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Exploring The Relationship Between Work Stress and Work-related Rumination

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Abstract

Current studies lack adequate analysis of the antecedents of the two forms of work-related rumination. However, understanding the relationship between different types of stress and the two forms of rumination is of profound significance for eliminating the influence of negative rumination. In this project, three studies were conducted to investigate the cumulative and immediate effects of challenge and hindrance stress on affective rumination and problem-solving rumination based on one-time, two-time points and daily measurements. Participants were 1109, 605 and 111 employees from a variety of jobs in Chinese mainland. The results showed the relationship between hindrance stress and affective rumination varies over different time course. There was no significant correlation between hindrance stress and problem-solving rumination over any time course. The relationship between challenge stress and two forms of work-related rumination varies over different time course. The results of this study suggest that the antecedent analysis of work-related rumination should not only give attention to the type of work stress, but also consider the time of work stress when analyzing its aftereffects.

Keywords

Challenge stress, hindrance stress, affective rumination, problem-solving rumination

Work-related rumination (WRR, Cropley & Zijlstra, 2011) is the inability to leave work behind after work, which has received a lot of attention in the ten years since it was first proposed as an independent concept. Most researchers have focused primarily on its effects on employee health and well-being (e.g., Cropley et al., 2012; Vahle-Hinz et al., 2014), but a small amount of research has begun to look at the effects of WRR on job performance (e.g., Zhang et al., 2021). What these studies agree on is that the two forms of WRR, affective rumination and problem-solving rumination, have different potency. Affective rumination has a harmful effect on outcome variables. In contrast, problem-solving rumination has a neutral or positive effect on outcome variables (e.g., Baranik et al., 2014; Kinnunen et al., 2017). In view of the significant detrimental effects of affective rumination, the focus of researchers on WRR has gradually developed to explore intervention approaches to eliminate affective rumination. However, according to the approach of Traditional Chinese medicine, this way of post-treatment is not as good as prevention in advance.

Employees not only ruminate negatively, but they may also think positively about their work in a problem-solving way (Cropley & Zijlstra, 2011). If we can understand why employees engage in problem-solving rumination rather than affective rumination, it may be possible to guide employees to engage in positive rumination, thus directly avoiding negative rumination. That said, one of the first things that needs to be addressed is to fully understand what triggers WRR. Most

current studies have looked at WRR from the perspective of work stress continuity (Van Laethem et al., 2019). This is a single negative perspective, which leads to existing studies focusing too much on the relationship between negative work stress and affective rumination (e.g., Syrek et al., 2017; Vandevala et al., 2017). The current consensus in the field of stress management is that work stress can be divided into two types: challenge stress and hindrance stress (Cavanaugh et al., 2000). However, the existing studies have not systematically analyzed the relationship between work stress and WRR from the perspective of challenge and hindrance stress. Based on existing research, the effects of challenging stress have both positive and negative effects, which are manifested as a "double-edged sword" effect (Mazzola & Disselhorst, 2019). The relationship between challenge stress and two forms of WRR, then, is a question worth exploring with a variety of possibilities.

The transactional models of stress take coping into the transactional process between one's environment and reactions to that environment (Lazarus & Folkman, 1984; Peacock & Wong, 1990). Coping can be divided into emotion-focused coping and problem-focused coping (Endler & Parker, 1999). Based on the concept of coping, WRR as a cognitive process can clearly be seen as a coping to work stress (Hamesch et al., 2014). This study will analyze the relationship between work stress and WRR from this perspective, so as to cover the two types of work stress and two forms of WRR. In recent years, researchers on work stress have increasingly emphasized the role of time in the influence of stress and paid attention to the influence of dynamic fluctuation of stress on outcome variables (Rosen et al., 2020).

While existing studies have mainly analyzed the relationship between hindrance stress and WRR from the cross-sectional level without taking the time factor into consideration (e.g., Syrek et al., 2017; Vandevala et al., 2017).

Based on the above, this study will advance the analysis of the relationship between work stress and WRR from two perspectives. First, the relationship between work stress and WRR was analyzed from a more comprehensive perspective, starting from challenge and hindrance stress. Moreover, the relationship between work stress and WRR at different levels is analyzed by taking time into consideration.

Specifically, the analysis will be carried out through three studies. First, the general relationship between work stress and WRR will be analyzed through cross-sectional data. Secondly, the predicted effect of work stress on WRR across four weeks will be analyzed using data from two time points. Finally, using daily measurement, the data from five consecutive working days will be analyzed to investigate the immediate effect of work stress on WRR and the effect of changes in work stress across two days on which WRR was recorded.

Study 1

Through the analysis of cross-sectional data, this study obtained the basic evidence of the relationship between work stress and WRR at the cumulative level.

Hindrance Stress and WRR

Hindrance stress reflects difficulties that are considered to be potentially harmful to performing one's work (Ventura et al., 2015). Both single studies and meta-analyses have drawn consistent conclusions on the harmful effects of hindrance stress on

employees' health, happiness, work and other fields (e.g., Mazzola & Disselhorst, 2019; O'Brien & Beehr, 2019). Therefore, it can be predicted that hindrance stress will cause negative work rumination. This is also confirmed by practical studies, such as uncivilized behavior in the workplace (Demskey et al., 2019; Vahle-Hinz et al., 2014), job insecurity (Richter et al., 2020), and customer abuse (Baranik et al., 2014) are all significantly associated with negative rumination after work. Hindrance stress is usually the negative pressure beyond the control of employees, which is difficult for employees to solve by their own strength. In problem-solving rumination, the purpose of the employee is to think about how to improve the problems in work and enhance their job performance (Cropley & Zijlstra, 2011; Syrek et al., 2017). Therefore, it can be predicted that

Hypothesis 1-1a: hindrance stress will be positively correlated with affective rumination

Hypothesis 1-1b: hindrance stress will be negatively correlated with problem-solving rumination

Challenge Stress and WRR

Challenge stress is relatively positive and can provide opportunities for individuals to gain performance and a sense of accomplishment (Webster et al., 2011). This dynamic of challenge stress made it sought after by a large number of scholars and organizational managers at the beginning of its proposal (Mazzola & Disselhorst, 2019). However, in the past few years, the positive effect of challenge stress has been controversial, because this positive effect has not been supported by some studies

(LePine et al., 2005; Mazzola & Disselhorst, 2019). Moreover, the nature of challenge stress belongs to the category of stress, and it is also significantly predictive of negative emotion, such as pressure (O'Brien & Beehr, 2019). At present, more and more researchers point out that more attention should be paid to challenge stress. They believe that we should make clear the conditions and scenarios under which challenge stress can play a positive role, and then advocate that the organization managers add challenges in their work to promote the growth of employees (Mazzola & Disselhorst, 2019; Rosen et al., 2020).

Summing up previous studies, challenge stress can not only have a significant positive effect on variables in the work domain and the happiness domain but also have a significant negative effect on emotional variables (e.g., LePine et al., 2005; Podsakoff et al., 2007; O'Brien & Beehr, 2019). That is to say, challenge stress has both positive and negative effects. However, the aftereffects of challenge stress are not clear and one cannot determine in when the positive effects of challenge stress are exerted. Therefore, for the two forms of WRR with opposite valence, challenge stress may be positively correlated with both. Based on the above, the following hypotheses were tested:

Hypothesis 1-2a: Challenge stress will be positively correlated with affective rumination

Hypothesis 1-2b: Challenge stress will be positively correlated with problem-solving rumination

Methods

Participants and procedure

The current study was approved by the University's Institutional review boards of Hainan College of Foreign Studies. Participants were full-time employees of enterprises and public institutions in Chinese mainland. Using a "snowball sampling" methodology, **online questionnaires were randomly distributed to employees in various industries by research assistants, and these employees continued to forward the questionnaires.** A total of 1109 valid questionnaires were collected. After completing the questionnaire voluntarily and anonymously, participants received a thank-you fee **15 yuan (about \$2.20)**. Of these participants, 497 were male, 426 had a junior college degree or less education, 609 had a bachelor's degree, and 74 had a master's degree or above. Their ages ranged from 18 to 65 years ($M = 34.02$, $SD = 10.57$), the average job tenure was 9.05 years ($SD = 9.48$), and the average working hours per week was 44.51 ($SD = 10.35$). There was a wide range of work settings, with 198 in state-owned enterprises, 357 in private enterprises, 37 in transnational enterprises, 361 in governmental agencies or public institutions, and 156 in other occupational settings. These demographic variables were used as control variables to avoid the influence of individual differences on outcome variables. Same thing with study 2 and study 3.

Measures

Chinese versions of all scales are available.

Work-related rumination. Two forms of WRR were measured with a ten-item questionnaire developed by Cropley et al. (2012) on a five-point Likert scale from 1

(= *strongly disagree*) to 5 (= *strongly agree*). The example items are "Are you irritated by work issues when not at work?" (Affective rumination). "I find solutions to work-related problems in my free time." (Problem-solving rumination). In the current study, Cronbach's Alpha was .89 for affective rumination and .86 for problem-solving rumination.

Stress. This was measured using the Challenge- Obstructive Stressors Scale developed by Cavanaugh et al. (2000). Six of the 11 questions measure challenge stress (e.g., "Time pressures I experience."), five measure hindrance stress (e.g., "The lack of job security I have."). The subjects were asked to rate the degree to which the situation described in the item caused their stress. The five-point Likert scale from 1 (= *no stress*) to 5 (= *a great deal of stress*). Cronbach's Alpha of the challenge stress subscale and hindrance stress subscale were 0.92 and 0.82, respectively.

Assessment of Common Method Variance

Two methods were used to reduce the impact of common method variance (Podsakoff et al., 2003). First, Harman's single-factor test was used to determine whether each measure explained unique variance in the data. Exploratory Factor Analysis showed there were four factors ($\lambda > 1$) when there was no rotation. The first factor explained 37.41% of the variance, which could not account for the majority of the covariance among the measures. Second, the discriminant validity test was conducted. The results of confirmatory factor analysis showed that the fitting index of the four-factor model ($\chi^2/ df = 4.44$, CFI = .96, TLI = .95, GFI = .94, RMSEA = .06) was significantly better than that of the single-factor model ($\chi^2/ df = 31.11$, CFI = .58, TLI

=. 53, GFI =. 56, RMSEA =. 17). In sum, results in this study cannot be solely attributed to common method variance.

Results

Preliminary Analyses

Means, standard deviations, and correlations are presented in Table 1. The results showed that both challenge stress and hindrance stress were positively correlated with the two forms of WRR. This provided some preliminary support for hypotheses 1-1a, 1-1b, and 1-2a, 1-2b.

[Insert Table 1 here]

Hypothesis Analyses

Through AMOS21, the structural equation model was used to test the whole research model. The degree of fit of the whole model was good ($\chi^2/df= 3.61$, CFI =. 94, TLI =. 94, GFI =. 93, RMSEA =. 05). Each standardized path coefficient is shown in Figure 1. Statistical results showed a significant correlation between hindrance stress and affective rumination ($\beta = 0.30, p < .001$), no significant correlation between hindrance stress and problem-solving rumination ($\beta = 0.08, p = .159$). Hypothesis 1-1a and 1-1b were supported. There were significant correlations between challenge stress and affective rumination ($\beta = 0.20, p < .001$), and a significant correlation between challenge stress and problem-solving rumination ($\beta = 0.22, p < .001$). Hypothesis 1-2a and 1-2b were supported.

[Insert Figure 1 Here]

Age was positively correlated with problem-solving rumination ($\beta = 0.09, p < .$

05). There was a significant positive correlation between education level and problem-solving rumination ($\beta = 0.08, p < .05$). Working setting was positively correlated with affective rumination ($\beta = 0.07, p < .05$). Working tenure was negatively correlated with problem-solving rumination ($\beta = -0.12, p < .01$).

Discussion

The results showed that the harmful effects of hindrance stress led to a significant positive association only with affective rumination. Hindrance stress is usually beyond the control of employees. Therefore, employees will give up trying to solve problems and generate a series of negative emotions and experiences when ruminating about this type of stress. Challenge stress has both the negative attributes of stress and also has the positive value of stimulating individuals to think and find possible ways to solve the stress at work. As a result, the double-edged sword effect of challenge stress made it positively correlated with both forms of WRR. The results of our study suggest that the previous research on the relationship between WRR and work stress from the perspective of stress continuation is not comprehensive (e.g., Wang et al., 2013). Affective rumination takes on the role of continuous stress, and it has a significant positive correlation with both types of work stress. Problem-solving rumination was significantly associated only with challenge stress, which plays more of a role in stress management. Our results also provide a possible explanation for previous results (e.g., Syrek et al., 2017; Vandevala et al., 2017) that failed to obtain the expected mediating effect of WRR on work stress and outcome variables because they did not differentiate between types of stress or forms of rumination.

One shortcoming of this study is that the results are based on cross-sectional data, which cannot identify a causal relationship. In order to solve this problem, the data from two-time points of a four-week interval study were analyzed in order to examine the predictive effect of work stress on WRR.

Study 2

Only a few studies have analyzed the longitudinal prediction of work stress on WRR.

The study of Vahle Hinz et al. (2014) showed that work stress on weekdays was significantly correlated with WRR that night but not with WRR on Saturday night.

Their research used work overload and working hours of the day to represent work stress, which is often seen as challenging (Khelifat et al., 2021). However, their study used only one item to measure WRR and did not distinguish the categories of WRR.

Van Laethem et al. (2019) showed that challenging job demands significantly and negatively predicted affective rumination one year later, while threatening job

demands did not significantly predict the affective rumination one year later. In view

of these, it is difficult to infer the direction of cross-time prediction of two types of

work stress on the two forms of WRR based on the existing research results. The

present longitudinal study examined the cumulative effect over a certain time. Study 2

tested the following hypotheses:

Hypothesis 2-1a: Hindrance stress will be positively correlated with affective rumination.

Hypothesis 2-1b: Hindrance stress will be negatively correlated with problem-solving rumination.

Hypothesis 2-2a: Challenge stress will be positively correlated with affective rumination.

Hypothesis 2-2b: Challenge stress will be positively correlated with problem-solving rumination.

Methods

Participants and procedure

In order to better analyze the causal relationship between variables, according to the research of Hasegawa et al. (2018), this study adopts a longitudinal design with an interval of 4 weeks. Participants in study 1 were coded (last name and the last four digits of mobile phone number), and then the group was contacted via WeChat for a second measurement. A total of 605 participants completed both tests. These participants were 259 men, 241 had a college degree or below, 327 had a bachelor degree, 37 had a master degree or above. Their mean age was 36.38 years ($SD = 10.57$). Average working hours per week were 45.1 hours ($SD = 8.96$), and average tenure was 10.76 years ($SD = 10.18$). A total of 95 worked in state-owned enterprises, 202 worked in private enterprises, 15 worked in transnational enterprises, 233 worked in government or public institutions, and 60 were from other occupational backgrounds.

In analyzing sample attrition, we compared the final sample ($N = 605$) to non-respondents at time point 2 ($N = 504$). The percentage difference μ test of gender, education level and working setting were carried out. The results showed that there were no significant differences between the two samples in terms of gender (male: $\mu =$

1.46, $p > .05$; female: $\mu = 1.67, p > .05$) and education level (college degree or below: $\mu = 1.06, p > .05$; Bachelor's degree: $\mu = 0.67, p > .05$; Master's degree or above: $\mu = 0.79, p > .05$). As for work background, there was no significant difference in the percentage of employees working in private enterprise ($\mu = 0.93, p > .05$) and transnational enterprises ($\mu = 1.71, p > .05$), while there was a significant difference in the percentage of employees working in state-owned enterprises ($\mu = 1.02, p < .05$), governmental agencies or public institutions ($\mu = 4.73, p < .01$) and other occupational backgrounds ($\mu = 4.28, p < .01$). An independent sample t test was performed to test for the differences in age, tenure, and working hours per week. The results showed no significant differences between the two samples in age ($t = 1.62, p = .105$) or working hours per week ($t = 1.96, p = .051$). There were significant differences in job tenure ($t = 6.87, p < .001$), with employees who completed the survey twice having longer job tenure on average ($M = 7.02$ vs. 10.76).

Measures

Work-related rumination. The measure was the same as study 1. In the two measurements, Cronbach's Alpha of affective rumination were 0.90 and 0.91, respectively. Cronbach's Alpha of problem-solving rumination were 0.87 and 0.88, respectively.

Stress. The measure was the same as study 1. In the two measurements, Cronbach's Alpha of challenge stress were 0.92 and 0.93, respectively. Cronbach's Alpha of hindrance stress were 0.82 and 0.87, respectively.

Control Variables. Two forms of WRR from time point 1 and other control variables

as in study 1.

Results

Preliminary Analyses

Means, standard deviations, and correlations are presented in Table 2. The results showed that there was a significant positive correlation between work stress at the two time points, and also a significant positive correlation with the two forms of WRR measured at the second time.

[Insert Table 2 here]

Model Analysis

The study model was tested using AMOS21. Each standardized path coefficient is shown in Figure 2. The degree of fit of the whole model is good ($\chi^2/df = 2.53$, CFI = .91, TLI = .90, GFI = .84, RMSEA = .05). Statistical results showed there was no significant correlation between hindrance stress (T1) and two forms of WRR (T2) (affective rumination: $\beta = 0.07$, $p = .355$, problem-solving rumination: $\beta = 0.05$, $p = .518$). There was no significant correlation between challenge stress (T1) and two forms of WRR (T2) (affective rumination: $\beta = 0.06$, $p = .343$, problem-solving rumination: $\beta = 0.10$, $p = .172$). Hypotheses 2-1a, 2-1b, 2-2a and 2-2b were not verified. Age was negatively correlated with affective rumination (T2) ($\beta = -0.16$, $p < .01$).

[Insert Figure 2 Here]

To test the robustness of our results, we also tested the proposed model without control variables and found the degree of fit to be identical ($\chi^2/df = 2.67$, CFI = .92,

TLI = .92, GFI = .86, RMSEA = .05). In addition, the autoregressions of variables measured at both time points were significant at the 0.001 level, ranging from 0.37 to 0.55, which indicates that the stability of variables over time was good.

Discussion

The results from this study showed that neither challenge nor hindrance stress significantly predicted either form of WRR four weeks later. A few existing studies provide limited about the long-term longitudinal relationship between work stress and WRR (e.g., Vahle Hinz et al., 2014; Van Laethem et al., 2019). Combined with the results of this study and existing studies, the predictive effect of hindrance stress on WRR may not be significant in one month. The predicted effect of challenge stress on WRR is more complex. In summary, it is difficult to draw conclusions about the longitudinal relationship between work stress and rumination based on existing research. Future research needs to pay more attention to this topic. Researchers have pointed out that time should be taken into account when doing analysis to get a clearer understanding of the role of stress (e.g., Baethge et al., 2018), because static research paradigms cannot capture complex and dynamic states, behaviors, and situations (George & Jones, 2000). One of the most important methods to analyze the relationship between variables from a dynamic perspective is to adopt a within-person study, which could enhance temporal precision, show variability over time, and provide novel insights (McCormick et al., 2020). The relationship between variables analyzed at the level of the within-person and the results analyzed at the level of the between-person can be significantly different (Curran & Bauer, 2011; Dalal et al.,

2014; Dalal & Hulin, 2008). For example, Rehm (1978) found that there was no significant relationship between stressful events accumulated within two weeks and mood, while changes of stressful events at the within-person level were significantly related to daily mood fluctuations. In other words what mattered was not the individual's overall level of stress compared to other individuals, but rather whether the individual had more or less stress than on previous days (Folkman et al., 1986).

Based on these views, and in order to comprehensively investigate the relationship between challenge stress and WRR, the final study conducted an analysis using the daily measurement level. It also examined whether the effect of hindrance stress on WRR is consistent across the within-person and between-person levels.

Study 3

Work stress fluctuates, and there may be differences in stress sources and stress levels faced by employees every day. In addition, studies have shown that employees may experience two forms of WRR alternately over time (Kinnunen et al., 2017). Therefore, the daily effects of work stress on rumination can be best reflected at the individual level using daily measurements. Within-person level analysis can exclude the influence of inter-person factors and obtain a purer analysis of the relationship between work stress and WRR. As mentioned above, in view of the double-edged sword effect of challenge stress (Mazzola & Disselhorst, 2019), this study predicts that when employees encounter challenging job requirements on the day of work, they may produce two forms of WRR after work. The hypotheses tested were:

H3-1a: Challenge stress at work during the day will be significantly

positively correlated with affective rumination after work.

H3-1b: Challenge stress at work during the day will be significantly positively correlated with problem-solving rumination after work.

Similarly, based on the stable harmful effects of hindrance stress, this study predicted that:

H3-2a: The hindrance stress encountered by employees on the day of work will be significantly positively correlated with affective rumination after work.

H3-2b: There will be no significant correlation between hindrance stress encountered by employees on the day of work and problem-solving rumination after work.

Some researchers have pointed out that it is not the negative nature of the event itself that causes the stress but the unstable nature of the event (Weiss, 1970; Katz & Wykes, 1985; Rosen et al., 2020). That is, in addition to the amount of stress, the change in stress plays an important role in the potency of its aftereffect. Employees are more negatively affected when work stress increases because a sudden increase in work pressure may make employees experience more stress or break the balance of stress coping that they have established (Parke et al., 2018). When the work stress moves downwards, the reduced pressure will make employees have more positive experiences, which in turn may cause employees to reduce their ruminations after work. Based on these assumptions, the present study predicted that:

H3-3a: At the within-person level, an increase in daily work stress (challenge and hindrance stress) will be significantly positively correlated with affective

rumination, and significantly negatively correlated with problem-solving rumination.

H3-3b: A reduction in daily work stress (challenge and hindrance stress) will be significantly negatively correlated with affective rumination and significantly positively correlated with problem-solving rumination.

In order to obtain as complete a picture as possible about the impact of work stress on rumination, study 3 also analyzed the relationship between work stress and rumination using the average level of five consecutive working days. This analysis of the relationship between variables at the chronic level involved a cross-sectional analysis. Therefore, according to the results from study 1, this study predicted that:

H3-4: The average level of challenge stress will be significantly positively correlated with affective rumination and problem-solving rumination.

H3-5: The average level of hindrance stress was positively correlated with affective rumination but not significantly correlated with problem-solving rumination.

Methods

Participants and procedure

Participants were recruited to participate in this study with the "snowball" sampling method. They were introduced to the purpose, value and confidentiality commitment of the study and promised to receive certain monetary reward (20 yuan) for each day they completed the electronic questionnaire. The demographic information was collected on a Sunday. They were asked to complete the

measurement twice a day for five consecutive working days from Monday to Friday. Specifically, according to the usual off-duty time and sleep time of most subjects (70%), two measurement time points were determined each day, 5 and 10 pm. The link to measure work stress was disabled at 7 pm. If they were doing overtime, they could contact the researcher to complete the measurement. The link to measure rumination before bedtime was disabled at 12 pm. A total of 111 participants provided data ten times for five consecutive days. All participants worked during the day without doing a night shift. These participants included 52 males. The average age was 33.8 years ($SD=5.17$). A total of 59 worked for five years or less, 32 worked for 5-10 years, and 20 worked for more than ten years. There were 3 of them who had high school (or below) education level, 26 had technical secondary school or junior college, 50 had a bachelor's degree, and 32 had a master's degree or above. A total of 12 were from state-owned enterprises, 31 from non-state-owned enterprises, 46 from public institutions, 7 from administrative organs, and 15 from others. Average working hours were 8.57 ($SD=1.73$) per day.

Measures

Stress. The daily measuring work stress scale developed by Rodell and Judge (2009) was used. Eight items measure the challenge stress (e.g., "Today, my job has required me to work very hard."). The hindrance stress scale (The fourth item is reverse scoring) also includes eight items (e.g., "Today, I have received conflicting requests from two or more people."). The five-point Likert scale from 1 (= *strongly disagree*) to 5 (= *strongly agree*). Cronbach's Alpha (mean internal consistency across all

measured days) of challenge stress in this study was 0.88, and Cronbach's Alpha (mean internal consistency across all measured days) of hindrance stress was 0.78.

Work-related rumination. The same measure as study 1 was used. The time frame of items in the original scale was adjusted to make it suitable for daily measurement. For example, "Are you irritated by work issues when not at work?" change to "Today after work, I was irritated by work issues." In this study, Cronbach's Alpha (mean internal consistency across all measured days) of problem-solving rumination was 0.90 and of affective rumination was 0.93.

Analysis

Following the study of Bledow et al. (2013), a multilevel structural equation model (MSEM) was used to test the between- and within-person effects simultaneously. At the within-person level, a shift in daily work stress and daily work stress were used as predictors. At the between-person level, the average level of work stress was entered as a predictor.

Results

Preliminary Analyses

Means, standard deviations, and correlations are presented in Table 3. The results of correlation analysis showed that daily hindrance stress was significantly positively correlated with daily affective rumination, while the daily challenge stress was significantly positively correlated with daily two forms of WRR. The 5-day average level of hindrance stress was significantly positively correlated with the two forms of WRR, and so was challenge stress. The daily change in challenge stress was

significantly negatively correlated with average affective rumination and problem-solving rumination. There was no significant correlation between daily changes in hindrance stress and the two forms of WRR.

[Insert Table 3 here]

Before testing the hypotheses, the intra-class correlation (ICC) was examined. This represents the proportion of variance at the between-person level and indicated that 56% of the variance in affective rumination (ICC=0.56), 69% of the variance in problem-solving rumination (ICC=0.69) were at the between-person level. These results indicate there were significant between- and within-person effects for each of the dependent variables, showing that it was appropriate to employ multilevel modelling.

Hypothesis Analyses

The results of MSEM are presented in Table 4. At level 1, the impact of the change in work stress on two adjacent days on two forms of WRR was tested, and the prediction of work stress on WRR at night before going to bed was tested. At level 2, the effect of an average level of work stress for five consecutive days on WRR was tested. The results showed that the challenge stress of the day was only significantly positively correlated with the problem-solving rumination at night. Hypothesis 3-1b was verified. The hindrance stress of the day was only significantly positively correlated with affective rumination at night. Hypothesis 3-2a and 3-2b were verified. There was no significant correlation between the daily shift of challenge or hindrance stress and the two forms of WRR. Hypothesis 3-3a and 3-3b were not verified. At the second

level, chronic challenge stress was significantly positively correlated with chronic problem-solving rumination and chronic affective rumination. Hypothesis 3-4 was supported. There was no significant correlation between chronic hindrance stress and chronic problem-solving rumination. Chronic hindrance stress was significantly positively correlated with chronic affective rumination. Therefore, hypothesis 3-5 was supported.

[Insert Table 4 here]

Discussion

Study 3 analyzed the relationship between work stress and WRR at both within- and between-person levels using daily measured data. The results show that the challenging work stress that employees face daily can trigger problem-solving rumination before bedtime. Using the 5-day average, challenge stress was both significantly associated with problem-solving rumination and affective rumination. These show the positive side of challenging stress on WRR lasted for at least a week. However, at the same time, the detrimental effect of challenge stress was present in the cumulative period of 5 consecutive days, which showed that the average level of challenge stress was significantly positively correlated with affective rumination. The hindrance work stress in daily work and its average level only causes affective rumination. The relationship between hindrance stress and problem-solving rumination is the same across the average level of five consecutive working days and daily levels, and there was no significant correlation. These results once again support the stable harmful effect of hindrance stress (Mazzola & Disselhorst, 2019). In this

study, changes in stress across two consecutive days did not have a significant effect on WRR, which may be attributed to the relatively stable work stress over a time (at least one week) for most occupational types. Therefore, future studies are needed to further analyze the effects of changes in work stress, especially challenge stress, on WRR over longer time frames (e.g., half a month or more).

This study found that within the time frame of one day, employees have a more positive attitude towards dealing with challenges at work and will think about them repeatedly to try to solve problems after work. If employees continue to experience challenging work demands within a working week, employees will have negative emotions because of WRR. This further confirms the view of Rosen et al. (2020), namely that time should be considered when analyzing challenging work demands. This is because the aftereffects of challenge stress differ in different time frames. According to the results of this study, the detrimental effects of challenge stress should accumulate over a certain period, which may be a working week. The results also suggest that when analyzing the relationship between work stress and WRR in the future, one should first pay attention to distinguishing the types of stressors because hindrance stress does not lead to problem-solving rumination in any time range. This may explain the failure of some previous studies to find a mediating role in problem-solving rumination (e.g., Syrek et al., 2017; Vandevala et al., 2017).

General Discussion

The present series of studies systematically analyzed the relationship between work stress and WRR. Study 1 showed that at the cross-sectional level, challenge stress was

significantly positively correlated with two forms of WRR, and hindrance stress was only significantly positively correlated with affective rumination. Study 3 further confirmed that the duration of this cumulative effect lasted for as long as one working week. However, according to the results of study 2, this significant relationship did not last for four weeks. Therefore, more research is needed to analyze how long the cumulative effect relationship between the two types of work stress and the two forms of WRR remains significant.

These results suggest that employees usually ruminate about the recent pressure at work. Therefore, in future relevant research, one should pay attention to the time course when using WRR as an internal mechanism to explain the relationship between work stress and outcome variables. This is because the impact of work stress on outcome variables a month ago may not be due to WRR. Besides, a series of findings from our study suggests that the duration of challenge stress may alter its aftereffects. The first response to the challenges of the day was problem-solving thinking, if the challenges continued throughout the working week, employees began to think negatively about them. The accumulating detrimental effect of challenge stress has been verified in some studies (e.g., Baethge et al., 2018). As Rosen et al. (2020) pointed out, when analyzing the aftereffects of challenging stressors, it is even more important to take time into account than to consider the cognitive assessment of stressors.

In short, the results of our study suggest that researchers analyzing the causes of WRR should not only clarify the type of work stress but also consider the timing of

the stress.

Practical Implications

First, this study found that when there is hindrance stress at work, employees will have negative WRR. Therefore, the most direct and effective way to reduce affective rumination is to reduce all kinds of obstructive pressures they may encounter at work, such as simplifying work procedures, creating a friendly cooperative atmosphere.

Secondly, when setting various challenges to motivate employees, organizational managers should pay attention to the duration of the challenge demands because work challenges that cannot be solved in a week will make employees have negative emotions and thus have a negative impact.

Limitations and Future Directions

First, this study considered the influence of time when analyzing the role of work pressure. However, this on its own may not be sufficient for several reasons. First, the interval between the two time points was four weeks, during which the work stress did not significantly affect the WRR. Therefore, future studies on the longitudinal relationship between work stress and rumination should select more time intervals between one week and four weeks to clarify the longitudinal predictive effect of work stress on WRR. Secondly, the analysis of stress change in this study was based on two consecutive working days, which failed to test the hypothesis. The effect of changes in work stress on WRR over time will need to be examined at longer intervals or even across multiple time points in the future.

In addition, this study selected employees from a variety of industries to obtain a

general understanding of the relationship between work stress and WRR. Future research should focus on specific industries or positions, such as managers of organizations. Managers often need to give more consideration to motivate employee performance and promote the creative development of the organization, so they may give more thought to work in non-working time (Weinberger et al., 2018). Analyzing the rumination phenomenon of this group and helping them cope with work stress effectively may contribute more to the development of the whole organization.

Finally, the analysis of control variables in this study only considered demographic variables. Situational variables at the organizational level may also have an impact on WRR, such as leadership style and organizational culture, etc. This also suggests that future research can start with these factors when analyzing the antecedent variables of WRR.

Conclusion

The results of this study indicate that the relationship between work stress and WRR is varies across different time scales. Across a day, and in one working week, hindrance stress is an important factor in explaining affective rumination, but in the time period of four weeks, the significant relationship between them disappeared. The relationship between challenge stress and problem-solving rumination was significant across a day and within a working week. At the same time, challenge stress can also significantly predict affective rumination over the working week, although the significant relationship also disappeared during a four-week interval. These results from the present study suggest that WRR and work stress (especially challenge stress)

are not simply a continuation of stress and that the form of rumination produced by employees varies with the duration of stress.

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Ethical Approval

All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Conflict of Interest

There is no conflict of interest in the present research.

All participants participated in this study voluntarily and anonymously.

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Table 1 Means, standard deviations, and correlations among study 1 variables

Variables	1	2	3	4
1 CS	1			
2 HS	.68**	1		
3 AR	.39**	.40**	1	
4 PSR	.28**	.23**	.31**	1
<i>M</i>	16.72	13.19	13.30	15.30
<i>SD</i>	5.55	4.23	3.99	3.64

Note^a. *N* = 1109. CS = challenge stress, HS = hindrance stress, AR = affective rumination, PSR = problem-solving rumination; ***p* < .01.

Table 2 Means, standard deviations, and correlations among study 2 variables

Variables	1	2	3	4	5	6	7	8
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1 CS _{t1}	1								
2 HS _{t1}	.65**	1							
3 CS _{t2}	.53**	.42**	1						
4 HS _{t2}	.42**	.48**	.72**	1					
5 AR _{t1}	.31**	.36**	.36**	.28**	1				
6 PSR _{t1}	.30**	.17**	.30**	.17**	.25**	1			
7 AR _{t2}	.24**	.27**	.35**	.33**	.48**	.19**	1		
8 PSR _{t2}	.26**	.19**	.33**	.25**	.35**	.40**	.35**	1	
<i>M</i>	16.39	12.78	16.51	12.94	12.94	15.1	12.70	14.64	
<i>SD</i>	5.50	3.94	5.22	4.05	3.79	3.49	4.01	3.63	

Note^c. *N* = 605. CS = challenge stress, HS = hindrance stress, t1 = time point 1, t2 = time point 2, AR = affective rumination, PSR = problem-solving rumination; ***p* < .01.

Table 3 Means, standard deviations, and correlations among study 3 variables

Variables	1	2	3	4	5	6	7	8	9	10
1 HS	1									
2 CS	.32**	1								
3 AR	.53**	.34**	1							
4 PSR	.06	.39**	.38**	1						
5 mHS	.84**	.31**	.56**	.09*	1					
6 mCS	.32**	.83**	.34**	.45**	.38**	1				
7 HSs	.02	.03	.05	.04	.07	.10	1			
8 CSs	.14	.22*	.16	.19*	.12	.20*	.09	1		
9 mAR	.58**	.35**	.81**	.33**	.69**	.42**	.06	.19*	1	

10 mPSR	.09*	.43**	.31**	.87**	.10*	.52**	.05	.21*	.38**	1
M	19.11	25.17	10.61	13.98	19.11	25.17	.03	.01	10.61	13.98
SD	5.60	6.30	3.79	4.36	4.69	5.25	4.03	4.29	3.06	3.78

Note^a. N at level 1 = 555; N at level 2 = 111. Level 1 refers to within-person level; Level 2 refers to between-person level; HS=hindrance stress, CS= challenge stress, AR= affective rumination, PSR=problem-solving rumination, mHS= average level of hindrance stress, mCS= average level of challenge stress, HSs= daily shift in hindrance stress; CSs= daily shift in challenge stress; ** $p < .01$, * $p < .05$.

Table 4 *Coefficients for Multilevel Analysis among study 3 variables*

Predictors	Dependent variables			
	AR	mAR	PSR	mPSR
	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)
Level 2 predictors				
Average Level of CS		.10(0.05)*		.43(0.08)***
Average Level of HS		.41(0.05)***		-.11(0.09)
Level 1 predictors				
Daily shift in CS	.00(0.00)		.00(0.00)	
Daily shift in HS	-.01(0.01)		.00(0.01)	

Daily CS	.11(0.09)	.72(0.11)***
Daily HS	.73(0.15)***	-.18(0.15)

Note^a. N at level 1 = 555; N at level 2 = 111. Level 1 refers to within-person level; Level 2 refers to between-person level; HS=hindrance stress, CS= challenge stress, AR= affective rumination, PSR=problem-solving rumination, mAR= average level of affective rumination, mPSR= average level of problem-solving rumination; *** $p < .001$, * $p < .05$.

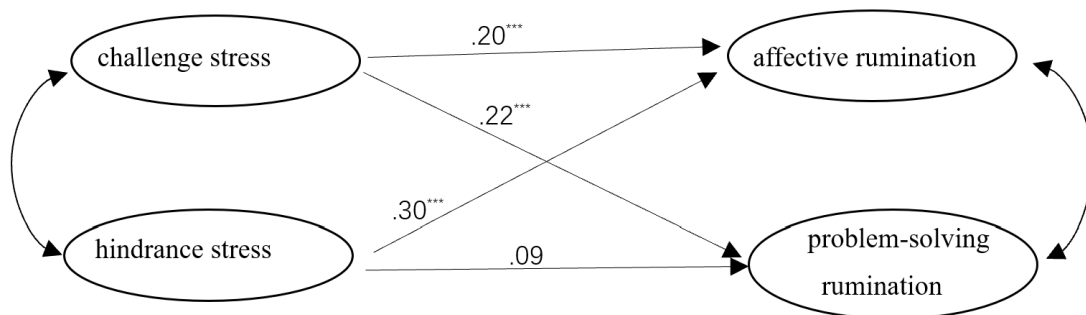


Figure 1. The results of overall research model (Study 1)

Note^b: N=1109, *** $p < .001$.

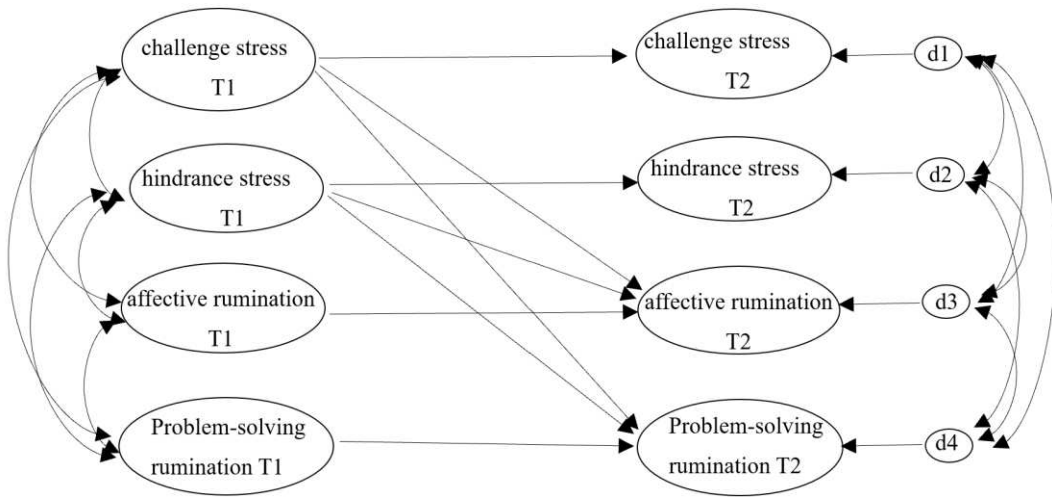


Figure 2. The overall research model (Study 2)

Note^d: N=605, T1= time point 1, T2= time point 2.