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Resilience, Work Engagement and Stress Reactivity in a Middle-Aged Manual Worker Population.

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Abstract

Work stress is a growing problem in Europe. Together, the negative physiological effect of stress on health, and increasing age increases the risk of developing cardiovascular disease in those aged over 50 years. Therefore, identifying older workers who may be at risk of work-related stress, and its physiological effects, is key to promoting their health and wellbeing in the workforce. The present study examined the relationship between perceived psychological resilience and work-related factors (work engagement and presenteeism) and the physiological response to acute psychological stress in older manual workers in the UK. Thirty-one participants, mean (SD) age 54.9 (3.78) years reported perceived levels of resilience, work engagement, and presenteeism using standardized questionnaires. Cardiovascular measurements (heart rate (HR) and blood pressure (BP) and salivary cortisol were used to assess their physiological response to an acute psychological stress task. Resilience was not associated with work-related factors or reactivity. However, workers with higher work engagement showed lower SBP (p = .02) and HR (p = .001) reactivity than those with lower work engagement. Further, those with higher sickness presenteeism also had higher HR reactivity (p = .03). This suggests a potential pathway by which higher work stress might contribute to the risk of future cardiovascular disease.

Keywords: cortisol; cardiovascular reactivity; older workers; resilience.

1. Introduction

Recently, perceived psychological stress has become a major occupational problem (Tripodi et al. 2012) and continues to be a growing issue in Europe (European Agency for Safety and Health at Work 2012). In 2014/2015, the Health and Safety Executive (2015) reported that work related stress in the UK accounted for 35% of all health-related work illness and 43% of work absence. Of particular concern are older workers occupying lower status jobs such as nursing, healthcare, industry and education (Fragar and Depczynski 2011; Jones et al. 2013; Koolhaas et al. 2012). This is because frequent, maladaptive response to work stress, is harmful to physical health and from the age of 50 years, the cardiovascular system undergoes significant changes which heighten the risk of cardiovascular disease (Lupien et al. 2009; McEniery et al. 2007).

Due to work-related sickness absence and the increasing problem of sickness presenteeism (attending work whilst not fully well), promoting the health and wellbeing of employees, is of growing interest, especially those who are termed 'older workers' (50+ years) (Department for Work and Pensions 2011), and particularly in manual occupations (Crawford et al. 2010). Manual workers aged over 50 years experience increasing levels of stress in occupations such as construction (Arndt et al. 2005; Dong et al. 2012). Further, there is evidence to suggest that work-related stress is related to low levels of work engagement and presenteeism in workers aged $\geq$ 50 years (Callen et al. 2013; Fiabane et al. 2013; Jones et al. 2013; Leineweber et al. 2011). However, to our knowledge, there are no studies examining such work-related factors in relation to stress reactivity. Consequently, the present study will examine this.

Research into psychological stress and wellbeing has suggested that future health and wellbeing can depend on the extent of one's physiological responses to stressful situations (Obrist, 1981). Physiological reactivity to acute psychological stress is related to an increased risk of cardiovascular disease (Obrist, 1981) and predicts conditions such as hypertension (Carroll et al. 2012b; Carroll et al. 2011; Carroll et al. 2001) carotid arteriosclerosis (Everson et al. 1997) and even cardiovascular disease mortality (Carroll et al. 2012a). Additionally, elevated cortisol (a stress hormone) secretion in response to acute mental stress is associated with the development of hypertension (Hamer and Steptoe 2012). However, negative health outcomes including depression, obesity and addiction are also related to blunted reactivity (Heaney et al. 2011; Phillips 2011). Thus, how older manual workers respond physiologically to psychological stress is key to understanding the potential risk of damage that may later affect health and wellbeing across working life and into retirement.

Recent research has begun to explore whether perceived high levels of psychological resilience might buffer against the effects of stress (de Paula Couto et al. 2011; Galatzer-Levy et al. 2014). In adults over 55 years old, high resilience was associated with good physical and mental health (Schure et al. 2013); those with low resilience had high levels of depression. Further, adults with a mean age 68 years with high levels of resilience had more positive wellbeing (de Paula Couto et al. 2011). In younger adults, policemen aged 27-32 years who were resilient displayed a significant cortisol increase (healthy) in response to acute psychological stress, while those less resilient showed a blunted (unhealthy) response (Galatzer-Levy et al. 2014). Recently, a review of 29 studies evidenced the relationship between work-related stress and elevated BP, and suggested a stronger association of increased BP and job strain in those aged 50 years and over (Landsbergis 2013). Additional evidence suggests that those who experience high job strain (high demand, low control) are at risk of sustained cardiovascular dysfunction over time (Clays et al. 2007; Steptoe 2001; Steptoe 2004). There has been scant research into stress reactivity and the association with job-related factors in older workers. Of the available studies, one found that men aged 55-65 years with high job strain had pronounced cardiovascular responses to mental stress (Steptoe et al. 1993). A further study found cardiovascular reactivity was positively associated with job strain in a group of workers with a mean age 51.9 years, and was higher among those over 50 (Clays et al., 2007). Equally, work-related stress has also been associated with higher cortisol reactivity (Hausser et al. 2011; Karhula et al. 2016; Steptoe et al. 2000). However, current evidence suggests that the relationship between work and stress reactivity is complex (Rudolph et al. 2016) and the majority of studies have not measured or found consistent results for both cardiovascular and cortisol responses to acute stress, or have not measured resilience. Therefore, further research is needed to understand how resilience and work-related factors may relate to the stress response within older workers.

There is evidence to suggest that social support plays a role in promoting resilience to psychological stress; those who are married or cohabiting have been shown to have higher levels of resilience than those who live alone (Guinn et al. 2009). Additionally, in occupations such as the police force where there are high levels of psychological stress, employees with greater levels of support from colleagues have higher resilience (de Terte et al. 2014). Although social support can reduce reactivity to stress ((Phillips et al. 2006), the impact of marital status on the response to stress is unclear (Zhao et al. 2003), and will be examined in the present study.

It is clear from the above evidence that the research into the relationships between resilience and work-related factors and physiological responses to acute psychological stress in this age group is limited. Further, those aged 45-54 years old have been found to be less resilient than those younger or older (Bonanno et al. 2007). Given that high levels of psychological stress and extremes of reactivity to acute psychological stress are a risk factor for cardiovascular pathology, and that after age 50 years, the risk of physiological health problems such as hypertension increases (McEniery et al. 2007), it is worthwhile attempting to understand the relationships between these factors among older workers if they are to remain healthy and employed for longer. Consequently, the objectives of this study were to identify the relationship between the physiological response to acute psychological stress and perceived psychological resilience to stress and work-related variables in older manual workers aged 50+ years. It was hypothesised that those who exhibited maladaptive (exaggerated or blunted) response to acute psychological stress would have low levels of perceived stress resilience, and display lower levels of positive work-related factors such as work engagement.

2. Methods

2.1. *Participants and Design*

Participants were 200 manual workers aged 50+ years (mean = 57.1, standard deviation (SD) = 5.62 years) who were recruited in 2015 via posters displayed in 20 organisations and industries including the welfare sector i.e. health professionals, education (teachers), service (fire and rescue and police officers) from around the UK. Other industries included retail, construction and farming. A purposive sample of thirty-one participants willing to undertake further testing were invited to complete a questionnaire to measure perceived levels of resilience and work-related factors, and to attend a testing session to measure cardiovascular and cortisol reactions to an acute psychological stress task. Previous correlational reactivity studies have revealed significant associations with similar sample sizes, e.g., (Almela et al. 2011; Domes 2002; Hogan et al. 2012), so we attempted to recruit a similar number. Participants were given gift vouchers for completing the stress testing session. Written informed consent was given and the University of Birmingham ethics committee approved the study.

2.2 Measures

2.2.1 *Stress Resilience Questionnaire*

The ability to recover from stress was measured using the Brief Resilience Scale (Smith et al. 2008). This is a one-dimensional self-report questionnaire containing six items e.g. "I tend to bounce back after hard times" with a possible response of 1 (strongly disagree) to 5 (strongly agree). A mean of the 6 items is taken to represent level of resilience. The questionnaire has previously demonstrated high internal consistency of α = .80 - .91 (Smith et al., 2008) and .78 in the present study.

2.2.2. *Sickness Presenteeism Questionnaire*

The Work Limitations Questionnaire (WLQ) (Lerner et al., 2001) was used to assess sickness presenteeism. Previous research has evidenced the scale as being suitable for measuring presenteeism (Schultz and Edington 2007). The scale includes four dimensions (Time demands e.g., work required hours, Physical demands e.g., repeat motions, Mental demands e.g., concentrate on work, and Interpersonal demands e.g., speak on the phone). The 25 item self-report instrument is a valid and reliable (internal consistency α = .90) method of measuring the degree to which chronic health problems interfere with the ability to perform job roles (Lerner et al. 2001). A 4-week WLQ is considered to be cost effective and more efficient when periods of time need to be matched across other instruments within a study (Lerner et al., 2001). This study therefore asked participants to respond with regard to the past 4 weeks. The scale had an internal consistency of .90.

2.2.3 *Work Engagement Questionnaire*

The Utrecht Work Engagement Scale (UWES – 9) (Schaufeli & Bakker 2006) was used to measure work engagement. The UWES -9 is a shortened version of the original 17-item UWES self-report questionnaire and measures three dimensions of work engagement; vigour, dedication and absorption. Responses were rated on a 7-point scale (1 = Never, 7 = Always) with higher scores indicating higher levels of work engagement. Evidence of the validity and internal consistency (α = .92) of the

UWES-9 has been reported (Schaufeli, Bakker & Salanova, 2006). In the present study the internal consistency was .90.

2.2.4 *Health Behaviours*

Smoking and alcohol consumption were measured using a single item question. Responses for smoking were statements rated as 'Previously', 'Currently', 'Never'. Alcohol consumption measured as 'Often', 'Sometimes', 'Rarely' or 'Never'.

2.2.5. *Psychological Stress Task Evaluation*

Participants rated to what extent they found the task to be difficult, stressful, and engaging as well as how they thought they had performed. Responses were made on a 0 (not at all) to 6 (extremely) Likert-type scales.

2.2.6. *Acute Psychological Stress Task*

Participants undertook the 10 min Paced Auditory Serial Addition Test (PASAT) (Gronwall 1977). The PASAT has been shown previously to reliably perturb both the cardiovascular system and salivary cortisol (Phillips et al. 2006; Phillips et al. 2009; Ring et al. 2002). Participants were presented with a series of single digit numbers by compact disc and required in each case to add the present number to the number previously presented and call out the answer. However, they had to retain each previous number presented in order to add it to the next number presented, thus the task also involves working memory. The intervals between the numbers were 4.5s for the first 2 min and shortened by .5s every subsequent 2 min. An experimenter sitting directly adjacent to the participants obtrusively scored participants' answers. The task also involved elements of competition and social evaluation. A leader board was displayed in the room with the top five scores previously reached and the participants were instructed to attempt to beat the displayed scores. Participants started with 1000 points and five points were deducted for every wrong answer. Participants were also instructed to watch themselves live on a laptop screen directly in front of them throughout the task; they were informed that the test was recorded and would be assessed by "body language experts". In reality, no such assessment or recording was made. They were told that they would hear a brief burst of loud aversive noise if they hesitated or made an error. If they did not make any errors within each block of 10 numbers, they received the noise at a point during the last five numbers of every block in order to standardise the number of noise bursts.

2.2.7. *Cardiovascular And Salivary Cortisol Measurements*

During the testing session, systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were measured discontinuously every two minutes from the participant's dominant arm using a standard brachial artery cuff and an Omron blood pressure monitor (Intelli Sense ™, Japan). Four stimulated saliva samples were obtained using salivettes (Sarstedt Ltd., Leicester, UK). Samples were obtained at 10 minutes into baseline. The remaining samples were taken within 1 min of the end of the task at the start of recovery and then 10 and 20 min following the stress task. Participants placed the salivette dental swab into their mouths and gently chewed for 60 secs to collect saliva. The swab was returned to the salivette tube and stored in the fridge until the end of the testing session. Salivettes were then centrifuged at 4000 rpm for 5 min and the saliva was pipetted into eppendorfs which were stored at − 20

°C until assay. Salivary cortisol samples were analysed all in the same day in duplicate by ELISA (IBL International, Germany). This assay is based on the competition principle and microplate separation. An unknown amount of cortisol present in the sample and a fixed amount of cortisol conjugated with horseradish peroxidase compete for the binding sites of antibodies coated on to wells. After two hours the microplate is washed to stop the competition reaction. After addition of a substrate solution the concentration of cortisol is inversely proportional to the optical density measured at 450 nm. The mean intra-assay coefficient of variation was 15% and the inter-assay coefficient was 7%.

2.3 *Procedure*

Prior to testing of the participants willing to complete further stress testing, a screening questionnaire pertaining to the participants' general health was administered. Those who had a history of cardiovascular or metabolic disease, taking prescription medication (contraception allowed) or using corticosteroid medication e.g. daily brown inhaler use, or had current illness or infection were excluded. Thirty-one participants who met the inclusion criteria i.e. not taking prescription medication or had previous medical conditions listed above and who were free from illness or infection, were invited back for testing. Prior to testing, participants were not allowed to exercise nor consume alcohol 12 hours beforehand or to consume caffeine or nicotine two hours beforehand or to eat for one hour before. Questionnaire completion, and cardiovascular and salivary cortisol measurements were carried out in a quiet room at the participant's home or a quiet place of their choice. The testing session consisted of four periods: 10 min adaptation, 10 min baseline, 10 min stress task and 20 min recovery. During the formal 10-min baseline, cardiovascular measurements were made at 2, 4, 6 and 8 minutes. Cardiovascular measurements were made at 2, 4, 6, and 8 min during the acute stress task and every two minutes during the recovery period. A 4-item questionnaire was administered immediately following the stress task exposure. At the end of the testing session, participants were debriefed and thanked.

2.4 *Data Analysis*

Data analysis was conducted using IBM SPSS version 22. Firstly, repeated measures ANOVAs were conducted to ensure the stress task perturbed the cardiovascular system and cortisol, as would be expected. Next, univariate regressions were performed to explore potential associations between the main psychosocial variables and reactivity. Finally, multivariate regressions were used with models in which all of the significant psychosocial variables were entered together, along with significant demographic variables in order to examine the prediction of reactivity from these variables together. Effects sizes are presented throughout as eta-squared or change in R-squared, as appropriate.

3. Results

3.1 Descriptive Statistics

The mean (SD) age of the sub-group of 31 participants was 55.0 (3.78) years including 13 (42%) women. Descriptive statistics for all participants are shown in Table 1.

Table 1: *Descriptive statistics. Means and standard deviations for all variables.*

Variable	**Mean/N**	**(SD)/%**
Age	54.9	(3.78)
Male	18	58
Female	13	42
Married	17.0	54.8
Drinks Alcohol:		
Often	10	32
Sometimes	14	45
Rarely	7	23
Smokes :		
Currently	5	16
Previously	8	25
Never	18	58
Resilience (BRS) (1-5)	3.9	(0.57)
Work Engagement (UWES, 1-6)	4.8	(0.93)
PASAT Score (1-1000)	582.6	(210.59)
PASAT Difficulty (0-6)	4.0	(1.36)
PASAT Stressfulness (0-6)	3.6	(1.35)
PASAT Performance (0-6)	2.7	(1.27)
PASAT Engaging (0-6)	4.2	(1.40)
Systolic Blood Pressure Baseline (mmHg)	120.2	(15.17)
Diastolic Blood Pressure Baseline (mmHg)	77.4	(10.30)
Heart Rate Baseline (mmHg)	66.3	(11.73)
Cortisol Baseline (nmol/dl)	0.1	(0.07)

(N = number of participants, % = percentage of participants)

3.2 Cardiovascular and Cortisol Reactivity to the Stress Task

From baseline to recovery, the PASAT evoked significant main effects of time for both cardiovascular and cortisol: for SBP, $F(3,90) = 81.2$, $p < .001$, $\eta^2 = .730$; DBP, $F(3,90) = 44.1$, $p < .001$, $\eta^2 = .595$; HR, $F(3,90) = 54.5$, $p < .001$, $\eta^2 = .645$ and cortisol, $F(3,87) = 7.1$, $p < .001$, $\eta^2 = .197$. These are illustrated in Figures 1 and 2. The mean (SD) reactivity for the group was: for SBP, 22.0 (10.22) mmHg, DBP, 11.4 (5.84) mmHg, HR, 8.5 (7.27) bpm, and cortisol, 0.04 (0.11) nmol/dl. Generally, all cardiovascular measurements increased with the stress task and subsequently recovered towards baseline after 20 minutes. Levels of cortisol meanwhile, increased with the stress task, then continued into the first 10 minutes of recovery and declined during the final 10 minutes.

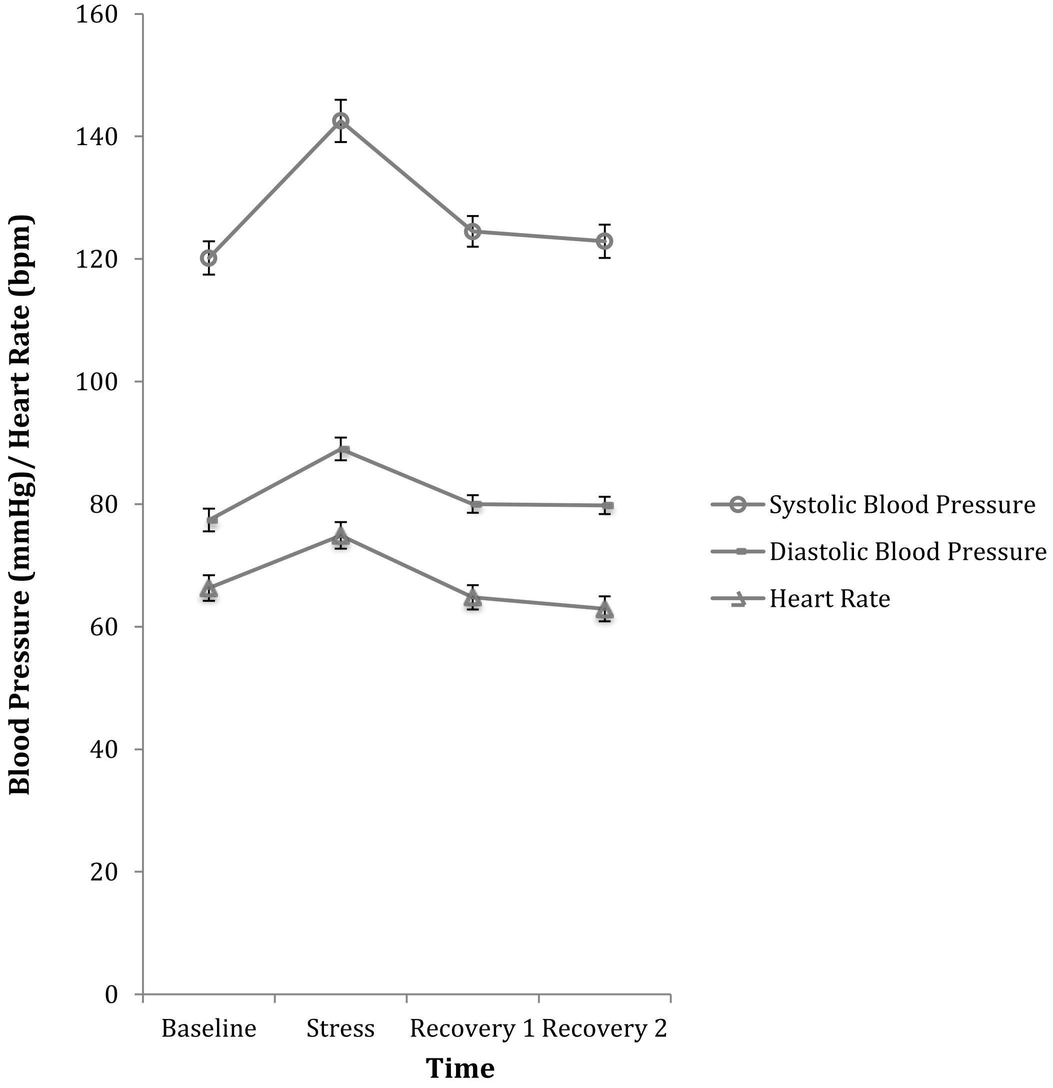

Figure 1. Cardiovascular change over time. Error bars represent ± 1 Standard Error of the mean.

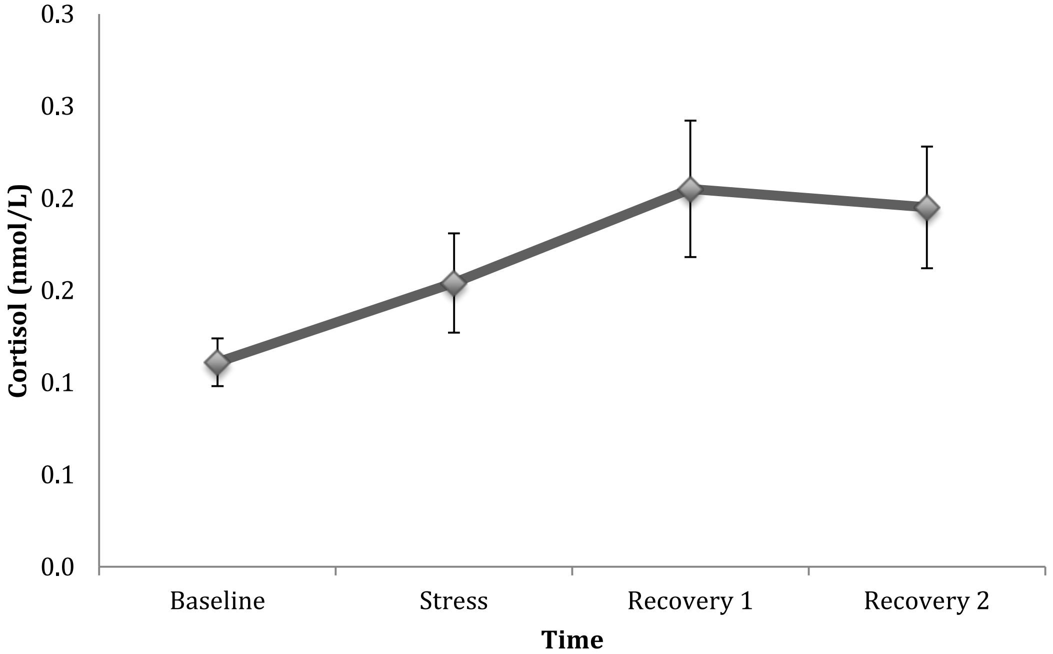

Figure 2. Cortisol change over time. Error bars represent ± 1 Standard Error of the mean.

3.3.1 Resilience and Reactivity.

There were no significant associations between resilience and reactivity, for SBP, β = .01, *p* = .94, ΔR^2 <.001; DBP, β = .10, *p* = .59, ΔR^2 =.010, HR, β = -. 33, *p* = .08, ΔR^2 =.109, or cortisol, β = -. 08, *p* = .68, ΔR^2 =.006, reactivity.

3.3.2 Work Engagement and Reactivity

There was a significant negative association between work engagement and SBP reactivity, β = -.50, *p* = .02, ΔR^2 = .248. Further, there was a significant negative association between work engagement and HR reactivity, β = -.63, *p* = .001, ΔR^2 =.393, such that those who reported higher levels of work engagement exhibited lower SBP and HR reactivity. There were no significant relationships between work engagement and DBP or cortisol reactivity.

3.3.3. *Sickness Presenteeism and Reactivity.*

A significant positive association was found between sickness presenteeism and HR reactivity, $\beta = .45$, $p = .03$, $\Delta R^2 = .200$, such that those with higher sickness presenteeism had HR reactivity. There were no significant associations between presenteeism and reactivity.

3.3.4 Socio-demographics and Reactivity

In regression analyses, age was not significantly associated with reactivity, and there were no significant gender differences in stress reactivity (all $p > .05$). However, marital status significantly predicted cortisol reactivity, $F(1,28) = 13.65$, $p = .001$, $\eta^2 = .304$. ANOVA indicated a significant difference between those who were married/cohabiting and those who were single/divorced/widowed for cortisol reactivity, $F(1,28) = 7.04$, $p = .013$, $\eta^2 = .201$, such that those living alone exhibited higher cortisol reactivity than those living with a spouse. Participants who were married or living with a partner showed a healthy cortisol response (0.02 nmol/dl) to the acute stressor whereas those living alone showed a somewhat exaggerated cortisol response (0.13 nmol/dl). There were no significant group differences across different levels of alcohol intake and reactivity. For smoking there was a significant effect for SBP reactivity, $F(2,27) = 4.58$, $p = .02$, $\eta^2 = .253$, such that those individuals who were previous smokers showed significantly higher reactivity than never smoker ($p = .05$) and current smokers ($p = .04$). There were no other associations or group differences for socio-demographics and reactivity.

3.3.5 Stress Task Performance, Ratings and Reactivity

Stress task performance and ratings of stressfulness did not significantly relate to reactivity (all $p > .05$). This suggests that the associations observed above were not due to task performance or perception differences in those with higher or lower work engagement or presenteeism.

3.3.6 Associations between Resilience and Work Variables

Resilience did not relate significantly to sickness presenteeism or work engagement. However, sickness presenteeism was significantly predicted by work engagement, $\beta = -.53$, $p = .007$, $\Delta R^2 = .284$, such that those with higher work engagement showed less presenteeism. There were no other significant associations between any of the questionnaire variables or with any of the socio-demographic variables.

3.3.7 Multivariate predictions of reactivity

Finally, in order to assess the impact of significantly related variables and socio-demographic variables, a series of regressions were run. For SBP reactivity, work engagement remained a significant predictor following adjustment for smoking, $\beta = .50$, $p = .02$, $\Delta R^2 = .244$. For HR reactivity, when work engagement and sickness presenteeism were entered together into the model, only work engagement remained a significant predictor, $\beta = -.63$, $p = .01$, $\Delta R^2 = .281$; sickness presenteeism was no longer related to HR reactivity, $\beta = .002$, $p = .99$, $\Delta R^2 = .112$. Consequently, we tested formally whether work engagement significantly mediated the association between presenteeism and HR reactivity using the PROCESS bootstrapping method (Hayes 2013) such that there was a significant indirect effect of presenteeism on HR reactivity mediated through work engagement, *ab* = 7.31, 95% CI [1.82 – 15.26], with the mediator accounting for about 75% of the total effect ($P_M = .74$).

4. Discussion

The present study sought to explore the relationship between perceived psychological resilience, work-related factors and physiological reactivity to acute psychological stress in a group of older manual workers. The findings revealed that both work-related factors were associated with HR reactivity; such that higher HR reactivity was displayed in those who reported low levels of work engagement and higher presenteeism. Low levels of work engagement were also associated with higher SBP reactivity. Interestingly, previous smokers exhibited significantly higher levels of SBP reactivity than current smokers or non-smokers, although adjustment for smoking did not alter the association between work engagement and SBP reactivity. Further, marital status was linked to cortisol reactivity, such that those who lived alone demonstrated an exaggerated response to acute stress.

With respect to work related factors, previous research has suggested that those with high levels of work engagement display high levels of psychological wellbeing (Koyuncu et al. 2006). Therefore, it is possible that high levels of work engagement promote psychological wellbeing and in turn buffer the physiological effects of high work demands (Leijten et al. 2015). This may explain why those with higher levels of work engagement did not display exaggerated HR reactivity. Of note, it has been previously demonstrated that work engagement predicts presenteeism, the higher the engagement, the lower the presenteeism levels (Admasachew and Dawson 2011). This was also the case in the present study. Further, in support of Leijten et al. (2015), work engagement mediated the effect of presenteeism on HR reactivity. Importantly, individuals with higher presenteeism and lower work engagement increase their risk of developing cardiovascular disease if their exaggerated physiological responses to acute stress persist over time (McEniery et al. 2007; Trieber 2003). The findings further existing research into negative health outcomes associated with presenteeism (Callen et al. 2013; Cancelliere et al. 2011; Leineweber et al. 2011) as well as those linking job-related stress to cardiovascular reactivity. Such that the link between reactivity and presenteeism underlines an added concern, in that high presenteeism may also exacerbate high reactivity previously associated with high job strain (Flynn and James 2009) and decreased work engagement. Given the mediating effect of work engagement mentioned above, it may be that work engagement is the key factor in determining a healthy rather than exaggerated level of HR reactivity. Further, the findings for HR reactivity add to the evidence linking job strain to BP reactivity (Flynn and James 2009; Steptoe 2001; Steptoe 2004). Participants in the present study who reported low levels of work engagement demonstrated significantly higher SBP reactivity than those with higher work engagement. This is also in accordance with previous research linking job strain to elevated ambulatory BP (Clays et al. 2007; Landsbergis 2013).

Interestingly, there was no link between resilience and work-related factors, or reactivity. This is in line with a previous study, which found no relationship between resilience factors and HR reactivity, although it was implied that resilience buffered against acute stress (Corina and Adriana 2013). Given this, it is necessary to bear in mind that other lifestyle factors such as physical activity may contribute to individual resilience. In a model of psychological resilience, de Terte et al., (2014) imply that healthy lifestyle practices, such as not smoking, suitable alcohol intake and social support, might help to promote psychological resilience. A good proportion of the present participants were non-smokers, married and moderate drinkers, however, we found no relationships between resilience and lifestyle factors or social support.

Contrary to previous research (Galatzer-Levy et al. 2014), the present study found no relationship between psychological resilience and cortisol reactivity. However, participants living alone displayed an exaggerated cortisol response to the stressor relative to married participants, indicating a risk of immune suppression and future hypertension (Fan et al. 2009; Hamer and Steptoe 2012). This finding lends some support to the buffering effect of social support for the impact of stress on health, as, in the present study, married participants mounted a healthy cortisol response to the acute stressor, indicating good physiological health (Phillips et al. 2005). Interestingly, marital status was not associated with resilience in the present study, however, it is evident from the findings and from previous research, that support of this nature has a bearing on how an individual responds to psychological stress (Bonanno et al. 2007; Corina and Adriana 2013). For example, men tested in the presence of a supportive spouse/partner showed lower cardiovascular reactivity to acute stress (Phillips et al. 2006); and individuals who perceive themselves generally to have good social support reveal lower resting cardiovascular function (Hughes and Howard 2009) and faster habituation to recurrent acute stress (Howard and Hughes 2012).

The present study is not without limitations. First, it is important to note that this study was correlational so no direction of causality can be assumed, however, it seems unlikely that one's habitual physiological response to acute stress might influence resilience and work engagement when participants seem to be unconscious of whether they are high or low physiological responders (Tucker 2007). Second, the associations found were not consistent across all cardiovascular measures and cortisol, however, the consistency of associations with HR reactivity would suggest that the present results are not simply due to random chance. Indeed, it has been shown that HR reactivity is also important as a predictor of future hypertension as well as BP reactivity (Moseley and Linden 2006; Treiber et al. 2003). Third, the present sample size was small, however, it is comparable with other correlational studies of reactivity, particularly among older adults (Almela et al. 2011; Domes 2002; Hogan et al. 2012). Additionally, the sample may be unusual in that all were aged 50+ years, unmedicated, without history of cardiovascular or metabolic disease. Thus, the sample might be representative of the 'healthy worker effect' (Shah, 2009) and potential selection bias. However, employees with long term sickness absence would not be available for recruitment, and the levels of presenteeism identified in the study highlight the need to promote the health and longevity of older employees. Further, the study has several strengths. First, participants were all manual workers and aged >50 years, a population that has been previously under-researched. With the increasing age of the workforce, research into this population is becoming more important. Further, rather than explore stress in this age group in association with work and health, the investigation into resilience in the present study offers an original contribution to resilience literature by extending the research into older manual workers. This study also considers the repercussions resilience may have for sickness presenteeism, thereby extending current knowledge on sickness presenteeism in this age group.

Conclusion

The present study suggests that there may be a relationship between work engagement, and presenteesism and HR reactivity in older manual workers. Given that HR reactivity was associated with lower work engagement and higher presenteeism, it is possible that exaggerated reactivity could be a consequence of these negative factors and a pathway through which they relate to increased disease risk and ill health. This indicates the need for further research into ways to promote work engagement and decrease presenteeism, thereby potentially protecting cardiovascular health in this group of workers. Exaggerated cardiac reactivity on top of ageing, less social support and poorer lifestyle behaviours, may contribute to the risk of negative health and poorer wellbeing. Additionally, implications from the present study, give rise to the consideration of the impact of job strain on stress reactivity. However, further research is needed to gain a broader understanding of the role of stress reactivity in the links between resilience, work-related factors and future health.

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Declaration of Interest

The authors declare that they have no conflicts of interest.

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