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# Your work may be killing you! Workaholism, sleep problems and cardiovascular risk

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**ABSTRACT**

This study tests the relationships between workaholism (i.e. working excessively and compulsively), sleep problems and cardiovascular risk in 537 employees from five Spanish hospitals. Four types of worker (i.e. workaholics, positive workers, compulsive workers and hard workers) were distinguished, and their health indicators were compared. The results showed that workaholics experienced significantly more sleep problems (i.e. morning tiredness, sleeping while driving and sleeping fewer hours both on weekdays and at weekends, with poorer quality), had higher relative risk scores, and consumed more caffeine and alcohol than the other patterns of worker (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 study emphasizes the fact that being a workaholic might be a significant risk factor for having sleep problems and cardiovascular disease.

## Introduction

Working 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 and 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 their partner (e.g. Matuska, 2010) and poor performance (e.g. Shimazu et al., 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 relationships among workaholism, sleep problems and different physiological indicators represented in several measures of CVR (based on those used in the Framingham Heart Study (Framingham Heart Study; D'Agostino et al., 2008) and on other isolated CVR factors) in order to better understand the consequences of being a workaholic.

## Four patterns of working

Following Schaufeli, Shimazu, and Taris (2009), four different patterns of work 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 working both obsessively and compulsively).

Research based on these different types of worker (e.g. Shimazu, Demerouti, Bakker, Shimada, & Kawakami, 2011) has yielded some interesting results. Compared to the other (three) groups, workaholics were found to experience 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 et al., 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 characterized 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 et al. (2006) showed that positive workers exhibited the lowest job demands, the highest job resources, the highest levels of well-being and the most favourable organizational 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 et al., 2006).

## Workaholism, sleep problems and CVR

As far as we know, the associations between workaholism and different physical health parameters have not been studied in depth. However, research on the Type A Behaviour Pattern (TABP) could provide information 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 manner (Vera-Villarroel, Sánchez, & Cachinero, 2004). Past research on the TABP reveals that those workers (mainly men) with TABP had more dissatisfied spouses and lower levels of well-being (e.g. Barling, Bluen, & Moss, 1990; Burke, Koyuncu, & Fiksenbaum, 2006). 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, that is, 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) in 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 Heart Study (D'Agostino et al., 2008) conducted at the University of Boston, which evaluates morbidity and mortality. Despite controversy surrounding TABP as a predictor of cardiovascular disease, a large body of research supports an association between the two (e.g. Smith & MacKenzie, 2006), in all types of population, 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 Type A individuals, workaholics report relatively high levels of psychological distress and physical complaints (e.g. Shimazu & Schaufeli, 2009), and also 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). Sleep problems are also associated with both cardiovascular disease, such as hypertension (Bansil et al., 2011), and mortality (Hamer, Batty, & Kivimaki, 2012). Other studies have

found an association between 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 cardio-vascular, 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, has also been observed (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 indicators used in 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 worker (i.e. positive, hard and compulsive workers).
*Hypothesis 2:* Workaholics will show greater 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 will positively mediate 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 per cent held a university degree, 70% were married and 42% had no children. Fifty-three per cent 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 = 5.8) 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 of the hospitals collected analytical samples and took 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 and 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 CVR (using the Spanish adaptation of the Framingham relative cardiac risk tool (REGICOR; Gil-Guillén et al., 2007)) because it is calculating "risk", and (b) not signing the informed consent. Twelve workers were consequently 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, Salas-Salvadó, Rubio, Barbany, & Moreno, 2007) for BMI values; NCEP ATP-III criteria (National Cholesterol Educational Program Adult Treatment Panel III, Grundy, Brewer, Cleeman, Smith, & Lenfant, 2004) for metabolic syndrome; Gallagher criteria for body fat values (Gallagher et al., 2000); 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, that is, number of hours), and the quality of sleep over the past year (from 0 "very bad" to 10 "very good').
(2) *Cardiovascular risk.* We used four different measures of CVR. These were as follows:

*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 hours of fasting overnight and tested in the laboratory within a maximum of 48–72 hours at −20°C 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.

The *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 10 years. We calculate cardiovascular age using the calculator available at the website 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 CVR like REGICOR, SCORE or heart age, but each is from a different perspective. Metabolic syndrome is a concept that is used in the prevention of CVR; it provides threshold values that are not pathological but are still above normal.

Finally, we assessed the *Isolated CVR* using nine indicators: hypercholesterolemia (above 250 mg/dl, yes = 1, no = 0); blood hypertension (>140 for systolic and >90 mmHg. 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) $\geq$ 88 cm in women and men with $\geq$ 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), Coca-Cola (yes = 1, sporadic = 2, frequently = 3, no = 0) and medication related to cardiovascular problems (yes = 1, no = 0) consumption.

(3) *Workaholism*. This 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 (five items; e.g. 'I stay busy and keep my irons in the fire'; $\alpha$ = .71) and working compulsively (five 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 $p < .05$. 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 showed that, as expected, the continuous and categorical scales were positively and significantly interrelated, ranging from $r = .08$, $p < .01$ to $r = .63$, $p < .001$. As expected, scores on the workaholism scales were related to sleep problems

(morning tiredness, sleeping while driving, sleeping on weekdays and at weekends and sleep quality), CVR (Framingham index, Difference between cardiovascular and biological age), and isolated CVRs (i.e. overweight–obesity, and alcohol consumption).

Table 1 shows sleep problems and CVR for all participants, as well as for the participants 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 proportions of morning tiredness, $14.69_{(3)}$, $p < .01$, and sleeping while driving were significantly higher in hard and workaholic workers, $6.89_{(3)}$, $p < .05$. Furthermore, workaholic workers slept significantly fewer hours both on weekdays, $2.61_{(3,\ 536)}$, $p < .01$ and at weekends, $2.18_{(3,\ 536)}$, $p < .05$. Again, workaholics showed significantly poorer sleep quality, $2.12_{(3,\ 536)}$, $p < .05$ than the other workers (supporting Hypothesis 1).

Secondly, regarding CVR, 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 the difference between cardiovascular and biological age. Similarly, no remarkable differences were observed among the four groups of workers for metabolic syndrome.

Thirdly, based on isolated CVR, no remarkable differences were observed among the four patterns of workers for hypercholerolemia, hypertension, overweight and obesity, body fat, or consumption of tobacco, Coca-Cola or medication related to cardiovascular problems. 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. Thus Hypothesis 2 was only partly supported.

## 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.

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 CVR through sleep problems; M2, the partial mediation model, in which a direct positive relationship was included from workaholism to CVR.

Two absolute indices were used to evaluate the goodness-of-fit of the models: (1) the $\chi^2$ 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 $\chi^2$ is

**Table 1.** Associations between types of work pattern of participants, sleep problems and cardiovascular risk ($N = 537$).

| Variable | All sample ($N = 537$) | | Positive ($n = 219$) | | Workaholic ($n = 162$) | | Compulsive ($n = 96$) | | Hard ($n = 60$) | | $\chi^2_{and}\ F_{(df)}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | 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 (0.85) | | 7.17 (0.79 | | 6.93a (0.88 | | 7.14 (0.92 | | 7.09 (0.82) | 2.61$_{(3,\ 536)}$** |
| Sleep on weekends | | 8.13 (1.27) | | 8.12 (1.20 | | 7.97a (1.31) | | 8.37 (1.42) | | 8.25 (1.15) | 2.18$_{(3,\ 536)}$* |
| Sleep quality | | 7.13 (1.81) | | 7.3 (1.80 | | 6.85 (1.93) | | 7.27 (1.677 | | 7.06 (1.75) | 2.12$_{(3,\ 536)}$* |
| ***Cardiovascular risk*** | | | | | | | | | | | |
| Diff. cardiovascular-biological age | | −0.62 (8.73) | | −0.47 (8.76) | | −0.25 (9.41) | | −0.82 (7.80) | | −1.88 (8.26) | .550$_{(3,\ 536)}$ |
| Metabolic syndrome (yes) | 7 | | 6 | | 6 | | 9 | | 5 | | 1.48$_{(3)}$ |
| Framingham | | 0.78 (0.75) | | 0.81 (0.72) | | 0.84a (0.76) | | 0.56 (0.67) | | 0.82 (0.66) | 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 | | |
| Coca-Cola | | | | | | | | | | | 11.70$_{(9)}$ |
| Yes | 10 | | 11 | | 12 | | 8 | | 7 | | |
| Sporadic | 23 | | 20 | | 21 | | 28 | | 30 | | |
| Frequently | 8 | | 5 | | 10 | | 12 | | 5 | | |
| Medication (yes) | 36 | | 33 | | 41 | | 29 | | 42 | | 5.27$_{(3)}$ |
| Workaholism (mean) | | | | | | | | | | | |
| Work excessively | 2.05 | | 1.58 | | 2.72 | | 1.76 | | 2.45 | | |
| Work compulsively | 1.73 | | 1.30 | | 2.25 | | 2.04 | | 1.42 | | |

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

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

| CFA models | $\chi^2$ | df | RMSEA | CFI | IFI | TLI | AIC | $\chi^2$diff |
|---|---|---|---|---|---|---|---|---|
| 1. One-factor model | 220.27 | 35 | .10 | .85 | .85 | .81 | 260.27 | |
| 2. Two-factor model Diff. M2 & M1 | 160.77 | 34 | .08 | .90 | .90 | .86 | 202.77 | 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) Diff M2 & M1 | 28.43 | 8 | .06 | .97 | .97 | .95 | 45.43 | 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.

sensitive to sample size (Marsh, Balla, & Hau, 1996); these were: (1) the Comparative Fit Index; (2) the Incremental Fit Index; and (3) the Non-Normed Fit Index or Tucker–Lewis Index. 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 (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 fitted our proposed fully mediated model (M1) to the data. The results indicated that model M1 fitted the data well. Furthermore, chi-square difference tests between M1 and M2 (the Partial Mediation Model) also showed 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 was positively and significantly related to CVR, $\beta = .21$, $p < .001$; (2) sleep problems were positively and significantly related to CVR, $\beta = .13$, $p < .001$; and (3) the relationship between workaholism and CVR became non-significant, $\beta = .08$ $p < .01$ when controlled by the effect of sleep problems. Thus, sleep problems fully mediated between workaholism and CVR, supporting Hypothesis 3.

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 on the intended latent factors, with estimates ranging from .38 to .89 for workaholism; (2) workaholism had a positive significant relationship with sleep problems, $\beta = .30$, $p < .001$ (9% of the explained variance), which, in turn, also had a significant and positive relationship with CVR s, $\beta = .19$, $p < .05$;

## Discussion

This study examined the associations among workaholism, sleep problems and different physiological indicators represented in several measures of CVR (based on those used in the Framingham Study and on other isolated CVR 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). These groups were: 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
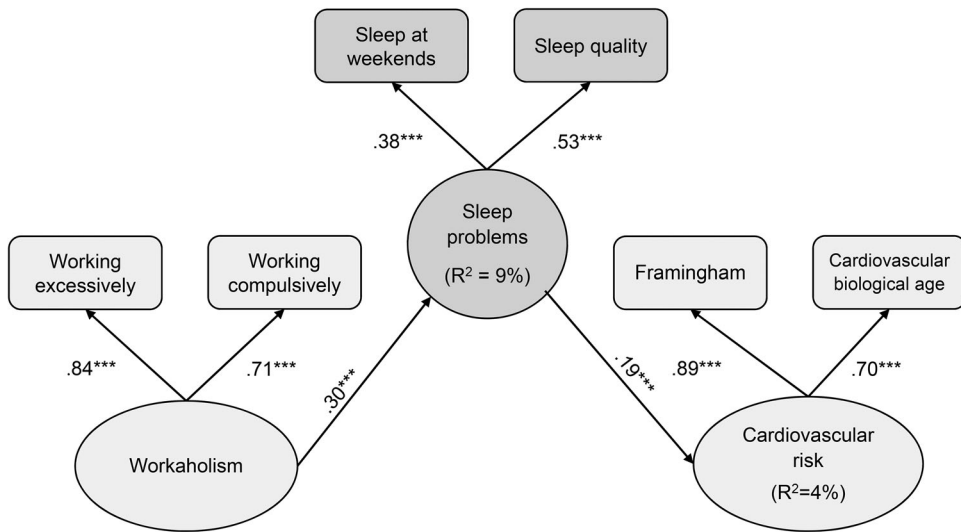
**Figure 1.** Standardized parameter estimates for relationships between workaholism, sleep problems and cardiovascular risk ($N = 537$). Notes: Framingham = Framingham relative cardiac risk tool. Only significant paths are shown. ***$p < .001$.

findings – for the first time – on the associations among these different working patterns of employees, sleep problems and CVR.

The main significant contribution of this study is that being a workaholic (working excessively and compulsively) was 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 at their work – or working – than the other types of workers (e.g. Van Beek, Taris, & Schaufeli, 2011). Moreover, the increase in job demands (which is 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); these feelings can also affect sleep quality.

Secondly, workaholics showed higher Framingham relative cardiac risk scores, which means a higher probability of having a cardiovascular event in the next 10 years. This probability increases due to the fact that workaholics also showed another isolated CVR: they consumed 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 complaints) are common symptoms of workaholics.

Our study did not find any significant relationships between workaholism and experiencing certain types of CVR, such as the difference between the cardiovascular and biological age, or scores on 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 CVRs, in terms of hypercholesterolemia, hypertension, overweight and obesity or body fat, as well as tobacco, Coca-Cola and consumption of medication were not found either. Moreover, further analyses based on CFA revealed that, as expected, workaholism was composed of two independent but related dimensions (working excessively and working compulsively). Finally, Structural Equation Modelling also showed the mediating role of sleep problems between workaholism (working excessively and compulsively) and CVR when the continuous variables were measured.

### Study limitations and 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 showed that there were significant and interpretable differences among the four study groups (that is, pattern of working) regarding sleep problems and CVRs. Future studies should investigate the causal link between those working patterns and the different outcomes considered in the study.

Second, participants were all from five hospitals; thus, particular care must be taken when generalizing 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 organizations to generalize the data, and use multilevel analysis to understand the variance in workaholism predicted by collective variables (that is, hospital or other organization and services).

Third, some of the data were collected through self-reports (workaholism and sleep problems), but the vast majority were objective data that were obtained using medical criteria (e.g. cardiovascular-biological age, metabolic syndrome, Framingham index, hypercholesterolemia and hypertension). Moreover, in the same instrument, different headings were used in the different parts of the questionnaire in order to hold participants' attention; both of these 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 could 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 CVRs. One of the strengths of our research is the inclusion of workers of different types (i.e. positive, workaholic and 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 did not only

include data measured using self-report questionnaires – we also used objective measures of physiological indicators (e.g. hypercholesterolemia and 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 CVR). Thus, our study indicates that workaholics have more sleep difficulties, higher levels of CVR, and a greater consumption of substances, such as alcohol and coffee, than other types of worker. In our study, we modelled sleep problems as a potential route to CVR and we showed empirical evidence of this. However, future studies could consider substance abuse as another potential mediator.

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

## Conclusions

In conclusion, our findings indicate that being a workaholic, that is, 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 help them to have healthy sleep (in terms of hours and quality) and to avoid cardiovascular risks.

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