Income and Obesity in OECD Countries

Betsy Eleuteri

The College of New Jersey

April 2004

I. Introduction

Over the past few decades, obesity rates have been climbing at an alarming pace. The Centers for Disease Control and Prevention reports that U.S. obesity rates among adults increased by 50% between 1980 and 1994 (Centers for Disease Control and Prevention, 1996). Using BRFSS data, Vandegrift and Yoked (2004) find that the average U.S. state reported a 49.8% increase in adult obesity between 1991 and 1998. This is an astonishing rate of growth, and it has continued to increase through the present. The number of lives that obesity claims per year is second only to tobacco related deaths. The World Health Organization's World Health Report, 2002 finds there are at least 300 million people world wide that are obese. Of these, about 500,000 people in North America and Western Europe die every year from obesity related diseases.

This report also finds that obesity leads to detrimental changes in people's metabolism, an increase in blood pressure and cholesterol, and increases the risks of heart disease, stroke, diabetes mellitus and different types of cancer (WHO 2002). In developing countries, rapid increases in body weight are occurring, especially among the younger generations. North America, Eastern Europe, the Middle East, the Pacific Islands, Australasia and China have all seen an increase in obesity by at least three times since 1980 (WHO 2002).

Obesity rates in the Organization for Economic Co-operation and Development (OECD) countries have been linked to income, employment, social status, education and gender differences. It is becoming increasingly apparent that controlling the skyrocketing levels of obesity on a global level is urgent. We need to understand why obesity is so prevalent among both developed and developing nations, and what factors put people at

risk for the disease. This paper tries to identify some of the leading causes of obesity, and how they affect the rate among OECD countries.

Rosengren et al (1999) found that body weight and weight gain in adult male life was associated with coronary heart disease and mortality. It assessed risks associated with BMI and weight gain from men age 20 to middle age. Even a slight amount of weight gain after the age of 18 increases the risk of coronary disease among middle aged women. After adjusting for smoking status and physical activity, they found that men who had a BMI greater than 30kg/m2 had a significantly increased risk of death from all causes.

While there have been many studies that attempt to connect income, education and socioeconomic status to obesity levels on an individual country level, there has been little systematic analysis of obesity rates across countries. This paper uses panel data to analyze obesity and income within the OECD. The paper analyzes the connection between caloric intake, health spending, the percentage of the population over 65 and obesity. The analysis suggests that rising caloric intake can not account for rising obesity in OECD countries and that socioeconomic status (i.e., income) does not have as strong an influence on obesity as was originally suggested by other studies.

II.   Background

A large and growing literature considers both the extent of the obesity epidemic and its causes. The WHO notes that both high and low income countries are experiencing a rise in obesity, and in more wealthy countries the problem appears in both middle-aged adults and children and adolescents. The issue of bi-directionality also

surfaces in relation to whether obesity causes socioeconomic status or vice versa (WHO TRS 916). Multiple studies find a higher risk of obesity in women. Wardle et al (2002) found that lower occupational status was a significant factor among women, but not men, in predicting obesity. In addition, both men and women were more likely to be obese as their years of education decreased. This links the educational aspect of socioeconomic status along with income resulting in obesity.

JL Gutierrez-Fisac et al. (2002) find that people who are moderately overweight (25 < BMI < 30) may not actually see themselves as having a problem that can lead to obesity. These people are at high risk for obesity, but there could be cultural differences in some of these countries that accept being overweight more readily than in the United States. Another relevant issue here is that men are more likely to misperceive their overweight than women (JL Gutierrez-Fisac et al). There are pressures for a woman to maintain a certain body image, but obesity is more prevalent among women, which creates a puzzling effect. One of the highest misperceptions of being overweight is noted in population age 65 and older.

Although obesity rates are higher in the U.S. than Europe, European countries have also experienced large increases in obesity rates. Malliard et al (1999) considers the changes in obesity between 1980 and 1991. This study classified professions: farmers, businessmen, professionals, technicians, employees, manual workers, never worked, students, and military, between both men and women to portray socioeconomic status. They found that the mean BMI was increasing for both genders in every socioeconomic class.

Recent work has identified a series of causes for the rise in obesity rates. At the most basic level obesity rates increase in a population either because caloric intake rises or activity levels fall (Nestle & Jacobson, 2000). Sobal and Stunkard (1989) reviewed 144 obesity studies, and found that there was an inverse relationship with obesity and socioeconomic status, especially among women in developed societies. They believe that more educated people, especially women, tend to be more knowledgeable about dieting. These women can afford the foods and programs that go along with dieting, which may reveal why obesity is not as prevalent among higher socioeconomic households.

Ellaway et al. (1997) studies areas of residence and body size. This relates where a person lives within a country to the total obesity rates over the whole country. The study reviewed four 'socially contrasting' neighborhoods in Scotland to determine whether the location of people's housing affected BMI and obesity. It shows that where you live can also significantly affect eating habits and obesity among the general population. People who lived in poorer neighborhoods had fewer 'health promoting activities' and were more likely to be overweight. Less affluent neighborhoods provide less security, and any areas that might promote physical activity could be seen as more threatening or dangerous to people who would normally partake in those activities.

Erlichman et al (2002) used data from Western societies that have energy-dense foods available. The article related different social classes with the number of cars and televisions that people owned. Correlation between rising obesity and a more sedentary lifestyle is shown, and it suggests a need for physical activity to reduce unhealthy weight gain. There is, however, a problem implementing public health policy internationally and on an individual level. Cutler et al. (2003) examined energy expenditure, comparing both

voluntary and involuntary energy use. They found that the only likely explanation for increasing obesity levels would come from caloric intake, not an increase in energy expenditure. This is inconsistent with other studies, which found an inverse relationship with activity level and obesity rates (Nestle & Jacobson, 2000).

Socioeconomic status is also linked with physical activity, and Ford et al. (1991) found that people who had a higher income were more likely to be involved in physical activity throughout the week. This activity is associated with leisure, work and household time. The Cutler et al. (2003) study found that physical activity was insignificant, which does not make logical sense and has already been proven important by multiple studies.

Laitinen et al (2002) found that unemployment could influence obesity due to negative effects on mental health resulting from a lack of income as well as motivation through unemployment. This study also found that unemployment did have a gender related effect, as it increased the risk of obesity in women, but did not have the same results for the male population. Laitinen et al (2002) solidify the argument that obesity may in fact be related to gender. This paper also showed that poor school performance increased the likelihood of obesity for both male and female subjects. They also concluded that one of the most important factors studied that could lead to adult obesity was being obese at age 14.

III. Empirical Model, Data and Methods

A fixed-effects model was used to analyze obesity rates in OECD countries for the period 1991-1995. This model assumes that differences across these countries are

captured by the differences in the constant term. Data were collected for 11 OECD

countries (Canada, Czech Republic, Denmark, Finland, France, Italy, Japan, Netherlands,

Spain, Switzerland, and United Kingdom) for the years 1991-1995. We analyze data at

the country level, because changes at the individual level are unlikely to bring about

population-wide change (Cheadle et al. 1992; Sallis et al. 1998). The independent

variables I regressed on the obesity rate from OECD countries were GDP per capita

(gdppc), caloric intake (calint), population over 65 (pop65) and total expenditure on

health as a percentage of GDP (hlthprcnt). Obesity was measured using the body mass

index (BMI), defined as body weight in kilograms divided by height in meters squared.

Obesity is defined as BMI $\geq$ 30. GDP per capita is included to show that income does in

fact significantly affect the obesity rate (Sobal and Stunkard, 1989). Caloric intake was

incorporated into this study to see whether a rise in the number of calories per person on

a countrywide level would directly affect the overall obesity rate (Cutler et al., 2003).

The prevalence of obesity is supposed to increase with age (Kuczmarski, 1992), so

population over 65 was included as an independent variable also. The final variable used

was the health expenditures as a total percentage of GDP, because increases in health

spending may cause healthier (and less obese) populations.

(1)   obesity rate = GDP per capita + caloric intake + population over 65 + total

expenditure on health as a % of GDP

I used the same variables to determine whether the female obesity rate was different than

that of the overall population.

(2)   female obesity rate = GDP per capita + caloric intake + population over 65 + total

expenditure on health as a % of GDP

IV.   Results

The results in Table 2 show that GDP per capita is a significant determinant at the

.01 level, and exerted a positive effect on the obesity rate. For every thousand-dollar

increase in per capita GDP, the obesity rate rose .172 percentage points. This is

surprising. A series of cross-section studies of individuals and geographic areas have

shown that obesity and income are inversely related (Sobal & Stunkard, 1989; Vandegrift

& Yoked, 2004). Vandegrift and Yoked (2004) find that at a point in time in the United

States, higher income states had lower obesity rates but that a change in income is not

associated with a change in obesity (2004).

Daily caloric intake exerted a significant effect (at the .01 level) on the obesity

rate. For every thousand-calorie increase, the obesity rate decreased by 2.8 percentage

points. This was not the expected outcome, as it is logical that more calories consumed

will increase weight gain (all other things held constant). This also does not include any

assessment of physical activity, which Nestle and Jacobson (2000) found to be relevant.

Presumably, activity levels are much higher in European countries with high caloric

intake. This contradicts claims by Cutler et al. (2003) and others that increases in caloric

intake are driving the increases in the obesity rate. The findings of this study indicate

that it is quite possible that caloric intake does not actually increase the prevalence of

obesity. It may in fact decrease the obesity rate as evidenced by these results. This

would only be significant when studied in conjunction with the amount of physical

activity that was taking place. Nestle and Jacobson (2000) contend that people are consuming more without compensating for the increase in caloric intake with appropriate physical activity which also leads to obesity. However, activity levels have been notoriously difficult to measure which impedes potential studies relating the two issues.

Because each of the cross-section parameter estimates (countries) was significant the R^2 was quite high (.99).

The regression on the percentage of female obesity (shown in Table 3) within the OECD countries, shows slightly different results. Here only the GDP per capita was significant at the .05 level, resulting in a .153 percentage point positive change in obesity for every thousand-dollar change in GDP per capita. Again, an increase in income is significant, and it exerts a positive effect on the obesity rate consistent with the theory that income actually increases obesity rates. This is especially important because it has to do with the female obesity rate, in which multiple studies have found the opposite results. Sobal and Stunkard (1989) found that wealthier women had lower obesity rates. They believe that this is due to their ability to learn about new diets, as well as be able to afford the food that goes along with those diets. According to this global data, however, I find that as wealth increases in women, the obesity rate is still rising.

I also performed a regression on the rate of female obesity and did not include health expenditure as a percentage of GDP, and found that GDP per capita was still the only significant indicator at the .05 level. There was a .153 percentage point positive change in the female obesity rate for every additional thousand-dollar increase per capita. The probability value for caloric intake was .1083, which just misses the cutoff for the

.10 level significance. This shows that caloric intake may still be affecting the female

obesity rate even when health expenditure is not controlled for in the regression.

Finally, I used the female obesity rate as the dependent variable, but only used

GDP per capita, caloric intake and health expenditure as a percentage of GDP as

independent variables. I left out the population over 65, to see what effect this would

have on the results. Shown in Table 3, again GDP per capita was significant at the .01

level, and created a .164 percentage point increase in the female obesity rate for every

additional thousand-dollar increase in GDP per capita. Now, caloric intake was

definitively significant at the .10 level, resulting surprisingly in a -2.032 percentage point

decrease in the female obesity rate for each additional increase of a thousand calories.

This is inconsistent with natural thinking, but may be a sign that caloric intake is not as

positively associated with weight gain as was once thought.

Cutler et al. (2003) performed a regression on obesity across countries with some

variables out of the OECD data. They find that income is not significantly related to

obesity, even when other variables are included. This is inconsistent with my study, and

they may have used too many proxies during their regression to maintain an accurate

result. They contend that obesity is directly related to the amount of pre-packaged food

people eat because of changes that have occurred through technological advancement

(2003). One of these changes is evident in the use of microwave ovens across countries.

The US and the UK both have similar obesity rates, and both have a high number of

microwaves owned by their populations. On the other hand in Italy, a less obese nation,

only 14% of its population owns microwaves. This may be a direct correlation to their

theory relating prepared food to the obesity rate. I question the precision of these results, however, because they have only a few observations for each variable

V.   Conclusion

Most studies find that an increase in income will decrease obesity levels, especially among women in the population. Cutler et al. (2003) find that higher incomes, as reflected by an increase in education, actually lower obesity. My results, however, indicate that income actually has a positive increase in the effect on obesity rates. This result is the same for both the entire population, as well as just the female segment. The results of this paper refute those found in Cutler et al. (2003), and may be significant when looking at determinants of the obesity rate. If on a global level, wealth does indeed bring about higher obesity levels on a countrywide basis, we need to formulate plans for developing countries that having growing GDPs to curtail obesity. These results are especially interesting, because as many developing countries are becoming wealthier, the obesity rates associated with them are climbing.

Many studies conducted state that an increase in caloric intake will result in an increase in obesity levels. The results of this paper suggest that the actual relation between caloric intake and obesity is more complex. For OECD countries in the 1990's higher caloric intake was associated with lower obesity levels. This suggests that activity levels are generally higher in countries with high caloric intake. In addition, it suggests that the increases in obesity that have occurred across developed countries are the result of lower activity levels rather than increased caloric intake.

Kuczmarski (1992) finds that obesity increases with an aging population. I used the percentage of the population over 65 as in independent variable, and found that it was never a significant factor in any of the regressions I performed. These results may be due to the fact that Kuczmarski only uses information relating to the United States, where my study includes information from countries around the world. Although other studies found the population over 65 an important factor in obesity levels, I did not.

I also did not find a significant relationship between the total expenditures on health as a percentage of GDP and obesity. While health expenditures might be effective in reducing obesity rates, it is also possible that obesity causes increases in health expenditures. This two-way causation may have obscured the actual relation between obesity and health spending.

The results from this study are important, and should be a cause for alarm. As countries grow richer, the obesity rates continue to rise. Other studies (Sobal and Stunkard, 1989) have found that income is negatively related to the obesity rate, but cannot figure out why. Vandegrift and Yoked (2004) say that it is important to learn more about why these rising incomes have failed to decrease obesity even though there is a negative relationship. It may be because the relationship between income and obesity worldwide is not as clear cut as other studies have found. This study provides actual results that show income is rising globally along with the obesity rate. It is also important to include results that take into account physical activity in relation to the obesity rate as Nestle and Jacobson (2000) found this factor significant. No matter how you look at it, obesity rates are rising along with income on a worldwide level, and something needs to be done to reverse this epidemic as quickly as possible.

References

Albom, M. (2004, March 07) Downsizing our food isn't the answer. *Detroit Free Press.*
(http://www.keepmedia.com/ShowItemDetails.do?nbdTopicID=5&item_id=390596)

Centers for Disease Control and Prevention (1996) Third National Health and Nutrition
Examination Survey. *National Center for Health Statistics.*

Cheadle, A., Wagner, E., Koepsell, T., Kristal, A., and Patrick D., (1992) Environmental
indicators: A tool for evaluating community-based health promotion programs, *American
Journal of Preventive Medicine,* **8**, 345-350.

Cutler, D., Glaeser, E., & Shapiro, J. (2003) Why have Americans become more obese?
Journal of Economic Perspectives, **17**, 93-118.

Ellaway A, Anderson A & Macintyre S. (1997) Does area of residence affect body size
and shape? *International Journal of Obesity* **21**, 304-308.

Erlichman J, Kerbey A. L. & James W. P. T. (2002) Physical activity and its impact on
health outcomes. Paper 2: prevention of unhealthy weight gain and obesity by physical
activity: an analysis of the evidence. *Obesity Reviews* **3**, 273-287.

Ford, E.S., Merritt, R. K., Heath, G.W., Powell, K. E., Washburn, R. A., Kriska, A.,
Haile, G., (1991) Physical activity behaviors in lower and higher socioeconomic status
populations. *American Journal of Epidemiology.* **133**, 1246-1255.

Gutierrez-Fisac J.L., Lopez Garcia E, Rodriguez-Artalejo F, Banegas Banegas JR &
Guallar-Castillon P. (2002) Self-perception of being overweight in Spanish adults.
European Journal of Clinical Nutrition. **56**, 866-872.

Kuczmarski, R. J., (1992) Prevalence of overweight and weight gain in the United States.
American Journal of Clinical Nutrition, **55**, 4955-5025.

Laitinen J, Power C, Ek E, Sovio U & Jarvelin M.R. (2002) Unemployment and obesity
among young adults in a northern Finland 1966 birth cohort. *International Journal of
Obesity.* **26**, 1329-1338.

Lawson, W. (2003, September 02) How the stomach talks to the brain. *Psychology
Today*.
(http://www.keepmedia.com/ShowItemDetails.do?nbdTopicID=5&item_id=293983)

Maillard G, Charles M.A., Thibult N, Forhan A, Sermet C, Basdevant A & Eschwege E.
(1999) Trends in the prevalence of obesity in the French adult population between 1980
and 1991. *International Journal of Obesity* **23**, 389-394.

Nestle, M., Jacobson, M., (2000) Halting the obesity epidemic: a public health policy approach. *Public Health Reports*, **115,** 12-24.

Rosengren A, Wedel H & Wilhelmsen L. (1999) Body weight and weight gain during adult life in men in relation to coronary heart disease and mortality. *European Heart Journal* **20**, 269-277.

Samuelson, R. (2004, March 02), The afflictions of affluence. *Newsweek*. (http://www.keepmedia.com/ShowItemDetails.do?nbdTopicID=5&item_id=396530)

Sallis, J., Bauman, A. and Pratt, M., (1998), Environmental and policy interventions that promote physical activity, *American Journal of Preventive Medicine*, **14**, 379-397.

Sobal, J. and Stunkard, A.J., (1989), Socioeconomic status and obesity: a review of the literature, *Psychological Bulletin,* **105**, 260-275.

Vandegrift, D. and Yoked, T. (2004), Obesity rates, income, and suburban sprawl: An analysis of US states, *Health and Place,* (forthcoming).

Wardle Jane, Waller Jo, & Jarvis Martin J. (2002) Sex differences in the association of socioeconomic status with obesity. *American Journal of Public Health* Vol 92, No. 8

World Health Organization, (2002) World Health Report 2002, (http://www.who.int/whr/2002/overview/en/index1.html)

World Health Organization. (2002) Diet, Nutrition and the Prevention of Chronic Diseases. *Report of a Joint WHO/FAO Expert Consultation*.

Table 1 Univariate Measures: Obesity Rate - Country Level

	Mean	Standard Deviation	Minimum	Maximum
Obesity Rate[*]	8.45	3.51	2.2	16
GDP Per Capita	18.29	3.65	9.53	25.67
Caloric Intake	3.21	0.21	2.8	3.65
Population over 65	14.21	1.31	11.5	16.6
Health % of GDP	7.87	1.13	5.2	10

[*]Obesity rate is the percentage of the population with a BMI ≥ 30 (by country)
All cross section estimates are suppressed.
[a] GDP per capita in $US
[b] Total caloric intake as reported by individuals
[c] Percentage of population over 65
[d] Health expenditure as a percentage of GDP

TABLE 2 - Fixed Effects Regressions: Independent Variables - Obesity Rate - Country Level

Dependent Variable: Obesity Rate

	1991-1995
GDP Per Capita[a]	0.172*
	(.053)
Caloric Intake[b]	-2.838*
	(1.04)
Pop Over 65[c]	-0.017
	(0.208)
Health Expenditure as % GDP[d]	0.037
	(0.132)
R^2	0.9907
F-Value	306.59
N	55

Standard Errors appear in parentheses.

All cross section estimates are suppressed.

[a] GDP per capita in $US (thousands)

[b] Total caloric intake as reported by individuals (thousands)

[c] Percentage of population over 65

[d] Health expenditure as a percentage of GDP

* = significant at the 0.01 level

Table 3 - Fixed Effects Regressions: Independent Variables - Female Obesity Rate - Country Level

Dependent Variable: Female Obesity Rate

	1991-1995 all variables	1991-1995 without health %	1991-1995 without over 65
GDP Per Capita[a]	.153*	0.153*	.164*
	(.065)	(0.064)	(.053)
Caloric Intake[b]	-1.903	-1.965	-2.032**
	(1.261)	(1.197)	(1.176)
Pop Over 65[c]	.077	.067	n/a
	(.252)	(.241)	n/a
Health Expenditure as % GDP[d]	-.028	n/a	-.016
	(0.160)	n/a	(.154)
R^2	0.9887	0.9886	0.9886
F-Value	256.43	281.79	269.18
N	55	55	55

Standard Errors appear in parentheses.

All cross section estimates are suppressed.

[a] GDP per capita in $US

[b] Total caloric intake as reported by individuals

[c] Percentage of population over 65

[d] Health expenditure as a percentage of GDP

* = significant at the 0.05 level

** = significant at the 0.10 level