CrossMark

Affective mediators of the association between pleasant events and global sleep quality in community-dwelling adults

Caitlan A. Tighe[1] · Kristy D. Shoji[1] · Natalie D. Dautovich[1] · Kenneth L. Lichstein[1] ·
Forrest Scogin[1]

Abstract This study explored the association of engagement in pleasant events and global sleep quality, as well as examined the intermediary roles of positive affect and depressive symptoms in this association. Data were derived from the Midlife in the United States-II study. The sample consisted of 1054 community-dwelling adults. Participants completed the Pittsburgh Sleep Quality Index and indicated the frequency and enjoyableness of experiences on a positive events scale. Depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale. Positive affect was measured using the Mood and Symptoms Questionnaire. Regression analyses indicated more frequent engagement in pleasant events was associated with better global sleep quality. Depressive symptoms, but not positive affect, partially mediated the association between pleasant events and global sleep quality. The findings suggest that behavioral engagement in pleasant events may be related to global sleep quality via depressive symptoms, but not positive affect. These findings highlight the potential for engagement in pleasant activities to influence both mood and sleep.

✉ Caitlan A. Tighe
catighe@crimson.ua.edu

Kristy D. Shoji
kdouglas@crimson.ua.edu

Natalie D. Dautovich
nataliedd@gmail.com

Kenneth L. Lichstein
lichstein@ua.edu

Forrest Scogin
fscogin@ua.edu

[1] University of Alabama, 356B Gordon Palmer Hall, 505 Hackberry Lane, Tuscaloosa, AL 35487-0348, USA

Introduction

The well-established link between mental and physical health, in conjunction with an increasingly integrated approach to health care, highlights the importance of focused research examining psychosocial factors that contribute to positive health outcomes. In particular, it is important to thoroughly understand psychosocial correlates of sleep outcomes due to the proposed role of sleep as a "pillar" of health (Wilson, 2005, p. 877). Whereas much research attention has been drawn to factors that result in decrements in sleep, there are benefits to be reaped from examining the role that positive factors play in maintaining or promoting sleep health across adulthood (Buysse, 2014). Engagement in pleasant events is one positive factor that has only recently been identified as a significant predictor of sleep outcomes (Moore et al., 2011). However, the mechanisms through which engagement in pleasant events (i.e., activities that individuals rate as enjoyable) may influence sleep have not been explored. Exploration of the predictive utility of engagement in pleasant events in sleep outcomes is merited for various reasons. Foremost, behavioral engagement is a modifiable target, as evidenced by existing behavioral interventions (e.g., behavioral therapy for depression; Cuijpers et al., 2007). Subsequently, the overarching aim of the present investigation was to understand how the experience of pleasant events relates to global sleep quality in a nationally representative sample of community-dwelling adults. Further, this study aimed to identify the roles of positive affect and depressive symptoms in the pleasant events-global sleep quality association.

Though the association between engagement in pleasant events and sleep is likely reciprocal, the Pleasant Events and Activity Restriction (PEAR) model (Mausbach et al., 2011) provides a rationale for examining the experience of pleasant events as a predictor of sleep quality. The PEAR model (Mausbach et al., 2011) proposes that more frequent engagement in pleasant events and lower levels of activity restriction promote well-being outcomes, including sleep, in caregivers of individuals with Alzheimer's disease. At present, the PEAR model has only been studied cross-sectionally (Mausbach et al., 2011; Moore et al., 2011), which precludes causal inferences. However, to alter psychosocial outcomes (e.g., in behavioral therapy), Mausbach et al. (2011) suggest that activity engagement serves as an important, initial target for change, therefore strengthening the rationale for examining this conceptualization of these constructs.

The PEAR model has been explored using a cross-sectional approach with findings suggesting that caregivers with more frequent engagement in pleasant events and lower activity restriction experienced greater subjective sleep quality than those with less frequent engagement in pleasant events and higher activity restriction (Moore et al., 2011). These results have several implications, but, namely, indicate that greater engagement in pleasant events may contribute to better sleep outcomes. Still, the limited generalizability of these findings must be considered. That is, these samples were comprised of, and the model was developed for study in, caregivers. Because the association of engagement in pleasant activities and sleep may not necessarily be contingent on caregiver status, the PEAR model is justifiable as a guiding model for the current study. Further, although the PEAR model also considers activity restriction, it is of interest to identify the contribution of pleasant events specifically, as there is a lesser likelihood of severe activity restriction in a community-dwelling sample. The current study will therefore shed light on the specific pleasant events-sleep association, as well as enhance generalizability of such an association.

Due to the lack of empirical studies concomitantly investigating the frequency of pleasant event experiences, sleep outcomes, and potential intervening processes, the present analyses also extend the existing literature by examining the pleasant event-global sleep quality association in relation to two dimensions of mood: positive affect and depressive symptoms. Depressive symptoms and positive affect were selected as potential mediators based on their known associations with engagement in pleasant events and sleep, respectively. Pleasant events have received little attention in relation to sleep, but have a well-established association with depression (Cuijpers et al., 2007), a close correlate of sleep (Mayers & Baldwin, 2006). Specifically, models of depression (Kanter et al.,

2008) associate reductions in the positive reinforcement of healthy or pleasurable behaviors, with the onset of depressive episodes. More time spent engaging in pleasurable activities has also been associated with greater positive affect (Pressman et al., 2009), a more recently identified, correlate of sleep (Ong et al., 2013; Steptoe et al., 2008). More specifically, momentary positive affect was associated with fewer reported sleep problems (Steptoe et al., 2008) and higher trait positive affect was associated with greater sleep quality (Ong et al., 2013), in samples of community-dwelling adults. It follows that experiencing pleasant events more frequently would promote the likelihood of having greater positive affect and fewer depressive symptoms, which may in turn be associated with better sleep. The tendency for affective phenomena to predict sleep has been corroborated by a recent synthesis of the empirical literature on emotion and sleep (Kahn et al., 2013). The study of both positive affect and depressive symptoms is necessary, given their proposed representation of independent dimensions of mood (Reich et al., 2003).

Present study

The present study generally aims to expand our understanding of the theoretically proposed (Mausbach et al., 2011) association of engagement in pleasant events and sleep. The specific aims of the present analyses were to examine: (1) whether engagement in pleasant events relates to global sleep quality, and (2) if positive affect and depressive symptoms mediate the association of pleasant experiences with global sleep quality in a sample of community-dwelling adults. Based on the aforementioned literature, we predicted that engagement in pleasant events would positively predict global sleep quality. Further, we hypothesized that depressive symptoms and positive affect would partially mediate the relation between the experience of pleasant events and global sleep quality.

Method

Participants

Data were derived from the longitudinal follow-up of the Midlife in the United States (MIDUS) national survey of health and well-being, MIDUS-II (Ryff et al., 2013; for additional information on MIDUS-II, see Love et al., 2010). The sample for the current study included individuals who completed the Biomarker Project (Project 4) of MIDUS-II. The overall sample consisted of 1054 respondents. Respondents ranged in age from 35 to 86 years ($M = 58.0$ years, $SD = 11.6$ years). The majority of respondents self-identified as white (92.8 %) and female

(54.7 %). See Table 1 for further details on participant demographics and characteristics.

Measures

Covariates

Data on participant demographics and other covariates were collected via mailed questionnaires. Gender, age, and physical health indices (number of symptoms and chronic conditions) were included as covariates in the present analyses, based on their known associations with sleep (Lichstein et al., 2004; Ohayon et al., 2004; Reyner et al., 1995; Shankar et al., 2011). Participants specified the number of physical symptoms and conditions by indicating *yes* (if they ever had the condition/illness) or *no* (if they never had the condition/illness) to a series of items (e.g., heart disease, diabetes, etc.) Total scores were constructed by summing the total number of *yes* responses.

Pleasant events

The experience of pleasant events was measured using the Positive Events Scale, a measure developed for the MIDUS-II biomarker project. The scale contains 49 items about positive experiences, including a subset of items from the Pleasant Events Schedule (MacPhillamy & Lewinsohn, 1982). Items from the Positive Events Scale include experiences such as "appreciating nature," "meeting someone new," and "laughing." Participants were asked to indicate how often during the past month they had each experience (frequency score, rated on a 3-point scale; never, 1-6 times, or greater than 7 times) and

Table 1 Participant demographics and characteristics

Variable	Statistic
M (*SD*) age (years)	58.0 (11.6)
Gender (% female)	54.7
Ethnicity (%)	
White non-Hispanic	92.8
African American	2.6
Other	4.6
M (*SD*) Physical health[a]	4.0 (2.9)
M (*SD*) Depressive symptoms[b]	7.1 (7.4)
M (*SD*) Positive affect[c]	44.8 (10.1)
M (*SD*) Global sleep quality[d]	5.92 (3.5)

[a] Total number of self-reported symptoms and chronic conditions

[b] Scores on the CES-D

[c] Scores on the MASQ High Positive Affect scale

[d] Total global sleep quality score from the PSQI

whether the experiences were pleasant, enjoyable, or rewarding (impact score, rated on a 3-point scale; 1 = *neutral or unpleasant*, 2 = *somewhat*, 3 = *very*). Based on the scoring approach of the Pleasant Events Schedule (MacPhillamy & Lewinsohn, 1982), the overall positive events score was calculated by multiplying the mean frequency scores by the mean impact scores, across the 49 total items. The internal consistency of the frequency (Cronbach's $\alpha = .90$) and impact (Cronbach's $\alpha = .92$) subscales of the Positive Events Scale in the current sample are acceptable.

Positive affect

The High Positive Affect scale of the Mood and Symptoms Questionnaire (MASQ; Clark & Watson, 1991) was used as a validated measure of positive affect. The High Positive Affect scale requires participants to respond to 14-items based on the following prompt: "How much have you felt or experienced things this way during the past week, including today". Sample items include "felt cheerful" and "felt like I was having a lot of fun". Participants responded on a 5-point Likert scale (1 = *not at all*, 2 = *a little bit*, 3 = *moderately*, 4 = *quite a bit*, 5 = *extremely*). Scale scores were calculated by summing the scores on all items without missing data; mean substitution was applied if data was missing only on one item. Higher scores indicate greater positive affect. The positive affect scale demonstrated good internal reliability in the present sample (Cronbach's $\alpha = 93$).

Depressive symptoms

Depressive symptoms were measured using the Center for Epidemiologic Studies Depression Inventory (CES-D; Radloff, 1977). The CES-D is comprised of 20 statements about symptoms that are indicative of current affective experiences of depression. Sample items include "I could not get going" and "I had crying spells". Respondents indicated on a 4-point Likert scale (0 = *rarely or none of the time*, 1 = *some or a little of the time*, 2 = *occasionally or moderate amount of the time*, 3 = *most or all of the time*) how frequently they had each experience over the past week. Item responses were coded so that higher scores reflect greater depressive symptomatology. One item, "my sleep was restless," was excluded from the construction of the scale score due its close relation to the outcome variable, sleep. As such, scale scores were calculated by summing the scores of 19 items. Based on existing scoring suggestions (Radloff, 1977), scale scores were only calculated if participants had no more than four item responses missing from the original 20-item measure. The

CES-D is a well-established measure of depression that was designed for use in epidemiological studies and has been validated in general populations (e.g., Radloff, 1977). The CES-D is internally consistent, as demonstrated in a general population (Cronbach's α = .85; Radloff, 1977) and in the present sample (Cronbach's α = .89).

Sleep

The Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989) was used to obtain a global measure of sleep quality. The PSQI is a retrospective, self-report questionnaire containing 19 items that assess seven components of sleep and yield one global score of overall sleep quality. For this measure, participants are asked to respond to questions based on their sleep experiences over the past month. Higher global PSQI scores indicate worse sleep quality. In addition to demonstrating adequate internal reliability (Cronbach's α = .83), the PSQI also displays discriminant validity, as evidenced by the ability to differentiate disordered from normal sleep (sensitivity = 89.6 %, specificity = 86.5 %; Buysse et al., 1989).

Procedure

The present study is an archival analysis of data from MIDUS-II, Project 4, as this project included measures of pleasant events, depressive symptoms, positive affect, and sleep. Data collection for Project 4, the Biomarker Study of MIDUS-II, occurred via mailed questionnaires and an in-person site visit. All participants provided informed consent. The Positive Events Scale, CES-D, and the MASQ were embedded within a packet of Project 4 self-administered questionnaires, which, in addition to the PSQI, were administered as part of the site visit at the participants' designated General Clinical Research Centers.

Analysis

A series of hierarchical regression analyses were used to assess the association of the experience of pleasant events and global sleep quality (aim 1) and the potential intermediary role of depressive symptoms and positive affect in the association between pleasant events and global sleep quality (aim 2), controlling for age, gender, and physical health. To test the significance of the indirect associations of positive affect and depressive symptoms, a bootstrapping procedure (based on $k = 10{,}000$ bootstrap samples, alpha = .05) was conducted using the PROCESS program (Hayes, 2013) in SPSS. The PROCESS program permits the inclusion of associated mediators in a parallel, multiple mediator model (Hayes, 2013).

Statistical significance was set at the .05 probability level with results reported from SPSS version 20. Preliminary analyses were run to assure that the assumptions for the present statistical analyses were satisfied. For a multiple regression analysis with five predictors, predicting an effect size (f^2) of at least .02, at an alpha level of .05, a sample size of 1054 participants yields a power of approximately .96 (Faul et al., 2007). Thus, there was sufficient power to detect small effect sizes with the current sample and analyses. The sample size in the present study was large and missing data were both minimal (<.5 % for predictors and equal to 5.2 % for the outcome variable) and missing completely at random (MCAR; Little's MCAR test Chi square = 17.86, $p = .09$). Missing values for each measure were accounted for by using the listwise deletion function, for all analyses. For regression analyses, predictors were standardized prior to entry into the models.

Results

Engagement in pleasant events and sleep

A series of regression analyses and subsequent bootstrapping procedures were used to test depressive symptoms and positive affect as mediators of the association between pleasant events and global sleep quality (Baron & Kenny, 1986; Preacher & Hayes, 2008). Of specific interest was determining if: (1) the predictor variable significantly predicted the outcome variable, (2) the predictor variable significantly predicted each mediator, (3) the mediators significantly predicted the outcome variable, and (4) the predictor variable significantly predicted the outcome variable when controlling for the mediators (Baron & Kenny, 1986). Covariates were included in each model.

The models in which depressive symptoms, $R^2 = .27$, $F (4, 1045) = 97.57$, $p < .001$, and positive affect, $R^2 = .35$, $F (4, 1047) = 137.77$, $p < .001$, were regressed on engagement in pleasant events were significant. Greater engagement in pleasant events significantly predicted lower depression scores, $\beta = -.45$, $p < .001$, and higher positive affect scores, $\beta = .55$, $p < .001$. Further, when global sleep quality was regressed on depressive symptoms and positive affect, the model was significant, $R^2 = .23$, $F (5, 991) = 61.51$, $p < .001$. Lower depressive symptoms, $\beta = .31$, $p < .001$, and more positive affect, $\beta = -.09$, $p = .01$, each predicted better global sleep quality, beyond the influence of covariates.

For the model assessing the association of pleasant events and global sleep quality, controlling for depressive symptoms and positive affect, covariates were entered in the first step, the pleasant events variable was entered in the second step, and depressive symptoms and positive affect

were entered in the third step. The overall model was significant, $R^2 = .24$, $F (6, 990) = 51.33$, $p < .001$. When entered in the second step, engagement in pleasant events was significant such that greater engagement in pleasant events predicted greater global sleep quality. However, when depressive symptoms and positive affect were entered in the third step, each of these were significant predictors of global sleep quality, but engagement in pleasant events was rendered non-significant. Greater positive affect and lower depressive symptoms were associated with greater global sleep quality (see Table 2).

The PROCESS program (Hayes, 2013) in SPSS was used to confirm the total indirect effect of the multiple mediator model, as well as to ascertain the significance of depressive symptoms and positive affect as individual mediators, after accounting for the selected covariates (Preacher & Hayes, 2008). Significant indirect effects are indicated when the 95 % confidence interval associated with the bootstrapped estimates does not contain zero. The findings from this procedure indicated a significant total indirect association with engagement in pleasant events and global sleep quality, through depressive symptoms and

Table 2 Hierarchical multiple regression of global sleep quality on pleasant events, depressive symptoms, positive affect, and covariates

Predictor	ΔR^2	B	SE B	β
Step 1	.10**			
Step 2	.04**			
Pleasant events		−.72	.10	−.21**
Step 3	.10**			
Gender		.40	.10	.12**
Age		−.17	.11	−.05
Physical health		.72	.11	.21**
Pleasant events		−.09	.12	−.03
Depression		1.06	.13	.31**
Positive affect		−.29	.14	−.08*

B = unstandardized regression coefficients; $β$ = standardized regression coefficients

* $p < .05$; ** $p < .001$

positive affect, Percentile 95 % CI [−.76, −.47]. However, analysis of the specific indirect effects indicated that depressive symptoms was significant, Percentile 95 % CI [−.61 −.33], but positive affect was non-significant, Percentile 95 % CI [−.30, .00].

Follow-up analyses

Follow-up analyses were conducted to explore potential explanations for why positive affect did not mediate the pleasant events and global sleep quality association. Specifically, age and gender were examined as potential moderators of the association of pleasant events with positive affect and/or depressive symptoms (see Fig. 1). Age was selected as a potential moderator given the tendency for age-related shifts in future-time perspective to precipitate changes in social and emotional goals (Carstensen, 1992). This shift makes it possible that the valence of pleasant event appraisals presented on the positive events scale may vary by age. Gender was selected based on prior work indicating that the association of activity participation and well-being outcomes differs based on gender (Adams et al., 2011). The PROCESS program in SPSS was used to test the moderated-mediation model. Neither age ($p = .85$) nor gender ($p = .96$) significantly moderated the association of pleasant events and positive affect. Further, the pleasant events-depressive symptoms association was not significantly moderated by age ($p = .24$) or gender ($p = .21$).

Additional follow-up analyses were run to explore the bidirectionality of the pleasant events-global sleep quality association. For these analyses, we examined whether global sleep quality predicted engagement in pleasant events, and also explored the potential intermediary roles of positive affect and depressive symptoms. As described above, a series of regression analyses and bootstrapping procedures were used to test this model. For the final model assessing the association of global sleep quality and pleasant events, covariates were entered in step 1, global sleep quality was entered in step 2, and depressive symptoms and positive affect were entered in the third step. The
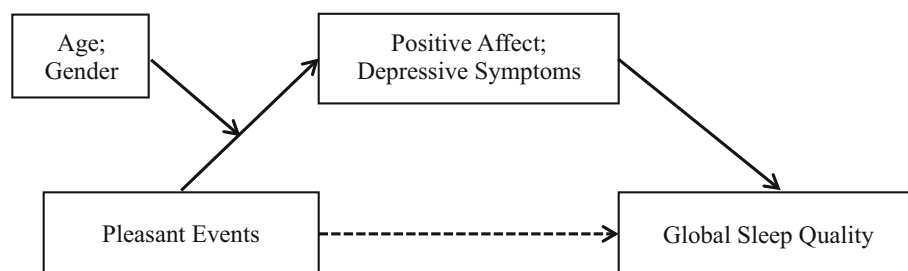

Fig. 1 Hypothesized multiple mediation model

overall model was significant, $R^2 = .33$, F (6, 990) $= 58.29$, $p < .001$. Better global sleep quality significantly predicted significantly greater engagement in pleasant events in step 2, $\beta = -.22$, $p < .001$, and accounted for an additional 5 % of explained variance in pleasant event engagement, beyond the association of covariates. An additional 26 % variance in the pleasant events outcome variable was explained by the entry of depressive symptoms and positive affect in the model in the third step; depressive symptoms, $\beta = -.16$, $p < .001$, and positive affect, $\beta = .44$, $p < .001$, were both significant predictors of engagement in pleasant events. Further, the entry of these variables rendered global sleep quality a non-significant predictor, $\beta = -.02$, $p = .46$. The findings from the PROCESS bootstrapping procedure indicated a significant total indirect association of sleep with engagement in pleasant events, through depressive symptoms and positive affect, Percentile 95 % CI [$-.73$, $-.05$]. In an analysis of the specific indirect effects, depressive symptoms, Percentile 95 % CI [$-.03$, $-.01$], and positive affect each played a significant intermediary role, Percentile 95 % CI [$-.05$, $-.03$].

Discussion

In the present study, more frequent engagement in pleasant events was associated with lower depressive symptoms, which was associated with better global sleep quality. Although positive affect was a significant predictor of global sleep quality, its role in the pleasant events-sleep association was not significant. The findings from this study have implications for furthering our understanding of behavioral and affective correlates of sleep, which are discussed in light of the limitations of the present study.

The present findings extend the existing literature on engagement in pleasant events and global sleep quality by identifying that this association exists not only in caregivers (Moore et al., 2011), but also in a population-based sample of community-dwelling adults. Further, as hypothesized, engagement in pleasant events was indirectly associated with global sleep quality via depressive symptoms, although the effect size was small. This finding corroborates existing literature suggesting links between mood and pleasant events as well as mood and sleep (Cuijpers et al., 2007; Mayers & Baldwin, 2006). Further, this finding complements evidence from a recent review, which identified that participation in manualized treatments for depression reduces symptoms of comorbid insomnia for those individuals with an average level of pretreatment depressive symptoms (Yon et al., 2014). The effects of specific treatment components (e.g., behavioral activation, cognitive restructuring, etc.) on sleep were not examined in the aforementioned

review, making it unclear whether behavioral activation, which is largely concerned with increasing engagement in pleasant events, uniquely contributes to improvements in sleep. The significant association of pleasant events, depressive symptoms, and global sleep quality identified in the present study, however, suggests that the behavioral activation component of treatment could play some role in improving sleep outcomes.

Interestingly, although independently associated with both engagement in positive events and global sleep quality, positive affect did not statistically mediate these two constructs. Age and gender were explored as potential moderators of the association between pleasant events and positive affect, but neither was significant. It may be that other factors, such as the ability to savor positive experiences (Bryant & Veroff, 2007), serve as additional mediators or moderators in this general association. Alternatively, as suggested by our data, despite the significant associations with global sleep quality and pleasant events, it is possible that positive affect simply does not significantly influence the pleasant events-global sleep quality association. Rather, low depressive symptoms, or greater affective balance, may be most beneficial for obtaining good global sleep quality.

Importantly, there has been a recent call to shift the focus of insomnia research towards a better understanding of factors that may help prevent the onset of sleep difficulties (Vitiello et al., 2013) and promote healthy sleep (Buysse, 2014). The present findings provide some insight into behaviors and activities that are associated with healthy sleep in community-dwelling individuals. Further, although the present analyses utilized a correlational approach to study how positive events and mood relate to global sleep quality, the significant findings encourage the experimental study of how engagement in pleasant events may improve sleep outcomes. When considered in light of studies identifying improvement in insomnia severity following treatment for depression (Mason & Harvey, 2014; Yon et al., 2014), although the size of the effects were small, the significant associations among engagement in pleasant activities, depressive symptoms, and global sleep quality identified in the present study also encourages additional research on the intersection of mood-enhancing behaviors and sleep. This area of study may be particularly important for enhancing interventions for, and preventive measures for, insomnia.

Though global sleep quality was the outcome of interest in the present study, follow-up analyses were conducted to examine the potential bidirectionality of the pleasant events-global sleep quality association. These analyses suggested that better global sleep quality predicted higher positive affect and lower depressive symptoms, which were each associated with greater engagement in pleasant activities.

Taken together with the findings that greater engagement in pleasant events was associated with greater positive affect which was, in turn, associated with greater global sleep quality; these findings point to a bidirectional association between engagement in pleasant events and sleep quality. Notably, however, the affective pathways linking these constructs may differ depending on the outcome of interest, given that positive affect played a significant intermediary role in the model examining engagement in pleasant events as an outcome, but not in the model examining global sleep quality as an outcome. Though these findings suggest a bidirectional association, the study of whether engaging in pleasant events predicts better global sleep quality may be relevant from a treatment perspective, as daily activities are amenable to change and are also often addressed in the treatment of psychological disorders that may be comorbid with sleep difficulties, or disorders of which sleep difficulties are a symptom.

There are several limitations of the present study that should be considered. Foremost, we recognize the limitations associated with assessing a mediation model with cross sectional data, as some bias might arise (e.g., causal inferences about temporal patterns cannot be drawn from these data, we cannot account for prior values of the constructs; Maxwell & Cole, 2007). However, developing a basic understanding of the associations of engagement in pleasant events, affective outcomes, and global sleep quality provides a strengthened rationale for the pursuit of future study of how these constructs interact and fluctuate longitudinally. This study is also limited to some extent in that activity restriction was not measured. The present sample was comprised of community-dwelling adults and it was, therefore, presumed that there would be a lesser likelihood that activity would be substantially restricted. Nevertheless, future studies in more generalized populations would benefit from incorporating a measure of activity restriction. To address the identified limitations of the present study and, further, to elucidate the causal relations between the phenomena of interest, future studies might utilize experimental or longitudinal approaches.

In sum, the present study provides an introductory examination of the interplay of engagement in pleasant events, positive affective experiences, depressive symptoms, and sleep. Though the effect sizes were small, findings from the current study suggest that greater engagement in pleasant events is associated with better global sleep quality, as well as lower depressive symptoms. Nevertheless, the role of mood and affective experiences in this association is undoubtedly complex, implicating the need for future research designed to further elucidate the mechanisms that underlie how everyday positive, psychosocial experiences relate to sleep.

References

Adams, K. B., Leibbrandt, S., & Moon, H. (2011). A critical review of the literature on social and leisure activity and wellbeing in later life. *Ageing and Society, 31*, 683–712.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173.

Bryant, F. B., & Veroff, J. (2007). *Savoring: A new model of positive experience*. Mahwah, NJ: Lawrence Erlbaum Associates.

Buysse, D. J. (2014). Sleep health: can we define it? Does it matter? *Sleep, 37*, 9–17. doi:10.5665/sleep.3298

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index (PSQI): A new instrument for psychiatric research and practice. *Psychiatry Research, 28*, 193–213.

Carstensen, L. L. (1992). Social and emotional patterns in adulthood: Support for socioemotional selectivity theory. *Psychology and Aging, 7*, 331.

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology, 100*, 316.

Cuijpers, P., Van Straten, A., & Warmerdam, L. (2007). Behavioral activation treatments of depression: A meta-analysis. *Clinical Psychology Review, 27*, 318–326. doi:10.1016/j.cpr.2006.11.001

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175–191.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: The Guilford Press.

Kahn, M., Sheppes, G., & Sadeh, A. (2013). Sleep and emotions: Bidirectional links and underlying mechanisms. *International Journal of Psychophysiology, 89*, 218–228.

Kanter, J. W., Busch, A. M., Weeks, C. E., & Landes, S. J. (2008). The nature of clinical depression: Symptoms, syndromes, and behavior analysis. *The Behavior Analyst, 31*, 1–21.

Lichstein, K. L., Durrence, H. H., Riedel, B. W., Taylor, D. J., & Bush, A. J. (2004). *Epidemiology of sleep: Age, gender, and ethnicity*. Mahwah, NJ: Erlbaum.

Love, G., Seeman, T. E., Weinstein, M., & Ryff, C. D. (2010). Bioindicators in the MIDUS national study: Protocol, measures, sample, and comparative context. *Journal of Aging and Health, 22*, 1059–1080. doi:10.1177/0898264310374355

MacPhillamy, D. J., & Lewinsohn, P. M. (1982). The pleasant events schedule: Studies on reliability, validity, and scale intercorrelation. *Journal of Consulting and Clinical Psychology, 50*, 363–380. doi:10.1037/0022-006X.50.3.363

Mason, E. C., & Harvey, A. G. (2014). Insomnia before and after treatment for anxiety and depression. *Journal of Affective Disorders, 168*, 415–421. doi:10.1016/j.jad.2014.07.020

Mausbach, B. T., Roepke, S. K., Depp, C. A., Moore, R., Patterson, T. L., & Grant, I. (2011). Integration of the pleasant events and activity restriction models: Development and validation of a "PEAR" model of negative outcomes in Alzheimer's caregivers. *Behavior Therapy, 42*, 78–88. doi:10.1016/j.beth.2009.11.006

Maxwell, S. E., & Cole, D. A. (2007). Bias in cross-sectional analyses of longitudinal mediation. *Psychological Methods, 12*(1), 23–44. doi:10.1037/1082-989X.12.1.23

Mayers, A. G., & Baldwin, D. S. (2006). The relationship between sleep disturbance and depression. *International Journal of Psychiatry in Clinical Practice, 10*, 2–16. doi:10.1080/13651500500328087

Moore, R. C., Harmell, A. L., Chattillion, E., Ancoli-Israel, S., Grant, I., & Mausbach, B. T. (2011). PEAR model and sleep outcomes in dementia caregivers: Influence of activity restriction and pleasant events on sleep disturbances. *International Psychogeriatrics, 23*, 1462–1469. doi:10.1017/S1041610211000512

Ohayon, M. M., Carskadon, M. A., Guilleminault, C., & Vitiello, M. V. (2004). Meta-analysis of quantitative sleep parameters from childhood to old age in healthy individuals: Developing normative sleep values across the human lifespan. *Sleep, 27*, 1255–1274.

Ong, A. D., Exner-Cortens, D., Riffin, C., Steptoe, A., Zautra, A., & Almeida, D. M. (2013). Linking stable and dynamic features of positive affect to sleep. *Annals of Behavioral Medicine, 46*, 52–61. doi:10.1007/s12160-013-9484-8

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879–891. doi:10.3758/BRM.40.3.879

Pressman, S. D., Matthews, K. A., Cohen, S., Martire, L. M., Scheier, M., Baum, A., & Schulz, R. (2009). Association of enjoyable leisure activities with psychological and physical well-being. *Psychosomatic Medicine, 71*, 725–732. doi:10.1097/PSY.0b013e3181ad7978

Radloff, L. S. (1977). The CES-D scale a self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385–401.

Reich, J. W., Zautra, A. J., & Davis, M. (2003). Dimensions of affect relationships: Models and their integrative implications. *Review of General Psychology, 7*, 66. doi:10.1037/1089-2680.7.1.66

Reyner, L. A., Horne, J. A., & Reyner, A. (1995). Gender-and age-related differences in sleep determined by home-recorded sleep logs and actimetry from 400 adults. *Sleep, 18*, 127–134.

Ryff, C. D., Seeman, T., & Weinstein, M. (2013). National Survey of Midlife Development in the United States (MIDUS II): Biomarker Project, 2004–2009. ICPSR29282-v6. Ann Arbor, MI: Inter-university Consortium for Political and Social Research (distributor). doi:10.3886/ICPSR29282.v6

Shankar, A., Charumathi, S., & Kalidindi, S. (2011). Sleep duration and self-rated health: The national health interview survey 2008. *Sleep, 34*, 1173–1177.

Steptoe, A., O'Donnell, K., Marmot, M., & Wardle, J. (2008). Positive affect, psychological well-being, and good sleep. *Journal of Psychosomatic Research, 64*(4), 409–415. doi:10.1016/j.jpsychores.2007.11.008

Vitiello, M. V., McCurry, S. M., & Rybarczyk, B. D. (2013). The future of cognitive behavioral therapy for insomnia: What important research remains to be done? *Journal of Clinical Psychology, 69*, 1013–1021. doi:10.1002/jclp.21948

Wilson, J. F. (2005). Is sleep the new vital sign? *Annals of Internal Medicine, 142*, 877–880. doi:10.7326/0003-4819-142-10-200505170-00026

Yon, A., Scogin, F., DiNapoli, E. A., McPherron, J., Arean, P. A., Bowman, D., & Thompson, L. W. (2014). Do manualized treatments for depression reduce insomnia symptoms? *Journal of Clinical Psychology, 70*, 616–630. doi:10.1002/jclp.22062