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ABSTRACT

This study examines racial, ethnic and gender differentials in physical activity. Individuals engage in physical activity during leisure-time and also during in many other activities such as walking to work, home maintenance, shopping and child care. Physical activity also occurs on the job is this is referred to as work physical activity. Prior studies have shown that non-work physical activity has a positive impact on health while work physical activity has a negative impact on health. Many prior studies have relied primarily on leisure-time physical activity, which typically constitutes only about 10% of non-work physical activity and does not capture specific information on the intensity or duration of the activity. This study addresses these limitations by constructing measures of physical activity from the American Time Use Surveys, which are all-inclusive and capture the duration of each activity combined with its intensity based on the Metabolic Equivalent of Task (MET). Non-work physical activity tends to be significantly lower for Blacks, Hispanics, other racial groups than for Whites and lower for males than for females. These adjusted differentials are consistent with racial, ethnic and gender differentials in health. About 25-46% of the differentials in non-work physical activity can be attributed to differences in education, socio-economic status, proxies for time constraints, and locational attributes.

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1. Introduction

This paper examines racial, ethnic and gender (REG) differentials in physical activity (PA) and the effects of various causal factors on these differentials. Differentials in PA are important since there is an extensive literature which shows that PA has significant direct and indirect effects on health. Thus REG differentials in PA may contribute to the persistent REG differentials in health. According to the National Center for Health Statistics (2007), mortality from heart disease is over 30 % higher among Blacks relative to Whites, and for diabetes is more than double. Among American Indians/Alaskan natives and Hispanics diabetes-related mortality is significantly higher relative to Whites. Furthermore, racial gaps in cancer-related, heart disease-related and diabetes-related mortality have generally failed to narrow over the past four decades.[1] A number of studies have investigated the underlying causes of the race/ethnic and socioeconomic status-related health gradient (Cutler, Lleras-Muney, and Vogl 2011; Farmer and Ferraro 2005), examining, for instance, racial and ethnic differences in income and education, smoking and drinking prevalence, participation in other risky activities, and access to less or lower-quality medical care. However, the association between race/ethnicity and health persists even within similar income categories and among insured individuals. Thus, accounting for these observed differences across race and ethnic groups does not fully explain the gap.

One understudied factor that may contribute to the persistent REG differentials in health may be differentials in PA and in the type of PA. An extensive literature suggests that non-work PAs have significant direct and indirect effects on physical and mental

[1] Woolf et al. (2004) estimate that, between 1991 and 2000, if the mortality rates of African-Americans were the same as Whites, there would have been 886,902 fewer deaths. This is five times the number of deaths averted through medical advances.

health. PA has been shown to be a protective factor in cardiovascular disease, diabetes, colon and breast cancer, obesity, hypertension, bone and joint diseases, and depression. Evidence from epidemiologic studies, cohort-based studies, cross-sectional analyses and clinical trials suggests that a physically-active lifestyle can reduce mortality and morbidity; there also appears to be a dose-response relation with generally higher cardio-respiratory fitness leading to larger decreases in mortality rates. The improvement in mortality and morbidity risk persists even after controlling for body mass index. Thus, PA can improve an individual's health status directly and indirectly by affecting obesity.

According to USDHHS (2002) the number of Americans with chronic illnesses that may be averted or improved through regular PA include: 12.6 million individuals with coronary heart disease; 1.1 million individuals who experience a heart attack in a given year; 15 million individuals who have type 2 diabetes plus 16 million more individuals who are 'pre-diabetic'; 107,000 individuals who are newly diagnosed with colon cancer each year; 300,000 individuals who incur hip fractures each year; 50 million individuals afflicted with hypertension; and 61% of the adult population who are either obese or overweight. The USDHHS (2002) also notes that regular PA can reduce morbidity and mortality from mental health disorders.

The strong association between PA and mental and physical health outcomes suggests that REG differentials in PA may contribute to REG differentials in health. Studies such as Mummery et al. (2005); King et al. (2001); Futon-Kehoe et al. (2001) find that all forms of non-work PA reduces mortality and various forms of morbidity. PA also occurs in market work although this type of PA may be detrimental to health. Studies by

Kukkonen-Harjula (2007) and Virkkunen et al. (2005) find that work PA has a negative effect on health.

Estimates from the 2007 National Health Interview Survey (NHIS) indicate significant differences in PA across racial groups. For instance, 33.8% of Whites, 23.8% of Hispanics and 23.2% of Blacks engage in regular leisure PA. However, the NHIS and other previously used national surveys (such as the Behavioral Risk Factor Surveillance System-BRFSS; National Health and Nutrition Examination Surveys-NHANES) are limited in their measures of PA. Most prior studies, based on these surveys, have measured only leisure PA, and generally overlooked other forms of PA including active forms of commuting to work, PA in home maintenance, shopping, child care and many other daily activities. An exclusive focus on leisure PA may lead to biased conclusions. Many of the national datasets employed in the prior work include only subjective retrospective measures of participation in leisure PA, which may be prone to recall bias, and these measures also generally do not capture specific information on the duration or intensity of the engaged activities. Data from the American Time Use Surveys (ATUS) indicate that leisure PA comprises only about 10% of total non-work PA. Also, due to substitution between various forms of PA, individuals who have lower leisure PA may not necessarily have lower total non-work PA.

This study addresses these issues by utilizing the American Time Use Surveys (ATUS) to more accurately measure all forms of PA undertaken by the individual and by capturing both the duration and intensity of the PA. This study is the first to provide estimates of REG differentials across these various types of PA, based on detailed measures constructed from the ATUS. Fixed-effects specifications further assess how much of the REG differentials in PA can be accounted for by observed individual differences in human capital and work status and by differences in location and environmental factors. These specifications also investigate the degree to which work PA, which significantly differs across race, ethnicity, and gender, substitutes for or complements other types of PA.

2. Literature

There are a number of prior studies that have documented REG differentials in PA. Using data from the 1987 National Medical Expenditure Survey (NMES), Hersch (1996) finds that Black females are least likely to participate in moderate to strenuous exercise, followed by White females and Black males. The highest prevalence is among White males. Jones et al. (1998) utilize the 1990 NHIS to examine the prevalence of adults who meet recommended guidelines for moderate PA. They find that only about one-third of the U.S. population meets these recommendations, with women, ethnic minorities, low-educated adults, and older adults being the least active. Brownson et al. (2000) conduct telephone surveys among 2,912 U.S. women 40 years of age and older, based on a sampling plan similar to the BRFSS. They note that leisure PA was lowest among Blacks and American Indians/Alaskan Natives. He and Baker (2005) examine differences in leisure and work PA among older adults from the 1992 Health and Retirement Study, across racial and ethnic minority groups. Leisure PA was lower among Blacks and Hispanics compared to Whites and steadily declined with lower levels of education. However, work PA showed the reverse pattern, being lowest among Whites and persons with greater education.

Some studies have examined corollary REG differences in inactivity. Crespo et al. (2000), for instance, estimate race/ethnic-specific prevalence of leisure physical inactivity based on the 3rd NHANES 1988-1994. They find the highest rate of leisure inactivity among Mexican-Americans, followed by Blacks and then Whites. Marshall et al. (2007) study the prevalence of leisure physical inactivity as well as the relationship between leisure inactivity and occupational PA across racial/ethnic groups and across social class indicators, based on the 2002 National PA and Weight Loss Survey (which uses self-reported PA questions from the BRFSS). Estimates indicate that leisure inactivity is lower among White men and women relative to non-Hispanic Black men and women. Highest rates of inactivity were found among Hispanic men and women. Leisure PA had no relationship to occupational PA except for the most strenuous occupational work for Hispanics. Education is found to be an important mediator in the link between race/ethnicity and leisure physical inactivity.

Hawkins et al. (2009) study 2,688 individuals, selected from the 10,122 individuals in the 2003-2004 NHANES, who carried accelerometers.[2] They find that PA decreases with age for both men and women across all racial/ethnic groups. Men are more active than women, with the exception of Hispanic women. Hispanic women are more active at ages 40–59 compared to younger or older ages. Hispanic men engage in more total PA and light-intensity PA relative to their White and Black counterparts for all age groups. These estimates may not be generalizeable due to the selected sample. These results also contrast with those from other studies that relied on self-reported

[2] The accelerometer used in NHANES is a small electrical device worn by the subject, which detects and stores the intensity of all movements and activity per one minute time intervals.

leisure PA, and underscore the importance of using better measures of unstructured PA that cannot be assumed to be homogenous across population subgroups.

A second strand of literature has investigated the determinants of PA, including environmental characteristics, income and education. Gordon-Larsen et al. (2006) study the relationship between the availability of recreational facilities and PA among adolescents. They find that lower-SES and high-minority areas had reduced access to facilities, which in turn was associated with decreased PA. Humpel, Owen and Leslie (2002) review 19 quantitative studies on the relationship between PA and environmental attributes. They find that access and aesthetic attributes are significantly associated with PA, while weather and safety-related attributes show a weaker relationship. Reviews of approximately 300 studies on the correlates of adult PA were performed by Bauman et al. (2002) and Sherwood and Jeffery (2000). These reviews find that males and Whites tend to be more physically active, and that income, education, and socioeconomic status are generally positively associated with PA. They also indicate that access to PA-supportive facilities tend to increase participation whereas adverse seasons and climate negatively impact PA. The general consensus from this literature is that environmental characteristics and measures of income and education are important correlates of all types of PA. However, causality is not well-established due to sample selection issues, unobserved heterogeneity, and simultaneity bias.

A major limitation in both strands of literature concerns the measurement of PA. Most of the studies have relied on surveys such as the BRFSS, NHIS, NMES or the NHANES wherein measures of PA are limited to self-reported participation in "moderate" or "vigorous" leisure PA in the past week or past month. In addition to potential recall bias due to the retrospective nature of the questions, these measures also do not specifically reflect the duration and intensity of the activity. Furthermore, most of the studies have utilized measures of leisure PA, which captures only about five to six percent of total PA. Due to potential substitutions between leisure and other PA, lower leisure PA may not necessarily translate into lower total PA. Thus, currently available REG differentials based on these limited constructs of PA may be biased. Many of the prior studies have also used relatively small and/or selected samples, which further limits their precision and external validity.

Furthermore, research on the determinants of PA specifically by REG group is limited. While studies have shown differences in PA across racial groups (albeit based on subpar measures of PA) and separate studies have shown income, education and environmental factors to be important correlates of PA, the literature is limited in its investigation of whether, and to what extent, REG differences in PA are related to differences in education, income, and environmental exposure.

This study addresses these limitations and utilizes a nationally-representative sample derived from the 2003-2009 American Time Use Surveys (ATUS). The ATUS yields a sufficiently large sample (approx. 98,000 observations) to reliably estimate differentials across REG subgroups. Importantly, all physical activities and their duration are carefully recorded for a specific diary day. Since specific PAs are identified in the ATUS, measures (described in the next section) are constructed to capture all types of PA including leisure PA, active travel PA home PA, other PA and work PA, and which reflect both the duration and intensity of these activities. Unlike other national surveys, the ATUS is not limited to telephone-based households. Approximately five percent of the ATUS consists of respondents that did not provide a telephone number which enhances the representativeness of the data. The ATUS also includes extensive information on individual demographics and socio-economic characteristics. To the best of our knowledge, this study provides the first estimates of REG differentials in all types of PA, using data from the ATUS and estimates the extent to which these differentials are driven by individual human capital and environmental factors.

3. Framework

The objective of this study is to assess REG differentials in PA, and the extent to which various individual and external factors impact PA and contribute to these differentials. This question can be framed within the human capital model for the demand for health (Grossman, 1972). Grossman combines the household production model of consumer behavior with the theory of human capital investment to analyze an individual's demand for health capital. In this paradigm, individuals demand health for its consumptive and investment aspects. That is, health capital directly increases utility and also reduces work loss due to illness, consequently increasing healthy time and raising earnings.[3] The individual maximizes an intertemporal utility function that contains health and other household goods as arguments.

Health is produced with market goods (x) and the individual's time (t). One way in which time can be used to produce health is through PA.[4] PA is defined as the energy expenditure, per unit of time, times the amount of time engaged in the activity (t_{pa}). The energy expenditure of an activity is known as the metabolic equivalent of task (MET), which measures the energy expenditure of a given activity relative to the energy

[3] Investment in health capital may also raise earnings by raising the marginal product of labor and consequently the wage rate.
[4] PA can also directly enter the utility function.

expenditure at rest. Equation (1) thus denotes the health production function with PA as an input, defined as t_{pa}*MET, and with time spent in other health-related activities (t_{other}) and market goods (x; for instance, medical care, gym membership, etc.) as other inputs. The efficiency parameter is denoted by E, which plays a similar role to technology in the firm's production process.

(1) $H = H(t_{pa}*MET, t_{other}, x; E)$

The cost constraint is represented by equation (2):

(2) $F = px + wt_h$

Total production costs (F) equal the costs of market inputs, valued at market price p, and the cost of time inputs, with t_h representing total time devoted to health production (t_{pa} + t_{other}) valued at the wage rate w.[5] Minimizing the cost function (2) subject to the production function (1) results in the individual's conditional input demand for PA (3):

(3) $PA = PA(w, p, H; E)$

The theoretical health production function (1) can be transformed into an estimable function by specifying empirical proxies for the denoted inputs. Individual efficiency in producing health can be proxied by education.[6] Environmental factors reflect the full cost of engaging in certain types of PA, and family structure (for instance, marital status, children) proxies for other time constraints. Additional individual factors can be included to account for person-specific heterogeneity.

Equation (4) below thus represents the empirical health production function.

(4) H = H(wage, price, Work PA, income, education, race, ethnicity, gender,

[5] For simplicity, the allocation of time between t_{pa} and t_{other} is ignored and the choice between t_{pa} and MET level in PA production is also ignored.
[6] Studies have shown that educated individuals are more allocatively efficient and more technically efficient in producing health. See Grossman and Kaestner (1997).

family structure, age, employment, environment factors, locational factors)

Substituting equation (4) into equation (3) results in the reduced-form input demand function for PA (equation 5).

(5) $PA_j = PA_j$(wage, price, Work PA, income, education, race, ethnic, gender, family structure, age, employment, environment factors, locational factors)

Equation (5) is estimated for different types of PA, denoted by the j^{th} subscript. It is assumed that individuals have greater flexibility in choosing their non-work PA relative to their work PA. That is, conditional on occupational choice, which to a large extent determines work PA , individuals then choose how to allocate their non-work time across various activities. Thus work PA also proxies for time constraints and for the full-cost of engaging in other forms of PA, and is therefore included as a causal determinant when estimating models for non-work PA. However, non-work PA is not assumed to have a causal effect on work PA due to the precedence of the occupational choice.

4. Data

American Time Use Surveys (ATUS)

The ATUS is the first federally-administered, continuous survey of time use in the U.S., conducted by the Bureau of Labor Statistics, with the specific objective of measuring how individuals divide up their time across all daily activities. The ATUS sample is drawn from the monthly Current Population Surveys (CPS). The CPS selects approximately 60,000 households every month from the civilian non-institutional population. About 7,500 of these retire permanently from the CPS sample each month after their eighth CPS interview attempt. Two months after households complete their eighth CPS interview attempt, they become eligible for selection into the ATUS sample.

Eligible households with a Hispanic or non-Hispanic Black householder are oversampled to improve the reliability of time-use data for these demographic groups; sampling weights are provided to yield nationally-representative estimates.

The analyses use data from 2003-2009 and restrict the sample to adults 18 years of age and older, which yields approximately 98,000 observations. Since environmental factors and locational fixed effects are potentially important determinants of PA, the sample is further restricted to individuals for whom geographic identifiers are available in the ATUS. Specifically, identifiers for metropolitan statistical areas (MSAs) are available for the approximately 76,000 individuals who reside in MSAs, and county-level identifiers are available for about 30,000 individuals who reside in large counties (with population exceeding 50,000). Data on self-reported health are only available since the 2006 wave, yielding about 29,000 observations with MSA information. Table 1 presents weighted means for all relevant variables for each of these three alternative analyses samples. There are no significant or systematic differences in means across these three samples, raising confidence in the comparability of the estimates across samples and their external validity.[7]

The time diary component of the ATUS interview contains a detailed account of the respondent's activities, starting at 4 a.m. the previous day and ending at 4 a.m. on the interview day. Interviews are based on conversational interviewing rather than scripted questions, which is a more flexible interviewing technique designed to allow the respondent to report on his or her activities comfortably and accurately. It also allows interviewers to guide respondents through memory lapses, to probe in a non-leading

[7] Strictly speaking, the estimates presented are representative of about 80% of the U.S. population that resides in MSAs.

way for the level of detail required to code activities, and to redirect respondents who are providing unnecessary information. The interviewers are trained to ensure that the respondent reports activities (and durations) actually done on the previous (diary) day, not activities done on a “usual” day. Furthermore, since the focus of the questionnaire is not specifically on PA, respondents are also less likely to under-report. Gordon and Kannel (1984) contend that the quality of reports of sensitive subjects such as alcohol consumption is greatly improved if the questions are included as a small part of a much larger survey that focuses on different issues. This applies to a large scale study such as the ATUS where the focus is on time-use rather than PA per se. The ATUS has also undergone substantive field testing, cognitive research, and follow-up testing to ensure consistency of the sampling frame, minimize reporting errors, and confirm the accuracy of the responses. All cases are 100-percent verified, meaning that two different coders cross-verify and code each case.   Unlike the BRFSS and the NHIS which sample only telephone-based households, approximately five percent of the ATUS consists of CPS respondents that did not provide a telephone number in order to make the sample truly representative.

Each activity in the time diary component is assigned a six-digit classification code. The first two digits represent one of 17 major activity codes (ranging from personal care to household services to exercise and sports); the next two digits represent the second-tier level of detail, and the final two digits represent the third and most detailed level of activity. For example, the ATUS code for “making the bed” is 020101. “Making the bed” is categorized under the third-tier category ‘interior cleaning’, which is part of the second-tier category ‘housework’, which falls under the major activity category ‘household activities’. Thus, unlike the national surveys used in prior studies (NHIS, BRFSS, NHANES, NMES, HRS), the ATUS does not limit the respondent to participation in a few pre-specified activities. Respondents are free to report on any activity they were engaged in, and these are meticulously coded in hundreds of categories as defined by the classification codes. For all activities, respondents report the duration in the prior 24 hours.

Dependent Variables

There are a total of five non-work PA variables defined with the ATUS data. The non-work PA variables are leisure PA, active travel PA, home PA, other PA and total non-work PA. Total non-work PA is the sum of all the PA variables except work PA. The PA variables for all activities included in the ATUS, except for work PA, are calculated by multiplying the duration of each activity reported in the ATUS by metabolic equivalent of task (MET) provided by the National Cancer Institute.[8] These activities are then aggregated into the higher level categories: leisure PA, active travel PA, home PA and other PA.[9] The MET is defined as the ratio of a person's working metabolic rate relative to their resting metabolic rate. For example, one MET is defined as the energy it takes to sit quietly. Walking has a MET value of two which means that walking expends twice as much energy as sitting quietly. The actual caloric expenditure for an individual in a given activity, for a given length of time depends on the individual’s bodyweight. However, the caloric expenditure may not be the best measure of PA since an overweight individual would burn more calories than a lighter individual, doing the same activity, for the same length of time. The PA measure used in this paper does not

[8] The MET values for a large number of activities are also contained in the Compendium of Physical Activities Tracking Guide (CPA) (Ainsworth, 2002).
[9] Other PA includes activities such as shopping, childcare, community activities, etc.

include body weight since the higher caloric expenditure by the overweight individual does not reflect more beneficial PA but rather reflects the fact that the individual is overweight. All PA variables were defined to exclude activities which had a MET of one since the health benefits of PA are related to moderate and vigorous PA. Home PA and work PA had no activities with values equal to one.

The work PA measure was computed based on the individual's reported occupation and reported usual time spent at work. Both usual and actual time at work are reported in the ATUS. However, the purpose of including this variable is to measure the effect of typical work effort rather than the effect of work effort on the specific interview day. Since the diary day for about 30 percent of the sample was a week-end day, and since many people do not work on week-ends, the usual time at work is better for computation of work PA. It is of interest to examine the impact of work PA on other forms of PA and whether REG differentials in PA are mediated by work PA. Generally, individuals who work in occupations requiring more PA participate less in leisure PA (MMWR, 2000). Since work PA is higher for Blacks and Hispanics relative to Whites, and higher for men than for women, differences in work PA may contribute to observed REG differentials in other PA and in health.

To compute work PA all 502 census occupation codes in the ATUS were assigned a MET value using data from the Dictionary of Occupational Titles (DOT) and the CPA.[10] The MET value for an individual's occupation was then multiplied by the individual's reported usual hours of work per day. When work PA is used as an independent variable it is defined as zero for individuals who do not work. A limitation of this measure is that it is derived from the individual's occupation code rather than

[10] Additional information on the computation of this variable is available from the authors.

information about the specific individual’s activities at work. However, prior research has found such measures to be well-correlated with individuals’ own reports of the physical demands of their jobs (Lakdawalla and Philipson, 2007).

Independent Variables

The ATUS contains extensive information on individuals’ demographic and socio-economic factors, all of which may be important determinants of PA. Indicators are defined for the following racial/ethnic groups: 1) non-Hispanic White (reference category); 2) non-Hispanic Black; 3) Asian; 4) other race (including American Indian, Alaskan Native, Hawaiian, and any other reported multi-racial identification; and 5) Hispanics. A dichotomous indicator is also defined for males.

A measure of total family income is constructed, representing income from all sources. Education is defined as years of schooling completed. Dichotomous indicators are defined for employment, part-time employment, marital status, and the presence of minor children in the household, all of which empirically proxy for time constraints. Non-linear changes in PA over the individual’s life cycle are captured through linear and quadratic terms for age.

The opportunity cost of time is proxied by the wage rate for individuals who are working. Since the wage rate is not observed for those who are not employed, an interaction term is used to differentiate these individuals. This interaction term is the product of the wage rate and a dichotomous indicator for employment. Thus, for an individual who is not employed, this interaction term is equal to zero and for an individual who is employed, the interaction term is equal to the wage rate. This ensures that the wage effect is identified only from changes in the observed wage rate across employed individuals. All monetary variables are deflated by the national consumer price index.

Appended Data

The full cost of engaging in PA is also related to environmental characteristics including population density, weather and crime rates. High crime rates, temperature extremes, and high levels of precipitation can raise the full price of engaging in PA in such neighborhoods, by making outdoor activities dangerous or more difficult, and thereby reduce PA. Low population density could increase driving (relative to walking or bicycling) but may also reflect more recreational options. Zhao and Kaestner (2010), for instance, find that population density is negatively related to obesity.

Information on recreational equipment rental stores per capita, pedestrian fatalities per capita, crimes per capita, population density, and weather is linked to the individual records in the ATUS based on the respondent's county of residence and time of interview. Identification of the county of residence is available for about 30,000 individuals who reside in large counties with a population over 50,000 individuals.[11] Information on the number of establishments for fitness and recreational sports centers is obtained from the U.S. Census County Business Patterns.[12] Pedestrian fatalities are obtained from the Fatal Accident Reporting System (FARS). Crime is proxied by arrest rates for all crime, property crime, and violent crime, derived from the Federal Bureau of Investigation's Uniform Crime Reports. Data on average daily temperature, average annual precipitation, and population density are obtained at the county-month level from

[11] Appended county level variables for 2009 are not yet available.
[12] See: www.census.gov/epcd/cbp/view/cbpview.html

Fedstats.[13] Non-linear effects of temperature are captured through a quadratic term. The Area Resource File (ARF) provides information on population density per square mile for all counties in the U.S.

Fixed Effects

Alternate models include locational fixed effects (MSA and county), which control for all time-invariant unobserved area-specific factors. These fixed effects also account for the individual's built environment, including sidewalks, presence of open spaces and parks, biking trails, public transportation, traffic, and other neighborhood attributes, to the extent that these have remained relatively unchanged in the individual's MSA or county of residence between 2003 and 2009. Time fixed effects (month and year), included in all models, account for seasonal factors and national trends affecting PA as well overall changes in the cost-of-living over time. Standard errors are adjusted for arbitrary correlation across individuals residing within the same MSA and residing within the same county (for models that exploit information on county of residence).

5. Results

Correlations

An important empirical issue highlighted by the prior studies of PA is the relationships between the various types of PA. That is, a specific type of PA may be likely to co-occur with another or to replace another type of PA. These relationships can be evaluated by examining the sign and significance of the correlations between the PA variables. These correlations do not suggest causality but simply establish the nature of the relationships between the PA variables. The partial correlations presented in table 2

[13] See: www.fedstats.gov

were computed between the PA variables holding constant all other PA variables and demographic and economic variables listed in the table footnote. Total non-work PA can only be correlated with Work PA since Total non-work PA is the sum of each type of non-work PA. All of these partial correlations are highly significant and three of the correlations are positive while eight of the correlations are negative.

All three positive correlations include active travel PA. The positive correlations are with Leisure PA, Other PA and Work PA. These positive correlations may be reflective of an active versus sedentary lifestyle. That is, individuals who opt for more (or less) PA in leisure may also opt for more (or less) PA in modes of travel. The same process may also be true for Other PA. However, Active travel is negatively correlated with Home PA suggesting that Home PA replaces Active travel PA. Home PA has a negative relationship with income (shown in table 3) and is also negatively correlated with each of the other categories of PA. This suggests that individuals may view Home PA as a chore to avoid as income permits rather than a component of an active lifestyle. The positive correlation between Active travel PA and Work PA may simply reflect the component of Active travel which is travel to work and can only occur for those who have non-zero Work PA, that is, individuals who work.

The eight negative correlations suggest replacement across these activities. Individuals with higher leisure PA generally have lower Home and Other PA. This suggests that a narrow focus on Leisure PA may understate the individuals actual level of PA. Also, individuals who have higher Work PA have lower Total non-work PA. This suggests that higher levels of Work PA can both lower health directly and indirectly lower health by lowering Total non-work PA. These correlations suggest that the limited focus on Leisure PA and a few other PA activities results in inaccurate estimates of Total non-work PA and how Total non-work PA differs by REG groups.

Leisure PA

Table 3 presents multivariate models for leisure PA. Since individuals have greater choice over their non-work PA relative to their activities at work, which are determined by occupational choice, work PA is included as a determinant of leisure PA and all other types of non-work PA (presented in subsequent tables). Specification 1 represents the baseline model, which includes only the REG variables and time fixed effects. The coefficients of the REG variables in this baseline specification are interpreted as observed or unadjusted REG differentials. Blacks and Hispanics have significantly lower leisure PA relative to non-Hispanic Whites, by about 0.50 and 0.28 MET*hours, representing about 33.7% and 18.9% reduction relative to the mean. Males have significantly higher leisure PA (1.03 MET*hours or 67% relative to the mean) than females. The coefficients for Asian and other race are insignificant.

Specification 2 extends the model by including individuals' human capital, family structure, employment, work PA, and fixed effects for MSA of residence. This extended specification provides a better measure of REG differentials, since the influence of observable individual heterogeneity, other than race, ethnicity or gender, and locational choice is held constant. The inclusion of these factors lowers the differential for Blacks by about 28% and raises the differential for Hispanics by about 18%. The differential for Asians declines from zero to -0.35 MET*hours). The differential for other races remains insignificant. The differential for males increases slightly by about 8%.

Specification 3 represents the baseline model for the sample of individuals who reside in large counties and for whom information on residential county is available. Although the sample size is only about 40% of the MSA sample (used in specification 1), the REG differentials are highly similar, suggesting that there are no substantial sample selection issues and that the estimates are comparable across samples. Specification 4 extends this model by including the individual-level human capital, employment, and other variables, county-level environmental factors, and fixed effects for county of residence. These county-level factors are potentially endogenous if individuals who have a preference for leisure PA choose to live in locations which are more conducive to these activities. The degree of this endogeneity may vary across racial and ethnic groups due to residential segregation. The differential in leisure PA for Blacks (versus non-Hispanic Whites) is reduced by about 44% (from -0.48 to -0.27 MET*hours), and that for Hispanics is reduced by about 17%. The gender differential remains virtually unchanged.

These specifications suggest that about 28% of the observed differential in leisure PA for Blacks can be explained by individual-level human capital, marital status, employment factors, work PA, and MSA residence, and about 44% can be explained by these factors plus county of residence and other environmental attributes of the residential county. For Hispanics, observed socio-economic and locational factors can explain about 17% of the differential in leisure PA (relative to non-Hispanic Whites). There are no substantial differences between the unadjusted and adjusted gender differentials.

Leisure PA generally decreases over the life-cycle, based on the coefficients of the age terms. Education and income are positively associated with this type of PA. Married and employed individuals are less engaged in leisure PA, consistent with a higher full cost of PA due to greater time constraints. Thus, part-time workers also have greater leisure PA relative to full-time workers. Work PA significantly crowds out leisure PA, though the crowd-out is far less than one-to-one. The county-level attributes, with the exception of population density and temperature (both positively affecting PA), are not significant determinants of leisure PA. This may be due to the inclusion of county-level fixed effects, which may already be capturing much of the variation across localities.

Active Travel PA

Table 4 presents the estimates for active travel PA. The baseline specification (model 1) shows that all racial/ethnic groups, with the exception of Asians, have significantly lower active travel PA (relative to non-Hispanic Whites) by between 7-10%. Males engage in significantly higher active travel PA (MET*hours of 0.57 or 29% relative to the mean) than females. Specification 2 adds individual measures for human capital and proxies for time constraints, work PA and MSA fixed effects. These added variables lower the observed differential for Blacks by about 50%, for other races by about 31%, and virtually eliminates the differential for Hispanics; the gender differential is reduced by about 17%. The differential for Asians, however, increases after controlling for the human capital and other factors since income and educational levels, which raise PA, tend to be higher among Asians.

Specification 3, is limited to individuals residing in large counties, shows similar REG differentials as those reported in specification 1, and is limited to individuals residing in MSAs.

Specification 4 adds county fixed effects and environmental attributes, individual-specific human capital, employment, work PA, and other proxies for time constraints. This virtually eliminates the differential in active travel PA for Blacks and Hispanics, reduces the differential for other races by about 28% and that for males by about 18%. Again, the differential for Asians is increased.

Active travel PA generally increases up to about age 47 and then declines. As with leisure PA, it also increases with education, income, and wages. Married individuals engage less in active travel PA, consistent with higher time constraints and the full cost of PA. There is also some complementarity between active travel PA and employment, which may reflect commuting to work; thus, part-time workers engage less than full-time workers. The presence of minor children in the household is also associated with higher travel-based PA. While the correlations suggest that work PA and travel PA may be complements, there is no significant relationship between work PA and active travel PA after adjusting for locational fixed effects. This indicates that much of the active travel PA reflects commuting to work; thus, after controlling for residence, the correlation is diminished.

A comparison of leisure PA and active travel PA shows that, after controlling for the extended covariates, Blacks and Hispanics have lower leisure PA relative to non-Hispanic Whites but generally the same level of active travel PA. Men engage more in both forms of PA, consistent with Rombaldi et al. (2010) who also find that leisure PA and active travel PA are likely to co-occur.

Home PA

Table 5 presents the estimates for home PA. Specification 1 shows that all other racial/ethnic groups engage in less home PA relative to non-Hispanic Whites. For instance, home PA among Blacks is about 1.94 MET*hours (41%) lower, and that among Asians is about 0.95 MET*hours (20%) lower. Males also engage significantly less in home PA, by about 1.72 MET*hours (37%).

Specification 2 indicates that virtually the entire differential in home PA for Hispanics is explained by the inclusion of individual-level human capital and time constraint measures, work PA, and MSA fixed effects. For Blacks and Asians, the differential is diminished by between 14-22%; among other racial groups, the included factors contribute to more than half of the observed difference in home PA. These factors also explain a significant portion of the gender difference, by about 16%.

Home PA generally increases over the life cycle until age 56 and then starts to decline. Expectedly, such PA is higher among married individuals with minor children, and lower among employed individuals, especially those employed full-time.

Other PA

Table 6 presents estimates for other PA that are not contained in leisure PA, active travel PA, and home PA. Blacks and Hispanics engage less in other PA, and Asians engage more, relative to non-Hispanic Whites. There is no significant differential with respect to other racial groups. Males also have significantly lower PA relative to females. Comparing specifications 1 and 2, virtually all (85%) of the unadjusted differential for Asians can be explained by the additional factors relating to human capital, marital status, employment, work PA, and MSA locational choice. Among Blacks, the differential is reduced by 42%, and among Hispanics the differential drops by 25%. The additional factors also contribute to the observed gender differential, explaining it by about 22%.

Other PA generally declines with age, employment (especially full-time employment) and work PA. It is positively associated with education, family income, marriage, and the presence of children in the household. Work PA also adversely impacts other PA, consistent with the correlations presented in Table 2.

Total Non-Work PA

Table 7 presents estimates for an aggregate measure capturing all forms of non-work PA. Specification 1 suggests that, with the exception of Asians, all other racial/ethnic groups engage in less total non-work PA than non-Hispanic Whites. For instance, Blacks have lower non-work PA by about 3.66 MET*hours (26%), and Hispanics have lower total non-work PA by about 1.44 MET*hours (10%). Males also engage in significantly less non-work PA (by about 1.8 MET*hours or 13%), relative to females. About 35% of this gender difference can be attributed to education, marital status, employment and income, work PA, and MSA fixed effects. Among Blacks and Hispanics, the gap relative to non-Hispanic Whites is reduced by 25% and 46% respectively with the inclusion of the additional covariates. However, the differential for Asians increases since education and income levels tend to be higher among this group and these factors also positively impact upon non-work PA.

Consistent with the correlations noted in Table 1, work PA significantly crowds out non-work PA though the substitution is not one-to-one. Based on the coefficients of the age terms, non-work PA tends to increase until about age 34 before declining. Non-work PA is also higher among educated, married individuals with higher incomes and who have minor children.

Work PA

Table 8 examines the REG differentials for work PA. When studying the effect of work PA as a determinant of the various other forms of PA, work PA was assigned a zero for individuals who do not work. This is reasonable since individuals who are not employed also do not engage in any work PA, by definition, and the inclusion of non-employed individuals maximizes the sample size. However, when examining work PA as the outcome variable, the inclusion of both employed and non-employed individuals is not appropriate since the probability of employment is highly correlated with demographics. For instance, women are less likely to be in the labor force, and the unemployment rate among Blacks and Hispanics is higher relative to non-Hispanic Whites. This would lead to mechanical correlations between work PA and the REG measures and with the employment indicator. Thus, models presented in Table 8 are restricted to employed individuals.

Specification 1 suggests significant REG differentials in work PA among working individuals. Blacks and Hispanics engage in significantly greater work PA (by about 1.9-3.0 MET*hours or 9.4-14.8%) relative to non-Hispanic Whites. Work PA is lower for Asians. Males engage in 6.4 (32%) MET*hours more of work PA compared to females. All of these REG differentials can be partially attributed to the individual-specific human capital and socio-economic measures and the MSA fixed effects. Specifically, the differential among Asians and Blacks falls by 57-58%, that among Hispanics falls by 65%, and the gender differential falls by 24%.

Work PA reflects an inverse parabolic relationship over the life cycle, reaching a maximum at about age 44. This suggests some sort of sorting process, initiated by either individuals or firms or both, which shifts workers away from more physically demanding jobs at some point in the work cycle. Education, income, and wage are negatively associated with work PA , consistent with more educated and higher income individuals working in less physically-demanding occupations.

Health

Table 9 presents estimates for specifications which use self-reported health as the dependent variable. Health is measured here as a dichotomous indicator reflecting individuals who report that their health is excellent or very good. These models are estimated via probit regression, and marginal effects are presented. Specification 1 shows that all racial/ethnic groups have a lower probability of reporting excellent or very good health by between 6.4-22.6 percentage points, relative to non-Hispanic Whites. Males have a two percent higher probability of reporting excellent or very good health relative to females.

Specification 2 adds controls for age, education, family structure, employment, income and wages, and MSA fixed effects. Comparing specifications 1 and 2, about 31-36% of the observed health differential for Blacks and Hispanics can be attributed to these factors. However, the inclusion of these factors causes the gender differential to reverse; males are now less likely to be in excellent or very good health by about 1.8

percentage points. Racial/ethnic differentials in health persist even after accounting for these individual-level human capital, socioeconomic factors, and residential choice.

Since non-work PA is associated with better health, REG differentials in PA may potentially contribute to REG differential in health. Specification 3 investigates this possibility by controlling for work PA and total non-work PA.[14] It should be noted that since PA and health are endogenous these coefficients should not be interpreted as causal. The PA measures act as controls and thus their coefficients can be interpreted as partial correlations. The coefficients in specification 3 can differ from those of specification 2 to the extent that the PA measures are correlated with the variables in equation 2, and to the extent that endogeneity bias has been introduced into the equation. The similarity in the other non-REG coefficients between specifications 2 and 3 suggests that whatever endogeneity bias is introduced by the PA measures does not significantly impact the conclusions derived from specification 3 at least with respect to sign and significance. Nevertheless, the endogenous coefficients of the PA variables are only suggestive of partial correlations and are not interpreted as measures of causal influence.

Work PA and total non-work PA does not substantially contribute to the observed health differential among Hispanics, Asians, or other racial groups. Among Blacks, PA, however, can potentially account for 9-10% of the observed health differential. Among males, it can account for 33% of the observed health differential (though the absolute health differential across genders is relatively small).

The causality from total non-work PA to health and from health to total non-work PA is theorized to be positive in both directions. The positive and significant coefficient

[14] Specification 3 represents a health production function as noted in equations 1 and 4.

of total non-work PA most likely reflects the fact that these two underlying relationships are both positive. However, in the case of work PA, prior studies suggest that work PA can adversely impact health, but that health has a positive effect on work PA. In specification 3, the coefficient of work PA is insignificant which may reflect the fact that the two underlying relationships are oppositely signed. The coefficients of the other factors are consistent with the literature; health is found to increase with education, income, and marital status.

6. Conclusions

This study utilizes all-inclusive measures of PA from a nationally-representative sample, and more precisely measures PA by capturing both the duration and intensity of the activities. Estimates indicate that leisure PA comprises only about 10% of total non-work PA which underscores the importance of considering all types of PA since an exclusive focus on a single type of PA can substantially understate PA and lead to biased estimates of REG differences. The data show that non-work PA is significantly lower among Blacks, Hispanics, other racial groups as well as among males. These differentials can be partially explained by education, socio-economic status, proxies for time constraints, and locational fixed effects. Observed differentials in non-work PA among Blacks, Hispanics, and males diminish by between 25-46% after including individual-level human capital, MSA fixed effects, work PA and other factors. Work PA is significantly lower among Asians and higher among all other racial/ethnic groups relative to non-Hispanic Whites. It is also significantly higher among males. Work PA is found to have a negative effect on non-work PA.

A number of studies have investigated education, health behaviors, and access to medical care as factors contributing to REG differences in health. However, PA remains an understudied factor as a potential contributor to these health differences. This study shows that significant REG differentials in work PA and non-work PA exist. And, while about 33-50% of these differences can be attributed to human capital, time constraints, and locational choices, a substantial differential still remains after controlling for these factors. Since non-work PA is associated with better mental and physical health outcomes, reducing the disparities in PA may help to reduce REG health gradients.

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Table 1
Means

Variable Name	ATUS Variables Definition	MSA Residents	MSA Residents with Health Data	Large County Residents
Leisure PA	Leisure PA (hours times MET).	1.485	1.513	1.54
Active travel PA	Active Travel PA (hours times MET).	1.981	1.964	2.002
Home PA	Home PA (hours times MET).	4.703	4.674	4.698
Other PA	PA in all other non-work Activity (hours times MET).	6.18	6.22	6.12
Total non-work PA	Total Non-work PA (hours times MET).	14.34	14.265	14.459
Work PA	Work PA (usual work hours times MET).	12.641	12.878	12.718
Work PA (employed only)	Work PA (usual work hours times MET). n = 47,396.	20.30		
Age	Age of individual.	43.426	43.484	43.06
Male	Equals one if the individual is Male.	0.485	0.487	0.484
Black	Equals one if the individual is Black.	0.124	0.124	0.121
White	Equals one if the individual is White.	0.668	0.663	0.627
Asian	Equals one if the individual is Asian.	0.04	0.039	0.045
Other Race	Equals one if the individual is American Indian, Alaskan Native, Hawaiian or reports any race combination.	0.017	0.019	0.019
Hispanic	Equals one if the individual is Hispanic.	0.154	0.156	0.188
Children	Number of children in the household under 18.	0.827	0.822	0.847
Employed	Equals one if the individual is employed.	0.652	0.662	0.652
Income	Annual Family income divided by 100.	5,3319.89	5,5469.58	5,2317.20
Wage	Wage rate times employed. Zero for individuals who are not employed.	11.04	11.54	11.02
Education	Years of education.	13.331	13.373	13.289
Married	Equals one if the individual is married.	0.535	0.533	0.531
Health	Equals one if the individual reports that their health is either excellent or very good.	_	0.54	_
	Appended Variables 2003-2008	-	-	-
Crime	Per capita crimes per year.	-	-	38.398
Pedestrian Fatalities	Per capita pedestrian fatalities per year.	-	-	0.016
Temperature	Average daily temperature.*	-	-	56.15
Temperature Squared	Average daily temperature squared.*	-	-	3,425.36
Precipitation	Average daily precipitation.*	-	-	3.255
Sports rental	Per capita number of stores that rent recreational equipment.	_	_	0.007
Density	Population per square mile.	-	-	1,481.35
Data Period		2006-2009	2006-2008	2003-2008
Sample size		76,623	29,234	30,090
* monthly and county variation but no annual variation				

Table 2
Correlations across Types of PA

Variable	Work PA	Leisure PA	Active Travel PA	Home PA
Total non-work PA	-0.050*** (0.0000)	–	–	–
Leisure PA	-0.008** (0.0337)	–	–	–
Active Travel PA	0.018*** (0.0000)	0.033*** (0.0000)	–	–
Home PA	-0.027*** (0.0000)	-0.050*** (0.0000)	-0.133*** (0.0000)	–
Other PA	-0.065*** (0.0000)	-0.081*** (0.0000)	0.024*** (0.0000)	-0.075*** (0.0000)

P values are in parentheses. *** $p<0.01$, ** $p<0.05$. Each correlation pair holds constant the other PA variables. Additional variables held constant are: Black, Hispanic, Asian, Other Race, Male, Age, Age Squared, Education, Income, Children, Married, Part-Time Employment, Wage, Employed and MSA, year and month fixed effects. The sample size is 76,623.

Table 3
Leisure PA

Model	(1)	(2)	(3)	(4)
Variables	MSA	MSA	County	County
Asian	-0.0818 (0.0886)	-0.349*** (0.0919)	0.0150 (0.140)	-0.234 (0.147)
Black	-0.496*** (0.0469)	-0.355*** (0.0497)	-0.478*** (0.0800)	-0.267*** (0.0872)
Hispanic	-0.273*** (0.0486)	-0.321*** (0.0601)	-0.259*** (0.0732)	-0.215** (0.0937)
Other Race	0.206 (0.193)	-0.0118 (0.184)	0.357 (0.307)	0.0976 (0.282)
Male	1.029*** (0.0368)	1.107*** (0.0394)	1.033*** (0.0591)	1.107*** (0.0636)
Age	–	-0.0935*** (0.00619)	–	-0.0931*** (0.00976)
Age Squared	–	0.000690*** (5.88e-05)	–	0.000695*** (9.50e-05)
Education	–	0.00580 (0.00673)	–	0.0195* (0.0108)
Income	–	0.00693*** (0.000525)	–	0.00673*** (0.000861)
Children	–	0.00549 (0.0183)	–	-0.0135 (0.0287)
Married	–	-0.269*** (0.0363)	–	-0.264*** (0.0558)
Part-time	–	0.168*** (0.0585)	–	0.184** (0.0924)
Wage	–	0.00638*** (0.00152)	–	0.00731*** (0.00210)
Employed	–	-0.392*** (0.0707)	–	-0.407*** (0.109)
Work PA	–	-0.0138*** (0.00240)	–	-0.0141*** (0.00402)
Crime	–	–	–	0.0100 (0.00941)
Pedestrian Fatalities	–	–	–	2.509 (5.648)
Sports Rental	–	–	–	5.451 (18.00)
Density	–	–	–	0.000538* (0.000296)
Temperature	–	–	–	0.0342*** (0.0127)
Temperature Squared	–	–	–	-0.000171 (0.000154)
Precipitation	–	–	–	-0.0305 (0.0271)
Observations	76,623	76,623	30,090	30,090
R-squared	0.018	0.043	0.019	0.052
Year & Month Indicators	Yes	Yes	Yes	Yes
MSA Indicators	No	Yes	No	No
County Indicators	No	No	Yes	Yes

Robust clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4
Active Travel PA

Model	(1)	(2)	(3)	(4)
Variables	MSA	MSA	County	County
Asian	-0.0468 (0.0440)	-0.246*** (0.0442)	-0.0127 (0.0660)	-0.170** (0.0672)
Black	-0.164*** (0.0237)	-0.0835*** (0.0247)	-0.128*** (0.0388)	-0.0470 (0.0419)
Hispanic	-0.139*** (0.0230)	0.0471* (0.0277)	-0.148*** (0.0355)	0.0418 (0.0434)
Other Race	-0.197*** (0.0618)	-0.136** (0.0612)	-0.186** (0.0881)	-0.134 (0.0868)
Male	0.574*** (0.0169)	0.473*** (0.0173)	0.588*** (0.0266)	0.483*** (0.0278)
Age	–	0.0509*** (0.00257)	–	0.0535*** (0.00410)
Age Squared	–	-0.000551*** (2.61e-05)	–	-0.000575*** (4.23e-05)
Education	–	0.0714*** (0.00301)	–	0.0702*** (0.00491)
Income	–	0.00129*** (0.000228)	–	0.000833** (0.000373)
Children	–	0.0690*** (0.00813)	–	0.0754*** (0.0129)
Married	–	-0.168*** (0.0187)	–	-0.153*** (0.0302)
Part-time	–	-0.119*** (0.0273)	–	-0.132*** (0.0433)
Wage	–	0.00183*** (0.000614)	–	0.00273*** (0.000845)
Employed	–	0.538*** (0.0333)	–	0.500*** (0.0532)
Work PA	–	-0.000125 (0.00115)	–	0.000804 (0.00184)
Crime	–	–	–	0.00254 (0.00424)
Pedestrian Fatalities	–	–	–	1.946 (2.437)
Sports Rental	–	–	–	6.893 (7.647)
Density	–	–	–	9.63e-05 (0.000138)
Temperature	–	–	–	0.0136** (0.00598)
Temperature Squared	–	–	–	-8.79e-05 (6.79e-05)
Precipitation	–	–	–	-0.00897 (0.0116)
Observations	76,623	76,623	30,090	30,090
R-squared	0.019	0.076	0.019	0.083
Year & Month Indicators	Yes	Yes	Yes	Yes
MSA Indicators	No	Yes	No	No
County Indicators	No	No	Yes	Yes

Robust clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5
Home PA

Model	(1)	(2)
Variables	MSA	MSA
Asian	-0.948*** (0.111)	-0.742*** (0.110)
Black	-1.940*** (0.0623)	-1.678*** (0.0679)
Hispanic	-0.281*** (0.0699)	0.0611 (0.0782)
Other Race	-0.782*** (0.191)	-0.386** (0.191)
Male	-1.720*** (0.0496)	-1.450*** (0.0509)
Age	–	0.308*** (0.00758)
Age Squared	–	-0.00275*** (8.08e-05)
Education	–	-0.00983 (0.00907)
Income	–	-3.75e-07 (6.40e-07)
Children	–	0.234*** (0.0235)
Married	–	0.865*** (0.0556)
Part-time	–	0.630*** (0.0806)
Wage	–	0.00229 (0.00165)
Employed	–	-1.775*** (0.102)
Work PA	–	-0.00391 (0.00354)
Observations	76,623	76,623
R-squared	0.027	0.081
Year Indicators	Yes	Yes
Month Indicators	Yes	Yes
MSA Indicators	No	Yes

Robust clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6
Other Non-work PA

Model	(1)	(2)
VARIABLES	MSA	MSA
Asian	0.970*** (0.128)	0.137 (0.122)
Black	-1.061*** (0.0584)	-0.618*** (0.0609)
Hispanic	-0.747*** (0.0585)	-0.560*** (0.0699)
Other Race	0.0772 (0.170)	-0.148 (0.165)
Male	-1.687*** (0.0405)	-1.311*** (0.0414)
Age	–	-0.167*** (0.00695)
Age Squared	–	0.00116*** (7.06e-05)
Education	–	0.245*** (0.00759)
Income	–	3.95e-06*** (5.65e-07)
Children	–	0.572*** (0.0212)
Married	–	0.545*** (0.0451)
Part-time	–	1.031*** (0.0704)
Wage	–	0.00256* (0.00134)
Employed	–	-1.789*** (0.0825)
Work PA	–	-0.0293*** (0.00257)
Observations	76,623	76,623
R-squared	0.029	0.123
Year Indicators	Yes	Yes
Month Indicators	Yes	Yes
MSA Indicators	No	Yes

Robust clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7
Total Non-work PA

Model	(1)	(2)
Variables	MSA	MSA
Asian	-0.106 (0.180)	-1.200*** (0.177)
Black	-3.661*** (0.0967)	-2.734*** (0.103)
Hispanic	-1.441*** (0.0976)	-0.773*** (0.114)
Other Race	-0.695** (0.303)	-0.682** (0.294)
Male	-1.804*** (0.0700)	-1.181*** (0.0724)
Age	–	0.0985*** (0.0116)
Age Squared	–	-0.00145*** (0.000118)
Education	–	0.312*** (0.0128)
Income	–	1.18e-05*** (9.33e-07)
Children	–	0.881*** (0.0344)
Married	–	0.973*** (0.0769)
Part-time	–	1.711*** (0.116)
Wage	–	0.0131*** (0.00248)
Employed	–	-3.418*** (0.143)
Work PA	–	-0.0471*** (0.00496)
Constant	15.84*** (0.134)	12.12*** (1.933)
Observations	76,623	76,623
R-squared	0.028	0.096
Year Indicators	Yes	Yes
Month Indicators	Yes	Yes
MSA Indicators	No	Yes

Robust clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8
Work PA
Employed Individuals

Model	(1)	(2)
Variables	MSA	MSA
Asian	-1.665*** (0.207)	-0.709*** (0.187)
Black	1.943*** (0.142)	0.818*** (0.129)
Hispanic	2.997*** (0.123)	1.057*** (0.128)
Other Race	0.461 (0.340)	-0.0193 (0.296)
Male	6.385*** (0.0853)	4.830*** (0.0757)
Age	–	0.358*** (0.0168)
Age Squared	–	-0.00411*** (0.000188)
Education	–	-0.579*** (0.0164)
Income	–	-0.00960*** (0.00111)
Children	–	0.0306 (0.0377)
Married	–	0.195** (0.0874)
Part-time	–	-10.47*** (0.0821)
Wage	–	-0.0635*** (0.00619)
Constant	15.97*** (0.172)	23.67*** (2.926)
Observations	47,396	47,396
R-squared	0.119	0.355
Year Indicators	Yes	Yes
Month Indicators	Yes	Yes
MSA Indicators	No	Yes

Robust clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9
Self-Reported Health
Probit Models

Model	(1)	(2)	(3)
Variables	MSA	MSA	MSA
Asian	-0.064*** (0.0159)	-0.164*** (0.0171)	-0.159*** (0.0172)
Black	-0.183*** (0.0084)	-0.117*** (0.0096)	-0.106*** (0.0097)
Hispanic	-0.226*** (0.0080)	-0.157*** (0.0104)	-0.155*** (0.0105)
Other Race	-0.089*** (0.0218)	-0.095*** (0.0236)	-0.093*** (0.0238)
Male	0.020*** (0.0059)	-0.018** (0.0064)	-0.012* (0.0065)
Age	–	-0.013*** (0.0010)	-0.014*** (0.0010)
Age Squared	–	0.000*** (0.0000)	0.0001*** (0.0000)
Education	–	0.033*** (0.0013)	0.031*** (0.0013)
Income	–	0.001*** (0.0001)	0.001*** (0.0001)
Children	–	-0.003 (0.0032)	-0.007* (0.0032)
Married	–	0.022** (0.0071)	0.018** (0.0071)
Part-time	–	-0.003 (0.0098)	-0.014 (0.0109)
Wage	–	0.0004* (0.0002)	0.0003 (0.0002)
Employed	–	0.098*** (0.0088)	0.121*** (0.0126)
Work PA	–	–	0.00005 (0.0004)
Total Non-work PA	–	–	0.005*** (0.0003)
Observations	29234	29234	29234
Pseudo R-squared	0.026	0.113	0.118
Year Indicators	Yes	Yes	Yes
Month Indicators	Yes	Yes	Yes
MSA Indicators	No	Yes	Yes

Marginal effects are reported, with robust clustered standard errors reported are in parentheses. *** p<0.01, ** p<0.05, * p<0.1