

Working hours and the metabolic syndrome: The moderating role of Physical activity

Theoretical background

Work plays an increasingly pervasive role in modern life, aggravating the stress it causes. Workload is a central component of the psychological demands and burdens of work, due to a variety of stressors (e.g., extensive work hours, subjective overload, low control or role conflict; Karasek & Theorell, 1990). Although long working hours can be considered as a major source for a variety of health impairments evidence suggests that working hours in Israel and the United States have risen dramatically during the past half-century (Cha, 2013).

The most widely accepted approach to understanding overwork identifies it as an established norm in the workplace. In many professional and managerial jobs, work hours are considered a proxy for a worker's commitment or professional competence. Workers are assessed by their "face time": those who are present at work for long hours are believed to be more committed and thus are rewarded; those who are present at work fewer hours are penalized (Epstein, Seron, Oglensky, & Saute, 1999; Sharone, 2004). Moreover, while working from home is becoming more normative, and various technologies are also making working outside the office more accessible, employees have not replaced the number of their in-office working hours with the equivalent number of home working hours, but actually increased the overall number of their working hours (Hill, Ferris, & Mårtinson, 2003). Hence, "by making time and place of work undefined, employees find themselves available for work all day long and everywhere, pledged to work" (Regev, 2013, p. 75). A growing body of evidence suggests that workload may be associated with adverse health outcomes such as

Cardiovascular Diseases (CVD) – one of the leading causes of death in the world (Kang et al., 2012;), and the onset of the metabolic syndrome (MetS), a major risk factor for CVD (Han & Lean, 2011).

The widely used guideline suggests a working definition of the Mets that includes the presence of at least three of five components: abdominal obesity, elevated levels of triglycerides, low levels of High Density Lipoprotein (HDL), hypertension and elevated levels of glucose. The presence of three or more components is considered a positive diagnosis for the MetS (NCEP, 2001).

Current data indicate that 34% of adult Americans are diagnosed as having the MetS (Mozumdar & Liguori, 2011). With obesity and sedentary behavior on the rise, the prevalence of the MetS is likely to become even higher in coming years and this should be of major concern for both researchers and policy makers. Hence, detecting those at higher risk of the MetS onset may provide opportunities to intervene earlier in the development of shared disease pathways that predispose employees to both CVD and type 2 diabetes (Han & Lean, 2011).

The conservation of resources (COR) theory encompasses several stress theories and provides important insights into the study of stressor and strain relationships (Hobfoll, 1989). COR theory places a strong emphasis on downward spirals, whereby resource loss in one domain may further exacerbate the depletion of resources in other domains (Hobfoll, 2011). One of the corollaries of COR theory is that those who lack a strong resource pool are more likely to experience cycles of resource loss, whereby resource loss in one domain may further exacerbate the depletion of resources in other domains (Hobfoll, 2011). This downward spiral has physiological manifestations such as interfering with normal sleep patterns and immune functions (for a review, see Melamed, Shirom, Toker, Berliner, & Shapira, 2006). The energetic resource loss and negative physiological manifestations may also be associated with poor health habits, including unhealthy diet and lack of participation in leisure physical activities, both documented risk factors of the MetS (Holmes,

Ekkekakis, & Eisenmann, 2009). Hence, as in the case of long working hours, the depletion of resources and the inability to replenish them over time may trigger physiological strain in the form of the MetS.

To date, only one study (Kobayashi et al., 2012), cross-sectional in nature, evaluated the relationship between long working hours and the MetS. Despite global concern regarding the MetS and its negative consequences, no study until the current study has prospectively investigated the relationship between long working hours and the MetS.

Another way in which the current study extends prior research is by investigating the possible moderating role of a behavioral resource (physical activity).

Researchers suggested that certain resources may protect, attenuate and form a buffer against the adverse impact of job demands (Hobfoll, 1989). According to COR, these gain cycles are plausible, because when initial gains are made, greater resources become available: “with resource surpluses employees are less vulnerable and able to invest more resources that are not required for everyday functioning or reserve capacity” (Hobfoll, 1998, p. 82). Faced with adverse job-demands, those with fewer resources are more vulnerable to resource loss. Conversely, those with greater resources are less vulnerable to resource loss and more capable of resource gain or the ability to build and expend future resources. Hence, the latter are more resilient and less vulnerable to the psychological and physical adverse impact of job demands.

Physical activity (PA) is defined as activity that increases the heart rate and brings on a sweat (U.S. Department of Health and Human Services, 2008). There are several possible reasons why PA should attenuate the working hours–MetS relationship. First, based on the premises of cognitive behavior therapy (Beck, 1976; Ellis, 1962), PA may be viewed as a behavioral distraction that takes people’s minds off stressful situations and thus reduces the psychological impact of the situation

(e.g., Jaret, 1995). Second, from a COR perspective (Hobfoll, 1989), PA can be seen as a recovery mechanism that halts the downward spiral by allowing employees to temporarily replenish their resources, before facing job demands once again (Siltaloppi, Kinnunen, & Feldt, 2009;). Third, to the degree that PA improves personal abilities (e.g., McAuley, 1992) it has the potential to instrumentally reduce sensitivity to negative stimuli. Finally, regular PA may impart increased resistance to the harmful consequences of stress because the physiological effects of PA may include or otherwise induce some modifications in the manner in, or the extent to which, individuals respond to stress (Fleshner, 2005).

While an accumulated body of research found PA to counterbalance the negative impact of a variety of health conditions (e.g., Forcier et al., 2006; Rejeski et al., 2010), the possible attenuating role of PA as a behavioral resource has rarely been considered (Holmes et al., 2009). In addition, research on the moderating effect of PA in healthy employees is limited.

Given the clinically proven efficiency of PA in health promotion (Hu et al., 2004; Lee & Paffenbarger, 2000), elucidating the buffering effect of PA in the working hours - strain relationship may have significant benefits.

Hypotheses (See figure 1 on page 12 for graphical illustration of study hypotheses)

H1: Working hours at T1 will predict onset of MetS at T3 as well as an increase in the number of the MetS components, such that the higher the number of working hours the stronger the relationship

H2: Physical Activity (PA) intensity will moderate the relationship between working hours at T1 and onset of the MetS at T3 as well as an increase in the number of the MetS components, such that the higher PA intensity, the weaker the relationship.

Method

Sample and procedure

The current study will apply a full-panel three-wave longitudinal design to a large sample of employees (N = 2,591), who came to a medical center between 2002 and 2009 for three consecutive routine health examinations. These examinations are sponsored or subsidized by employers as a fringe benefit, and each employee, independent of health status, is eligible to attend screenings every 18-36 months until retirement.

The medical checkups took place in the morning, after an overnight fast, and lasted for approximately four hours. In addition to obtaining an overnight fast blood sample, the participants' weight, height, circumferences and blood pressure, were assessed. While waiting for these various tests, respondents filled out a comprehensive questionnaire consisting of socio-demographic variables, personal and family medical history, health behaviors, among them dietary and sports habits, objective work conditions and various psychological scales.

We excluded respondents with either a self-reported history of relevant diseases (e.g., cancer, CVA, diabetes and CVD) or mental crisis treated with medications. In addition, respondents who reported not working, or working less than 2 hours a day or less than 3 days a week, were also omitted from the final sample.

Measures

Working hours were measured at T1 by self-report of: the number of daily working hours.

The *metabolic syndrome* was measured at T1 and T3 and defined according to the criteria proposed by the Third Report of the National Cholesterol Education Program (NCEP, 2001). According to the ATP III criteria, the MetS is identified by the presence of three or more of the

following components: central obesity as measured by waist circumference, greater than 102 cm among men or greater than 88 cm among women; fasting blood triglycerides greater than or equal to 150 mg/dL; blood HDL cholesterol less than 40 mg/dL among men or less than 50 mg/dL among women; blood pressure greater than or equal to 130/85 mmHg; fasting glucose greater than or equal to 110 mg/dL. The MetS was measured both as a continuous variable (number of components) and as a dichotomous variable (three components or more coded as having the MetS).

Physical activity intensity was measured at T2 and assessed based on participants' self-reports. Consistent with the American College of Sports Medicine and the American Heart Association guidelines (Haskell et al., 2007), respondents were asked how many times per week and how many minutes each session did they engage in strenuous PA over the past week. Such single-item instruments (e.g., minutes per week of vigorous PA) allow rapid assessment of general patterns of PA and have been used extensively (e.g., Andersen et al., 2006; Miles, 2007; Richardson, Kriska, Lantz, & Hayward, 2004). Self-report measures of PA have been validated in past studies against objectively measured PA (McMurray et al., 2004).

Control variables – I will control for the possible effect of participants': age, gender, education, job tenure, time gaps between measurements, and smoking.

Analytic strategy

I will apply linear regressions to explore whether number of working hours at T1 are associated with an increase in MetS components' number from baseline to T3, and logistic regressions to examine whether number of working hours at T1 will predict new cases of the MetS at T3. The sub-sample for the logistic analyses will include only employees free of the MetS at baseline. Participants with the MetS at baseline will be excluded from the corresponding analysis.

Moderation analyses will follow the strategy suggested by Hayes (2013) applying PROCESS macro for SPSS. PROCESS macro uses an ordinary least squares (for continuous outcomes) or logistic regression-based (for dichotomous outcomes) path analytical framework for estimating two and three way interactions in moderation models along with simple slopes and regions of significance for probing interactions.

Research Contribution

The study's findings will emphasize the role of working hours in labor relations. In addition, the findings will assist health policy makers and organizations to identify and support employees at higher risk, and develop interventions that may buffer the negative cascading effects of working hours on health.

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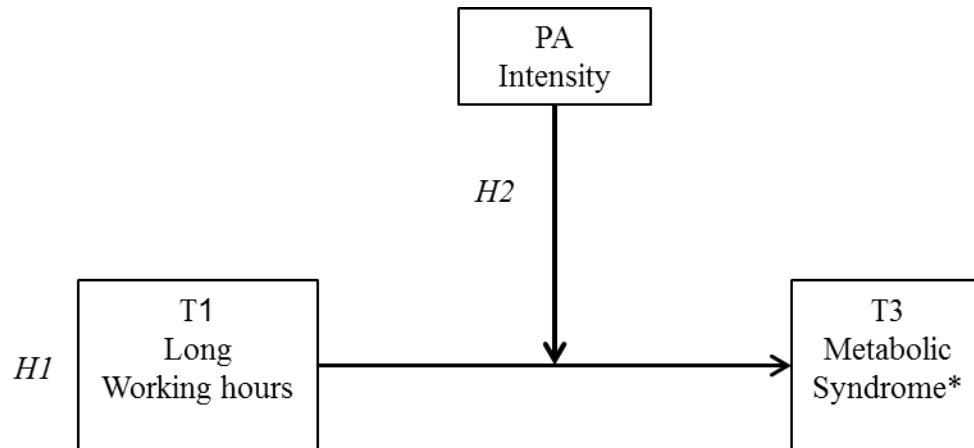
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Figure 1: graphical illustration of study hypotheses



* The MetS was measured both as a continuous variable (number of components) and as a dichotomous variable (three components or more coded as having the MetS).