivity of the U.S. agricultural sector and note that Americans now spend only 10% of their disposable income on food, one of the lowest shares in the world. The number of hours Americans must work to buy food has also diminished greatly (Cox and Alm, 1997). For example, buying a 3-pound chicken required two hours and 37 minutes of paid labor on average in 1919 and only 14 minutes in 1997. When food becomes cheaper, people generally eat more and gain weight (Cawley 1999; Chou *et al* 2002). Lakdawalla and Philipson (2002) use individual data from the U.S. over the period 1976-94 and estimate that 40% of the growth in body weight is due to improved agricultural technology making food cheaper. U.S. agricultural and trade policies have also contributed to the drop in food prices (Critser 2003, Nestle 2002, Sims 1998). Cutler *et al* (2003) emphasize the role of the falling time cost of food preparation in the rise in obesity. They estimate that because of technological advances food preparation and clean-up time fell by about 50% for both working and non-working women from 1965 to 1995.

Not only has food in general become relatively cheaper, but calorie dense foods, such as fats and sugars, exhibit particularly large drops in relative expense. Putnam *et al* (2002) report that while the Consumer Price Index (CPI) for "fresh fruits and vegetables" rose by 118% from 1985 to 2000, the CPI for "fats and oils" and "sugars and sweets" rose by only 35% and 46% respectively.

Because the poor spend a greater proportion of their income on food than do wealthier individuals (Rogers and Gray 1994; Tan 2000) they may be more sensitive of food prices (i.e., they may have more elastic demand). Leibtag and Kaufman (2003), using nationally representative data on "food-at-home" purchases in late 1990s, present evidence that low income households economize on their food purchases by buying cheaper, lower quality products, such as higher fat cuts of meat. Curtis and McClellan (1995) and Adelaja *et al*

(1997) find that low-income shoppers economize by buying fewer fruits, vegetables and dairy products and instead buying more meat and calorie-dense carbohydrates. Drewnowski and Spector (2004) note that calorie dense foods like refined grains, sugars, and fats may represent the lowest cost option to consumers.

In addition to lower income, the price and availability of healthy foods may exacerbate poor household's inability to acquire a nutritious diet. Research on whether food prices are higher in poor neighborhoods has produced mixed results. The more recent research often finds evidence that food store prices are higher in lower income neighborhoods. For example, Kaufman *et al* (1997) and Frankel and Gould (2001) find that the poor tend to pay more for groceries because they are concentrated in urban and rural areas, where food prices are generally higher (food prices tend to be lower in the suburbs). However, Hayes (2000) examines food prices in New York City and doesn't find any statistically significant differences across neighborhoods of varying socioeconomic status. He does observe that refrigeration standards are more often not met in low-income area grocery stores and that the prices of half of the non-perishable items he surveyed were higher in poorer areas.

Eisenhauer (2001) provides an historical overview of trends in urban food retailing in the 20th century. She highlights the net loss of supermarkets in urban areas, particularly during the 1980s. Food retailers have shifted from being small, independent neighborhood stores in the city to large, chain supermarkets located in the suburbs. Sallis *et al* (1986) finds that in the San Diego area supermarkets offered twice the average number of heart-healthy foods as small neighborhood stores. Morland *et al* (2002b) report that residents in census tracts with a supermarket consumed 32% more fruit and vegetables than residents in tracts with no supermarket. Sloane *et al* (2003) survey three predominately African American areas of Los Angeles County and observe that wealthier neighborhoods offered more supermarkets on average. Furthermore, they report that low-income areas offered lower quantities and less variety in fresh fruits and vegetables than in their control area. Low fat dairy products, tofu and whole grain pastas were also less available in the poor areas. Morland *et al* (2002a) broaden the scope of their analysis from a single urban area to 221 census tracts in four states (MS, NC, MD, MN). They also find evidence supporting the hypothesis that those living in poor neighborhoods have less access to healthy foods.

Changes in the labor market may have also contributed to an increasingly obesogenic environment by reducing the amount of time families have for home production of food and meals (Chou *et al 2002*; Philipson 2001). Women's labor force participation rates have risen dramatically since the 1960s (Szafran 2002) and hours worked per family have increased (Bluestone and Rose 1997). Less time for food preparation at home means more Americans eat out and meals away from home tend to be more calorie dense (Lin *et al* 1999; Schlosser 2001; Gallo 1998). Cutler *et al* (2003) estimate that less than 10% of the rise in obesity is attributable to women's increased labor force participation. They suggest that increases in women's labor force participation may have resulted from declines in food preparation time rather than labor force participation leading to greater reliance on prepared foods. In any case, greater reliance on prepared foods tends to increase the calorie intake of the consumers.

Whether due to increased time in the labor market or to the drop in food preparation time (or both), it is clear that Americans are purchasing more meals away from the home (Boynton-Jarret *et al* 2003). Lin *et al* (1996), Popkin (2001), Guthrie *et al* (2002) and Utter *et al* 2003 all find evidence that greater consumption of fast foods increases calorie intake. Jeffery and French (1998) and French *et al* (2000) find that fast food consumption is

positively associated with women's BMI. They also report that fast food consumption was greater for younger women, poorer women, and women of color. Schlosser (2001) and Critser (2003) assert that the fast food industry has targeted urban areas for market growth and that by the late 1990s a quarter of all hamburgers purchased from fast food restaurants were consumed in inner city urban locations.

While labor market changes and declines in food preparation time discourage home preparation of meals, the fast food industry's efforts to maximize profits reinforce the trend away from home cooked meals. Advertising of processed, fast foods, which are typically calorie dense, has accelerated and a growing amount of advertising targets children (Byrd-Bredbenner and Grasso 2000, Coon and Tucker 2002, Critser 2003). Welch (2003) finds that brand advertising for fast foods, beverages, and confectionary goods reached $9.3 billion in 2001. In contrast, the National Cancer Institute spent about $1.5 million promoting healthy lifestyle via the "5-A-Day program" that year (DiSogra 2004).

Another factor is the association between sedentary leisure pursuits, especially TV viewing, and food consumption. TV viewing requires little energy expenditure and stimulates snacking. Thus, the more TV viewing the more established snacking habits become, with the consequent increase in caloric intake (Gore *et al*. 2003). Delacote (1987) and Shalla and Schellenberg (1998) report that low-income adults spend more time watching TV than do those with higher income. Certain and Kahn (2002) find that in the National Longitudinal Survey of Youth (NLSY), less-educated women are more likely to report that their young children watch more TV than is recommended by the American Academy of Pediatrics. This suggests the poor may view more food-promoting ads and thus may be more influenced to consume these calorie dense products

Children are exposed to advertising for high calorie, low nutrient foods not only at home, but also at school. Levine (1999) summarizes how fast food and soft drink companies have developed extensive advertising in U.S. schools. Bauer *et al* (2004) find in their focus group discussions with students and employees at two middle schools that the availability of non-nutritious snacks helps explain why students don't eat healthier meals while at school. Schools earn much needed cash via snack and soda vending contracts and fast food vendors increasingly sell their products at outlets on school property, at school sporting events and fundraising drives. These contracts have already provided schools with more than $200 million dollars (AAP, 2004). Because schools in poorer districts are more cash strapped such contracts could be particularly appealing. However, we have not found any research comparing the number of pouring rights contracts across school districts of varying SES or comparing soda and vending machine snack availability across public schools of varying SES or private vs. public schools.

Another strategy fast food producers use to encourage consumption of their products, is to appeal to customers' desire to "get the most for their money" by offering deals on food combinations or enlarged portions. Young and Nestle (2003) present evidence that current industry defined portions of fast foods average two to five times the original size. Shell (2002) notes that consuming pizza or M&M's gives one roughly 1000 calories and 3000 calories per dollar respectively. Spinach, in contrast, yields a paltry 30 calories per dollar. In this sense, fast foods appear to be a great deal. However, offering lower per unit prices on larger portions of calorie dense food encourages over consumption. Marketing food value may appeal more strongly to the poor because, as mentioned earlier, they face greater budget constraint on food purchases and may have more elastic demand.

5 Environmental Causes of Obesity: Physical Activity

Lakdawalla and Philipson (2002) estimate that while 40% of the growth in weight is due to improved agricultural technology making food cheaper, 60% is associated with declining physical activity on the job and at home. In the past, more jobs were physically strenuous; people were essentially paid to engage in physical activity. However, technological change has lead to a shift towards more sedentary jobs and has also reduced the amount of physical exertion needed to accomplish basic household chores. Cutler *et al* (2003) note that the percent of Americans working in highly physically active jobs fell from 68% to 42% from 1910 and 1990. In short, the price of physical activity has increased, and consequently people expend fewer calories.

Does the general trend towards less physical activity impact the poor more than others? The CDC reports that in 1990 persons with less than a high school education engaged in the most occupational physical activity, and the amount decreased as education level increased (CDC 2000). Variyam (2002) finds that lower income men consume more calories than higher income men, but aren't that much heavier or more obese. He that suggests low income men have physically demanding blue collar occupations and thus burn the additional calories on the job.

With work generally less physically demanding, more of us have to pay in order be physically active, joining health clubs, buying exercise equipment, and joining sports leagues. The National Sporting Goods Association (NSGA) surveyed the purchases of 100,000 households and found that the greatest share of sports equipment customers earn between $50,000 and $74,999. For example, individuals in this income category account for 21% of exercise equipment purchases while those earning less than $15,000 account for only 6%. The NSGA also surveyed nearly a quarter of a million respondents regarding their participation in sports. The results, shown in Figure 1, suggest that lower income is associated with lower participation rates. The Centers for Disease Control and Prevention (CDC) reports that the percent of adults reporting no leisure time physical activity is highest among those with incomes below the poverty line and falls to a minimum among the wealthiest (CDC 2000).

The spatial organization of our communities exacerbates the trend towards less physical activity by creating incentives to drive and disincentives to walking and bicycling. Both the EPA and the U.S. Department of Transportation have produced studies that suggest community design can impact people's selection of transportation modes (EPA 1998, USDOT 1994). For example, people in areas with good sidewalks and grid-designed streets tend to walk more. Ewing *et al* (2003) find that the urban sprawl index at the county level is negatively associated with walking and positively associated with BMI, obesity and hypertension. However, at the metropolitan level there is only evidence of association only between the sprawl index and walking. Frumkin (2002) discusses several studies from the transportation literature that also support the hypothesis that urban sprawl is associated with more car travel and less walking and bicycling. A growing body of research suggests that access to green spaces and pleasant walking areas can also increase physical activity (Huston *et al* 2003), lower BMI (Saelens *et al* 2003) and modestly increase longevity (Takano *et al* 2002).

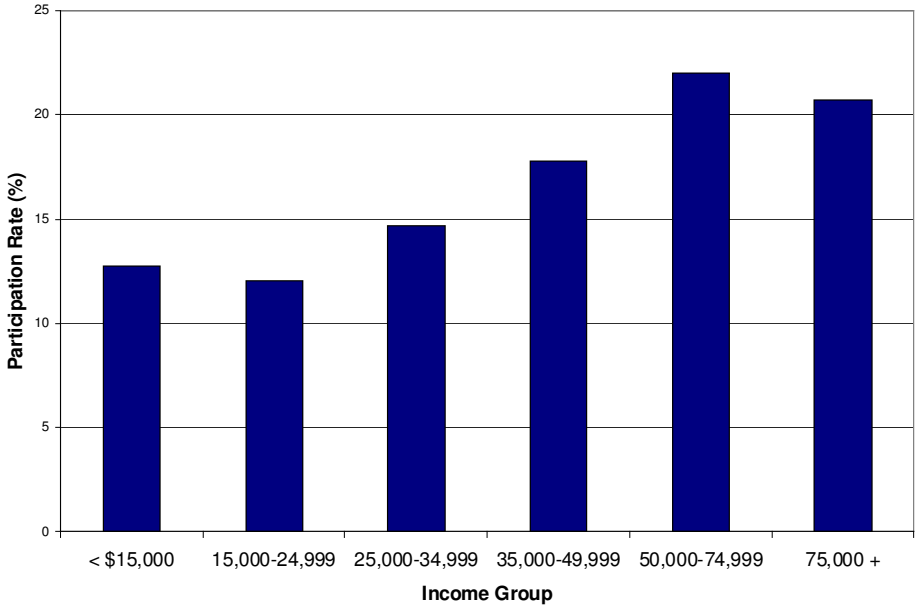

Figure 1. Participation rate in series II sports by household income group. Series II sports: archery, boating (power), canoeing, dart throwing, bow hunting, ice hockey, ice skating, mountain biking, muzzle loading, roller hockey, roller skating, roller blading, sailing, scooter riding, scuba, skateboarding, skiing, snorkeling, snowboarding, step aerobics, target shooting, water skiing, wind surfing, work-out at club.

Does geography impact the poor more than the wealthy? Income determines where one can afford to live and the amenities available. Ellaway *et al* 1997 find evidence of higher BMIs in poorer neighborhoods. Estabrook *et al* (2003) examined the availability of physical activity resources (parks, trails, community centers, fitness clubs, and sports facilities) in one small U.S. city. They find that low and medium SES census tracts have fewer physical activity resources than high SES census tracts. While these tracts didn't exhibit much difference in the number of pay-for-use resources, the low and medium SES tracts did have significantly fewer free-for-use resources. While low-income adults may get more on-the-job physical exertion than their wealthier counterparts, they and their families probably have less access to leisure time physical activity because they can only afford to live in neighborhoods with fewer facilities.

In addition to the availability of facilities, neighborhood safety is a barrier for physical activity. Because the poor tend to live in less safe areas, they have reduced opportunities for engaging in outdoor physical activities (CDC 2003a). The CDC also reports evidence of higher BMIs in neighborhoods that are poorer and perceived as more dangerous.

6 Time Preference and Obesity

A less explored theory of increased obesity, which may be related to changes in technology and food marketing, focuses on the role of time preference in consumption and exercise decisions. Time preference refers to how much value one places on the future. People with a

high time preference have a strong preference for getting satisfaction now rather than later. They discount the future highly; they are impatient and unwilling to delay gratification. Because people with high time preference greatly discount future consequences, they are more likely to consume the types and amounts of food they please with little concern for future consequences, such as obesity and its attendant health problems.

Cutler *et al* (2003) develop a model of obesity that predicts the drop in the time cost of food is most likely to harm persons with high rates of time preference, but do not empirically test this hypothesis. They do note that the right tail of the BMI distribution (which they theorize contains the most impatient people) is growing especially fast.

Komlos *et al* (2004) argue that a general increase in American's time preference (i.e., increased impatience) could help explain, in part, their rising propensity to be obese. Their descriptive analysis of patterns in American's personal savings and the debt-to-income ratio, proxies for time preference, support their hypothesis: after the mid-1970s savings fell and the debt-to-income ratio increased, suggesting increasing time preference, as the prevalence of obesity increased. In their analysis of ten developed nations, they find some evidence that nations with higher savings rates (lower time preference) tend to have lower rates of obesity. Given the aggregate nature of their data these results can only be considered suggestive. Longitudinal studies that track time preference and obesity of individuals are much needed in order to test the hypothesis that time preference is a causal factor in the obesity epidemic.

Does time preference vary by income? Fisher (1931) argued that poverty "increases the want for immediate income even more that it increases the want for future income." That is, poverty tends to increase the preference for current utility. Becker and Mulligan (1997) present a model of endogenous time preference that implies time preference declines (patience increases) as wealth increases. Harrison *et al* (2002) use surveys in which respondents answer questions about hypothetical monetary trade offs to the estimate time preference in the Danish population. Their results indicate that poorer individuals have higher time preference than wealthier persons. Lawrance (1991) and Trostel and Taylor (2001) use consumption and socioeconomic data from the Panel Study of Income Dynamics, rather than a survey posing hypothetical trade offs, to estimate time preference in the U.S. Lawrance finds that persons in the top 5% of labor incomes have lower rates of time preference that those in the bottom fifth percentile. Trostel and Taylor, however, find no difference in time preference across permanent income. Samwick (1998) uses data from the Survey of Consumer Finances and reports evidence that time preference falls as income rises.

On balance the evidence suggests that the poor probably have higher time preference on average than those with greater current income and assets. Fuchs (1982) argues that time preference influences various health outcomes and Komlos *et al* (2004) argue that it impacts the likelihood of obesity in particular. If the poor do indeed have higher time preference and time preference affects health, it would then follow that the poor face a greater risk of obesity. Becker and Mulligan (1997), however, argue that causal pattern runs the opposite direction: health status influences time preference. Their model predicts that persons with health problems, such as obesity, anticipate less ability to enjoy themselves in the future and thus focus on present enjoyment. The possible link between time preference and obesity is an area needing much more research. In particular, better measures of time preference would greatly enhance our ability to test its impact on obesity and other health problems.

7 Welfare Programs' Impact on Obesity

A new thread in the discussion of the causes of obesity is the possible contribution of welfare programs, notably food assistance benefits. The U.S. federal government offers three principle food programs: food stamps (FSP), National School Lunch Program (NSLP), and supplemental nutrition for Women, Infants, and Children (WIC). The majority of recipients of these benefits are women and children. Besharov and Germanis (2001) note that when WIC was designed and implemented hunger was America's top nutrition problem. Now, however, the problem is obesity and WIC does little to address excess consumption of calories. In his 2003 testimony to the Committee on Agriculture, Nutrition, and Forestry, Besharov expands this criticism to the food stamps and National School Lunch programs. He presents evidence from the Third National Health and Nutrition Examination Survey (NHANES III) showing that poor adults consumed more calories, on average, in the period 1988-94 than in the period 1971-74:

	Mean Caloric Intake 1971 - 74	**Mean Caloric Intake 1988 - 94**	**% Change**
Male	2,393	2,517	5.18
Female	1,618	1,764	9.02
Poor Men	2,108	2,350	11.48
Poor Women	1,575	1,767	12.19
Non-poor Men	2,434	2,575	5.79
Non-poor Female	1,624	1,770	8.99

Both the poor and non-poor consumed more calories in 1988/94 than in 1971/74, but the rate of increase was greater among the poor. However, we don't know which of the poor actually received food assistance. Furthermore, the mean calories consumed by the poor in the latter time period don't generally exceed the National Research Council's Recommended Dietary Allowances (2,900 for younger men; 2,300 for men over 50 years of age; 2,200 for young women; 1,900 for women over age 50).

Gordon *et al* (1995) report that children in the National School Lunch Program get a higher percent of their food energy from fat and saturated fat both at lunch (at school) and during a 24-hour period (at and away from school). Lin *et al* (1996) find that foods prepared at schools are higher in fat, fiber and calcium than home-prepared meals. Gleason and Suitor (2003) use the Consumer Survey of Food Intake by Individuals (CSFII) from 1994 to 1996 to examine the nutritional impact of the NLSP. They report greater intake of six vitamins and minerals and fat among program participants, but lower consumption of added sugars. The higher fat consumption of the NLSP recipients underlies the concern the program may cause weight problems.

Jones *et al* (2003) use the Panel Study of Income Dynamics Child Development Supplement to examine if participation in the food stamps and the school breakfast and lunch programs impacts the probability a child is overweight (BMI $\geq 85^{th}$ percentile). They find that girls in food insecure households who participated in all three food assistance programs are less likely to be overweight than food insecure girls who did not participate. Participation

didn't impact the likelihood of overweight for girls from food secure households or boys (either food secure or insecure). Hofferth and Curtain (2003) also use the Panel Study of Income Dynamics Child Development Supplement and find no evidence that participation in food stamps and the National School Lunch programs raises the probability a poor child is obese. However, they do find some evidence that non-poor children in low and moderate income families who participate in NLSP (but not food stamps) are more likely to be overweight than non-recipient children of similar income status.

While there is fairly compelling evidence that NSLP participants tend to consume more fat in their school lunches, it is not clear that this is contributing to childhood obesity. If there is any impact on obesity, it is among low to moderate income children, not poor children. More study on the nutritional intake of NSLP participants and its impact of their BMI, controlling for other factors, would help clarify to what degree, if any, this program contributes to childhood obesity.

What impact does the food stamps program, which serves both children and adults, have on obesity? Basiotis *et al* (1998) examine the CSFII and find that participation in the food stamps and WIC programs improves overall diet quality as measured by the USDA's Healthy Eating Index. Wilde *et al.* (2002), however, present evidence that Food Stamps recipients consume more meats, added sugars, and total fats than non-recipients. Butler and Raymond (1996) argue that better nutrition may be observed in food stamp participants due to self-selection – those more interested in good nutrition may be more likely to join the program. Once they control for participation, Butler and Raymond (1996) find lower nutrient intake among food stamps recipients in the Elderly Food Stamp Cashout Project, although the levels aren't below Recommended Dietary Allowances. Townsend *et al* (2001) use the CSFII and find that female food stamp recipients are more likely to be overweight than non-recipients. Gibson (2003), using the National Longitudinal Survey of Youth, also finds that low-income women who receive food stamps are more likely to be obese than non-participants.

Perhaps the increase in purchasing power afforded by food stamps enables recipients to purchase more convenient, but calorie dense, foods. Alternatively, variations in purchasing power may impact food selections. Many food stamps participants only shop for groceries once a month. Thus, their energy consumption drops by the fourth week of the month, and this may create a behavioral cycle that impacts nutrition and weight gain (Wilde and Ranney 2000). After having little food at the end of the month, food stamp recipients may use their benefits to buy especially palatable, calorie dense food at the beginning of the month. While there is some evidence that food stamp receipt and women's weight are associated, there has been little research that disentangles the causal pattern. Current findings are consistent both with food stamps contributing to obesity and with obesity contributing to low income and thus a greater likelihood of food stamps receipt.

Few studies consider the impact of cash welfare benefits (AFDC or TANF) on recipients' BMI. Townsend *et al* (2001) find a greater prevalence of overweight among AFDC recipients in a bivariate analysis, but do not include AFDC receipt in their logistic regression model of BMI. Thus, it's not clear if AFDC receipt impacts the probability of overweight independent of other factors. TANF, which replaced AFDC, requires most mothers to work, which could lead recipients to rely more heavily on convenience foods, which tend to be more calorie dense. However, no one has conducted a thorough empirical investigation of this hypothesis yet.

8 Obesity's Impact on Welfare Programs

Government efforts to reduce welfare dependency, particularly in the TANF program, focus on moving recipients into the workforce and self-sufficiency. Some government efforts also aim to encourage marriage as a means to increase household income and move people off the welfare rolls. Might the rise in obesity impede the transition from welfare to work? Puhl and Brownell (2001) review the literature on prejudice against the obese in education and employment settings. They find evidence that employers often hold negative stereotypes of the obese and judge them more harshly. They also report evidence of discrimination in schools, beginning at the elementary level and continuing through college. Such discrimination may contribute to the observed lower educational attainment among the obese.

Not only do the obese face discrimination and the associated psychosocial harm, but also a substantial body of evidence indicates that the obese can expect poorer labor market outcomes (Gortmaker *et al* 1993, Pagan and Davila 1997, Averett and Korenman 1996, 1999; Puhl and Brownell 2001, Laitinen *et al* 2002). Gortmaker *et al* (1993) examine a group of 16 to 24 year-olds whose BMI lies in the 95th percentile and observe that in a seven year follow up they earn less income and have higher poverty rates than do their lower weight counterparts. Averrett and Korenman (1996, 1999) present evidence that obese women earn less than healthy weight women and that the effect is stronger for whites than for African Americans. Mitra (2001) finds evidence in the National Longitudinal Survey of Youth that among professionals and blue-collar women, being heavier carried a wage penalty.

Obesity is also a barrier in the marriage market. Gortmaker *et al* (1993) find that those above the 95th percentile in BMI at ages 16 to 24 are less likely to be married seven years later. Laitinen *et al* 2002 reports that the obese are both less likely to marry and are more likely to be married to a low-income spouse than the non-obese. Averrett and Korenman (1996, 1999) produce similar results and estimate that the majority of the economic penalty of obesity for white women results from poorer outcomes in the marriage, rather than labor, market.

The body of evidence indicates that the obese, especially women, face greater difficulties both in the labor and marriage markets. Because obesity rates are higher among women, particularly poor and minority women, it is potentially a significant barrier to the welfare-to-work transition. Government efforts to reduce welfare dependency through the labor and marriage markets will, in theory, be less successful the greater the prevalence of obesity among the poor. Few studies examine whether obesity impacts welfare dependency. Kaplan *et al* (2004) analyze data on current and former welfare recipients in an urban Michigan county (the Women's Employment Study) and find higher BMI and rates of obesity in this group than in a nationally representative sample of women matching in age and racial composition (NHANES 1999-2000). Cawley and Danziger (2003) use the same data and find that higher BMI is associated with a lower probability of employment and a greater length of time on welfare for white women. Among black women higher body weight was inversely associated with hours worked per week.

While the empirical evidence on obesity as a barrier to financial success is strong regarding the general population of women, there is not enough research yet to determine if this holds for welfare recipients in particular. We need more research on the prevalence of obesity among welfare recipients and the degree to which obesity is a barrier to the welfare-

to-work transition. Studies of a nationally representative sample of TANF recipients would be especially useful. If indeed obesity is an important barrier to leaving welfare, programs to reduce obesity would be complementary to efforts to reduce welfare caseloads and costs.

Rising obesity may also impact government medical assistance to the poor due to its association with an array of diseases. An extensive medical literature clearly establishes the association between obesity and diabetes, gallbladder disease, cardiovascular disease, some types of cancer, and osteoarthritis (Field *et al* 2001; Must *et al* 1999; Visscher and Seidell 2001; Wang and Dietz 2002). Finkelstein *et al* (2003) estimates that Medicare and Medicaid pay about half of the medical costs associated with overweight and obesity.

Another avenue through which obesity may impact welfare programs is through its association with disability. The American Obesity Association notes on its website that disability may result from obesity and explains that in certain circumstances the obese are eligible for disability benefits (www.obesity.org). Ferraro *et al* (2002) present evidence that obesity is positively associated with work disability. Lakdawalla *et al* (2004) analyze data from the National Health Interview Survey (NHIS) and find a rising rate of "routine needs" disability among people ages 18 to 59. The authors estimate that obesity accounts for roughly half of the rise in disability among persons aged 18 to 29 years and about 25% of those aged 30 to 39. Lakdawalla *et al* (2004) acknowledge that part of the rise in disability claims may be due to changes in public disability programs, which have encouraged young adults to report disability.

If the link between obesity and disability were causal, then the rise in obesity would mean a future increase in disability claims. However, Cawley (2004) argues that the association is not causal. Using an instrumental variables approach and female respondents from the National Longitudinal Survey of Youth, he finds no evidence that body weight influences the likelihood of employment disability. Instead, he suggests that disability causes obesity and/or that some other factor, such as time preference, causes both obesity and disability. If Cawely is correct, then estimates of the cost of obesity that include costs associated with disability are overestimates. As there is no current consensus, more research needs to be conducted to establish the causal flow between obesity and disability.

10 The Relationships between Poverty and Overweight and Obesity in the NHANES III

This section offers an original analysis of the relationship between poverty, welfare receipt, and overweight and obesity using data from the Third National Health and Nutrition Examination Survey of the United States (NHANES III). The NHANES is a periodic survey conducted by the U.S. National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC). The NHANES III, conducted from 1988 through 1994, was the seventh in a series of these surveys based on a complex, multi-stage sample plan. It was designed to provide national estimates of the health and nutritional status of the United States' civilian, non-institutionalized population aged two months and older in the 50 states and the District of Columbia.

The major design parameters of the NHANES III have been summarized elsewhere (NCHS, 1994). In NHANES III, 39,695 persons were selected over the six years; of those,

33,994 (86%) were interviewed in their homes. From this sample we extracted 31,311 cases with data relating to demography (e.g. age, sex, "race/ethnicity," family/household size), anthropometry (e.g., height, weight), health status (e.g., physician's exam), food security (e.g., days per month without enough food), and physical activity (e.g., days per week of vigorous exercise, hours per day of television viewing).

In our statistical analysis we use the reported data without any sample weights or other adjustments. Such weighting and adjustment is needed when the NHANES III data are used to estimate national prevalences and rates. For our purposes, however, we examine the relationships between indicators of overweight and obesity (e.g., body mass index) and the variables from the categories listed above. Using the NHANES III sample weights in these analyses greatly inflates the sample size, reducing standard errors and making all results appear statistically significant.

We divide the sample into three age groups, three "race/ethnic" groups, and two income groups. The age groups are: children (ages 2-10 years), teens (ages 11-20 years) and adults (ages 21-49 years old). "Race/ethnicity" was self-reported or reported by the respondent of the Family Questionnaire of the NHANES III. We examine three "race/ethnic" groups: whites, blacks, and Mexican-Americans. The NHANES III defined four "race/ethnic" groups: Non-Hispanic white, Non-Hispanic black, Mexican-American, and Other, but there are too few individuals in the "Other" category for reliable analysis.

We consider the NHANES III "race/ethnic" codes as social categories and not as well defined genetic or biological groups. In this we follow the position of the American Anthropological Association (AAA 1998) that in the United States "race" and "ethnicity" are social constructs that often have biological impacts. This means anthropometric variables, such as height, weight, and BMI, may differ significantly between "racial" groups and the cause of such differences are usually due to social, economic, and political factors that impact the way life is lived in each "racial" group (see Bogin, 2001, pp. 229-242, for a discussion of the biocultural nature of human "races").

We examine two income groups based on the Poverty Income Ratio variable reported in the NHANES III. The poverty income ratio (PIR) is computed as a ratio of two components. The numerator is the midpoint of the observed family income category reported in the Family Questionnaire. The denominator is the poverty threshold, based on the age of the family reference person, and the calendar year in which the family was interviewed. The poverty threshold values (in dollars) are produced annually by the Census Bureau and are adjusted for inflation. Reports for each of the calendar years in the survey (1988-94) are used in the calculation of PIR. The poverty income ratio allows income data to be analyzed in a comparable manner across the six years of the survey.

Persons who reported having had no income were assigned a zero value for PIR. A substantial proportion of persons refused to report their income or income category during the application of the Family Questionnaire. Due to the rate of income non-response the potential for bias in PIR may be high. However, PIR is the most consistently measured income variable available in the NHANES III data set. Of the 31,311 cases in our database, 18,180 cases report PIR. The mean PIR is 2.08 (sd = 1.62), the median is 1.65, and the range is 0-11.89. Table 1 presents the PIR frequency distribution.

The NHANES III survey over-sampled low-income families and as shown in Table 1, almost 52 percent of the sample has a PIR below 2.0. The NHANES III also over-sampled blacks and Mexican-Americans. In 1990, blacks constituted about 12 percent and Hispanics

(including Mexican-Americans) constituted about 9 percent of the United States population. In the NHANES III the sample sizes by "race/ethnicity are: whites=11,652, blacks=9,074, Mexican-American=9,138, Other=1,447. Thus, blacks and Mexican-Americans each account for about 29 percent of the NHANES III sample.

Table 1: Frequency distribution of Poverty Income Ratio (PIR) in NHANES III

PIR	Count	Cumulative	Percent	Cumulative
		Count		Percent
0-0.99	5666	5666	27.68900	27.6890
1.00-1.99	4924	10590	24.06294	51.7519
2.00-2.99	3267	13857	15.96540	67.7173
3.00-3.99	2161	16018	10.56052	78.2779
4.00-4.99	1006	17024	4.91619	83.1941
5.00-5.99	667	17691	3.25954	86.4536
6.00-6.99	277	17968	1.35366	87.8073
7.00-7.99	110	18078	0.53756	88.3448
8.00-8.99	72	18150	0.35185	88.6967
9.00-9.99	19	18169	0.09285	88.7895
10.00-10.99	5	18174	0.02443	88.8140
11.00-11.99	6	18180	0.02932	88.8433

To be conservative and cautious (due to the non-response rate and to over-sampling), we created two PIR groups: respondents with a PIR of 0-1.99 and those with a PIR of 3.0 or greater. A PIR of 1.0 represents poverty level, and income at twice the poverty level is still considered low income. Our group of PIR 0-1.99 captures the lower income segment of the NHANES III sample. Our group of PIR 3.0 and greater captures the moderate to higher income groups. We excluded anyone with a PIR from 2.0-2.99 to make the income contrast more definitive. We ran our analyses with other PIR groupings (e.g., PIR=0-1.3 versus PIR=2.0 and higher) but found very little difference in results.

For children and teens we converted the data for height, weight, and BMI into z-scores (e.g., Z height-for-age and Z BMI). This allowed us to combine the values for different sexes and ages within the age groups and to compare age groups. We used EpiInfo, a software package available from the NCHS, to calculate these z-scores. EpiInfo provides two methods for computing z-scores, one uses the NHANES III sample as the reference sample and the other uses the Center for Disease Control/World Health Organization (CDC/WHO) 1978 reference sample. We chose the CDC/WHO 1978 method because of our focus on overweight and obesity. The CDC/WHO 1978 reference data precede the upsurge in rates of overweight and obesity of the last 20-25 years (the segment of the CDC/WHO 1978 sample we use here is from the NHANES I and NHANES II surveys). Using the CDC/WHO 1978 reference sample to calculate z-scores allows us to not only compare our age, sex, "race/ethnic," and PIR groupings, but also see how each group compares in overweight and obesity to earlier times. For adults we employ the original BMI data, rather than z-scores, from the NHANES III.

We begin our analysis by examining the anthropometric data divided by age group, sex, "race/ethnicity", and PIR groups. Although, our focus is on overweight and obesity, we also

looked at height as it is a global measure of physical growth and it is sensitive to socioeconomic factors (Bogin, 1999). There is no statistically significant effect for sex, so we combine boys and girls in these graphs. Figures 2 and 3 present the results for height-for-age z-scores for children and teens.

Figure 2

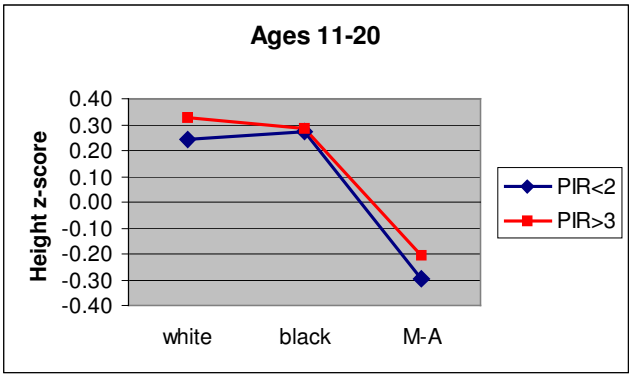

Figure 3

All children and both white and black teens are taller, on average, than the CDC/WHO 1978 reference data (the "0.0" line for z-height). Mexican-American teens are shorter than the reference. The finding that children and teens generally exceed the height standard indicates that poverty in the U.S. is not so severe as to produce widespread stunting and that health status, as measured by height, has improved on average.

In both age groups the mean height values are greater for the higher PIR group, but the differences are not statistically significant. There is, however, a significant effect for "race/ethnicity." This finding results from the Mexican-Americans being shorter than blacks in the 2-10 year old group (children) and shorter than both whites and blacks in the 11-20 year old group (teens). There are several possible reasons for the relative shorter stature of the Mexican-American children and teens. It is possible that Mexican-Americans have a genetic propensity toward shorter stature than European and African-Americans (Martorell *et al.* 1984). However, in our estimation the most likely explanation is that many of these teens, especially the older ones, are immigrants to the United States or their parents are immigrants. These older teens were more likely to grow-up under less favorable conditions for health and this is reflected in their shorter average stature (Bogin, 1999). In an anthropometric sense,

reduced leg length is the reason for shorter stature in Mexican-Americans (Martorell *et al.* 1988, Frisancho *et al.* 2001). Several recent studies indicate that reduced leg length is a sensitive indicator of a less favorable environment for growth and health (Bogin *et al.* 2002; Bogin and Rios, 2003).

Figures 4 and 5 show the results for BMI z-scores for children and teens. Again, there is no significant effect for sex, so boys and girls are combined. All groups have greater mean BMIs than the CDC/WHO 1978 reference data (horizontal axis). Among children, the BMI of whites and blacks are only 0.1 to 0.15 z-score units greater than the reference, but the Mexican-Americans are about 0.4 z-score units greater. Among teens, Mexican-Americans average nearly 0.5 z-score units greater than the reference, followed by blacks and then whites.

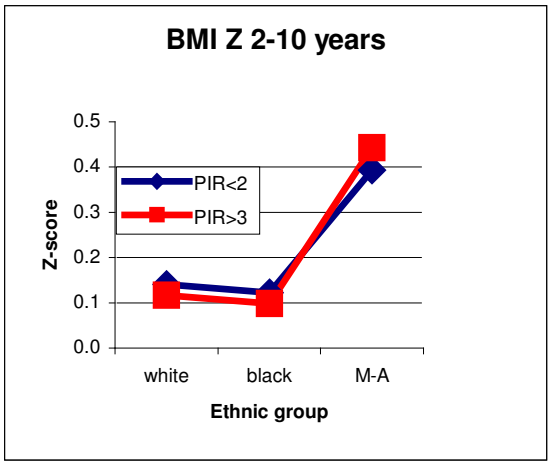

Figure 4

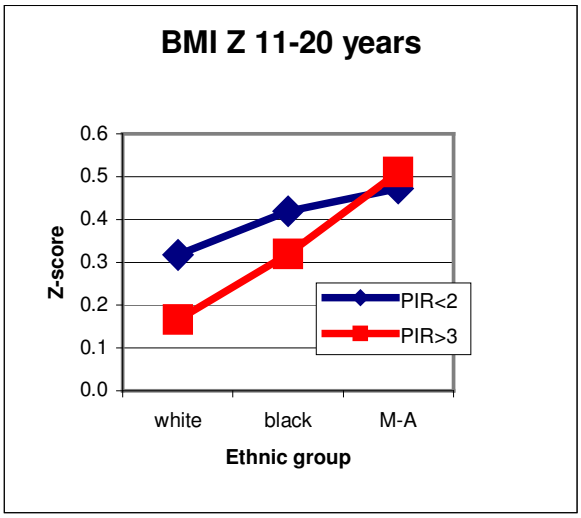

Figure 5

There are no significant effects for PIR within "race/ethnic" groups for either children or teens. Mexican-American children have significantly greater BMI than their white and black counterparts. For the teens we observe statistically significant differences associated with PIR between "race/ethnicity" groups. The Mexican-American teens of both lower and higher PIR categories have significantly greater BMI than white teens in the higher PIR group. Furthermore, the lower PIR black teens have greater average BMI than do higher income white teens.

We next examine the distribution of BMI in the children and teens. We classify sample members by three BMI groups, following the categorization of nutritional status proposed by Frisancho (1990). Group 1 includes boys and girls with BMI z-scores below –1.04 (below the 15th percentile). Group 2 includes boys and girls with BMI z-scores between –1.036 to +1.30 (between the 15th and 85th percentile). Group 3 includes boys and girls with BMI z-scores above +1.36 (above the 85th percentile). These three groups may be considered "thin," "normal," and "overweight/obese" respectively.

Table 2 reports the BMI distributions for children and indicates no PIR effect. The table does shows that about 19 percent of white and black children and 27 percent of Mexican-American children are overweight or obese, an alarming result.

Table 2: Number and Prevalence of Thin, Normal, and Overweight/Obese Children by "race/ethnicity" and PIR group.

"race/ethnic"	**PIR**	**Thin**	**Normal**	**Overweight/Obese**
White	< 2	n=114	702	191
		11.32%	69.71%	18.97%
	> 3	57	283	77
		13.67%	67.87%	18.47%
Black	< 2	157	835	234
		12.81%	68.11%	19.09%
	> 3	60	324	93
		12.58%	67.92%	19.50%
Mex-Amer	< 2	125	807	355
		9.71%	62.70%	27.58%
	> 3	40	333	138
		7.83%	65.17%	27.01%

Table 3 presents the BMI distributions for teens and shows that the prevalence of overweight/obesity ranges from about 19 to 32 percent. A greater percent of low-income white and black teens is overweight or obese compared to the higher PIR groups. These differences are not, however, statistically significant. Among the Mexican-American teens, both the low and high PIR groups are more than 30 percent overweight/obese.

Tables 4 and 5 show the height and BMI distributions for adult men and women respectively. In general, the findings for adult height follow the same general pattern as for the children and teens, except men are taller on average than women in all of the groups. Mexican-Americans are significantly shorter than whites and blacks. We find no statistically significant differences in height associated with PIR within "race/ethnic" groups.

Table 3: Number and Prevalence of Thin, Normal, and Overweight/Obese Teens by "race/ethnicity" and PIR Group.

"race/ethnic"	PIR	Thin	Normal	Overweight/Obese
White	<2	n=45	304	121
		9.57%	64.68%	25.74%
	>3	24	153	43
		10.91%	69.55%	19.55%
Black	< 2	74	400	219
		10.68%	57.72%	31.60%
	> 3	29	164	69
		11.07%	62.60%	26.34%
Mex-Amer	< 2	60	398	203
		9.08%	60.21%	30.71%
	> 3	20	161	84
		7.55%	60.75%	31.70%

The results for BMI show different patterns for men and women. All groups of men have an average BMI greater than 26 (a BMI of 25 or greater indicates overweight). Men's BMI does not differ significantly by PIR or "race/ethnic" group. All groups of women are at or above a BMI of 25. Black women have the highest average BMI, followed by Mexican-Americans and then whites. The black and Mexican-American women's BMIs are significantly greater than white women's. While we observe BMI differences across racial/ethnic groups, there is no evidence that BMI varies across PIR within "race/ethnic" groups.

Table 4: Mean Height and BMI for Adult Men.

"race/eth"	PIR	n	Height	sd	BMI	sd
White	<2	638	177.63	6.91	26.43	5.43
	>3	301	176.97	6.33	26.56	5.61
Black	< 2	695	177.08	10.02	26.27	5.75
	> 3	295	177.16	6.45	26.58	5.94
Mex-Am	< 2	789	169.35	10.71	26.85	4.82
	> 3	294	169.94	6.78	26.61	4.74
All Groups		3012	174.47	9.47	26.55	5.36

Table 5: Mean Height and BMI for Adult Women.

"race/eth"	PIR	n	Height	sd	BMI	sd
White	<2	798	163.73	6.18	25.95	6.65
	>3	371	164.14	6.76	25.24	5.99
Black	< 2	920	163.41	8.41	28.61	7.55
	> 3	366	163.18	6.86	28.58	7.47
Mex-Am	< 2	809	157.67	6.01	27.81	6.44
	> 3	325	157.12	5.86	27.51	5.80
All Groups		3589	161.67	7.44	27.38	6.90

Table 6 shows the prevalence of thinness, normal weight, and overweight/obesity among adult men in the NHANES III data. All groups of men range from 52 to 62 percent overweight/obese. Poorer Mexican-American men are a bit more likely to be overweight/obese than their wealthier counterparts, but the difference is not statistically significant. Women (Table 7) present a different pattern. There are no significant BMI differences associated with PIR within "race/ethnic" groups, although poorer white women tend to be more likely to be overweight/obese than wealthier white women. However, compared with white women, there are significantly more overweight/obese black and Mexican-American women.

Table 6: Number and Prevalence of Thin, Normal, and Overweight/Obese Male Adults by "race/ethnicity" and PIR group.

"race/ethnic"	**PIR**	**Thin**	**Normal**	**Overweight/Obese**
White	<2	n=12	284	334
		1.90%	45.08%	53.02%
	>3	4	134	161
		1.34%	44.82%	53.85%
Black	< 2	10	315	364
		1.45%	45.72%	52.83%
	> 3	6	133	153
		2.05%	45.55%	52.40%
Mex-Am	< 2	11	283	485
		1.41%	36.33%	62.26%
	> 3	4	122	166
		1.37%	41.78%	56.85%

Table 7: Number and Prevalence of Thin, Normal, and Overweight/Obese Female Adults by "race/ethnicity" and PIR group.

"race/ethnic"	**PIR**	**Thin**	**Normal**	**Overweight/Obese**
White	<2	n=30	413	352
		3.77%	51.95%	44.28%
	>3	15	204	147
		4.10%	55.74%	40.16%
Black	< 2	24	315	574
		2.63%	34.50%	62.87%
	> 3	14	124	227
		3.84%	33.97%	62.19%
Mex-Am	< 2	20	284	498
		2.49%	35.41%	62.09%
	> 3	5	114	202
		1.56%	35.51%	62.93%

10.1 Relationship between BMI and Welfare Participation

With this background, we now evaluate our major hypothesis: does welfare participation increase the risk for overweight and obesity? From the Adult Interview file of the NHANES III database we extracted two indicators of welfare participation: receipt of WIC benefits and receipt of food stamps, coded as "yes=1" or "no=2." WIC is a food program for pregnant women and women with infants. We test the hypothesis in each of our three age groups, using BMI as our criterion measure of body fatness.

For the children and teens groups we first step estimate an OLS regression between BMI z-scores and the independent variables "race/ethnicity," "poverty income ratio," "WIC," and "food stamps." For children, both "race/ethnicity" and "WIC" were significant predictors of BMI z-scores (detailed results available upon request). Notably, receipt of WIC is inversely associated with the BMI z-score, lowering children's BMI by 0.04 z-score points on average. However, the mean BMI z-scores of recipient children still lie within the normal range. There are no significant differences in mean BMI z-scores between those receiving WIC and those who did not within ethnic categories. For the teens, "race/ethnicity" is the only significant predictor of BMI z-score. Neither food stamps nor WIC participation significantly impacts average BMI z-scores for teens.

The regression analysis of the adults used the BMI scores, rather than z-scores, and the following predictor variables: "sex," "race/ethnicity," "poverty income ratio," "age," "WIC," and "food stamps." We include "age" as a variable for two reasons. First, BMI tends to increase with age in adults and second WIC recipients are likely to be younger than non-recipients. Without some control for "age" our analysis would confound the influences of welfare and aging on BMI. Four of the independent variables, "sex," "race/ethnicity," "age," and "food stamps" are significant predictors of adult BMI. Consistent with prior research, age has a positive impact on average BMI. Food stamp receipt also has a positive impact, raising BMI by 0.07 units on average. This result supports the hypothesis that food stamps receipt leads to weight gain among adults.

Table 8 presents ANOVA analysis of women's BMIs by "race/ethnic" group and food stamp status while Table 9 provides the results for men. The important contrasts to note in Tables 8 and 9 are those within ethnic groups and between food stamp statuses. In all three ethnic groups, women participating in the food stamp program have higher average BMI scores. However, these differences are statistically significant only for Mexican-American women. For the men, those participating in the food stamp program exhibit slightly lower mean BMIs, but the differences are not statistically significant. From a strictly statistical standpoint, the results suggest that food stamp receipt increases the mean BMI of Mexican-American women only. The observed differences for whites and blacks may still be of biological significance, as each point increase in BMI scores increases the risk of diseases related to obesity (Calle *et al*. 1999).

In sum, the regression analyses produce no evidence that receipt of WIC or food stamps increases BMI for children and teens. There is evidence that food stamp receipt raises adults' mean BMI. The ANOVA analysis indicates that the impact of food stamps on BMI is especially relevant for Mexican-American women.

Table 8: Women's Mean BMI by "race/ethnic" Group and Participation in Food Stamps Program

race/eth	Food stamps	Mean BMI	N	s.d.
White	Yes	26.82	145	8.15
	No	25.33	1425	6.06
Black	Yes	28.64	539	8.16
	No	28.38	1182	7.27
Mex-Amer	Yes	29.01	386	6.72
	No	27.18	1154	6.05
All Groups		27.23	4831	6.88

Table 9: Men's Mean BMI by "race/ethnic" Group and Participation in Food Stamps Program.

race/eth	Food stamps	Mean BMI	n	s.d.
White	Yes	25.21	65.	5.31
	No	26.30	1221	5.31
Black	Yes	25.94	255	6.59
	No	26.56	1089	5.61
Mex-Amer	Yes	27.40	245	5.32
	No	26.55	1255	4.54
All Groups		26.47	4130	5.27

Table 10: Logistic Regressions of Overweight/Obese

Parameter	Children Estimate (p-value)	Teens Estimate (p-value)	Adults Estimate (p-value)
Poverty Income Ratio	-0.062 (0.363)	-0.041 (0.605)	-0.020 (0.154)
Male	0.075 (0.697)	-0.397 (0.068)	-0.034 (0.467)
Black	-0.140 (0.593)	0.124 (0.660)	**0.534** **(.000) ***
Mex-Amer	-0.230 (0.340)	0.226 (0.402)	**0.727** **(0.000)***
Received WIC (Yes=0; No = 1)	0.162 (.575)	-0.195 (0.578)	-0.055 (0.490)
Received Food Stamps (Yes=0; No = 1)	0.159 (0.498)	-0.070 (0.793)	**-0.179** **(0.008)***
Age			**0.053** **(0.000)***

Next we ran binary logistic regressions to estimate the impact of welfare receipt on the probability of overweight/obesity in the three age groups. We estimate overweight/obese as a function of the poverty income ratio (PIR), gender, race/ethnicity, receipt of WIC and receipt

of food stamps in the equations for children and teens. In the adult equation we also include age as a regressor. Table 10 shows that none of the predictor variables are statistically significant in the children and teen equations. Thus, we find no evidence that receipt of either WIC or food stamps increases the likelihood a child or teen is overweight or obese.

For the adults, being black or Mexican-American significantly raises the likelihood of being overweight or obese. Age also positively impacts the likelihood of overweight or obesity. Receipt of food stamps is a statistically significant predictor of overweight/obesity among adults. The significant and negative coefficient on Received Food Stamps means that persons who didn't receive food stamps are less likely to be obese or overweight. Thus, these results indicate that adults who receive food stamps are more likely to be overweight or obese.

10.2 Associations of BMI with Health and Food Security

We now broaden our analysis of BMI, performing a series of OLS regressions using BMI as the dependent variable and several measures of health, food security, exercise, TV viewing, and characteristics of the home environment as independent variables. The health variables are a physician's overall assessment of health (ranging from "excellent" to "poor" on a 5 point scale) and a physician's assessment of the ability to run 100 yards without difficulty (ranging from "no difficulty" to "cannot" on a 4 point scale). Food security was assessed in the NHANES III by questionnaire, asking if families had enough food each month, if adults reduced the portion size of meals or skipped meals, and if caregivers reduced the child's portion size or if children skipped meals during the month. Exercise was assessed by a question "How many times per week do you play or exercise hard enough to sweat and breathe hard?" TV viewing represents the hours people watched television on the day prior to the interview. Household characteristics included the number of people in the family, number of people living in the household, and the number of smokers in the household. The majority of NHANES III participants do not have data for all of these variables, which greatly reduces the sample size available for analysis (less than 600 individuals in each age group) and the power of any statistical test.

We present a summary of the regression findings here (detailed results are available upon request). For the children, the significant predictors of BMI z-scores are "health status" and "cut adult meal size." Reporting a lower health status and residence in homes that did not reduce the portion sizes of adult meals is associated with higher average child BMI. For teens, the significant predictors of BMI z-scores are "health status," "ability to run 100 yards," "cut adult meal size," and "cut child meal size." Reporting lower health status and less ability to run 100 yards, and residing in homes that did cut adult meals size, but did not cut the portion size of child meals is associated with higher average teen BMI.

Sex is not a significant predictor of adult BMI, so the regression analysis used data for men and women combined. We ran separate regressions for each of the "race/ethnic' groups. For adult whites the significant predictors of BMI are "health status" and "ability to run 100 yards." For blacks the significant predictors of BMI are "health status," "ability to run 100 yards," and "cut child meal size." For adult Mexican-Americans the significant predictors of BMI are "health status" and "ability to run 100 yards.

10.3 Discussion of the NHANES Analysis

The descriptive analysis shows that all of the age groups, PIR groups, and "race/ethnic" groups in the NHANES III exhibit a higher average BMI than the CDC/WHO references. Mexican-American children and adolescents present the highest mean BMIs, and significantly so when compared with white children and adolescents. The BMI distributions (thin, average, overweight/obese) reinforce the fact that the epidemic of excess body fatness in the U. S. involves all ethnic groups and all ages.

The mean BMI of poorer (PIR<2.0) black adolescents is significantly greater than higher PIR (>3.0) whites, suggesting complex relationships involving both income and ethnicity. The interactions between income and ethnicity become clearer in the case of adult women, as there are significantly more overweight/obese black and Mexican-American women than white women. Ethnic variation in conceptions of body image, desirable weight, and fatness certainly play some role. Furthermore, a greater percentage of blacks and Mexican-Americans than whites live in poverty. These results are consistent with previous reports of an inverse relationship between income and body fatness in women (Garn 1986; Zhang and Wang, 2004).

The ANOVA and regression analyses indicate that the impact of poverty, as measured by the PIR, on BMI and the likelihood of overweight/obesity is small and not statistically significant. However, there is evidence that some of the consequences of poverty, such as poor health and food insecurity do result in greater mean BMI.

Binary logistic regressions produce no evidence that PIR significantly impacts the likelihood of overweight and obesity. Nor do we find any evidence that receipt of WIC influences the probability of overweight/obesity. We do, however, find evidence that adults who receive food stamps are more likely to be overweight or obese.

Finally, our expanded regression analysis shows no evidence that exercise, TV viewing, smoking or smokers in the home, and family or household size impacts mean BMI, but small sample size limits the meaningfulness of these analyses. Where we do have sufficient sample sizes (more than 1,000 per age group) we find significant effects of health status, ability to run 100 yards, and reducing meal portion sizes on mean BMI. These independent variables are not highly correlated among themselves or with BMI. In other words, high BMI is not in itself the reason to be ascribed to a poor health group or not be able to run 100 yards. The meal size associations are not obvious. For adolescents, cutting child meal size reduces BMI, but cutting adult meals size raises BMI. For black adults, cutting child meal size raises BMI. Possibly, any report of cutting meal size indicates a fairly high level of food insecurity. This food insecurity exerts multiple influences on eating behavior and the risk for overweight and obesity, some increasing and some decreasing the risk.

11 Summary and Conclusions

The current literature from an array of disciplines supports the hypothesis that the rise in obesity results largely from our increasingly obesogenic environment. There are good theoretical reasons to suspect that a number of the environmental changes impact the poor more than others. Empirical evidence indicates that the falling relative price of calorie dense foods, increased convenience food advertising, changes in the physical demands of labor, and

decreasing availability of supermarkets in urban areas all pose greater barriers for the poor than others to the healthy lifestyle needed to avoid weight problems. Higher time preference and neighborhoods lacking the amenities and safety that encourage leisure time physical activity may also contribute to higher BMI and higher rates of overweight and obesity among the poor.

Does welfare contribute to obesity among the poor? Little work has been conducted on the possible impact of cash assistance on BMI and weight problems; instead efforts have focused on food assistance programs. Like previous studies, we find no evidence that participation in WIC increases the likelihood of overweight or obesity among children and adults. We did not examine the impact of participation in the National School Lunch Program (NSLP), but the few existing studies present evidence that the program raises the chance that children in non-poor low and moderate income households are obese, but does not impact the likelihood that children in families living below the poverty line are obese. Like previous studies, we find no evidence that receipt of food stamps impacts the probability of obesity among children and teens. Also like previous studies, we do find that food stamp receipt tends to increase the likelihood of overweight and obesity among adults. Some may argue that this evidence suggests that food stamp benefits need to be reduced; we are overfeeding poor adults. However, this same evidence may lead others to suggest that policy makers need to review the items allowed for purchase with food stamps, the schedule of food stamps allocations (perhaps once a month is not optimal), and the availability of nutrition education for recipients in government food assistance programs.

Does obesity impact welfare caseloads and costs? The literature clearly establishes obesity as a significant barrier in the marriage and labor markets, particularly for women. While this suggests that obesity could be a major barrier to moving welfare recipients from the rolls to self-sufficiency, not enough empirical analysis has been completed to ascertain the degree to which obesity prevents the transition. Only two studies to date directly examine the impact of obesity on the labor market outcomes for recipients of cash benefits and both rely on data from a single county in one midwestern state. They do find some evidence that obesity lowers the probability of employment and lengthens welfare spells among white TANF recipients. Among black TANF recipients there is evidence that higher BMI is associated with fewer hours worked per week. Much more work need to be done in order for us to understand how obesity impacts welfare recipients' ability to achieve financial independence through work and marriage.

Similarly, the work investigating the possible contribution of obesity to the costs of government disability programs is not sufficiently developed to allow us to draw firm conclusions. While it is clear that the obese have higher rates of disability, it is not clear whether obesity causes disability or disability causes obesity or both. The literature more strongly establishes the link between obesity and various diseases, and thus suggests that reducing obesity could reduce government medical costs.

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