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RUNNING TITLE: WORKAHOLISM AND CARDIOVASCULAR RISK

Your Work May be Killing You!

Workaholism, Sleep Problems and Cardiovascular Risk

Marisa Salanova[a], Angel Arturo López-González[b], Susana Llorens[a], Mario del Líbano[c], M[a] Teófila Vicente-Herrero[b] and Matias Tomás-Salvá[b]

[a]WANT Research Unit, Department of Social Psychology, Universitat Jaume I, Castellón, Spain; [b]Occupational Health Research Unit, IUNICS (Institut Universitari d'Investigació en Ciències de la Salut), Universitat de les Illes Balears, Palma, Spain; [c]Educational Science Department, Universidad de Burgos, Burgos, Spain

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Abstract

This study tests the relationship among workaholism (i.e. working excessively and compulsively), sleep problems and cardiovascular risk in 537 hospital employees. Four types of workers (i.e. workaholics, positive, compulsive and hard workers) were distinguished, comparing the health indicators. The results show that workaholics experience significantly more sleep problems (i.e. morning tiredness, sleeping while driving and sleeping fewer hours both on weekdays and at weekends, with poorer quality), have higher relative risk scores, and consume more caffeine and alcohol than the other patterns of workers (positive, compulsive and hard workers). Further analyses revealed that sleep problems fully mediated the relationship between workaholism (i.e. working excessively and compulsively) and cardiovascular risk. The present study emphasises the fact that being a workaholic might be a significant risk factor for having sleep problems and cardiovascular disease.

Key terms: workaholism, sleep problems, cardiovascular risk.

Your Work May be Killing You! Workaholism, Sleep Problems and Cardiovascular Risk

Work life is currently becoming more and more complex, and, for example, working under time pressure is quite common (e.g., fixed jobs, advanced communication technologies, high-performance work systems). Workers seem to have to work harder to achieve better performance. Moreover, when hard work is combined with an inner compulsion to work more and more, an addiction to work can develop.

Workaholism has varied greatly in terms of whether this is considered a positive or negative attribute. Although the earliest research on workaholism considered the construct to be positive, rather than negative (i.e., Machlowitz, 1980), more recent studies have treated workaholism as uniformly negative (e.g., Schaufeli, Taris, & Bakker, 2006). The conception of workaholism exclusively in terms of working extremely hard (i.e., number of working hours) is misleading because it neglects its *addictive* nature (e.g., Porter, 1996). In fact, there seems to be a growing consensus that workaholism may be defined by two core characteristics: working an excessive amount of time and having a compulsive drive to work (e.g., Del Líbano, Llorens, Salanova, & Schaufeli, 2010; Taris, Geurts, Schaufeli, Blonk, & Lagerveld, 2008).

Thus, we consider the "*addictive*" nature of workaholism to be essentially negative, and we adopt the position that workaholism is basically a negative psychological construct. In this direction, empirical research has also shown that workaholics work 'in a wrong and unhealthy way' and lose control of the time they spend working. Compared to non-workaholics, they generally report more ill-health or negative consequences, such as job strain (e.g. Shimazu, Schaufeli, & Taris, 2010), psychosomatic symptoms (e.g., Burke, Oberklaid, & Burgess, 2004), physical exhaustion (Sonnentag, 2003), burnout (e.g., Schaufeli, Bakker, Van der Heijden, & Prins, 2009), poor relationships with others at work and at home (e.g., Burke & Koksal, 2002), work-family conflicts and poor

support provided to the partner (e.g. Matuska, 2010) and poor performance (e.g. Shimazu, Schaufeli, & Taris, 2010).

Despite the relevant research on workaholism and psychosocial damage, less research has been conducted to relate workaholism to various types of physical damage, such as sleep problems (i.e., Kubota et al., 2010) and cardiovascular risk (CVR). The aim of this study is to test the relationship among workaholism, sleep problems and different physiological indicators represented in several measures of CVR (based on the Framingham Study and other isolated CVR factors), in order to better understand the consequences of being a workaholic.

"Four Types of Employees"

Following Schaufeli, Shimazu and Taris (2009), four different patterns of workers emerge when we combine the dimensions of workaholism: positive workers (workers who score low on both working excessively and working compulsively), hard workers (workers who score high only on working excessively), compulsive workers (workers who score high only on working compulsively) and workaholics (workers who score high on both workaholism scales).

Research based on these different types of workers (e.g., Shimazu, Demerouti, Bakker, Shimada, & Kawakami, 2011) has yielded some interesting results. Compared to the other (three) groups, workaholics experienced the highest job demands, the poorest job resources, and the highest levels of burnout and presenteeism. They also showed the lowest levels of recovery, happiness and performance in a sample of medical residents (Schaufeli, Taris, & Bakker, 2006). If we compare workaholics to compulsive workers, the former devote an excessive amount of time and energy to their work, thereby neglecting other areas of life such as leisure and family time (e.g. Buelens & Poelmans, 2004). Compulsive workers do not work excessively, but they are mainly characterised

by strong internal drives to work and feel that they 'have to' work (Kravina, Falco, Girardi, & De Carlo, 2010). On the other hand, the study by Schaufeli and colleagues (2006) showed that positive workers exhibited the lowest job demands, the highest job resources, the highest levels of well-being, and the most favourable organisational behaviours. In another study, people who worked excessively in a compulsive manner were more likely to find that their work interfered with their family lives (Shimazu et al., 2011), and they were viewed as 'unhealthy employees'. Regarding hard workers, although working excessively hard is detrimental to employees, research shows that people who also score high on working compulsively feel even worse (Schaufeli, Taris, & Bakker, 2006).

Workaholism, Sleep Problems and Cardiovascular Risk

As far as we know, the association between workaholism and different physical health parameters has not been studied in depth. However, research on the Type-A Behaviour Pattern (TABP) could provide findings about the negative consequences of dysfunctional behaviour at work. Workaholism and TABP describe similar consequences of high stress levels and frequently-associated physical and health problems. Both depict a hard-driving, urgent and impatient approach to life (Robinson & Kelley, 1999), and both are characterized by the presence of a high level of competitiveness and ambition, along with an excessive workload (all aimed at achieving goals) and a notably hostile and impatient behavioural expression (Vera-Villarroel, Sánchez, & Cachinero, 2004). Past research on the TABP reveals that those workers (mainly man) with TABP show spouses more dissatisfied and with low levels of well-being (e.g., Barling, Bluen, & Moss, 1990; Burke, Koyuncu, & Fiksenbaum, 2006). The workaholic behaviour has also been closely related to TABP in other studies that have directly measured these concepts (e.g., McMillan, Brady, O'Driscoll, & Marsh, 2000). Seybold and Salomone (1994) argued that

people who exhibit TABP and obsessive-compulsive traits are the most likely to become workaholics. Schwartz (1982) also linked compulsive behaviour, Type-A behaviour and workaholism. He stated that Type-A people with an obsessive style are commonly workaholics.

A major focus of TABP research is related to cardiovascular diseases (CVD), i.e., a group of disorders of the heart and blood vessels that include events such as heart attacks and strokes. Specifically, CVR represents a person's probability of suffering from a vascular disease affecting the heart (i.e. a heart attack) or the brain (i.e. a stroke) over a period of time, usually 5 or 10 years. At the international level, there are different models to calculate CVR, although the most widely used are those based on the Framingham Study (Framingham Heart Study; D'Agostino et al., 2008) conducted at the University of Boston, which values morbidity and mortality, and the SCORE scale, which determines mortality. Despite the controversy surrounding TABP as a predictor of CVD, a large body of research supports an association between the two (e.g., Smith & MacKenzie, 2006), in all types of populations, including children and teenagers (e.g., Kawachi et al., 1998), and especially when individual facets of Type A behaviour are assessed (Smith, Glazer, Ruiz, & Gallo, 2004).

Based on the similarities between Type A behaviour and workaholism, it can be argued that two of the consequences of workaholism are sleep problems and CVR. On the one hand, as in TABP individuals, workaholics report relatively high levels of psychological distress and physical complaints (e.g., Shimazu & Schaufeli, 2009), and sleep problems related to different physical complaints (e.g., Doi, 2005). The sleep problems are considered in terms of subjective lack of sleep, excessive daytime sleepiness at work, difficulty awakening in the morning, feeling tired when waking up in the morning (Kubota et al., 2010), work-related fatigue (Querstret & Cropley, 2012) and

burnout (Söderström, Jeding, Ekstedt, Perski, & Åkerstedt, 2012). Moreover, we know that sleep loss may increase CVR by deregulating the stress physiology (Bansil, Kuklina, Merritt, & Yoon, 2011). Moreover, sleep problems are also associated with both CVD, such as hypertension (Bansil et al., 2011), and mortality (Hamer, Batty, & Kivimaki, 2012). Other studies have associated sleep deprivation and higher blood pressure in the older population (Fung et al., 2011). Finally, insomnia, short sleep durations and hypersomnia have high medical comorbidity with chronic pain and diabetes, as well as several cardiovascular, respiratory, gastrointestinal, urinary and neurological diseases (Canivet, Nilson, Lindeberg, Karasek, & Östergren, 2014). In addition, an association between short sleep duration and overall cardiovascular events, more specifically myocardial, was observed in another study (Westerlund et al., 2013).

The Current Study

Previous research has shown that workaholism is related to higher risks of sleep problems in terms of subjective sleep insufficiency, excessive daytime sleepiness at work, difficulty awakening in the morning, and feeling tired when waking up in the morning. Working excessively and compulsively is associated with poor sleep, which increases CVR by deregulating the stress physiology. The present study adds further findings about the relationship between workaholism, sleep problems and CVR (based on the Framingham Study and other isolated indicators) by using objective indicators of CVR. While research on job stress has shown some associations between job strain and CVR (e.g., Backé, Seidler, Latza, Rossnagel, & Schumann, 2012), to our knowledge only one empirical study has described the manifestation of cardiovascular ailments, as evidenced by hypertension, as well as heart and kidney complications, as common symptoms of workaholism (Elowe, 2010). Moreover, to our knowledge, this is the first time this relationship has been addressed in a single study, comparing the risks related to

workaholism to those of other types of workers, such as compulsive, hard and positive workers.

Based on previous research, we expect that:

Hypothesis 1: Workaholics will show more sleep problems than the other types of workers (i.e. positive, hard and compulsive workers).

Hypothesis 2: Workaholics will show more CVR (i.e. a higher Framingham relative risk score and greater caffeine and alcohol consumption) than the other types of workers.

Hypothesis 3: Sleep problems positively mediate in the relationship between workaholism and CVR.

Methods

Participants and Procedure

A total of 537 hospital employees (65% auxiliary nurses, nurses and laboratory technicians, and 35% clerical employees) from five Spanish hospitals participated in the study. Their mean age was 41 years (SD = 10), and 74% were females. Fifty-two percent held a university degree, 70% were married, and 42% had no children. Fifty-three percent of these employees worked the morning shift, and 29% worked the rotary shift, with an average of 36 (SD = 7.5) work hours per week. In addition, 53% had a permanent contract, and the average tenure in their current job was 6 years (SD = 5.81) and in their careers, 12 years (SD = 9.3).

After an interview with each hospital's management, a research contract was signed, and the study began, with the approval of the hospital research committees. Participants were asked to fill in a self-report questionnaire as part of an occupational health and safety research project. Participation was voluntary with guaranteed confidentiality.

Data were collected in 2010. Four experienced healthcare employees (two medical doctors and two nurses) from the occupational health departments conducted analytical samples and other clinical and anthropometric measurements. The workers under the supervision of these health employees completed questionnaires, and a clinical interview was held to obtain the necessary data (sleep problems, etc.). All the measures related to clinical (blood pressure), anthropometric (height weight) analytical (cholesterol) and psychological (questionnaires) parameters were determined on the same day as the medical examination. Employees filled in the questionnaires and had the medical examinations in the medical service of the hospital very early in the morning (between 8-9 am), just before starting work.

The inclusion criterion was being between 18 and 65 years old (the current working age), and we used the following exclusion criteria: a) Having a cardiovascular disease (this condition makes it impossible to calculate the cardiovascular risk (REGICOR tool) because it is calculating "risk", and b) not signing the informed consent. Twelve workers were previously excluded for having cardiovascular diseases, and two for not signing the informed consent.

Measures

Data about sleep problems, CVR, and workaholism were obtained. To measure CVR, the recommendations of different scientific societies were followed: SEEDO criteria (Spanish Society for Obesity study) for BMI values; NCEP ATPIII criteria (National Cholesterol Educational Program Adult Treatment Panel III) for metabolic syndrome; Gallagher criteria for body fat values; and NCEP ATPIII criteria to assess waist perimeter.

1) ***Sleep problems***. Participants were asked to use a self-construed and self-administered questionnaire to report whether they felt tired in the morning (yes = 1, no = 0), if they

ever fell asleep while driving (yes = 1, no = 0), the number of hours they slept on weekdays and at weekends (continuous variable, i.e., number of hours), and the quality of sleep over the past year (from 0 'very bad' to 10 'very good').

2) Cardiovascular risk. We use 4 different measures of CVR:

- *Cardiovascular age* is a continuous variable that is a composite of gender, height (cm), waist perimeter, family antecedents (mother's or father's antecedents in terms of health problems related to cardiovascular pathology, hypertension, hypercholesterol, diabetes or cardiopathy), smoking, diabetes (determined from a blood sample taken during the visit after 12 h of fasting overnight and tested in the laboratory within a maximum of 48-72 hours at -20 ºC using an enzymatic method), levels of total cholesterol (determined by automated enzymatic methods), HDL cholesterol (determined by precipitation with Cl2Mg/dextran sulphate), and systolic blood pressure values.
- *Framingham relative risk score* is a continuous variable computed by a composite of: age (people with an age equal to or above 35 years), gender, total cholesterol (using automated enzymatic methods), HDL cholesterol (precipitation with Cl2Mg/dextran sulphate), blood pressure (Omron M3), tobacco consumption and presence of diabetes (using the enzymatic method). The lower the values are, the lower the probability of suffering a cardiovascular event in the next ten years. We calculate cardiovascular age using the calculator available in www.heartage.me. This calculator uses the following parameters: age, gender, height, weight, waist circumference, blood pressure, total cholesterol, HDL, snuff consumption, personal and family history of diabetes and cardiovascular disease.

- To measure the *metabolic syndrome* (categorical variable), we used the modified ATP-III criteria (Martínez-Larrad et al., 2005). It is a measure of cardiovascular risk like REGICOR, SCORE or heart age, but each from a different perspective. Metabolic syndrome is a preventive concept of cardiovascular risk, established as threshold values that are not pathological but are still above normal.
- Finally, we assessed the *Isolated cardiovascular risk* using nine indicators: hypercholesterolemia (above 250 mg/dl, yes = 1, no = 0); blood hypertension (> 140 for systolic and > 90 mm Hg. for diastolic, yes = 1, no = 0), overweight-obesity (BMI was calculated using Quetelet's index; > 25 and 30 are considered overweight and obesity, respectively, yes = 1, no = 0); body fat was determined by bioelectrical impedance (Body Composition Analyzer Tanita BF-350) ≥ 88 cm in women and men with ≥ 102; yes = 1, no = 0; tobacco consumption (yes = 1, no = 0), caffeine intake (yes = 1, no = 0), alcohol (sporadic = 1, at weekends = 2, daily = 3, no = 0), coke (yes = 1, sporadic = 2, frequently = 3, no = 0) and drug (yes = 1, no = 0) consumption.

3) Workaholism was assessed as a continuous variable by the short Spanish version of the DUWAS -Dutch Work Addiction Scale (Del Líbano et al., 2010), which includes two dimensions: working excessively (5 items; e.g. *'I stay busy and keep my irons in the fire'*; alpha = .71) and working compulsively (5 items; e.g. '*I feel that there's something inside me that drives me to work hard';* alpha = .86). Scores ranged from 1 ('almost never') to 4 ('almost always'). According to the mean scores on working excessively and compulsively, the participants were classified as: 'positive workers' (low scores on working excessively and low scores on working compulsively; n = 219); 'workaholic workers' (high scores on working excessively and high scores on working compulsively,

n = 162); ‘compulsive workers’ (low scores on working excessively and high scores on working compulsively; n = 96) and ‘hard workers’ (high scores on working excessively and low scores on working compulsively, n = 60).

Results

Analyses were performed using SPSS 19.0 software (SPSS Inc, Chicago, IL, USA). All probability values were two-tailed, and the level of statistical significance was set at $p < 0.05$. Multiple Analyses of Variance (MANOVA) for continuous variables and Chi-square tests for categorical variables were used to test the associations of the four patterns of workers with sleep problems and CVR.

The intercorrelations show that, as expected, the continuous and categorical scales are positively and significantly interrelated, ranging from r = $\left|.08\right|$, $p < .01$ to r = $\left|.63\right|$, $p < .001$. As expected, workaholism scales are related to sleep problems (morning tiredness, sleeping with driving, sleep on weekdays and weekends, and sleep quality), cardiovascular risk (Framingham index, Difference between cardiovascular-biological age), and isolated cardiovascular risks (i.e., overweight-obesity, and alcohol consumption).

Table 1 shows sleep problems and cardiovascular risk for all subjects, as well as for the subjects in each of the four patterns of workers (positive, workaholic, compulsive and hard workers).

Results of Chi-square tests and one-way analyses of variance between patterns of workers and sleep problems show that the proportion of morning tiredness, $14.69_{(3)}$, $p<.01$, and sleeping while driving was significantly higher in hard and workaholic workers, $6.89_{(3)}$, $p<.05$. Furthermore, workaholic workers sleep significantly fewer hours both on weekdays, $2.61_{(3,536)}$, $p<.01$ and at weekends, $2.18_{(3,536)}$, $p<.05$. Again,

workaholics show significantly poorer sleep quality, $2.12_{(3,536)}$, $p<.05$ than the other workers.

Secondly, regarding cardiovascular risk, workaholics had a significantly higher Framingham index, which reflects a higher probability of experiencing a cardiovascular problem, $3.62_{(3, 536)}$, $p<.05$. On the other hand, there were no significant differences among the types of workers in cardiovascular and biological age. Similarly, no remarkable differences were observed among the four groups of workers for metabolic syndrome.

Thirdly, based on isolated cardiovascular risk, no remarkable differences were observed among the four patterns of workers for hypercholesterolemia, hypertension, overweight and obesity, body fat, or consumption of tobacco, coke or drugs. However, the prevalence of caffeine was significantly higher in the positive and workaholic workers, $6.95_{(3)}$, $p<.05$. Finally, the prevalence of drinking alcohol at weekends and daily (with meals) was significantly higher in the workaholic group, $17.29_{(9)}$, $p<.05$, while in positive workers the alcohol consumption was only sporadic.

INSERT TABLE 1 ABOUT HERE

Further analyses

Table 2 shows the results of Confirmatory Factor Analyses (CFA) to determine the factorial structure of dimensions of workaholism. The CFA on workaholism with two pairs of correlated errors (working excessively 1-2; working compulsively 4-5) indicates that, compared to the one-factor model, Delta $\chi^2(3) = 92.73$, $p < .001$, and the original two-factor model, Delta $\chi^2(2) = 33.23$, $p < .001$, the model that best fits the data is the revised two-factor model. This revised model is composed of two latent and correlated factors: working excessively and working compulsively (by constraining two pairs of errors) with factor weight values ranging from .53 to .69, $p < .001$ (median value = .54)

for working excessively, and from .28 to .83, $p < .001$ (median value = .59) for working compulsively.

INSERT TABLE 2 ABOUT HERE

Finally, Table 2 shows the results of the SEM analyses to test Hypothesis 3, including only the continuous variables. Two alternative models were compared: M1, the fully mediated model, in which workaholism (i.e. working excessively and working compulsively) is positively related to cardiovascular risk through sleep problems; M2, the partial mediation model, in which a direct positive relationship was included from workaholism to cardiovascular risk.

Two absolute indices were used to evaluate the goodness-of-fit of the models: (1) the χ^2 Goodness-of-Fit Statistic, and (2) the Root Mean Square Error of Approximation (RMSEA). The use of relative goodness-of-fit measures is recommended because χ^2 is sensitive to sample size (Marsh, Balla, & Hau, 1996): (1) the Comparative Fit Index (CFI); (2) the Incremental Fit Index (IFI); and (3) the Non-Normed Fit Index or Tucker-Lewis Index (TLI). Values less than .07 for RMSEA and greater than .90 for the relative indices indicate an acceptable fit (values less than .07 for RMESA and greater than .93 for the rest are indicative of good fit) (Hoyle, 1995). Finally, we computed the Akaike Information Criterion (AIC; Akaike, 1987) to compare competing non-nested models.

Based on the four basic processes to establish mediation effects proposed by Baron and Kenny (1986) and Judd and Kenny (1981), we fit our proposed fully mediated model (M1) to the data. Results indicate that our M1 fits the data well. Furthermore, chi-square difference tests between M1 and M2 (the Partial Mediation Model) also shows a significant difference between the two models, Delta $\chi^2(1) = 5.56$, $p < .05$ in favour of M1. Regarding the mediation process, the Baron and Kenny (1986) conditions were met: (1) workaholism is positively and significantly related to cardiovascular risk, $\beta = .21$, $p <$

.001; (2) sleep problems are positively and significantly related to cardiovascular risk, β = .13, $p < .001$; and (3) the relationship between workaholism and cardiovascular risk became non-significant, β = .08 $p < .01$ when controlled by the effect of sleep problems. Thus, sleep problems fully mediate between workaholism and cardiovascular risk.

Figure 1 shows a graphic representation of the results of the final model (M1). Different aspects should be mentioned: (1) all the manifest variables loaded significantly in the intended latent factors, ranging from .38 to .89 for workaholism; (2) workaholism has a positive significant relationship with sleep problems, β = .30, $p < .001$; 9% of explained variance, which, in turn, also has a significant and positive relationship with cardiovascular risks, β = .19, $p < .05$;

INSERT FIGURE 1 ABOUT HERE

Discussion

This study examined the association among workaholism, sleep problems and different physiological indicators represented in several measures of cardiovascular risks (based on the Framingham Study and other isolated cardiovascular risk factors). To achieve this objective, the study sample was divided into four groups according to the two dimensions of workaholism (i.e. working excessively and working compulsively): positive workers, compulsive workers, hard workers and workaholics, which were compared to each other. The present study adds value to the literature on workaholism due to the findings – for the first time – on the associations among different patterns of employees, sleep problems and cardiovascular risk.

The main significant contribution of this study is that being a workaholic (working excessively and compulsively) is associated with poor sleep, which increases CVR by deregulating the stress physiology. Workaholics, compared to the rest of the workers, had significantly higher risks related to poor sleep, such as tiredness upon awakening in the

morning, falling asleep while driving, and lack of sleep (during the week but also at weekends). Furthermore, they perceived a poorer quality of sleep. Some of the adverse effects of workaholism are attributable to the fact that workaholics spend more time on their work – or working – than the other types of workers (e.g., van Beek, Taris, & Schaufeli, 2011). Moreover, the increase in job demands (typical of workaholics) may offer fewer opportunities to recover from excessive efforts and greater exhaustion (Sonnentag, 2003). Poor sleep can also be related to the compulsive component of workaholism. In fact, academic literature has shown that working compulsively may be related to internal pressure, and it is generally agreed that workaholics may consider excessive investment in work as a means to bolster their self-esteem and reduce feelings of guilt, shame or anxiety (e.g., Van den Broeck et al., 2011), feelings that can also affect sleep quality.

Secondly, workaholics showed higher Framingham relative risk scores, which means a higher probability of having a cardiovascular event in the next ten years. This probability increases due to the fact that workaholics also showed another isolated cardiovascular risk: they consume caffeine and alcohol more frequently than the other (positive, compulsive and hard) workers. These results are in accordance with past research on job stress that has shown some associations between job strain and CVR (e.g., Markovitz, Matthews, Whooley, Lewis, & Greenlund, 2004), and with the Elowe (2010) study, which showed that cardiovascular ailments (as evidenced by hypertension, along with heart and kidney complications) are common symptoms of workaholics.

Our study did not find any significant relationships between workaholism and experiencing relevant cardiovascular risk, such as the difference between the cardiovascular and biological age or metabolic syndrome. This lack of significance can be explained because the Framingham index and the Cardiovascular and Biological age

are obtained by using different procedures that have variable levels agreement. As this agreement can sometimes be very low, it is likely that they have different relationships with workaholism. Similarly, the expected relationships among workaholism and several cardiovascular risks, in terms of hypercholesterolemia, hypertension, overweight and obesity or body fat, as well as tobacco, coke and drug consumption, were not found either. Moreover, further analyses based on Confirmatory Factor Analyses revealed that, as expected, workaholism is composed of two (working excessively and working compulsively) independent but related dimensions. Finally, Structural Equation Modelling also shows the mediating role of sleep problems between workaholism (working excessively and compulsively) and cardiovascular risk when the continuous variables are measured.

Study Limitations/Strengths and Future Studies

The first limitation is related to the source of the data, that is, a cross-sectional convenience sample. The cross-sectional nature of the sample implies that causal inferences are not warranted. Thus, this study shows that there are significant and interpretable differences among the four study groups regarding sleep problems and cardiovascular risks. Future studies should investigate the causal link between the groups of employees and the different outcomes considered in the study.

Second, participants were all from five hospitals; thus, particular care must be taken when generalising the findings reported here. However, it is likely that combining data from the five different hospitals increases the generalizability of our findings, compared to data from only one hospital (e.g., Kageyama, Nishikido, Kobayashi, Oga, & Kawashima, 2001). Future studies should consider a broader number of hospitals to generalize the data, and use multilevel analysis to understand the variance in workaholism predicted by collective variables (i.e., hospital, services).

Third, some of the data has been collected through self-reports (workaholism, sleep problems), but the vast majority are objective data that have been obtained using medical criteria (e.g., cardiovascular-biological age, metabolic syndrome, Framingham index, hypercholesterolemia, hypertension). Moreover, in the same instrument, different headings were used in the different parts of the questionnaire in order to hold participants' attention; both are valid strategies to avoid common method bias stemming from the research design (Podsakoff, MacKenzie, & Podsakoff, 2012).

Finally, sleep problems were assessed by using only a single self-report questionnaire. Although this is a well-documented method for assessing sleep quality, future studies should also include objective measures to validate our results.

In spite of these limitations, the present study extends and enhances our current knowledge of workaholism and its relationship with sleep problems and cardiovascular risks. One of the strengths of our research is the inclusion of different types of workers (i.e., positive, workaholic, compulsive and hard workers) and their relationships with different indicators of physical health, such as sleep problems and CVR, in order to compare different indicators of physical health in the same study. Furthermore, our study does not only include data measured using self-report questionnaires – we also used objective measures of physiological indicators (e.g. hypercholesterolemia, hypertension).

Another important contribution refers to the clinical significance of the study because it shows a direct relationship between a non-medical concept (workaholism) and medical parameters (i.e. sleep problems and cardiovascular risk). Thus, workaholics have more sleep difficulties, higher levels of cardiovascular risk, and a greater consumption of substances, such as alcohol and coffee, than other types of workers. In our study, we model sleep problems as a potential route to CVR and we showed empirical evidence.

However future studies could consider substance abuse as another potential mechanism next to sleep problems.

Finally, we consider that an important contribution of future studies could be to address the effects of positive workers on sleep problems and CVR because this area remains underdeveloped in the stress and well-being research.

Final Note

In conclusion, being a workaholic, i.e. working in an excessive and compulsive way, can be considered a significant risk factor for having sleep difficulties and for developing cardiovascular problems. Our results suggest that ensuring that people work in non-abusive conditions (i.e. in neither an excessive way nor a compulsive way) may enhance healthy sleep (in terms of hours and quality) and help them to avoid cardiovascular risks.

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Table 1. Associations between patterns of workers, sleep problems and cardiovascular risks (N = 537)

Variable	All sample N = 537		Positive n = 219		Workaholic n = 162		Compulsive n = 96		Hard n = 60		χ^2 and F (df)
	%	M(SD)	%	M(SD)	%	M(SD)	%	M(SD)	%	M(SD)	
Sleep problems											
Morning tiredness (yes)	20		15		24a		17		35a		$14.69_{(3)}$**
Sleeping while driving (yes)	24		20		30a		20		30a		$6.89_{(3)}$*
Sleep on weekdays		7.08		7.17		6.93a		7.14		7.09	$2.61_{(3, 536)}$**
Sleep on weekends		8.13		8.12		7.97a		8.37		8.25	$2.18_{(3, 536)}$*
Sleep quality		7.13		7.3		6.85a		7.27		7.06	$2.12_{(3, 536)}$*
Cardiovascular risk											
Diff. cardiovascular-biological age		-.62		-.47		-.25		-.82		-1.88	$.550_{(3, 536)}$
Metabolic syndrome (yes)	7		6		6		9		5		$1.48_{(3)}$
Framingham		.78		.81		.84a		.56		.82	$3.62_{(3, 536)}$*
Hypercholesterolemia (yes)	6		6		6		2		8		$3.33_{(3)}$
Hypertension (yes)	12		14		13		7		8		$3.90_{(3)}$
Overweight-obesity											$12.32_{(9)}$
Overweight (yes)	26		28		27		20		28		
Obesity (yes)	12		10		17		8		13		
Body fat											$3.80_{(9)}$
High	32		34		31		29		30		
Very high	21		20		22		19		27		
Tobacco (yes)	30		76		76		64		78		$.93_{(3)}$
Caffeine (yes)	74		76a		76a		64		78		$6.95_{(3)}$*
Alcohol											$17.29_{(9)}$*

Sporadic	33	38a	31	27	27	
At weekends	5	28	45a	20	7	
Daily (meals)	12	38	40a	8	14	
Coke						$11.70_{(9)}$
Yes	10	11	12	8	7	
Sporadic	23	20	21	28	30	
Frequently	8	5	10	12	5	
Drugs (yes)	36	33	41	29	42	$5.27_{(3)}$
Workaholism (mean)						
W. Excessively	2.05	1.58	2.72	1.76	2.45	
W. Compulsively	1.73	1.30	2.25	2.04	1.42	

Note. M = mean, SD = standard deviation, χ^2 = Chi-square test for categorical variables, F = one-way analyses of variances for continuous variables, df = degrees of freedom, W. = working, * $p < .05$, ** $p < .01$. a: represents the group in which the dependent variable is significant high/low compared to the rest of the groups.

Table 2. CFA Fit indices of workaholism and SEM fit indices for Workaholism, sleep problems and CVR (N = 537)

CFA Models	χ^2	df	RMSEA	CFI	IFI	TLI	AIC	χ^2diff
1. One factor model	220.27	35	.10	.85	.85	.81	260.27	
2. Two factor model	160.77	34	.08	.90	.90	.86	202.77	
Diff. M2 & M1								59.5***
3. Two factor model (revised)	127.54	32	.07	.92	.92	.90	173.54	
Diff. M3 & M1								92.73***
Diff. M3 & M2								33.23***
SEM Models								
1. Model 1 (M1)	22.87	9	.05	.98	.98	.96	46.87	
2. Model 2 (M2)	28.43	8	.06	.97	.97	.95	45.43	
Diff M2 & M1								5.56*

Notes. $\chi 2$ = Chi-square; *df* = degrees of freedom; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; IFI = Incremental Fit Index; TLI = Tucker-Lewis Index; AIC = Akaike Criterion. *** $p < .001$, *$p < .05$.

Figure 1. Standardized parameter estimates for workaholism, sleep problems and cardiovascular risk (N = 537). Notes: Only significant paths are showed. *** $p < .001$.