Published in final edited form as:

J Health Econ. 2010 May ; 29(3): 347–352. doi:10.1016/j.jhealeco.2010.03.005.

THE ECONOMICS OF INTENSE EXERCISE

David O. Meltzer and Anupam B. Jena

The University of Chicago

Abstract

Despite the well-known benefits of exercise, the time required for exercise is widely understood as a major reason for low levels of exercise in the US. Intensity of exercise can change the time required for a given amount of total exercise but has never been studied from an economic perspective. We present a simple model of exercise behavior which suggests that the intensity of exercise should increase relative to time spent exercising as wages increase, holding other determinants of exercise constant. Our empirical results identify an association between income and exercise intensity that is consistent with the hypothesis that people respond to increased time costs of exercise by increasing intensity. More generally, our results suggest that time costs may be an important determinant of exercise patterns and that factors that can influence the time costs of exercise, such as intensity, may be important concerns in designing interventions to promote exercise.

The benefits of exercise for improved longevity and health are well known. Walking for half an hour a day, five days a week, has been reported to increase life expectancy by 1.5 years while more intense exercise may double these gains (Franco, 2005). Despite the potential for such benefits, more than 60 percent of Americans do not meet these recommended guidelines for moderate physical activity (Martin, 2000). Knowledge about why this occurs is limited. There is no evidence that people fail to recognize the health benefits of exercise. However, there is good evidence that many people simply do not enjoy exercise, and especially intense exercise. Another major barrier to exercise is the time required.ⁱⁱ Intensity of exercise is interesting in this regard since increased intensity can allow a given amount of total exercise to be accomplished with lower time requirements (Burgomaster et al. 2005). This is especially important since the time required for exercise is one of the most commonly reported barriers to regular exercise (King et al., 2000). However, since increasing the intensity of exercise can be unpleasant (Ekkekakis, et al., 2006; Lind et al. 2008) and increase the rate of injury (Perri et al 2002), increasing the intensity of exercise has limited capacity to reduce the time costs of exercise. Thus, while the time costs and dislike of exercise are both likely to be important independent barriers to higher levels of exercise, they are also related. When wages are high and time is costly, how does exercise behavior, i.e. the length and intensity of exercise, change?

This paper develops and tests a simple model of exercise behavior that incorporates the time cost of exercise, the disutility associated with intense exercise, and the utility gains from exercise-induced improvements in health. It is qualitatively similar to existing models of the household allocation of time (Becker, 1965; Michael 1973) and adds to the literature on the

Address correspondence to: David Meltzer MD, PhD, 5841 S. Maryland MC 2007, Chicago, IL 60637. (773) 702-0836. dmeltzer@medicine.bsd.uchicago.edu.

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ⁱⁱSee Martin et al. (2000) for a list of studies documenting the determinants of physical activity.

time costs of health investments (Grossman, 1972; Philipson and Posner, 2003; Grossman et al., 2004; Cutler et al., 2003). The main prediction of this model is that as wages increase, individuals will shift towards less time-intensive, but more physically-intensive, forms of exercise. While the overall time exercised may increase if health is a sufficiently normal good, that time will be spent more intensively as wages rise. The main implications, then, are that increasing intensity may be an important strategy for reducing the time costs of exercise and, more generally, that factors which influence the time costs of exercise, such as intensity, may be important concerns in the design of interventions to promote exercise.

We examine this hypothesis by using data from the National Health and Nutrition Examination Surveys (NHANES) to assess the association between measures of income and exercise intensity. Our empirical results identify an association between income and exercise intensity that is consistent with the hypothesis that people respond to increased time costs of exercise by increasing intensity. Although we cannot prove that this association reflects a causal effect of income on exercise, we discuss alternative hypotheses and conclude that alternative hypotheses appear unlikely.

Model

To illustrate these points, consider a simple utility maximization model in which utility U depends on health H , exercise intensity I , and consumption of a composite good X , so that $U = U(H, I, X)$. We assume that utility is increasing in H and X but decreasing in I . Intense exercise is assumed to be unpleasant at the margin; otherwise, people would continually increase intensity to save time while maximizing the amount of exercise. We further assume that health is produced via a health production function $H = H(E, I)$, where E is the amount of exercise. H is assumed to be concave and increasing in both E and I . Finally, we assume that individuals face simple budget constraints for time ($L + E = 24$), and goods, $Lw + A = pX$, where L is hours worked, w is the hourly wage, A is endowment income, and p is the price of X .

Maximizing utility subject to the health production function and budget constraints yields the following relationship:

$$\frac{H_E}{H_I} = \frac{wU_X}{-pU_I} \quad (1)$$

The left hand side of expression (1) is the marginal health benefit of increasing exercise time relative to the marginal health benefit of increasing exercise intensity. The right hand side is the cost of increasing exercise time relative to the cost of increasing intensity—the cost of increasing exercise time is simply the foregone wage w while the monetized cost of increasing intensity is $U_I \cdot (p/U_X)$. Increases in wage income will have potentially opposing income and substitution effects. The income effect will lead to increases in health H and decreases in intensity I if both health and the distaste for intense exercise are normal goods—this has the effect of increasing the time spent exercising. The corresponding substitution effect of an increase in wage will favor increases in intensity relative to time spent exercising. This implies that holding health constant, higher wages should be correlated with higher intensity exercise.

Consider, for example, when health depends solely on the total energy expended through exercise, $H = EI$. If E is measured in total hours of exercise time, a natural interpretation of intensity I would be the number of calories expended per hour of exercise. Expression (1) would then simplify to:

$$\frac{I}{E} = \frac{wU_x}{-pU_l} \quad (2)$$

Here, it is clear that the substitution effect of increasing w is to increase intensity relative to time spent exercising. Empirically, *holding health or exercise energy expenditure constant*, higher wages will be associated with higher intensity exercise.

DATA

To test the predictions of our model, we combine data from three cycles of the National Health and Nutrition Examination Surveys (NHANES) conducted in 1999–2000, 2001–2002, and 2003–2004. In addition to collecting data on various demographic variables, these nationally representative surveys use a combination of questionnaires, on-site examinations, and laboratory testing to collect detailed information on the health status and health habits of a nationally representative sample of Americans. Importantly, since the earliest waves of the NHANES, the Survey has collected increasingly detailed information on the physical activities of its respondents. In particular, for each activity an individual reports having done in the past month, information is collected on the nature of that activity (i.e. basketball, running, yoga, etc.), the duration (i.e. hours spent in the past month), and the level of exertion (i.e. moderate versus rigorous).ⁱⁱⁱ

Using responses to the physical activity questionnaire, we construct several measures of exercise behavior. First, we define total exercise time as the total time spent exercising across all reported activities. Next, we define the average intensity of exercise as a weighted average across all reported activities—weights are constructed according to the share of total exercise time spent in a given activity. Following the measures used in the medical literature (see e.g. Ainsworth et al., 2000), we summarize the exercise intensity of a given activity by its Metabolic Equivalent Score (METs). The METs of a given exercise is the ratio of the exercise metabolic rate to the metabolic rate when sitting quietly, typically defined to be one MET. For a given amount of time, an activity with an intensity of 2 METs requires twice as much energy expenditure as resting. Table 1 lists the intensity of several activities as measured by their Metabolic Equivalent Score.

Note that the intensity attributed to a certain activity depends on the level of exertion per unit of time. For example, aerobics is seven times more intense than sitting quietly when done vigorously, while only five times more intense when done moderately. For each physical activity reported in the NHANES, respondents are asked to rate whether their participation is moderate or vigorous. This allows us to more finely classify exercise intensity than measures which do not make this distinction.

We define the total energy expenditure from exercise as the product of average intensity and exercise duration. For an average adult at rest, one MET corresponds to roughly 3.5 ml of oxygen uptake per kilogram of body weight per minute, or roughly 1.2 kcal/min for a 70-kg individual (CDC). Thus, a 70-kg individual exercising at an intensity of 3 METs for a period of 60 minutes would expend 216 kcal ($3 \times 1.2 \times 60$), approximately 144 kcal more than at rest.

Finally, the demographic variables included in our analysis are race, education, age, marital status, and income. While our theory emphasizes the role of wages in determining optimal

ⁱⁱⁱThe main reason we restrict our attention to the post-1999 NHANES surveys is that earlier surveys, e.g. NHANES III, do not contain information on the *duration* of each reported physical activity, an important variable in our analysis of exercise behavior.

exercise behavior, the income data reported in the NHANES does not distinguish between asset and non-asset income. In addition, the income measure is limited to annual family income and is top-coded for families earning more than \$75,000 annually. To the extent that the price effects of exercise may be relatively more important for high wage earners, our estimated effects will be diluted by this top-coding. Moreover, if higher family incomes are driven by assets (i.e. non-wage income), our estimated effects may be too low if the distaste for intense exercise is a normal good. Finally, because our primary emphasis is on individuals in the labor force, we restrict our attention to individuals older than 25 with a family income exceeding \$5,000 annually. This results in a sample size of 10,853 individuals from 1999–2004.

EMPRICAL ANALYSIS

Descriptive Statistics

Table 2 presents several descriptive statistics of exercise behavior in the NHANES sample. Across all measures of exercise behavior, wealthier individuals exercise more. Nearly 67% (48%) of individuals with family income greater than \$75,000 report some moderate (vigorous) exercise in the past month, while nearly 37% (20%) of those with family income below \$20,000 report these levels of exercise. Muscle strengthening exercise exhibits a similar pattern across income groups, with individuals in the highest income group more than two times as likely to report muscle strengthening exercise in the past month. Consistent with these findings, individuals in the highest income group exercise, on average, seven hours more than those in the lowest income group (17.7 hours versus 10.8 hours monthly). This difference could be driven by an increased propensity to exercise among wealthier individuals, along with increased exercise duration among those exercising. Most relevant to our discussion, exercise intensity appears to rise with income, with individuals in the lowest income group exercising roughly 6% less intensively than those in the highest income group (METs of 4.8 and 5.1, respectively). Similar patterns hold across education groups as well, with the most educated income group (some college or more) exercising almost twice as much as those without a high school degree.

Several important differences in exercise behavior emerge when looking across demographic groups, as well. Whites exercise more often than both Blacks and Hispanics (15.1 hours monthly, compared to 12.0 hours for Blacks and 8.5 hours for Hispanics) and are most likely to report moderate (57%) or vigorous (34%) physical activity in the past month. Conditional on exercising, however, Whites exercise less intensively than both Blacks and Hispanics. Similar analysis across age groups reveals declines in exercise with increasing age, with 47% (15%) of the elderly engaging in moderate (vigorous) activity, compared to 54% (44%) of individuals aged 25–35. In particular, total exercise time and intensity falls sharply with increasing age, with large changes around retirement age—exercise intensity, for example, falls from 5.4 METs for individuals aged 25–35 to 4.2 METs for individuals above 65. Finally, for all measures of exercise, men tend to exercise more than women; that is, both more often (17.0 versus 11.3 hours monthly) and more intensively (5.2 versus 4.7 METs).

Multivariable Determinants of Exercise Behavior

This section presents the baseline determinants of exercise behavior, in particular the determinants of exercise length, intensity, and importantly, the decision to exercise at all. Table 3 presents these results for various exercise regressions which control for the effects of age, race, marital status, and gender. The main variable of interest is income, and in particular, the effect of differences in income on the intensity and length of exercise. We include several specifications in which the exercise outcomes analyzed are in natural logs.

Table 3 reveals several interesting findings about exercise behavior. First, as suggested by the descriptive statistics, males tend to exercise 25.6% more hours and 7.5% more intensively than their female counterparts. Similar results hold for Blacks and Whites, relative to Hispanics - both groups exercise less intensively (8.1% and 4.2% less, respectively) though they spend more time exercising (roughly 25% more for both). Among those exercising, intensity falls with age, almost 24% between the youngest (below 25) and oldest (above 75) age groups.

Income is associated with exercise in three ways. First, income is positively associated with the likelihood of exercise, with individuals in the highest income group 31 percentage points more likely to exercise than those with an annual family income below \$20,000. Second, among those exercising, wealthier individuals spend more time exercising, almost 27% more for couples earning more than \$75,000. Third, individuals in the highest income group exercise 7.1% more intensively than those in the lowest income group.

These results are consistent with a price effect of exercise driving wealthier individuals to exercise more intensively. As our theory predicts, the price effect of exercise is most clear when health or total energy expenditure is accounted for in exercise intensity regressions. In these regressions, the exercise measures are in natural logs—thus, coefficients can be interpreted in terms of their percentage effect on the relevant exercise behavior. In these regressions, which are reported in Table 4, we also include separate specifications which include income by itself, education by itself, and both income and education together. Education is included for several reasons. First, education may be a much better measure of lifetime income. Second, education may be a better measure of the true opportunity costs of time. For example, if education increases efficiency in household production in other areas, for example child-rearing, this may produce incentives to increase intensity of exercise. Finally, education may increase the efficiency of exercise itself by helping educated person to better understand that a given level of health benefits can be gained in less time through more intense exercise.

The first column of Table 4 examines the effect of income and education on energy expenditure, here defined to be the product of exercise intensity and length. Our point estimates suggest that the wealthiest and most educated groups, those with family income above \$75,000 annually and with more than a high school education, spend roughly 25% more calories through exercise than the poorest and least educated groups. The second column of Table 4 presents the effects of income and education on exercise intensity when total energy expenditure from exercise is accounted for. When both income and education are included as controls, we find that individuals in the wealthiest income group exercise 3.4% more intensively than those with annual family income below \$20,000—this amounts to roughly 30 kilocalories more per hour of exercise. The time-price effect of exercise, as measured by differences in exercise intensity across income groups, remains robust to controls for education status in all specifications. While the increase in exercise intensity may seem modest, it is important to keep in mind two things. First, even an additional 30 kilocalories spent per hour of exercise may have implications for weight, particularly if exercise is long in duration and frequent.^{iv} Second, our highest income group, individuals with *family* income above \$75,000 dollars, covers a broad range of incomes and therefore under-represents those for whom the time costs of exercise may be most important.

An alternative explanation of our finding that income is positively related to the observed intensity at which individuals exercise is that income may only proxy for health or physical fitness. If wealthier individuals are more physically fit and the disutility associated with intense

^{iv}E.g., Cutler et al. (2004) estimate that an additional 100–150 kcal consumed per day leads to steady-state increases in weight of 10–12 pounds.

exercise is decreasing in fitness, then the observed positive relationship between income and exercise intensity would emerge due to confounding by greater health among wealthier individuals. This explanation might also be reinforced by the dynamic nature of investments in health—all things being equal, increases in intensity will increase physical fitness which, in turn, makes additional increases in exercise intensity less costly. We can examine this issue further by using the rich data on physical fitness present in the NHANES to control for previously unobserved health status.

A natural measure of health status, commonly used in discussions of obesity, is the body mass index (BMI). The BMI is thought to be a reliable indicator of body fat and is defined as the ratio of body weight in kilograms to height in meters squared. If income is negatively correlated with BMI and individuals with lower BMI can exercise more intensively, including BMI as a control in exercise intensity regressions may lower the estimated effect of income. In addition to the BMI, several finer measures of body fat can be used to proxy for overall physical fitness. In all of our specifications, we also include additional measurements from two skin-fold tests: triceps and waist. Finally, we include systolic and diastolic blood pressure measurements to control for unobserved cardiovascular problems that may limit the ability to exercise intensively.^v

When BMI alone is included with the full set of demographic controls in exercise intensity regressions, it has a negative effect on exercise intensity. A one-point increase in BMI leads to a 0.3% decrease in exercise intensity. Including the additional controls for health status, the effect of BMI turns positive, while both skin fold tests are negatively related to intensity. In so far as a large BMI may proxy for muscle mass in individuals with low percentage body fat, these results seem intuitive. Importantly, in both specifications, the effect of income on exercise intensity is essentially unchanged, with the highest income group still exercising roughly 4.7% more intensively than the poorest income group.

CONCLUSION

Despite the well-known benefits of exercise, the time required for exercise is widely understood as a major reason for low levels of exercise in the US. While high wage individuals have greater incentive to invest in health through exercise, healthier eating, and better access to medical care, those same higher wages make investments in exercise and cooking more costly through their use of time. For the same reason that healthy, time-sparing, but relatively expensive food options exist, increasing intensity of exercise, rather than duration, may be a preferred strategy for many persons in whom time costs are high.

Although our results are consistent with the hypothesis that a higher opportunity cost of time encourages more intense exercise, the association we observe may not necessarily reflect a causal association. A pure story of reverse causation in which greater exercise intensity raises earnings by making people more productive at work seems unlikely because few jobs are of a sufficiently physical nature. Similarly, an omitted factor, such as better underlying health status, may affect both exercise intensity and earnings. Better health may imply both greater intensity and higher earnings. Controlling for health status may be one way to test whether confounding of this nature is important. This is limited, however, by the fact that exercise itself affects health status and because the health status measures we have are limited. Nevertheless, our inclusion of BMI, lean-muscle mass, and blood pressure – all variables which correlate

^vThe NHANES also includes actual physical examination data on cardiovascular fitness for some individuals aged 12–49. This data is derived from treadmill tests and include, among other variables, measures of max VO₂, the maximum amount of oxygen that can be consumed when exercising at maximum capacity. Individuals with high max VO₂ can typically exercise more intensively than those who are less well conditioned. While max VO₂ is an ideal summary measure of an individual's ability to engage in intense exercise, the number of observations for which both maxVO₂ data exists and a positive amount of exercise is reported are limited.

with health status -leave our basic findings unchanged. Therefore, though we cannot prove that the association we observe reflects a causal effect of income on exercise, we conclude that these alternative explanations for our findings appear less likely.

If one accepts the idea that increases in the opportunity cost of time encourage greater intensity of exercise, such preferences may also have implications for understanding variations in exercise patterns across demographic groups and for designing health promotion efforts. For example, our results suggest that physician recommendations for regular low intensity exercise (such as walking) may be unlikely to result in a sustainable exercise regimen for persons with high costs of time, unless such walking can be incorporated into required daily activities, such as commuting. In contrast, recommendations to undertake more intense exercise regimens may be of greater value to such individuals. While these hypotheses have not been directly tested, the idea that physicians recommend exercise is well-established (e.g. Pate et al., 1995), and a growing literature argues that the specific dimensions of the recommendation (in terms of frequency, duration, and intensity) may affect adherence (Perri et al., 2002; Cox et al. 2003). An emerging literature also argues for individualization of recommendations, at least with respect to intensity (Ekkekakis et al, 2006). Our findings suggest additionally that individualized recommendations that vary with respect to the recommended intensity may also be worth further study.

Our findings suggest that high wage individuals may be willing to make large investments in order to increase the intensity of exercise. This is perhaps most vividly reflected in a recently advertised exercise machine promising full-body workouts in 4 minutes a day at a cost of \$14,000 dollars, but is probably reflected to some degree in the increasing level of private and public capital expenditures to facilitate exercise, whether in private health clubs or public parks.^{vi}

The potential for increased intensity to reduce the time cost of exercise also suggests that exercise regimens may be more successful over time if they encourage an individual to progressively increase the intensity of exercise as they become more fit. This could argue for strategies such as the short term use of personal trainers or vacations designed to jumpstart fitness programs.^{vii} Interestingly, as noted by Ekkekakis et al. 2006, the recommendations in the United States Department of Health and Human Services Healthy People 2020 suggest that individuals start exercise slowly with an activity they enjoy and gradually increase its frequency and duration. The recommendations do not discuss gradually increasing intensity as a strategy to enhance the long term sustainability of exercise by lowering the time required to maintain a given level of exercise. Whether such a strategy would promote long term maintenance of physical activity is not known, but our findings suggest it may be worthy of study. More generally, our analyses suggest that advice about exercise intensity may be an important determinant of the efficacy of strategies to promote greater exercise.

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^{vi}See e.g. <http://www.fastexercise.com/>.

^{vii}See e.g. <http://www.cnn.com/HEALTH/9902/01/canyon.ranch/index.html>.

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Table 1

Exercise Intensity for Various Activities

Description of Activity	Metabolic Equivalent Score	
	Moderate Exertion	Vigorous Exertion
Aerobics	5.0	7.0
Bicycling	4.0	8.0
Golf	3.5	4.5
Jogging	6.0	7.0
Running	7.0	10.0
Soccer	6.0	10.0
Walking	3.5	5.0
Yard Work	4.0	6.0
Yoga	2.5	4.0

Notes: For a given time spent in a particular activity, the Metabolic Equivalent Score (METS) is defined as the ratio of the exercise metabolic rate to the standard resting metabolic rate—one metabolic equivalent task is similar to the resting metabolism while sitting quietly, while one hour of moderate bicycling results in four times the total metabolic expenditure as resting.

Table 2

Descriptive Statistics of Exercise Habits by Demographic Group

	Moderate Activity	Vigorous Activity	Muscle Strengthening	Hours Exercised	Average Intensity
Income (Dollars)					
Below 20,000	0.371 (0.018)	0.201 (0.011)	0.178 (0.008)	10.792 (1.02)	4.821 (0.072)
20,000–45,000	0.484 (0.014)	0.282 (0.012)	0.228 (0.012)	13.57 (0.835)	4.979 (0.064)
45,000–75,000	0.578 (0.011)	0.374 (0.012)	0.286 (0.013)	14.484 (0.455)	4.933 (0.052)
Above 75,000	0.667 (0.017)	0.478 (0.018)	0.377 (0.016)	17.694 (0.778)	5.135 (0.045)
Race					
Hispanic	0.357 (0.014)	0.271 (0.013)	0.188 (0.01)	8.523 (0.701)	5.513 (0.075)
White	0.57 (0.012)	0.344 (0.012)	0.274 (0.011)	15.083 (0.508)	4.91 (0.039)
Black	0.383 (0.013)	0.282 (0.012)	0.281 (0.014)	11.97 (0.573)	5.191 (0.067)
Age					
25–35	0.542 (0.016)	0.444 (0.016)	0.341 (0.014)	15.843 (0.803)	5.412 (0.063)
35–45	0.537 (0.016)	0.382 (0.015)	0.29 (0.011)	13.223 (0.517)	5.146 (0.054)
45–55	0.536 (0.015)	0.336 (0.016)	0.253 (0.015)	14.785 (0.788)	4.898 (0.053)
55–65	0.5 (0.022)	0.251 (0.015)	0.22 (0.014)	13.993 (1.077)	4.724 (0.055)
Above 65	0.467 (0.013)	0.146 (0.011)	0.161 (0.011)	11.747 (0.698)	4.238 (0.037)
Marital Status					
Married	0.544 (0.013)	0.339 (0.011)	0.256 (0.01)	14.259 (0.525)	4.945 (0.035)
Widowed	0.392 (0.018)	0.13 (0.014)	0.156 (0.012)	8.894 (0.699)	4.301 (0.08)
Divorced	0.499 (0.016)	0.313 (0.019)	0.281 (0.014)	14.813 (1.306)	4.929 (0.077)
Never Married	0.505 (0.020)	0.401 (0.015)	0.338 (0.013)	16.136 (0.954)	5.436 (0.077)
Gender					
Male	0.529 (0.011)	0.382 (0.01)	0.294 (0.01)	16.997 (0.682)	5.2 (0.039)
Female	0.516 (0.012)	0.283 (0.011)	0.235 (0.010)	11.297 (0.473)	4.7 (0.044)
Education					
< High School	0.322 (0.016)	0.164 (0.01)	0.132 (0.009)	8.566 (0.587)	4.883 (0.063)
High School	0.493 (0.013)	0.262 (0.012)	0.203 (0.011)	14.048 (0.764)	4.785 (0.052)
> High School	0.605 (0.012)	0.421 (0.012)	0.339 (0.011)	15.959 (0.49)	5.082 (0.035)

Table 3

Determinants of Exercise Intensity and Length

	Probability exercised	Hours exercised	Intensity of exercise	Ln(Total hours)	Ln(Intensity)
AGE					
35–45	–0.059 (0.016)	–3.042 (1.2)	–0.206 (0.08)	–0.073 (0.062)	–0.043 (0.016)
45–55	–0.094 (0.018)	–0.087 (1.516)	–0.461 (0.068)	0.038 (0.061)	–0.091 (0.014)
55–65	–0.134 (0.021)	1.051 (2.327)	–0.598 (0.078)	0.07 (0.073)	–0.116 (0.015)
65–75	–0.115 (0.018)	–0.777 (1.744)	–0.926 (0.071)	0.174 (0.062)	–0.179 (0.014)
Above 75	–0.185 (0.022)	–0.069 (1.908)	–1.18 (0.106)	0.189 (0.068)	–0.234 (0.021)
MARITAL STATUS					
Married	–0.029 (0.029)	4.66 (1.551)	–0.01 (0.101)	0.035 (0.08)	–0.002 (0.019)
Widowed	–0.027 (0.04)	4.006 (2.488)	0.124 (0.135)	0.093 (0.127)	0.019 (0.026)
Divorced	0.035 (0.031)	8.471 (2.699)	0.044 (0.131)	0.173 (0.112)	0.008 (0.025)
Never Married	0.045 (0.032)	7.196 (1.578)	0.246 (0.136)	0.238 (0.077)	0.044 (0.025)
RACE					
White	0.145 (0.019)	5.52 (1.255)	–0.464 (0.085)	0.265 (0.048)	–0.081 (0.015)
Black	0.005 (0.022)	6.917 (1.819)	–0.239 (0.1)	0.272 (0.075)	–0.042 (0.018)
GENDER					
Male	0.03 (0.012)	7.382 (1.132)	0.411 (0.05)	0.256 (0.05)	0.075 (0.009)
INCOME (DOLLARS)					
20,000–45,000	0.115 (0.019)	–0.797 (2.314)	0.134 (0.075)	0.067 (0.065)	0.027 (0.015)
45,000–75,000	0.213 (0.018)	–2.761 (1.89)	0.091 (0.077)	0.151 (0.073)	0.024 (0.015)
Above 75,000	0.31 (0.026)	–1.163 (2.175)	0.336 (0.086)	0.274 (0.076)	0.071 (0.016)
CONSTANT	0.435 (0.031)	5.357 (0.131)	10.062 (2.958)	1.832 (0.014)	1.623 (0.057)
N	10,853	6,135	6,135	6,135	6,135

Notes: The Columns present coefficients from regressions in which the dependent variable is one of several measures of exercise habits performed in the last month. The omitted groups in the independent variables are: AGE (ages 25–35), MARITAL STATUS (Living with partner), RACE (Hispanic), and Income (Less than \$20,000). Standard errors are in parentheses and are adjusted for the NHANES survey design.

Table 4
Effect of Income and Education on Exercise Intensity and Length, Holding Exercise Energy Expenditure Constant

	I Ln(Energy Expenditure)			II Ln(Exercise intensity)		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Energy expenditure)	-	-	-	0.069 (0.004)	0.069 (0.004)	0.069 (0.004)
INCOME (DOLLARS)						
20,000–45,000	0.094 (0.069)	-	0.045 (0.069)	0.021 (0.014)	-	0.017 (0.014)
45,000–75,000	0.175 (0.075)	-	0.112 (0.078)	0.012 (0.014)	-	0.006 (0.015)
Above 75,000	0.344 (0.078)	-	0.258 (0.085)	0.047 (0.016)	-	0.034 (0.017)
EDUCATION						
High school	-	0.254 (0.051)	0.229 (0.054)	-	-0.022 (0.014)	-0.025 (0.015)
More than high school	-	0.334 (0.048)	0.269 (0.057)	-	0.024 (0.011)	0.015 (0.012)
Number of Observations	6,135	6,135	6,135	6,135	6,135	6,135

Notes: Columns I–II present coefficients on income and education in exercise regressions including the full set of controls—the dependent variables are (I) Ln(Energy expenditure) and (II) Ln(Exercise Intensity). In Column II, Ln(Energy Expenditure) is included as a control, whereas in Column I it is the dependent variable. Columns (1)–(6) include controls for income alone (1 and 4), education alone (2 and 5), and both income and education (3 and 6). Standard errors are in parentheses and are adjusted for the NHANES survey design.