



Short communication

Can social support and physical activity buffer cognitive impairment in individuals with depressive symptoms? Results from a representative sample of young to older adults

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ABSTRACT

Background: Previous study results on associations between depressive symptoms and cognitive functioning, mainly based on clinical samples and explanatory mechanisms including potential protective factors, are yet to be clarified. To this end, we investigated relations between depressive symptoms and executive functioning as well as episodic memory in a representative population sample. Furthermore, we determined the role of social support and physical activity in the explanation of cognitive performance differences in individuals with depressive symptoms.

Methods: A total of $N = 3661$ participants (52% female) from the German Health and Examination Interview for Adults (18–79 years; $M = 52.71$, $SD = 16.06$) were included in the present study. Within a larger assessment protocol, participants answered a depressive symptom questionnaire and completed a neuropsychological test battery including executive functioning and episodic memory.

Results: Depressive symptoms significantly predicted executive functioning and episodic memory scores with small effects of $\beta = -0.04$. Social support and physical activity mediated the relationships between depressive symptoms and cognitive functioning.

Limitations: As the present study is cross-sectional, future research is warranted to provide more insight into causality by following individuals with depressive symptoms over time.

Conclusions: The present findings indicate that effects from depressive symptoms on cognitive functioning (a) have been overestimated and do not generalize to non-clinical populations and (b) vary owing to behavioral lifestyle factors such as social support and physical activity. Thereby, the present results highlight opportunities for buffering cognitive decline in individuals with depressive symptoms in the general population.

1. Introduction

Recently, depression has been discussed as one of the primary disorders within the global burden of disease rankings (e.g., Whiteford et al., 2015; WHO, 2017), associated with high individual and social costs such as quality of life and productivity constraints, comorbidity and cognitive impairment (e.g., Bouwmans et al., 2014; Moussavi et al., 2007). However, depressive symptoms such as loss of energy or concentration problems can also affect persons that do not fulfill the necessary clinical diagnostic criteria of depression but are very common within the general population and contribute to the individual and economic burden (e.g., Bretschneider et al., 2017). Thus, there is a pressing need to identify protective factors within both an individual and a societal perspective as well as a therapeutic and general population context.

Previous results on associations between depressive symptoms and cognitive impairment showed low to moderate effects on executive functioning and episodic memory (see meta-analyses by McDermott and Ebmeier, 2009; Rock et al., 2014). Overall, the effects found are primarily limited to small clinical populations with already diagnosed depression and do not generalize to non-clinical populations with depressive symptoms. As a consequence, effects might be overestimated owing to a high severity as indicated by clinical diagnosis and little variability of depressive symptoms within such selective samples.

Until now, underlying mechanisms have not been fully explored. Explanatory approaches suggest that depressive symptoms are accompanied by cognitive decline due to low motivation, a negative cognitive set (i.e., expectations) and already high cognitive load (i.e., stress, rumination) disrupting reflective processing and in turn leading to response bias, lower processing speed and less cognitive resources (e.g.,

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Austin et al., 2001; Beevers, 2005). In addition, there are several indications of beneficial effects from certain lifestyle factors on both depressive symptoms and cognitive functioning that might play a role in this regard. The majority of research points towards social support and physical activity as significant factors involved in the maintenance or enhancement of mental health and cognitive functioning (e.g., Harris et al., 2006; Kawachi and Berkman, 2001; Sofi et al., 2010; Pillemer and Holtzer, 2016). However, their role for the explanation of cognitive functioning differences in individuals with depressive symptoms has not been clarified so far and awaits further elucidation.

2. Rationale and hypotheses

The present research aims to investigate how well previously identified relationships between depressive symptoms and cognitive functioning also apply to the general population. We expected to replicate previous findings on the interrelatedness between depressive symptoms and executive functioning respective to episodic memory in the general population and also expected to find smaller effects as compared with previous meta-analyses focusing only on clinical samples (Hypothesis 1; H1). Second, the present study aims to determine potential mediating effects on the relationship between depressive symptoms and cognitive functioning. More precisely, we hypothesized that social support and physical activity mediate the relationship between depressive symptoms and executive functioning as well as episodic memory (Hypothesis 2; H2).

3. Methods

3.1. Sample and procedure

The present sample comprises $n = 3661$ (52% female) participants from the nationally representative German Health and Examination Interview for Adults (DEGS1) and the additional Mental Health Module (DEGS1-MH; data collection: 2009–2012; see in detail in Jacobi et al., 2013) who also completed a neuropsychological testing battery. Representativeness was maintained using two-stage stratified cluster sampling and examining power and sample size estimations as well as by sampling weights adjusted for deviations from the German population in 2010, as described in detail in Scheidt-Nave et al. (2012). Participants' ages ranged from 18 to 79 years ($M = 52.71$, $SD = 16.06$), and the majority of participants were categorized as having moderate socioeconomic status (61%), while for 19% the socioeconomic status was low and for 20% high, based on an index score including education, occupation and income (Lampert et al., 2013). Participants with diagnosed neuropsychological diseases (e.g., dementia, Alzheimer's) were excluded. The present study was approved by the Medical Ethics Review Committee of the Charité Berlin, Germany and of the Technische Universität Dresden, Germany. Informed consent was obtained from all participants included in this study.

3.2. Measures

3.2.1. Depressive symptoms

With the help of the 9-item Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) we assessed the frequency of depressive symptoms (values of 0 = not at all to 3 = nearly every day) over the preceding 2 weeks. The total score (min = 0, max = 27) was used as a continuous indicator for depressive symptom severity. The present sample's mean score was $M = 3.50$ [95% CI: 3.32; 3.68].¹

¹ Overall, 20% had mild depressive symptoms as indicated by a PHQ-9 score of 5–9 and 5% had moderate to severe depressive symptoms as indicated by a PHQ-9 score of ≥ 10 . The PHQ-9 scale reliability was satisfactory with $\alpha = .79$.

3.2.2. Executive functioning

Participants' executive functioning was assessed via four standardized tests including verbal fluency, trail making, digit span backwards and letter digit substitution as described in Wagner et al. (2017). For the present analyses, we used a composite measure of global executive functioning that converts and averages each of the three test performances into a z-standardized score (adjusted by age and SES), as suggested by the results from a factorial analysis (Wagner et al., 2017). The average executive functioning performance was $M = 0.10$ [95% CI: 0.05; 0.14].

3.2.3. Episodic memory

Episodic memory was assessed via immediate and delayed word list recall (see Wagner et al., 2017). Similarly to executive functioning, the z-standardized composite measure was used as an indicator of episodic memory. The average episodic memory performance was $M = 0.09$ [95% CI: 0.04; 0.13].

3.2.4. Social support

Social support was assessed via the 3-item Oslo Social Support Scale (Dalgard et al., 2006) covering the number of close persons (from 1 = none to 4 = six or more), the sense of concern from others (from 1 = none to 5 = a lot) and the easiness to get help from neighbors (from 1 = very difficult to 5 = very easy). Answers were summarized to a total score and thereafter categorized as low (≤ 8), moderate (9–11) and high (≥ 12) perceived social support. Overall, 11% of the participants showed low, 49% moderate and 40% high social support.

3.2.5. Physical activity

Participants' regular physical activity (during the last 3 months) was measured via the item "How often do you play sports?". Answers were categorized as never (0), up to 2 hours a week (1) and more than 2 hours a week (2). Thirty percent of the participants reported they never play sports, 43% reported playing sports for up to 2 hours and 27% for more than 2 hours a week.

3.3. Statistical analyses

To investigate the relationship between depressive symptoms and cognitive functioning, we conducted multiple regression analyses from depressive symptoms on executive functioning and episodic memory. The participant's age, sex and SES were included as control variables.²

Next, we analyzed mediation with the help of two sets of regression analyses on executive functioning and episodic memory, including four steps each: (a) regression from depressive symptoms on social support respective to physical activity; (b) regression from social support respective to physical activity on executive functioning / episodic memory; (c) regression from depressive symptoms on executive functioning / episodic memory; (d) regression from depressive symptoms and social support respective to physical activity on executive functioning / episodic memory. Afterwards, we calculated the proportion explained by, and effect sizes for, *completely standardized indirect effects* (Preacher and Kelley, 2011) and tested their significance using bootstrapping estimation procedures with 1000 samples (Shrout and Bolger, 2002).

4. Results

Results from two multiple linear regression analyses in control of age, sex and SES indicate that an increase in current depressive symptoms was significantly related to lower executive functioning as well as lower episodic memory performances (Table 1).³ Effect sizes were

² Statistical analyses were carried out with Stata 14.

³ An alternative analysis with depressive symptoms as dummy coded variables (PHQ-9

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