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Dhaval Dave

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ABSTRACT

We examine the first-order internal effects of unemployment on a range of health behaviors during the most recent recession using longitudinal data from the Panel Study of Income Dynamics (PSID) and the National Longitudinal Survey of Youth 1979 (NLSY79). Consistent with prior studies based on cross-sectional data, we find that becoming unemployed is associated with a small increase in leisure-time exercise and in body weight, a moderate decrease in smoking, and a substantial decline in total physical activity. We also find that unemployment is associated with a decline in purchases of fast food. Together, these results imply that both energy consumption and expenditure decline in the U.S. during recessions, the net result being a slight increase in body weight. There is generally considerable heterogeneity in these effects across specific health behaviors, across the intensive and extensive margins, across the outcome distribution, and across gender.

Gregory Colman
Pace University
Department of Economics
41 Park Row, 11th Floor
New York, NY 10038
and NBER
gcolman@pace.edu

Dhaval Dave
Bentley University
Department of Economics
175 Forest Street, AAC 195
Waltham, MA 02452-4705
and NBER
ddave@bentley.edu

I. Introduction

Unemployment often imposes a heavy financial burden on households, but whether it also imposes a health cost is much debated (Jin, Shah, & Svoboda, 1995; Ruhm, 2000; Stevens, Miller, Page, & Filipski, 2011). Some health effects are direct and uncontroversial, such as an increase in psychological stress and stress-related illnesses, while others are indirect and more complex. In particular, some researchers find that unemployment causes persons to behave more healthily: they smoke and drink less, and exercise and sleep more, changes that if maintained would improve health (Ruhm, 2003, 2005). Others have found that unemployment does not improve health behaviors or even makes them worse (Böckerman et al., 2007; Charles & DeCicca, 2008; Colman & Dave, 2013; Dave & Kelly, 2012). The studies mentioned above consider the effect of the macroeconomy on health behaviors. A separate and older literature has looked at the effects on health and health behaviors of a person's own employment status. These studies, however, have generally focused on narrow samples of workers (i.e. construction workers, as in Leino-Arjas, Liira, Mutanen, Malmivaara, and Matikainen, 1999), or they have focused simply on correlations without attempting to infer causal effects, or sought causal effects but lacked plausibly exogenous shocks to employment. In this study we use two nationally-representative longitudinal surveys, the Panel Study of Income Dynamics (PSID) and the National Longitudinal Survey of Youth 1979 (NLSY79), to examine whether a large exogenous shock to employment—the Great Recession from 2007 to 2009—affected cigarette smoking, obesity, recreational exercise, total physical activity, routine medical visits, and several measures of dietary behavior.

We address several key gaps in the literature and make a number of contributions. To begin with, ours is the first study, as far as we know, that analyzes the effect of unemployment

on energy intake, energy expenditure, and the net effect (BMI) among a given sample of persons over time, that is, using longitudinal data. This is especially valuable in studying BMI. Prior research on the effects of unemployment on BMI has either found no or small effects of unemployment. This may reflect that the true effect, if it exists, is simply too small to measure given the errors in measuring height, weight, and employment status in a sufficiently large population-based sample. Therefore there is value in determining the effect by joining a combination of related outcomes. By analyzing both energy intake and expenditure we can assess if they appear to balance, and thus support a null BMI effect, or if they both imply that BMI should increase or decrease. In any case, analyzing both energy intake and outflow for the same persons over time can place the BMI results in context.

Second, unlike other longitudinal studies of health behaviors and unemployment (e.g. Ásgeirsdóttir, Corman, Noonan, Ólafsdóttir, & Reichman, 2014; Falba, Teng, Sindelar, & Gallo, 2005; Leino-Arjas et al., 1999; Morris & Cook, 1991; Novo, Hammarström, & Janlert, 2000), our data sets span two recessions for most of our outcomes, and envelopes the recent recession for all of them (Ásgeirsdóttir et al., 2014).[1] All studies seeking the causal effect of unemployment rely on exogenous increases or decreases in unemployment. Job loss is much more likely to be exogenous in a recession, especially one as deep as the most recent one. Also, job loss in a booming economy is less likely to identify the effects of unemployment than in a prolonged recession. Recent job losers will change their behavior little if they expect soon to be re-employed, whereas if they expect joblessness to last, they will adjust to a possibly prolonged decline in income and increase in non-working time. In addition, compared with prior

[1] Ásgeirsdóttir et al. (2014) study the effects of the Icelandic financial crisis on health behaviors, based on two waves pre- and post-crisis.

longitudinal studies, our data contain multiple observations on each participant over a much longer time span, from 1999 to 2009 in the PSID, and from 1998 to 2010 in the NLSY79.

Finally, a number of the outcomes we study have been analyzed previously using only cross-sectional data (e.g. Pharr, Moonie, and Bungum (2011)), essentially comparing the health behaviors of employed and unemployed persons. Of course, such comparisons cannot reveal unemployment's causal effect because of the many unobserved differences between the two groups, many of which can be controlled for in longitudinal analysis. Some studies have sidestepped the endogeneity of employment status by looking only at unemployed persons who lost their jobs because their companies closed down (Deb, Gallo, Ayyagari, Fletcher, & Sindelar, 2011; Salm, 2009). Nonetheless, certain questions can only be addressed with longitudinal data. For example, prior cross-sectional studies have found that an increase in unemployment is associated with an increase in light physical activity, though not with an increase in vigorous physical activity (e.g Ruhm, 2005). These studies have tended to interpret this result as showing that formerly inactive persons have become moderately active. However, perhaps the higher unemployment rate has caused vigorous exercisers to become light exercisers. There is no way to distinguish these possibilities using cross sectional data. With our long-span longitudinal data, we can parse out the effects for persons who are initially sedentary or active prior to any shift in their employment status. Similarly, if recessions reduce smoking, cross-sectional data cannot reveal whether the change reflects light smokers quitting or heavy smokers cutting back. We are also able to differentiate the effects of short-term versus long-term unemployment, which may elicit heterogeneous responses across various health behaviors. Another issue, which cannot be studied with cross-sectional data and that has subsequently been bypassed in the literature, relates to potential compositional selection bias arising from inter-state migration that is

correlated with job prospects and health. With longitudinal information, we can assess the sensitivity of the estimates to controlling for this selective migration.

II. Literature Review

Prior studies on the effect of unemployment on health and health behaviors fall into two groups (Burgard, Ailshire, & Kalousova, 2013; Colman & Dave, 2013). The first looks at the effect of a person's own employment status, the second, on the effect of the unemployment rate or employment-to-population ratio in a person's area of residence. The effects found in the two groups of studies need not be similar, as a rise in the local unemployment rate may affect a person's behavior even if she herself remains employed. It may reduce demand for her product, causing her to work fewer hours, or lead her spouse to become unemployed, affecting the distribution of activities within the household (Colman & Dave, 2013). It may also cause her to work harder in fear that her own job is in jeopardy. The effects of the local economy may be termed the "external" effects of unemployment on health behavior. Naturally a higher local unemployment rate may cause someone to lose her own job, which in turn will affect her health behaviors, changes that may be termed the "internal" effects of unemployment. A change in the local employment situation may affect households through both internal and external channels.

A number of recent studies have focused on the effect of local-area employment conditions, with divergent results for most outcomes. Ruhm (2005) finds that obesity decreases during recessions. Other studies find the reverse (for instance, Böckerman et al., 2007; Charles & DeCicca, 2008; Latif, 2014), at least among certain segments of the population, and still others find no effect (Nicholson & Simon, 2010). Most studies (Ruhm, 2005; Xu, 2013) find that an increase area employment reduces the proportion of persons who exercise regularly. The results with respect to smoking are less consistent. Ruhm (2005) and (Xu, 2013) find that increased

local-area employment increases smoking participation, while Charles and DeCicca (2008) find that, among those least likely to be employed, smoking declines. Studies using European data tend to find that a rise in local-area unemployment raises the probability of smoking and the amount smoked (Öhlander, Vikström, Lindström, & Sundquist, 2006), though a study of the recent Icelandic financial crisis finds a decrease in smoking (Ásgeirsdóttir et al., 2014). As noted by Böckerman et al. (2007) and others, one reason results may differ between the U.S. and other high-income countries is the more generous unemployment insurance available in those countries, blunting the income effect of unemployment. Another reason is that the effect of the recent crisis on the exchange rate, and hence on the price of food and tobacco, was much greater outside the U.S., for example, in Iceland (Ásgeirsdóttir et al., 2014).

A distinct, older, and longer strand of the literature considers the effect of a person's own unemployment on health behaviors and obesity. Most studies find that unemployment raises BMI (Leino-Arjas et al., 1999; Marcus, 2014; Virtanen et al., 2008) though some find no statistically significant effect (Montgomery, Cook, Bartley, & Wadsworth, 1998); others find that reduced (but still positive) hours of work lower BMI (Berniell, 2012; Courtemanche, 2009). As in the studies using macro-level unemployment, in general own unemployment is associated with a higher likelihood of exercise (Berniell, 2012; Leino-Arjas et al., 1999). In contrast to macro-level studies, however, own unemployment is associated with a higher probability of smoking (Bolton & Rodriguez, 2009; De Vogli & Santinello, 2005; Henkel, 2011; Marcus, 2014; Novo et al., 2000) and of relapse (Falba et al., 2005).

We address several gaps and contribute to the literature along multiple dimensions. First, we provide the first longitudinal evidence on the effects of unemployment on energy intake, energy expenditure, and the net effect on BMI. Given the prior conflicting evidence on how

unemployment impacts BMI, examining behavioral pathways that affect bodyweight for the same set of individuals over time is important towards assessing the plausibility of the BMI effects. Second, in contrast to other, albeit limited set of longitudinal studies of unemployment and health behaviors, our data sets span a much longer time period, spanning two recessions for most of our outcomes and enveloping the recent Great Recession for all of them. The severity of the Great Recession, in particular, provides an excellent opportunity to study behavioral impacts. Job losers are more likely to adjust to an extended decline in income and increase in non-work time, and hence change their behaviors, if they expect joblessness to last. Third, a number of the important outcomes we study have been analyzed previously using only cross-sectional data, essentially through comparisons of employed and unemployed persons, which limit a causal interpretation and also limit a more deeper assessment of the composition of the effects (that is, if recessions reduce smoking, cross-sectional data cannot reveal whether the change reflects light smokers quitting or heavy smokers cutting back; effects of long-term vs. short-term job-loss). In summary, we provide the most comprehensive analysis to date of how unemployment affects health behaviors, exploiting longitudinal relationships and the large adverse shocks to labor demand over the recent Great Recession.

III. Analytical Framework

The question of how unemployment affects individuals' health behaviors can be framed within a human capital model for the demand for health.[2] Individuals are assumed to maximize utility, which is a function of their health and other broad commodities. Health behaviors can indirectly affect utility through their effects on health, and may also directly affect utility as the individual may find certain behaviors (for instance, smoking, fast food consumption, or

[2] See Colman and Dave (2013) and Dave and Kelly (2012) for versions of this framework extended to specifically study exercise and eating habits.

recreational exercise) inherently pleasurable or distasteful. Maximization occurs subject to a set of constraints including a health production function, by which individuals produce health investments by combining the various market and time inputs constituting the health behaviors; a similar production function for other broad commodities; and constraints imposed by household income and time endowments. Investments in health reduce time lost to illness and therefore raise the total available time for other pursuits including work; this is the investment return to health.

Unemployment may affect individuals' health behaviors in this framework through associated shifts in time and income constraints. These mechanisms affect both health-promoting as well as health-depreciating behaviors. The decrease in labor supply due to unemployment, and the subsequent easing of time-endowment constraints, is predicted to increase behaviors which are relatively more intensive in time inputs, for instance activities such as recreational exercise. Reduced household income due to job-loss may also raise the demand for health behaviors which are inferior, such as smoking or fast food consumption, although constrained budgets may also lead some smokers to reduce their cigarette consumption or quit smoking altogether. Furthermore, lower household income may also lead to a substitution away from health behaviors which are relatively more intensive in market inputs such as consuming food outside the home. Increased stress or depression associated with job-loss (Classen & Dunn, 2012; Mandal, Ayyagari, & Gallo, 2011) may lead to a greater demand for health-depreciating behaviors such as smoking or fast-food consumption, consistent with a "self-medication" hypothesis (Dave & Kelly, 2012; Dave & Saffer, 2008). In addition, loss of healthcare coverage associated with unemployment is predicted to have counteracting effects on health behaviors. On the one hand, reduced contact with medical care professionals may increase (decrease)

participation in unhealthy (healthy) behaviors, though on the other hand, becoming uninsured may also induce individuals to engage more in health-promoting behaviors in the context of an ex-ante moral hazard effect (Dave & Kaestner, 2009) .

These mechanisms primarily capture the internal effects of unemployment, that is, effects which are realized through the individual's own job-loss.[3] The upshot of this discussion is that the net effects of unemployment on health behaviors are a priori indeterminate. Furthermore, we expect that the effects would be heterogeneous across specific behaviors, partly due to the various mechanisms at play, and partly due to the differences in the relative strength of the shifts in time and income constraints interacting with differences in the relative intensity of time versus market-based inputs across different behaviors.

III. Methods

The objective of this study is to assess whether, and to what degree, job-loss has a causal effect on health behaviors. To that purpose, we estimate the following model for the i^{th} person observed at time t:

$$y_{it} = X_{it}\beta + Z_i\theta + \gamma_t + \delta U_{it} + u_{it} \quad (1)$$

where X_{it} is a vector of individual characteristics or behaviors that vary over time, Z_i is a vector of individual characteristics that do not vary over time, γ_t is the period effect, U_{it} is an indicator that reflects the respondent's employment status, and u_{it} includes all time-varying unobserved influences on the outcome.

The time varying controls, X_{it}, include the respondent's age, marital status, state or region of residence, month of interview, and, in some specifications, lagged self-reported health

[3] To the extent that the individual's job-loss is induced by, and thus also reflective of, the general economic downturn over our analysis period, secondary external effects from the business cycle may also be at play. For instance, expectations of prolonged job-loss due to the severity of the recent recession may lead to potentially stronger shifts in health behaviors, as would any intra-household allocation of resources due to any individual member's job-loss.

status. The observable time-invariant controls, Z_i, include gender, highest grade completed, race, and ethnicity. In alternate specifications, we further include person-specific fixed effects, which account for all unobserved time-invariant factors that differ across individuals, for instance life-cycle investments, family background, ability and aptitude, risk tolerance, and time preference.

We restrict the PSID sample to persons between the ages of 25 and 55, ages with the highest labor force participation rates and therefore least likely to suffer from selection bias due to unobserved factors affecting selection into the labor force instead of schooling and selection out of the labor force due to retirement. The NLSY79 sample is by its nature restricted to persons between the ages of 46 and 53 in 2010.

We use a number of alternate indicators of unemployment. The first simply equals one if the respondent is unemployed. Of the different measures of unemployment, this variable is most vulnerable to producing biased estimates. A person's unemployment status may be correlated with a number of time-varying unobserved factors that may also influence his health behaviors. For example, perhaps a person's health may decline and induce him to look for a different job closer to home, and also to become less physically active, which is one of our outcomes of interest.

Therefore we construct several other indicators of unemployment that are arguably less likely to be correlated with the respondent's unobserved characteristics. One is an indicator that equals one if the respondent was unemployed due to being laid off, that is, let go because there was insufficient demand for the company's product or service or for some other reason that was not the employee's fault. The NLSY79 distinguishes between respondents who were laid off and those who were fired. The PSID groups both together. Ideally we would exclude persons who were fired, but since many more persons are laid off than fired, particularly in the current

recession, grouping them together should not severely bias the results. Being laid off is probably not entirely exogenous to a worker's characteristics. When they must lay off workers, companies are likely first to release the least able. However, ability is constant from one wave of the survey to the next, and hence would be removed by person fixed-effects.

Finally, we define an indicator that equals one if the respondent is unemployed because his firm went out of business. This variable has been used by, among others, Salm (2009) and Deb et al. (2011) to look at the effect of unemployment on health and certain health behaviors. This indicator of unemployment is the one most plausibly exogenous to health behaviors since relatively few respondents can have been the cause of their companies going out of business. Thus the coefficient on this variable is arguably consistent, even without adding person fixed-effects.

In addition, for the NLSY only, we estimate models with different indicators of long-term unemployment. These indicators equal one if the respondent has been unemployed for 13, 26, and 52 weeks, respectively. The effect of long- versus short-term unemployment is likely to matter for some outcomes more than others. For example, a person's weight is unlikely to change the very week he becomes unemployed. If unemployment does affect body weight, its effect is likely to become apparent only for persons who have been unemployed for some time. Other behavioral outcomes, however, such as going out to dinner, may respond immediately to the loss of income following the start of unemployment.

The parameter of interest is δ, which captures the reduced-form effect of unemployment on health behaviors operating through any and all competing and reinforcing channels. We first estimate equation (1) using a random-effects specification as a baseline, which assumes that Z_i is uncorrelated with u_{it}. We test this assumption using a test of overidentifying restrictions

(Wooldridge, 2010). The null hypothesis is that the between-effects estimates of the coefficients are statistically indistinguishable from the fixed-effects estimates, implying that Z_i are uncorrelated with u_{it}. Since the null hypothesis of this test is commonly rejected as unobserved person-specific factors are likely to be correlated with the error term, we next estimate equation (1) using person fixed-effects. This will produce consistent estimates of δ under the somewhat weaker assumption that U_{it} is uncorrelated with u_{it}, or, less formally, if a person's labor force status is unrelated to unobserved characteristics that change over time. One such confounding variable is health, which may change how much physical activity a person engages in as well as his labor force status. To control for this possibility, in alternative models we include lagged measures of the respondent's health. Further, to control for possible income effects, we include in some models measures of the per capita income in the county of the respondent's residence. We restrict the analysis to respondents whose data are in at least two waves.[4] Standard errors are adjusted for arbitrary correlation in the error term for a given person over time.

IV. Data

Panel Study of Income Dynamics (PSID)

The Panel Study of Income Dynamics began in 1968 as a nationally-representative survey of about 4,800 families. It was conducted partly by the Census Bureau and partly by the Survey Research Center (SRC) at the University of Michigan. Since then, the SRC has re-interviewed the original participants as well as their offspring when they form their own families, or, in PSID terminology, "family units". Re-interviews have been conducted every year through

[4] STATA does not automatically do this when calculating fixed-effects coefficients. If one of the respondents contributes only one year of data, converting that row to mean-difference form will produce a row of zeros. Similarly, if a respondent has only two waves of data and his dependent and independent variables actually do not change from one wave to the next, this will also create a row of zeros in mean-difference form. We view the second example a legitimate row of zeros and a valid comparison group, whereas the first is not, and so we drop persons with only one wave of data.

1997 and biennially since then. Response rates were above 95 percent until 1993 and have been in the low 90s afterwards. As of 2009, the PSID includes about 9,000 families and 24,000 persons.

In each interview, one person answers all the questions for everyone in the family unit. Usually, the respondent is the family unit "head", the male in the family unit who is most responsible for its financial decisions. His female domestic partner, if he has one, is designated the "wife", whether or not they are married. All the data in this study refer to the head or wife of the family unit. Also, we consider data only from 1999 through 2009, because many of the health-related variables are available continuously only during that period and because this time span includes the two most recent recessions.

The PSID reports height and weight in each wave. From these, we compute the respondent's body-mass index (BMI) according to the standard formula.[5] In addition to its effect on mean BMI, we would like to assess the effect of unemployment on the distribution of BMI. Therefore we create three dummy variables indicating "normal weight" (BMI between 18.5 and 25), "overweight" (BMI 25 and over but less than 30), and "obese" (BMI of 30 and above). Some prior research, based on cross-sectional evidence, has found that not only does BMI decline during recessions, but that it declines mainly among the overweight and obese (Ruhm 2005). We exploit the longitudinal information in our datasets and directly test this by estimating the effect of unemployment on obesity only among persons who were overweight or obese during the first wave in which they appeared in the sample. The disadvantage is that it creates a sample based on the dependent variable, which can lead to biased estimates if the selection depends on unobserved characteristics. Since many unobserved differences are removed by

[5] BMI is computed as: (weight in kilograms)/(height in meters)^2. We exclude observations with calculated BMI below 15 and above 70 to avoid possible recording errors.

fixed-effects methods, however, we expect to find, if bias is a problem, that fixed-effects and random-effects models differ significantly, and in which case the fixed-effects estimates would be more credible.

Since 1999, the PSID has asked questions on how often the respondent engages in light, vigorous, or strength-building physical activity in his or her leisure time. The questions are, respectively, "How often do you do light or moderate activities for at least 10 minutes that cause only light sweating or slight to moderate increases in breathing or heart rate?"; "How often do you do vigorous physical activities for at least 10 minutes that cause heavy sweating or large increases in breathing or heart rate?"; and "How often do you do physical activities specifically designed to strengthen your muscles such as lifting weights?". From the responses to these questions, we construct measures for the number of times per week that the respondent engaged in the specified type of activity.[6] Note that these variables refer to habitual physical activity rather than physical activity in the past week, in contrast to the unemployment indicator, which refers to the week of the interview.

Continuously since 1999, the PSID has asked participants about cigarette use. We construct three measures based on the responses, an indicator for whether the respondent is a current smoker, a continuous measure of the number of cigarettes smoked daily among smokers, and another continuous measure of the number of cigarettes smoked daily among those who smoked a pack or more of cigarettes per day in their *first wave* of the PSID since 1999, whom we term "heavy smokers at entry". We define this latter measure in order to explore whether unemployment has a larger effect on smoking among initially heavy smokers than among average smokers.

[6] We set to missing the few observations whose reported values are greater than seven.

National Longitudinal Survey of Youth – 1979 Cohort (NLSY79)

The NLSY79 is a nationally representative sample of 12,686 young men and women who were 14-22 years old when they were first surveyed in 1979. Due to deaths, attrition, and the dropping of two subsamples, the total number of eligible respondents dropped to approximately 8,400 in 1998 and 7,700 in 2010. Participants were interviewed annually from 1979 to 1994, and have been interviewed biennially since then.

Since 2006, the NLSY has not asked respondents their labor force status during the week prior to the interview. Therefore, we use the information from the weekly labor force status variables, which are based on retrospective information on the start and stop dates of the respondents' jobs and their activities while not working. For those unemployed, the NLSY asks the reason that the respondent left his previous job. The responses include "fired", "laid off", and "plant closed", among others. We create an indicator that equals one if the respondent was unemployed and was laid off from their previous job, and another that equals one if the respondent was unemployed and his prior employer had gone out of business.

The NLSY asks questions on physical activity that are quite similar to those in the PSID, which in turn are similar to those asked in the NHIS. The questions are, "How often do you do vigorous activities for at least 10 minutes that cause heavy sweating or large increases in breathing or heart rate?"; "How often do you do light or moderate activities for at least 10 minutes that cause only light sweating or slight to moderate increase in breathing or heart rate?"; and "How often do you do physical activities specifically designed to strengthen your muscles such as lifting weights or doing calisthenics?". The key difference between the first two variables and those in the PSID is that the NLSY does not restrict the reference to leisure-time activities. That is, the questions on moderate and on vigorous activities refer to both work-related and

leisure-time physical activity, whereas those in the PSID are only in reference to leisure-time activity. Given the substitution between work-related physical activity and leisure-time physical activity associated with job-loss (Colman & Dave, 2013; Saffer, Dave, & Grossman, 2013), we expect the effects of unemployment to differ on both of these sets of physical activity measures from the PSID and the NLSY79. The NLSY also asks how many minutes the respondent spent in each activity. We create variables measuring the number of minutes per week that the respondent engaged in vigorous, and in light or moderate activities.[7] The variable relating to strength-building activity does refer to leisure time. Thus we expect to find that unemployment has a similar effect on this measure as it does on the physical activity measures in the PSID.

The NLSY collects information on weight in every round but on height only in 1981, 1982, 1985, and 2006 onwards. For the years 1998 through 2004 we use the average of the heights reported in 1985 and 2006. We calculate BMI as in the PSID.[8]

Since 2002 the NLSY has asked each respondent, "About how long has it been since your last general physical exam or routine checkup by a medical doctor or other health professional? Do not include a visit about a specific problem." We create a dummy that equals one if the respondent has not had a physical for over a year, as an indicator of routine, preventive healthcare utilization.

For 2008 and 2010, questions have been asked about diet. Specifically, the NLSY asks: "In the past seven days, how many times did you eat food from a fast food restaurant such as McDonalds, Kentucky Fried Chicken, Pizza Hut, or Taco Bell?" Parallel questions are asked about the frequency of snacks, skipping meals, and consuming a soft drink. We create

[7] We set to missing the few values above 3360 minutes (8 hours times 60 minutes times 7 days a week).
[8] In alternate specifications, we adjust reported BMI for potential measurement and reporting errors based on objectively-measured BMI from the National Health and Nutrition Examination Surveys, as described in Cawley (2004). Reported estimates below are not sensitive to this correction.

continuous measures of the number of times per week that the respondent engages in each of these activities.

For both the PSID and the NLSY we construct and control for indicators for educational attainment (less than high school, high school graduate, some college, college or more), race and ethnicity (non-Hispanic white, non-Hispanic black, non-Hispanic other, and Hispanic), marital status (never married, married, divorced, separated, widowed), region or state of residence, and month (to capture seasonal effects on health behaviors). Age is left as a continuous variable.[9]

V. Results

PSID Estimates

Tables 1 and 2 report means for the PSID sample. Our central results for the PSID are evident in these tables. Among PSID participants, the unemployment rate rose by two percentage points from 1999 to 2003, and by 4 percentage points from 2007 to 2009, yet in neither span of time did leisure-time exercise rise significantly. In fact, the trend in exercise was downward throughout the period. Similarly, neither BMI nor the percent obese changed appreciably during recessionary periods, or to put it differently, the strength or weakness of the economy had no effect on the upward trend in both indicators of body weight. The number of cigarettes smoked among smokers, however, declined in both recessionary periods, while the share of the sample that smoked trended downward throughout the sample period.

[9] All means and regressions are unweighted. In regression analysis weights are unnecessary when they are functions of exogenous variables included in the models. The original PSID oversampled low-income families. We cannot include income as a covariate because it depends on employment status, our key covariate. Instead, we control for the factors that have been found to be correlated with income, such as age, education, ethnicity, experience, and marital status. The NLSY originally included oversamples of persons with low incomes and also persons serving in the military, but these subsamples were dropped in waves prior to those we use in this study. In any case, the variables used to construct weights, with the exception of sample attrition, are constant over time, and thus fall out of our fixed-effects models. For completeness, we compared the coefficients from weighted and unweighted fixed-effects models, and found no statistically significant differences. Similarly, the weighted and unweighted coefficients from the maximum likelihood random effects models did not differ significantly.

Before turning to the regression results we first consider the exogeneity of the different reasons for unemployment. Some information on this is given in Tables 2 and 5. Ideally, to find the effect of unemployment on behavior, workers would be out of work completely randomly. If the world worked this way, the characteristics of the unemployed, laid off, and those who have lost their job due to a plant closing would be the same, within sampling error. But as Table 2 suggests, this is not so. All three categories of the unemployed contain more persons of color, high school dropouts, obese, unmarried, and heavy smokers than the population in general. Thus even though a plant-closing is exogenous with respect to the worker, it does not happen to a random subsample of the population. Hence plant closings alone will likely not identify the average treatment effect of unemployment on behavior. This highlights the importance of using fixed-effects to control for the many unmeasurable differences between the employed and unemployed, at least differences that are constant over time. Table 5 also shows that during the current recession, the unemployed became more similar to the general population of workers. That is, relative to those who are generally unemployed or laid off or affected by a plant closing in 2005, those in similar categories in 2009 are less likely to be persons of color, high school dropouts, obese, unmarried, and heavy smokers. This highlights the benefits of data that cover recessions when the goal is to learn the effect of unemployment.

Models based on the PSID are presented in Tables 6 (for females) and 7 (for males). The PSID regressions, shown in Table 6, confirm the correlations evident in the means. We estimate separate models for men and women because recessions generally, and the current recession especially, reflect greater contractions in industries, such as construction and durable manufacturing, in which men constitute a larger share of workers. Most likely for this reason, unemployment generally has a larger effect among men than women.

Among women, becoming unemployed generally raises the probability of smoking, by about 3 to 4 percentage points in the random-effects models, and about 2 percentage points in the fixed-effects models for being laid-off. The stronger random-effects results probably reflect the higher share of smokers among the unemployed, rather than a causal effect. Since few persons start to smoke after age 25, which is the minimum age in our sample, the 2 percentage point change in the fixed-effects model reflects relapse and/or a reduction in the likelihood of quitting smoking due to the stress of unemployment. There is some suggestive evidence, based on women who lost their jobs due to their firm closing, that cigarette consumption among those who were heavy smokers at baseline may have declined, which may directly income constraints as well as potential intra-household reallocation of resources from reduced household income.[10] We do not find consistent or significant effects on other health behaviors.

Among men, becoming unemployed has no consistent effect on vigorous leisure time exercise. This is not surprising since those who exercise vigorously when employed are committed to exercise, and will likely continue to exercise when unemployed. In fact, becoming unemployed may reduce vigorous exercise, since such exercisers may be more likely than others to pay for membership at a gym or health club, which becomes less affordable after a job loss. In contrast, unemployment slightly increases the amount of light exercise, with the effect consistent across reasons for unemployment, though the effect is significant only for "Laid off".

Becoming unemployed is associated with a consistent but only marginally significant increase in the BMI of men who were obese at baseline. This contrasts with Ruhm (2005), but accords with Charles and DeCicca (2008), Nicholson and Simon (2010), and Böckerman et al. (2007). We discuss the effects on obesity further on when we discuss the results from the NLSY.

[10] Reduced smoking at the intensive margin, among prior heavy smokers, may also reflect increased uncertainty regarding finding another job and a subsequent downward revision of expected future income.

The largest effects in the table pertain to cigarettes smoked among smokers. Unemployment reduces the number of cigarettes smoked among smokers by 5 to 10 percent among males, though the effect is significant only at the 10 percent level. The effect is twice as large and consistently significant among those who were heavy smokers in the first wave. Similar to the effect for women, this is likely an income effect associated with job-loss, since many workplaces restrict smoking on premises, so being at home rather than at a workplace would tend to increase the amount smoked. In addition, heavy smokers tend to earn less than other smokers, and hence would respond more to job loss.

NLSY79 Estimates

As with the PSID data, the means of the NLSY sample, shown in Tables 3 and 4, prefigure our regression results. The frequency of strength-building exercise, the only measure of exercise in the NLSY that specifically refers to leisure-time activity, is unchanged over the sample period. Total moderate or heavy physical activity, however, drops substantially from 2006 to 2010. Purchases of fast food, soft drinks, consumption of snacks, and the number of skipped meals decline, but since we have only two years of data on these variables, not much can be learned just from the means.

The regression results from the NLSY, in Tables 7 and 8, show no significant or consistent effect of unemployment on women's total physical activity, including both work- and leisure-time, which is expected, since in general their jobs are not as physically demanding as men's. In contrast, men's total physical activity declines substantially. Vigorous activity declines by about 2 hours per week, and moderate activity, by about an hour to an hour and a half. This is

consistent with the large decline in jobs in construction and manufacturing, which tend to be physically demanding (Colman & Dave, 2013).

These results reflect that women are much less likely to have a physically demanding job than men. Unemployment has a similar effect on strength-building activities in the NLSY as it does on the leisure-time activities in the PSID, that is, none. Note that strength-building is solely a leisure-time activity in both the NLSY and the PSID. The effect, however, on total physical activity, moderate or heavy, which includes both leisure- and work-related exertion, is quite pronounced. Unemployment reduces moderate or vigorous physical activity by roughly an hour to an hour and a half per week. This accords with the findings of Colman and Dave (2013) , which used the American Time Use Survey (ATUS). While job-loss reduces time constraints, the freed-up time is generally allocated towards more sedentary activities; hence, the loss of physical activity from work for those which physically-demanding jobs is not compensated from the increase in these other activities, causing total physical activity to decline.

Unemployment reduces the number of fast-food meals respondents eat by about half a meal per week, which is significant across most models and reasons for unemployment. One question is whether this reflects mainly the effect of unemployment on time available or on income. We attempt to parse the income effect using three measures of income, all adjusted for inflation: the respondent's own family income, the per capita income in the respondent's county residence, and the per capita transfers in the respondent's county of residence. The latter two measures, from the Bureau of Economic Analysis, were chosen because they are likely correlated with the respondent's own income but arguably not with his or her unmeasured characteristics that affect fast-food consumption. The inclusion of income as an additional independent variable had no effect on the coefficient on unemployment, regardless of the

measure of income used. Thus we tentatively infer that the reduced consumption of fast-foods reflects the greater availability of time for cooking rather than less income available to purchase the fast-food. This is supported by data from the American Time Use Survey (ATUS), which show that the time spent on meal preparation is positively correlated with the unemployment rate in respondents' states. In other words, "fast food" is what its name implies, fast, which is important to workers with little spare time, but it is not actually cheap compared with cooking at home, a point made in an editorial by a food columnist for the New York Times.[11] Some confirmation of this point is available from the Bureau of Economic Analysis, which reports that inflation-adjusted sales of fast-food restaurants fell slightly from 2008 to 2010, though the decline was much less than that of full-service restaurants. Over the same period, real sales of food consumed at home rose. These changes are consistent with a shift among consumers towards preparing more meals at home.

The estimates in Table 10 and 11 (for females and males, respectively) consider differential effects based on the duration of unemployment. In addition to actual job-loss, health behaviors may also respond to expectations about the duration of job-loss and prospects of finding other work. There may be little behavioral effects if job-losers expect soon to be re-employed, whereas if they expect joblessness to last, they will adjust to a possibly prolonged decline in income and increase in non-working time. Thus, the channels discussed above are expected to become more pronounced with the duration of unemployment.

For both males and females, there is some evidence of stronger negative effects on moderate daily physical activity as well as fast-food consumption with longer unemployment. The results do not show any consistently stronger effects on BMI with prolonged job-loss,

[11] Mark Bittman (see http://www.nytimes.com/2011/09/25/opinion/sunday/is-junk-food-really-cheaper.html?pagewanted=all)

however, which suggests that the null to weak BMI effects are driven by the counteracting effects of reduced physical activity associated with reduced caloric intake. The results also indicate that being unemployed for longer periods of time is associated with a greater likelihood of delaying a physical exam. This suggests that loss of healthcare coverage and the negative income effect may outweigh any positive effects of reduced time constraints. Additionally, this may also reflect a displacement effect, wherein individuals are delaying healthcare utilization until they have a job and healthcare coverage.

One issue that arises, and which has generally been bypassed in the prior literature as it cannot be investigated with cross-sectional data, relates to potential compositional selection from inter-state migration. That is, individuals living in communities facing prolonged contraction of key industries may relocate to other states with better job prospects. These individuals who face prolonged job-loss and choose to relocate are not necessarily a random subset of all unemployed individuals, and hence may differ along unobserved characteristics that would also be correlated with their health behaviors. Barsky, Kimball, Juster, and Shapiro (1997) found, for instance, that migrant individuals are likely to be more risk-tolerant. To the extent that risk-tolerance would also be associated with greater engagement in unhealthy behaviors, such selection would be expected to provide upward biased effects of unemployment on healthy behaviors.[12] On the other hand, studies have also found some evidence of a healthy-migrant effect within the US and other countries (for instance, Lu, 2008; Wingate & Alexander, 2006). Such health-based selection into migration would provide downward biased effects of unemployment on healthy behaviors. We exploit the longitudinal information from both the PSID and NLSY to assess the robustness of the above estimates to accounting for inter-state migration. Specifically, we re-

[12] Dave & Saffer (2008), for instance, find that greater risk tolerance raises alcohol consumption among older adults.

estimate all models for a subset of individuals who did not move across states, and alternately a subset of individuals who did not move at all over the sample period. The estimates from these alternate samples, specifically the fixed-effects estimates, were generally robust to those discussed above, indicating the value of using longitudinal data and suggesting that any systematic selection into migration across or within states is generally purged by the person-specific fixed effects.[13]

VI. Discussion

This study provides a comprehensive look at how health behaviors respond due to actual job-loss over the business cycle, providing some of the first longitudinal evidence on the internal effects of unemployment for several key behaviors spanning two recessions, including the recent Great Recession. We also provide the first study of the effect of unemployment on physical activity (energy expenditure), food consumption (energy intake), and the net effect (BMI) among the same sample of persons over time. This is particularly valuable in studying BMI, since prior research on the effects of unemployment on BMI has either found no or small effects. On the one hand, the true effect on BMI, if it exists, may be too small to measure reliably. On the other hand, a null or small effect may also imply counteracting effects on caloric intake and expenditure. Hence, there is value in analyzing a combination of behavioral inputs (physical activity and food consumption) into BMI, which may respond more readily to job-loss and also help place prior BMI results in context.

One interpretation of our joint results of physical activity, fast-food consumption, and BMI is that both energy intake and expenditure decline after a job loss, leaving BMI unchanged or only slightly higher (mostly among previously obese individuals), even with prolonged job-loss. Our findings do not contradict results using data from European countries (e.g. Böckerman

[13] Results are not reported, and available upon request.

et al., 2007), which consistently find that unemployment raises BMI. European countries have much more generous unemployment insurance programs than the U.S. According to the OECD, on average U.S. unemployment insurance replaces about 13 percent of gross compensation, whereas European countries typically replace three times that. Thus the income shock from job-loss in Europe is much less than here, while the drop in physical activity could well be similar, causing an increase in BMI in Europe but not in the U.S.

There is also some suggestive evidence for other health behaviors, particularly smoking and forgoing a physical. While prior work on the effects of job-loss and area unemployment on smoking has been mixed, the longitudinal evidence in this study suggests that this may be due to heterogeneity across various margins as well as across the smoking distribution. Among females, we find that the smoking effects are somewhat heterogeneous at the intensive and extensive margins. While job-loss is associated with an increase in the probability of being a current smoker, consistent with a decline in smoking cessation or a relapse into smoking among former smokers due to stress, we also find that those who were heavy smokers at baseline tend to somewhat reduce their cigarette consumption, consistent with an income effects. Among males, there is generally no significant effect on smoking at the extensive margin, though similar to females, we find a reduction in cigarettes consumed particularly among heavy smokers.

We underscore that the effects in this study are reflective of the first-order internal effects of job-loss, that is effects realized due to actual job-loss, as opposed to the second-order external effects which are realized even if the individual does not lose their job.[14] The weight of the evidence from these estimates shows that the effects of job-loss on health behaviors are complex and multi-faceted, and cannot necessarily be reduced to broad generalizations along the form of

[14] Prior studies which have estimated reduced-form specifications linking area unemployment to health outcomes and behaviors conflate both internal and external effects (for instance, Colman & Dave, 2013; Dave & Kelly, 2012; Ruhm, 2003).

job-loss leading individuals to engage in more or less healthy lifestyles. As different behaviors vary in terms of their relative intensity of time versus market-purchased inputs, they would respond differently to shifts in resource constraints associated with job-loss. Furthermore, stress due to job-loss and expectations regarding prolonged duration of job-loss would also elicit different responses with respect to the various behaviors. At the same time, however, prior work has shown that physical activity can be health-promoting, conditional on a given BMI (Colman & Dave, 2013; Surgeon General, 1996). Thus, even though unemployment is only weakly associated with BMI, the lower total physical activity may have adverse effects on health, as may delaying routine healthcare visits.

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Table 1
Means of PSID sample by Year

Variable	1999	2001	2003	2005	2007	2009
Heavy physical activities per week	1.9	1.9	1.8	2.3	2.4	2.4
Light physical activities per week	4.2	4.1	4.2	3.6	3.5	3.5
Strength activities per week				1.2	1.2	1.2
Body mass index	26.6	27.0	27.3	27.7	27.9	28.2
Obese BMI >30 (percent)	21.0	23.3	25.6	27.5	29.6	31.2
Overweight 25 < BMI <= 30 (percent)	37.9	38.4	38.1	38.0	37.1	37.2
Normal weight 18.5 < BMI <= 25 (percent)	39.6	37.0	35.1	33.2	32.1	30.5
Whether smokes (percent)	22.4	22.5	23.4	22.4	21.7	20.7
Cigarettes per day among smokers	15.5	15.0	14.8	13.7	13.2	12.3
BMI among obese at entry	34.3	34.2	34.5	34.9	35.4	35.5
Light physical activity per week among sedentary at entry	0.0	2.2	2.9	2.4	2.3	2.6
Cigs/day among heavy smokers at entry	24.7	22.3	22.1	20.4	20.1	18.3
Unemployed (percent)	3.6	4.6	5.8	4.8	5.3	9.3
Laid off or fired (percent)	1.3	1.8	2.3	1.6	1.8	4.3
Workplace closed (percent)	0.4	0.4	0.3	0.3	0.4	0.5
Number of children in family unit	1.3	1.2	1.1	1.1	1.1	1.1
Female (percent)	47.6	47.7	48.5	49.9	49.8	49.8
Non-Hispanic White (percent)	61.4	60.9	59.5	57.9	57.9	57.4
Non-Hispanic other (percent)	4.3	4.2	3.7	3.5	3.5	3.6
Non-Hispanic Black (percent)	27.9	28.6	29.6	30.9	30.5	30.3
Hispanic (percent)	6.3	6.3	7.1	7.6	8.1	8.7
Married (percent)	70.7	70.0	67.7	66.5	65.3	65.6
Cohabiting (percent)	4.8	5.0	5.8	6.8	8.0	7.0
Age in years	39.0	40.1	40.2	39.9	39.7	40.7
Less than HS (percent)	14.6	14.9	13.2	12.9	12.9	12.6
Has HS degree (percent)	32.7	32.9	35.0	33.6	32.8	32.0
Some college (percent)	26.4	26.2	26.8	27.6	27.8	28.1
College or more (percent)	26.3	25.9	25.0	25.9	26.5	27.3
Observations	5739	6351	6669	6669	6761	6023

Table 2
Means of PSID sample by Reason for Unemployment, 1999 – 2009

Variable	Total	Unemployed	Laid off	Plant closed
Heavy physical activities per week	2.1	2.0	2.1	2.1
Light physical activities per week	3.8	3.8	3.8	3.5
Strength activities per week	1.2	1.2	1.3	1.1
Body mass index	27.5	28.1	28.3	29.0
Obese BMI >30 (percent)	26.4	30.4	32.4	33.3
Overweight 25 < BMI <= 30 (percent)	37.8	35.7	34.8	43.8
Normal weight 18.5 < BMI <= 25 (percent)	34.5	32.8	32.0	21.6
Whether smokes (percent)	22.2	41.4	39.6	32.0
Cigarettes per day among smokers	14.1	12.7	13.0	13.6
BMI among obese at entry	34.8	35.1	35.2	34.9
Light physical activity per week among sedentary at entry	2.1	2.2	2.2	2.2
Cigs/day among heavy smokers at entry	21.5	19.7	20.1	21.9
Number of children in family unit	1.2	1.3	1.2	1.2
Female (percent)	48.9	52.1	45.7	51.0
Non-Hispanic White (percent)	59.1	34.5	40.0	37.9
Non-Hispanic Other (percent)	3.8	3.3	3.6	3.3
Non-Hispanic Black (percent)	29.7	54.2	49.5	47.7
Hispanic (percent)	7.4	7.9	6.8	11.1
Married (percent)	67.6	38.5	46.9	54.2
Cohabiting (percent)	6.3	9.3	9.4	7.8
Age in years	39.9	38.8	39.2	41.8
Less than HS (percent)	13.5	31.3	24.3	29.4
Has HS degree (percent)	33.2	36.4	39.4	40.5
Some college (percent)	27.2	21.0	23.6	17.0
College or more (percent)	26.1	11.3	12.6	13.1
Observations	38212	2126	834	153

Table 3
Means of NLSY sample by Year

Variable	1998	2000	2002	2004	2006	2008	2010
Frequency strength-building activity per week			1.6	1.6	1.6	1.6	1.6
Minutes vigorous physical activity per week			265.0	262.6	240.7	205.7	214.4
Minutes moderate physical activity per week			326.8	298.5	283.7	240.1	246.1
Obese BMI > 30 (percent)	25.5	29.3	30.5	31.3	32.3	34.1	35.9
Body Mass Index	27.3	27.9	28.2	28.3	28.4	28.7	29.0
Over a year since physical (percent)			37.6	30.6	33.8	30.9	29.1
Snacks per week						6.3	6.2
Meals skipped per week						2.8	2.6
Soft drinks per week						3.9	3.4
Fast food per week						1.7	1.5
Unemployed (percent)	2.8	2.3	4.2	4.4	3.2	4.7	8.5
Laid off (percent)	0.5	0.6	1.4	0.8	0.9	1.1	3.3
Plant closed (percent)	0.2	0.1	0.4	0.2	0.1	0.1	0.3
Unemployed for 13 weeks (percent)	1.6	1.3	2.6	3.2	1.7	2.9	6.9
Unemployed for 26 weeks (percent)	1.1	0.8	1.7	2.4	1.3	2.1	5.6
Unemployed for 52 weeks (percent)	0.7	0.6	0.9	1.7	0.9	1.4	3.9
Female (percent)	49.2	49.9	50.2	50.5	50.2	50.3	50.8
High School (percent)	43.9	43.6	43.7	43.1	42.7	42.4	41.9
Less than HS (percent)	10.1	9.7	9.1	8.6	8.5	8.0	7.5
Some college (percent)	24.0	24.6	24.4	25.0	25.1	25.2	25.1
College and above (percent)	22.1	22.2	22.7	23.3	23.7	24.4	25.6
Age in years	37.3	39.4	41.3	43.3	45.2	47.1	49.0
Married (percent)	58.6	58.5	59.4	58.8	59.2	57.5	57.7
Never married (percent)	20.5	19.1	18.1	17.3	16.6	15.9	15.0
Separated (percent)	5.1	5.7	4.8	4.7	4.6	5.1	4.6
Divorced (percent)	15.0	15.9	16.8	18.2	18.4	20.1	21.1
Widowed (percent)	0.8	0.8	0.9	1.1	1.2	1.4	1.6
Non-Hispanic White (percent)	49.9	50.0	50.0	50.3	49.6	49.5	50.3
Non-Hispanic Black (percent)	30.1	30.2	30.4	29.9	29.7	29.7	29.4
Non-Hispanic other (percent)	1.1	1.1	1.1	1.0	1.1	1.2	1.2
Hispanic (percent)	18.8	18.6	18.5	18.8	19.6	19.5	19.2
Observations	4909	4996	4949	5005	5386	5352	4994

Table 4
Means of NLSY Sample by Reason for Unemployment

Variable	Total	Unemployed	Laid off	Plant closed
Minutes vigorous physical activity per week	236.5	250.8	252.5	243.0
Minutes moderate physical activity per week	277.8	264.5	267.9	339.7
Obese BMI > 30 (percent)	31.3	32.1	34.9	32.8
Body Mass Index	28.3	28.4	28.8	28.7
Over a year since physical (percent)	32.4	41.8	41.4	30.6
Snacks per week	6.2	5.7	6.1	5.8
Meals skipped per week	2.7	2.9	3.1	2.6
Soft drinks per week	3.7	4.6	3.8	2.9
Fast food per week	1.6	1.3	1.2	1.5
Female (percent)	50.2	44.2	41.5	57.8
High School (percent)	43.0	52.8	54.8	62.5
Less than HS (percent)	8.8	16.6	13.5	15.6
Some college (percent)	24.8	20.5	18.8	18.8
College and above (percent)	23.4	10.1	12.8	3.1
Age in years	43.3	44.5	45.2	43.3
Married (percent)	58.5	34.3	39.2	42.2
Never married (percent)	17.5	30.5	26.4	28.1
Separated (percent)	4.9	8.9	8.9	7.8
Divorced (percent)	17.9	24.7	24.8	17.2
Widowed (percent)	1.1	1.6	0.7	4.7
Non-Hispanic White (percent)	49.9	34.2	39.4	32.8
Non-Hispanic Black (percent)	29.9	46.1	39.0	45.3
Non-Hispanic other (percent)	1.1	0.7	1.1	1.6
Hispanic (percent)	19.0	19.0	20.4	20.3
Observations	35591	1532	436	64

Table 5
Means of PSID Sample by Reason for Unemployment and Year

Variable	Total 2005	Total 2009	Unemployed 2005	Unemployed 2009	Laid off 2005	Laid off 2009	Plant closed 2005	Plant closed 2009
Heavy physical activities per week	2.3	2.4	1.9	2.4	2.1	2.5	2.2	2.4
Light physical activities per week	3.6	3.5	3.1	3.6	3.4	3.7	3.7	3.2
Strength activities per week	1.2	1.2	1.1	1.3	1.3	1.3	1.4	1.2
Body mass index	27.7	28.2	29.1	28.5	29.2	28.8	32.1	30.1
Obese BMI >30 (percent)	27.5	31.2	37.6	33.8	39.8	37.8	50.0	39.4
Overweight 25 < BMI <= 30 (percent)	38.0	37.2	32.3	35.6	26.9	33.6	40.9	39.4
Normal weight 18.5 < BMI <= 25 (percent)	33.2	30.5	28.9	29.5	32.4	27.8	9.1	21.2
Whether smokes (percent)	22.4	20.7	38.2	38.8	40.7	36.7	22.7	30.3
Cigarettes per day among smokers	13.7	12.3	12.1	11.2	14.2	11.7	13.6	13.3
BMI among obese at entry	34.9	35.5	35.5	35.4	36.4	35.8	38.1	35.9
Light physical activity per week among sedentary at entry	2.4	2.6	2.4	2.6	3.0	2.9	5.5	2.6
Cigs/day among heavy smokers at entry	20.4	18.3	16.9	16.8	19.2	18.8	20.0	22.0
Number of children in family unit	1.1	1.1	1.3	1.2	1.2	1.1	1.1	0.9
Female (percent)	49.9	49.8	57.5	47.9	52.8	44.0	59.1	48.5
Non-Hispanic White (percent)	57.9	57.4	27.6	36.8	34.3	43.6	27.3	42.4
Non-Hispanic other (percent)	3.5	3.6	2.2	3.4	1.9	3.9	0.0	6.1
Non-Hispanic Black (percent)	30.9	30.3	63.7	49.8	58.3	44.0	68.2	30.3
Hispanic (percent)	7.6	8.7	6.5	10.0	5.6	8.5	4.5	21.2
Married (percent)	66.5	65.6	35.4	40.0	45.4	45.9	54.5	60.6
Cohabiting (percent)	6.8	7.0	8.7	9.8	9.3	10.4	0.0	15.2
Age in years	39.9	40.7	38.2	39.8	37.5	40.1	41.0	42.9
Less than HS (percent)	12.9	12.6	35.1	26.7	24.1	20.1	36.4	21.2
Has HS degree (percent)	33.6	32.0	34.5	38.6	38.0	42.9	36.4	48.5
Some college (percent)	27.6	28.1	22.0	21.7	26.9	22.4	18.2	15.2
College or more (percent)	25.9	27.3	8.4	13.0	11.1	14.7	9.1	15.2
Observations	6669	6023	322	562	108	259	22	33

Table 6
The effects of unemployment on health behaviors, by reason for unemployment
Panel Study of Income Dynamics (PSID)
Females

Outcome	Unemployment indicator & estimation method					
	Unemployed		Laid-off		Plant closed	
	Random Effects 1	Fixed Effects 2	Random Effects 3	Fixed Effects 4	Random Effects 5	Fixed Effects 6
Heavy physical activities per week	0.07+	0.13	-0.00+	-0.01	0.46+	0.53
	(0.08)	(0.09)	(0.12)	(0.13)	(0.32)	(0.33)
Light physical activities per week	0.09+	0.13	0.01+	0.00	0.06+	0.14
	(0.09)	(0.10)	(0.14)	(0.16)	(0.35)	(0.41)
Strength activities per week	0.11+	0.13	0.07+	0.04	-0.16+	-0.17
	(0.08)	(0.11)	(0.14)	(0.16)	(0.32)	(0.41)
Body mass index	-0.01+	0.01	0.21+	0.24	0.47+	0.45
	(0.11)	(0.11)	(0.17)	(0.17)	(0.39)	(0.39)
Whether smokes	0.03***+	0.01	0.04**+	0.02*	-0.00+	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)
Log of cigs/day among smokers	-0.00+	-0.01	-0.03+	-0.05	0.00+	-0.02
	(0.03)	(0.03)	(0.05)	(0.05)	(0.08)	(0.09)
BMI among obese at entry	-0.29+	-0.16	0.03+	0.14	0.92+	1.27
	(0.29)	(0.29)	(0.43)	(0.43)	(0.95)	(0.84)
Light physical activity per week among sedentary at entry	-0.29+	-0.31	0.08+	-0.05	1.18*+	0.31
	(0.25)	(0.28)	(0.33)	(0.36)	(0.59)	(0.54)
Log of cigs/day among heavy smokers at entry	-0.02+	-0.03	0.02+	-0.02	-0.23**+	-0.34***
	(0.05)	(0.06)	(0.08)	(0.09)	(0.08)	(0.10)

Notes: Each cell represents a separate regression model. Fixed-effects models control for age, marital status, state of residence, and month. Random-effects additionally control for gender, highest grade completed, race, and Hispanic origin. Standard errors, adjusted for arbitrary correlation within individual cells over time, are reported in parentheses. Asterisks denote significance as follows: *significant at 10% level; **significant at 5% level; ***significant at 1% level
+ random-effects model rejected at 5% level (i.e. panel effects are correlated with independent variables)

Table 7
The effects of unemployment on health behaviors, by reason for unemployment
Panel Study of Income Dynamics (PSID)
Males

Outcome	Unemployment indicator & estimation method					
	Unemployed		Laid-off		Plant closed	
	Random Effects 1	Fixed Effects 2	Random Effects 3	Fixed Effects 4	Random Effects 5	Fixed Effects 6
Heavy physical activities per week	-0.17**+	-0.11	-0.05+	0.05	-0.01+	0.19
	(0.08)	(0.10)	(0.11)	(0.12)	(0.25)	(0.27)
Light physical activities per week	0.13+	0.15	0.17+	0.27*	0.09+	0.25
	(0.10)	(0.11)	(0.13)	(0.15)	(0.32)	(0.34)
Strength activities per week	0.03+	0.09	0.01+	0.05	0.40+	0.58
	(0.09)	(0.11)	(0.13)	(0.15)	(0.38)	(0.37)
Body mass index	0.06+	0.09	0.11+	0.13	0.24+	0.28
	(0.10)	(0.10)	(0.12)	(0.12)	(0.30)	(0.29)
Whether smokes	0.01+	-0.01	0.01+	-0.01	0.03+	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)
Log of cigs/day among smokers	-0.05*+	-0.06*	-0.07+	-0.08*	-0.11+	-0.16
	(0.03)	(0.03)	(0.04)	(0.05)	(0.11)	(0.12)
BMI among obese at entry	0.60**+	0.47	0.63**+	0.64*	1.14+	1.23
	(0.29)	(0.30)	(0.32)	(0.32)	(0.88)	(0.83)
Light physical activity per week among sedentary at entry	0.34+	0.10	-0.07+	0.15	-0.96+	-0.18
	(0.34)	(0.48)	(0.49)	(0.71)	(0.66)	(0.81)
Log of cigs/day among heavy smokers at entry	-0.10**+	-0.11**	-0.11**+	-0.13**	-0.19+	-0.29*
	(0.05)	(0.05)	(0.05)	(0.05)	(0.16)	(0.15)

Notes: Each cell represents a separate regression model. Fixed-effects models control for age, marital status, state of residence, and month. Random-effects additionally control for gender, highest grade completed, race, and Hispanic origin. Standard errors, adjusted for arbitrary correlation within individual cells over time, are reported in parentheses. Asterisks denote significance as follows: *significant at 10% level; **significant at 5% level; ***significant at 1% level
+ random-effects model rejected at 5% level (i.e. panel effects are correlated with independent variables)

Table 8
The effects of unemployment on health behaviors, by reason for unemployment
National Longitudinal Study of Youth 1979
Females

Outcome	Unemployment indicator & estimation method					
	Unemployed		Laid-off		Plant closed	
	Random Effects 1	Fixed Effects 2	Random Effects 3	Fixed Effects 4	Random Effects 5	Fixed Effects 6
Frequency strength-building activity per week	0.12+	0.28	0.13	0.20	0.21	0.07
	(0.15)	(0.19)	(0.24)	(0.33)	(0.53)	(0.43)
Minutes vigorous physical activity per week	-3.00	-22.66	-13.79	-11.96	-29.63	-50.74
	(14.41)	(17.41)	(21.82)	(28.77)	(52.15)	(71.82)
Minutes moderate physical activity per week	18.83	-6.18	6.02	-52.90	74.21	86.04
	(21.45)	(27.07)	(41.03)	(47.79)	(120.98)	(138.31)
Obese BMI > 30	0.01+	0.01	-0.01+	-0.01	0.07+	0.07
	(0.01)	(0.01)	(0.03)	(0.03)	(0.05)	(0.05)
Body Mass Index	0.12+	0.13	-0.02+	-0.04	0.95**+	0.96**
	(0.12)	(0.12)	(0.25)	(0.25)	(0.46)	(0.43)
Over a year since physical	0.06***	0.03	0.05	0.06	-0.03+	-0.06
	(0.02)	(0.02)	(0.03)	(0.04)	(0.08)	(0.09)
Snacks per week	-0.22+	-0.12	0.81+	0.17	0.10+	0.02
	(0.70)	(1.20)	(0.88)	(1.29)	(2.29)	(2.44)
Meals skipped per week	0.60**+	-0.08	0.68+	0.09	1.38+	1.79
	(0.27)	(0.33)	(0.41)	(0.52)	(1.06)	(1.28)
Soft drinks per week	0.42+	0.12	-0.92+	-0.92	-1.21+	1.19
	(0.60)	(0.73)	(0.56)	(0.96)	(0.85)	(1.17)
Fast food per week	-0.43***+	-0.70**	-0.34**+	-0.01	-0.43+	-2.14**
	(0.10)	(0.29)	(0.15)	(0.21)	(0.80)	(1.05)

Notes: Each cell represents a separate regressions model. Fixed-effects models control for age, marital status, state of residence, and month. Random-effects additionally control for gender, highest grade completed, race, and Hispanic origin. Standard errors, adjusted for arbitrary correlation within individual cells over time, are reported in parentheses.
Asterisks denote significance as follows: *significant at 10% level; **significant at 5% level; ***significant at 1% level
+ random-effects model rejected at 5% level (i.e. panel effects are correlated with independent variables)

Table 9
The effects of unemployment on health behaviors, by reason for unemployment
National Longitudinal Study of Youth 1979
Males

Outcome	Unemployment indicator & estimation method					
	Unemployed		Laid-off		Plant closed	
	Random Effects 1	Fixed Effects 2	Random Effects 3	Fixed Effects 4	Random Effects 5	Fixed Effects 6
Frequency strength-building activity per week	-0.30**	-0.18	-0.47**	-0.52	-0.12	0.31
	(0.14)	(0.18)	(0.20)	(0.31)	(0.65)	(0.71)
Minutes vigorous physical activity per week	-81.03***+	-117.55***	-112.11***+	-161.82***	-92.07+	-188.04
	(22.70)	(29.20)	(35.69)	(45.52)	(114.82)	(120.65)
Minutes moderate physical activity per week	-74.86***	-93.98***	-106.64***	-138.79***	-21.90	-9.51
	(21.83)	(28.42)	(33.21)	(43.84)	(157.32)	(171.91)
Obese BMI > 30	-0.01+	-0.00	-0.01	-0.01	-0.06	-0.06
	(0.01)	(0.01)	(0.02)	(0.02)	(0.06)	(0.06)
Body Mass Index	-0.07+	-0.05	-0.12+	-0.13	-0.02+	0.01
	(0.09)	(0.09)	(0.14)	(0.15)	(0.31)	(0.32)
Over a year since physical	0.06***	0.04**	0.07**	0.04	-0.10	-0.12
	(0.02)	(0.02)	(0.03)	(0.03)	(0.09)	(0.10)
Snacks per week	-0.32+	-0.02	-0.08+	0.29	0.31+	3.00**
	(0.33)	(0.46)	(0.56)	(0.74)	(1.58)	(1.26)
Meals skipped per week	-0.16+	-0.13	0.02+	-0.36	-0.34+	-0.23
	(0.20)	(0.31)	(0.39)	(0.61)	(0.71)	(0.70)
Soft drinks per week	-0.44	-0.94*	-0.13+	-0.48	1.23+	2.98
	(0.43)	(0.56)	(0.59)	(0.71)	(2.60)	(2.74)
Fast food per week	-0.60***	-0.45**	-0.53***+	-0.45*	-0.74+	-1.18
	(0.12)	(0.19)	(0.16)	(0.23)	(0.53)	(1.15)

Notes: Each cell represents a separate regressions model. Fixed-effects models control for age, marital status, state of residence, and month. Random-effects additionally control for gender, highest grade completed, race, and Hispanic origin. Standard errors, adjusted for arbitrary correlation within individual cells over time, are reported in parentheses. Asterisks denote significance as follows: *significant at 10% level; **significant at 5% level; ***significant at 1% level
+ random-effects model rejected at 5% level (i.e. panel effects are correlated with independent variables)

Table 10
The effects of continuous unemployment on health behaviors, by duration unemployment
National Longitudinal Study of Youth 1979
Females

Outcome	Unemployment indicator & estimation method					
	Unemployed for 13 weeks		Unemployed for 26 weeks		Unemployed for 52 weeks	
	Random Effects 1	Fixed Effects 2	Random Effects 3	Fixed Effects 4	Random Effects 5	Fixed Effects 6
Frequency strength-building activity per week	0.10+	0.25	-0.03	0.03	0.08	0.24
	(0.19)	(0.24)	(0.15)	(0.23)	(0.17)	(0.23)
Minutes vigorous physical activity per week	16.36	-3.78	16.37	-7.62	17.67	4.19
	(19.01)	(21.89)	(20.98)	(24.74)	(24.52)	(32.13)
Minutes moderate physical activity per week	-0.30	-22.08	-8.53	-39.24	-16.10	-68.44
	(23.19)	(29.00)	(25.77)	(33.60)	(31.36)	(41.87)
Obese BMI > 30	-0.00+	0.00	0.00+	0.01	-0.00+	0.01
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Body Mass Index	0.22+	0.25*	0.25+	0.28	0.18+	0.21
	(0.14)	(0.14)	(0.18)	(0.18)	(0.23)	(0.23)
Over a year since physical	0.06**	0.04	0.07**	0.05	0.09**	0.07
	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Snacks per week	-0.77*+	-0.98	-0.85+	-1.81	-1.03+	-2.62
	(0.46)	(1.10)	(0.56)	(1.40)	(0.89)	(2.22)
Meals skipped per week	0.34+	-0.39	0.43+	-0.45	0.51+	-0.13
	(0.34)	(0.37)	(0.42)	(0.43)	(0.64)	(0.61)
Soft drinks per week	0.34+	0.05	0.27+	0.15	0.96+	0.65
	(0.72)	(0.84)	(0.87)	(1.06)	(1.56)	(1.65)
Fast food per week	-0.50***+	-0.72*	-0.52***+	-0.82	-0.58**+	-1.19
	(0.12)	(0.39)	(0.15)	(0.50)	(0.23)	(0.85)

Notes: Fixed-effects models control for age, marital status, state of residence, and month. Random-effects additionally control for gender, highest grade completed, race, and Hispanic origin. Standard errors, adjusted for arbitrary correlation within individual cells over time, are reported in parentheses. Asterisks denote significance as follows:
*significant at 10% level; **significant at 5% level; ***significant at 1% level
+ random-effects model rejected at 5% level (i.e. panel effects are correlated with independent variables)

Table 11
The effects of continuous unemployment on health behaviors, by duration unemployment
National Longitudinal Study of Youth 1979
Males

Outcome	Unemployment indicator & estimation method					
	Unemployed for 13 weeks		Unemployed for 26 weeks		Unemployed for 52 weeks	
	Random Effects 1	Fixed Effects 2	Random Effects 3	Fixed Effects 4	Random Effects 5	Fixed Effects 6
Frequency strength-building activity per week	-0.21+	0.03	-0.17	0.08	-0.36*	0.03
	(0.17)	(0.21)	(0.19)	(0.25)	(0.21)	(0.28)
Minutes vigorous physical activity per week	-100.40***+	-125.89***	-112.71***+	-138.39***	-121.50***+	-150.49**
	(28.23)	(37.55)	(32.46)	(42.85)	(41.30)	(56.85)
Minutes moderate physical activity per week	-87.35***	-96.78***	-86.40***	-90.63**	-96.37***	-95.23**
	(24.16)	(31.39)	(27.67)	(35.65)	(33.58)	(44.79)
Obese BMI > 30	0.00	0.00	0.02	0.02	0.02	0.02
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Body Mass Index	0.01+	0.03	0.04+	0.05	0.07+	0.08
	(0.12)	(0.12)	(0.15)	(0.15)	(0.19)	(0.20)
Over a year since physical	0.09***+	0.06**	0.09***	0.06**	0.15***	0.14***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Snacks per week	-0.41+	-0.20	-0.28+	0.27	-0.12+	0.57
	(0.38)	(0.56)	(0.47)	(0.62)	(0.64)	(0.82)
Meals skipped per week	0.02	-0.07	0.13+	-0.18	-0.14	0.00
	(0.27)	(0.42)	(0.33)	(0.54)	(0.35)	(0.48)
Soft drinks per week	-0.49	-1.19*	-1.03**	-1.67**	-0.57+	-0.51
	(0.49)	(0.69)	(0.51)	(0.77)	(0.58)	(0.75)
Fast food per week	-0.62***	-0.51**	-0.64***	-0.72**	-0.74***+	-0.72*
	(0.13)	(0.22)	(0.15)	(0.27)	(0.19)	(0.39)

Notes: Fixed-effects models control for age, marital status, state of residence, and month. Random-effects additionally control for gender, highest grade completed, race, and Hispanic origin. Standard errors, adjusted for arbitrary correlation within individual cells over time, are reported in parentheses. Asterisks denote significance as follows: *significant at 10% level; **significant at 5% level; ***significant at 1% level
+ random-effects model rejected at 5% level (i.e. panel effects are correlated with independent variables)