The Influence of Access: Longitudinal BMI Change and Socioeconomic Status in the Health and Retirement Study, 1992-2006

The current population of the United States is experiencing an obesity epidemic where more than half of the population age 25 and older is considered overweight or obese (Must et al. 1999). Comorbidities associated with obesity include the onset of type 2 diabetes, cardiovascular disease, musculoskeletal disorders, prohibitive physical disability, and sleep apnea (Visscher and Seidell 2001). It is estimated that obesity-related deaths in the US adult population lie between 280,000 to 325,000 (Allison et al. 1999). The treatment of obesity-related health outcomes account for 5 to 7% of the total annual medical expenditures in the United States, or approximately $75 billion per year (Finkelstein et al. 2003). Not simply a burden of the American populace, obesity poses a threat to health on a global scale (W.H.O. 1998; James et al. 2001).

Populations threatened by unfavorable social and economic circumstances are more likely to be obese (James et al. 2001; Pena and Bacallao 2000). Though the relative impact of obesity on health is greater for younger individuals (Stevens et al.1998), elderly populations who experience higher absolute prevalence rates of morbidity and disability than younger populations are likely to experience a greater impact of obesity on health (Visscher and Seidell 2001). The toll of obesity on physical health has been well documented (ibid; Fontaine et al 2003; Poirier and Eckel 2002; Rashid et al. 2003; Colditz et al. 1990; Colditz et al. 1995; Hu et al. 2001; Giovannucci et al. 1995; Galanos et al. 1994; Launer et al. 1994; Ferraro and Booth 1999; Himes 2003). The effects of weight change over time have also been shown to impact mortality (Lee et al. 1994; Yarnell et al. 2000; Andres et al. 1993; Rosengren et al. 1999; Strandberg et al. 2003) and quality of life associated with health (Strandberg et al. 2003). Obesity's relationship with mental health has been investigated with mixed result. Clinical studies employing cross-sectional methods provide support for the link between obesity and psychological health (Schwimmer et al. 2003) but little supporting evidence is offered by population based studies (Strandberg et al. 2003, Fine et al. 1999; Hällström 1981; Yancy et al. 2002; Hayes and Ross 1986; Istvan et al. 1992; Ross 1994). Upstream from the association between obesity and long-term health, social factors channel individuals toward obesity through determining access to various resources, in-turn influencing the adaption of health behaviors and lifestyles that eventually manifest into socially-stratified patterns of obesity.

To contribute to the obesity and aging literature, we use latent growth curve modeling to estimate trajectories in BMI based upon numerous variables commonly associated with the socioeconomic status of individual health outcomes. The sample used in analysis is the most recent update to the Heath and Retirement Study. Using this sample will provide results from a recently updated version of an expansive longitudinal study. Modeling BMI change based upon common socioeconomic resources associated with the fundamental cause of health disparities (Link and Phelan 1995), this work adds to the sociological literature by turning from the well-documented relationship between BMI and health outcomes to focusing on the upstream influences of BMI and BMI change. In addition, the current analysis synthesizes numerous previous studies into a complex statistical design able to account for the upstream source of numerous health shaping covariates.

Literature Review and Hypothesis Development

Socioeconomic Status and Obesity

Various theoretical perspectives and empirical analyses have outlined the relationship between health and socioeconomic position. The stratification of societies based upon access to various resources channels individuals grouped by these strata towards similar health outcomes (Lynch and Kaplan 2000). Integrating these perspectives into the literature of health sociology, the fundamental cause perspective (Link and Phelan 1995) posits that the determinants of disease reside not within the individual but instead influence externally through social conditions which determine in-equal access to resources.

The resources to which Link and Phelan (1995) refer are numerous forms of economic, social, and cultural capital which embed individual health within a larger socio-cultural context. Lynch and Kaplan (2000) weigh the relative contributions of traditional measures of SES of education, occupation, and income. The authors support the use of these SES indicators, providing that each measurement is individually specified and keen attention is paid to the structural determinants of access to resources. Studying mortality differentials, Blane et al. (1997) suggest occupation, diet, housing, and atmospheric pollution contribute to differences in health through inequitable exposure to deleterious environmental factors and behavioral conditioning. Taken together, health status is largely determined by access to various forms of resources and differential exposure to injurious conditions. Those with higher levels of various SE indicators enjoy a buffer from the harmful consequences of harsh environmental conditions. Realistically, those with lower access to various forms of capital are disproportionately exposed to health degrading circumstances. For purposes of this study, education, monetary income, and assets will be used to test late-adult BMI change.

How may education, income, and assets as measures of SES be related to obesity levels and their change over time? These indicators of SES are important predictors of health related outcomes because they embody both material and social resources that are developed over one's life course and are inherited and bequeathed over generations. Higher levels of education provide access to more prestigious and better paying jobs, allowing greater asset accumulation and social network development. With greater access to resources that provide for basic needs, those in better occupational settings are likely to have more choices in way of nutrition, recreational activities, network selection, and personal development than others who experience the constrained choices of poverty. Health behaviors develop within a context of the individual's life chances, influencing the range of choice, acceptability, and effectiveness of an individual's health behaviors (Cockerham 2000). Given better chances to make sound decisions in the development of a health lifestyle, individuals with higher SES experience more favorable structural conditions which in turn allow health lifestyle choices to be made that would reduce the likelihood of becoming obese. The resources embodied by SES give those with higher SES better life chances, in turn providing more opportunities to make beneficial choices towards improving health and avoiding obesity

Researching these insights, many authors have used elements of the fundamental cause argument to analyze the relationship between obesity and socioeconomic status, using varying strategies and producing varying results. Sobal and Stunkard (1989) provide a comparative review of the literature on SES and obesity between developed and developing countries. Women in developed countries who enjoy higher SES also enjoy lower rates of obesity, reflecting the symbolic meaning of thinness in developed countries as well as adequate access to resources to control body weight. In contrast, obesity rates of women in developing countries were shown to have a relatively linear relationship with SES. As excess bodyweight has been considered a sign of wealth in developing countries, women with higher SES were found to also be disproportionately overweight. The relationship between SES and obesity in men did not show similar relationships to women, reflecting disparities in the stigmatization of male and female bodies. Using these observations, one would expect to find an inverse relationship between SES and obesity in the female population of the United States.

Education

Education has been found to be a robust predictor of obesity and weight change in the United States (Mokdad 1999 cited in Visscher and Seidell 2001; Flegal et al. 1998; Peeters et al 2004; Damush 2002; Himes 2000). Using longitudinal data from 1991-1997, Mokdad et al. (1999) show those with lower than a high school education on average have the highest prevalence of obesity as well as the greatest increase in obesity prevalence over time. In comparison, those with some college education start out with lower obesity prevalence but over the seven year measurement have obesity prevalence increases similar to those without a high school diploma. Thus, while those with lower education levels have higher obesity prevalence compared to those with higher levels of education, the general trend in all educational groups has been moderate increases in obesity prevalence. These observation imply that those with greater levels of education are likely to have lower BMI scores than those with less education at baseline measurement, but over time are likely to experience BMI increases with slopes similar to those of individuals with less education.

Income and Assets

Income and assets as indicators for socioeconomic status have been less utilized in the obesity literature. A reason for this may be due to the inconsistent relationship found between income and obesity in numerous articles (Ball and Crawford 2005). Damush et al. (2002) find income to have a u-shaped relationship with BMI category where those who earned less than $10,000 per year were found to have the lowest (<19) and highest (>35) BMI scores. The authors found the same relationship for those individuals who reported having a net worth below $10,000. Compared to education, income and assets display less convincing evidence of contributing to obesity differentials.

Occupation, Retirement and Work Status

Though fewer articles examine the relation between occupational category and obesity, those that do provide the most consistent relationship to weight change (Ball and Crawford 2005). Lahman et al. (2000) found that occupational prestige was inversely related to weight change and the event of retirement produced greater weight change in women than non-retired women. Wagner et al. (2001) found that those in lower socio-professional classes had greater BMI change than those in higher socio-professional classes. Power and Moynihan (1988) found that those from manual labor classes had greater changes in BMI than those in non-manual classes. In summary, those with higher levels of occupational prestige can expect to experience BMI increases that are less than those in less-prestigious occupational categories.

Structural Determinants of Health and Socioeconomic Status

Gender

Gender is influential on both obesity and overall health status. It is frequently noted that women enjoy longer life expectancies than men but are confronted with larger amounts of morbidities over time (Macintyre 1993). The fact than women have greater life expectancies than men but experience more health problems emphasizes the need to focus on gendered health outcomes in later life.

In seminal research, Mirowsky and Ross (1983) found that for women, being overweight is associated with lower class positions but for men there is little relation between weight and class. This finding is supported by international comparisons of gender disparities in obesity (Sobal and Stunkard 1989; James et al. 2001; Ball and Crawford 2005). In developed countries, obesity disparities between men and women are accredited to gender differentials in access to economic and social resources as well the cultural stigmatization of the old and overweight female body; a standard not as strongly enforced upon the aging male figure. Accordingly, gender disparities in baseline BMI and BMI change over time is a central consideration of this analysis.

Race/Ethnicity

Racial/ethnic studies that take account of the social aspects of race and race differentials in health explain the structural contexts which produce ethnic and race based inequalities in health. Discrimination is enacted and experienced at institutional, structural, and inter-personal levels (Krieger 1999). Discrimination based on racial categorization creates differential access to various health related resources. The discrimination that does occur largely affects the discriminated party's ability to access health-related resources; thus it has been shown that the mortality differences which exist between races (Rogers 1992) concerning health outcomes such as functional status in old age vanish when SES is controlled for (Smith and Kington 1997). Nevertheless, studies show that African American women are disproportionately affected by obesity (Kumanyika 1987) and racial segregation and isolation are associated with higher BMI in non-Hispanic blacks but not among whites (Chang 2006). Research also shows that Hispanic women are more likely to be overweight than Hispanic men, but for whites this relationship is reversed (Ross and Mirowsky 1983). Given the stratification of health related resources based upon racial discrimination, race and ethnicity should certainly exude pressure on BMI trajectories. While it is possible that the effects of race on baseline BMI and BMI change will disappear when socioeconomic conditions are controlled for, it is likely that there will be significant race effects net of SES due to effects of racial discrimination not captured by proxy measurements of SES, such as the stress produced by the perception of being discriminated against.

Age

Age is a category which stratifies societies much like race and gender. Age is associated with various transitions in employment and resource eligibility. One's SES and health in old age are products of the accruing of these variables over time; an accumulative process by which the health of those in later ages can be considered a stock of past experience (Smith and Kington 1997). Differences in mortality and morbidity experienced by men and women in old age are considered evidence of the health stock worth of each individual. Accordingly, those that have unhealthy BMI in old age possibly experienced runs earlier in life that diminished their well-being's net worth.

To create hypotheses about the relationship of structural determinants of BMI change, a few basic assumptions about age and body weight need to be put forth. Age and body weight are positively correlated (Mirowsky and Ross 1983) and greater BMI is associated with higher mortality from all causes and from cardiovascular disease in men and women up to 75 years of age (Stevens et. al.1998). In contradiction, the health risk associated with BMI reduces with age, where the health of older adults is less influenced by BMI than is the health of younger populations (ibid.). In sum, older adults experience increased levels of BMI but their health is less influenced by BMI as compared to younger populations. If these findings are reflected in the HRS data, analysis should show that BMI increase is positively associated with adults who are older at the first wave of measurement.

Methods

Analysis employs the Health and Retirement Study (HRS) which was first collected in 1992 with follow up surveys taken every two years. The HRS is sponsored primarily by the National Institute of Aging and is administered by the Institute for Social Research located at the University of Michigan (RAND 2006). The HRS was created to explore the transitions, both economic and health related, experienced by those advancing towards retirement (Juster and Suzman 1995; Wallace and Herzog 1995). This initial

HRS cohort was born between 1931 and 1941, consisting of nearly 13,000 respondents. The first measurement of the HRS cohort took place in 1992 through in-home interviews and has been collected every second-year (1994, 1996, 1998, 2000, 2002, 2004, and 2006) through follow up phone interviews. The longitudinal design and population weight adjusted sample offers current researchers a rich source of information.

Measures

DV

BMI (kg/m^2) – Body mass index is calculated by dividing the respondent's weight in kilograms by their height in meters squared. Self reported weight and height are used in the HRS, requiring the Imperial BMI formula where weight in pounds must be multiplied by a factor of 703 before being divided by height in inches squared. While self reported measurements of height and weight can introduce bias, research has shown that self reports of weight and height fairly represent actual height and weight (Stevens et al. 1990; Gunnell et al. 2000). All respondents with missing BMI information at wave 1 were deleted from analysis, yielding an initial sample of 8,645.

Optimal BMI and the thresholds distinguishing between levels of BMI are necessary generalizations if BMI categorization is to provide reliable measure of body mass. Using the World Health Organization standard for BMI, those between 18.5 to 24.99 are considered to be of normal body mass. A BMI below 18.5 is considered underweight and levels of overweight are distinguished as such; a BMI of 25-29.99 is considered overweight grade I, a BMI of 30 to 39.99 is considered overweight grade II and a BMI over 40 is considered overweight grade III. The National Heart, Lung, and Blood Institute (1998) defines a BMI between 25 and 29.99 as overweight and a BMI greater than 30 to be obese. For simplicity of interpretation, these definitions of overweight and obese will be used in further sections of analysis.

Covariates

Respondent's Socioeconomic Resources

Numerous variables were employed to measure the amount and variety of socioeconomic resources of respondents. Years of education is a continuous measurement that represents the respondent's educational obtainment. Access and quality of education is stratified in the United States based upon race, thus race is measured by dummy variables for White, Black and Hispanic where White is the reference category in analysis. Since each measurement of race is presented separately and thus not mutually exclusive, there is some overlap between the different races.

Numerous types of insurance are included to measure access to protective services provided by being insured. The number of health insurance plans held by each respondent is included under the belief that with health insurance, a greater number of health insurance plans provides more robust coverage for the respondent. Being given greater access to health services, it is likely that those with health insurance have better opportunities to monitor their health and consult with a doctor when making decisions related to their health behaviors. Life insurance status (1=has life insurance) is included to measure other types of protective services offered by differing types of insurance. While health insurance is a better indicator of access to health services, life insurance is a better indicator of favorable economic conditions and high social status.

Measurements of economic resources include household annual income earnings as well as respondent's household net assets. Both income and net assets are natural-log adjusted to account for a positively skewed sample distribution. Due to the inclusion of debt in the assets variable as well as zero values in the income variable, $100 was added to every observation. In addition, absolute values of the assets variable which included debt were logged then transformed back to their original polarity.

Highly related to availability to economic and social resources is one's occupation. Occupation is dummy coded into four groups; professional, service industry, skilled trade, and machine operators, with professional occupation being used as the reference group. The measure of occupation used refers not to the individual's current employment, but the occupation which they spent the most time in over their lifespan. This measurement of occupation is believed to be superior to occupation at time of interview because the loss of information in occupation at time of interview due to unemployment and retirement. In addition, longest occupation should be a better indicator of the long-term effects of employment category compared to one's current occupation due to the importance of accumulated habits and experiences associated with one's most familiar occupation. It is likely that those who have spent greater amounts of time in more prestigious occupations will show more favorable BMI characteristics compared to those who spent more time in occupations of lower prestige.

Retirement status is included in analysis due to the belief that BMI may be influenced by retirement through decreases in activity levels, changes to consumption patterns, and distancing from one's personal identity developed through employment (Forman-Hoffman et al. 2008) Retirement is coded as self-report of considering oneself retired (1=considers self retired). It is believed that retirement status will impact BMI levels at baseline and over time through changes to behavior that are not fully explained by income changes related to retirement.

Life-Course Socioeconomic Status

Including net assets, other variables are included that attempt to get at the inter-generational transmission of health and socioeconomic status. Both mother's and father's education are included in analysis to measure the early-life environment in which respondents were socialized, providing rooted strength to the analysis by using a life-course perspective. Number of living parents is also provided as a proxy-measurement of parent's health as well as being an indicator of intergenerational influence on respondent's health and longevity. As obesity is related to increased morbidity and mortality, it is believed that those with long living parents are more likely to come from favorable biological and social backgrounds, thus being another inter-generational indicator of one's likelihood of being or becoming obese.

Other Covariates

Marriage is a dichotomous variable where those married or married without partner present are combined (married=1) and those partnered, separated, divorced, or never married are combined (married=0). Measurements of respondent's self reported health and number of doctor diagnosed health conditions account for both self-perceived and professionally diagnosed health status. Smoking history (1=smokes now or has ever smoked) controls for the inverse relationship between smoking and BMI. Means and percentages of all measurements are presented below in Table 1.

Table 1. Adjusted Mean and SD for BMI for Men and Women in the HRS (1992-2006)

	Aggregated			Male		Female	
	Obs	Mean	SD	Mean	SD	Mean	SD
BMI 1	8645	27.1	.073	27.26	4.48	27.1	5.71
BMI 2	7455	27.27	.071	27.41	4.41	27.19	5.72
BMI 3	7042	27.47	.073	27.53	4.33	27.38	5.81
BMI 4	6732	27.63	.073	27.64	4.39	27.57	5.85
BMI 5	6321	27.85	.075	27.87	4.52	27.84	5.96
BMI 6	6086	27.97	.076	28.04	4.63	27.95	5.96
BMI 7	5847	28.06	.08	28.07	4.77	28.1	6.13
BMI 8	5504	28.29	.082	28.27	4.86	28.45	6.31

Statistical Analysis

M-Plus version 5 was employed to estimate latent growth curve models. Latent growth curve models allow the modeling of change over time in an outcome variable where the trajectory of this change over time is adjusted for influence of covariates. BMI is used as a time-varying dependent variable where each independent variable provides direction to both the baseline intercept of the model as well as the slope which corresponds to the change in BMI over the numerous waves of measurement.

Table 2: Weighted Descriptive Statistics at Baseline and BMI Trajectory (1992-2006)

Variable	Obs	Mean	SD	Min	Max	%
Respondent Level, at Baseline						
Age	8645	54.56	2.751	50	59	
Gender	8645	0.541	0.498	0	1	54.1 (female)
Years of Education	8645	12.08	3.204	0	17	
Mother’s Years of Education	7890	9.222	3.644	0	17	
Father’s Years of Education	7572	8.958	3.981	0	17	
Smokes Now or Ever	8645	0.632	0.482	0	1	63.2
White	8645	0.788	0.409	0	1	78.8
Black	8645	0.173	0.378	0	1	17.3
Hispanic	8641	0.095	0.293	0	1	9.5
Birth Year	8645	1937	2.762	1932	1943	
Married	8645	0.743	0.437	0	1	74.3
Self Report Health (1=Excellent, 5=Poor)	8645	2.575	1.205	1	5	
# Doctor Reported Health Conditions	8645	1.058	1.129	0	7	
# Health Insurance Plans	8551	0.775	0.579	0	4	
Has Life Insurance?	8538	0.702	0.457	0	1	70.2
Log Household Income	8645	10.312	1.168	4.61	14.08	
Log Assets	8301	10.31	4.656	-13.5	15.97	
Occupation: Professional/Managerial	5803	0.304	0.46	0	1	30.4
Occupation: Service/Sales	5803	0.4	0.49	0	1	40
Occupation: Skilled/Non-Skilled Labor	5803	0.145	0.352	0	1	14.5
Occupation: Machine operations	5803	0.15	0.358	0	1	15

Note: Respondent level weighted by R1WTRESP:W1 Person-Level Analysis Weight

Figure1: Measurement model of unconditional unspecified growth curve

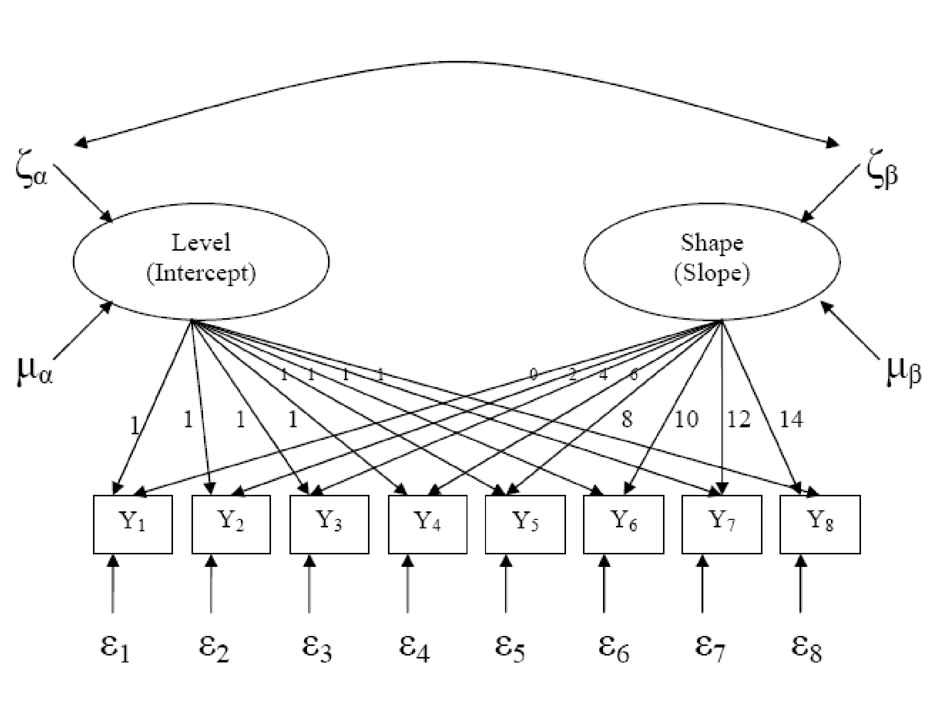
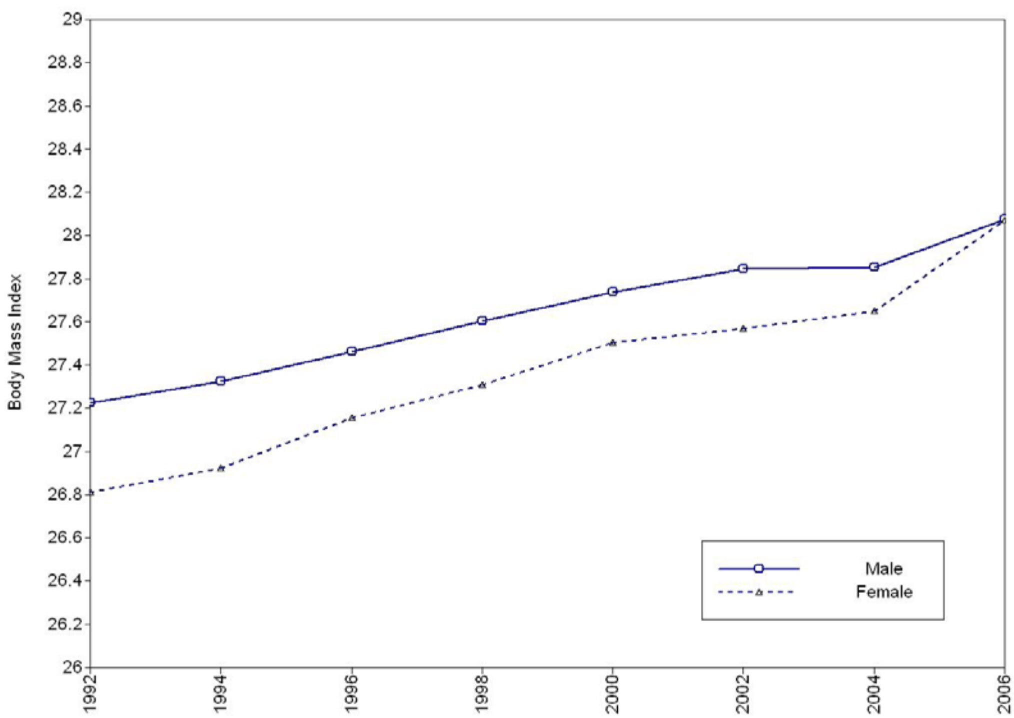


Figure 2. Sample Means of BMI for Men and Women in HRS (1992-2006)



Results

Referring to Table 2, one can see that the mean BMI for men and women at wave 1 was around 27, which is generally considered overweight. Baseline BMI differs for men and women as shown in Figure 2. Women have a baseline BMI of 27.1 where male baseline is around 27.3. As Figure 2 shows, the unadjusted trajectories of BMI for men and women generally increase over time, and surprisingly, women's BMI eventually surpasses male BMI scores. Tempering this finding, one can see that the standard deviations for both men and women generally increase over 14 years, but also the standard deviation of women's BMI is greater than that of men's BMI SD at each point of measurement.

Tests of Model Fit

To formally test if there was in fact a significant difference between men and women in the sample, a global nested model test was used to assess if differences between groups was significant. According to Sattora and Bentler (1999), the use of maximum likelihood estimation requires an amendment to basic chi-square difference testing. Difference testing using the MLR requires the use of log-likelihood values and scaling factors obtained with the MLR estimator. Accordingly, model fit was assessed based on these recommendations. Nested model testing indicates that when the both loadings and casual paths between variables are constrained, the model has a significantly worse fit (TRd=690.993, d.f. difference=57; $p<.001$). Thus, stratifying analysis upon gender reflects the statistically significant difference between men and women in the effects of the combination of covariates upon BMI change.

Other tests of model fit indicate that the combination of predictors do a good job of describing the relationship between gender and BMI change over the 14 year measurement period. The comparative fit index (CFI) for the model with unconstrained casual paths indicates that the model is a good fit (CFI=.97). Values near zero of the root mean square error of approximation (RMSEA) indicate a close model fit. The RMSEA of the model with unconstrained casual paths designates that the model is a good fit to the observed data (RMSEA=.026). Taken in tandem, the multiple group growth curve model appears to be a good fit.

Analysis of Model Results

Referring to Table 3, one can see that numerous differences exist between men and women in relation to both initial BMI level and change in BMI over time. The initial intercepts will first be discussed, followed by interpretation of male and female BMI change over time.

Baseline Levels of BMI

Control Variables

Numerous covariates are significantly related to the baseline BMI levels of both men and women. Beginning with ethnicity, the Black female has an initial BMI score 2.166 (p<.001) units greater than non-Black females. This effect of being a Black female upon BMI represents the single greatest increase to baseline BMI found in the model. This finding supports the conclusion of Kumanyika (1987) that the African American female is disproportionately influenced by obesity. The Hispanic male also has a baseline BMI significantly greater than that of non-Hispanic men (.62; p<.05).

Married men had initial BMI scores significantly higher than non-married men (.713; $p<.001$), but this was not experienced by women. Age was inversely related to baseline BMI in men (-.081; $p<.001$) and women (-.084; $p<.001$). Smoking was also negatively related to initial BMI, and this was observed in both men (-.605; $p<.001$) and women (-.709; $p<.05$). Self reported health (1=excellent, 5=poor) was positively associated with preliminary BMI for both men (.253; $p<.001$) and women (.427; $p<.001$). The relation between health and BMI intercept reflected the above relation, where both women (.921; $p<.001$) and men (.649; $p<.001$) who were diagnosed with more health conditions also had greater baseline BMI. Number of living parents was inversely related to the initial BMI of men (-.253; $p<.05$), but not women.

Socioeconomic Status/Resource Variables

Respondent's education was negatively related to baseline BMI for women (-.096, $p<.001$), but this did not hold for men. Education of the respondent's mother and father was not found to be significantly related to baseline BMI for either men or women. Number of health insurance plans was not related to preliminary BMI for women or men. Having life insurance was found to be positively related to the BMI intercept of men (.447; $p<.05$) and women (.583; $p<.01$). The complex differences between men and women in baseline BMI will be discussed later.

Table 3: Unstandardized Maximum Likelihood Estimates of Covariates for Conditional Growth Curve Model of BMI (HRS 1992-2006)

	Intercept Male		Slope Male		Intercept Female		Slope Female	
	Est	SE	Est	SE	Est	SE	Est	SE
White (Reference)								
Black	-.304	.225	-.036*	.016	2.166***	.266	-.02	.015
Hispanic	.62*	.294	-.013	.018	.377	.32	-.022	.019
Education Years	-.028	.034	-.001	.002	-.096*	.047	.005	.003
Mother's Ed.	-.001	.029	0	.002	-.059	.038	-.002	.002
Father's Ed	-.003	.026	-.001	.002	-.027	.032	-.002	.002
Married	.713***	.194	-.012	.013	-.053	.223	-.033**	.013
Age	-.081**	.028	-.005**	.002	-.084*	.033	-.009***	.002
Smoke	-.605***	.164	.007	.009	-.709***	.17	.008	.01
# Living Parents	-.235*	.104	.012	.007	-.151	.129	-.007	.007
Self Report Health	.253**	.075	-.016**	.005	.427***	.097	-.009	.006
# of Conditions	.649***	.091	.002	.006	.921***	.098	-.005	.006
# of Health Insurance Plans	.189	.142	.015	.009	.086	.159	.018	.01
Has Life Insurance	.447*	.194	0	.013	.583**	.189	-.002	.011

X^2 (df)=1129.273(290); CFI=.98; TLI=.96; RMSEA=.026; **p*<.05; ***p*<.01; ****p*<.001

Table 3 (continued): Unstandardized Maximum Likelihood Estimates of Covariates for Conditional Growth Curve Model of BMI (HRS 1992-2006)

	Intercept Male		Slope Male		Intercept Female		Slope Female	
	Est	SE	Est	SE	Est	SE	Est	SE
Log Earnings	.133	.092	.009	.005	-.151	.089	.009	.005
Log Assets	.027	.021	.001	.001	-.031	.024	.002	.001
Retirement Status	-.033	.21	-.013	.014	.14	.3	.001	.016
Occupation Professional (reference)								
Service	.43	.23	.035*	.015	-.496	.296	.052**	.016
Skilled Labor	.474	.246	.023	.016	.143	.79	.071*	.035
Operators	.184	.279	.018	.018	-.133	.556	.076*	.031
R^2	.062		.034		.13		.034	

X^2 (df)=1129.273(290); CFI=.98; TLI=.96; RMSEA=.026; *p<.05; **p<.01; ***p<.001

BMI Change over Time

The relationship between male and female BMI slopes and the covariates produce significant results, but the unstandardized coefficients are much smaller than those found within the intercepts. The reason behind this is that over the 14 year period of measurement, BMI changed on average between one and one and one-half unit. With an outcome variable presenting little change over the 14 year period of measurement, the coefficients for slope reflect the small amount of change in BMI over time. Though producing small coefficients, growth curve modeling is well suited to detect change in slope over time which can be attributed to the numerous covariates. When measuring small amounts of variance over long temporal intervals, resulting coefficients reflect small yet meaningful changes.

Control Variables

In contrast to the positive relationship between being a Black female and having a higher initial BMI, Black men enjoy a decreasing BMI over time (-.036; $p<.05$). This is not experienced by any of the other ethnic categories of men or women. Age is inversely related to BMI slope where both women (-.009; $p<.05$) and men (-.005; $p<.05$) who were younger at baseline measurement had BMI trajectories that increased less than those who were older. Initial self reported health was negatively related to BMI trajectories for men (-.016; $p<.05$) but not for women.

Socioeconomic Status/Resource Variables

Once again, neither respondent's education nor the education of their parents was significantly related to BMI change. No insurance variables were found to be significant predictors of BMI change. Log assets and log income were not related to either male or female BMI change over time. Referring to occupational category, both males (.035; $p<.05$) and females (.052; $p<.05$) found in service sector jobs had significant increases in BMI over time. In addition, women found in occupations of skilled labor (.071, $p<.05$) and machine operations (.076, $p<.05$) had greater BMI changes over the 14 year measurement interval than women found in professional occupations.

Discussion

Being faced with an obesity epidemic on national and global scales, understanding the role of socio-demographic characteristics and structural determinants of access to health-enabling resources is integral to the alleviation of the global health burden of obesity. Using longitudinal data benefiting from a large initial sample and bi-annual follow up over 14 years, this study integrates previous literature into a single statistical model accounting for various ascribed and achieved characteristics which channel individuals towards disparate BMI outcomes. As high BMI and obesity can be seen as upstream determinants of negative health outcomes, further upstream is the reality of differential access to resources which influence the BMI of individuals and populations. The findings of this study suggest that for men and women, different processes, both biological and social, can be implicated for the current obesity epidemic.

The initial difference between men and women in both BMI slope and intercept is evidence of the fact that women are faced with higher amounts of morbidities then are men, even thought they do experience more years of life. This study's findings suggest that worse self reported health and a higher amount of doctor diagnosed health conditions are more strongly related to baseline BMI levels of women then for men, although the positive relationship between poor health and BMI holds significant for men. While not tested here, the relationship between BMI and health is likely one of a complex feedback loop where poor health influences behaviors which increase BMI, and in reciprocation BMI fuels the flame of degenerating health. Regardless, gender disparities in BMI reflect both natural tendencies for women to have BMI trajectories that increase with greater intensity than those of men as well as the influence of economic limitations placed upon women in a society where power is bifurcated upon gendered lines.

The most striking finding of data analysis is the more than 2 BMI point baseline increase experienced by Black compared to non-Black women. Confirming Kumanyika's (1987) proposition that African American are disproportionately afflicted by obesity, this study's findings point to the multiple layers of discrimination experienced by Black women. To begin to draw casual paths between Black women's bio-social histories and their BMI outcomes, various research methods would be required. Social factors such as health lifestyle, perceived discrimination, and stress responses would need to be measured if a nuanced picture of African American women's relation to BMI were to be painted.

Another interesting finding produced in the analysis was the fact that years of education is protective of baseline female BMI but this did not hold for men. With each unit increase in years of education, there is a decrease in baseline BMI of 1/10th of a point. What factors could lie behind the difference between men and women concerning education? The fact that women experience gender discrimination in many realms of social life may force them to rely more on their education than men. As an asset which instills cognitive capacities and reflects family histories that value education, women with greater amounts of education have access to resources which protect them from social factors that may contribute to obesity.

The results of this analysis warrant an analysis of the relationship between BMI change and one's longest occupational category. Using professional occupations as the reference category allows comparisons in occupation to be set against those who enjoy the highest occupational prestige. For men, BMI slope for those in service occupations was .035 units greater than those found in professional occupations. This relation to BMI trajectories held for women in service occupations (.052), skilled labor (.071), and machine operations (.075). These findings generally harmonize with previous investigations of BMI change and occupational setting (Lahman et al. 2000; Power and Moynihan 1988; Wagner et al. 2000).

For men and women who spent most of their careers in service positions, two factors may contribute to increased BMI change over time. First, those found in service positions likely find themselves in sedentary positions where weight may accumulate due to inactivity. Secondly, the emotional labor associated with service positions may increase stress hormones which promote storage of energy as fat. As for the possible casual explanations of increased BMI change in women found in skilled labor and machine operations, it is likely that these women experience stressful working environments. On top of this, these women are likely underpaid for their work and probably experience large amounts of discrimination due to working in a typically male trade. While males in service sector jobs do experience greater BMI increases than those found in professional occupations, only women in occupations of skilled labor and machine operations face even greater BMI change over time than those in service occupations.

The fact that female machine operators had greater BMI increases over time than those found in positions of skilled labor, and that those in occupations of skilled labor had greater BMI changes over time than those in service sector jobs attests to a continuum of BMI change based on ranking of occupational prestige. Since this relationship was not found between the various levels of occupational prestige for men, placement in the hierarchy of occupational prestige seems to be especially important for BMI trajectories of women. As women have had to struggle for equality in employment opportunities, placement in the hierarchy of occupational prestige may be a better indicator of a woman's occupational opportunities than that of men's opportunities because men typically enjoy greater occupational mobility than women. Thus, placement in the occupational continuum may be indicative of the glass ceiling experienced by females which reduces upward occupational mobility for women but not men.

In sum, the findings of this research suggest that resources and opportunities to protect oneself from obesity are largely stratified by gender and racial discrimination. Females face greater BMI change over time than men and Black females experience greater BMI at baseline than both men and non-Black females. Acting as the criteria by which gatekeepers of opportunity restrict access to resources such as education and occupational prestige, socio-demographic characteristics determine whether resources and opportunities are extended or denied. As education was a significant predicator of female baseline BMI, yet not male baseline BMI, it seems the resources embodied in education are stronger predictors of initial female BMI because education is more accessible to men than women. While female education levels indicate hard earned educational advancement reached in a context of gender discrimination, male education may be composed of both one's scholastic opportunities as well as their favored status in a gendered society.

Similarly, one's longest occupational role indicates the social context in which job opportunities are presented and acted upon. Women's occupations are those bounded by the glass ceiling dampening female occupational mobility where male occupations are those developed through both achievement and favored status. Females in less prestigious occupations experience greater BMI change than those in more prestigious occupations. Being that this was not found for men, it appears that female occupation is a better indicator of BMI change over time because occupational obtainment is an uphill battle for women where men often enjoy occupational advancements due to gendered favoritism. In all, levels of health-enabling resources such as education and occupation predict initial BMI and BMI change over time better for women than men because they are proxies of institutionalized oppression which negatively impact female opportunity. With gender discrimination acting as the first insult to female health, men enjoy greater access to resources which allow them to maintain stable BMI over time. As racial discrimination is experienced in tandem with gender discrimination by the Black female, relatively high BMI at baseline may indicate the embodied outcomes of experiencing a lifetime of struggle under multiple hierarchies of oppression.

As an increasing percentage of the population will reach old age, morbidities associated with obesity will increasingly tax the health care system. Although the initial BMI's of men and women in the sample used here cannot be generally considered to be detrimental to individual health, on a population level even small numbers of morbidities associated with being overweight will place increasing stress upon a health care system that is already fraught with fractures. As for BMI change over time, the same logic applies. Although an average BMI change of a few points over 14 years is probably not detrimental to individual health, morbidities associated with obesity are sure to increase the strain on a health care system that will be experiencing increased burden from various other morbidities associated with an aging population. In accord, promoting healthy BMI in late age is of dire importance if obesity related health care expenditures are not to contribute to the breaking of the camel’s back.

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