

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/310816165>

The role of basic psychological need satisfaction, sleep, and mindfulness in the health-related quality of life of people living with HIV

Article in *Journal of Health Psychology* · November 2016

DOI: 10.1177/1359105316678305

CITATIONS

8

READS

451

7 authors, including:



Rachel Campbell

The University of Sydney

11 PUBLICATIONS 93 CITATIONS

[SEE PROFILE](#)



Maarten Vansteenkiste

Ghent University

305 PUBLICATIONS 17,467 CITATIONS

[SEE PROFILE](#)



Liesbeth Delesie

Universitair Ziekenhuis Ghent

34 PUBLICATIONS 208 CITATIONS

[SEE PROFILE](#)



Bart Soenens

Ghent University

240 PUBLICATIONS 12,761 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



PhD: The human immune response to HIV-1: its role in disease progression and vaccine development [View project](#)



Master thesis [View project](#)

The role of basic psychological need satisfaction, sleep, and mindfulness in the health-related quality of life of people living with HIV

Journal of Health Psychology
1–11

© The Author(s) 2016

Reprints and permissions:

sagepub.co.uk/journalsPermissions.nav

DOI: 10.1177/1359105316678305

hpq.sagepub.com



Rachel Campbell¹, Maarten Vansteenkiste¹,
Liesbeth Delesie², Bart Soenens¹, Els Tობback²,
Dirk Vogelaers² and An Mariman²

Abstract

Research has not yet examined the relationship between psychological need satisfaction, sleep, mindfulness, and health-related quality of life in people living with HIV. This cross-sectional study ($N = 101$; 84% male; mean age = 45.48, $SD = 12.75$) found need satisfaction to relate positively to physical and mental health. Sleep quality fully mediated the association with physical health and partially mediated the association with mental health. Furthermore, mindfulness related to higher sleep quality through higher need satisfaction. Findings underscore the role of need satisfaction in determining health-related quality of life and sleep quality in people living with HIV and suggest that mindfulness may facilitate need satisfaction.

Keywords

Health-Related Quality of Life, HIV, Mindfulness, Self-Determination Theory, Sleep

Introduction

The advent of continuous antiretroviral therapy (cART) greatly transformed the outlook for people living with HIV (PLHIV). While once considered a death sentence, HIV is now a chronic yet manageable disease (Oberjé et al., 2015). However, despite these advances, living with HIV still presents many challenges including life-long adherence to medication, adverse treatment side effects, and psychosocial difficulties often resulting from stigma and discrimination (Bravo et al., 2010; Gakhar et al., 2013). Because living longer does not necessarily equate to “living well” health-related quality of life (HRQOL), defined as perceived physical and mental health over time (Centers for Disease Control

and Prevention [CDC]), 2016), has become an important outcome in HIV research (Degroote et al., 2013; Lin et al., 2002). Moreover, an increasing number of studies have begun to examine the role of psychosocial factors, such

¹Department of Developmental, Personality and Social Psychology, Ghent University, Ghent, Belgium

²Department of General Internal Medicine, Ghent University Hospital, Ghent, Belgium

Corresponding author:

Rachel Campbell, Department of Developmental, Personality, and Social Psychology, Ghent University, Henri Dunantlaan 2, Ghent 9000, Belgium.
Email: rachel.campbell@ugent.be

as social support (Uphold et al., 2007) and stigma (Peltzer, 2012) in predicting HRQOL.

In this study, we draw upon self-determination theory (SDT; Deci and Ryan, 2000; Vansteenkiste and Ryan, 2013), a broad theory of human motivation and the factors that promote versus impede human flourishing. SDT provides a useful framework for examining predictors of HRQOL as it specifies the universal and inherent psychological needs for autonomy, competence, and relatedness as essential for optimal functioning. Autonomy involves experiencing a sense of volition and self-endorsement in one's behavior; competence involves feeling capable and effective in achieving desired outcomes; and relatedness involves experiencing reciprocal care and closeness with others. The relation between these psychological needs and wellness is well documented with various studies showing need satisfaction to be positively related to well-being (e.g. life satisfaction) and negatively related to ill-being (e.g. depression, anxiety) (Deci and Ryan, 2000). Similar findings have emerged across diverse domains and cultures and at both the inter- and intra-personal level (Vansteenkiste and Ryan, 2013).

There is some evidence that these fundamental psychological needs play a role in determining the HRQOL of PLHIV. For example, social support, which is likely conducive to the need for relatedness, relates positively to HRQOL (Uphold et al., 2007), whereas stigma, which likely thwarts all three needs, is negatively associated with HRQOL (Peltzer, 2012). Furthermore, a qualitative study of HIV-positive women indicated that feeling competent in managing one's condition and experiencing warmth with one's caregiver were important determinants of the decision to enter into care, whereas re-establishing autonomy emerged as a key element for long-term engagement in treatment (Quinlivan et al., 2013). Moreover, caregiver support for HIV-positive patients' need for autonomy has been shown to predict treatment adherence (Kennedy et al., 2004). Finally, in a qualitative study of HIV-positive youth, decisions to disclose HIV status were dependent on whether the youth perceived the context

of the disclosure as being supportive of their psychological needs (Gillard and Roark, 2013). This is an important finding given that status disclosure yields several benefits including increased social support (Wong et al., 2009) and the development of more adaptive coping strategies (Medley et al., 2009).

Although psychological need satisfaction is robustly related to well-being (Deci and Ryan, 2000; Vansteenkiste and Ryan, 2013), mechanisms accounting for this association are yet to be examined. One possible pathway may be through quality and quantity of sleep. Approximately, 58% of PLHIV are estimated to suffer from sleep disturbances (Wu et al., 2015), a problem which has been linked to a number of adverse outcomes including fatigue, depression, and reduced quality of life in HIV-positive individuals (Phillips et al., 2004, 2005, 2006). These sleep disturbances reported by PLHIV may be at least in part due to their confrontation with need frustrating experiences (e.g. stigmatic or hostile reactions). For example, psychological need frustration resulting from unjust treatment or discrimination after HIV status disclosure likely leads to stress which may negatively impact on quality and quantity of sleep.

In line with this, previous research in a non-clinical heterogeneous sample indicated that individuals with low psychological need satisfaction reported poorer sleep quality and somewhat shorter sleep duration (Campbell et al., 2015). Furthermore, a longitudinal study among university students indicated that increases in psychological need frustration were associated with increases in poor sleep quality and a reduction in sleep quantity through increases in perceived stress (Campbell et al., 2016). However, despite the relevance of basic psychological needs to sleep, these associations have not been examined in PLHIV.

Given the preliminary evidence suggesting that psychological need satisfaction may play a salutary role in the sleep and HRQOL of PLHIV, the question can be raised as to which factors relate to enhanced psychological need satisfaction. One likely predictor of need satisfaction, which has received growing attention within

the health psychology literature, is mindfulness. One reason for this rising interest in mindfulness, which is conceptualized as an open and receptive awareness of present moment experiences (Brown and Ryan, 2003), is that it has consistently been shown to display salutary relations with indicators of both physical and mental health within a variety of clinical (e.g. Costa et al., 2016) and non-clinical populations (e.g. Brown and Ryan, 2003; Xu et al., 2016). Moreover, although the evidence is still somewhat inconsistent, recent findings suggest that mindfulness may also be linked to bio-markers of well-being, including cortisol levels (e.g. O'Leary et al., 2016).

With regard to psychological need satisfaction, the increased awareness typical of mindful individuals likely allows for the selection of more need-satisfying activities, for better attunement to activities such that greater need satisfaction is derived and also for less emotional reactivity to need frustrating experiences. Accordingly, a few previous studies found mindfulness to be positively associated with need satisfaction (Brown and Ryan, 2003; Campbell et al., 2015). Furthermore, need satisfaction was found to account for the relation between mindfulness and poor sleep quality (Campbell et al., 2015). Although mindfulness has been shown to be negatively related to ill-being (e.g. depression) in PLHIV (Moskowitz et al., 2015), the relation with need satisfaction and sleep-related functioning has not yet been examined.

In sum, although previous research examining sleep and HIV-related outcomes within the SDT literature is rather limited, there is some evidence to suggest that mindfulness and psychological need satisfaction may be implicated in the sleep and HRQOL of PLHIV. Thus, in this cross-sectional study, we aimed to shed further light on these issues by examining two aims in a sample of PLHIV. In line with Kline's (2005) recommendations, due to our limited sample size, we examined our aims in two parts to reduce the number of parameters in our models and limit model complexity. The first aim was to examine the outcomes associated with need satisfaction in PLHIV. Specifically, first,

we examined whether psychological need satisfaction related to indicators of HRQOL and, second, whether quality and quantity of sleep would account for (i.e. mediate) the relation between need satisfaction and the indicators of HRQOL. We expected need satisfaction to relate to higher physical and mental health (Hypothesis 1). Furthermore, we expected need satisfaction to relate to the two indicators of HRQOL through higher quality and quantity of sleep, although in line with Campbell et al. (2015), we expected the relation with sleep quantity to be less pronounced (Hypothesis 2). The second aim was to examine the role of mindfulness in predicting need satisfaction and quality and quantity of sleep. Consistent with Campbell et al. (2015), we expected mindfulness to be uniquely related to higher sleep quality (Hypothesis 3) through higher psychological need satisfaction (Hypothesis 4).

Method

Participants and procedure

All participants were recruited during a routine check-up by their physician at the AIDS Reference Centre within the Department of General Internal Medicine at Ghent University Hospital. After registering interest in the study, all participants were referred to a research assistant who explained the purpose and requirements of the study in greater detail. Participants were eligible for inclusion if they were HIV+, older than 18 years of age, Dutch-speaking, and had a CD4 T-lymphocyte count >250 cells/ μ L. Individuals were excluded if they had children under the age of 3 or were employed in shift work, given their likely detrimental impact on sleep. Signed informed consent was provided by all participants and the study was approved by Ghent University Hospital's Ethical Review Board.

Measures

Demographic and clinical variables. Age, gender, level of education, nationality, marital status,

and employment status were reported by all participants. Clinical data (i.e. CD4+ cell count) was assessed as part of routine clinical care.

Basic Psychological Need Satisfaction and Need Frustration Scale. Satisfaction of the basic psychological needs for autonomy, competence, and relatedness was assessed using the Basic Psychological Need Satisfaction and Need Frustration Scale (BPNSNFS) (Chen et al., 2015). All participants rated whether they felt their needs for autonomy, competence, and relatedness were satisfied or frustrated over the past month on a scale of 1–5. The scale consists of 24 items, 8 items per need, 4 of which assess need satisfaction and 4 of which measure need frustration. Because the mean score of the 12 items assessing need satisfaction and the 12 items assessing need frustration showed similar relations with all study variables, yet in the opposite direction, we proceeded by using a composite score of need satisfaction in all subsequent analyses. This was done by reverse scoring the 12 items assessing need frustration and then creating three separate need scores by averaging the eight items assessing autonomy ($\alpha = .87$), competence ($\alpha = .84$), and relatedness ($\alpha = .84$). Next, consistent with previous research, a composite score of need satisfaction ($\alpha = .93$) was created by averaging the sum of the three need variables (Campbell et al., 2015; Deci et al., 2001).

Medical Outcomes Study 36-Item Short Form Health Survey. Physical and mental health was assessed using the Medical Outcomes Study 36-Item Short Form (MOS SF-36) (Ware and Sherbourne, 1992), which taps into eight different health domains. A global score for physical health was created by averaging the scores on physical functioning, role limitations due to physical health, bodily pain, and general health, whereas a global score for mental health was created by averaging the scores on role limitations due to emotional problems, emotional well-being, social functioning, and energy/fatigue. Higher global scores represent better physical/mental health status.

Pittsburgh Sleep Quality Index. The Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989) was used to assess quality and quantity of sleep over the past month. The PSQI consists of 19 items which generate seven component scores: poor subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of hypnotics, and daytime dysfunction. However, because our primary interest was in qualitative and quantitative indicators of sleep, the daytime dysfunction component was omitted from subsequent analyses. Because higher scores on the PSQI components are indicative of poorer sleep, the sleep duration and habitual sleep efficiency components were reverse coded such that higher scores represented a higher amount of the labeled construct.

Mindfulness Attention Awareness Scale. Dispositional mindfulness was assessed using the Mindfulness Attention Awareness Scale (MAAS) (Brown and Ryan, 2003). The scale consists of 15 items which were rated on a scale of 1–6. The MAAS had good reliability ($\alpha = .93$).

Statistical analyses

The two research aims were examined by testing path models (with manifest variables) using Mplus7 with maximum-likelihood as estimator. Model fit was assessed using the χ^2 test, the comparative fit index (CFI), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA). An acceptable fit was indicated by χ^2 /degrees of freedom (df) ratio of 2 or below, CFI values of .90 or above, and SRMR and RMSEA values of around .08 or below (Hu and Bentler, 1999; Kline, 2005). Patient characteristics (i.e. age, gender, CD4 count, and employment status) were controlled for in all models.

We began by testing Hypotheses 1 and 2, thereby examining the outcomes associated with need satisfaction. In the first model, we examined the relation between need satisfaction and physical/mental health (Hypothesis 1) and in a second model we investigated the intervening

role of quality and quantity of sleep in these associations (Hypothesis 2). Next, we proceeded to test Hypotheses 3 and 4, thereby examining the role of mindfulness in predicting need satisfaction and the sleep outcomes. Specifically, we tested a third model in which we examined the relation between mindfulness and quality and quantity of sleep (Hypothesis 3), and a fourth model in which we examined the intervening role of need satisfaction in these relations (Hypothesis 4). To test for mediation (i.e. Hypotheses 2 and 4), we followed Holmbeck's (1997) recommendations by testing (a) a direct effect model by adding paths between the independent variable and the dependent variable (i.e. Hypotheses 1 and 3), (b) a full mediation model by only including indirect paths via the mediator, and (c) a partial mediation model by adding the direct paths between the independent variable and the dependent variable back in. Full mediation is demonstrated when the addition of direct paths in model three does not lead to an improved fit compared to the second model.

In line with previous research (Campbell et al., 2015; Deci et al., 2001) when testing the role of need satisfaction, we used a composite score of need satisfaction by averaging the mean score of the three needs. Furthermore, also consistent with Campbell et al. (2015), a composite score was created for poor sleep quality, by computing the mean of the sleep quality, sleep disturbances, sleep latency, and use of sleep medication component scores from the PSQI, and for sleep quantity by computing the mean of the sleep duration and habitual sleep efficiency components from the PSQI.

Results

Preliminary analyses

Participants. A total of 144 patients met the inclusion criteria and agreed to participate. In total, 101 participants completed the questionnaire, resulting in a response rate of 70.14%. All participants were of Belgian nationality, 84% were male and 67.4% were homosexual. The average age of the sample was 45.48 years (ranging from

21 to 75 years; $SD=12.75$). In total, 70% were employed and 46% had completed a form of higher level education. A total of 40% were single, 31% married, 2% widowed, and 4% divorced. Mean time since HIV diagnosis was 10.94 years, ranging from 2 to 33 years. The mean CD4 count of the sample was 640.25 (ranging from 271 to 1830; $SD=262.75$).

Correlations. The means, SDs, and correlations between all the study variables are available in the supplementary file available at: <http://hpq.sagepub.com/>. The subscales for autonomy, competence, and relatedness were highly correlated and showed similar relations with mindfulness and the sleep and HRQOL outcomes.

Patient characteristics. The relation between the participants' background characteristics and the outcomes was examined using a multivariate analysis of covariance (MANCOVA) with employment status and gender as fixed factors, age and CD4 T-lymphocyte count as covariates, and the sleep and HRQOL outcomes as dependent variables. Neither gender, $F(8,38)=.65$, *ns*, employment status, $F(8,38)=.44$, *ns*, age, $F(8,38)=1.45$, *ns*, or CD4 T-lymphocyte count,¹ $F(8,38)=.42$, *ns*, yielded a significant multivariate effect.

Primary analyses

Hypothesis 1: Examining the need satisfaction—HRQOL relation. First, a direct effect model was tested by allowing paths from the need satisfaction composite to global physical and mental health. The two HRQOL indicators were allowed to correlate. Need satisfaction related positively to both global physical ($\beta=.27$, $p<.01$) and mental health ($\beta=.54$, $p<.001$). Given that this model was fully saturated, the model fit was perfect.

Hypothesis 2: Examining the intervening role of quality and quantity of sleep. Next, we tested a full mediation model by introducing poor sleep quality and sleep quantity as intervening variables between the need satisfaction composite and the two

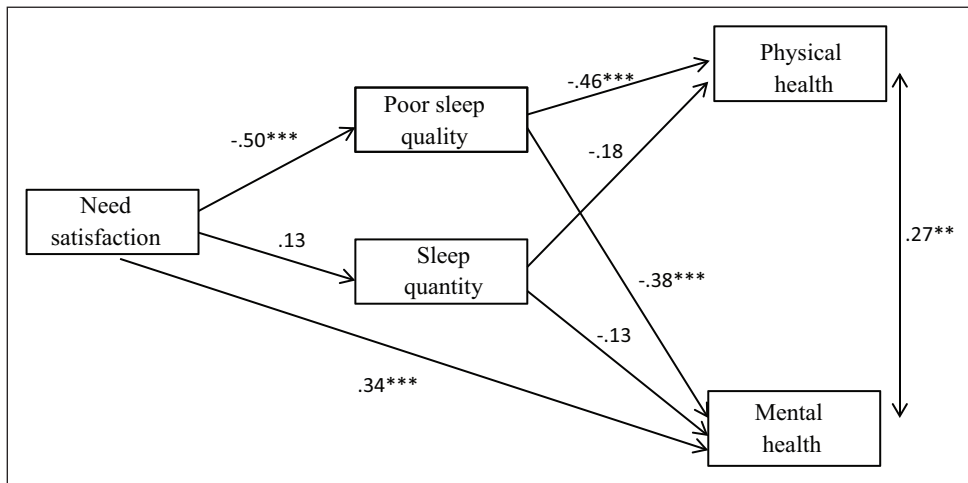


Figure 1. Need satisfaction predicting physical and mental health via quality and quantity of sleep.
* $p < .05$, ** $p < .01$, *** $p < .001$.

HRQOL outcomes. This model had the following fit: $\chi^2/df=2.49$, CFI=.87, RMSEA=.13, SRMR=.07. Next, a partial mediation model was tested by adding direct paths between the need composite and the two outcomes. Although the relation between the need composite and global physical health was fully accounted for by quality of sleep, the need composite continued to yield a direct positive association with global mental health, which led to a significantly improved fit, $\Delta\chi^2(1)=11.67$, $p < .001$. The fit of the final partial mediation model was $\chi^2/df=1.48$, CFI=.96, RMSEA=.07, SRMR=.06. This model is shown in Figure 1. The indirect association between the need composite and global physical ($\beta=.23$, $p < .01$; 95% CI [.12–.34]) and mental health ($\beta=.20$, $p < .01$; 95% CI [.10–.31]) via poor sleep quality was significant indicating that poor sleep quality fully mediated the relation with global physical health and partially mediated the relation with global mental health. In contrast, sleep quantity was unrelated to the need composite and global physical and mental health and thus failed to account for the association between need satisfaction and the two HRQOL outcomes.

Hypothesis 3: Examining the mindfulness—sleep relation. A direct effect model was tested by adding paths from mindfulness to poor sleep

quality and sleep quantity, which were allowed to correlate. The results indicated that mindfulness related negatively to poor sleep quality ($\beta=-.35$, $p < .01$) but was unrelated to sleep quantity ($\beta=.12$, *ns*). This model was fully saturated and thus had a perfect model fit.

Hypothesis 4: Examining the intervening role of need satisfaction. Next, a full mediation model was tested by adding the need satisfaction composite as an intervening variable in the relation between mindfulness and the two sleep outcomes, resulting in the following fit: $\chi^2/df=1.49$, CFI=.97, RMSEA=.07, SRMR=.05. Results from this model indicated that mindfulness related positively to the need composite and that the need composite, in turn, was negatively related to poor sleep quality and unrelated to sleep quantity. We then tested a partial mediation model by adding direct paths between mindfulness and the two sleep outcomes. The fit of the partial mediation model was not significantly better than the full mediation model, $\Delta\chi^2(2)=.69$, *ns*, indicating that the association between mindfulness and poor sleep quality was fully mediated by need satisfaction. This indirect association was significant ($\beta=-.31$, $p < .001$; 95% CI [-.41–.21]). The final model is shown in Figure 2.

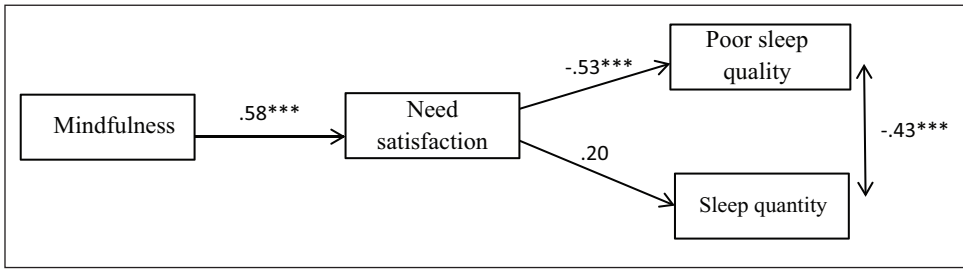


Figure 2. Mindfulness predicting quality and quantity of sleep via need satisfaction.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion

Although previous work grounded in SDT (Deci and Ryan, 2000; Vansteenkiste and Ryan, 2013) has focused on the role of need satisfaction in sleep (Campbell et al., 2015) and on psychological well-being among PLHIV (Igreja et al., 2000), to the best of our knowledge, this cross-sectional study is the first to combine these two foci. That is, we examined the relation between the satisfaction of the psychological needs for autonomy, competence, and relatedness and PLHIV's HRQOL via their sleep. In addition, we investigated the role of mindfulness in contributing to the satisfaction of these basic psychological needs. Findings confirmed our hypotheses. Specifically, PLHIV who experienced higher need satisfaction also reported higher HRQOL which was largely explained through a negative relation with poor sleep quality. The findings further suggest that mindfulness facilitated higher psychological need satisfaction, which in turn contributed to better sleep quality. To the best of our knowledge, this study is the first to demonstrate such associations in PLHIV.

The finding that psychological need satisfaction relates to higher physical and mental health is consistent with previous research in non-clinical populations which showed need satisfaction to relate positively to indicators of well-being (Deci and Ryan, 2000) and testifies to the universal character of these needs by extending previous findings to PLHIV. Although previous studies examining the relation between psychological needs and well-being have tended to focus more

exclusively on the relation with psychological well-being, the number of studies demonstrating relations with indicators of physical health is steadily increasing (e.g. Di Domenico and Fournier, 2014; Gonzalez et al., 2016; Ryan et al., 2010). The present results add to this body of work by providing further evidence that the benefits of psychological need satisfaction also extend to physical health, this time among PLHIV. Furthermore, given that we controlled for CD4+ cell count in all of the models tested, the present results indicate that need satisfaction related to higher perceived physical health over and above an objective marker of health status. This finding is especially relevant for PLHIV given that their physical health, in particular, is compromised.

Interestingly, poor sleep quality, rather than sleep quantity, was uniquely associated with lower need satisfaction and lower mental and physical health and further accounted for the association between psychological need satisfaction and the two indicators of HRQOL. This finding is consistent with a previous study of university students which found sleep quality to be more strongly related to measures of physical and psychological health than sleep quantity (Pilcher et al., 1997). The current sleep quality component is a multifaceted construct that includes sleep latency, number of nocturnal awakenings, use of sleep medication, as well as subjective appraisals of the quality of sleep. Thus, while sleep quantity simply constitutes total time asleep, sleep quality is more an indication of uninterrupted sleep that likely allows the individual to go through the various sleep stages that restore emotional and physical health.

However, it should be noted that while poor sleep quality completely accounted for the relation between need satisfaction and physical health, it only partially accounted for the relation with mental health suggesting that sleep quality is only one pathway through which need satisfaction contributes to mental health and that other explanatory mechanisms should be considered. One other potential pathway is through the use of more adaptive emotion regulation styles such as emotional integration which is characterized by an openness to experiencing and exploring emotions (Roth et al., 2014). Indeed, one previous study indicated that maternal support for their adolescent child's need for autonomy predicted increases in adolescent self-esteem through increases in emotional integration 1 year later (Brenning et al., 2015). However, more research is needed to explore emotion regulation styles as intervening processes in the relation between need satisfaction and a broader range of mental health outcomes.

The second global aim of this study was to examine the role of mindfulness. Consistent with past work in a non-clinical sample (Campbell et al., 2015), a more mindful approach was related positively to psychological need satisfaction which, in turn, facilitated better sleep quality. Together, the present results imply that one way caregivers can help to improve the HRQOL of PLHIV is by helping them to cultivate mindfulness. This in turn is likely to aid their awareness of and receptivity to cues for psychological need satisfaction thereby also enabling better sleep quality. Encouragingly, there is evidence that mindfulness can be improved with meditation practice as evidenced by significant increases in dispositional mindfulness following mindfulness-based stress reduction (MBSR) interventions (e.g. Creswell et al., 2012). Moreover, previous studies examining the efficacy of MBSR interventions with PLHIV found participants to display improvements in both physical and psychological well-being post-intervention (Creswell et al., 2009; Gayner et al., 2012; Seyed Alinaghi et al., 2012). However, these studies did not consistently assess changes in mindfulness following the interventions; thus, the underlying mechanisms

accounting for these changes remain unclear. Indeed, the present results suggest that in addition to increasing mindfulness, MBSR may improve health outcomes through facilitating need satisfaction and better quality sleep.

This study has a number of limitations. First, this study is cross sectional, which prevents us from drawing any causal conclusions. For example, poor sleep quality may not only contribute to but may also stem from poor physical and mental health.² Future experimental or longitudinal research is needed to address this issue. Second, all of our primary measures were based on self-reports which can inflate the observed associations due to shared method variance. Future studies could overcome this problem by using objective sleep measures such as polysomnography and actigraphy. Finally, our sample size was limited which prevented us from testing an integrative model with all of the assessed study variables. Furthermore, our sample was fairly homogeneous (e.g. predominantly male and Caucasian). Future research is needed to examine the generalizability of the present findings to the larger spectrum of PLHIV.

In sum, this study underscores the role of basic psychological need satisfaction in determining the HRQOL of PLHIV. Specifically, the results indicate that HIV-positive individuals who feel volitional and effective in their behavior and close and connected to important others are likely to experience higher physical and mental health through better sleep quality. The results further suggest that dispositional mindfulness plays a role in facilitating need satisfaction and higher quality of sleep. Overall, the current findings provide initial evidence that healthcare professionals seeking to improve the HRQOL of PLHIV may focus on helping to develop a more mindful approach while also providing support for basic psychological needs.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Fund for Scientific Research Flanders (FWO. OPR.2013. 0140.01—IV2).

Notes

1. CD4+ cell count was not significantly related to any of the assessed variables. One potential explanation for this null relation was that there was little variation in the objective health condition of the studied sample. The majority of the sample was under stable antiretroviral therapy, had full virologic suppression and stable recovered cellular immunity. Thus, their physical health status was fairly stable.
2. We also tested an alternative model in which paths were added from need satisfaction to mental and physical health and from mental and physical health to poor sleep quality and sleep quantity. Results indicated that need satisfaction related positively to physical ($\beta = .31, p < .01$) and mental health ($\beta = .52, p < .001$) and that in turn, physical ($\beta = -.19, p < .05$) and mental health ($\beta = -.22, p < .05$) were negatively related to poor sleep quality but unrelated to sleep quantity. Furthermore, need satisfaction continued to yield a direct association with poor sleep quality ($\beta = -.40, p < .001$). However, comparison of the Akaike information criterion (AIC) fit indices indicated that the model testing need satisfaction predicting HRQOL via the sleep outcomes had a better fit (AIC=1891.60) than the model testing need satisfaction predicting sleep via the HRQOL indicators (AIC=2071.97).

References

- Bravo P, Edwards A, Rollnick S, et al. (2010) Tough decisions faced by people living with HIV: A literature review of psychosocial problems. *AIDS Reviews* 12: 76–88.
- Brenning K, Soenens B, Van Petegem S, et al. (2015) Perceived maternal autonomy support and early adolescent emotion regulation: A longitudinal study. *Social Development* 24(3): 561–578.
- Brown KW and Ryan RM (2003) The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology* 84: 822–848.
- Buysse DJ, Reynolds CF, Monk TH, et al. (1989) The Pittsburgh Sleep Quality Index—A new instrument for psychiatric practice and research. *Psychiatry Research* 28: 193–213.
- Campbell R, Vansteenkiste M, Beyers W, et al. (2016) Shifts in emerging adults' sleep pattern during an examination period: The role of basic psychological needs and stress. Manuscript submitted for publication.
- Campbell R, Vansteenkiste M, Delesie LM, et al. (2015) Examining the role of psychological need satisfaction in sleep: A self-determination theory perspective. *Personality and Individual Differences* 77: 199–204.
- Centers for Disease Control and Prevention (CDC) (2016) Health-related quality of life. Available at: <https://www.cdc.gov/hrqol/> (accessed 7 November 2016).
- Chen B, Vansteenkiste M, Beyers W, et al. (2015) Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion* 39: 216–236.
- Costa J, Pinto-Gouveia J and Maroco J (2016) Chronic pain experience on depression and physical disability: The importance of acceptance and mindfulness-based processes in a sample with rheumatoid arthritis. *Journal of Health Psychology*. Epub ahead of print 15 June. DOI: 10.1177/1359105316649785.
- Creswell JD, Irwin MR, Burklund LJ, et al. (2012) Mindfulness-based stress reduction training reduces loneliness and pro-inflammatory gene expression in older adults: A small randomized trial. *Brain, Behavior, and Immunity* 26: 1095–1101.
- Creswell JD, Myers HF, Cole SW, et al. (2009) Mindfulness meditation training effects on CD4+ T lymphocytes in HIV-1 infected adults: A small randomized controlled trial. *Brain, Behavior, and Immunity* 23: 184–188.
- Deci EL and Ryan RM (2000) The 'what' and 'why' of goal pursuits: Human needs and the self determination of behavior. *Psychological Inquiry* 11: 227–268.
- Deci EL, Ryan RM, Gagné M, et al. (2001) Need satisfaction, motivation, and well-being in the work organizations of a former Eastern Bloc country: A cross-cultural study of self-determination. *Personality and Social Psychology Bulletin* 27: 930–942.
- Degroote S, Vogelaers DP, Vermeir P, et al. (2013) Socio-economic, behavioural, (neuro)psychological and clinical determinants of quality of

- life (QoL) in people living with HIV: A pilot study. *Journal of the International AIDS Society* 16(1): 18643.
- Di Domenico SI and Fournier MA (2014) Socioeconomic status, income inequality, and health complaints: A basic psychological needs perspective. *Social Indicators Research* 119: 1679–1697.
- Gakhar H, Kamali A and Holodniy M (2013) Health-related quality of life assessment after antiretroviral therapy: A review of the literature. *Drugs* 19: 1398–1407.
- Gayner B, Esplen MJ, DeRoche P, et al. (2012) A randomized controlled trial of mindfulness-based stress reduction to manage affective symptoms and improve quality of life in gay men living with HIV. *Journal of Behavioral Medicine* 35(3): 272–285.
- Gillard A and Roark MF (2013) Support for basic psychological needs in the context of HIV disclosure for older youth. *Children and Youth Services Review* 35: 102–111.
- Gonzalez MG, Swanson DP, Lynch M, et al. (2016) Testing satisfaction of basic psychological needs as a mediator of the relationship between socioeconomic status and physical and mental health. *Journal of Health Psychology* 21(6): 972–982.
- Holmbeck GN (1997) Toward terminological, conceptual, and statistical clarity in the study of mediators and moderators: Examples from the child-clinical and pediatric psychology literatures. *Journal of Consulting and Clinical Psychology* 65: 599–610.
- Hu L and Bentler PM (1999) Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling* 6: 1–55.
- Igreja I, Zuroff DC, Koestner R, et al. (2000) Applying self-determination theory to the prediction of distress and well-being in gay men with HIV and AIDS. *Journal of Applied Social Psychology* 30(4): 686–706.
- Kennedy S, Goggin K and Nollen N (2004) Adherence to HIV medications: Utility of the theory of self-determination. *Cognitive Therapy and Research* 28(5): 611–629.
- Kline RB (2005) *Principles and Practice of Structural Equation Modeling*. New York: Guilford Press.
- Lin MK, Wu AW and Revicki DA (2002) Incorporating quality of life measures in HIV clinical trials. *HIV Clinical Trials* 3(3): 202–218.
- Medley AM, Kennedy CE, Lunyolo S, et al. (2009) Disclosure outcomes, coping strategies, and life changes among women living with HIV in Uganda. *Qualitative Health Research* 19(12): 1744–1754.
- Moskowitz JT, Duncan LG, Moran PJ, et al. (2015) Dispositional mindfulness in people with HIV: Associations with psychological and physical health. *Personality and Individual Differences* 86: 88–93.
- Oberjé EJM, Dima AL, Van Hulzen AGW, et al. (2015) Looking beyond health-related quality of life: Predictors of subjective well-being among people living with HIV in the Netherlands. *AIDS and Behavior* 19: 1398–1407.
- O’Leary K, O’Neill S and Dockray SJ (2016) A systematic review of the effects of mindfulness interventions on cortisol. *Journal of Health Psychology* 21: 2108–2121.
- Peltzer K (2012) Health-related quality of life and antiretroviral therapy in Kwazulu-Natal, South Africa. *Social Behavior & Personality* 40(2): 267–282.
- Phillips KD, Mock KS, Bopp CM, et al. (2006) Spiritual well-being, sleep disturbance, and mental and physical health status in HIV-infected individuals. *Issues in Mental Health Nursing* 27: 125–139.
- Phillips KD, Sowell RL, Boyd M, et al. (2005) Sleep quality and health-related quality of life in HIV-infected African-American women of childbearing age. *Quality of Life Research* 14: 959–970.
- Phillips KD, Sowell RL, Rojas M, et al. (2004) Physiological and psychological correlates of fatigue in HIV disease. *Biological Research for Nursing* 6: 59–74.
- Pilcher J, Douglas G and Sadowsky B (1997) Sleep quality versus sleep quantity: Relationships between sleep and measures of health, well-being and sleepiness in college students. *Journal of Psychosomatic Research* 42(6): 583–596.
- Quinlivan EB, Messer LC, Adimora AA, et al. (2013) Experiences with HIV testing, entry, and engagement in care by HIV-infected women of color, and the need for autonomy, competency and relatedness. *AIDS Patient Care and STDs* 27(7): 408–415.
- Roth G, Benita M, Amrani C, et al. (2014) Integration of negative emotional experience

- versus suppression: Addressing the question of adaptive functioning. *Emotion* 14(5): 908–919.
- Ryan RM, Bernstein JH and Brown KW (2010) Weekends, work, and well-being: Psychological need satisfactions and day of the week effects on mood, vitality, and physical symptoms. *Journal of Social and Clinical Psychology* 29(1): 95–122.
- Seyed Alinaghi S, Jam S, Foroughi M, et al. (2012) Randomized controlled trial of mindfulness-based stress reduction delivered to human immunodeficiency virus-positive patients in Iran: Effects on CD4+ T lymphocyte count and medical and psychological symptoms. *Psychosomatic Medicine* 74(6): 620–627.
- Uphold CR, Holmes W, Reid K, et al. (2007) Healthy lifestyles and health-related quality of life among men living with HIV infection. *Journal of the Association of Nurses in AIDS Care* 18(6): 54–66.
- Vansteenkiste M and Ryan RM (2013) On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration* 23: 263–280.
- Ware JE and Sherbourne CD (1992) The MOS 36-item short-form health survey (SF-36): 1—Conceptual framework and item selection. *Medical Care* 30: 473–483.
- Wong LH, Van Rooyen H, Modiba P, et al. (2009) Test and tell: Correlates and consequences of testing and disclosure of HIV status in South Africa. *Journal of Acquired Immune Deficiency Syndromes* 50(2): 215–222.
- Wu J, Wu H, Lu C, et al. (2015) Self-reported sleep disturbances in HIV-infected people: A meta-analysis of prevalence and moderators. *Sleep Medicine* 16: 901–907.
- Xu W, Oei TPS, Liu X, et al. (2016) The moderating and mediating roles of self-acceptance and tolerance to others in the relationship between mindfulness and subjective well-being. *Journal of Health Psychology* 21: 1446–1456.