



Contents lists available at ScienceDirect

# Personality and Individual Differences

journal homepage: [www.elsevier.com/locate/paid](http://www.elsevier.com/locate/paid)



## Alexithymic traits, independent of depression and anxiety, are associated with reduced sleep quality

Jennifer Murphy<sup>a,\*</sup>, Katharina Wulff<sup>b</sup>, Caroline Catmur<sup>c</sup>, Geoffrey Bird<sup>a,d</sup>

<sup>a</sup> MRC Social, Genetic and Developmental Psychiatry Centre, Institute of Psychiatry, Psychology and Neuroscience, King's College London, United Kingdom

<sup>b</sup> Sleep and Circadian Neuroscience Institute, University of Oxford, United Kingdom

<sup>c</sup> Department of Psychology, Institute of Psychiatry, Psychology and Neuroscience, King's College London, United Kingdom

<sup>d</sup> Department of Experimental Psychology, University of Oxford, United Kingdom



### ARTICLE INFO

**Keywords:**  
 Alexithymia  
 Depression  
 Anxiety  
 Sleep quality  
 Sleep

### ABSTRACT

Disrupted sleep is a transdiagnostic factor characterising a multitude of psychiatric conditions. Although this is well-recognised, the cause of poor sleep across conditions is unclear. One possibility is that poor sleep is driven by traits which also co-occur with multiple conditions. Previous research suggests that alexithymia (an inability to identify and describe one's emotions) is a candidate trait, as it is linked to poor sleep quality and elevated levels of alexithymia are seen across multiple diagnostic groups. The association between alexithymia and poor sleep quality has been questioned however, with studies arguing that it is depression and anxiety, rather than alexithymia, which impact sleep quality. Problematically, such studies typically utilise measures of depression and anxiety which include items relating to sleep – meaning that apparent associations between depression and anxiety may be due to measurement issues, rather than to depression and anxiety per se. Study 1 confirmed the relationship between alexithymia and subjective sleep quality, whilst Study 2 utilised an independent sample to replicate the association between alexithymia and sleep quality, and to demonstrate that it is not a product of co-occurring depression or anxiety. Results therefore support the suggestion that alexithymia may explain disrupted sleep across multiple psychiatric conditions.

### 1. Introduction

Poor sleep quality is reported across multiple psychiatric conditions (e.g., Freeman et al., 2017) including depression (see Tsuno, Besset, & Ritchie, 2005) and certain subtypes of anxiety disorders (see Papadimitriou & Linkowski, 2005). Given the importance of sleep for wellbeing (Freeman et al., 2017), identifying factors responsible for poor sleep across the disorders in which it is experienced is an important research aim. In recent years there has been a growing appreciation that transdiagnostic symptoms, including poor sleep, may be explained by traits that co-occur with multiple disorders, rather than by the disorders themselves. In particular, the contribution of alexithymia, a sub-clinical condition characterised by difficulties identifying and describing one's own emotions and an externally orientated thinking style, has begun to be appreciated (Sifneos, 1973). Alexithymic individuals often exhibit poor emotional functioning in a number of domains outside their defining inability to identify and describe their own emotions, including emotion recognition (Brewer, Cook, Cardi, Treasure, & Bird, 2015; Cook, Brewer, Shah, & Bird, 2013; Grynberg

et al., 2012; Heaton et al., 2012) and empathy (Bird et al., 2010). Perhaps as a consequence, individuals with alexithymia also experience problems with interpersonal relationships and exhibit increased rates of mental and physical ill-health (Taylor, Bagby, & Parker, 1999). Importantly, increased rates of alexithymia are observed across many psychiatric conditions (e.g., Brewer, Cook, & Bird, 2016; Murphy, Brewer, Catmur, & Bird, 2017), and alexithymia has been demonstrated to be responsible for a range of symptoms across these conditions (e.g., Brewer et al., 2015; Cook et al., 2013).

With respect to sleep, previous studies have identified an association between alexithymia and poor sleep quality using both subjective (e.g., Bauermann, Parker, & Taylor, 2008) and objective measures of sleep quality (e.g., Bazydlo, Lumley, & Roehrs, 2001). For example, using subjective measures alexithymia has been associated with sleep-related problems in community samples (e.g., Bauermann et al., 2008; Hyypä, Lindholm, Kronholm, & Lehtinen, 1990) as well as in clinical groups such as men with depression (e.g., Honkalampi, Saarinen, Hintikka, Virtanen, & Viinamäki, 1999) and individuals with depression (e.g., Aydin, Ozdemir, & Selvi, 2012); and rates of alexithymia are reported to

\* Corresponding author at: Social, Genetic and Developmental Psychiatry Centre (MRC), Institute of Psychiatry, Psychology and Neuroscience, PO80, De Crespigny Park, Denmark Hill, London SE5 8AF, United Kingdom.

E-mail address: [Jennifer.Murphy@kcl.ac.uk](mailto:Jennifer.Murphy@kcl.ac.uk) (J. Murphy).

<https://doi.org/10.1016/j.paid.2018.03.023>

Received 19 January 2018; Received in revised form 7 March 2018; Accepted 10 March 2018

Available online 27 March 2018

0191-8869/ © 2018 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

be higher in those with insomnia (e.g., Engin, Keskin, Dulgerler, & Bilge, 2010). Whilst few studies have employed objective measures, there are also reports that alexithymia is associated with increased light sleep (Bazydlo et al., 2001; but see De Gennaro et al., 2002). Furthermore, recent evidence links alexithymia to atypical interoception (perception of one's internal bodily state; Brewer et al., 2016; Herbert, Herbert, & Pollatos, 2011; Shah, Hall, Catmur, & Bird, 2016; Murphy, Catmur, & Bird, 2018), and poor interoception has also been linked to poor self-reported sleep quality in clinical conditions (Ewing et al., 2017). These studies are therefore consistent with the proposal that heightened levels of alexithymia may confer risk of disrupted sleep.

Although a body of evidence links alexithymia to poor sleep, it should be acknowledged that individuals with higher levels of alexithymia are more likely to report increased symptoms of depression and anxiety (e.g., Hendryx, Haviland, & Shaw, 1991; Honkalampi, Hintikka, Tanskanen, Lehtonen, & Viinamäki, 2000), which have both been associated with poor sleep (see Tsuno et al., 2005; Papadimitriou, & Linkowski, 2005). As a consequence, it is possible that it is depression or anxiety, and not alexithymia, that is responsible for poor sleep quality. Indeed, previous studies examining the specific contribution of alexithymia, depression and anxiety to poor sleep quality have produced mixed results, with some studies suggesting that the relationship between alexithymia and sleep disturbance is driven by anxiety (Lundh & Broman, 2006; with anxiety quantified using the Karolinska Scales of Personality; KSP; Gustavsson, Weinryb, Göransson, Pedersen, & Åsberg, 1997) or depression (De Gennaro, Martina, Curcio, & Ferrara, 2004; with depression assessed using the Center for Epidemiological Studies Depression scale; CES-D; Radloff, 1977), and some not (Kronholm, Partonen, Salminen, Mattila, & Joukamaa, 2008; with depression assessed using the Beck Depression Inventory; BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). Problematically, however, many measures of depression and anxiety include items relating to sleep, and all of the previous studies investigating the relationship between alexithymia, anxiety, depression and sleep have utilised measures that include items assessing sleep. For example, the most commonly used measure of depressive traits, the BDI (Beck et al., 1961) includes items relating to both sleep (e.g., “I don't sleep as well as I used to”) and tiredness (e.g., “I get tired more easily than I used to”). The same is true for other routinely-used measures such as the CES-D (Radloff, 1977) which also includes items relating to sleep (e.g., “My sleep was restless”); and measures of anxiety that include items relating to tiredness (e.g., “Quite often, especially when I am tired, I get the feeling that either I or the world around me is changing - a feeling of unreality”; KSP; Gustavsson et al., 1997). The association between depression and anxiety and sleep, and whether anxiety and depression are responsible for the association between alexithymia and sleep quality, may therefore depend on the degree to which items relating to sleep contribute to assessment of depression and anxiety on a particular measure. Specifically, studies utilising depression or anxiety measures that have a greater focus on sleep quality than other measures may inflate relationships between anxiety, depression and sleep, which in turn obscure, or reduce, associations between alexithymia and sleep quality (De Gennaro et al., 2004; Kronholm et al., 2008; Lundh & Broman, 2006). The degree to which the association between alexithymia and sleep quality is suppressed will, in turn, depend on the proportion of individuals in a particular sample with co-occurring clinical symptoms and sleep problems. These factors make it very difficult to determine whether alexithymia contributes to poor sleep quality independent of its relationship with depression and anxiety when measures of depression and anxiety are utilised that include items relating to sleep.

Consequently, the aim of the present set of studies was to 1) confirm the relationship between alexithymia and poor sleep quality and 2) examine whether these associations are driven by anxiety or depression using measures which do not include items that assess sleep quality.

## 2. Study 1

### 2.1. Participants

Participants were recruited via pre-existing databases of individuals who had indicated an interest in taking part in psychological research and via social media advertisements. Participants were informed that the study aimed to investigate links between emotional and bodily awareness, and physical health. 86 participants took part in Study 1. Of these, 70 participants fully completed the questionnaires, had English as their first language and identified their gender as male or female ( $M_{\text{age}} = 42.93$ ,  $SD_{\text{age}} = 21.80$ , range 18–91, 26 Males) and were included in analyses. 13.95% were removed as they had English as their second language, 3.49% were removed for a failure to complete all measures and 1.16% were removed as they identified as a non-binary gender. Ethical approval was granted by the local ethics committee, all participants gave informed consent, and were fully debriefed upon completion.

### 2.2. Method

Participants completed the Toronto Alexithymia Scale (TAS-20; Bagby, Parker, & Taylor, 1994) and the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) in a randomised order online via Qualtrics (Provo, UT). High scores on these measures indicate elevated alexithymic traits and poor sleep quality, respectively. The TAS-20 is comprised of three subscales, difficulties describing feelings, difficulties identifying feelings and externally orientated thinking.

## 3. Results

Where directional predictions are made, one-tailed tests are utilised. Alexithymia scores ranged from 21 to 79 ( $M = 46.90$ ,  $SD = 13.55$ ). As predicted, total alexithymia scores were associated with reduced sleep quality ( $r(68) = 0.462$ ,  $p < .001$ ; one-tailed). Analysis of the TAS-20 sub-factors indicated a significant association between reduced sleep quality and each sub-factor (all  $p < .006$ ; one-tailed).

As the relationship between alexithymia and sleep quality may vary across genders (e.g., Honkalampi et al., 1999; Kronholm et al., 2008), and levels of alexithymia have been reported to vary across the lifespan (e.g., Mattila, Salminen, Nummi, & Joukamaa, 2006), additional analyses were conducted controlling for these variables. Regression analyses predicting sleep quality from age (years), gender (0 = female, 1 = male) and alexithymia total scores suggested that both alexithymia (standardised  $\beta = 0.534$ ,  $t = 4.903$ ,  $p < .001$ ; one-tailed) and age (standardised  $\beta = 0.265$ ,  $t = 2.408$ ,  $p < .010$ ; one-tailed) were predictive of poor sleep quality and the overall model was significant ( $F(3,66) = 8.420$ ,  $p < .001$ ).

To uncover whether the relationship between alexithymia and sleep varied as a function of gender, the regression analysis was re-run including the interaction term between gender (−1 = female, and 1 = male) and mean-centred alexithymia scores. The interaction term did not predict sleep quality (standardised  $\beta = 0.154$ ,  $t = 1.302$ ,  $p > .05$ ; two-tailed).

## 4. Study 2

Having confirmed an association between alexithymia and poor sleep quality, the aim of Study 2 was to determine whether this association was driven by depression or anxiety using measures which do not include items relating to sleep quality.

### 4.1. Participants

A power analysis using the effect size observed in Study 1 for the

correlation between alexithymia and sleep quality indicated an  $N$  of 27 would provide 80% power to detect an effect at  $\alpha = 0.05$  (one-tailed). Participants were recruited as per Study 1 and the same ethical guidelines were adhered to. 108 participants completed the online questionnaires anonymously via Qualtrics (Provo, UT). Of these, 73 fully completed the surveys, had English as their first language and identified as male or female ( $M_{\text{age}} = 38.84$ ,  $SD_{\text{age}} = 15.82$ , Range 18–79, 26 Males). 26.9% of the sample were removed as they had English as their second language, 2.8% of the sample were removed for non-completion and 2.8% of the sample were removed as they identified as a non-binary gender.

## 4.2. Method

Participants completed the TAS-20 and PSQI as well as the Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) online. The DASS-21 provides separate subscales for depression and anxiety, and no items relating to sleep are present in either subscale. As is typical, scores from the DASS-21 were doubled to equate to the DASS-42 to allow ease of comparison with studies using this measure (Lovibond & Lovibond, 1995), with higher scores indicative of greater depression or anxiety.

## 5. Results

An adequate range of alexithymia ( $M_{\text{age}} = 50.19$ ,  $SD_{\text{age}} = 12.16$ , Range 24–79), depression ( $M_{\text{age}} = 10.77$ ,  $SD_{\text{age}} = 10.0$ , Range 0–38) and anxiety scores ( $M_{\text{age}} = 8.27$ ,  $SD_{\text{age}} = 7.62$ , Range 0–30) were obtained, with scores on the anxiety and depression DASS subscales ranging between normal and extremely severe (Lovibond & Lovibond, 1995) and scores on the TAS-20 ranging from very low to high alexithymic traits (Bagby et al., 1994). Likewise, a large range of PSQI scores were obtained ( $M_{\text{age}} = 6.49$ ,  $SD_{\text{age}} = 3.60$ , Range 0–18). As expected, significant correlations were observed between these variables (all  $p < .001$ ; one-tailed; Table 1.). As in Study 1, all three subscales of the TAS-20 were correlated with poor sleep quality ( $p < .05$ ; one-tailed).

Analysis of the data was carried out using hierarchical regression. Participant age (years), gender (0 = female, 1 = male) and anxiety scores were entered into the first step, depression into the second step, and alexithymia total scores into the third step of a regression model predicting sleep quality. Visual examination of the residuals confirmed a normal distribution and no multicollinearity (all VIF < 1.88). At step one only anxiety scores predicted sleep quality (standardised  $\beta = 0.408$ ,  $t = 3.513$ ,  $p < .001$ ; one-tailed) and the overall model was significant  $F(3,69) = 5.041$ ,  $p = .003$ . At step two only depression scores predicted sleep quality (standardised  $\beta = 0.428$ ,  $t = 3.328$ ,  $p < .001$ ; one-tailed), and the overall model was significant ( $F(4,68) = 7.103$ ,  $p < .001$ ). Anxiety no longer predicted sleep quality (standardised  $\beta = 0.131$ ,  $t = 0.959$ ,  $p > .15$ ; one-tailed). When alexithymia was added (step three), both alexithymia (standardised  $\beta = 0.261$ ,  $t = 2.133$ ,  $p < .02$ ; one-tailed) and depression predicted sleep quality (standardised  $\beta = 0.338$ ,  $t = 2.561$ ,  $p = .007$ ; one-tailed). The inclusion of alexithymia significantly increased the variance accounted for by the model (by 4.5%;  $F(1, 67) = 4.551$ ,  $p = .037$ ), and

the overall model was significant ( $F(5,67) = 6.889$ ,  $p < .001$ ). Although residuals appeared normally distributed, the Kolmogorov–Smirnov test indicated that the residuals were not normally distributed ( $D = 0.183$ ,  $p < .001$ ). Accordingly, the analysis was re-run using robust regression (entry method), which is less sensitive to departures from normality (Field & Wilcox, 2017). This analysis confirmed the same pattern of results, whereby depression (standardised  $\beta = 0.107$ ,  $t = 2.353$ ,  $p = .011$ ; one-tailed) and alexithymia (standardised  $\beta = 0.096$ ,  $t = 2.753$ ,  $p = .004$ ; one-tailed) were the only predictors of poor sleep quality.

The original regression analysis was repeated including the interaction between gender (−1 = female, 1 = male) and mean centred alexithymia scores in step four. This had little effect on the results obtained, and the interaction term was not a significant predictor of sleep quality (standardised  $\beta = 0.065$ ,  $t = 0.554$ ,  $p > .250$ ).

## 6. Discussion

The present set of studies sought to examine the association between alexithymia and sleep quality. Consistent with previous evidence, Study 1 confirmed that alexithymia is associated with poor sleep quality and, in this sample, the impact of alexithymia on sleep quality did not vary across genders. In Study 2, the association between alexithymia and poor sleep quality was replicated, and analyses confirmed that the association was not a product of co-occurring depression or anxiety.

As expected, anxiety, depression and alexithymia were all associated with reduced sleep quality (e.g., Tsuno et al., 2005; Papadimitriou, & Linkowski, 2005; Bauermann et al., 2008). However, no relationship between anxiety and sleep quality was observed once depression was controlled for, suggesting that the relationship between anxiety and sleep quality may be driven in part by the high comorbidity between depression and anxiety (see Papadimitriou, & Linkowski, 2005). It remains a possibility, however, that a unique effect of anxiety on sleep quality may be observed for distinct subtypes of anxiety disorders.

In contrast to previous evidence suggesting associations between alexithymia and sleep quality are driven by heightened rates of anxiety and depression (De Gennaro et al., 2004; Lundh & Broman, 2006) in the alexithymic population, this study found an independent effect of alexithymia on sleep quality. Such findings are consistent with data from Kronholm et al. (2008), who found an independent effect of alexithymia on sleep not explained by depression despite using a depression measure that included items relating to sleep (the BDI). Whilst these findings conflict with some previous reports (e.g., De Gennaro et al., 2004; Lundh & Broman, 2006), as previously noted it is possible that the measures of depression and anxiety used in previous studies that specifically ask about sleep quality or refer to tiredness (e.g., the BDI, CES-D, and KSP) masked the relationship between alexithymia and sleep in samples with particular patterns of covariance between clinical symptoms and sleep quality. These data therefore underscore the importance of ensuring independence of measurement when selecting measures of depression and anxiety, and highlight the usefulness of the DASS-21 (which does not include items that assess sleep-related factors) when assessing correlations between depression, anxiety, and sleep quality.

The finding that heightened alexithymia is associated with poor sleep suggests that alexithymia may contribute towards the often-observed sleep disturbances across a range of disorders (e.g., Freeman et al., 2017) that are also characterised by heightened rates of alexithymia (e.g., Murphy et al., 2017). Whilst the mechanism by which alexithymia confers risk of disrupted sleep remains unclear, suggestions include increased nocturnal arousal as a result of poor verbalisation of emotions (Hyyppä et al., 1990), and increased light sleep (e.g., Bazydlo et al., 2001; see Bauermann et al., 2008). More recent associations between alexithymia and interoception (e.g., Brewer et al., 2016;

**Table 1**  
Zero-order correlations for Study 2.

Measure	1.	2.	3.	4.
1. Sleep quality	1			
2. Alexithymia	0.477*	1		
3. Depression	0.509*	0.478*	1	
4. Anxiety	0.421*	0.482*	0.584*	1

\* Denotes  $p < .001$  (one-tailed).



Herbert et al., 2011; Murphy et al., 2018; Shah et al., 2016), and evidence that low interoceptive accuracy is associated with poor sleep quality in certain disorders (Ewing et al., 2017), also raise the possibility that poor interoception may be the mechanism by which alexithymia confers risk of disrupted sleep. However, the direction of causality remains unclear (see also Ewing et al., 2017); it is also possible that poor interoception results in heightened alexithymia which in turn results in poor sleep quality and a greater risk of psychiatric disorders, or that poor sleep may impact upon interoception which results in increased alexithymia and risk of poor mental health. As is clear from this speculation, future studies using longitudinal designs should examine the relationship between alexithymia, interoception, and sleep, using both subjective and objective measures of interoception and sleep quality.

It is important to acknowledge certain limitations of these studies. First, although several potential confounds were controlled for, body composition (e.g., obesity), often associated with both sleep (Beccuti & Pannain, 2011) and alexithymia (Pinna et al., 2011), was not controlled for. However, given that associations between alexithymia and sleep quality have been reported when body composition is controlled for (Kronholm et al., 2008), it is unlikely this would have changed the pattern of results. Second, although sleep quality is often quantified using self-report measures (e.g., the PSQI), discrepancies between objective and subjective measures of sleep quality have been reported, with some suggestion that PSQI scores may be influenced by general negativity (Grandner, Kripke, Yoon, & Youngstedt, 2006). However, as previous reports suggest that alexithymia is associated with objective measures of poor sleep even when depression (CES-D) is controlled for (Bazydlo et al., 2001), it is likely that alexithymia also makes a contribution to objective measures of sleep disturbance. Future research, therefore, should investigate the association between alexithymia, depression, anxiety, and sleep quality, using complementary measures of both subjective and objective sleep quality. Third, in the present study, depression and anxiety were assessed over the previous week whereas sleep quality was rated over the previous month. Whilst this method has been utilised previously (e.g., De Gennaro et al., 2004), it is possible that these differing time frames may influence the relationship between these measures. It is therefore important that future studies equate the measurement period for each factor assessed. Finally, in comparison to previous work, the sample size recruited for the present study was small. However, it is important to note that an adequate range of scores was present for all key variables, the association between alexithymia and sleep quality was replicated across independent samples, and sample sizes were above those determined using formal power analyses.

In summary, these data demonstrate that alexithymia is an independent predictor of poor self-reported sleep quality, raising the possibility that alexithymia may contribute towards sleep problems observed across a number of psychiatric disorders.

## Acknowledgements

JM was supported by a doctoral studentship from the Economic and Social Research Council [1599941; ES/J500057/1]. GB was supported by the Bailly Thomas Charitable Trust.

## References

- Aydin, A., Ozdemir, P. G., & Selvi, Y. (2012). P-470-the effect of alexithymia on somatization and sleep quality in major depressive patients. *European Psychiatry*, 27, 1.
- Bagby, R. M., Parker, J. D., & Taylor, G. J. (1994). The twenty-item Toronto alexithymia scale-I. Item selection and cross-validation of the factor structure. *Journal of Psychosomatic Research*, 38(1), 23–32.
- Baumann, T. M., Parker, J. D., & Taylor, G. J. (2008). Sleep problems and sleep hygiene in young adults with alexithymia. *Personality and Individual Differences*, 45(4), 318–322.
- Bazydlo, R., Lumley, M. A., & Roehrs, T. (2001). Alexithymia and polysomnographic measures of sleep in healthy adults. *Psychosomatic Medicine*, 63(1), 56–61.
- Beccuti, G., & Pannain, S. (2011). Sleep and obesity. *Current Opinion in Clinical Nutrition and Metabolic Care*, 14(4), 402–412.
- Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, 4, 561–571.
- Bird, G., Silani, G., Brindley, R., White, S., Frith, U., & Singer, T. (2010). Empathic brain responses in insula are modulated by levels of alexithymia but not autism. *Brain*, 133(5), 1515–1525.
- Brewer, R., Cook, R., & Bird, G. (2016). Alexithymia: A general deficit of interoception. *Royal Society Open Science*, 3(10), 150664.
- Brewer, R., Cook, R., Cardi, V., Treasure, J., & Bird, G. (2015). Emotion recognition deficits in eating disorders are explained by co-occurring alexithymia. *Royal Society Open Science*, 2(1), 140382.
- Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193–213.
- Cook, R., Brewer, R., Shah, P., & Bird, G. (2013). Alexithymia, not autism, predicts poor recognition of emotional facial expressions. *Psychological Science*, 24(5), 723–732.
- De Gennaro, L., Ferrara, M., Curcio, G., Cristiani, R., Lombardo, C., & Bertini, M. (2002). Are polysomnographic measures of sleep correlated to alexithymia? *Journal of Psychosomatic Research*, 53(6), 1091–1095.
- De Gennaro, L., Martina, M., Curcio, G., & Ferrara, M. (2004). The relationship between alexithymia, depression, and sleep complaints. *Psychiatry Research*, 128(3), 253–258.
- Engin, E., Keskin, G., Dulgerler, S., & Bilge, A. (2010). Anger and alexithymic characteristics of the patients diagnosed with insomnia: A control group study. *Journal of Psychiatric and Mental Health Nursing*, 17(8), 692–699.
- Ewing, D. L., Manassei, M., Gould van Praag, C., Philippides, A. O., Critchley, H. D., & Garfinkel, S. N. (2017). Sleep and the heart: Interoceptive differences linked to poor experiential sleep quality in anxiety and depression. *Biological Psychology*, 127, 163–172.
- Field, A. P., & Wilcox, R. R. (2017). Robust statistical methods: A primer for clinical psychology and experimental psychopathology researchers. *Behaviour Research and Therapy*, 98, 19–38.
- Freeman, D., Sheaves, B., Goodwin, G. M., Yu, L. M., Nickless, A., Harrison, P. J., ... Hinds, C. (2017). The effects of improving sleep on mental health (OASIS): A randomised controlled trial with mediation analysis. *The Lancet Psychiatry*, 4(10), 749–758.
- Grandner, M. A., Kripke, D. F., Yoon, I.-Y., & Youngstedt, S. D. (2006). Criterion validity of the Pittsburgh sleep quality index: Investigation in a non-clinical sample. *Sleep and Biological Rhythms*, 4(2), 129–139.
- Grynberg, D., Chang, B., Corneille, O., Muraire, P., Vermeulen, N., Berthoz, S., & Luminet, O. (2012). Alexithymia and the processing of emotional facial expressions (EFES): Systematic review, unanswered questions and further perspectives. *PLoS One*, 7(8), e42429.
- Gustavsson, J. P., Weinryb, R. M., Göransson, S., Pedersen, N. L., & Åsberg, M. (1997). Stability and predictive ability of personality traits across 9 years. *Personality and Individual Differences*, 22(6), 783–791.
- Heaton, P., Reichenbacher, L., Sauter, D., Allen, R., Scott, S., & Hill, E. (2012). Measuring the effects of alexithymia on perception of emotional vocalizations in autistic spectrum disorder and typical development. *Psychological Medicine*, 42(11), 2453–2459.
- Hendryx, M. S., Haviland, M. G., & Shaw, D. G. (1991). Dimensions of alexithymia and their relationships to anxiety and depression. *Journal of Personality Assessment*, 56(2), 227–237.
- Herbert, B. M., Herbert, C., & Pollatos, O. (2011). On the relationship between interoceptive awareness and alexithymia: Is interoceptive awareness related to emotional awareness? *Journal of Personality*, 79(5), 1149–1175.
- Honkalampi, K., Hintikka, J., Tanskanen, A., Lehtonen, J., & Viinamäki, H. (2000). Depression is strongly associated with alexithymia in the general population. *Journal of Psychosomatic Research*, 48(1), 99–104.
- Honkalampi, K., Saarninen, P., Hintikka, J., Virtanen, V., & Viinamäki, H. (1999). Factors associated with alexithymia in patients suffering from depression. *Psychotherapy and Psychosomatics*, 68(5), 270–275.
- Hyppä, M. T., Lindholm, T., Kronholm, E., & Lehtinen, V. (1990). Functional insomnia in relation to alexithymic features and cortisol hypersecretion in a community sample. *Stress and Health*, 6(4), 277–283.
- Kronholm, E., Partonen, T., Salminen, J. K., Mattila, A. K., & Joukamaa, M. (2008). Alexithymia, depression and sleep disturbance symptoms. *Psychotherapy and Psychosomatics*, 77(1), 63–65.
- Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the depression anxiety stress scales (DASS) with the Beck depression and anxiety inventories. *Behaviour Research and Therapy*, 33(3), 335–343.
- Lundh, L. G., & Broman, J. E. (2006). Alexithymia and insomnia. *Personality and Individual Differences*, 40(8), 1615–1624.
- Mattila, A. K., Salminen, J. K., Nummi, T., & Joukamaa, M. (2006). Age is strongly associated with alexithymia in the general population. *Journal of Psychosomatic Research*, 61(5), 629–635.
- Murphy, J., Brewer, R., Catmur, C., & Bird, G. (2017). Interoception and psychopathology: A developmental neuroscience perspective. *Developmental Cognitive Neuroscience*, 23, 45–56.
- Murphy, J., Catmur, C., & Bird, G. (2018). Alexithymia is a multi-domain, multi-dimensional failure of interoception: Evidence from novel tests. *Journal of Experimental Psychology: General*, 147(3), 398–408.
- Papadimitriou, G. N., & Linkowski, P. (2005). Sleep disturbance in anxiety disorders. *International Review of Psychiatry*, 17(4), 229–236.
- Pinna, F., Lai, L., Pirarba, S., Orrù, W., Velluzzi, F., Loviselli, A., & Carpiniello, B. (2011). Obesity, alexithymia and psychopathology: A case-control study. *Eating and Weight Disorders*, 16(3), e164–70.
- Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1(3), 385–401.
- Shah, P., Hall, R., Catmur, C., & Bird, G. (2016). Alexithymia, not autism, is associated with impaired interoception. *Cortex*, 81, 215–220.
- Sifneos, P. E. (1973). The prevalence of 'alexithymic' characteristics in psychosomatic patients. *Psychotherapy and Psychosomatics*, 22(2–6), 255–262.
- Taylor, G. J., Bagby, R. M., & Parker, J. D. (1999). *Disorders of affect regulation: Alexithymia in medical and psychiatric illness*. Cambridge University Press.
- Tsuno, N., Besset, A., & Ritchie, K. (2005). Sleep and depression. *The Journal of Clinical Psychiatry*, 66(10), 1254–1269.