Trends in Obesity-Free Life Expectancy in the United States 1995-2005: Gender and Racial Differences and Alternative Categorizations

Li-Chung Hu

Abstract

Obesity is a major public health issue in the U.S., and has been linked to increased risks for health outcomes and mortality. This paper defines health as "obesity free" to examine trends in obesity-free life expectancy (OFLE) across gender and race from 1995 to 2005 in the U.S. Specifically, this paper will investigation the changes in OFLE by gender and race from 1995 to 2005. Additionally, alternatively criteria of Body Mass Index (BMI) for measuring obesity across gender and race will be used to examine the sensitivity of conventional BMI criteria. The results show that OFLE has decreasing about 2.7 years for males and 4.3 years for females from 1995 to 2005. In addition, the patterns of gender and racial differences show change as different criteria for measuring obesity are applied, which indicates applying monotonic criteria across gender and race leads to inaccurate estimation of the prevalence and severity of obesity in the U.S.

Li-Chung Hu, Ph.D candidate in Demography, Graduate Group in Demography, University of Pennsylvania. 239 McNeil Building, 3718 Locust Walk, Philadelphia, PA 19104-6298 (e-mail: hu6@sas.upenn.edu). I thank Jason Schnittker, Jamaica Corker and Apoorva Jadhav for useful comments.

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Li-Chung Hu

Introduction

Obesity is a major public health issue in the United States (US), with implications for individuals and society, as obesity has been linked to increased risk for health outcomes and mortality. This paper aims to propose another measurement of healthy life expectancy. Here I define health as an "obesity free" state and examine trends in obesity-free life expectancy (OFLE) across gender and race in the US from 1995 to 2005.

This paper will first demonstrate the changes in prevalence of obesity by gender and race from 1995 to 2005. Next, I will calculate OFLE to demonstrate the number of person years lived without obesity to reflect one aspect of quality of life among U.S. population. Finally, alternative criteria of Body Mass Index (BMI) for measuring obesity across gender and race will be applied to examine the sensitivity of conventional BMI criteria.

Results show that OFLE has decreased about 8% for White population and 10% for Black population from 1995 to 2005. This may be part of explanations to account for health differences across gender and race since the total amount of time in exposure to obesity at the population level are differs for both subgroups.

In addition, if different criteria for measuring BMI are used, the results of gender and racial gap will show different pattern, indicating that the monotonic criterion of obesity for all subgroups could distort the prevalence of obesity and its consequence of health disparities across gender and race.

Background

Life expectancy and Healthy Life Expectancy

Life expectancy has been improving over recent years in the US population. In the last decade alone, life expectancy at birth for American women increased from 76.9 to 80.2 years and from 74.3 to 75.1 years for men. Among Blacks and Whites, life expectancy has increased from 76.5 to 77.9 years for the White population and from 69.6 to 72.8 years among the Black population (US Census Bureau, 2005).

However, life expectancy is a quantitative measure of human life; longer life expectancy does not necessarily imply better quality of life. Increases in life expectancy could be the result of better health conditions that delay the onset of diseases, or of medical and technological innovations that treat or control diseases effectively by using drugs or medical care. If, on the contrary, the increasing in life expectancy is due to better disease control, it implies people live longer with poorer health.

New measurements have been constructed to examine the both quantity and quality of life. The most well-known index is disability-free life expectancy (DFLE). The DFLE measures how many years will a person will live without disability at any given age of his/her remaining life (Sullivan, 1971). A longer DFLE thus implies a better quality of life because people live longer years without disability through their life.

In the United States, increases in life expectancy in the 1970s were due primarily to people living longer but with more disability (Crimmins et al, 1989), while in the 1980s life expectancy improved but without increases in disability (Crimmins, Saito and Ingegneri, 1997). The relative change of DFLE and life expectancy could be measured as the proportion of DFLE to overall life expectancy. If the proportion of DFLE to life expectancy is higher than the proportional gain in overall life expectancy, it implies the improvement in life expectancy without disability.

Although DFLE is one of the most common overall measures of health, some authors propose different definitions of health to compare the changes in life expectancy and health life expectancy. Two examples are from Yang (2008) and Cunningham *et al.* (2011). Yang (2008) defines health as subjective well-being and uses prevalence of happiness to construct happy life expectancy. The author shows that both life expectancy and happy life expectancy are increasing in the United States during 1970 to 2000. Cunningham *et al.* (2011) used the same method to construct diabetes-free life expectancy. Their research shows that among obese individuals, diabetes-free life expectancy decrease 5.6 years for men and 2.5 years for women between the 1980s and the 2000s.

In this study, I propose another measurement to explore healthy life expectancy. I define health as “obesity free” and measure the trends in OFLE across gender and race during 1995 to 2005, paying attention to absolute change in years of OFLE as well as the relative changing of OFLE to the overall increase in life expectancy in the U.S.

Obesity-Free Life Expectancy (OFLE)

Obesity is a major health issue in the United States. A growing body of research shows that obesity is associated with many chronic diseases and contributes to mortality associated with obesity. Using five prospective cohort studies, Allison *et al.* (1999) estimated annual deaths attributable to obesity in 1991 in the United States and found that approximately 13% of deaths among U.S adults are associated with obesity.

Flegal *et al.* (2007) demonstrated that cardiovascular disease (CVD) accounts for 37% deaths of US adults and that 13% of total CVD mortality was associated with obesity. The authors also found that being overweight and/or obese increased mortality from non-CVD mortality especially kidney and diabetes (Flegal et al, 2007). Fontaine *et al.* (2003) found that the maximum total years of life lost over the lifespan among White males and females between age 20 to 30 with severe obesity is about 13 years and 8 years respectively. For Black males and females, the maximum years of lost is about 20 years and 5 years respectively at age 20 with severe obesity.

Obesity not only has adverse impact on physical health for individuals, but also has negative effects on mental health. Stunkard, Faith and Kelly (2003) found that there is an association between major depression and obesity for females - relation that increases with SES. For males, there is an inverse relationship between major depression and obesity which is not associated with SES. Obesity has also been shown to be associated with a 47% and 27% increase in the odds of bipolar disorder and panic disorder or agoraphobia respectively (Simond *et al.* 2006).

Furthermore, obesity also has important implications for macro economic outcomes. In Finkelstein, Ruhm and Kosa's review article (2005), the authors posit that 5% to 7% of annual total medical expenditures are related to obesity, and find that 37% of annual average increases in medical expenditure associated with obesity. Additionally, they found that obese women are more likely to have lower paying jobs and to be excluded from higher paying or managerial positions.

As outlined above, obesity has been shown to be significantly associated with lower personal physical and mental health, as well as increase the economic costs to individuals and society. If the duration of exposure to obesity is longer at individual and population level, it implies higher health and economic cost. Recent research demonstrates that not only is high BMI detrimental to individual's health, but also how long an individual "lives with obesity" has independent adverse influence on mortality. The risk of dying due to CVD, cancer and other-cause mortality is higher every additional 2 years lived with obesity (Abdullah *et al.* 2011), indicating the severity of obesity impact.

Defining health as "obesity free" and calculating of OFLE can provide an insightful measurement of the duration of obesity at the population level and provide a better understanding in changes in the extent and magnitude of obesity exposure among the American population. If proportion of OFLE to total life expectancy (TLE) has increased in the last 10 years, this implies that US population is exposed to shorter amount of OFLE over their life and this in turn would be associated with lower health and economic outcomes. It also implies the U.S. population is not living longer with better quality of life as overall life expectancy increases.

Measurement of Obesity

BMI is designed to measure body fat composition by dividing a person's weight in kilograms by his/her height in meters squared. According to the World Health Organization (WHO), obesity is defined as BMI>=30, a universally recognized measurement in the study of obesity. This paper will apply the conventional definition of obesity to calculate OFLE to understand of the extent and magnitude of obesity exposure across gender and race in the US, before then applying a new set of criteria to measure obesity.

Despite research showing that obesity has a negative effect on health outcomes at the individual level, it is important to acknowledge emerging research which points to a potential protective effect of obesity in relation to some chronic conditions. For example, Cutis *et al*. (2005) found that higher BMI has protective effect for heart failure patients. Their research also showed that higher BMI was associated with decreased risk of mortality and that, compared to patient with normal weight, overweight and obese patients have a lower risk of death. However, one possible explanation for this apparent obesity paradox could be the inaccurate measurement of body fat by using BMI.

The accuracy of BMI as a predictive measurement has been questioned, and some other measurements of body fat have been proposed on response, including waist circumference, waist-to-hip ratio, and waist-to-height ratio (Cepeda-Valery *et al.* 2011). However, most research on obesity in the social sciences continues to use BMI as an index of obesity largely because it is easy to measure and to ask respondents through survey design.

Different Criteria of Obesity across Gender and Race

Research shows that the accuracy of BMI in measurement of body fat varies across age, gender and race. For instance, females have higher body fat than males at the same level of BMI. Similarity, Asians have a higher body fat at the same BMI compared to Blacks and Whites, although the actual difference between Blacks and Whites is still in dispute (Deurenberg, Yap and van Staveren, 1998; Gallagher *et al.*, 1996; Prentice and Jebb, 2001; Wang *et al.*, 1996). Furthermore, the association between chronic diseases and BMI also varies by race. For example, Asians generally suffer from chronic diseases at a lower level of BMI than other races and the WHO provides different criteria of obesity for Asians (Choo 2002, WHO 2004), recognizing the importance of distinct criteria by racial category. However, for research purposes, obesity is defined based on single criterion, which is independent of gender and race, thus is unable to reflect the variation in real body fat composition across gender and race, which could result in substantial bias of identified subjects as obesity (Jackson et al, 2002).

Data and Measurement

Data

US Life Table

To construct trends in OFLE from 1995 to 2005 by gender and race, single age interval U.S life table from 1995 to 2005 were used (Center for Diseases Control and Prevention, http://www.cdc.gov/nchs/products/life_tables.htm). As the number of cases among single age-race-gender specific prevalence of obesity is not enough to provide a stable estimation in prevalence of obesity, I constructed a 5-year age-interval abridged life table based on the complete US life table.

Behavioral Risk Factor Surveillance System (BFRSS)

The data in this analysis comes from the Behavioral Risk Factor Surveillance System (BRFSS), a telephone survey conducted in each state since 1984. The survey is conducted monthly and respondents are aged 18 and above. I exclude respondents at 18 and 19, because it cannot be constructed 5-years age groups to match 5-year age-interval abridged life table. I combine single year age into five years age group from age group 20-24 to 80-84. Individuals above 85 are considered as one group. When using the BRFSS, it is important to acknowledge the fact that BMI here is based on self-reported height and weight and that self-reported BMI is more likely to underestimate BMI than anthropometrically measured data (Flegal *et al.*, 2002).

The racial categories included in the BFRSS are Whites, Blacks, Asians and Hispanics. However, there were not enough Asian and Hispanic respondents to estimate age-race specific prevalence of obesity, and thus this analysis is limited to Whites and Blacks. Though are different survey questions for each state in the BRFSS, information about self-reported height and weight are included by every state and in each monthly survey. Hence, a representative sample from combination of surveys conducted by each state can be obtained from this survey.

Sullivan Method

To construct OFLE, I use the Sullivan method of calculating life expectancy. Although the Sullivan method assumes the population is stationary and ignores individuals recovery from health problem, it is still a widely used method to calculate healthy life expectancy because cross-sectional data is prevalent and easy to apply (Laditka and Hayward, 2003). Life table of the population of interests and prevalence of defined health are the information needed to construct OFLE.

The formula to calculate OFLE is as follows:

$$T_x^{OFLE} = \sum {}_nL_x(1 - {}_n\pi_x)$$

$$e_x^{OFLE} = \frac{T_x^{OFLE}}{l_X}$$

${}_nL_x$: persons-years live between age x to x+n.

${}_n\pi_x$: prevalence of obesity between age x to x+n

l_x : numbers of alive at exact age x.

T_x^{OFLE} : Total person-years without obesity above age x.

e_x^{OFLE} : Obesity-free life expectancy at age x

Results

First, conventional BMI categories were used to classify individuals as: underweight (BMI<18.5), normal weight (BMI 18.5-24.9), overweight (BMI 25-29.9) and obese (BMI>=30). The changes in body classification among White males, White females, Black males and Black females from 1995 to 2005 are shown in Table 1. In general, the prevalence of obesity among all groups increased substantially during this time. Overall, the prevalence of obesity increased by approximately 8% among Whites and 12% among Blacks. Of note is the change in the prevalence of overweight individuals that reduced the proportion of those with normal weight. Slight changes in the prevalence of overweight are likely due to the amount of population that became obese from being overweight equal to the amount of population that transitions from normal weight to overweight.

Table 1: Proportion of Classifications by Year, Gender and Race

	Underweight	**Normal**	**Overweight**	**Obese**	**Underweight**	**Normal**	**Overweight**	**Obese**
		White Males				White Females		
1995	0.94	37.02	45.84	16.21	3.88	55.28	26.54	14.30
2000	0.69	32.06	46.74	20.51	3.01	50.62	28.07	18.30
2005	0.72	28.64	45.67	24.98	2.51	46.1	29.07	22.32
		Black Males				Black Females		
1995	0.72	34.31	45.18	19.78	2.08	36.08	34.06	27.78
2000	0.97	29.06	43.9	26.07	1.61	30.34	33.45	34.59
2005	0.71	26.77	41.1	31.42	1.45	26.21	32.8	39.55

Prevalence of Obesity in the U.S. from 1995 to 2000 by Gender and Race

Prevalence of obesity across age and race among Whites and Blacks in 1995 and 2005 are shown in Table 1. Both Whites and Blacks have a higher prevalence of obesity in 2005 than in 1995. Blacks have a higher proportion of being obese than Whites at both times - a proportion that is increasing faster at each age.

Age-race-sex specific prevalence of obesity across age and percent change in obesity prevalence between 1995 and 2005 are shown in Table 2. In terms of gender differences, a higher proportion White males are more likely to be obese than White females, a lower proportion of Black males are obese than Black females. Although a lower proportion of Whites are obese, the proportion of obese at some age groups of White males and females are growing faster than for Blacks. For example, in the age interval 20-24, White males have the highest change rate between 1995 and 2005, followed by increasing rates for White females. The proportion of those considered obese increased by 96% for White males and 89% for White females at age 20-24. The prevalence of obesity at age 20-24 is cumulative outcome of incidence of obesity before age 20-24. The rapidly increasing obesity proportion at age 20-24 reflects that the sum of incidence rate in childhood and teenage are higher in 2005 than in 1995.

Among the age groups, we can see that both Black males and females show the fastest increases in the proportion of obesity between the ages of 20 to 35. White males and females show approximately 11% and 6% increases, respectively, in the prevalence of obesity between age 20-35. The prevalence of obesity increase 14% for Black males and 10% for Black females between age 20 and 35 in 2005. Both Black males and females not only have higher prevalence of obesity than Whites, but also saw their obesity rates increase more rapidly than for Whites.

Table 2: Prevalence of Obesity and Change Rate by Age Distribution, Gender and Race

	White Males				***White Females***			
age	1995	2000	2005	1995-2005 (% change)	1995	2000	2005	1995-2005 (%change)
20	8.5	11.8	16.7	*96*	7.7	10.2	14.5	*89*
25	13.1	17.8	20.8	*59*	10.4	15.1	19.2	*85*
30	14.3	19.7	22.6	*58*	10.9	16.3	20.8	*91*
35	16.6	21.1	27.7	*67*	13.1	17.1	21.1	*61*
40	17.8	22.5	27.6	*55*	15.0	18.1	22.7	*52*
45	18.9	24.2	28.0	*48*	17.5	21.5	24.0	*37*
50	26.6	27.2	29.7	*11*	18.8	22.5	26.6	*41*
55	20.7	25.5	31.5	*52*	19.5	24.7	28.6	*47*

60	20.6	23.8	29.3	*42*	22.2	22.0	28.7	*29*
65	17.8	21.4	25.8	*45*	16.7	22.0	27.0	*61*
70	11.8	18.0	21.5	*83*	15.0	20.5	22.8	*52*
75	10.9	13.7	17.5	*61*	13.2	15.3	19.7	*49*
80	6.8	8.1	11.4	*67*	11.5	12.4	15.1	*32*
85	5.7	2.1	6.1	*8*	5.6	9.3	8.2	*47*
Total	16.2	20.5	25.0	*54*	14.3	18.3	22.3	*56*

	Black Males				***Black Females***			
Age	1995	2000	2005	1995-2005 (% change)	1995	2000	2005	1995-2005 (% change)
20	16.1	14.7	21.5	*34*	18.	20.9	28.0	*54*
25	16.2	22.7	26.5	*63*	20.2	31.5	35.2	*75*
30	17.8	27.8	35.7	*100*	26.4	31.6	38.5	*46*
35	20.8	32.5	35.6	*71*	24.1	34.6	37.6	*56*
40	25.6	28.5	34.9	*37*	29.3	37.5	41.0	*40*
45	21.3	25.3	34.5	*62*	28.0	37.8	45.5	*62*
50	23.2	31.8	36.2	*56*	39.7	40.6	46.5	*17*
55	27.3	33.5	31.9	*17*	36.7	40.5	47.6	*30*
60	16.5	21.9	31.0	*87*	38.7	44.5	43.6	*13*
65	20.2	25.7	30.6	*52*	37.3	42.6	47.0	*26*
70	11.9	24.3	25.8	*117*	32.6	31.7	43.8	*34*
75	25.6	21.7	26.7	*4*	31.2	30.6	29.8	*-5*
80	9.7	9.2	25.7	*164*	24.7	28.1	32.9	*33*
85	24.3	59.9	4.0	*-83*	16.8	23.1	23.8	*42*
Overall	19.8	26.1	31.4	*59*	27.8	34.6	39.6	*42*

Total Life Expectancy (TLE) and Obesity-Free Life Expectancy at age 20 by Gender and Race

TLE, OFLE at age 20 and the proportion of OFLE to TLE by age groups are shown in Table 2. TLE increased across all race and gender categories during 1995 to 2005. However, life expectancy of males and Blacks increased more than for that of females and Whites. Life expectancy of Black males increased from 47 to 51 years between 1995 and 2005. Given that Black males had the largest increase in TLE, it is 6 years shorter than Black females and 10 yeas shorter than White females.

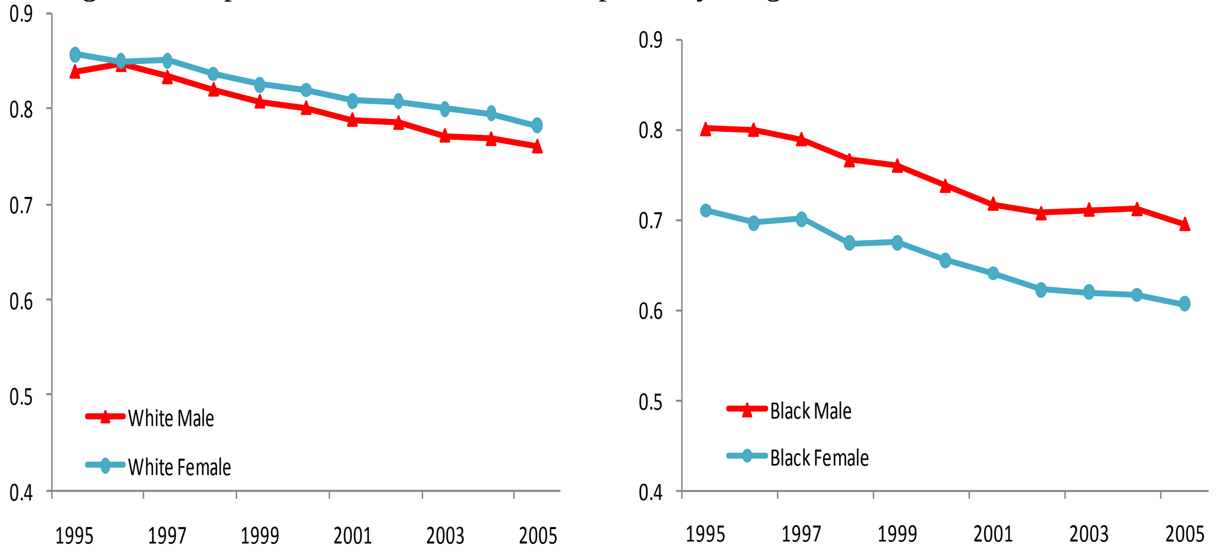
There are also gender-specific and racial differences in OFLE. For instance, OFLE is longer for females than for males and for Whites than for Blacks. White females can expect 48 more years OFLE at age 20 compared with only 36 years for Black males. Although females have longer OFLE, their proportion of OFLE to TLE is declining faster than males. OFLE decreases by 4.1 years for Black females and 3.7 for White females. Proportion of OFLE to TLE and TLE are all declining in the past decade. Both Black males and Black females experienced a 10% decline in proportion of OFLE to TLE and TLE. White males and females both experienced about 7% decrease in proportion of OFLE and life expectancy.

The proportion of OFLE to TLE and TLE at age 20 from 1995 to 2005 are shown in figure 1. We can clearly see that the proportion of OFLE and life expectancy is higher for Whites than for Blacks and gender gap among Whites is smaller than for Blacks. Both the absolute number years of OFLE and the proportion of OFLE to TLE, as well as TLE generally, have been declining in the past decade and there is no sign of stopping at the current level. The result implies that the overall population of U.S population currently has a higher exposure to the adverse effects of obesity in 2005 that in the period 10 years previous.

Table 3: Total Life Expectancy, OFLE and Proportion at age 20 by Gender and Race

	Males	Females	White Males	White Females	Black Males	Black Females
Total Life Expectancy						
1995	53.8	59.9	54.5	60.4	47.2	55.4
2000	55.1	60.2	55.7	60.6	49.9	56.4
2005	55.9	60.7	56.3	61	51	57.4
Change (2005)-(1995)	2.1	0.8	1.8	0.6	3.8	2
OFLE						
1995	44.9	50.3	45.7	51.7	37.8	39.3
2000	43.7	48.0	44.6	49.7	36.8	36.9
2005	42.2	46.0	42.8	47.7	35.4	34.8
Change (2005)-(1995)	-2.7	-4.3	-2.9	-4	-2.4	-4.5
Percentage of Total Life Obesity-Free						
1995	83.6	84.1	83.9	85.6	80.0	71.0
2000	79.4	79.7	80.0	81.9	73.7	65.5
2005	75.4	75.9	76.0	78.2	69.5	60.6
Change (2005)-(1995)	-8.2	-8.2	-7.9	-7.4	-10.5	-10.4

Figure 1: Proportion of OFLE and Life Expectancy at age 20 from 1995 to 2005



Applying different BMI criteria to measure obesity

In this section, I seek to illustrate the how alternative BMI criteria can effect on the change of obesity free life expectancy. Several sets of alternative BMI criteria are tested. First, the cut-off point BMI>=30 is assumed to be underestimated in all subgroups, and the new sets of criteria are assumed to be 29.5, 29 and 28.5. Second, assuming BMI>=30 overestimates the prevalence of obesity and the hypothetical criteria is 30.5, 31 or 31.5. Third, gender differences are considered. Females are assumed to have higher body fat than males as the same level of BMI. The criteria of obesity for males is BMI>=30, but here I adjusted BMI for females with the same body fat at hypothetical obesity criteria of BMI>=29.5, 29 and 28.5. Fourth, racial differences are considered. Since there is no conclusive and consistence evidence in the difference between Whites and Blacks, I will explore both scenarios: first the situation in which Whites have a lower BMI threshold than Blacks and second, where Blacks have a lower BMI threshold than Whites. The fifth and final alternative criteria for obesity is to incorporates both gender and racial differences. This means that the one criterion for all subgroups distorts the ability to identify obesity most for White females or Black females. In this situation, the hypothetical BMI criteria of obesity for Black females or White females are greater than 29, 28 or 27.

BMI>=30 underestimate or overestimate obesity across all subgroups

The results of BMI>=30 are shown in Table 4. Not surprisingly, the lower threshold of obesity decreases the proportion of OFLE at age 20 across all subgroups and higher criteria results in increasing proportion of OFLE to TLE. The proportion of OFLE to TLE is about 2%-3% higher than when obesity is defined as BMI>=28.5 than as

BMI>=30. However, even when obesity is defined as BMI>=31.5, the decreasing in proportion of OFLE to TLE from 1995 to 2005 is about 6%-8%.

Table 4: Different Criteria for Obesity: Underestimate or Overestimate across all Subgroups

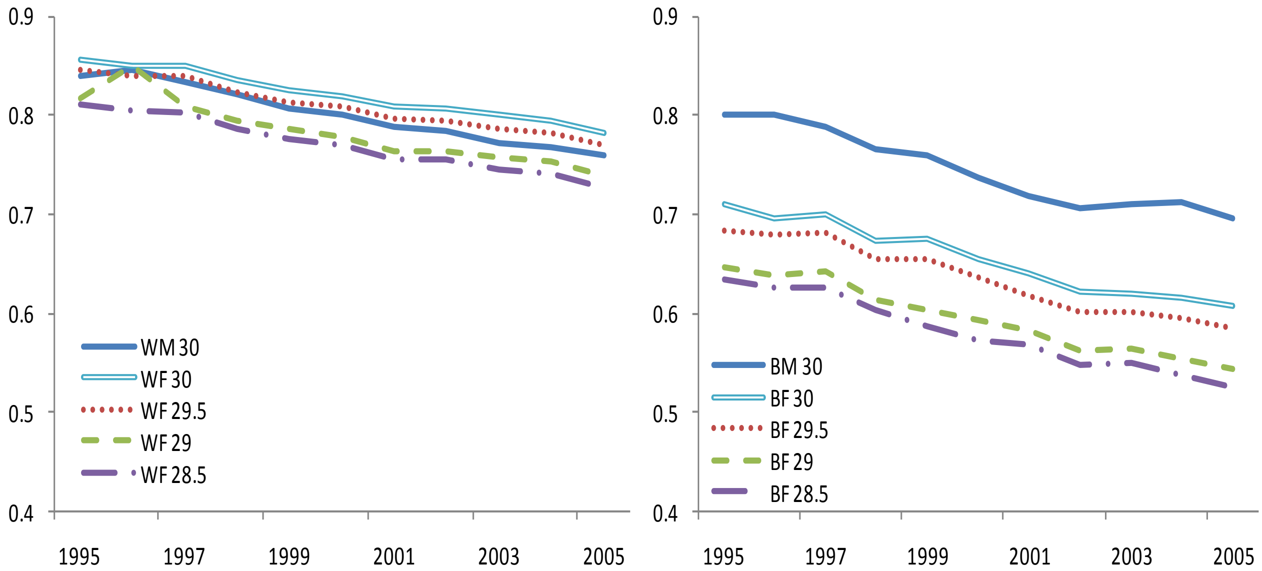
	White Males					***White Females***			
BMI	1995	2000	2005	Change 1995-2005	BMI	1995	2000	2005	Change 1995-2005
28.5	74.8	70.0	65.3	-9.5	28.5	81.8	77.9	73.9	-7.9
29	78.0	73.9	69.6	-8.8	29	81.1	77.0	72.7	-8.3
29.5	81.0	76.7	72.9	-8.1	29.5	84.6	80.8	76.9	-7.7
30	83.9	80.1	76.0	-7.9	30	85.7	81.9	78.2	-7.5
30.5	85.7	82.2	78.9	-6.7	30.5	87.3	83.9	80.8	-6.5
31	87.9	84.7	81.0	-6.9	31	88.3	85.1	82.4	-5.9
31.5	89.7	86.5	83.4	-6.4	31.5	90.0	87.2	83.9	-6.1
	Black Males					***Black Females***			
BMI	1995	2000	2005	Change 1995-2005	BMI	1995	2000	2005	Change 1995-2005
28.5	69.6	62.8	59.2	-10.4	28.5	63.5	57.3	53.8	-9.7
29	73.3	66.5	63.3	-10.0	29	64.7	59.2	55.3	-9.4
29.5	80.0	73.7	69.5	-10.5	29.5	68.4	63.5	59.4	-8.9
30	77.1	69.7	66.2	-11.0	30	71.0	65.5	61.6	-9.4
30.5	82.3	76.3	73.2	-9.1	30.5	74.0	68.3	64.9	-9.1
31	85.2	79.5	75.6	-9.6	31	75.7	70.1	67.5	-8.2
31.5	87.0	81.9	78.8	-8.3	31.5	78.2	73.4	69.5	-8.7

Gender Differences

To take gender into account, females and males should thus have different criteria for measuring the proportion of body fat for obesity categorization. Since females have a higher proportion of body fat than males at the same level of BMI, in the scenario below, male's cut-off point for obesity is assumed as BMI>=30 and female's criteria for obesity is >= 29.5, 29 and 28.5. In Figure 2, we can see that the proportion of OFLE is higher for White males than for White females if both of them have the same BMI criteria for obesity. However, if we apply BMI>=28.5 as criteria for females and BMI>=30 for males, the proportion of OFLE to TLE is higher for White females than White males. Among Blacks, Black males have a higher proportion of OFLE to TLE than Black females. When different criteria are applied, the proportion of OFLE to TLE is still higher for Black males than for Black females, but the gender gap widens.

These results indicate that using BMI>=30 as the criterion in measuring health differences attributed to obesity among males and females could result in unreliable findings. Applying monotonic criteria and ignore gender difference in the measurement of obesity could yield wrong conclusions. As Figure 2 shows, the gender differences in health could be narrower or have reverse outcomes for Whites and the gap between Black males and Black females could be underestimated.

Figure 2: Females have lower BMI for obesity than males



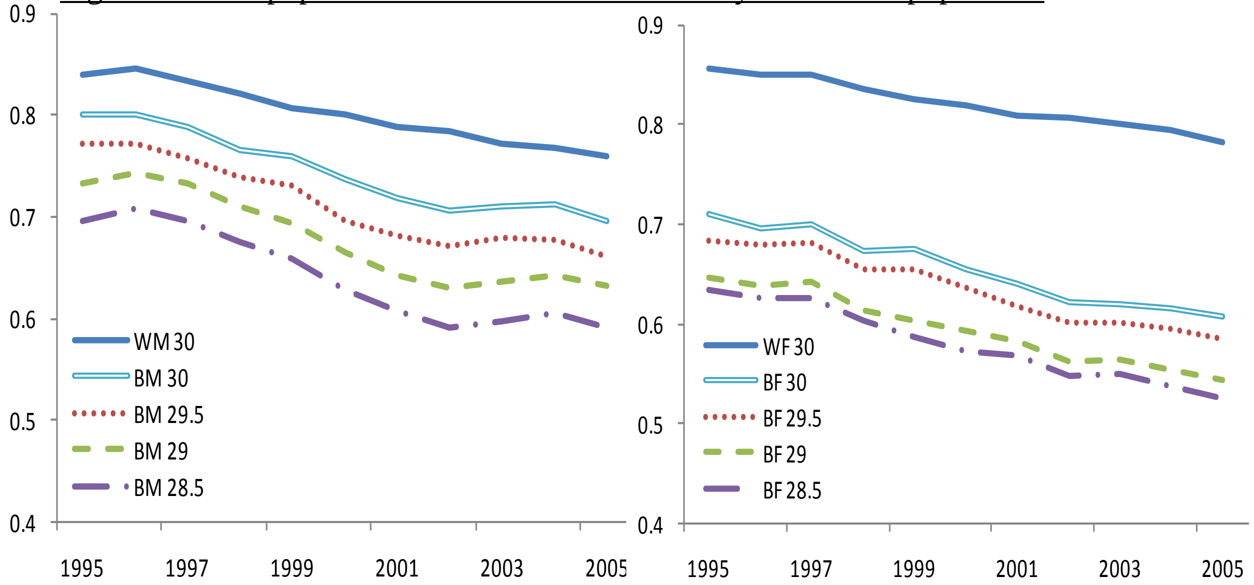
WM: White Males; WF: White Females BM: Black Males; BF: Black Females

Racial Differences

(1) Black population has lower criteria of BMI for obesity

For racial differences, I will demonstrate two scenarios. First, where both Black males and females have lower BMI criteria for obesity and second, where White males and females have lower BMI criteria than Black males and females. Figure 3 shows that if the criteria are the same for both Blacks and Whites, White males and females have higher proportion of OFLE to TLE than Black males and females. The gap between White males and Black males is smaller than between White females and Black females and the gap is much wider if the BMI for obesity among Blacks is lower. As a result, different criteria of obesity for different ethnicity groups do not change the trends of declining in proportion of OFLE to TLE. However, it doe change the level and the gap of proportion of OFLE to TLE within and between racial groups.

Figure 3: Black population has lower BMI for obesity than White population

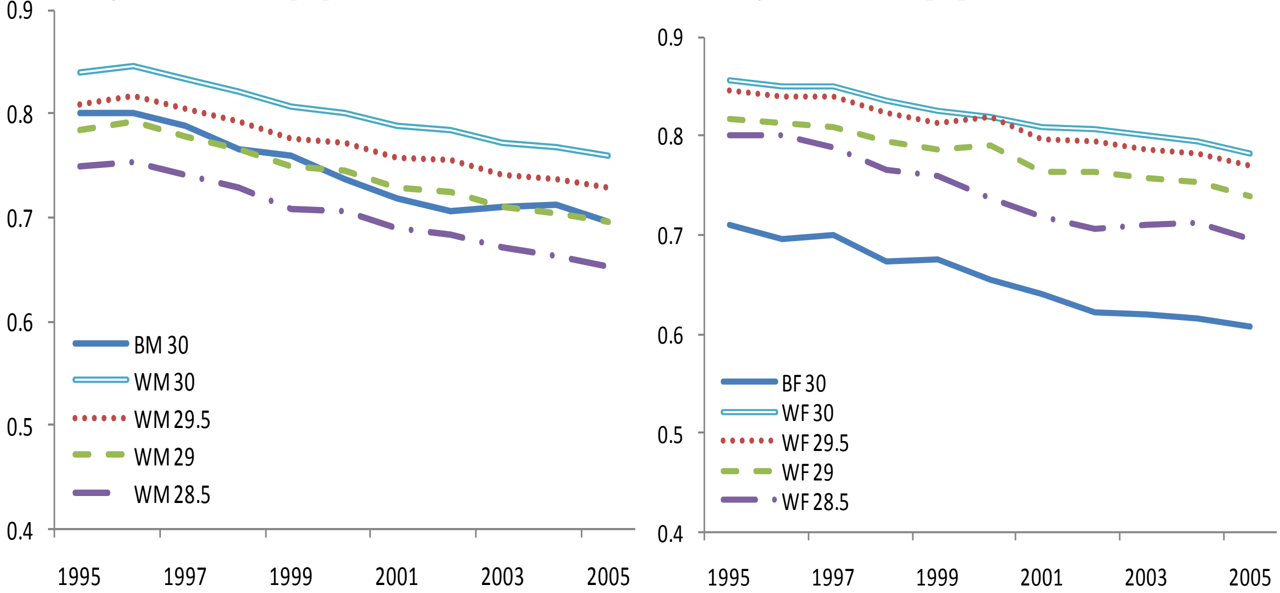


WM: White Males; BM: Black Males WF: White Females; BF: Black Females

(2) White population has lower criteria of BMI for obesity

Figure 4 shows that the gap between Black males and White males is narrowing, when the criteria for BMI categories for White males are lower. If the criteria of obesity for White males are greater than 29, then the proportion of OFLE to TLE for White males are almost the same as Blacks. If the criterion is only greater than 28.5, the proportion of OFLE to TLE for Black males are higher than for White males. This is totally different from applying BMI>=30 as the criteria for both Black males and White males. For White and Black females, the gap is smaller if the criterion for White females are lower than for Black females, however, the proportion of OFLE to TLE for White females are still higher than Black females.

Figure 4: White population has lower BMI for obesity than Black population



BM: Black Males; WM: White Males

BF: Black Females; WF: White Females

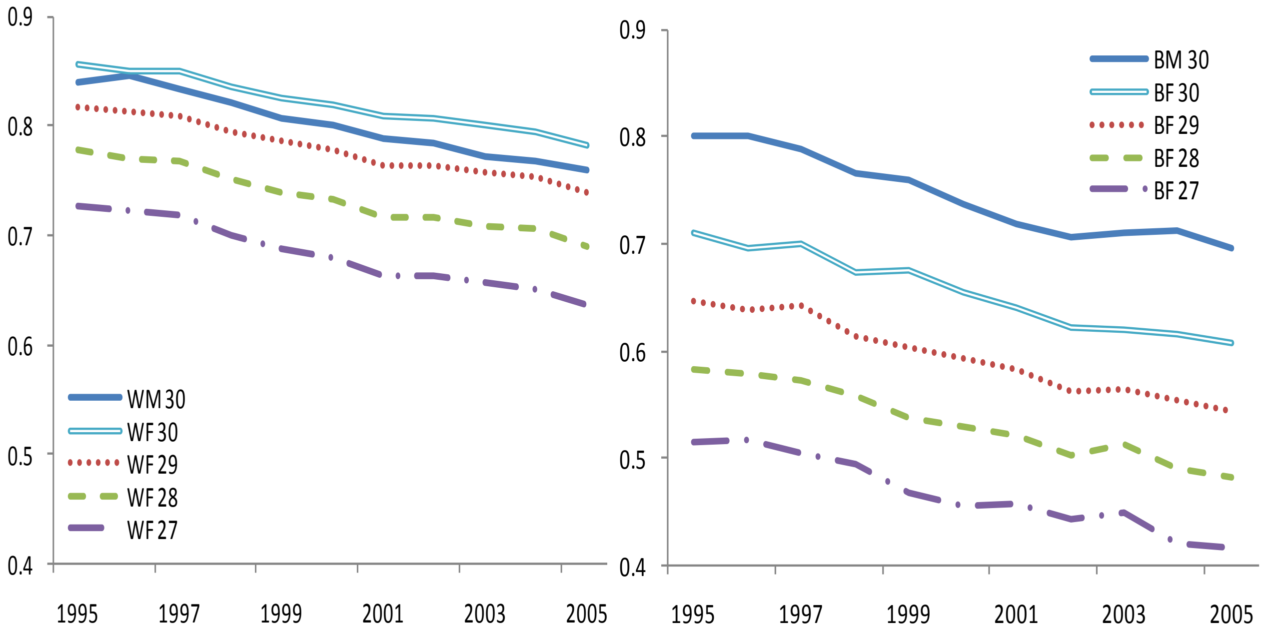
In sum, applying different criteria of obesity for different racial groups shows that the results of proportion of OFLE to TLE would produce different results. If the White population has lower criteria for obesity, the gap between Whites and Blacks is widening for both males and females. If the BMI of obesity for Whites is lower, as I show in figure 6, the proportion of OFLE to TLE of White males will be lower than Black males. For females, the gap will be narrower, but would not change the order between Blacks and Whites. The result implies that research about comparison in health outcomes result from obesity among race, could be distorted if doesn’t take the racial differences in criteria for obesity

Gender and Racial Differences

While previous scenarios consider gender or racial difference separately, in this section both differences are combined. In order to do so, only White females and Black females have different results from previous analysis. If White population has lower BMI criteria, the different settings of cutting-off point of obesity for White females are 29, 28 and 27. If Black population has lower BMI criteria, the settings of criteria for Black females are also 29, 28 and 27.

As shown in figure 5, if White females have lower BMI criteria for obesity, resulting in White females has much lower proportion of OFLE to TLE than White males. If Black females have lower BMI criteria for obesity, the level of obesity for Black females are much more meaningful than the criteria as BMI 30 and the gap between Black males and Black females are much wider.

Figure 5: Incorporate both gender and racial differences for BMI criteria



WM: White Males; WF: White Females

BM: Black Males; BF: Black Females

Discussion

In this analysis, health state were defined as "obesity free" and applying the Sullivan method to estimate the duration of obesity at the population level. Obesity is an important risk factor related to adverse physiological conditions, poor mental health and high economic cost. The prevalence of obesity among the U.S population has been increasing rapidly in the last decade, with the prevalence of obesity increasing by almost 50% during 1995 to 2005. In some subgroups, the rate of increase is even higher. For example, prevalence of obesity among White males and White females increase 96% and 87% at age 20-24 which implies the incidence of obesity below age 20-24 is higher than 10 years ago.

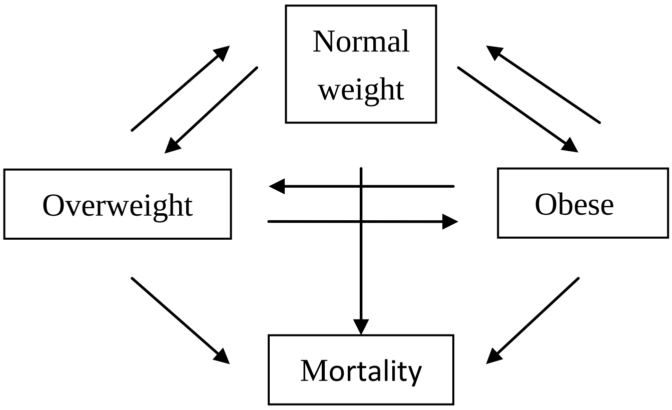
For overall life expectancy, males and Blacks show more improvements in life expectancy than females and Whites in the years of analysis. Although Black males showed the largest increase in life expectancy, the life expectancy of Black males are still lowest, and 10 years less than White females. For OFLE, White has longer OFLE than Blacks. Although females have longer OFLE, it is declining faster than males. For proportion of OFLE and life expectancy, all groups are declining in proportion of OFLE to TLE at age 20. Blacks and males decline faster in proportion of OFLE to TLE than Whites and females.

This research also instituted different criteria of obesity for different subgroups. As a result, the declining trends in proportion of OFLE to TLE from 1995 to 2005 across gender and race remains the same, about 6% - 8% less for Whites and 8%-10% less for Blacks. However, the level of OFLE varies as the cut points of obesity changes. The gap between gender and between racial categories changes as different criteria of obesity are applied

Overall, this study finds that the quality of life measured by "obesity free" of the U.S. population has decreasing in the last decade. If applying different criterion in measurement of obesity to subgroups, the changing in OFLE and proportion of OFLE to TLE over time remain constant, but the gap between gender and racial groups change significantly. To incorporate trends in OFLE over last decade into future population project, can provide more precisely understanding in burden of medical cares as well as implicitly and explicitly social and economic costs attributed to obesity epidemic the in the U.S.

Future directions

The future direction of this type of research should apply longitudinal data to introduce more explanatory variables and estimate real transition rates by using multistate life table (Preston et al, 2001). The real transition space could be outlined as follow:



To understand more about the transition rate from obesity to mortality, we can have better understating how obesity contributes to death and evaluation the costs of obesity. To estimate the transition from overweight to obese, we can have precisely evaluate potential of being obesity and the causes of people with overweight become obesity. Estimation of transition rate from obesity or overweight to normal weight, can improve our understating in the causes might help reduce prevalence of obesity. For policy makers, better understanding of the causes of increases transition rates from obesity or overweight status to normal weight help reduce the level of prevalence in obesity and that decreases transition rate from overweight to obesity can prevent further severity of prevalence of obesity in the future.

Conclusion

The evidence from this analysis can be a part of large explanations to account for health differences across races and gender since the total amount of time in exposure to risk factors at population level are different for each subgroup. Females and Whites have lower levels of exposure to risk factors, hence have better health conditions than males and Blacks - also indicating that the quantity of life has improving, but quality of life is getting worse.

Furthermore, research about obesity generally defined obesity as BMI>=30 and applied this monotonic criterion to all race and gender. This research conclusively shows that the accuracy of BMI is affected by gender and race. As this paper shows, the monotonic criterion of obesity for all subgroups could distort the prevalence of obesity and its consequence of health disparities across gender and race. It is important for future researchers to note that conventional measurement of obesity could results in biased estimation with regards to gender- and racial- difference in obesity.

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