



12-2018

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Rachel Cusatis

Medical College of Wisconsin

Dana Garbarski

Loyola University Chicago, dgarbarski@luc.edu

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ELSEVIER

Contents lists available at ScienceDirect

SSM - Population Health

journal homepage: www.elsevier.com/locate/ssmph

Article

Which activities count? Using experimental data to understand conceptualizations of physical activity

Rachel Cusatis^{a,*}, Dana Garbarski^b^a Medical College of Wisconsin, CIBMTR, 9200 W. Wisconsin Ave., Suite C5500, Milwaukee, WI 53226, United States^b Department of Sociology, Loyola University Chicago, 1032 W. Sheridan Rd., 440 Coffey Hall, Chicago, IL 60660, United States

ARTICLE INFO

Keywords:

health disparities
physical activity
gender
socioeconomic status
experimental design
survey methods
Mechanical Turk
United States

ABSTRACT

US health surveys consistently report that men and those with higher socioeconomic status (SES) engage in more physical activity than women and lower SES counterparts, using questions that ask about physical activity during leisure time. However, social characteristics such as gender and SES shape understandings of and access to leisure-based physical activity as well as other domains where healthy activity is available – namely house work, care work, and paid work. Thus, the physical activity of US adults may look different when what counts as physical activity expands beyond leisure activity.

The current study uses Amazon's Mechanical Turk platform to conduct a 2-by-2-by-2 factorial experiment that crosses three types of physical activities: leisure, house or care work, and paid work. We find that physical activity questions that prime respondents – that is, ask respondents – to consider house/care work or paid work lead to increased minutes reported of physical activity compared to not priming for physical activity, while asking about leisure is no different from having no physical activity primed. The effect on reported physical activity of priming with house/care work is stronger for women than men, demonstrating support for gendered specialization of time spent in the house and care work domain. The effects on reported physical activity of priming with house/care work and paid work are stronger for those with less education compared to more education, consistent with socioeconomic divisions in access to physical activity in house/care work and employment. This study highlights the contingency of our understanding of the physical activity of US adults on both its measurement in surveys and the social forces which shape understanding of and access to physical activity.

Introduction

One of the central reasons physical activity is consistently tracked in health surveys is the importance of this indicator for public health. In the US, one major strategy for preventing obesity, cardiovascular diseases, diabetes, and even some cancers are recommendations to increase physical activity (Jakicic & Otto, 2005). Despite these recommendations, overall daily activity levels have declined, and as of 2010, only 48% of US adults achieve the recommendations of ≥ 30 min of moderate-to-vigorous physical activity (MVPA) on at least five days per week (CDC, 2014; Flegal, Carroll, Kit, & Ogden, 2012).

Currently, three main surveys track the overall health and physical activity of the country. The National Health and Nutrition Examination Survey (NHANES), National Health Interview Survey (NHIS), and Behavioral Risk Factor Surveillance System (BRFSS) serve as key sources of information furthering our understanding of the relationship

between habitual physical activity and chronic disease morbidity and mortality (Carlson, Densmore, Fulton, Yore, & Kohl, 2009).

National data demonstrate that men and those with higher socioeconomic status (SES) meet physical activity guidelines compared to women and those with lower SES, respectively (Seo & Torabi, 2007). The Center for Disease Control and Prevention (CDC) reported men are more likely to meet physical activity guidelines compared to women by ten percentage points (56% vs. 46%), and Americans who are more educated and have a family income above the poverty line are more likely to meet physical activity guidelines compared to their lower SES counterparts (CDC, 2014). Thus, our best public health data indicate important gender and SES disparities in physical activity.

However, the survey questions used to produce these data focus on physical activity during leisure time (Maddison et al., 2007). This is problematic because social characteristics such as gender and SES shape understandings of and access to leisure and other physical activity in

* Corresponding author.

E-mail addresses: rcusatis@mcw.edu (R. Cusatis), dgarbarski@luc.edu (D. Garbarski).<https://doi.org/10.1016/j.ssmph.2018.10.002>

Received 19 February 2018; Received in revised form 5 October 2018; Accepted 7 October 2018

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ways that might influence estimates of overall physical activity (Mattingly & Sayer, 2006; Mullahy & Robert, 2010; Smith, Ng, & Popkin, 2014; Wajcman, 2014). An understanding of the gendered (Bittman, England, Sayer, Folbre, & Matheson, 2003; England & Srivastava, 2013; Gupta, 2007; Raley, Bianchi, & Wang, 2012; Sullivan, 2013) and socioeconomically stratified (Beenackers, et al., 2012; Krieger, Williams, & Moss, 1997; Wright, 1995) patterns surrounding other domains of physical activity, such as housework and dependent care work (here after “house/care work”) and paid work, suggests different opportunities for physical activity. For housework, activities such as interior and exterior cleaning as well as vacuuming provide physically active tasks. For paid work, occupations most likely to provide people with physically active tasks are service and manufacturing professions (e.g. construction worker, plumber, electrician, carpenter, cleaner, hospital nurse) as well as forestry, farming, and fishing.

We first review previous theory and empirical evidence that demonstrates how different definitions of “physical activity” shape the magnitude and direction of gender and SES differences in time spent in physical activity. We then present the results from a question-design experiment in which we manipulate the types of activities respondents are asked to consider when reporting physical activity in order to examine (1) how priming respondents with different domains of physical activity is associated with reported levels of physical activities and (2) whether the association between the type of physical activity questioned and the reported physical activity varies by respondents’ gender and socioeconomic status.

Background

Historical conceptualizations of physical activity

The conceptualization of what counts as physical activity and how it should be measured from a public health perspective has seen many transformations. For decades, research on physical activity and health outcomes relied on an occupational classification system to indicate the intensity of men’s physical exertion on the job (Haskell, 2012; Morris & Crawford, 1958). These data were used to draw associations among men’s level of activity and severe coronary events and mortality (Morris & Crawford, 1958). In fact, until the mid-1970s, studies on physical activity did not include data on women or the unemployed (Haskell, 2012). Thus, activities traditionally done by women or lower SES individuals were not even accounted for in public health measures of physical activity for the majority of the 20th century.

The 1970s saw a shift away from occupation-based activity measurement towards self-reported physical activity that included women and those not captured in the occupational rating system. At this point, women and lower SES individuals were finally, at least implicitly, included in empirical inquiry. However, most of the current measures of physical activity focus on activities performed during leisure time, defined as time that is not spent in paid work, unpaid work, or self-care (Mattingly & Sayer, 2006; Robinson & Godbey, 2010).¹ Thus, an important and understudied area of research is unpacking the potential for health promoting physical activity across the domains of time allocation beyond leisure: home, care, and work.

Current public health research utilizes metabolic equivalents (METs) to measure moderate to vigorous activity, or activity that is physically benefitting (WHO, 2012). Thus, METs are used to inform questions priming about physical activity to ensure reports reflect individuals time spent in ‘health benefitting’ activity.

¹ Leisure time, or free time, is a finite resource that represents greater time autonomy, particularly the freedom to protect sufficient time from obligatory demands (Robinson & Godbey, 1997; Bittman & Wajcman, 2000; Bianchi & Mattingly, 2003; Mattingly and Sayer 2006).

Gender and SES disparities across three domains

Early theoretical understandings of time allocation have trichotomized an individual’s time into a balance between three domains: market work (paid work), housework (unpaid work), and leisure time (Becker, 1965; Gronau, 1976). From the beginning, SES and gender were recognized as social forces influencing the appropriation of time to these three domains (Gronau, 1976).

Gronau (1976) posited that the presence of children, especially younger ones, decreased women’s time in leisure more significantly than men’s. More recent research confirms, suggesting that in contemporary society, access to leisure is still not equally distributed across gender (Sayer, 2005). Research indicates that women have less free time than men and that employment, marriage, and children curtail women’s free time more than men’s (Bianchi, Robinson, & Milkie, 2007; Sayer, 2005). Additionally, research asserts women dedicate smaller portions of their time to pure, uninterrupted leisure-time exercise than men (Becker, 1965; Robinson & Godbey, 2010).

There is general consensus in the literature, rooted in the theory of time allocation, that people in higher socioeconomic positions—education, occupation, income and wealth—are more likely to engage in moderately active leisure activities compared to those in lower socioeconomic positions (Beenackers et al., 2012). A major barrier to leisure time physical activity among lower-SES individuals is access and resource availability (Becker, 1965; Crespo, Ainsworth, Keteyian, Heath, & Smit, 1999; Gronau 1976; McNeill, Kreuter, & Subramanian, 2006). Increased income results in alleviation of time from other domains, namely housework, that results in more time available to dedicate to leisure for both men and women (Gronau, 1976; Becker, 1965). Moreover, leisure time physical activity, especially vigorous activity, requires resources (i.e. gym membership, athletic equipment, team fees) that creates more of a challenge and barrier for lower-SES individuals compared to their higher-SES counterparts (Beenackers et al., 2012). A lack of safe and walkable neighborhood green spaces in lower-SES neighborhoods also poses a hindrance on leisure-time physical activity (McNeill et al., 2006; Sallis et al., 2009).

It is understood that housework is a deeply gendered activity and that women have retained the responsibility for it, especially for routine housework activities, despite economic gains (Hook, 2017). Gender specialization of time means women who engage in more unpaid work such as childcare and housework may be more likely to engage in activities that qualify as moderate physical activity through non-leisure activities compared to men. Further, both cross-sectional and longitudinal studies suggest intensive domestic work significantly lowers all-cause mortality (Besson et al., 2008; Stamatakis, Hamer, & Lawlor, 2009). This key link among gender specialization in time use and differential exposure to moderate physical activity is not captured in current measures of self-reported physical activity or addressed in public health research.

The gender ideology and gendered life course perspectives both emphasize the role of identity as well as larger systemic structural processes that reinforce links among gender and work/family roles (Goffman, 1977; West & Zimmerman, 1987). The “man as breadwinner/woman as care provider” model, which has been historically relevant since the mid-19th century, remains culturally influential in contemporary society (Warren, 2007). This cultural model continues to promote a gendered division of paid and unpaid work (Craig & Brown, 2017). In addition, the life course perspective recognizes the important interplay of gender and age due to the timing of role transitions (e.g. child, homeownership, job transition, adult care) (Umberson, Williams, Powers, Liu, & Needham, 2006; Moen & Chermack, 2005). For instance, women work less than men and continue to be the primary household managers and care providers, in spite of involvement in the labor force (Moen & Sweet, 2002). Additionally, caring for older relatives is still performed predominantly by women (Chesley & Poppie, 2009; Laditka & Laditka, 2000). Throughout the life course, roles, relationships, and

resources, which are all shaped by gender, provide different opportunities for physical activity (Moen & Chermack, 2005; Williams & Umberson, 2004). Most critical is women's higher likelihood to: (1) engage in daily housework; (2) care for children at the early child stage in life and (3) care for older adults at yet another life course stage (Williams & Umberson, 2004).

Theoretical foundations for SES inequalities in time spent on house/care work are similar to gender inequalities, focusing on resource availability, time constraint, and technological advancements as key mechanisms impacting socioeconomic differences in house/care work. Resource availability perspectives assert that more affluent individuals have more liquid income to outsource the tasks of housework and childcare (e.g., hiring cleaning services and child care services) or purchase technological solutions (e.g., dishwashers, robotic vacuums) whereas less affluent individuals are more limited in their ability to outsource domestic work (John & Shelton, 1997).

Yet activity in house/care work does not show a clear relationship with SES. Some literature suggests there are no socioeconomic divisions in cleaning and house care (Greenstein, 2000; Gregson & Lowe, 1993). Other literature suggests both positive and negative relationships. Researchers found that financial limitations among lower-socioeconomic individuals leads to increased likelihood for engaging in physical activity in housework and care activities such as multi-tasking with child care, housework, and physical exertion for transportation (Ford et al., 1991; McNeill et al., 2006; Smith et al., 2014). Further, higher SES individuals often have more favorable working conditions with more resources (e.g. flexibility and control over the work situation), in addition to better pay. These resources have been suggested to facilitate combining work and family for those with higher SES (Falkenberg, Lindfors, Chandola, & Head, 2016; Schieman, Whitestone, & Van Gundy, 2006). Yet, Schieman et al. (2006) found that higher SES individuals reported higher levels of conflict between work and family, suggesting the advantages in resources for higher SES individuals failed to counterbalance demands. With such inconclusive results in the literature, further understanding of the relationship between socioeconomic standing and physically active house/care work is necessary.

For decades, labor markets have been segmented along gender lines, with some jobs being predominantly restricted to men, while other jobs are primarily restricted to women (Reich, Gordon, & Edwards, 1973). Even today, gender segregation within occupations remains high (Cohen, 2013), with cultural consensus on who does what job is a key mechanism maintaining gender divisions in paid work (Reskin & Bielby, 2005). Further, workplaces incorporate gender segregation into employment structures and practices such as job assignment and promotion practices (Reskin & Bielby, 2005). Other theory points to the work and family dichotomy where “doing gender” is a mechanism influencing gender segregation at paid work, such that women are expected to retain responsibility in other domains for time constraints caused by paid work (Hochschild, 1997; West & Zimmerman, 1987).

Gender-based workforce segregation impacts physical activity because of the differential opportunities available for physical activity while on the job (Church et al., 2011). Though most contemporary jobs are sedentary, there are still some occupations providing opportunity for physical activity (Tudor-Locke, Washington, Ainsworth, & Troiano, 2009). These occupations include service, manufacturing, laborers, and farming/forestry (Tudor-Locke et al., 2009). According to the Bureau of Labor Statistics (BLS), of the top twenty jobs occupied by women, about three of the top twenty (janitors and building cleaners, restaurant servers, and housekeeping cleaners) require moderate physical activity (BLS, 2014). In contrast, six of the top jobs for men (construction, durable and nondurable goods manufacturing, repair and maintenance services, janitors and building cleaners, and restaurant servers) require moderate physical activity (BLS, 2014). The potential for gender segregation within the labor force may lead to gender differences in the proportion of time spent in sedentary or moderate activity at work, which may leave men with greater opportunity than women for

moderate physical activity (Parry & Straker, 2013). Importantly, time spent in physically demanding activity at work has been significantly associated with negative health outcomes among men who disengage in leisure physical activity, suggesting consistent moderate activity may not promote health (Holtermann et al., 2012) or has demonstrated no significant relationship with health outcomes like glucoregulation (Tsenkova, Lee, & Boylan, 2017). Activity at work still remains largely understudied, and further understanding among Americans is important (Spinney et al., 2011).

Positions with more power, and therefore more social and monetary compensation, are managerial and non-manual labor positions that require more credential assets (Wright 1995; Krieger et al., 1997). As a result, the hierarchy of occupations places non-manual labor skilled jobs higher in the social and monetary capital ladder compared to professions associated with more manual labor skill (Wright, 1995; Krieger et al., 1997). Systematic reviews of the research confirm the higher prevalence of physical activity among lower-income occupations (Beenackers et al., 2012; Tudor-Locke et al., 2009).

Current study

Given the focus on physical activity during leisure time, current health surveillance questions are not able to account for pathways to physical activity that are taken on by women and lower-SES individuals, potentially misrepresenting levels of physical activity engagement in the US both overall and across social groups. Based on these theoretical understandings of the ways in which gender, SES, and different domains of activity are related to physical activity, we expect the following:

H1. The amount of physical activity (number of minutes per week) respondents report engaging in will vary across the experimental conditions in which different combinations of physical activity domains are primed. In particular, we expect that more types of physical activities mentioned in the question will allow respondents more opportunities to think of physical activities engaged in. Thus, the fewest minutes of physical activity will be reported with no priming of types of physical activity, and the most minutes when three types of physical activities are primed.

H2a. The effect on reported physical activity of priming respondents to consider *leisure* compared to no priming of physical activity domains will vary by *gender*, such that the effect of priming for leisure compared to no priming will be positive and stronger for men than women.

H2b. The effect on reported physical activity of priming respondents to consider *leisure* compared to no priming will vary by *SES* (proxied by education), such that the effect of priming for leisure compared to no priming will be positive and stronger for higher SES than lower SES individuals.

H3a. The effect on reported physical activity of priming respondents to consider *house/care work* compared to no priming will vary by *gender*, such that the effect of priming for house/care work compared to no priming will be positive and stronger for women than men.

H3b. We have no a priori hypotheses with respect to priming with house/care work compared to no priming varying by *SES*, since prior research suggests both more and less engagement with house/care work across higher and lower SES.

H4a. The effect on reported physical activity of priming respondents to consider *paid work* compared to no priming will vary by *gender*, such that the effect of priming for paid work compared to no priming will be positive and stronger for men than women.

H4b. The effect on reported physical activity of priming respondents to consider *paid work* compared to no priming will vary by *SES*, such that the effect of priming for paid work compared to no priming will be

positive and stronger for lower SES than higher SES individuals.

Methods

Sample

We used Amazon's Mechanical Turk to recruit participants, and Qualtrics as the survey platform. In 2005, Amazon introduced Mechanical Turk (MTurk) as a "marketplace for work that requires human intelligence," by bringing together the people and tools to enable task creation, recruitment, compensation, and data collection (Buhrmester, Kwang, & Gosling, 2011). MTurk does not yield a nationally representative probability sample—workers tend to be younger and more educated than the general population, and anyone with a Social Security Number can participate, regardless of where they live. While we lack external validity in this sense, the experimental design does have internal validity—a common tradeoff in many experimental studies. The survey was distributed in July 2016.

A power analysis (not shown) indicated a sample size of 3500 has the potential to illustrate large effect sizes when investigating gender differences and small to intermediate effect sizes for education differences; our final sample size was 3652, although the analytic sample is variably smaller depending on the analysis due to item nonresponse.

Experimental design

We used a 2-by-2-by-2 factorial design to examine the effects of priming respondents to think about three domains when answering questions about physical activity: house/care work, paid work, and leisure. Each of these factors is either present or absent in questions about physical activity, leading to eight experimental treatment groups in which respondents are randomly assigned to one of the following question wordings about physical activity: (1) no domain of physical activity primed in question wording; (2) leisure activity (using the NHANES question wording); (3) physical activity within the unpaid house or care work (house/care work condition) domain; (4) physical activity within the paid work domain (paid work condition); (5) physical activity within both leisure and house/care work domains (leisure + house/care work condition); (6) physical activity within both leisure and paid work domains (leisure + paid work condition); (7) physical activity within both the house/care work and paid work domains (house/care work + paid work condition); and finally (8) physical activity within all three domains (all domains condition).

The question wording used derives from the wording of the NHANES physical activity questions. Each treatment condition holds as much of the original wording constant as possible, varying only the types of activities primed in the script and question. The first question asks about the number of days in a week spent engaging in moderate physical activity. The second question asks respondents for about how long they engage in moderate activity (for exact question wording, see Online Appendix A).

Measures

Dependent variables

The key measurement of moderate physical activity engagement in the study is *minutes per week* spent in moderate physical activity (i.e. the multiplication of respondents' answers to both experimental questions). This operationalization represents the weekly amount of physical activity respondents engage in (e.g., HHS recommends a minimum of 150 min per week of moderate physical activity) (US Dept HHS, 2008). The physical activity measurement tools are likened off of the NHANES question wording, which makes use of "typical week" question wording based on the Physical Activity Questionnaire (PAQ) which has demonstrated construct validity when tested against accelerometer data

(National Health and Nutrition Examination Survey, 2016; van Poppel, Chinapaw, Mokkink, Van Mechelen, & Terwee, 2010).

Gender and SES

Gender (woman = 1, man = 0) and educational attainment (less than a college degree = 1, college degree or more = 0) are the two key independent dichotomous variables in this analysis.² Sex and gender are inextricably linked constructs (Springer, Stellman, & Jordan-Young, 2012). Given that this is self-reported data which is more aligned with gender identity than physiological constructs of "sex," a concept that is also not binary (Ainsworth 2015; Davis 2015), from here on we will refer to the concept as gender.

Analytic strategy

The analytic strategy involves a series of regression analyses, using linear regression for log-transformed minutes per week since the distribution of "minutes per week" is skewed. We regress the dependent variable log transformed minutes per week of physical activity on the experimental factors and their interactions, i.e., leisure, house/care work, paid work, leisure*house/care work, leisure*paid work, house/care work*paid work, and leisure*house/care work*paid work (Table 2). We then examine whether the effects of the physical activity priming vary across gender and levels of education by including interactions among combinations of the experimental factors with gender (Table 3) and education (Table 4).

Results

In Table 1, the first column on the left represents the full sample derived from MTurk. The remaining eight columns represent demographics specific to each treatment group. Non-probability samples generated through methods like MTurk tend to look different from the general population in their sociodemographic characteristics (Buhrmester et al., 2011). However, systematic differences between a non-probability sample and the population are less problematic for an experiment, given the internal validity of experiments through random assignment of respondents to experimental treatments.

Fig. 1 shows the minutes per week by each experimental treatment group (from Table 1). We assessed the differences across the eight experimental treatment groups by regressing natural log minutes per week on experimental treatments and assessed significant differences between treatments with zero, one, two, and three domains primed using t-tests of coefficients across the different reference groups. Rather than focusing on all pairwise comparisons, we examine results in terms of increasing the domains of physical activity being asked (e.g., no priming vs. leisure, leisure alone vs. leisure + paid work, leisure + paid work vs. all three) to align with Hypothesis 1 that more domains of physical activity being primed would lead to more physical activity being reported. We found that asking about paid work alone and house/care work alone were significantly different than not priming for any domain (in other words, two out of three possible differences comparing no priming to one domain primed). Leisure + paid work and leisure + house/care work are significantly different from leisure alone, and house/care + paid work is significantly different from both paid

² Analyses assessing the relationship between household income, a common indicator of SES, and different primes of physical activity were run. Two indicators: (1) one comparing the top 12% of household incomes to those lower and (2) one comparing the top 22% of household incomes to those lower were used to operationalize higher and lower SES. These cutoffs were used because of the categories of our income response scale in the survey. In both cases, regressions did not yield any significant differences between higher and lower household income and were therefore not included in this study. (Results available upon request).

Table 1

Descriptive statistics for the conditions and independent variables from the mechanical turk data collection ($N = 3652$ not including item non-response) *standard errors in parentheses.*

	Full sample	No prime ($N = 473$)	Leisure ($N = 477$)	House/care work ($N = 447$)	Paid work ($N = 452$)	Leisure + house/care work ($N = 451$)	Leisure + paid work ($N = 471$)	House/care work + paid ($N = 438$)	All domains ($N = 449$)
Dependent Variables									
<i>Min/Week</i>	587.5 (16.60)	261.6 (26.31)	214.6 (15.98)	923.2 (60.05)	299.0 (25.48)	867.7 (56.03)	319.6 (29.86)	1031.6 (66.79)	860.7 (52.04)
Independent Variables									
<i>Gender</i>									
Women	55.3	56.2	54.5	55.5	56.6	58.1	55.8	51.6	54.1
Men	44.7	43.8	45.5	44.5	43.4	41.9	44.2	48.4	45.9
<i>Educational Attainment</i>									
H.S. Or Less	9.9	9.3	11.7	8.7	10.2	9.3	8.7	11.0	9.8
Some College	37.8	38.7	36.9	38.9	40.5	36.1	38.9	35.8	36.1
Bachelor's Degree	36.6	36.2	33.1	35.6	34.3	39.7	39.1	35.6	39.2
Master's or More	15.8	15.9	18.2	16.8	15.0	14.9	13.4	17.7	14.9
<i>Household Income (1000s)</i>	44.1 (.4501)	43.4 (1.257)	44.9 (1.371)	41.8 (1.208)	44.29 (1.270)	45.6 (1.312)	45.5 (1.255)	44.8 (1.371)	42.3 (1.294)
Married	38.1	39.9	35.2	37.8	39.2	36.1	41.7	37.8	36.7
Not Married	61.9	60.1	64.8	62.2	60.8	63.9	58.3	62.2	63.7
<i>Age</i>	34.8 (.1901)	34.6 (.5363)	34.4 (.5104)	34.9 (.5535)	35.2 (.5631)	34.6 (.5286)	35.5 (.5302)	34.7 (.5508)	34.9 (.5349)
<i>Health</i>									
Excellent	12.3	12.4	13.7	13.2	10.1	12.0	12.8	14.5	11.2
Very Good	40.9	40.0	40.4	40.6	39.3	39.9	38.5	41.8	44.2
Good	33.1	32.8	32.2	33.0	37.3	31.6	35.5	31.0	32.1
Fair	11.5	12.4	11.8	10.3	10.8	14.3	10.6	10.4	10.3
Poor	2.3	2.4	1.9	2.9	2.5	2.2	2.6	2.3	2.2
<i>Race</i>									
Hispanic	7.7	5.5	8.9	11.5	7.8	6.9	8.1	6.1	5.4
White	74.6	74.6	74.4	71.2	75.8	74.2	74.0	73.7	78.9
Black	6.2	5.5	5.7	7.0	6.0	7.3	7.0	8.6	3.8
Other	7.8	10.0	7.2	6.3	6.7	7.8	7.9	7.9	8.5
Multi-racial	3.7	4.3	3.8	4.1	3.8	3.8	3.0	3.7	3.4
<i>Occupation</i>									
Professional, managerial, Sales	36.5	36.2	36.4	35.9	39.4	34.9	38.9	36.9	33.0
Administrative & service	12.8	14.5	11.5	12.4	11.7	11.7	14.6	12.3	13.2
Education & healthcare	20.2	19.9	19.2	17.0	21.2	22.0	18.5	20.6	23.2
Manual labor	9.5	8.3	8.2	10.2	10.1	12.9	9.8	7.7	9.0
Other	21.1	21.2	24.7	24.6	17.6	18.6	18.3	22.6	21.4
<i>Caretaker Status</i>									
Not a Caretaker	69.0	73.7	73.2	61.7	74.2	66.2	72.3	61.2	68.8
Caretaker of Child < 6	18.1	14.8	15.4	22.7	16.4	20.3	14.3	22.9	18.6
Caretaker of Child > = 6 Or Adult	12.9	11.6	11.4	15.7	9.4	13.6	13.4	15.9	12.6

work alone and house/care work alone (four out of six possible differences comparing one to two domains in which the two domains version contains the single domain being compared). Finally, leisure + paid work was significantly different from all three domains being presented simultaneously (one out of three possible differences). Thus, Hypothesis 1 is partially supported: increasing the number of domains presented to respondents resulted in increasing the number of minutes of physical activity reported in about half of the comparisons

considered moving from zero to three domains of activity being primed, and the content of the domain of activity likely plays a role as well. (Importantly, these analyses test the differences across experimental treatments from Table 1. The analysis in Table 2 assesses the unconditional and conditional effects of the experimental factors to show their overall effects. Fig. 1 [deriving from Table 1] addresses Hypothesis 1 whereas Table 2 sets the stage for the analyses in Tables 3 and 4, which address Hypotheses 2–9).

Table 2
Linear regression of the log-transformed minutes a week reported in physical activity by experimental factors.

Experimental factors and interactions	Minutes a week coefficient	Standard errors	Significant
Paid work	0.231	0.103	*
House/care work	1.03	0.091	***
Paid × house/care work	0.018	0.139	
Leisure	−0.056	0.092	
Paid × leisure	0.100	0.143	
House/care work × leisure	0.094	0.130	
Paid × house/care work × leisure	−0.208	0.193	
Intercept	4.94	0.064	***

Data: 2016 Mechanical Turk Physical Activity Survey, N = 3189.

*p < .05; ** < .01; *** < .001.

Table 3
Linear regression of the log-transformed minutes a week reported in physical activity by experimental factors and gender.

Gender, experimental factors, and interactions	Minutes a week coefficient	Standard errors	Significance
Women	−0.164	0.129	
Paid work	0.209	0.153	
Women × Paid	0.033	0.207	
House/care work	0.671	0.137	***
Women × house/care work	0.646	0.183	***
Paid × house/care work	0.158	0.205	
Women × paid × house/care work	−0.220	0.278	
Leisure	−0.028	0.137	
Women × leisure	−0.056	0.185	
Paid × leisure	0.150	0.185	
Women × paid × leisure	−0.097	0.285	
House/care work × leisure	0.291	0.195	
Women × house/care work × leisure	−0.346	0.260	
Paid × house/care work × leisure	−0.390	0.285	
Women × paid × house/care work × leisure	0.317	0.387	
Intercept	5.03	0.096	***

Data: 2016 Mechanical Turk Physical Activity Survey, N = 3188.

*p < .05; ** < .01; *** < .001

Table 2 shows the regression of (natural log) minutes per week of physical activity on the experimental factors and their interactions. Compared to not priming with any physical activity domain, priming respondents to think of paid work is associated with a significant increase in minutes of physical activity per week reported by respondents, as is priming respondents to think about house/care work. Notably, priming respondents to think of leisure activities—the current method of reporting physical activity in NHANES—is no different from having no type of physical activity mentioned in the question (the effect of leisure compared to no priming is not significant). None of the interactions among the domains of physical activity are statistically significant (See Table 2).

Online Appendix B shows the mean minutes reported for each domain of physical activity (that is, each experimental factor) by gender and educational attainment to provide context for the differences in minutes reported between women and men and lower and higher educated respondents. Table 3 shows the regression of minutes per week of physical activity on the experimental factors, their interactions, and interactions with gender. Hypotheses 2a and 4a are not supported, as the effects of priming for leisure and paid work on reported physical activity do not vary by gender. As evidenced by the significant interactions with gender, the effect of priming respondents to think about house/care work (compared to no priming) on reported physical activity is stronger for women than men. When the question includes

Table 4
Linear regression of the log-transformed minutes a week reported in physical activity by experimental factors and education.

Education, experimental factors, and interactions	Minutes a week coefficient	Standard errors	Significance
No college	−0.052	0.128	
Paid work	−0.107	0.150	
No college × paid	0.619	0.207	**
House/care work	0.832	0.125	***
No college × house/care work	0.430	0.181	*
Paid × house/care work	0.403	0.196	*
No college × paid × house/care work	−0.703	0.278	*
Leisure	−0.016	0.126	
No college × leisure	−0.071	0.184	
Paid × leisure	0.185	0.202	
No college × paid × leisure	−0.115	0.285	
House/care work × leisure	0.143	0.177	
No college × house/care work × leisure	−0.114	0.259	
Paid × house/care work × leisure	−0.208	0.269	
No college × paid × house/care work × leisure	−0.068	0.387	
Intercept	4.96	0.088	***

Data: 2016 Mechanical Turk Physical Activity Survey, N = 3182.

*p < .05; ** < .01; *** < .001.

house/care work (compared to no priming), women show a 91% increase in reported physical activity compared to men (100 × (EXP(0.646) − 1)). Thus, Hypothesis 3a is supported (see Table 3).

Table 4 shows the regression of minutes per week of physical activity on the experimental factors, their interactions, and interactions with education. Hypothesis 2b is not supported, as the effect of priming for leisure on reported physical activity does not vary by level of education (see Online Appendix B for average minutes by education). We had no a priori hypotheses about how the effect of priming with house/care work may vary across education (Hypothesis 3b), given previous research that documents both more and less engagement with house/care work for both lower and higher socioeconomic groups. In this study, the relationship appears to demonstrate more house/care work physical activity among the lower socioeconomic group: when the question includes house/care work (compared to no priming), the respondents in the lower education group show a 54% increase in reported physical activity compared to those in the higher education group (100 − (EXP(0.430) − 1)). We found evidence in support of Hypothesis 4b: among those receiving the paid work version of the physical activity question (compared to no priming), those in the lower education group showed an 86% increase in minutes of physical activity than those in the higher education group (100 × (EXP(0.619) − 1)).

We had no a priori hypotheses about how the different experimental factors would interact with each other and education. However, we found a significant negative interaction between house/care work, paid work, and education. Examining the interactions among the experimental factors for each education level separately (see online Appendix C) indicates that the interaction between paid and house/care work is positive and significant (p < .05) among those with a college education or more and not significant among those with less than a college education. Thus, priming for house/care work and paid work simultaneously has a multiplicative effect on the minutes per week reported of physical activity among those with a college education or more that does not occur among those with less than a college education.

Discussion

Physical activity is considered one of the key health indicators providing insight into the overall health of both groups of individuals

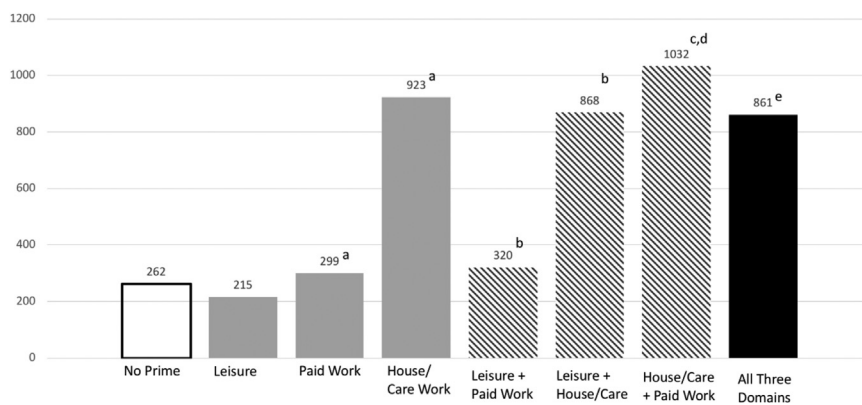


Fig. 1. Average number of minutes per week reported in physical activity by experimental treatment group. Data: 2016 Mechanical Turk Physical Activity Survey, $N = 3189$, ^aSignificantly different ($p < .05$) from no prime, ^bSignificantly different ($p < .05$) from leisure, ^cSignificantly different ($p < .05$) from paid work, ^dSignificantly different ($p < .05$) from house/care work, ^eSignificantly different ($p < .05$) from leisure + paid work.

and societies as a whole (HHS 2008). Accurate understanding of who is accessing physical activity and where they are accessing it is crucial for informing and updating the blueprint of US public health. This research seeks to determine if the current method health surveys use to ask about individuals' level of physical activity was giving a comprehensive picture of this important health determinant.

The findings of this study suggest that priming for different domains of physical activity result in varying levels of reported physical activity engagement. Priming for paid work and house/care work together significantly increases the number of minutes reported compared to only asking about each individually. When time spent in house/care work and paid work are each introduced in survey questions, self-reported minutes per week are higher when compared with wording that mentions no particular type of physical activity. Further, the results suggest that the current reporting methods anchored in language that emphasizes *leisure-time* appears to generate the same estimates of physical activity as questions with no physical activity primed, the latter of which produce significantly lower estimates of physical activity than when similarly-worded questions invite opportunities to consider activity in other domains: paid work and house/care work.

Indeed, results suggest that inattention to social forces connected to gender and SES is limiting our understanding of how much physical activity Americans engage in, and the pathways through which different groups might access these activities. An understanding of the gendered and socioeconomically stratified patterns surrounding activity in house/care work and paid work suggests the potential for different opportunities for physical activity. First, language on house/care work leads to more reported physical activity for women than for men. These results provide support for the gender specialization of time use theory that contends patterns in time use manifest in certain domains, with women allocating more time than men to housework and dependent care activities (Bianchi et al., 2007; Schneider, 2011).

For educational disparities, consistent with theory of occupational segregation that falls along SES and physically active lines, results demonstrate that priming for house/care work and paid work increases physical activity reports for those with less education compared to those with more education (Beenackers et al., 2012; Wright, 1995; Krieger et al., 1997). These results may be indicative of other social forces, for instance, individuals with lower educational attainment might have less control of their time and are more likely to be pulled into obligatory tasks like housework, child care, and care for family members (Becker, 1965; Crespo et al., 1999; Gronau, 1976; McNeill et al., 2006).

Overall, this experiment documents that accounting for time in physical activity in domains *beyond leisure* tells a different story about health and health disparities. Considering a broader range of physical activities should improve our understanding of who is potentially meeting moderate physical activity requirements in the US.

Results should be interpreted with some important limitations in mind. One important area for future research is to link the reported

physical activity to actual physical activity. This study reports on and analyzes *perceptions* of physical activity and not *actual* activity. To that end, perceptions of physical activity are gendered, with men tending to over report physical activity more than women, particularly for house/care work (Kamo, 2000). Further, evidence suggests self-reports of more routine tasks in housework and paid work are less reliable than leisure estimates, which may conflate the results of the gender differences in house/care work and educational differences in paid work (Matthews, Moore, George, Sampson, & Bowles, 2012). Without a secondary source of data to check validity of self-reports (i.e. accelerometers), there is no way to understand the extent to which over (or under) reporting impacted results. Future studies could benefit from more accurate measurements of physical activity such as accelerometers or Fitbits as criteria of interest.

Second, although this study has increased understandings of reported physical activity under certain conditions, we are not able to provide evidence of the validity of these reports without linking to actual physical activity. Therefore, this study is unable to speak to validity of question wording and whether each set of priming language has external validity. Instead, this study provides valuable information regarding the differences that can and, according to our results, *do* occur when with changes to the domain of physical activity referenced.

A third limitation is the use of one indicator (educational attainment) to conceptualize socioeconomic status. Public health and sociological research often use income and occupation as indicators of SES in addition to educational attainment. Limited statistical power with our sample size inhibits our ability to use occupation in this study. Further, analyses comparing the top decile and quarter income households (compared to others) did not yield any significant difference and were, therefore, not discussed in this study. However, much of the research on disparities in physical activity recognize educational attainment as one key indicator that accounts for most of the variation in socioeconomic differences in activity (Seo & Torabi, 2007). Further, educational attainment alone has been found to serve as a key mechanism shaping time in both housework and care work (England & Srivastava, 2013; Sullivan, 2010). Therefore, education as one indicator of SES is an important focus for this work.

Even with these limitations, this study adds valuable knowledge about gender and socioeconomic differences in public health with respect to physical activity. The findings highlight the consequences of relying on survey questions designed to assess levels of physical activity without considering the broad social forces, like gender specialization in time use and SES-segregation patterns in American occupational structures, that shape access to and experiences of physical activity. Indeed, these findings demonstrate that gender and SES create different access points to physical activity through house/care work and paid work. Thus, current physical activity statistics continue to reify common notions of gender and SES disparities in physical activity, rather than illustrating a more accurate picture of the different pathways to moderate physical activity Americans are engaging in. As the

concerns surrounding physical inactivity grows in the United States, results like these underscore that future health surveillance systems must recognize potentially biased results that arise from survey questions that neglect the social processes influencing differences in access to and experience with various types of physical activity.

Ethics disclosure

The data collected for this original, unpublished material was fully reviewed and approved by the University of Wisconsin-Milwaukee Institutional Review Board.

The authors acknowledge no actual or potential conflict of interest including financial, personal or other relationship with other people or organizations within three years of beginning the submitted work that could inappropriately influence, or be perceived to influence, this work.

Declarations of interest

None.

Acknowledgements

The authors would like to acknowledge the Gannon Center for Women and Leadership and Loyola University Chicago for financial support. Dr. Cusatis received support from the Health Resources and Services Administration (HRSA) of the US Department of Health and Human Services (HHS) under grant number and title T32HP10030, Academic Fellowship in Primary Care Research \$1,214,732.00, with 0 percent financed with nongovernmental sources. This information or content and conclusions are those of the authors and should not be construed as the official position or policy of, nor should any endorsements be inferred by HRSA, HHS or the US Government. The authors would like to thank Noelle Chesley, PhD; Marcus Britton, PhD; and Celeste Campos-Castillo, PhD for their help on this project, as well as the anonymous reviewers for their thoughtful feedback. The opinions expressed here are those of the authors.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ssmph.2018.10.002.

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