The Effect of Retirement on Weight

Sukyung Chung,1 Marisa E. Domino,2 and Sally C. Stearns2

1 Philip R. Lee Institute for Health Policy Studies, University of California, San Francisco.
2 Department of Health Policy and Management, University of North Carolina at Chapel Hill.

Objectives. People who are close to retirement age show the highest rates of weight gain and obesity. We investigate the effect of retirement on the change in body mass index (BMI) in diverse groups varying by wealth status and occupation type.

Methods. Six panels of the Health and Retirement Study (1992–2002) on individuals aged 50–71 were used (N = 37,807). We used fixed-effects regression models with instrumental variables method to estimate the causal effect of retirement on change in the BMI.

Results. Retirement leads to modest weight gain, 0.24 BMI on average. Weight gain with retirement was found among people who were already overweight and those with lower wealth retiring from physically demanding occupations. The cumulative effect of aging among people in their 50s, however, outweighs the effect of retirement; the average BMI gain between ages 50 and 60 is 1.30, 5 times the effect of retirement.

Conclusions. Given the increasing number of people approaching retirement age, the population level impact of the weight gain ascribed to retirement on health outcomes and health care system might be significant. Future research should evaluate programs targeted to older adults who are most likely to gain weight with retirement.

Key Words: Retirement—Obesity—Body mass index—Occupation—Wealth.

Obesity has been identified as epidemic in the United States, imposing public health and financial burdens to society. Among all the age groups, adults in their 50s to 60s, the group close to retirement age, show the highest prevalence of obesity and the greatest increase in the prevalence of obesity (Mokdad et al., 1999). The link between obesity and increased morbidity and mortality from the most common diseases among older adults, such as strokes, heart diseases, diabetes, osteoarthritis, and certain types of cancer, is well established (Center for Disease Control and Prevention, 2005). Weight gain among older adults, regardless of obesity status, also increases risks for these diseases (Eng et al., 2005; Jenkins, 2004; Koh-Banerjee et al., 2004; Lee, Kawakubo, Kashihara, & Mori, 2004). Consequently, obesity-related medical care costs among this aging population are considerable (Finkelstein, Fiebelkorn, & Wang, 2003).

Retirement may be one of many factors contributing to weight change among older adults. Retirement generally is associated with a significant change in the availability of leisure time and financial resources, which are important determinants of weight-related health behavior such as exercise and diet (Boutelle, Jeffery, & French, 2004; Chou, Grossman, & Saffer, 2004). We aim to provide empirical evidence of the effect of retirement on weight. One of the complicating issues in the estimating is that weight is related to health problems and other individual preferences, which also affect retirement decisions (Anderson & Burkhauser, 1985; McGarry, 2004). In the estimation of the causal effect of retirement, we control for unobserved individual heterogeneity using six waves of the Health and Retirement Study (HRS) spanning 1992–2002 and instrumental variables (IV) methods. We also examine heterogeneous weight responses to retirement among people with different age groups, baseline weight levels, wealth status, and occupation types.

Findings from this study could inform public health policy and financial impacts of policies affecting labor market participation decisions of older adults approaching retirement age. Given the health complications of obesity and the excess Medicare expenditures ascribed to obesity among the retired population, changes in Social Security policy to delay retirement may have spillover effects on Medicare spending if retirement accounts for a large proportion of the weight gained by people near retirement age. Furthermore, given socioeconomic disparity in obesity and obesity-related diseases among older adults (Fonda, Fultz, Jenkins, Wheeler, & Wray, 2004; Paeratakul, Lovejoy, Ryan, & Bray, 2002), identification of heterogeneous weight responses to retirement among diverse groups will help policy makers determine whether certain subgroups might warrant greater interventions at the time of retirement.

Previous Research

Only a few published studies to date addressed the impact of retirement on body weight, and findings are inconclusive. Patrick, Bassey, and Fentem (1982) studied healthy British men who retired from manual work and found an increase in fat mass in the first year of retirement followed by a decline in the second to fifth years of retirement. This study, however, used only unadjusted pre–post comparisons among men who
retired. Morris, Cook, and Shaper (1992) compared British
men who remained employed with those noncontinuously
employed, finding that noncontinuously employed men were
more likely to either gain or lose weight, whereas weight was
stable among the continuously employed men. Nooyens and
colleagues (2005) compared healthy Dutch men who re-
mained employed with those retired either voluntarily or
mandatorily, finding that retired men gained more weight
than continued employed men and that the weight gain was
greater among retirees from physically active jobs than retir-
ees from sedentary jobs. Forman-Hoffman and colleagues
(2008), the first published study using the U.S. population-
based data, examined the relationship between retirement
and change in body mass index (BMI) by gender, finding that
retirement is associated with a significant but modest weight
gain only among women. Although these studies inform the
relationship between retirement and weight, the causality of
retirement is not yet fully explored.

Although two previous studies (Morris et al., 1992;
Nooyens et al., 2005) attempted to address heterogeneity
between the two groups, several methodological issues cast
doubt on the causality and generalizability of their results.
First, information on job transitions and health condi-
tions was limited. Both studies used two waves of data in which
the interval from the baseline to the follow-up was 5+ years; 
job termination could have occurred at any time postbase-
line, and the analyses did not adjust for changes in health
during follow-up. Second, these studies compared a broad
category of noncontinuously employed, including unem-
ployed and current workers, with a continuously employed
group. Temporary job loss may change health behavior but
do so differently from retirement. Third, generalizability is
limited as these studies used samples drawn from limited
geographic areas or used selected healthy subsamples; none
included women. A recent study by Forman-Hoffman and
colleagues (2008) addressed these issues using longitudinal
data and by adjusting for several indicators of current health
status but still does not answer the causal effect of retire-
ment; weight change with retirement in their study may be
associated with unobserved health problems that are more
likely to occur among retirees who are on average older
than current workers.

The present study aims to advance our understanding of
the causal effect of retirement on weight by adopting rigor-
ow econometric methods using recent U.S. population-
based data representing diverse socioeconomic groups. This
study addresses potential endogeneity of retirement by us-
ing individual-level panel data and instruments for retire-
ment. The measurement of retirement in our study is
primarily based on an objective indicator of current work-
ing status and does not rely solely on the ambiguity in the
voluntariness of job termination. Furthermore, this study
examines variations across subgroups defined by age,
weight, wealth, and preretirement occupation type to iden-
tify the effect of retirement in diverse subpopulations.

Theoretical Framework

Traditional economics theories such as human capital
and production of health theory (Becker, 1965; Grossman,
1972) suggest that an individual may adopt a healthier life-
style and control weight after retirement because retire-
ment provides greater time to undertake health-producing
activities. In contrast, retirement may lead to weight gain
if nonworking hours are not as physically active as the
time previously spent at work or if sedentary or unhealthy
habits develop. Furthermore, retirement may increase risk
for social isolation and depression, which can result in re-
duced effort toward healthy activities. Overall, the direc-
tion of change in weight with retirement is ambiguous a
priori.

The effect of retirement may depend on preretirement oc-
cupation type, after accounting for other factors. For retirees
from physically demanding jobs, retirement means the loss of
an economic incentive for being physically active (Philipson
& Posner, 2003) and may lead to weight gain unless the retir-
ees maintain the same level of physical activity during retire-
ment as they did when working. In contrast, retirees from
sedentary jobs may lose weight if the additional nonworking
hours are more physically active than time at work.

Wealth status may also affect weight response to retire-
ment for at least two main reasons. First, wealth provides
financial security and protects against downturns in income
upon retirement (Robert & House, 1996). Persons with low
or no wealth may have more difficulty affording a healthy
diet, adequate housing, exercise opportunities, and social
activities after retirement. Second, wealth is associated with
other preferences that determine individuals’ health behav-
ior. For example, individuals with a higher level of accumu-
lated earnings are more likely to have low discount rates
and engage in healthier behaviors that improve future health
(Barsky, Juster, Kimball, & Shapiro, 1997; Bernheim,
Skinner, & Weinberg, 2001). The effect of wealth on health
behavior, if any, could be amplified with retirement when
people have less income.

Empirical Model

Our goal was to estimate the causal effect of retirement
on BMI. Health problems and relevant socioeconomic fac-
tors that may affect both the individual’s retirement deci-
sion and the BMI were controlled in a multivariate analysis
according to Equation (1):

\[ BMI_{it} = f[RETIREMENT_{it}, HEALTH_{it}, \\
SOCIOECONOMIC_{it}, \mu_i, \nu_t] \] (1)

where \( \mu_i \) and \( \nu_t \) are unmeasured time-invariant and time-
varying individual heterogeneities, respectively. The in-
dexes \( i \) and \( t \) are individual and time indicators and \( f \) is a
linear function.

In the estimation of the model, we used fixed-effects and
IV techniques to control for the fact that unobserved health
Methods

Data

Data from the HRS (1992–2002) were used for the study. We used a subset of the HRS sample, which represents birth cohorts of 1931–1947, and their spouses in the same birth cohorts. The baseline interview was conducted as an in-home face-to-face interview, and follow-up interviews were conducted by telephone every 2 years. Spouses responded to the same set of questions. The HRS data are publicly available (http://hrsonline.isr.umich.edu).

Overall, 933 (1.7%) of the baseline participants died and 1,916 (3.5%) persons were lost to follow-up, leaving 55,364 observations across six waves (11,834 unique individuals at baseline). The analyses used observations from five waves, 1994 (Wave 2) to 2002 (Wave 6); baseline information for each individual was used only to identify history of job, marital status, and health problems. Among the 43,530 observations in Waves 2–6, we excluded people who were not in the labor force for 5 or more years and people who were currently neither retired nor working (e.g., looking for a job; 5,217 observations and 2,401 unique individuals), who could be treated as neither retired nor currently working. We further excluded observations with missing data on weight or height (n = 506). The remaining observations for analyses were 37,807 from 10,565 unique individuals.

At baseline, as compared with other people with complete information, people who were lost to follow-up or people who did not report weight in some waves did not differ in the likelihood of being retired (21.3% vs. 22.1%; p = .42) nor in the BMI (27.9 vs. 28.1; p = .20). Therefore, the coefficient on retirement should not be biased due to these missing cases. Similarly, people who died during the study period did not differ in the BMI (27.9 vs. 28.2; p = .26), although they were more likely to be retired at baseline than those who remained in the sample.

Among the 10,565 individuals in the analysis sample, the majority were men (51%) and non-Hispanic Whites (74%), with an education level of at least high school (76%) and an average age of 60.5 years (range 52–71 years). The next section describes definitions and statistics of each variable used in the analysis in detail as is summarized in Table 1.

Variables

Retirement.—Among the various definitions of retirement (Lumsdaine & Mitchell, 1999), we used current working status as the primary source for defining retirement status for several reasons. First, retirement is not an absorbing state as people flow back and forth between working and retired status (Gustman & Steinmeier, 2000). In this study sample, 1,046 (8.8%) of the respondents reported returning to the workforce in a subsequent interview after retirement during the 10-year period. Second, the voluntariness of job loss is often reported with error that is correlated with health status (Bound, 1991). Third, people often retire from career jobs but participate in a second career for a lengthy period especially for people departing a career job prior to age 60 (Ruhm, 1990).

For each wave-specific observation, retired was defined as “currently not working for pay” and required an indication that the person considered oneself to be retired, with a referent category of currently working status. Thus, people who were either newly retired between the previous interview conducted 2 years ago and current interview or those who remained retired for the previous 2 years (i.e., retired for 2–5 years) were categorized as “retired.” Using these definitions, 40% of the observations were classified as retired. The data show a large shift from working status into retired status: from 22% of the sample retired at baseline to 50% of the sample retired at the latest interview.

Body mass index.—The dependent variable, BMI, is defined as current weight in kilograms/height in meters$^2$ at the end of each wave. In the HRS, height was reported once at baseline and weight at each wave. We used weight and height after adjusting for potential reporting errors using predicted actual height and weight, following the methods used in other studies using self-reported data (e.g., Cawley, 1999; Chou et al., 2004). The National Health and Nutrition Examination Survey data, which contain both measured and self-reported height and weight for each individual, were used for the validation. The average BMI was 28.3. Based on BMI, 30% of the sample were classified as obese (BMI ≥ 30) and 72% overweight or obese (BMI ≥ 25).

Physical demands of occupation.—Individuals’ occupation type was classified as sedentary or physically demanding based on the current occupation, if currently working, and on the previous longest occupation, if not working. The occupation-specific strength factors defined in the Dictionary of Occupation Titles (DOT; U.S. Department of Labor, U.S. Employment Service, and the North Carolina Occupational Analysis Field Center, 1981) were used for the classification. For each of the 503 Standard Occupation Classification System (Bureau of Labor Statistics, U.S. Department of Labor, 1980) codes in the HRS, a corresponding strength factor was
assigned. “Sedentary” or “light-” strength occupations defined in the DOT are recategorized into sedentary (53%), and “medium-,” “heavy-,” or “very heavy-” strength occupations were categorized into physically demanding (47%) for the present study.

Health shocks.—A health shock was defined as the onset of new serious health problem during the past 2 years. To understand different weight responses to health problems, health events were grouped into five—cardiovascular disease (heart attack, heart failure, and stroke), severe diabetes (diabetes with hospitalization, kidney problem, or insulin injection), cancer any cancer except skin cancer, lung disease lung problem that limits activity, ADL limitation difficulty in ADL five items, other hospitalization 3+ day hospitalization, excluding experience of health shocks.

Health behavior.—Physical activity and smoking status were included to examine whether the effect of retirement still persists after controlling for these indicators of health behavior that are known to be associated with weight. Physical activity was coded as 1 if the respondent participated in vigorous physical activity (such as sports, heavy housework, or a job that involves physical labor) or exercise 3+/week in the past 12 months. Smoking was coded as 1 for the current smokers (20.2%).

Other demographic characteristics.—Several spousal characteristics were introduced into the model. Spouse retired was defined analogously as for the survey participants.

Table 1. Variables: Definitions and Summary Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Frequency/M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main dependent variable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>Adjusted BMI: (weight in kg)/(height in m$^2$)</td>
<td>28.32 (5.32)</td>
</tr>
<tr>
<td>Main independent variable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>Currently not working and considering themselves as retired</td>
<td>0.399</td>
</tr>
<tr>
<td>Instruments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pension eligible</td>
<td>Eligible for a DB pension benefit, 1-year lag</td>
<td>0.236</td>
</tr>
<tr>
<td>Social Security eligible</td>
<td>Age eligible for the Social Security benefit, 1-year lag, i.e., age 63+</td>
<td>0.331</td>
</tr>
<tr>
<td>Spouse pension eligible</td>
<td>Spouse eligible for a DB pension benefit, 1-year lag</td>
<td>0.144</td>
</tr>
<tr>
<td>Other covariates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health shocks (onset of new serious health problem during the past 2 years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>Heart attack, heart failure, and stroke</td>
<td>0.028</td>
</tr>
<tr>
<td>Severe diabetes</td>
<td>Diabetes with hospitalization, kidney problem, or insulin injection</td>
<td>0.011</td>
</tr>
<tr>
<td>Cancer</td>
<td>Any cancer except skin cancer</td>
<td>0.027</td>
</tr>
<tr>
<td>Lung disease</td>
<td>Lung problem that limits activity</td>
<td>0.013</td>
</tr>
<tr>
<td>ADL limitation</td>
<td>Difficulty in ADL five items</td>
<td>0.045</td>
</tr>
<tr>
<td>Other hospitalization</td>
<td>3+ day hospitalization, excluding experience of health shocks</td>
<td>0.089</td>
</tr>
<tr>
<td>Health behavior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical activity</td>
<td>Vigorous physical activity (sports, heavy housework, or a job that involves physical labor) or exercise 3+/week in the past 12 months</td>
<td>0.495</td>
</tr>
<tr>
<td>Smoking</td>
<td>Currently smoking</td>
<td>0.202</td>
</tr>
<tr>
<td>Demographic characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Current age</td>
<td>60.55 (4.311)</td>
</tr>
<tr>
<td>Female</td>
<td>Sex is female</td>
<td>0.494</td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>Race/ethnicity is non-Hispanic White</td>
<td>0.742</td>
</tr>
<tr>
<td>College education</td>
<td>College graduate or higher level of education</td>
<td>0.338</td>
</tr>
<tr>
<td>High school education</td>
<td>High school graduate, not college, level of education</td>
<td>0.419</td>
</tr>
<tr>
<td>Occupation type—physically demanding</td>
<td>Strength of current and/or previous longest job is medium, heavy, or very heavy</td>
<td>0.494</td>
</tr>
<tr>
<td>Income (/100,000)</td>
<td>Household income ($) minus individual’s divided by 100,000</td>
<td>0.330 (0.867)</td>
</tr>
<tr>
<td>Wealth (/100,000)</td>
<td>Total household wealth by 100,000</td>
<td>3.216 (10.35)</td>
</tr>
<tr>
<td>Spousal factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spouse retired</td>
<td>Spouse’s retired status defined identically as the individual’s</td>
<td>0.236</td>
</tr>
<tr>
<td>Spouse ADL</td>
<td>Spouse has any limitation in ADL</td>
<td>0.064</td>
</tr>
<tr>
<td>Divorced</td>
<td>Divorced or separated during the past 2 years</td>
<td>0.015</td>
</tr>
<tr>
<td>Widowed</td>
<td>Widowed during the past 2 years</td>
<td>0.018</td>
</tr>
<tr>
<td>New marriage</td>
<td>Current length of marriage is 5 or less years</td>
<td>0.026</td>
</tr>
<tr>
<td>Unmarried</td>
<td>Marital status 2 years ago, unmarried</td>
<td>0.274</td>
</tr>
</tbody>
</table>

Note: N = 37,807 (for 10,565 unique individuals), with an exception on occupation type: n = 36,899 (for 10,116 individuals). ADL = activity of daily living; BMI = body mass index; DB = defined benefit.
Spouse ADL limitation was defined as the spouse having any limitation in five basic ADLs. Those who have not been married during the previous 2 years were coded as 0 for these two variables and coded as 1 for the variable indicating “unmarried” status. A new marriage was defined as a marriage within the past 5 years. Divorced and widowed are those events occurring during the previous 2 years.

Income was defined for each wave as household total income minus the individual’s own income. In this way, the income variable captures financial status that is not purely endogenous to the individual’s retirement. For the analyses by wealth level, we used median household wealth at baseline as the cutoff. Household wealth includes equity in primary housing and other nonfinancial assets and financial wealth possessed at each interview. Survey weights were taken into account in calculating the cutoffs.

Age was introduced as a quadratic form. Other time-invariant demographic factors including education and race or ethnicity were also included in the ordinary least squares (OLS) model; in person fixed-effects models, these are captured by fixed effects and are not separately estimated.

Instruments.—Pension eligibility, Social Security benefit eligibility, and spouse’s pension eligibility were used as instruments for retirement. Pension eligibility was defined as the 1-year lagged eligibility of unreduced defined benefit (DB) pension benefit from all previous and current jobs. Spouse pension eligibility was defined analogously. Social Security benefit eligibility was defined as being 63 years or older, which is a proxy of 1-year lagged eligibility for the early Social Security benefit. Workers tend to leave a firm near the age at which they can receive an unreduced pension or are eligible for Medicare and Social Security income (e.g., Burtless & Moffitt, 1984; Lumsdaine & Wise, 1994; Rust & Phelan, 1997). Because the timing of eligibility for full benefits from DB pension plans or Social Security benefit is exogenously determined rather than at the enrollee’s discretion, these variables are likely to be strong predictors of retirement and to be uncorrelated with unobserved factors (e.g., health problems) in the BMI regression. Overall, 24% of the study sample (i.e., number of observations) was pension eligible and 33% was Social Security eligible. Because variations in all the instruments were present in diverse demographic groups defined by working status, job type, age, and gender, the IV estimates using these instruments should be appropriate for each of these subpopulations.

Estimation Methods and Specification Tests

To examine endogeneity of retirement, we estimated the model presented in Equation (1) with several methods and compared them with specification test. The model was initially estimated with OLS; the OLS assumption of no unobserved heterogeneity was rejected in favor of fixed-effects estimates according to a Hausman test (p < .001). Then, we compared estimates from two fixed-effects models: one with and one without IV, based again on Hausman test statistics (Hausman, 1983). All the analyses were conducted using the Stata statistical program (Stata 10; StataCorp, College Station, TX).

To produce a consistent IV estimate, instruments should be highly correlated with retirement to capture the variation in retirement but should be unrelated with error term in the BMI equation. In the fixed-effects IV model, all instruments were strong predictors of retired (overall F statistic = 585; p < .01) at the first stage model and were excluded from the BMI model (i.e., associated with BMI only through “retired”: Lagrange multiplier test statistic = 2.51; p = .11). The fixed-effects IV estimates were significantly different from the fixed-effects (with no IV) estimates as indicated by the Hausman test (p < .01). We conducted the same specification tests for models with subgroups defined by wealth, occupation type, age, and initial BMI level and drew the same conclusions. Therefore, the fixed-effects IV model was preferred for all the regressions.

In Table 2, we present results from all three models—OLS, fixed effects, and fixed-effects IV—for comparison purposes. In all the models, the BMI is defined at the time of the interview and retirement is defined based on changes in working status between the previous interview and current interview. The OLS model uses cross-sectional relationships between variables, whereas fixed-effects (either with or without IV) models consider within-person variation for the estimation. In other words, current (t) BMI is compared with the average BMI of the person over multiple waves to identify the effect of independent variables on BMI. Thus, in fixed-effects models, the coefficients β on an independent variable X can be interpreted as “the association of a change in X (by one unit for continuous variables or from 0 to 1 for dichotomous variables) with the change in the BMI of β.” For further details on fixed-effects models, see Wooldridge (2000).

The fixed-effect IV estimate of retired, which is identified by Social Security benefit and DB pension eligibilities as instruments, is positive and significant (p < .05), but the fixed-effects estimate of retired is not significant. The fixed-effects IV model appears to control for remaining endogeneity (e.g., occurrence of health problems that were associated with weight loss) not addressed by fixed effects only. Coefficients for the health shock variables in both fixed effects and fixed-effects IV models are very similar but are generally opposite to the signs of OLS coefficients; this result indicates that a large proportion of the correlation between health shocks and weight in the OLS is confounded by underlying chronic health conditions associated with the health shocks. Thus, all the results presented and discussed hereafter are based on the fixed-effects IV models.
The Effect of Retirement on BMI

Overall, people gain weight when they retire. The marginal effect of retirement on BMI is 0.242 (Table 2), which is equivalent to a 1.45-pound gain for a person with mean height and weight (5 feet 7 inches, 178 pounds). The average weight gain solely due to retirement is larger than weight change explained by any other dichotomous factor in the regression. However, the effect of aging (measured as a continuous variable) is cumulative and quickly exceeds the effect of retirement within 4 years. The average BMI gain during the 10 years between ages 50 and 60 is 1.23, five times as large as the effect of retirement. The effect of age is quadratic and diminishes as people age, which means people gain weight faster in their 50s than at later ages.

In contrast, the effect of retirement interacts with age. In the analysis by age group (Table 3), the estimate for retired among people 62 years or older (or Social Security benefit eligible; 0.589; p < .01) is more than twice of the effect in the overall sample but is not significant among people younger than 62 years. Taken together, retirement is responsible for weight gain among older but not among younger retirees; for the latter, aging is more responsible for the weight gain than retirement.

Some variables indicating health shocks and changes in marital status are significant determinants of weight loss. Onset of cardiovascular disease decreases weight more than onset of cancer does (−0.471 vs. −0.274, in the BMI, respectively). Onset of severe diabetes and 3+ days hospitalization also lead to weight loss (−0.209 and −0.137 BMI, respectively). In contrast, onset of ADL limitation leads to weight gain (by 0.168 BMI). Participation in regular physical activity and current smoking status were strong predictors of decreased BMI (−0.134 and −0.678, respectively). None of the variables reflecting spouse’s retirement, spouse’s ADL limitation, and new marriage has a significant effect on an individual’s weight. Income is not a significant factor; we examined several different specifications of income and found similar results. To confirm that our estimate on retirement is not confounded by health problems, we analyzed six subgroups defined by onset of any of the five health shocks during
study period. We found that the effect of retirement on BMI in this subgroup was similar to the effect in the overall sample (0.390; p < .05).

We then examined the timing of the effect of retirement by estimating the effect of retirement as an event rather than a state; we recoded retired = 1 only for the first wave of retirement and 0 if currently working or retired in the previous wave or earlier, with an additional variable, lag retired, which indicates staying retired from the previous wave or earlier. We found a similar effect of retirement (0.265; p < .05) and a weaker effect of lag retired (0.144; p < .1; results not in the table). This suggests that the weight gain occurs immediately after retirement.

The Effect of Retirement on the Probability of Being Obese

We explored whether retirement shifts the distribution of weight uniformly or if retirement has a greater effect on weight gain for certain segments of the initial weight distributions. First, we used two models with dichotomous dependent variables, overweight or obese (BMI ≥ 25) and obese (BMI ≥ 30) defined in each wave, and found that retirement does not exhibit a statistically significant effect in either model (results not reported; available from authors by request or linked on journal Web site).

We then examined whether the weight change from retirement depends on the initial weight using subgroups of normal-weight or underweight (BMI < 25), overweight or obese (BMI ≥ 25), and obese (BMI ≥ 30) individuals based on BMI at baseline (Table 3). The BMI gain with retirement among people in the overweight or obese (0.294; p < .05) category was larger than that of the overall sample, whereas retirement does not have a significant effect on weight among people in either normal-weight or obese-only category. Note that in the reported results, we combined underweight and normal weight into one category because the underweight (BMI < 20) fraction of the sample was very small (n = 1,182; 2.8% of the sample); the results for the underweight category and normal-weight category were similar (i.e., no effect of retirement on BMI) when these two groups were analyzed separately.

Role of Wealth and Occupation Type in the BMI Response to Retirement

The effect of retirement is heterogeneous across subgroups defined by wealth and occupation type. Among people at less than median wealth at baseline, being retired is associated with a 0.643 gain in the BMI (p < .01), whereas retirement does not change weight for the wealthier group (Table 4, A and B). By occupation type, retirement increases BMI for people retiring from physically demanding occupations by 0.478 (p < .05); in contrast, retirement does not change weight for people in sedentary occupation (Table 4, C and D).

We further classified the sample into four subgroups defined by both wealth and occupation to examine whether the heterogeneous BMI response to retirement by occupation

<table>
<thead>
<tr>
<th>Table 3. Effect of Retirement on BMI by Age and Initial Weight Level—Fixed-Effects IV Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>51–61 Years</td>
</tr>
<tr>
<td>62–71 Years</td>
</tr>
<tr>
<td>By Age</td>
</tr>
<tr>
<td>Normal or Underweight (&lt;25)</td>
</tr>
<tr>
<td>Overweight or Obese (≥25)</td>
</tr>
<tr>
<td>Obese (≥30)</td>
</tr>
<tr>
<td>By BMI Category</td>
</tr>
</tbody>
</table>

Notes: Standard errors are in parentheses. The same covariates as presented in Table 2 are retained but not reported in this table. BMI = body mass index; IV = instrumental variables.
*Significant at 5%; **Significant at 1%.

<table>
<thead>
<tr>
<th>Table 4. Subgroups by Wealth Level and Occupation Type—Fixed-Effects IV Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, Lower Wealth</td>
</tr>
<tr>
<td>B, Higher Wealth</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Coefficient on retired</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Number of individuals</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Notes: Standard errors are in parentheses. The same covariates as presented in Table 2 are retained but not reported in this table. IV = instrumental variables.
*Significant at 5%; **Significant at 1%.
type is an artifact of the greater economic constraints imposed on people in physically demanding occupation. Among the four occupation/wealth groups, retirement has a significant effect on BMI only among people with physically demanding occupations and lower wealth \( (1.013; p < .01; \text{Table 4, E–H}) \). The magnitude of this effect is more than four times the effect observed in the overall sample and is more than twice the effect observed among people with physically demanding occupations or in the lower wealth group, suggesting an interaction effect of occupation type among people with lower wealth.

**Discussion**

This study addresses a gap in the literature on the causal effect of retirement on weight and finds evidence of weight gain with retirement, which is driven by some subgroups of older adults. By age, retirement leads to weight gain for people retiring in their 60s; retirement decision of people 62 years or older might be influenced by the availability of Social Security retirement benefits. By weight, the weight gain effect of retirement is evident among those who are already overweight or obese, and retirement is not likely to shift people of normal weight into the obese or overweight category. By occupation and wealth, the weight gain effect of retirement is concentrated among people who are retiring from physically demanding occupations or retirees with low wealth status.

The effect of aging is striking; aging over a modest period of time contributes more to weight gain than any other factors in our model. This finding may have significant public health implications because the risk of weight-related health problems increases with age, and the health risk of weight gain is larger among older adults in their 50s and 60s than in any other age groups \( (\text{Eng et al., 2005; Jenkins, 2004; Koh-Banerjee et al., 2004; Lee et al., 2004}) \). Both aging and retirement are inevitable parts of life, so health interventions or education programs targeting older adults should specifically address potential weight gain with aging and its adverse health effects.

Simply put, people gain weight when the calorie consumption from food intake exceeds the energy expenditure from physical activities. The literature is not conclusive on whether decreased physical activity or increased food consumption is the dominant pathway of the weight gain with retirement. Studies on change in physical activity with retirement have inconsistent findings. Some prior studies found decreased physical activity with retirement \( (\text{Chung, Domino, Popkin, & Stearns, 2008; Nooyens et al., 2005}) \), whereas other studies show opposite findings partly due to the limited representativeness of the sample \( (\text{Evenson et al., 2002}) \). On the food consumption side, one study indicates that retirees may reduce the frequency of eating out while maintaining similar level of consumption of food at home \( (\text{Chung, Popkin, Domino, & Stearns, 2007}) \). However, to date, concrete evidence on change in actual calorie consumption with retirement does not exist.

Our study suggests that the efficiency of nonworking hours in producing healthy weight may be lower than working hours, particularly among retirees from physically demanding jobs, and is not better than working hours among retirees from sedentary jobs. This finding is consistent with two previous studies \( (\text{Forman-Hoffman et al., 2008; Nooyens et al., 2005}) \) that reported a greater weight gain with retirement among people with physically active jobs than those with sedentary jobs. Although the physical demands of traditional manual occupations have been reduced with technological advances \( (\text{Lakdawalla & Philipson, 2002}) \), wide variation in physical demands across occupations may still exist.

The potential public health implication of weight gain due to retirement is significant for the subgroup of retirees from physically demanding jobs with low wealth status. The weight gain in this group \( (\text{an increase of 1.06 BMI or 6.9 pounds}) \) implies a substantial potential impact on health risks. Literature suggests that even a small weight gain among older adults is linked with increased risks for type II diabetes and its complications. Extrapolating from Koh-Banerjee and colleagues \( (2004) \), a 1.06-BMI increase would be associated with an increase in diabetes incidence by 24% among men 40–75 years old. It is also notable that the weight gain effect of retirement appears among people who are already overweight or obese before retirement; the health risk of weight gain is higher for obese people than for people with normal weight or underweight \( (\text{Burke et al., 2003}) \).

Our finding of weight gain with retirement among people with lower wealth suggests that the existing disparities in obesity by wealth would be widened as people retire. However, welfare programs providing financial assistance to retirees with lower wealth may not be effective in reducing the disparity. It is because disparities in health behavior by wealth level are not likely due to short-term fluctuations in income. Although income may be associated with individual’s weight, we found that within-individual variations in income do not change individual’s weight. In the long run, the role of wealth might be mediated by multiple environmental factors favoring healthy behavior such as physical activities and a healthy diet. Pathways through which wealth affects the health behavior of retirees merit further investigation to better inform policies to reduce the disparity in obesity.

Several limitations of our study warrant discussion. First, BMI does not distinguish fat mass from lean mass. Therefore, the impact of retirement on obesity \( (\text{based on fat percentage}) \) could be larger than the estimated impact \( (\text{based on BMI}) \) if people tend to gain more fat than muscle after retirement. This relationship is particularly relevant for retirees from physically demanding occupations whose muscle mass might have been replaced with lighter fat mass. Second, occupation type is potentially endogenous to weight because people who are overweight may opt out of physically demanding occupations \( (\text{Lakdawalla & Philipson, }} \)
2007). Although this concern is particularly relevant to studies looking on the effect of occupation choice on weight, our focus is to estimate the effect of “retirement” on weight by occupation type among people in their 50s and 60s whose occupation type is fairly stable. The use of fixed effects should offset this risk as well. Third, we did not examine the underlying pathways of weight gain with retirement, which could be explored with more detailed data sets in future studies.

In conclusion, given the increasing number of people approaching retirement age, the impact of the weight gain ascribed to retirement on health outcomes and the health care system at a population level is expected to be considerable. Thus, Social Security policy changes to encourage later retirement may have positive spillover effects on Medicare. However, the effect of retirement on weight is not universal. The potential exacerbation of health disparity with retirement should be addressed in health and Social Security policy because the adverse health consequence of retirement on weight seems to exist most strongly among low-income or obese people who are most vulnerable to adverse economic consequences of retirement.

Acknowledgments

We thank Frank Sloan for his valuable comments on the earlier versions of this article. We also appreciate comments from Barry Popkin, Peggy Dilworth-Anderson, and seminar participants at the Triangle Health Economics Workshop. S.C. planned the study, conducted data analysis, and wrote the paper. M.E.D. and S.C.S. helped plan the study, interpret the results, and revise the manuscript.

Correspondence

Address correspondence to Sukyung Chung, PhD, Philip R. Lee Institute for Health Policy Studies, University of California, San Francisco, 795 El Camino Real, Palo Alto, CA 94301. Email: sukyung.chung@ucsf.edu

References


Handbook of labor economics (pp. 3261–3308). Amsterdam: North Holland.


