The influence of employees' workspace satisfaction on mental health while working from home during the COVID-19 pandemic

Lisanne BERGEFURT*[1], Minou WEIJS-PERRÉE[1], Rianne APPEL-MEULENBROEK[1] and Theo ARENTZE[1]

[1] Eindhoven University of Technology, Eindhoven, The Netherlands
* *Corresponding author: a.g.m.bergefurt@tue.nl*

ABSTRACT

Previous research has, to some extent, investigated the influence of satisfaction with the workplace on employees' mental health (i.e. mood, sleep quality, fatigue, and stress). However, insights in these relationships while working from home have been lacking. The purpose of this study is therefore to gain understanding in which personal and workspace characteristics are related to employees' mental health. This study used a cross-sectional data collection approach and a seemingly unrelated regression analysis (SUR) to analyse the relationships. Results indicated that sleep quality, mood, stress, and fatigue are influenced by employees' satisfaction with the workspace temperature, artificial light, and support of informal interactions while working from home. Personal characteristics (i.e. neuroticism, conscientiousness, and age) are also related to mental health. These findings could be used by workplace managers or employers to optimize their home workplace strategy.

INTRODUCTION

Worldwide, the COVID-19 pandemic has led to unprecedented changes, including the obligation to work (fully) from home (Oakman et al., 2020; Targa et al., 2020). Work activities that were previously performed at the office, including formal and informal meetings, are now performed at home, even when employees' homes are not suitable (Waizenegger et al., 2020). Such a withdrawal from the office reduces (spontaneous) face-to-face meetings (Waizenegger et al., 2020), which can cause more negative moods and increase job stress among prior office workers (Mann & Holdsworth, 2003; Zvolensky et al., 2020). Other mental issues that might arise due to the obligation to work from home, include reduced sleep quality (Cellini et al., 2021) and elevated fatigue (Terry et al., 2020). The obligation to work from home also means that people might have to adapt some physical aspects of their home workspace (e.g. artificial light and daylight), since the majority of their time is spent indoors (Aries et al., 2015). As Peters and Halleran (2020) argued, these physical workspace characteristics can become critical factors for employees' mental health while working from home.

Previous research has mainly focused on the office workspace context in relation to the mental health of office workers. For instance, studies have indicated that the amount of daylight and artificial light is related to employees' sleep quality (Colenberg et al., 2020). Hubalek et al. (2010) argued that the exposure to daylight during the workday could lead to a better sleep quality the following night. As the attention restoration theory by Kaplan (1995) implies, having access to daylight and having a natural view outside might restore people's attention and reduce feelings of fatigue (Jamrozik et al., 2019). Kaplan (1995) argued that natural environments can also mitigate or even prevent stress. Overall, research has suggested that contact with natural environments, including daylight, natural views outside, and plants cause a systematic relaxation effect that reduces feelings of stress (Sander et al., 2019).

In the office workplace context, research has also shown that noise exposure is related to people's sleep quality during the night (Lin et al., 2018), increases feelings of fatigue and tiredness (Jahncke et al., 2011) and is related to their mood (Lamb & Kwok, 2016). In addition, in modern office designs, such as open-plan and shared offices, levels of visual and auditory privacy have been found to be lower, while noise levels and distractions were higher. Such a poor office layout, reduced privacy (i.e. possibility to withdraw from people and to regulate interactions with people) and increased noise levels negatively relate to people's stress levels (Sander et al., 2019). Research has also indicated that temperature is an important contributor to job stress (Sander et al., 2019). More specifically, extreme temperatures, those above or below the conventional range for thermal comfort, can increase employees' feelings of stress and fatigue (Lan et al., 2020) and can affect their mood (Butala & Muhič, 2007; Lamb & Kwok, 2016).

While previous results showed some effects of physical workplace characteristics on employees' mental health (i.e. mood, fatigue, sleep quality and stress) at the office, it remains unclear how these physical aspects affect employees' mental health at the home workspace during the COVID-19 pandemic. First studies that were conducted during the pandemic have focused on the influence of personal characteristics (e.g. personality and age) on employees' mental health. For instance, it was found that employees who score high on neuroticism are more likely to feel stressed while working from home (Bergefurt et al., 2021). It seems that people who are able to adapt to the COVID-

19 obligations (e.g. working from home) are less likely to feel stressed, and are more likely to experience a positive mood (Besser et al., 2020). Among younger aged employees the obligation to work from home could trigger feelings of stress due to an imbalance between work and family life (Bergefurt et al., 2021; Carnevale & Hatak, 2020; Mauno et al., 2013).

Although previous research has indicated, to some extent, how employees' mental health might be related to personal characteristics during the COVID-19 pandemic (Cellini et al., 2021; Targa et al., 2020; Terry et al., 2020), it remains unclear how both personal and workspace characteristics are related to employees' mental health while working from home. The aim of this study is therefore to analyse the influence of workspace and personal characteristics on employees' stress levels, mood, fatigue, and sleep quality while working from home. The results of this study can be used by both workplace managers and employers to adjust the home workspace according to the changing workspace demands to optimize employees' mental health.

METHODS

Measurement

To study the relationships between personal- and workspace characteristics and stress, fatigue, sleep quality and mood, previously validated measurement scales were mostly used. The questions regarding personal characteristics consisted of respondents' age, gender, personality, contractual work hours and actual work hours. The 10-item Big Five Inventory was used to measure five personality types: neuroticism, extraversion, conscientiousness, openness and agreeableness (Rammstedt & John, 2007). With regard to workspace characteristics respondents were asked about the number of persons who used the workspace simultaneously and to indicate their satisfaction with the artificial light and daylight, sound, noise and privacy, air quality, temperature, and ventilation, and with the greenery, plants, and views outside at their home workspace on a five-point Likert scale (e.g. Candido et al., 2019). Respondents were also asked to rate their satisfaction, on a five-point Likert scale, with the extent to which work activities were supported at their home workspace, including concentrated work, informal interactions, formal interactions and 'online' interactions.

Stress was measured by the 4-item Patient Health Questionnaire (PHQ-4) (Kroenke et al., 2009), of which two items were selected that measure stress (i.e. 'feeling nervous, anxious, or on edge' and 'not being able to stop or control worrying'). These items were combined with two items developed by Beute and de Kort (2018) (i.e. 'feeling stressed' and 'think deeply about something'). Cronbach's Alpha (α) equals 0.821, which indicates that the sum score could be used for these four items. For fatigue, eight items of the

Checklist Individual Strength were used. Summed (α=0.909), these items form the subscale 'Subjective feeling of fatigue' (Beurskens et al., 2000). Sleep quality was measured using four items of the Health at Work Survey that was developed by the World Health Organisation (WHO, 2001). Cronbach's Alpha (α) equals 0.619, which is somewhat low. For mood, the UWIST Mood Adjective Checklist was used (Matthews et al., 1990), of which eight items were included. Cronbach's Alpha (α) equals 0.846, which means that the items could be summed.

Procedure

Data were collected in the autumn and winter of 2020, during the COVID-19 pandemic among 393 employees of three private companies in the Netherlands. A cross-sectional approach was used, which involved collecting data based on an online questionnaire. More than half of the sample (59.5%) was obtained from a large engineering and project management company. Another 28.0% was obtained from an office furniture developer, and 12.5% was gained from an advisory company specialized in strategic corporate real estate management.

Analytical approach

To gain insights in the independent variables that significantly affect the dependent variables (i.e. mood, sleep quality, fatigue, and stress), four multiple regression analyses (stepwise) were performed. The independent variables selected in the separate models were then included in a seemingly unrelated regression analysis (SUR). SUR can be used to simultaneously analyse different dependent variables that are influenced by different independent variables. SUR is an extension of linear regression analysis, in which correlated errors between equations are allowed (Sun et al., 2014). SUR was used in this study because the dependent variables could be related on the level of their error terms.

RESULTS

Sample

Table 1 shows the descriptive statistics of the personal and workspace characteristics. The sample consists of more male than female respondents, with a mean age of 45. While the data were collected at technology related companies, the overrepresentation of male respondents is not surprising, since only 21% of the Dutch female workforce works at engineering companies (CBS, 2021). The mean age of the Dutch workforce equals 42, which indicates that the sample was, on average, somewhat older (UWV, 2020).

Table 1 also indicates that people are least satisfied with the support of the workspace to perform informal interactions (M=3.20, SD=1.223) and most satisfied with the support to perform concentrated work (M=3.71, SD=1.322) (on a scale from 1 to 5). In addition, respondents are least satisfied with greenery

and plants (M=3.34, SD=1.443) and with artificial light (M=3.53, SD=1.221), while they are most satisfied with privacy (M=4.05, SD=1.307) and air quality (M=3.98, SD=1.135) at their home workspace. For all mental health concepts sum scores were calculated and converted to a scale from 1 (negative mental health) to 8 (positive mental health). Stress has the highest mean (M=6.444, SD=1.265), followed by sleep quality (M=6.055, SD=1.173), mood (M=5.520, SD=1.144), and fatigue (M=5.341, SD=1.538). These sum scores indicate that, overall, respondents do not frequently feel stressed or fatigued, and rate their sleep quality and mood rather positive.

Regression analyses

Four multiple regression analyses were performed between the independent variables and dependent variables. The normal probability (P-P) plots of the residuals of the regression analyses were interpreted to test the assumption of normality and homoscedasticity of the residuals. This assumption may have been violated for stress. While the deviations from normality are only small, results of the regression analyses are still valid, but should be carefully interpreted (Rani Das, 2016).

The results of the regression analyses indicate that mood is significantly related to neuroticism, satisfaction with temperature, and satisfaction with support of informal interactions. Sleep quality is related to neuroticism, satisfaction with support of informal interactions, age, and satisfaction with artificial light. Neuroticism, conscientiousness, and satisfaction with temperature are found to be related to respondents' stress levels. Fatigue is related to neuroticism, agreeableness, satisfaction with temperature, and satisfaction with support of informal interactions. These relationships are used as input for the seemingly unrelated regression analysis.

Seemingly Unrelated Regression Analysis

Table 2 shows values for R^2 and adjusted R^2. The (adjusted) R^2 indicates the proportion of explained variance by the model (Akossou & Palm, 2013). As Table 2 indicates, personal- and workspace characteristics explain between 8.8% and 25.9% of the total variance of employees' mental health (i.e. stress, mood, fatigue, sleep quality). These results show that there are also some other characteristics that are related to employees' mental health that were not included in the current model.

Furthermore, the results of the SUR (see Figure 1) indicate that mood is significantly related to neuroticism (negative), satisfaction with temperature (positive), and satisfaction with the support of the workplace for informal interactions (positive). Respondents who score high on neuroticism are more likely to rate their mood negative. Employees who are satisfied with the temperature and the support of informal interactions at their home workspace are

more likely to perceive a positive mood. For stress, significant relationships with neuroticism (negative), conscientiousness (negative), and satisfaction with temperature (positive) are found. Employees with neurotic or conscientious traits are more likely to feel stressed, while employees who are satisfied with the temperature at the workspace are less likely to feel stressed. Fatigue (i.e. lack of energy or feelings of tiredness) is significantly related to neuroticism (negative), conscientiousness (positive), satisfaction with temperature (positive) and satisfaction with the support of informal interactions (negative). While employees with neurotic traits are more likely to feel fatigued, conscientious employees are less likely to feel fatigued. The positive relationships between satisfaction with the temperature and with the support of informal interactions indicate that employees are less likely to feel fatigued when they are satisfied with both these aspects of the workspace. For sleep quality, significant relationships are found between age (negative), neuroticism (negative), satisfaction with artificial light (positive) and satisfaction with the support of informal interactions (positive). Employees who score high on neuroticism and who are older are more likely to be negative about their sleep quality. In addition, employees who are satisfied with the artificial light and with the support of informal interactions are more likely to be positive about their sleep quality.

DISCUSSION

The results of the SUR indicate that three workspace characteristics, namely satisfaction with temperature, artificial light, and support of informal interactions, are significantly related to stress, mood, fatigue, or sleep quality. The positive relationships indicate that employees who are satisfied with these workspace characteristics are more likely to experience a positive mental health, while employees who are dissatisfied are more likely to experience a negative mental health while working at home. As Vischer (2007) explained by 'the environmental comfort model', indivuals' performance of work tasks depend on the perceived comfort level of workplace resources (e.g. temperature, noise level and lighting). Low comfort levels could cause mental health issues, such as feelings of stress. While previous studies (e.g. Colenberg et al., 2020; Sander et al., 2019) have mainly focused on the office workspace, current results add insights about the influence of home workspace characteristics on mental health. These results, combined with previous findings, can be used by employers to adjust their workspace strategies to optimize the future hybrid mix of working from home and working at the office.

More specifically, results indicate that satisfaction with temperature is related to mood, fatigue and stress. Previous research has shown that homeworkers have experienced higher levels of control over the home

temperature, because they could adjust the thermostats and radiators at any time. This might lead to higher satisfaction with the workspace temperature (Hampton, 2017). In contrast, other researchers (eg. Domínguez-amarillo et al., 2020) have indicated that indoor home temperatures are more influenced by outdoor temperatures than indoor office temperatures. The risk of more extreme temperatures at the home workspace might increase employees' feelings of stress and fatigue, and could negatively relate to employees' mood (Butala & Muhič, 2007; Lamb & Kwok, 2016; Lan et al., 2020). Therefore, further research could elaborate on the influence of control over workspace characteristics while working from home on employees' mental health. In addition, future research might use objective measures (e.g. sensors to measure temperature) to gain insights in comfortable home workspace temperatures and how these comfortable temperatures influence employees' mental health.

Next to satisfaction with temperature, satisfaction with artificial light is significantly related to employees' sleep quality. This result is confirmed by Mello et al. (2020), who found that exposure to artificial light and decreased exposure to daylight while working at home reduces employees' sleep quality. There might be several explanations for these findings. For instance, the reduced travel behaviour of homeworkers might decrease exposure to daylight and increase exposure to artificial light. Moreover, the quality of the artificial light and daylight at home may be lower than the quality at the office. As Long and Richter (2019) suggest, people who work from home might experience discomfort from lighting, because a conflict may occur between task lighting requirements and aesthetic requirements (e.g. people may be unable to change the light or may not wish to do so because of aesthetics). Further research could expand on measuring both the quality and quantity of daylight and artificial light (via sensors) and its influence on employees' sleep quality.

Third, a significant relationship is found between employees' satisfaction with the support of their workplace to perform informal interactions and mood, fatigue, and sleep quality. As van den Berg et al. (2020) indicated, working from home could hinder serendipitous informal interactions between colleagues. Although not previously investigated, it seems logical that employees' mood, fatigue, and sleep quality are related to reduced informal interactions due to the obligation to work from home. Future research could analyse the influence of working from home on changes in communication styles between colleagues more in-depth and how these changes affect employees' mental health. In general, insights in the influence of workspace characteristics on employees' mental health can be used by employers to improve their home workspace strategies. For instance, working at home could be promoted among employees who are most satisfied or who experience most comfort while working at home.

Next to workspace characteristics, several personal characteristics (i.e. age, neuroticism, and conscientiousness) influence stress, mood, sleep quality, and fatigue. In line with previous research, higher neuroticism is associated with increased stress levels (Liu et al., 2021), negative affect (i.e. distressed, fearful, jittery, nervous, hostile, and scornful), physical fatigue (i.e. drowsy, dull, sleepy, and sluggish) (Meyer & Shack, 1989), and reduced sleep quality (Gray & Watson, 2002). Current results also indicate that conscientious employees are more likely to experience stress and less likely to feel fatigued. As Pollak et al. (2020) explained, conscientiousness is a positive predictor of the stress appraisal. In addition, Calderwood and Ackerman (2011) found increased engagement and higher levels of vigour among conscientious employees, which could reduce feelings of fatigue during the workday. Finally, a significant relationship between age and sleep quality is found. Previous research showed mixed results; while some researchers (e.g. Åkerstedt et al., 2002) have indicated that sleep quality decreases with age, others (e.g. Pieh et al., 2020) have found that sleep quality is the lowest among individuals below 35 and above 65. Workplace managers and employers can use these insights to better understand personal differences in employees' experience of working at home and can adjust workplace strategies according to these differences.

LIMITATIONS AND CONCLUSIONS

There are some limitations related to this research. First, the results of the SUR indicated that personal and workspace characteristics explained 8.8% to 25.9% of the total variance of employees' mental health. Although these results indicate that personal and physical workspace characteristics have a substantial influence on employees' mental health, there are several other characteristics that also affect mental health that have not been introduced in this study. For instance, previous research has indicated that ergonomic and adjustable furniture were requirements for employees to work from home (Ng, 2010). While employees were obliged to work from home during the COVID-19 pandemic, family-related aspects (e.g. having children) (Ng, 2010) and social work-related aspects (e.g. work pressure, lack of supervision or support from colleagues) (Bellmann & Hübler, 2020; Diab-Bahman & Al-Enzi, 2020) could also be related to employees' mental health. The influence of such aspects could be explored in further research.

For future research, it would be interesting to collect data among a larger and more heterogeneous sample. Also, personal characteristics could be introduced in the model as interaction variables, to explore whether relationships between workplace characteristics and mental health are influenced by personal

characteristics. Further research could also focus on the comparison of employees' mental health while working from home between different countries, which could be related to cultural differences. While in the Netherlands homeworking was already more common before the COVID-19 pandemic (14.1% usually worked from home) (Eurostat, 2020), it might be easier for Dutch employees to adapt to the COVID-19 obligations. In addition, the influence of the residential location (e.g. living in rural or urban regions) might also have an effect. Finally, mental health includes more than the concepts stress, mood, sleep quality and fatigue. As the definition of WHO (2004) indicates, mental health includes the absence or presence of diseases, and includes health-promoting factors (e.g. well-being, productivity, and engagement) (Forooraghi et al., 2020). These factors, as well as the relationships between these factors, should be further explored.

Overall, this study showed a significant influence of personal characteristics, including personality (i.e. neuroticism and conscientiousness) and age, on employees' mental health. Moreover, results indicated that employees' satisfaction with artificial light, temperature, and the support of the workplace to have informal interactions with colleagues could affect employee mental health. These results give new insights about physical workplace characteristics that could affect employees' sleep quality, mood, fatigue, and stress, specifically in the home-workplace context, which was up till now still lacking.

ACKNOWLEDGMENTS

REFERENCES

Åkerstedt, T., Knutsson, A., Westerholm, P., Theorell, T., Alfredsson, L., & Kecklund, G. (2002). Sleep disturbances, work stress and work hours. *Journal of Psychosomatic Research*, *53*(3), 741–748. https://doi.org/10.1016/s0022-3999(02)00333-1

Akossou, A. Y. J., & Palm, R. (2013). Impact of data structure on the estimators R-square and adjusted R-square in linear regression. *International Journal of Mathematics and Computation*, *20*(3), 85–93. http://www.ceser.in/ceserp/index.php/ijmc/article/view/2579

Aries, M. B. C., Aarts, M. P. J., & Hoof, J. van. (2015). Daylight and health : A review of the evidence and consequences for the built environment. *Lighting Research and Technology*, *47*, 6–27.

Bellmann, L., & Hübler, O. (2020). Working from home, job satisfaction and work–life balance – robust or heterogeneous links? *International Journal of Manpower*. https://doi.org/10.1108/IJM-10-2019-0458

Bergefurt, L., Weijs-perrée, M., Maris, C., & Appel-meulenbroek, R. (2021). Analyzing the Effects of Distractions While Working from Home on Burnout Complaints and Stress Levels among Office Workers during the COVID-19 Pandemic. *The 3rd International Electronic Conference on Environmental Research and Public Health*, 1–9.

Besser, A., Flett, G. L., Nepon, T., & Zeigler-Hill, V. (2020). Personality, Cognition, and Adaptability to the COVID-19 Pandemic: Associations with Loneliness, Distress, and Positive and Negative Mood States. *International Journal of Mental Health and Addiction*. https://doi.org/10.1007/s11469-020-00421-x

Beurskens, A. J. H. M., Bültmann, U., Kant, I., Vercoulen, J. H. M. M., Bleijenberg, G., & Swaen, G. M. H. (2000). Fatigue among working people: validity of a questionnaire measure. *Occupational and Environmental Medicine*, *57*, 353–357.

Beute, F., & Kort, Y. A. W. De. (2018). Stopping the Train of Thought: A Pilot Study Using an Ecological Momentary Intervention with Twice-Daily Exposure to Natural versus Urban Scenes to Lower Stress and Rumination. *Applied Psychology: Health and Well-Being*, *10*(2), 236–253.

Butala, V., & Muhič, S. (2007). Perception of Air Quality and the Thermal Environment in Offices. *Indoor and Built Environment*, *16*(4), 302–310.

Calderwood, C., & Ackerman, P. L. (2011). The relative impact of trait and temporal determinants of subjective fatigue. *Personality and Individual Differences*, *50*(4), 441–445. https://doi.org/10.1016/j.paid.2010.10.030

Candido, C., Chakraborty, P., & Tjondronegoro, D. (2019). The Rise of Office Design in High-Performance, Open-Plan Environments. *Buildings*, *9*(100), 1–16. https://doi.org/10.3390/buildings9040100

Carnevale, J. B., & Hatak, I. (2020). Employee adjustment and well-being in the era of COVID-19: Implications for human resource management. *Journal of Business Research*, *116*, 183–187. https://acces.bibl.ulaval.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=143516794&amp%0Alang=fr&site=ehost-live%0Ahttps://doi.org/10.1080/13678868.2020.1780078%0Ahttps://doi.org/10.1080/13678868.2020.1779544

CBS. (2021). *Werkzame beroepsbevolking; beroep*. https://opendata.cbs.nl/statline/?dl=4B4D9#/C

BS/nl/dataset/82808NED/table

Cellini, N., Conte, F., De Rosa, O., Giganti, F., Malloggi, S., Reyt, M., Guillemin, C., Schmidt, C., Muto, V., & Ficca, G. (2021). Changes in sleep timing and subjective sleep quality during the COVID-19 lockdown in Italy and Belgium: age, gender and working status as modulating factors. *Sleep Medicine*, *77*, 112–119. https://doi.org/10.1016/j.sleep.2020.11.027

Colenberg, S., Jylhä, T., & Arkesteijn, M. (2020). The relationship between interior office space and employee health and well-being–a literature review. *Building Research and Information*, *0*(0), 1–15. https://doi.org/10.1080/09613218.2019.1710 098

Diab-Bahman, R., & Al-Enzi, A. (2020). The impact of COVID-19 pandemic on conventional work settings. *International Journal of Sociology and Social Policy*, *40*(9–10), 909–927. https://doi.org/10.1108/IJSSP-07-2020-0262

Domínguez-amarillo, S., Fernández-agüera, J., Cesteros-garcía, S., & González-lezcano, R. A. (2020). Bad air can also kill: Residential indoor air quality and pollutant exposure risk during the covid-19 crisis. *International Journal of Environmental Research and Public Health*, *17*(19), 1–34. https://doi.org/10.3390/ijerph17197183

Eurostat. (2020). *How usual is it to work from home?* https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20200424-1

Forooraghi, M., Miedema, E., Ryd, N., & Wallbaum, H. (2020). Scoping review of health in office design approaches. *Journal of Corporate Real Estate*, *22*(2), 155–180. https://doi.org/10.1108/JCRE-08-2019-0036

Gray, E. K., & Watson, D. (2002). General and specific traits of personality and their relation to sleep and academic performance. *Journal of Personality*, *70*(2), 177–206. https://doi.org/10.1111/1467-6494.05002

Hampton, S. (2017). An ethnography of energy demand and working from home: Exploring the affective dimensions of social practice in the United Kingdom. *Energy Research and Social Science*, *28*, 1–10. https://doi.org/10.1016/j.erss.2017.03.012

Hubalek, S., Brink, M., & Schierz, C. (2010). Office workers daily exposure to light and its influence on sleep quality and mood. *Lighting Research and Technology*, *42*(1), 33–50. https://doi.org/10.1177/1477153509355632

Jahncke, H., Hygge, S., Halin, N., Marie, A., & Dimberg, K. (2011). Open-plan office noise: Cognitive performance and restoration. *Journal of Environmental Psychology*, *31*(4), 373–382.

https://doi.org/10.1016/j.jenvp.2011.07.002

Jamrozik, A., Clements, N., Shabih, S., Zhao, J., Zhang, R., Campanella, C., Loftness, V., Porter, P., Ly, S., Wang, S., & Bauer, B. (2019). Access to daylight and view in an office improves cognitive performance and satisfaction and reduces eyestrain : A controlled crossover study. *Building and Environment*, *165*. https://doi.org/10.1016/j.buildenv.2019.10637 9

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, *15*(3), 169–182. https://doi.org/10.1016/0272-4944(95)90001-2

Kroenke, K., Spitzer, R. L., Williams, J. B. W., & Löwe, B. (2009). An Ultra-Brief Screening Scale for Anxiety and Depression: The PHQ–4. *Psychosomatics*, *50*(6), 613–621. https://doi.org/10.1016/s0033-3182(09)70864-3

Lamb, S., & Kwok, K. C. S. (2016). A longitudinal investigation of work environment stressors on the performance and wellbeing of office workers. *Applied Ergonomics*, *52*, 104–111. https://doi.org/10.1016/j.apergo.2015.07.010

Lan, L., Xia, L., Hejjo, R., Wyon, D. P., & Wargocki, P. (2020). Perceived air quality and cognitive performance decrease at moderately raised indoor temperatures even when clothed for comfort. *Indoor Air*, *30*(5), 841–859. https://doi.org/10.1111/ina.12685

Lin, C., Tsai, P., Lin, K., Chen, C., Chung, L., Wu, J., & Leon, Y. (2018). Will daytime occupational noise exposures induce nighttime sleep disturbance ? *Sleep Medicine*, *50*(35), 87–96. https://doi.org/10.1016/j.sleep.2018.05.025

Liu, S., Lithopoulos, A., Zhang, C., Garcia-barrera, M. A., & Rhodes, R. E. (2021). Personality and perceived stress during COVID-19 pandemic : Testing the mediating role of perceived threat and efficacy. *Personality and Individual Differences*, *168*, 1–6. https://doi.org/10.1016/j.paid.2020.110351

Long, J., & Richter, H. (2019). The pitfalls of the traditional office ergonomics model in the current mobile work environment: Is visual ergonomics health literacy the remedy? *Work*, *63*(3), 447–456. https://doi.org/10.3233/WOR-192937

Mann, S., & Holdsworth, L. (2003). The psychological impact of teleworking: Stress, emotions and health. *New Technology, Work and Employment*, *18*(3), 196–211. https://doi.org/10.1111/1468-005X.00121

Matthews, G., Jones, D. M., & Chamberlain, A. G. (1990). Refining the measurement of mood: The

UWIST Mood Adjective Checklist. *British Journal of Psychology*, *81*, 17–42.

Mauno, S., Ruokolainen, M., & Kinnunen, U. (2013). Does aging make employees more resilient to job stress? Age as a moderator in the job stressor-well-being relationship in three Finnish occupational samples. *Aging and Mental Health*, *17*(4), 411–422. https://doi.org/10.1080/13607863.2012.747077

Mello, M. T. De, Silva, A., Guerreiro, R. de C., Da-Silva, F. R., Esteves, A. M., Poyares, D., Piovezan, R., Treptow, E., Starling, M., Rosa, D. S., Pires, G. N., Andersen, M. L., & Tufik, S. (2020). Sleep and COVID-19: considerations about immunity, pathophysiology, and treatment. *Sleep Science*, *13*(3), 199–209. https://doi.org/10.5935/1984-0063.20200062

Meyer, G. J., & Shack, J. R. (1989). Structural Convergence of Mood and Personality: Evidence for Old and New Directions. *Journal of Personality and Social Psychology*, *57*(4), 691–706. https://doi.org/10.1037/0022-3514.57.4.691

Ng, C. F. (2010). Teleworker ' s home office : an extension of corporate office ? *Facilities*, *28*(3), 137–155. https://doi.org/10.1108/02632771011023113

Oakman, J., Kinsman, N., Stuckey, R., Graham, M., & Weale, V. (2020). A rapid review of mental and physical health effects of working at home: how do we optimise health? *BMC Public Health*, *20*(1), 1–13. https://doi.org/10.1186/s12889-020-09875-z

Peters, T., & Halleran, A. (2020). How our homes impact our health: using a COVID-19 informed approach to examine urban apartment housing. *Journal of Architectural Research*. https://doi.org/10.1108/ARCH-08-2020-0159

Pieh, C., Budimir, S., & Probst, T. (2020). The effect of age, gender, income, work, and physical activity on mental health during coronavirus disease (COVID-19) lockdown in Austria. *Journal of Psychosomatic Research*, *136*(May), 110186. https://doi.org/10.1016/j.jpsychores.2020.110186

Pollak, A., Dobrowolska, M., Timofiejczuk, A., & Paliga, M. (2020). The effects of the big five personality traits on stress among robot programming students. *Sustainability*, *12*, 1–10. https://doi.org/10.3390/su12125196

Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less : A 10-item short version of the Big Five Inventory in English and German ૬. *Journal of Research in Personality*, *41*, 203–212.

Rani Das, K. (2016). A Brief Review of Tests for Normality. *American Journal of Theoretical and Applied Statistics*, *5*(1), 5–12. https://doi.org/10.11648/j.ajtas.20160501.12

Sander, E. J., Caza, A., & Jordan, P. J. (2019). The physical work environment and its relationship to stress. In *Organizational Behaviour and the Physical Environment* (pp. 268–284). Routledge. https://doi.org/10.4324/9781315167237-15

Sun, Y., Ke, R., & Tian, Y. (2014). Some overall properties of seemingly unrelated regression models. *AStA Advances in Statistical Analysis*, *98*(2), 103–120. https://doi.org/10.1007/s10182-013-0212-2

Targa, A. D. S., Benítez, I. D., Moncusí-Moix, A., Arguimbau, M., de Batlle, J., Dalmases, M., & Barbé, F. (2020). Decrease in sleep quality during COVID-19 outbreak. *Sleep and Breathing*. https://doi.org/10.1007/s11325-020-02202-1

Terry, P. C., Parsons-Smith, R. L., & Terry, V. R. (2020). Mood Responses Associated With COVID-19 Restrictions. *Frontiers in Psychology*, *11*, 1–10. https://doi.org/10.3389/fpsyg.2020.589598

UWV. (2020). *Duiding arbeidsmarktontwikkelingen*.

van den Berg, J., Appel-Meulenbroek, R., Kemperman, A., & Sotthewes, M. (2020). Knowledge workers' stated preferences for important characteristics of activity-based workspaces. *Building Research and Information*, *48*(7), 703–718. https://doi.org/10.1080/09613218.2020.1726169

Vischer, J. C. (2007). The effects of the physical environment on job performance: Towards a theoretical model of workspace stress. *Stress and Health*, *23*(3), 175–184. https://doi.org/10.1002/smi.1134

Waizenegger, L., McKenna, B., Cai, W., & Bendz, T. (2020). An affordance perspective of team collaboration and enforced working from home during COVID-19. *European Journal of Information Systems*, *29*(4), 429–442. https://doi.org/10.1080/0960085X.2020.1800417

WHO. (2001). *Health at work survey*.

WHO. (2004). Promoting mental health. In *Promoting Mental Health*.

Zvolensky, M. J., Garey, L., Rogers, A. H., Schmidt, N. B., Vujanovic, A. A., Storch, E. A., Buckner, J. D., Paulus, D. J., Alfano, C., Smits, J. A. J., & Cleirigh, C. O. (2020). Psychological, addictive, and health behavior implications of the COVID-19 pandemic. *Behaviour Research and Therapy*, *134*.

Table 1. Descriptive statistics (N=393)

	Sample (N)	Sample (%)	Mean	SD
Age			44.86	11.489
Gender				
Male	271	69.0		
Female	122	31.0		
Contractual work hours			36.85	5.241
Actual work hours			41.96	12.200
Personality				
Neuroticism			4.49	1.500
Conscientiousness			8.07	1.313
Openness			7.31	1.546
Extraversion			7.85	1.480
Agreeableness			7.75	1.222
Nr. people workspace shared				
Private workspace	308	78.4		
1 other person or more	85	21.6		
Satisfaction with support workspace activities				
Concentrated work			3.71	1.322
Informal interactions			3.20	1.223
Formal interactions			3.43	1.248
'Online' interactions			3.64	1.259
Satisfaction with physical aspects workspace				
Artificial light			3.53	1.221
Daylight			3.89	1.237
Sound and noise			3.81	1.172
Privacy			4.05	1.307
Air quality			3.98	1.135
Ventilation			3.96	1.212
Temperature			3.68	1.220
Greenery and plants			3.34	1.443
Views outside			3.60	1.400
Stress			6.444	1.265
Mood			5.520	1.144
Fatigue			5.341	1.538
Sleep quality			6.055	1.173

Table 2. Results Mental health+

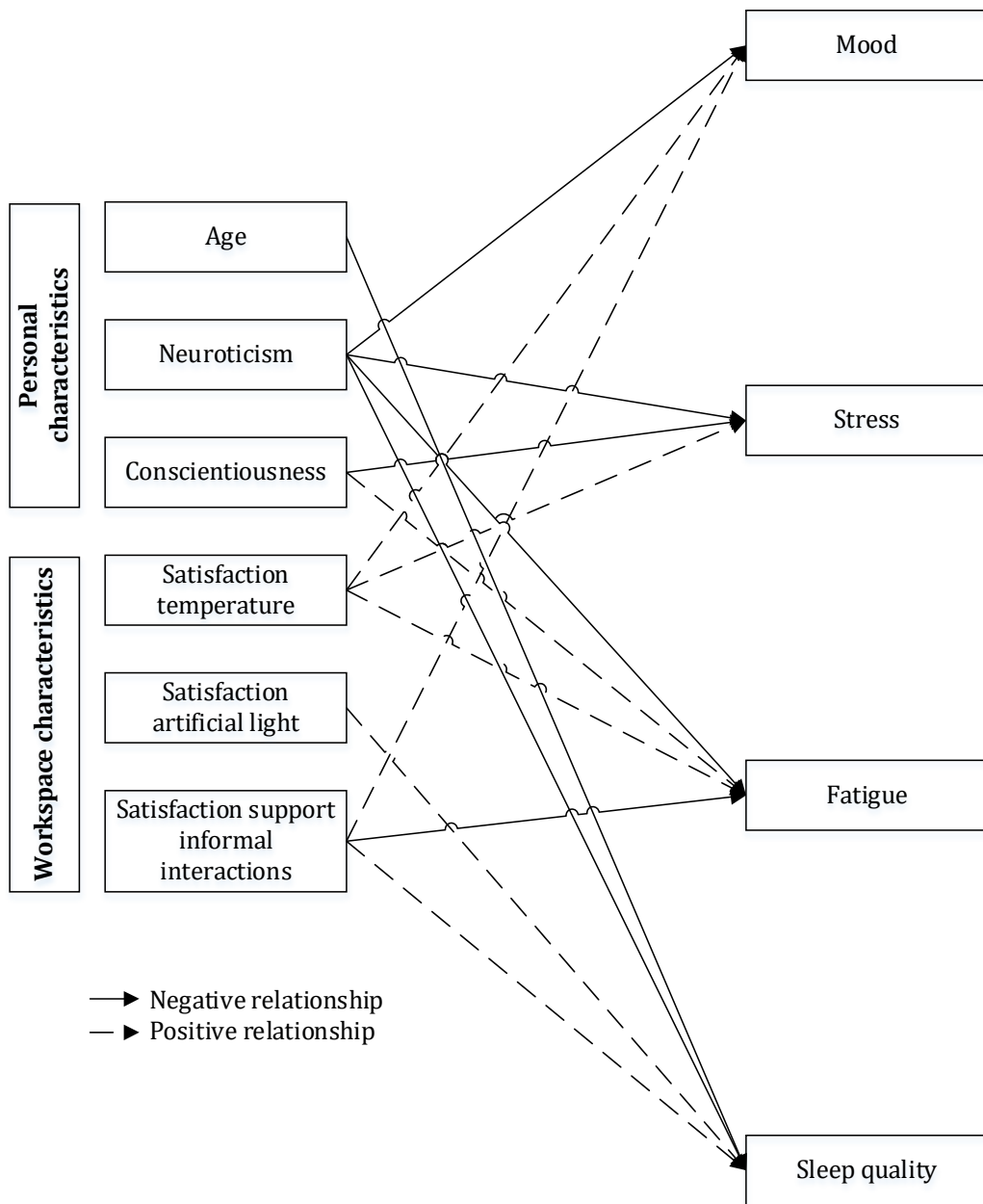|	Mood	Stress	Fatigue	Sleep quality
	Coeff.	Coeff.	Coeff.	Coeff.
Personal characteristics				
Age				-0.0329**
Neuroticism	-1.100***	-0.688***	-1.838***	-0.420***
Conscientiousness		-0.248***	0.715*	
Agreeableness			0.564	
Work hours last two weeks				
Workspace characteristics				
Satisfaction with temperature	0.397**	0.270***	0.803*	
Satisfaction with privacy				
Satisfaction with artificial light				0.215*
Satisfaction with daylight				
Satisfaction support informal interactions	0.310**		1.676***	0.312**
R²	0.229	0.265	0.172	0.0973
Adjusted R²	0.223	0.259	0.161	0.0880

Note: ***, and **, and * indicate the significance at 0.001, 0.05 and 0.01 level.

Figure 1. Conceptual model