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A within-individual investigation on the relationship between day-level workaholism and systolic blood pressure

Abstract

Most research on workaholism has been conducted at the between-person level and has considered mainly psychological outcomes of the phenomenon (e.g., burnout, job satisfaction). Building on the allostatic load model and on the idea that workaholic cognition and behavior may show variation at the within-person level, we tested the hypothesis that fluctuations in daily workaholism would be related to parallel fluctuations in daily systolic blood pressure as reported at the end of the working day. Additionally, based on previous research and theoretical contributions in the field, we also tested the hypothesis that the daily workaholism-systolic blood pressure relationship would be particularly accentuated for women, when compared to men. Data have been collected from a sample of 61 participants who were followed for ten consecutive working days, for a total of 544 observations. In line with the hypotheses, workaholism revealed substantial variation at the day level and daily workaholism predicted daily systolic blood pressure. The workaholism-systolic blood pressure relationship was only partially mediated by the objective number of hours worked in the day and, as hypothesised, was more accentuated in women. The study contributes to advancing workaholism research by showing micro-processual (i.e., day-level) aspects of the health impairment path potentially activated by workaholism.

A within-individual investigation on the relationship between day-level workaholism and systolic blood pressure

Recent years have seen an increasing attention towards the phenomenon of workaholism, which may be defined as a dysfunctional form of heavy work investment where the individual feels compelled to work because of an uncontrollable inner drive and work for very long hours – usually well-beyond what is expected or required (Atroszko et al., 2020; Clark et al., 2016; Loscalzo & Giannini, 2017; Snir & Zohar, 2008; Taris et al., 2014).

Studies have consistently shown that workaholism is related both cross-sectionally and longitudinally to stress-related problems such as mental health symptoms (anxiety and depression), poor sleep quality, and burnout (e.g., Avanzi et al., 2012; Clark et al., 2016; Gilet et al., 2018; Schaufeli et al., 2009; Spagnoli et al., 2019). Although most research has considered psychological outcomes of workaholism (see Clark et al., 2016; Di Stefano, & Gaudiino, 2019), there is some evidence that workaholism may reach beyond the psychological level and affect physiology as well, particularly at the cardiovascular level (Balducci et al., 2018; Girardi et al., 2019; Salanova et al., 2016; Ten Brummelhuis et al., 2017). Indeed, it has been found that workaholism is significantly related to systolic blood pressure (Balducci et al., 2018) and increased cardiovascular risk (Salanova et al., 2016).

Although the true nature of workaholism is still somewhat unclear (Clark et al., 2016; 2020; Ng et al., 2007; Griffith et al., 2018), research has been based on the idea that workaholism is an enduring personal characteristic, a trait-like phenomenon. For example, Scott et al. (1997, p. 292) defined it as a "fairly stable behavior pattern exhibited by the same person in multiple organizations". Additionally, workaholism is related in the moderate-high range with type A behavior (see Clark et al., 2016) and overcommitment (Littman-Ovadia et

al., 2014), two personal psychological characteristics associated with a strong investment in work which are considered to have a dispositional base (Nabi et al., 2008; Siegrist, 1996). According to Griffiths (2018) and Atroszko et al. (2020), workaholism is intimately connected with obsessive compulsive personality – that is, an enduring psychological problem. As a consequence of such conceptualization, the standard study in this area has adopted a between-person approach, investigating how individual differences in workaholism are related to other variables such as burnout (see Clark et al., 2016).

Such an approach completely neglects the potential within-individual variance in workaholism, the study of which may be useful for elucidating micro (e.g., day-level) processes related to the health impairment effects of workaholism. Such within-individual variation may be substantial; indeed, there is evidence that even for stable characteristics such as attachment style, there is as much variation within a typical individual as there is variation across individuals (Haak et al., 2017). Therefore, in the present study we will focus on daily workaholic cognition and behavior, which we define as *state workaholism*, and by building on the few studies that have investigated the physiological correlates of workaholism, we will link its within-individual fluctuations with parallel fluctuations of systolic blood pressure. Our aim is to provide additional evidence on the potential effects of workaholism with an original design and by using objective health data.

Additionally, research investigating the moderators of the workaholism-health outcomes relationship has lagged behind (Clark et al., 2016). Examining such moderators would help in identifying boundary conditions or subgroups of individuals for which workaholism may be more or less deleterious for health, which is essential for reaching a more fine-grained view of the consequences of the phenomenon and better targeting interventions. In the present study we will focus on gender as a moderator of the day

workaholism-blood pressure relationship and argue that women may be particularly vulnerable to workaholic cognition and behavior in terms of their health-related consequences. Indeed, women experiencing workaholism may face extra pressure as compared to men, since their heavy investment in work clashes with societal norms according to which women should invest more heavily in their families rather than work (Clark et al., 2015). Thus, women may be exposed to a unique role conflict situation and tension, which may lead them to experience more negative outcomes in relation to workaholism.

Defining state workaholism

Traditionally, it has been assumed that people present a relatively stable pattern of cognitions, affects and behaviors across time and situations (Goldberg, 1990). Such an assumption is at the core of the notion of personality and personality traits. However, recent studies have demonstrated the existence of within-person variability in personality and its corresponding traits. Debuscher et al. (2017), for example, showed that daily fluctuations in conscientiousness, which they called "state conscientiousness" were significant and consequential in terms of daily performance and organizational citizenship behavior. In another study, the same authors found similar results for core self evaluations (Debuscher et al., 2016), which is considered a broad personality dimension, with its daily fluctuations relating positively to job performance and negatively to counterproductive work behavior. According to Fleeson (2001; 2017), although there is robust evidence for individual differences in average global personality traits, there is also increasing evidence that people vary substantially around these averages. Such observation led to the conceptualization of stable psychological tendencies and dispositions as density distributions of momentary states. Traditional measures of such tendencies and dispositions focus on the average of a person's density distribution – the level at which the person usually falls. However, it is also

possible to examine the fluctuations people show around their general tendencies as represented by the mean of their distribution. There is value in studying the same psychological content (affects, cognitions, and behaviors) at shorter durations. For example, it may help to answer questions about stability and flexibility of the corresponding trait (i.e., how often people enact the trait); it may also enable a better understanding of the processes of trait formation and consolidation and their consequences (Fleeson, 2017).

Unfortunately, the study of within-individual variation in workaholism has been neglected so far (see Clark et al., 2016), thus impairing our understanding of its potential short-term dynamics and related antecedents and implications. On the contrary, such within-individual variation has been extensively studied in the case of similar work-related psychological characteristics such as, for example, work engagement – an enduring and positive mental condition considered to be a healthy form of heavy work investment (Di Stefano & Gaudiino, 2019), with which workaholism is positively related (Balducci et al., 2021; Clark et al., 2020). Such studies on work engagement have significantly advanced our understanding of its genesis (Simbula, 2010) and consequences (Sonnentag, 2003).

Given our focus in the present study on the physiological correlates of workaholism, if we can show that the already emerged relationship between workaholism and blood pressure at the between-person level (Balducci et al., 2018) is also valid within the same individual, we will demonstrate that it is really the *enactment* of workaholism in day-to-day working life that is crucial for the workaholism-blood pressure relationship. This would provide support that the focused relationship belongs to the domain of basic processes of individual psycho-physiological functioning (see Fleeson et al., 2002). In other words, we will provide evidence that the covariation at the between-person level between workaholism and blood pressure may be explained by the fact that individuals with stronger trait

workaholism more often experience workaholism in their daily working life, thus reporting higher levels of systolic blood pressure.

Development of the study hypotheses

The allostatic load model (Ganster & Rosen, 20013; McEwen, 2005) has become one of the dominant perspectives in the physiology of the stress response. According to this model, when an individual perceives a stressor, a set of primary physiological processes (e.g., increased cardiovascular activation and cortisol release) are triggered with the aim of helping the individual to cope with the threat. Frequent and chronic activation of the primary processes, however, may over time lead to alterations of established set points of the homeostatic systems (e.g., the cardiovascular and immune systems) that control health. As an example, frequent transient daily alterations of blood pressure level may elevate, in the long run, the resting blood pressure of the individual to the level of hypertension. Such set points changes constitute secondary allostatic processes reflecting relatively stable (at least, in the medium term) between-individual differences, as compared to the transient, state-like quality of the primary processes (Ilies et al., 2016). Finally, prolonged and repeated changes in secondary set points can subsequently lead to tertiary allostatic processes, which can include cardiovascular disease and even health endpoints such as myocardial infarction.

Interestingly, a study by Salanova and colleagues (2016) found a significant relationship between workaholism and secondary allostatic processes as reflected by a higher cardiovascular risk (CVR) reported by more workaholic individuals. In another study by Balducci et al. (2018), workaholism was related to higher systolic blood pressure at the between-person level, further confirming its involvement in secondary allostatic processes. Such involvement implies, as a theoretically logical consequence, that primary allostatic processes may also be activated by workaholism, for example in the form of transient

perturbations of blood pressure. To demonstrate this, the notion of state workaholism, which we introduced above, is particularly useful as it enables to see whether its within-individual daily dynamic is related to fluctuations in blood pressure.

On the basis of the above considerations, we propose that day-level (or state) workaholism is able to activate the stress response on a daily basis and lead to transient increases in daily blood pressure. More specifically, on days when individuals experience more workaholic cognition and enact more workaholic behavior, they will also report higher levels of daily blood pressure at the end of the working day. This is in line with the idea that when work-related effort expenditure is higher, such as when individuals experience more workaholism, the stress-related psychophysiological activation is sustained and manifests itself at the end of the working day with delayed cardiovascular recovery; that is, higher levels of blood pressure (Geurts & Sonnentag, 2006).

Hypothesis 1: Day-level workaholism will be positively related to day-level blood pressure as reported at the end of the working day.

Furthermore, we propose that the relationship between state workaholism and blood pressure will be partially mediated by the objective number of hours worked in the day. Indeed, according to commonly accepted operationalizations (Robinson, 1999; Spence & Robbins, 1992) workaholism comprises aspects such as exerting a high effort at work, continuing to accept additional tasks while already busy, and doing two or three different activities at the same time. Additionally, workaholics are not able to stop working since they experience a feeling of uneasiness when detaching themselves from work. Thus, different core aspects of workaholism drive the individual to extend the *objective* time devoted to work, and working more hours is related to higher blood pressure (e.g., Yang et al., 2006). Therefore, it is likely that the relationship between day-level workaholism and day-level

blood pressure is mediated by a longer day in terms of hours worked. However, we expect that the mediation of hours worked is partial, rather than full, since the obsessive-compulsive aspects of workaholism may directly fuel anxiety and tension and, at the physiological level, sympathetic activation and higher blood pressure levels. In other words, workaholism may affect the stress response at least partially independent of the duration of the working day.

Hypothesis 2: Daily working hours will partially mediate the positive relationship between day-level workaholism and day-level blood pressure.

While workaholism may lead to higher levels of blood pressure overall, our premise is that this may happen particularly for women. In other words, we anticipate that primary allostatic load processes indicators (i.e., including higher blood pressure) in response to workaholic cognition and behavior may be particularly elevated in women. Previous research has found some evidence in line with this idea. Balducci et al. (2018) found that job-related negative affective reactions (e.g., anger) – which may be taken as indicators of primary allostatic load processes associated with job stress (see Ganster & Rosen, 2013) – were more strongly related to workaholism among women. From a theoretical perspective, this makes sense. According to Clark et al. (2015), workaholic women may face extra pressures compared to men, and may in fact suffer even greater negative consequences as a result of their workaholic behavior. These extra negative consequences are largely due to the internal conflict women experience between their inner drive to work and traditional gender role expectations (see Powell & Greenhaus, 2010; Shockley & Shen, 2016) according to which women should be primarily devoted to their families rather than work. Such conflict does not affect workaholic men in the same way. As a consequence, on days with higher state workaholism, women may experience a greater internal conflict between the compulsion to work hard and their gender role expectations, leading to a stronger stress response (i.e., primary allostatic load processes) and thus delayed cardiovascular recovery at

the end of the working day. Statistically, this translates to a cross level moderation of gender (i.e., a between-person factor) of the within-person relationship between day-level workaholism and systolic blood pressure.

Hypothesis 3: Gender will moderate the day-level workaholism-blood pressure relationship, such that the relationship will be stronger among women than among men.

A graphical representation of the tested hypotheses is reported in Figure 1.

Figure 1 about here

Method

Participants and procedure. Participants were a heterogeneous group of 61 workers who took part in a diary study lasting for two weeks (i.e., ten working days, from Monday of the first week to Friday of the second week). They provided a total of 544 usable daily observations with a mean of 8.9 observations per participant [*SD* = 1.8]). Participants were women in 42.6% of the cases [n = 26], had a mean age of 47.5 years (*SD* = 12, range 23-68) and in the majority of cases lived with their partner (26.2%) or with their partner and children (39%). They had high school level education in 58% of the cases and university education in the remaining cases and they were self-employed or entrepreneurs (30%; e.g., lawyer, veterinary doctor, architect), managers (25%; e.g., human resources manager, key account manager, banking manager) and employees (45%). They had a standard working week and mostly worked in the private sector (70.5% of the cases). Additionally, in a typical week they worked on average for 43.2 hours (*SD* = 8.9), with more than a third of the participants working more than 48 hours.

Participants were contacted among acquaintances of the researchers and by means of snowball sampling, mainly targeting workers with potentially high levels of workaholism (see Taris et al., 2012). They were invited to take part in a daily survey on work-related well-

being. Participation was voluntary. The refusals were very low, with only five individuals declining invitation due to a lack of interest in the nature of the study.

Data were collected by means of two questionnaires, a general questionnaire administered during a preliminary meeting with one member of the research team, and a diary questionnaire self-administered at the end of the working day for ten consecutive (working) days. The 10 diary questionnaires were included in a survey pack and provided to participants during the preliminary meeting, with instructions on how to return the pack at the end of the diary period. To reinforce compliance, the researchers carefully explained to participants how to fill in the daily surveys, emphasizing the importance of completing them at the end of the working day and for the agreed series of consecutive days. During the meeting, participants were provided with an upper arm digital blood pressure monitor device and instructed how to measure their blood pressure in line with standard guidelines (Zusman, 2018). Specifically, the researcher emphasised the importance of resting quietly while sitting for five minutes before taking the blood pressure measure. Participants were instructed to take the blood pressure measures as part of the diary study at the end of the working day before filling in the diary questionnaire. The blood pressure reading, including the time when it was taken, was reported in the diary questionnaire. A post hoc inspection of the time recorded in the diary questionnaires indicated that the diary surveys were filled in between 4 pm and 10 pm and that the time of survey completion was very similar for the same participant across the ten working days. We didn't consider the different time of completion of the daily surveys between participants as a main issue, since the hypotheses were formulated at the within-individual level and the analyses included as a study variable also the duration of the working day (see below).

Measures. *Trait-level measures*. We measured trait-level workaholism with the general questionnaire by using the 10-item Dutch Work Addiction Scale (DUWAS;

Schaufeli et al., 2009). The DUWAS investigates the respondent's feelings about his/her work, which reflect the two core components of workaholism: working compulsively (WC, e.g., "I feel that there's something inside me that drives me to work hard") and working excessively (WE: "I stay busy and keep many irons in the fire"). Responses were given on a 4-point scale varying from 1 ("Never or almost never") to 4 ("Almost always or always"). The DUWAS has been adopted repeatedly in studies with both employees and managers (e.g., Litman-Ovadia et al., 2014; Taris et al., 2012), suggesting that the scale is appropriate for a variety of occupations. Furthermore, the DUWAS has been validated in the national context of the present study (Balducci et al., 2017) and has been used repeatedly as a single overall score of workaholism (e.g., Taris et al., 2012). Cronbach's alpha (α) for the scale was .77 in the present study.

Day-level measures. We measured state workaholism by adapting five items of the DUWAS (see above) to the day-level – i.e., three WE items (e.g., "Today, I seemed to be in a hurry and racing against the clock") and two WC items (e.g., "Today, I felt obliged to work hard, even when it was not enjoyable"). We chose items based on two criteria. First, we focused specifically on the items of the DUWAS that showed a high factor loading (≥ 60) in the Italian validation (Balducci et al., 2017), to ensure items that strongly reflected the underlying construct. Second, two members of the research team evaluated each item and eliminated ones that would not be appropriate if modified to reflect day-level workaholism (e.g., the item "I feel guilty when I take time off work" would not be interpretable to participants if they had worked that day). Responses were collected on a 7-point scale (Strongly disagree-Strongly agree). Internal consistency (α) varied between .78 to .87 across the ten working days of observation. The five items showed an ICC from .52 to .64, suggesting that there was adequate variation at both the between and within levels. A multilevel confirmatory factor analysis ran with Mplus 8.4 showed that the items adapted

fairly well to a one-factor solution ($\chi^2(10)=39.74$, $p<.001$; CFI=.92; TLI=.84; RMSEA=.072; $SRMR_{within}=.052$; $SRMR_{between}=.067$). The fit improved by freeing the *within* error covariance between two WE items ($\chi^2(9)=22.20$, $p<.01$; CFI=.96; TLI=.92; RMSEA=.051; $SRMR_{within}=.030$; $SRMR_{between}=.067$). Standardized factor loadings for the latter solution varied between .58 and .72 at the within-level and between .66 and .85 at the between-level.

We measured day workload – which we used as control variable given its relationship with both workaholism (Clark et al., 2016) and systolic blood pressure (Ilies et al., 2010) – by using three items from the Job Content Questionnaire (JCQ; Karasek et al., 1998). An example item is: "Today I had to work very fast". Responses were given on a 7-point scale varying from 1 ("Strongly disagree") to 7 ("Strongly agree"). The five items showed an ICC from .46 to .55 and an internal consistency (α) varying between .82 to .93 across the ten observation days.

Day blood pressure (i.e., the study dependent variable) was measured by using a upper arm digital blood pressure monitor device as described above. In the main analyses, we focused exclusively on systolic blood pressure because it is believed that this is the crucial indicator of high blood pressure, especially in middle-aged and older individuals (Zusman, 2018; see also Ilies et al., 2010). The ICC for this measure was .54.

Analyses. Each participant provided data at the person-level (higher level, or level 2) and at the day-level (lower level, or level 1), with level 1 data being nested within level 2 data. Thus, data were multilevel and required the use of multilevel analysis (Hox, 2010), which we implemented by using SPSS-25. Level 1 predictors (i.e., state workaholism, day workload, day hours worked) were centered within individuals to remove level 2 variance. Since there was no level 2 variance in the level 1 predictors, their relationship with day blood pressure was not confounded by any possible level 2 (or between-individual) difference among the study participants (e.g., personality, chronic hypertension, etc.; see

Ilies et al., 2010). Level 2 predictors (i.e., trait workaholism and age) were centered at the sample mean (i.e., grand mean) with the exception of gender (0=woman, 1=man).

To test the study hypotheses, we fitted the following series of nested models following the recommendations of Aguinis et al. (2013). We first estimated a null (or intercept only) model. Then, we estimated a model (Model 1) with state workaholism as the only level 1 predictor. In a subsequent model (Model 2) we entered day workload and day hours worked as additional level 1 predictors. In Model 3 we further included trait workaholism, age and gender as level 2 predictors. In Model 4 we included a random slope for state workaholism, which allowed each individual participant to have his/her specific slope for the relationship between state workaholism and day-level blood pressure. Finally, in Model 5 we included the state workaholism by gender cross-level interaction. To assess the tested interaction, we examined not only the significance of the interaction parameter, but also the amount of variance in the state workaholism slope explained by the interaction. The estimation method adopted was maximum likelihood. The relative fit of nested models were compared by conducting a -2Log likelihood difference (or deviance) test (see Aguinis et al., 2013). The mediating role of day hours worked in the state workaholism–day systolic blood pressure relationship was tested by using the SPSS macro MLmed (Hayes & Rockwood, 2020; Rockwood, 2017), which provides a Z-test for the significance of the indirect effect and Montecarlo (MC) confidence intervals.

Results

Table 1 reports the correlations between the study variables. At level 1 (or day-level), day systolic blood pressure correlated significantly and positively with day workaholism (r = .20, p < .001), day workload (r = .15, p < .001) and day hours worked (r = .15, p < .001). At level 2 (or person level), only gender was significantly associated with day systolic blood

pressure (r = .34, p < .05), indicating that women reported a lower level of day systolic blood pressure (as averaged across the ten-day observation period) when compared to men.

Table 1 about here

Because day workaholism and day workload were measured at the same time, we then examined whether the two constructs could be discriminated empirically. Multilevel confirmatory factor analysis revealed that a two-factor model (i.e., day workaholism and day workload) fit the data well [$\chi^2(37)=87.83$, $p<.001$; CFI=.95; TLI=.92; RMSEA=.049; $SRMR=.032_{within}$, $.078_{between}$] and better than a one-factor model ($\Delta\chi^2(2) = 89,23$, $p < .001$), suggesting that participants clearly discriminated between the two constructs.

To test the study hypotheses, we conducted multilevel regression analysis with day systolic blood pressure acting as dependent variable. The results of this analysis are reported in Table 2. The first independent variable to be entered in the analysis was day workaholism (see Table 2, Model 1). Results showed that day workaholism was significantly and positively related to systolic blood pressure (B = 2.04, p < .001), indicating that on days when participants reported higher levels of workaholism, they also reported higher levels of systolic blood pressure at the end of the working day. This supported Hypothesis 1. In Model 2, we entered day workload and day hours worked in addition to day workaholism. Results showed that while day workload was not a significant predictor of day systolic blood pressure, day hours worked was (B = .70, p < .05). Day workaholism remained significantly related to day systolic blood pressure in Model 2, although its relationship with the criterion dropped substantially. A mediation analysis conducted separately with MLmed (Rockwood, 2017) indicated that day hours worked significantly mediated the day workaholism-day systolic blood pressure relationship (unstandardized estimate = 0.28, SE = 0.14, Z = 2.02, p

< .05, 95% MC CI = .03-.56). Overall, the emerged results were compatible with partial mediation of day hours worked and supported Hypothesis 2. In Model 3 (see Table 2) we included trait workaholism, gender, and age in addition to the predictors already included in Model 2. Results indicated that only gender was significantly related to day systolic blood pressure, with men reporting higher systolic blood pressure than women. In Model 4, we freed the day workaholism slope parameter, letting each participant having his/her characteristic slope in the day workaholism-systolic blood pressure relationship. This change produced a significant increase in model fit (Δ -2 log likelihood M3-M4 (2) = 10.85, $p < .01$). Having freed the day workaholism slope in Model 4, in Model 5 we additionally included the day workaholism by gender interaction, which was statistically significant ($B = -2.33$, $p < .05$; Δ -2 log likelihood M4-M5 (1) = 4.05, $p < .05$).

Table 2 about here

Additional computations based on Aguinis et al. (2013) indicated that gender explained 27% of the variance in the slope of day workaholism across participants. A representation of the interaction is provided in Figure 1, from where it can be seen that for women there was a stronger day workaholism-systolic blood pressure relationship than for men. In other words, on days with higher levels of workaholism, it was particularly for women that systolic blood pressure was higher at the end of the day, when compared with days with lower levels of workaholism. These results supported Hypothesis 3.

Figure 1 about here

In additional analyses, we explored whether trait workaholism strengthened the state workaholism-day systolic blood pressure relationship, which would indicate that the relationship may be particularly accentuated for individuals high in trait workaholism.

However, we didn't find evidence in line with such cross-level moderation, suggesting that state workaholism is equally positively related to day systolic blood pressure for both individuals high and low in trait workaholism.

Discussion

With the present study we showed that workaholism, generally seen as a stable personal characteristic (Scott et al., 1997), actually shows a substantial degree of within-individual daily variation. In other words, we demonstrated that 'not all days are created equal' as far as the experience of workaholic cognition and behavior is concerned. Such finding is in line with whole trait theory of personality (Fleeson, 2017), which asserts that personality traits may be seen as density distributions of momentary states. In other words, individuals have their own density distributions characterized by a specific and relatively stable average level of a trait, but they also vary substantially around such average. Our finding is also in line with empirical evidence that has confirmed that people fluctuate extensively in their behavior as they go about their daily lives (e.g., Heller et al., 2007). Notably, we found a moderately strong relationship between trait workaholism and the average level of day workaholism as measured across the study observation period (i.e., ten days), indicating that participants with a higher trait workaholism tended to report on average higher levels of day workaholism. This is also consistent with hole trait theory, according to which personality states consist of the enactment of the corresponding trait: those who are higher on a trait enact more frequently the related states in daily situations.

In line with our first hypothesis, we showed that daily fluctuations in workaholism may be consequential in terms of short-term health-related physiological outcomes (i.e., day systolic blood pressure). Previous research has mainly concentrated on psychological and behavioral outcomes of workaholism by adopting a between-person approach (Clark et al.,

2016). Our findings show that workaholism may reach beyond the psychological level and potentially affect cardiovascular functioning. Two previous studies (Balducci et al., 2018; Salanova et al., 2016) provided some evidence for this relationship by focusing on trait workaholism. We extend this line of research by demonstrating that the relationship between workaholism and cardiovascular functioning holds at the within-individual level, providing initial evidence that the 'enactment' of workaholism in everyday working life is central to the workaholism-blood pressure relationship.

Additionally, in line with our second hypothesis, we also found that day hours worked partially mediated the relationship between state workaholism and day systolic blood pressure. Previous research did not study such a mediation and more generally didn't investigate the role of workaholism on health-related outcomes vis-a-vis objective time dedicated to work. This is likely because the amount of time spent at work is included in the working excessively component of workaholism, which may lead one to conclude that controlling for objective time dedicated to work is inappropriate. However, the working excessively component of workaholism also assesses a number of other aspects in addition to long working hours, such as not taking work breaks, multitasking, and accepting additional tasks while being already busy – aspects that do not regard the objective amount of time dedicated to work. Thus, the results of the present study are important for a two-fold reason: they highlight a mechanism through which workaholism may impact health on a daily basis and, at the same time, they also show that the impact of workaholism on health may go beyond such a mediating mechanism. Such impact becomes understandable by considering also the working compulsively aspects of workaholism, which concerns anxiety cognitions and emotions that may independently and directly affect heart rate and systolic blood pressure.

Taken together, findings from the current study along with those of prior between-person studies of the relationship between workaholism, blood pressure, and cardiovascular risk (Balducci et al., 2018; Salanova et al., 2016) may be integrated in a more general view on the physiological health implications of workaholism based on the allostatic load model. The within-individual relationship between workaholism and systolic blood pressure suggests that state-level workaholism can activate the stress response on a daily basis, producing transient changes of primary stress mediators such as higher blood pressure. Of course, state workaholism may be experienced by both workaholic individuals and non-workaholic individuals. However, for workaholics it may be a more common or frequent occurrence over longer periods of time, which may explain how a transient perturbation of blood pressure may give rise to presumably more stable between individual differences in systolic blood pressure and cardiovascular risk (Salanova et al., 2016) as a function of trait workaholism. The latter correlates of workaholism may be seen as secondary mediators of stress in the process leading to compromised health, also called allostatic load states. Such states may reflect alterations in established set points of the cardiovascular system which, if not treated, may lead to tertiary mediators of stress or allostatic overload states, corresponding to serious cardiovascular problems. Providing evidence linking workaholism to tertiary mediators of stress (health endpoints) is an important avenue for future research.

As a further contribution, we found that state workaholism has physiological implications (i.e., increased systolic blood pressure) particularly for women. On days characterized by higher state workaholism, it is particularly women that report increased systolic blood pressure at the end of the working day. This finding parallels results from a previous between-person study (Balducci et al., 2018) in which it was found that the link between workaholism and job-related affective strain is accentuated for women. Thus, both within- and between-person, gender seems to be a vulnerability factor for the stress-related

implications of workaholism. Such an idea has already been proposed (Clark et al., 2015) but has rarely been tested. Results of this study are compatible with the view that the uncontrollable inner drive to devote time and effort to work may be more stressful for women because such drive clashes with internalized social norms, according to which women should devote more time and effort to the family, rather than to work. This exposes them to a particular role conflict, which may have unique health-related consequences.

Main limitations and implications

A major limitation of the present study is that it was based on a small sample (i.e., 61 participants). Although at the day-level (or level 1) the sample of observations (n = 544) could be considered adequate, at the person-level (or level 2) a higher number of participants would have been better (see Gabriel et al., 2019). Indeed, low power at level 2 may be one reason that in contrast to prior studies (Balducci et al., 2018), we did not find a relationship between trait workaholism and systolic blood pressure at the person-level. Thus, future studies should obtain larger samples if interested in person-level relationships. However, the main focus of our study was at the day-level (within-person), and number of participants and total observations such as those of the present study are common in previous research with a similar focus (see Gabriel et al., 2019; González-Romá & Hernández, 2017).

A further limitation is that since we used a paper and pencil diary, we cannot be sure that participants completed the daily survey at the end of their workday as they were instructed to do (see Ohly et al., 2010). Future research could replicate the present findings by implementing an electronic daily diary study that allows time of completion to be tracked.

Additionally, state workaholism and systolic blood pressure were measured in the same occasion (i.e., end of the working day), limiting our ability to make causal inferences. Thus, future studies could separate the measurement of the predictor and the outcome during

the working day. Future studies could even use more complex designs (see Csikszentmihalyi & Larson, 2014; Gabriel et al., 2019) such as collecting repeated measures of blood pressure and momentary workaholism multiple times within the day. Such studies would allow to get closer to the lived experiences of participants and test in a more sophisticated way the state workaholism-day systolic blood pressure relationship.

Furthermore, although the within-individual relationship found between day workaholism and day systolic blood pressure was not confounded by any possible between-individual differences of the participants, such as chronic hypertension, smoking habits, and health status, it would have been better to know the general profile of the participants on such variables to have an idea of the degree of their homogeneity in such regard. Additionally, it would have been better to include more day-level control variables (e.g., interpersonal conflict, family issues) to strengthen the obtained results. It is well known, however, that long daily surveys run the risk of higher attrition (Gabriel et al., 2018).

Finally, to assess workaholism we used the DUWAS, which doesn't have a validated threshold to identify 'true' workaholics. In other words, what we actually measured were participants' 'workaholic tendencies'. Although we sampled among occupations with a high risk for workaholism, we do not know how many true workaholics were included. This is a well-known challenge in this area of research (see Loscalzo & Giannini, 2017). However, our main focus was on 'state workaholism' and its daily fluctuations, based on the idea that transient manifestations of workaholism may be experienced by both workaholics and non-workaholics. So, in our case, concerns regarding the true number of workaholics recruited for the study may perhaps be less critical.

The present study suggests that workaholism may reach beyond the psychological level and lead to day-level increases in blood pressure, which in the long run may have

significant cardiovascular consequences. To avoid such consequences, it is important that individuals learn to dedicate time to recovery (Geurts & Sonnentag, 2006), especially on days they are experiencing higher levels of workaholic cognition and behavior. Recovery activities that have been specifically suggested to control blood pressure are those that elicit the relaxation response (e.g., meditation), as well as additional activities such as getting enough sleep, exercising and learning time management skills (see Zusman, 2018).

However, individuals high in trait workaholism may find dedicating time to recovery to be difficult (see Molino et al., 2018). Thus, organizations should invest efforts in spreading a culture where recovery is considered an important factor for preserving health and performance, including explicitly discouraging excessive work and emphasizing the right of workers to disconnect from work. This is particularly relevant today, where an increasing number of individuals are working remotely due to the COVID-19 pandemic. Such working arrangements have been found to be related to long working hours, blurring of the boundaries between work and family life, and high levels of stress (Eurofound & ILO, 2017). Pfeffer (2018) argued that a long-hours culture is the result of managerial decisions and often is not justified for business reasons, implying that such a culture is a policy variable that may be modified. Since workaholism may potentially be activated by trait-relevant situational cues at the social and organizational levels (see Tett & Burnett, 2003), such as managers creating an overwork climate, changing such cues may contribute to make workaholism ‘silent’, with significantly positive health-related consequences.

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Table 1. Descriptive Statistics and Intercorrelations of Study Variables

	M (*SD*) [a]	1	2	3	4	5	6	7	8
1 Day systolic blood pressure[a]	122.72 (10.81)	1	.54***	.20***	.15***	.15***			
2 Day diastolic blood pressure[a]	76.79 (7.19)	.62***	1	.13**	.15***	.12***			
3 State workaholism[a]	3.39 (1.18)	-.03	-.02	1	.59***	.26***			
4 Day workload[a]	4.34 (1.22)	-.02	-.03	.80***	1	.27***			
5 Day hours worked[a]	8.37 (1.68)	.01	-.07	.51**	.30*	1			
6 Trait workaholism	2.43 (0.50)	-.06	.13	.44**	.21	.13	1		
7 Gender[b]	-	.34*	.19	-.25	-.18	.37*	.04	1	
8 Age	47.52 (11.95)	.11	.25	-.14	-.19	.03	-.08	-.11	1
9 Hours worked in typical week	43.16 (8.89)	.02	-.09	.44***	.26***	.70***	.31*	.42**	-.01

Note. $N = 61$ participants who provided 544 observations. [a] Reported *M*, *SD* and correlations of day level variables (i.e., variables 1-4) have been computed by first averaging the variable scores across the ten days of the diary study. Level 1 (i.e, *within*) correlations are reported above the diagonal; Level 2 (i.e., between) correlations are reported below the diagonal. [b] 0 = woman, 1 = man. * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 2. Results of multilevel regression analysis predicting day systolic blood pressure

	Null model	Model 1	Model 2	Model 3	Model 4	Model 5
	Estimate (*SE*)	Estimate (*SE*)	Estimate (*SE*)	Estimate (*SE*)	Estimate (*SE*)	Estimate (*SE*)
Intercept	121.79 (1.52)	121.79 (1.52)***	121.79(1.52)***	115.60(2.07)***	114.73(2.03)***	115.56(2.07)***
Day workaholism		2.04 (0.47)***	1.54 (0.58)**	1.54(0.58)**	1.26(0.67) $^{p=.06}$	2.61(0.87)**
Day workload			0.34 (0.48)	0.34(0.48)	0.39(0.48)	0.43(0.47)
Day hours worked			0.70 (0.34)*	0.70(0.34)*	0.66(0.34) $^{p=.05}$	0.68(0.34)*
Trait workaholism				1.56(2.74)	1.26(2.65)	1.46(2.66)
Age				0.06(0.11)	0.02(0.11)	0.03(0.11)
Gender (man)				10.75(2.74)***	12.27(2.64)***	10.82(2.74)***
Day workaholism X Gender (man)						-2.33(1.06)*
Within person (L1) variance	89.96	85.53	85.59	85.55	81.26	81.68
Intercept (L2) variance	129.77	130.16	130.27	100.23	101.51	100.85
Slope (L2) variance					4.94	2.76
Intercept-slope (L2) covariance					12.98	10.74
-2 log lilkelihood (ML)	4150.54	4131.771	4126.54	4111.61	4100.76	4096.71
n. of estimated parameters	3	4	6	9	11	12
Δ -2 log lh (Δ n. estimated parameters)		18.77 (1)***	5,23 (2)	14.93 (3)**	10.85 (2)**	4.05 (1)*

Note. Day level variables have been centered at the person mean. Person level variables were centered at the grand mean. Gender was not centered (0=woman; 1=man). * $p < .05$; ** $p < .01$; *** $p < .001$.

Figure 1. Conceptual model with hypothesised relationships

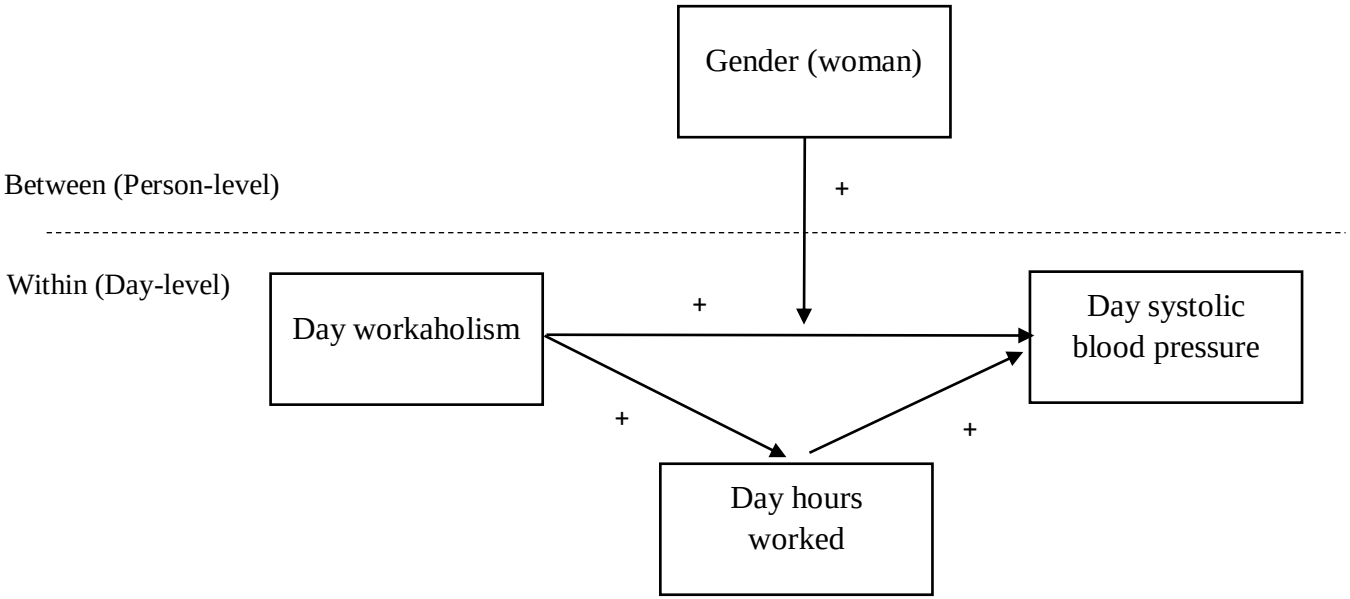
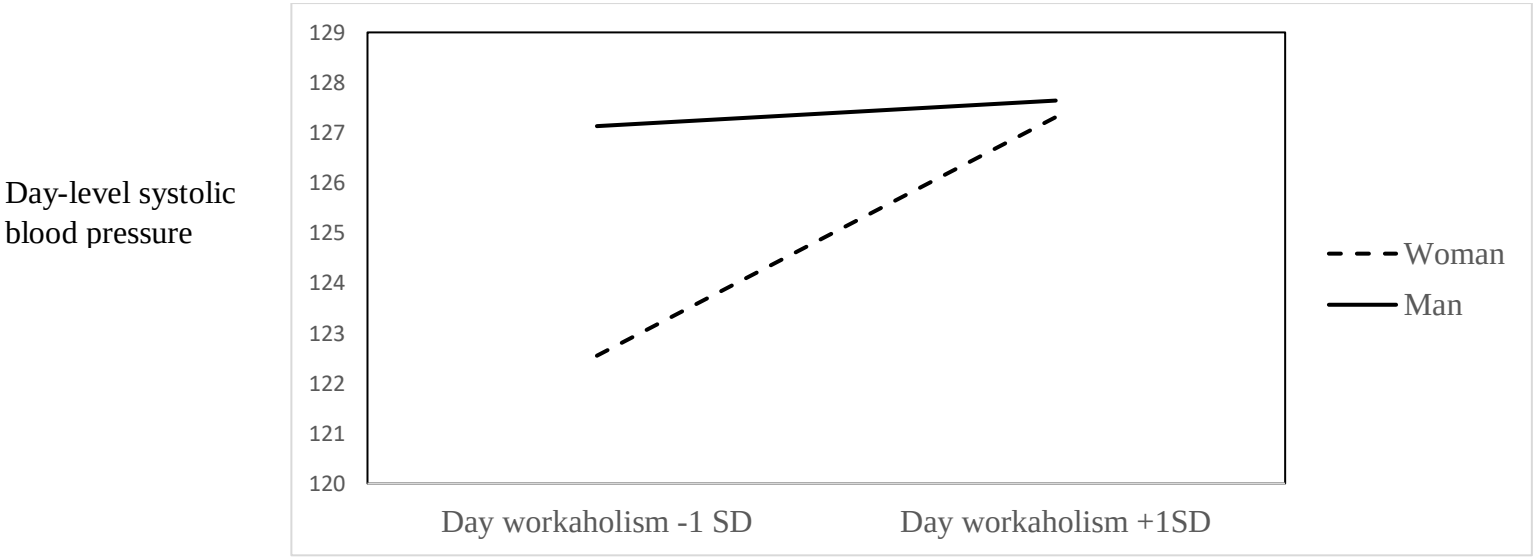
Figure 2. Representation of the day-level workaholism by gender interaction on day-level systolic blood pressure