

Losing Sleep over Work:

A Self-Determination Theory View on Need Frustration, Sleep Disturbance, and Mental Ill
Health

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Abstract

Given the centrality of sleep and work in most individuals' lives, it is interesting to note that an empirical understanding of the association between what happens in the workplace and how well people sleep is in an early stage of development, at least relative to other topics that are of interest in the literature on stress and health. Using self-determination theory, the current study examined how maladaptive motivational processes at work relate to sleep disturbance and mental ill health. In line with hypotheses, the results of a cross-sectional analysis and analyses using data from two time points over 15 months revealed that employees are more likely to report sleep disturbance, anxiety, and depressive symptoms when they experience frustration of the basic psychological needs for autonomy, competence, and relatedness in the workplace. Additional results revealed an indirect effect of change in basic psychological need frustration on change in anxiety—but not on change in depressive symptoms—through change in sleep disturbance. Taken together, these findings add to the burgeoning literature on the maladaptive *motivational* origins of ill health and dysfunction in the workplace.

Keywords: Anxiety, Basic Psychological Need Frustration, Depressive Symptoms, Self-Determination Theory, Sleep Disturbance, Workplace

Sleep is a basic physiological need, and most adults spend a third of their life asleep. While awake, working adults spend another third of their life on the job, on average (Harter, Schmidt, & Keyes, 2003). Given the centrality of sleep and work in most individuals' lives, it is interesting to note that an empirical understanding of the association between what happens in the workplace and how well people sleep is in an early stage of development (cf. Burgard & Ailshire, 2009), at least relative to other topics that are of interest in the literature on stress and health. To be sure, there is a rapidly growing empirical literature on the interplay between work and sleep. Based on a systematic review, for instance, Linton et al. (2015) reported that control (or decision latitude), social support, and organizational justice at work are related to lower levels of future sleep disturbance; in contrast, demands, strain, organizational injustice, effort-reward imbalance, and bullying are related to higher levels of future sleep disturbance. In their meta-analysis of 152 studies on sleep among employees in organizations, Litwiller, Snyder, Taylor, and Steele (2017) found that organizational antecedents of perceived control and workload are related to higher and lower levels of sleep quality, respectively, while sleep quality is related to a variety of outcomes that have direct impacts on both employees (anxiety and depression) and organizations (job satisfaction, engagement, organizational commitment, turnover intention, and accidents and/or injuries).

The literature reviewed so far makes it clear that a wide variety of psychosocial factors at work have the potential to impact the quality of employees' sleep. Toward the end of their systematic review, Linton et al. (2015) called for the development of new and more powerful models that explain the etiology of sleep disturbance in employees, the importance of which is underscored by Litwiller et al.'s (2017) identification of only two models of employee sleep that focus on antecedents, correlates, and outcomes (Krauss, Chen, DeArmond, & Moorcroft, 2003; Mullins, Cortina, Drake, & Dalal, 2014). Both conceptual models consider sleep to be a mechanism (or mediating variable) that explains the relation of individual and organizational

factors to individual and organizational outcomes. Yet the importance of introducing a well-established perspective on motivation to an understanding of employee sleep is that doing so can begin to unify and bring parsimony to this rapidly growing empirical literature.

Accordingly, the current study was designed (1) to contribute to this rapidly growing empirical literature on the interplay between work and sleep in a way that (2) utilizes a well-established approach to human motivation, namely, self-determination theory (SDT; Deci & Ryan, 2008; Niemiec, Ryan, & Deci, 2010; Ryan & Deci, 2017; Vansteenkiste, Niemiec, & Soenens, 2010), with the intention being that such a perspective can be used to generate future research on how to promote employees' sleep quality and mental health through interventions. The concept of basic psychological needs is central within SDT, and some research (described below) has begun to explore the association between need satisfaction and sleep quality. Yet to our knowledge, no previous research has examined the relation of basic psychological need frustration to sleep quality, which represents an important gap in the literature given that need frustration is not theorized to be the antipode of need satisfaction (see Vansteenkiste & Ryan, 2013) and these constructs have been shown empirically to be distinct factors (r range = -.21 to -.27; Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). Theoretically, then, it is important to examine whether frustration of basic psychological needs can undermine the satisfaction of a basic physiological need, namely, sleep.

Of theoretical importance as well, it is possible to use SDT to bring not only concision but also coherence to an understanding of the association between contextual factors at work and the quality of employees' sleep. For instance, we speculate that the psychosocial factors of control (or decision latitude), social support, and organizational justice not only relate to lower levels of future sleep disturbance (Linton et al., 2015) but also are likely to yield lower levels of basic psychological need frustration among employees. By contrast, the psychosocial factors of demands, strain, organizational injustice, effort-reward imbalance, and bullying not

only relate to higher levels of future sleep disturbance (Linton et al., 2015) but also are likely to engender higher levels of basic psychological need frustration among employees. If this is true, then understanding the relation of basic psychological need frustration to the etiology of sleep disturbance among employees—a primary focus in the current study—will represent an important first step toward the development of new and (potentially) more powerful models of the relation of psychosocial factors of the workplace (and other organizational antecedents) to sleep and health.

It is important to reflect on the potential practical relevance of the current study, too. SDT is a well-established empirical approach to human motivation that not only identifies the concept of basic psychological needs as necessary for living well but also has been utilized to develop interventions that promote health behavior change (see Ntoumanis et al., 2021, for a meta-analysis) and positive outcomes among employees (see Deci, Connell, & Ryan, 1989; Hardré & Reeve, 2009; Spence & Niemiec, 2019). Ample research has shown that individuals who are in positions of responsibility, such as managers, can be trained on how to support the basic psychological needs of others (Su & Reeve, 2011; cf. Niemiec & Muñoz, 2019). To our knowledge, though, no research has explored the possibility of training individuals who are in positions of responsibility to reduce factors that are likely to be perceived as need frustrating. Thus, if it is shown that natural variations in basic psychological need frustration covary with changes in sleep disturbance and mental ill health among employees then such results would highlight the potential value of workplace interventions that are designed not only to promote need satisfaction but also to reduce need frustration among employees so as to enhance their sleep quality and mental health. Such a focus on training managers to enhance the experience of need satisfaction *and* limit the experience of need frustration among employees would go beyond the most common workplace interventions that deliver educational programs on sleep hygiene and fatigue management, or modify individual and/or workplace factors that might

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contribute to sleep quality (Redeker et al., 2019). Although several high-quality longitudinal studies have revealed a negative relation of job demands (e.g., time pressure) to sleep quality and a positive relation of job control (e.g., decision authority) to sleep quality (Van Laethem, Beckers, Kompier, Dijksterhuis, & Geurts, 2013), it is useful to note that these psychosocial work characteristics—though related to—are neither theoretically nor empirically identical to the concept of basic psychological needs (Trépanier, Forest, Fernet, & Austin, 2015). Indeed, interventions that have been shown to improve these psychosocial work characteristics have had little, if any, effect on sleep quality (Van Laethem et al., 2013). By contrast, interventions based on SDT that have targeted the concept of basic psychological needs have been shown to affect physical health (see Ntoumanis et al., 2021), and thus hold promise with regard to sleep quality. Yet it is necessary to quantify the strength of association between basic psychological need frustration and sleep disturbance, and the current study will make a contribution to the literature by testing the associations among work-related need frustration, sleep disturbance, and mental ill health both at a single point in time and across 15 months.

Sleep, sleep disturbance, and their implications for health and wellness

Sleep is integral to living well (see Reid et al., 2006), and sleep quality is associated with higher levels of cognitive functioning (Lim & Dinges, 2010), emotional wellness (Benca, Obermeyer, Thisted, & Gillin, 1992), and physical health (Strine & Chapman, 2005). Thus, it is unfortunate to note that sleep disturbance is relatively common among both working adults (McKnight-Eily et al., 2011) and the general population (Ford, Cunningham, & Croft, 2015). In the current study, sleep disturbance was operationalized as not being able to fall asleep and waking up early and not being able to fall back to sleep (American Psychiatric Association, 2013). Previous research has shown that sleep disturbance predicts poor cognitive functioning (Curcio, Ferrara, & De Gennaro, 2006) and mortality risk in healthy older adults (Dew et al., 2013), along with anxiety, depressive symptoms, fatigue, general strain, and negative affect

(Litwiller et al., 2017). In the workplace, employees with sleep disturbance are more likely to be absent and have errors and/or accidents, and are less likely to receive promotions (Bonnet & Arand, 2006; Léger, Massuel, Metlaine, & SISYPHE Study Group, 2006). To be sure, the emotional burden, medical issues, and diminished work performance that are associated with sleep disturbance can have costs both for individuals and for society (Daley, Morin, LeBlanc, Grégoire, & Savard, 2009; Ozminkowski, Wang, & Walsh, 2007). Hence, the implications of sleep—and sleep disturbance—for health and wellness are readily apparent.

Generally speaking, it is believed that psychological stress and reactivity to stress can contribute to the development of sleep disturbance (Espie, 2002; Morin, Rodrigue, & Ivers, 2003), as neurotransmitters and hormones that are released in response to stressful events can undermine sleep quality (Linton, 2004). In the work domain, employees report that stress at work contributes to their sleep disturbance (Henry, McClellan, Rosenthal, Dedrick, & Gosdin, 2008), and research using SDT has shown that one contributing factor to an experience of stress in the workplace is the frustration of the basic psychological needs for autonomy, competence, and relatedness (Olafsen, Niemiec, Halvari, Deci, & Williams, 2017). It is important to note, however, that the concept of stress is not conceptually equivalent to the frustration of these basic psychological needs, and the average strength of correlation between these constructs was $r = .42$ in Olafsen et al. (2017; see Table 3). Hence, an important feature of the current study is that it utilizes a well-established approach to human motivation to bring insight and theoretical clarity to the issue of how maladaptive motivational processes at work, such as basic psychological need frustration, can affect sleep disturbance and mental ill health (more specifically, anxiety and depressive symptoms). The next section provides an overview of SDT, which will offer a theoretical and empirical context into which the conceptual model for this study (see Figure 1) can be placed.

Self-determination theory

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Self-determination theory (SDT; Ryan & Deci, 2017) is an empirically based approach to human motivation, emotion, and personality in social contexts that has been applied to the workplace (Deci, Olafsen, & Ryan, 2017; Gagné & Deci, 2005; Niemiec & Spence, 2017) and to health care (Ng et al., 2012), among other life domains. The concept of basic psychological needs is a unifying principle within SDT, which maintains that the satisfaction of autonomy, competence, and relatedness is critical for full functioning and organismic wellness (Niemiec & Ryan, 2013). SDT asserts that these basic psychological needs specify the psychological content of human nature (cf. Niemiec, Soenens, & Vansteenkiste, 2014) and often function in similar ways in natural settings (cf. Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). Therefore, our primary focus in the current study was on the higher-order construct of basic psychological need frustration, rather than on the individual needs *per se*. With that said, at times we describe dynamics that are relevant to each of the individual needs for the sake of illustration.

According to SDT, the need for autonomy (de Charms, 1968) refers to the experience of behavior as self-governed and personally endorsed. In contrast, frustration of the need for autonomy refers to the experience of feeling pressured and coerced to think, feel, or behave in a particular way due to internal or external factors. The need for competence (White, 1959) refers to the experience of behavior as enacted with a sense of capability, effectiveness, and mastery in pursuing and achieving desired outcomes. In contrast, frustration of the need for competence refers to the experience of inability to accomplish important goals. The need for relatedness (Baumeister & Leary, 1995) refers to the experience of care, concern, and support from, and for, important others. In contrast, frustration of the need for relatedness refers to the experience of disconnection and alienation from others. From the perspective of SDT, need satisfaction is theorized to be a universal requirement for optimal functioning and wellness,

whereas need frustration is theorized to contribute to compromised functioning and ill-being (Deci & Ryan, 2000).

Many studies using SDT have shown that support for and/or satisfaction of autonomy, competence, and relatedness are associated with higher levels of psychological wellness and physical health (for a meta-analytic review, see Ng et al., 2012). For instance, in a sample of Norwegian employees managerial need support was associated with lower levels of somatic symptom burden, emotional exhaustion, turnover intention, and absenteeism (Williams et al., 2014). Similarly, in a sample of Gabonese employees supervisor need support was associated with higher levels of job satisfaction and life satisfaction (Levesque, Blais, & Hess, 2004). An emerging corpus of recent research using SDT has shown that need frustration is particularly detrimental to employee health and work-related functioning. Among Norwegian employees, for instance, need frustration predicted higher levels of somatic symptom burden, emotional exhaustion, and turnover intention (Olafsen et al., 2017). Indeed, it is important to note that comparable findings have been reported by other investigative teams (see Gillet, Fouquereau, Forest, Brunault, & Colombat, 2012; Gillet, Fouquereau, Huyghebaert, & Colombat, 2015; Gillet, Lafrenière, Vallerand, Huart, & Fouquereau, 2014; Schultz, Ryan, Niemiec, Legate, & Williams, 2015; Trépanier et al., 2015).

Based on these findings and other research using SDT at the intersection of work and health (for a review, see González, Niemiec, & Williams, 2014), it is reasonable to assert that the concept of basic psychological needs is applicable to physical and psychological health. It is less clear, however, whether the concept of basic psychological needs is applicable to sleep quality, although very recent research using SDT has begun to address this topic. In a sample of HIV+ adults, for instance, poor sleep quality fully explained (or, statistically mediated) the association between basic psychological need satisfaction and physical health, whereas poor sleep quality partially explained the link between need satisfaction and psychological health

(Campbell et al., 2016). More germane to the focus of the current study, changes in university students' sleep quality from before, to during, to after an exam period covaried with changes in basic psychological need satisfaction across those times (Campbell, Soenens, Beyers, & Vansteenkiste, 2018).

Theoretically, though, basic psychological need frustration is not considered to be the polar opposite of basic psychological need satisfaction, and thus it is not isomorphic with a lack of satisfaction of autonomy, competence, and relatedness (cf. Olafsen et al., 2017; also, see Vansteenkiste & Ryan, 2013). Basic psychological need *dissatisfaction* (i.e., low levels of need satisfaction) is likely to result from social contexts that passively ignore the experiences of autonomy, competence, and relatedness, and basic psychological need *frustration* is likely to result from social contexts that actively thwart (that is, undermine) these nutrients that are essential for integrated functioning. In the workplace, an employee who experiences a lack of voice in organizational decision making, a lack of recognition for achievements, and a lack of connection with others is likely to perceive a lack of basic psychological need satisfaction. By contrast, an employee who experiences forced compliance with organizational decisions and objectives, communication of negative feedback, and rejection by (or ostracism from) work colleagues is likely to perceive basic psychological need frustration. Therefore, although the results from Campbell and colleagues (2016, 2018) are suggestive, they do not speak directly to the issue of whether basic psychological need frustration (rather than dissatisfaction) relates to sleep disturbance and, in turn, mental ill health. Also, this previous research was conducted outside of the work domain, and thus leaves unanswered the question of whether maladaptive motivational factors in the workplace affect how well employees sleep. Both of these matters are important to address given recent “calls” for the development of more effective employee health interventions (Tetrick & Winslow, 2015).

In an effort to advance this initial, yet encouraging evidence for the relevance of basic psychological needs to sleep, the current study examined changes in basic psychological need frustration in a context of organizational change that was likely to be perceived as demanding. Need frustration is “the mechanism that links negative dimensions of the social environment to indices of compromised functioning and well-being” (see Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011, p. 1460) and has been shown to be a stronger predictor of compromised functioning than low levels of need satisfaction (Unanue, Dittmar, Vignoles, & Vansteenkiste, 2014). Theoretically, basic psychological need frustration is likely to disrupt the innate organismic processes that are necessary for optimal functioning and wellness (Deci & Ryan, 2000; Ryan & Deci, 2017), thereby promoting compromised functioning of which sleep disturbance and mental ill health are symptoms at the physical and psychological levels, respectively. More specifically, Vansteenkiste and Ryan (2013) reviewed evidence suggesting that basic psychological need frustration not only yields an immediate cost in the form of ill-being (e.g., anxiety and depressive symptoms) but also evokes vulnerabilities for other forms of diminished functioning that can undermine sleep quality. For instance, basic psychological need frustration has been shown to predict elevations in secretory immunoglobulin A, which occurs with the anticipation of acute stressors (Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011); engagement in compensatory behaviors (e.g., alcohol abuse and self-harm) that reflect an erosion of self-control and can deplete the vital energy that is necessary for healthy self-regulation (Knee & Neighbors, 2002); and the enactment of rigid behavior patterns (e.g., self-critical standards) that can maintain the cycle of basic psychological need frustration and ill-being over time (Soenens et al., 2008). Critically, research has revealed associations between sleep disturbance and perceived stress (Morin et al., 2003), heavy alcohol use (Britton, Fat, & Neligan, 2020), and less self-compassion (Butz & Stahlberg, 2020), thereby establishing the

conceptual link between basic psychological need frustration and sleep disturbance through a variety of forms of compromised functioning.

Also of relevance, by quantifying the strength of associations among changes in basic psychological need frustration, sleep disturbance, and mental ill health, the current study can facilitate the development of new and (potentially) more powerful models that might explain the relation of psychosocial factors of the workplace to employees' sleep and health. Indeed, such models might "pave the way" for the development of workplace interventions that are designed to reduce need frustration among employees and, in doing so, enhance their sleep quality and mental health.

Statement of hypotheses

The following hypotheses were specified based on this literature overview, which has documented the relevance of basic psychological needs to sleep (Campbell et al., 2016, 2018); the relation of need frustration to indices of compromised functioning, such as negative affect, secretory immunoglobulin A (biomarker for stress), and depressive symptoms (Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011); and the associations among sleep disturbance, anxiety, and depressive symptoms (Litwiller et al., 2017).

Hypothesis 1: Basic psychological need frustration at baseline will be positively associated with sleep disturbance, anxiety, and depressive symptoms at baseline.

Hypothesis 2: Change in basic psychological need frustration from baseline to 15 months will be positively associated with changes in sleep disturbance, anxiety, and depressive symptoms from baseline to 15 months.

Hypothesis 3: There will be a significant indirect effect of change in basic psychological need frustration from baseline to 15 months on changes in anxiety (Hypothesis 3a) and depressive

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symptoms (Hypothesis 3b) from baseline to 15 months through change in sleep disturbance from baseline to 15 months.

In an initial analysis (see Hypothesis 1), we tested the cross-sectional relations of basic psychological need frustration to sleep disturbance, anxiety, and depressive symptoms so as to quantify the strength of these associations at a single point in time. Next, in a second analysis (see Hypothesis 2), we tested the same associations using data from two time points separated by 15 months so as to quantify the strength of these relations over an extended period of time. In a final analysis (see Hypothesis 3), we tested a model in which there are indirect effects of change in basic psychological need frustration to changes in anxiety and depressive symptoms through change in sleep disturbance. This model is consistent with the SDT Model of Health, which posits that factors relevant to basic psychological needs have a downstream impact on health and wellness (see Ng et al., 2012; Ntoumanis et al., 2021), and with conceptual models that view sleep as a mechanism that transmits the impact of individual/organizational factors (such as basic psychological need frustration) to individual/organizational consequences (such as anxiety and depressive symptoms). In each analysis, we examined sleep disturbance, which was operationalized as the core symptoms of insomnia, because this construct reflects a form of compromised functioning that not only is relevant to the workplace but also has associated adverse consequences. Also, we examined mental ill health, which was operationalized as the presence of anxiety and depressive symptoms, because this construct has been linked to basic psychological need frustration and sleep disturbance, and because it has salient implications for employee functioning.

Context for the present research

Applying SDT to the interplay between work and sleep, the present research examined a model of basic psychological need frustration, sleep disturbance, and mental ill health using a sample of unit leaders who worked in the Norwegian health care system at a time in which a

national reform was being implemented that shifted responsibility for advanced treatment and follow-up from the hospitals to the municipalities, which previously had been responsible for providing services related to prevention, simple treatment, and rehabilitation. In the context of this national reform, these managers were of interest in this study because they worked in a setting where need frustration is likely to occur. Specifically, these unit leaders had to allocate resources to new, more advanced health care demands while managing limited annual budgets and staff who were not necessarily able to execute their roles successfully. Amid this set of demands, unit leaders were charged with the responsibility of delivering high-quality health care to their patients, which can leave them feeling “stuck between a rock and a hard place” (see Nilsen, Olafsen, Steinsvåg, Halvari, & Grov, 2016, p. 154). Notably, a focus on managers is not meant to imply that other employees in the organization (such as subordinates) do not face the very real possibility of basic psychological need frustration. Rather, unit leaders were recruited for the current study because they encounter a unique confluence of “pressures from above” (such as cost limitations) and “pressures from below” (such as staff issues) while still having to deliver quality service to patients.

It is interesting to note that Nilsen et al. (2016) presented a qualitative analysis of nine unit leaders in the Norwegian health care system, which revealed a controlling, burdensome, and (at times) impersonal organizational structure that was experienced by these managers as thwarting of their basic psychological needs for autonomy, competence, and relatedness. Such a social context offers an intriguing opportunity to examine associations among work-related need frustration, sleep disturbance, and mental ill health. In the present research, quantitative data were collected during a period of *transition* to the aforementioned national reform (after its conceptualization, but prior to its full implementation) and 15 months later, which afforded the opportunity to capture natural variations in these constructs during an extended period of time.

Method

Participants and procedure

As detailed in Olafsen et al. (2017, 2021), participants were 267 (205 female, 60 male, 2 unspecified) unit leaders who worked in the Norwegian health care system.¹

An invitation for study participation was sent via email to the 428 municipalities in Norway with a request that the online link be sent to unit leaders in the municipalities' health care services industry. Unit leaders were informed about the aim and anticipated length of the study, and that participation in the study was voluntary. As well, unit leaders were informed about the structure of the study questionnaire and how to respond (viz., answer truthfully and based on one's own experiences), and that their responses would be handled in a confidential manner. This study was approved by the Norwegian Social Science Data Service prior to data collection.

Unit leaders from 131 municipalities² in all 19 counties in Norway participated in the study. Many participants were between 50 years and 59 years old (40.8%), while the others were 29 years old or younger (0.7%), between 30 years and 39 years old (12.4%), between 40 years and 49 years old (33.3%), 59 years old or older (12.4%), and of unspecified age (0.4%). Many participants worked in a rural municipality (56.6%), while the others worked in an urban municipality (42.7%) or at an unspecified location (0.7%). As well, many participants worked at a home-based care unit (43.8%), while the others worked at an institution (36.0%) or at an unspecified unit (20.2%). Participants were contacted via email at 15 months after the baseline assessment, and 115 (43.1%) participants provided follow-up data at this time.

Measures

The study questionnaire was administered in Norwegian, and measures that were not available in Norwegian were translated using a standard back-translation procedure.

Basic psychological need frustration. The Psychological Needs Thwarting Scale (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011) was modified for the work context and assessed personal experiences regarding frustration of autonomy (4 items; I feel prevented from making choices with regard to the way I work), competence (4 items; There are situations when I am told things that make me feel incompetent), and relatedness (4 items; I feel others can be dismissive of me). Participants answered all items with work in mind, as this measure included an introductory stem that asserted, “The following statements relate to your personal experiences at work...” Responses were made on a 5-point scale from 1 (*totally disagree*) to 5 (*totally agree*). The reliability for autonomy frustration was $\alpha = .83$ at baseline and $\alpha = .89$ at 15 months. The reliability for competence frustration was $\alpha = .85$ at baseline and $\alpha = .84$ at 15 months. The reliability for relatedness frustration was $\alpha = .78$ at baseline and $\alpha = .81$ at 15 months.

Confirmatory Factor Analyses (CFAs) were performed in order to determine whether a hierarchical structure exists within this measure. These two analyses tested models in which a higher-order latent construct basic psychological need frustration is indicated by subordinate latent constructs autonomy frustration, competence frustration, and relatedness frustration, which are indicated by their four respective items. At baseline, this CFA yielded acceptable fit of the model to the data, $\chi^2 (df = 51) = 114.43, p < .001; \chi^2/df = 2.24; CFI = .96; IFI = .96; RMSEA = .068$ (90% CI: .052, .085). All item loadings were significant ($p < .001$) and ranged in magnitude from .52 to .85 (mean $\lambda = .74$). Factor loadings for autonomy frustration ($\lambda = .81$), competence frustration ($\lambda = .97$), and relatedness frustration ($\lambda = .69$) to the higher-order construct of basic psychological need frustration were significant ($p < .001$). Similarly at 15 months, this CFA yielded acceptable fit of the model to the data, $\chi^2 (df = 51) = 95.01, p < .001; \chi^2/df = 1.86; CFI = .95; IFI = .95; RMSEA = .057$ (90% CI: .039, .075). Again, all item loadings were significant ($p < .001$) and ranged in magnitude from .45 to .89 (mean $\lambda = .77$).

Importantly, factor loadings for autonomy frustration ($\lambda = .94$), competence frustration ($\lambda = .95$), and relatedness frustration ($\lambda = .68$) to the higher-order construct of basic psychological need frustration were significant ($p < .001$). Taken together, these results justify the use of the higher-order construct basic psychological need frustration in subsequent analyses. This latent construct was indicated by the three observed (or measured) variables autonomy frustration, competence frustration, and relatedness frustration, and each of these variables was computed as the average of their four respective items noted above. It is useful to note that this approach to modeling basic psychological need frustration in primary analyses was determined *a priori* in order to manage the ratio of sample size to model complexity.

Sleep disturbance. Two items assessed sleep disturbance experienced during the last month (Neckelmann, Mykletun, & Dahl, 2007). The first item focused on participants' experience of not being able to fall asleep and the second item focused on participants' experience of waking up early and not being able to fall back to sleep. Responses were made on a 4-point scale from 1 (*never*) to 4 (*almost every night*). The reliability for sleep disturbance was $\alpha = .69$ at baseline and $\alpha = .73$ at 15 months.

Mental ill health. Mental ill health was operationalized as the presence of anxiety and depressive symptoms experienced during the last week. The Hospital Anxiety and Depression Scale (Mykletun, Stordal, & Dahl, 2001; Zigmond & Snaith, 1983) assessed experiences of anxiety (7 items; Worrying thoughts go through my mind) and depressive symptoms (7 items; I look forward with enjoyment to things—reverse scored). Responses were made on a 4-point scale from 1 (*not at all*) to 4 (*very often*). The reliability for anxiety was $\alpha = .80$ at baseline and $\alpha = .84$ at 15 months. The reliability for depressive symptoms was $\alpha = .80$ at baseline and $\alpha = .88$ at 15 months.

Analytic overview

Primary analyses were conducted using two analytic techniques.

Structural equation modeling in AMOS 25 was used to test the hypothesized models illustrated in Figures 2-3. Using the recommendations of Gefen, Straub, and Boudreau (2000) and Hu and Bentler (1999), good model fit is indicated by a chi-square likelihood ratio (χ^2/df) that is less than 3:1 and a RMSEA value that is close to or lower than .08, accompanied by a CFI value that is close to or higher than .95. As recommended by Allison (2003), the analyses were conducted with Full Information Maximum Likelihood (FIML) to impute missing data. Four latent constructs were created, namely, *basic psychological need frustration*, which was indicated by the three subscales that were used to measure autonomy frustration, competence frustration, and relatedness frustration; *sleep disturbance*, which was indicated by the two items that were used to measure sleep disturbance; *anxiety*, which was indicated by the six items that were used to measure anxiety (one item was dropped due to a poor factor loading); and *depressive symptoms*, which was indicated by the five items that were used to measure depressive symptoms (two items were dropped due to poor factor loadings).^{3,4} The estimated models included all hypothesized paths as well as correlations among the error terms for *sleep disturbance*, *anxiety*, and *depressive symptoms*. Using the recommendation of Enders (2006), gender, age, smoking status, alcohol use, physical activity, and weight were used as auxiliary variables in testing models relevant to Hypotheses 1-3. RMediation (Tofighi & MacKinnon, 2011) was used to test the hypothesized model illustrated in Figure 4, as this software builds confidence intervals using the distribution of the product, which is more accurate with regard to Type I error than the bias-corrected and accelerated bias-corrected bootstrap tests when the sample size is relatively small (Fritz, Taylor, & MacKinnon, 2012).

Results

Preliminary analyses

Table 1 presents means, standard deviations, and intercorrelations for the study variables.

Primary analyses

Hypothesis 1 posited that basic psychological need frustration at baseline will be positively associated with sleep disturbance, anxiety, and depressive symptoms at baseline (see Figure 2). The fit of the model to the data was acceptable, $\chi^2 (df = 170) = 264.51, p < .001$; $\chi^2/df = 1.56$; CFI = .95; IFI = .95; RMSEA = .046 (90% CI: .035, .056). This prediction was supported, as basic psychological need frustration at baseline related positively to sleep disturbance ($\beta = .50, p < .001$), anxiety ($\beta = .52, p < .001$), and depressive symptoms ($\beta = .35, p < .001$) at baseline. With the auxiliary variables, this model explained 32.9% of the variance in sleep disturbance, 29.5% of the variance in anxiety, and 15.8% of the variance in depressive symptoms.

Hypothesis 2 posited that change in basic psychological need frustration from baseline to 15 months will be positively associated with changes in sleep disturbance, anxiety, and depressive symptoms from baseline to 15 months (see Figure 3). The fit of the model to the data was acceptable, $\chi^2 (df = 170) = 232.82, p < .01$; $\chi^2/df = 1.37$; CFI = .93; IFI = .94; RMSEA = .037 (90% CI: .024, .049). This prediction was supported, as change in basic psychological need frustration from baseline to 15 months related positively to changes in sleep disturbance ($\beta = .45, p < .01$), anxiety ($\beta = .62, p < .001$), and depressive symptoms ($\beta = .32, p < .01$) from baseline to 15 months. With the auxiliary variables, this model explained 24.3% of the variance in change in sleep disturbance, 43.5% of the variance in change in anxiety, and 28.8% of the variance in change in depressive symptoms.

Hypothesis 3 posited that there will be a significant indirect effect of change in basic psychological need frustration from baseline to 15 months on changes in anxiety (Hypothesis 3a) and depressive symptoms (Hypothesis 3b) from baseline to 15 months through change in sleep disturbance from baseline to 15 months (see Figure 4). Structural equation modeling was used to generate the necessary inputs for use in RMediation. The fit of the model to the

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data was acceptable, $\chi^2 (df = 176) = 236.15, p < .01$; $\chi^2/df = 1.34$; CFI = .93; IFI = .94; RMSEA = .036 (90% CI: .023, .047). Change in basic psychological need frustration from baseline to 15 months related positively to changes in sleep disturbance ($\beta = .44, p < .01$), anxiety ($\beta = .49, p < .001$), and depressive symptoms ($\beta = .40, p < .01$) from baseline to 15 months, and change in sleep disturbance from baseline to 15 months related positively to change in anxiety ($\beta = .29, p < .05$), but was unrelated to change in depressive symptoms ($\beta = -.20, ns$), from baseline to 15 months. With the auxiliary variables, this model explained 19.4% of the variance in change in sleep disturbance, 49.8% of the variance in change in anxiety, and 32.9% of the variance in change in depressive symptoms. The predictions made in Hypotheses 3a and 3b were partially supported, as there was a significant indirect effect of change in basic psychological need frustration from baseline to 15 months on change in anxiety ($B = .12$; 95% CI: .011, .265) from baseline to 15 months through change in sleep disturbance from baseline to 15 months, but this indirect effect on change in depressive symptoms from baseline to 15 months was not significant ($B = -.11$; 95% CI: -.288, .016).

Discussion

Sleep disturbance—conceptualized herein as the experience of difficulties with falling asleep or staying asleep—has associated adverse consequences for individuals' quality of life, psychological wellness, and physical health. Based on self-determination theory (SDT), this study examined a motivational model in which basic psychological need frustration at work is associated with higher levels of sleep disturbance, which in turn is associated with anxiety and depressive symptoms. In line with our hypotheses, the results of a cross-sectional analysis and analyses using data from two time points over 15 months revealed that employees are more likely to report sleep disturbance, anxiety, and depressive symptoms when they experience frustration of the basic psychological needs for autonomy, competence, and relatedness in the workplace. It is intriguing to note the possibility that the frustration of autonomy, competence,

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and relatedness might be one component of the “life stressors” that are thought to initiate and maintain the core symptoms of insomnia (Espie, 2002; Morin et al., 2003). Yet this possibility does not suggest that basic psychological need frustration is conceptually equivalent to stress at work. Rather, with an experience of basic psychological need frustration the nutrients that are essential for integrated functioning are actively thwarted by the social context. Additional results revealed an indirect effect of change in basic psychological need frustration on change in anxiety—but not on change in depressive symptoms—through change in sleep disturbance. This result is consistent with research on the interplay between basic psychological needs and sleep quality (Campbell et al., 2016, 2018) and it also highlights an important dynamic among motivational factors at work, physical functioning, and psychological wellness. Indeed, the results of this study add to the burgeoning literature on the maladaptive *motivational* origins of ill health and dysfunction in the workplace—the so-called dark side of work (Olafsen et al., 2017).

It is interesting to note that support was found for the hypothesized indirect effect of change in basic psychological need frustration on change in anxiety through change in sleep disturbance, but similar support was not found for the hypothesized indirect effect on change in depressive symptoms.⁵ Litwiller et al. (2017) reported sample-weighted mean correlations between sleep quality and anxiety ($r = -.39$) and depressive symptoms ($r = -.35$) that were of comparable magnitude. It was, therefore, surprising that support for this hypothesized indirect effect on change in depressive symptoms was not found. Accordingly, we offer two possible reasons for these results. First, it is possible that the shared variance among changes in sleep disturbance, anxiety, and depressive symptoms functioned to suppress the relation of change in sleep disturbance to change in depressive symptoms when these variables were modeled in the same analysis. Indeed, whereas at the zero-order level the association between change in sleep disturbance and change in depressive symptoms had a positive sign (as expected), in the

analysis that was used to test Hypothesis 3 this association had a negative sign, thus lending credibility to this possibility. Second, it is possible that the Hospital Anxiety and Depression Scale (Mykletun et al., 2001), with its focus on items that tap into the absence of depressive symptoms, functions differently than more standard measures of depressive symptoms. In any event, it is important for future research to disentangle the relations of sleep disturbance to the symptoms of anxiety and depression by assessing these indicators of mental ill health during non-overlapping periods of time, which would afford an opportunity to examine directionality among these constructs.

It is important to consider the practical implications of these findings, too. It has been estimated that the annual average cost associated with insomnia per employee in the United States is 11.3 days, or USD 2,280 in lost job productivity (Kessler et al., 2011). When coupled with research that has associated employee health with job performance (Wright, Cropanzano, & Bonett, 2007), competitive advantage (Grawitch, Gottschalk, & Munz, 2006), absenteeism (Aldana, 2001), and turnover (Wright & Bonett, 2007), it becomes clear that the potential cost associated with need frustration in the workplace is considerable. In surveys conducted by the American Psychological Association, over half of the employees who were sampled report having considered or decided to decline a promotion, look for a new job, or leave a job due to adverse work-related experiences (American Psychological Association, 2007). Additionally, more than half of the employees who were sampled report being less productive at work due to such experiences in the workplace (American Psychological Association, 2009). Therefore, it is important to consider how to develop work climates that conduce to optimal functioning, broadly defined, among employees.

Managers are encouraged to limit factors in the workplace that are conducive to need frustration, including—but not limited to—bullying (Trépanier, Fernet, & Austin, 2016), job insecurity (Van den Broeck et al., 2014), and job demands (Trépanier et al., 2015). Also, trait

mindfulness has been shown to reduce the adverse impact of lower levels of managerial need support on employees' experience of need frustration (Schultz et al., 2015). Finally, managers can learn to be more supportive of their employees' basic psychological needs for autonomy, competence, and relatedness, with important associated benefits for employees (Deci et al., 1989; Hardré & Reeve, 2009). In short, need-supportive managers begin from the employee's perspective and encourage self-initiation and self-direction, remain positive that the employee can succeed, and develop a warm interpersonal climate (see also Niemiec & Coulson, 2017; Niemiec et al., 2014; Williams et al., 2011). Indeed, employees tend to thrive and flourish in need-supportive work climates (for a review, see Deci et al., 2017), and the aforementioned reflections on how to optimize workplace experiences are broadly applicable to "unit leaders" (examined herein, who themselves often have supervisors) and to "rank and file" employees, given that the adverse consequences associated with basic psychological need frustration are theorized to detract from healthy functioning regardless of one's status in an organization.

Several limitations deserve mention. First, although the data were gathered at two time points over 15 months, they were correlational and thus cannot be used to infer causality. It is important for future research to replicate this study using more complex, longitudinal designs with more than two time points. In doing so, investigators can begin to examine the direction of associations within the model of employee sleep that was examined in the current study. As well, the possibility of "reverse causality" could be tested using such designs. In addition, it is important for future research to develop randomized clinical trials designed to examine effects of need-supportive interventions in the workplace on sleep quality and mental health. Second, there was considerable attrition across the 15-month study period. This is common in multi-wave research, and it is notable that missing values were imputed with recommended analytic procedures. Third, all data were collected using self-report. It is important for future research to replicate this study using objective measures of sleep quality that are not prone to common

method bias, such as “wearable” technology. Fourth, in the current study sleep disturbance was operationalized using the core symptoms of insomnia (American Psychiatric Association, 2013), yet it remains difficult to capture the complexities of sleep using such a limited number of items (cf. Linton et al., 2015). Although previous research has almost exclusively used self-report assessments of sleep (cf. Litwiller et al., 2017), and shorter assessments of sleep tend to have a strong amount of association with their more complete counterparts (Hahn, Binnewies, Sonnentag, & Mojza, 2011), it is important for future research to use a more robust set of self-report and objective measures of sleep disturbance (also, sleep quality and/or sleep quantity) to obtain a more complete understanding of the complexities of sleep. Fifth, the respondents reported their personal experiences of basic psychological need frustration at work *in general*, sleep disturbance *during the last month*, and anxiety and depressive symptoms *during the last week*. Such a measurement strategy made it not possible to evaluate competing models in this initial application of SDT to the interplay between work and sleep, as changes in anxiety and depressive symptoms *during the last week* cannot produce change in sleep disturbance *during the last month*. It is important for future research to utilize a measurement strategy that affords the opportunity to examine plausible alternative models, especially given that previous studies have revealed bi-directional associations between sleep and mental ill health (Alvaro, Roberts, & Harris, 2013; Jansson-Fröjmark & Lindblom, 2008).

Having highlighted these five limitations, we recommend that future research focus on the development of workplace interventions that are intended to enhance need satisfaction *and* limit need frustration and examine their effects on sleep quality and mental health. To date, no such interventions exist, yet we envision that such interventions—based on SDT—could train managers in the principles of need support (see Deci et al., 1989; Hardré & Reeve, 2009) with an additional focus on limiting practices that are likely to be perceived by employees as need thwarting. Of course, the scope of such interventions could be expanded beyond managers to

include training for employees in how to maximize opportunities for job resources (e.g., skill variety and task significance) and minimize exposure to job demands (e.g., role ambiguity and conflict), which predict need satisfaction and need frustration in theoretically consistent ways (Trépanier et al., 2015). With a blend of “top down” and “bottom up” approaches and a focus on enhancing need satisfaction and limiting need frustration, such interventions could advance our understanding of how to optimize motivation and promote psychological well-being and physical health at work. As well, we recommend that future research focus on more complex, longitudinal designs that can be used to determine “directionality” among basic psychological need frustration, sleep disturbance, and mental ill health. Finally, we recommend that future research focus on a more robust set of self-report and objective measures of sleep disturbance. Such methodological improvements would advance the promising results of the current study.

Conclusion

In a two-wave study, health care workers were more likely to report sleep disturbance, anxiety, and depressive symptoms when their autonomy, competence, and relatedness were experienced as frustrated at work. These findings contribute to a growing literature on how maladaptive motivational factors in the workplace relate to dysfunction among employees and highlight basic psychological need frustration as a potential target of intervention for research using SDT. It is important that organizational and clinical interventions that support the basic psychological needs be designed, implemented, and evaluated to reduce (potentially) the sleep disturbance, anxiety, and depressive symptoms that appear to arise in need-frustrating social contexts.

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Footnotes

1. As implied, data for the current study are part of a larger project on occupational health among municipal health care leaders. Of note, the focus of the current study is unique relative to the focus of Olafsen et al. (2017) on stress, somatic symptom burden, and various work-related outcomes and the focus of Olafsen et al. (2021) on mindfulness as a moderator of the adverse association between basic psychological need frustration and work-related outcomes.
2. Concern about dependencies in the data based on participant location was mitigated by the observation that 63.4% of the 131 municipalities sampled were represented by one respondent only, and that an additional 21.4% of the 131 municipalities sampled were represented by two respondents only. It is also not justified to examine dependencies in the data at the level of the unit (or organization), as each respondent (i.e., unit leader) was responsible for managing one unit (or organization)—thereby rendering equivalent the respondent, unit, and organization.
3. To manage the ratio of sample size to model complexity in testing the models relevant to Hypotheses 2-3, these four latent constructs were created using unstandardized residuals that reflect change in the study variables from baseline to 15 months.
4. The Hospital Anxiety and Depression Scale (Mykletun et al., 2001) consists of seven items that assess experiences of anxiety and seven items that assess experiences of depressive symptoms. It is important to note that among the items that assess experiences of anxiety, six of these items are worded for the presence of anxiety (see sample item) and one of these items is worded for the absence of anxiety (viz., I can sit at ease and feel relaxed). Also, among the items that assess experiences of depressive symptoms, five of these items are worded for the absence of depressive symptoms (see sample item) and two of these items are worded for the presence of depressive symptoms (viz., I feel as if I am slowed down, I have lost interest in my appearance). Interestingly, the three items that were dropped due to poor factor loadings

(listed herein) are the only reverse-scored items in the Hospital Anxiety and Depression Scale. Theoretically, then, we speculate that these reverse-scored items might not be direct antipodes of the non-reverse-scored items, thereby yielding poor factor loadings.

5. In *post hoc* analyses, the relations of change in basic psychological need frustration to changes in anxiety and depressive symptoms through change in sleep disturbance were tested in separate models. For anxiety, the fit of the model to the data was acceptable, $\chi^2 (df = 95) = 100.40$, *ns*; $\chi^2/df = 1.06$; CFI = .99; IFI = .99; RMSEA = .015 (90% CI: .000, .036), and change in sleep disturbance related positively to change in anxiety ($\beta = .32$, $p < .05$). For depressive symptoms, the fit of the model to the data was acceptable, $\chi^2 (df = 80) = 112.08$, $p < .01$; $\chi^2/df = 1.40$; CFI = .95; IFI = .95; RMSEA = .039 (90% CI: .020, .055), but change in sleep disturbance was unrelated to change in depressive symptoms ($\beta = -.17$, *ns*).

Table 1

Means, Standard Deviations, and Intercorrelations for the Study Variables.

Variable	M_{BL}	SD_{BL}	M_{15m}	SD_{15m}	1	2	3	4	5	6	7	8	9	10
1. Basic psychological need frustration	2.04	0.63	2.02	0.65	---	.45*	.64***	.36**	.03	-.07	.06	.11	-.03	.06
2. Sleep disturbance	1.75	0.69	1.77	0.66	.50***	---	.55**	.05	-.11	-.07	-.01	.09	-.12	.07
3. Anxiety	1.58	0.45	1.56	0.50	.52***	.66***	---	.24*	.06	-.14	.06	.10	-.12	.04
4. Depressive symptoms	1.43	0.43	1.44	0.52	.36***	.37***	.33***	---	.02	-.01	-.06	.25**	-.27**	.10
5. Gender	1.77	0.42	1.77	0.42	.06	-.13 ⁺	.03	-.02	---	---	---	---	---	---
6. Age	3.52	0.89	3.52	0.89	-.03	.10	-.11	.01	-.01	---	---	---	---	---
7. Smoking status	1.24	0.43	1.24	0.43	-.02	.09	-.02	.08	.06	-.01	---	---	---	---
8. Alcohol use	3.38	1.37	3.38	1.37	.06	.13 ⁺	-.06	-.05	-.11 ⁺	.09	-.08	---	---	---
9. Physical activity	2.61	1.06	2.61	1.06	-.11	-.14 ⁺	-.13 ⁺	-.17*	-.10	-.02	-.21***	.14*	---	---
10. Weight	76.02	14.23	76.02	14.23	-.04	-.02	.00	-.03	-.55***	.09	-.09	-.08	-.03	---

Note. Intercorrelations for the study variables at baseline (along with the auxiliary variables at baseline) are presented below the diagonal. Intercorrelations for change in the study variables from baseline to 15 months (along with the auxiliary variables at baseline) are presented above the diagonal. Intercorrelations among the auxiliary variables at baseline are presented below the diagonal only in order to reduce redundancy in the table. **Gender** was coded as 1 (*male*) and 2 (*female*). **Age** was coded as 1 (< 29 years), 2 (30 – 39 years), 3 (40 – 49 years), 4 (50 – 59 years), and 5 (> 60 years). **Smoking status** was coded as 1 (*no*) and 2 (*yes*). **Alcohol use** was coded as 1 (*never*), 2 (*1 time per month*), 3 (*2 – 3 times per month*), 4 (*1 time per week*), 5 (*2 – 3 times per week*), and 6 (*4 – 7 times per week*). **Physical activity** (moderate to vigorous) was coded as 1 (*never*), 2 (< 1 hour per week), 3 (1 – 2 hours per week), and 4 (> 3 hours per week). **Weight** was recorded in kilograms.

⁺ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Figure Captions

Figure 1. The conceptual model for this study.

Figure 2. The structural equation model, with standardized parameter estimates, examining the associations among basic psychological need frustration, sleep disturbance, anxiety, and depressive symptoms at baseline while modeling gender, age, smoking status, alcohol use, physical activity, and weight as auxiliary variables. $^+p < .10$, $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Figure 3. The structural equation model, with standardized parameter estimates, examining the associations among changes in basic psychological need frustration, sleep disturbance, anxiety, and depressive symptoms from baseline to 15 months while modeling gender, age, smoking status, alcohol use, physical activity, and weight as auxiliary variables. $^+p < .10$, $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Figure 4. The structural equation model, with standardized parameter estimates, examining the indirect effect of change in basic psychological need frustration on changes in anxiety and depressive symptoms through change in sleep disturbance from baseline to 15 months while modeling gender, age, smoking status, alcohol use, physical activity, and weight as auxiliary variables. $^+p < .10$, $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Figure 1. The conceptual model for this study.

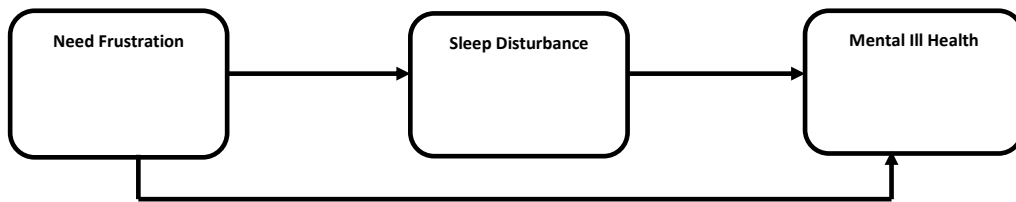


Figure 2. The structural equation model, with standardized parameter estimates, examining the associations among basic psychological need frustration, sleep disturbance, anxiety, and depressive symptoms at baseline while modeling gender, age, smoking status, alcohol use, physical activity, and weight as auxiliary variables. $^+p < .10$, $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$.

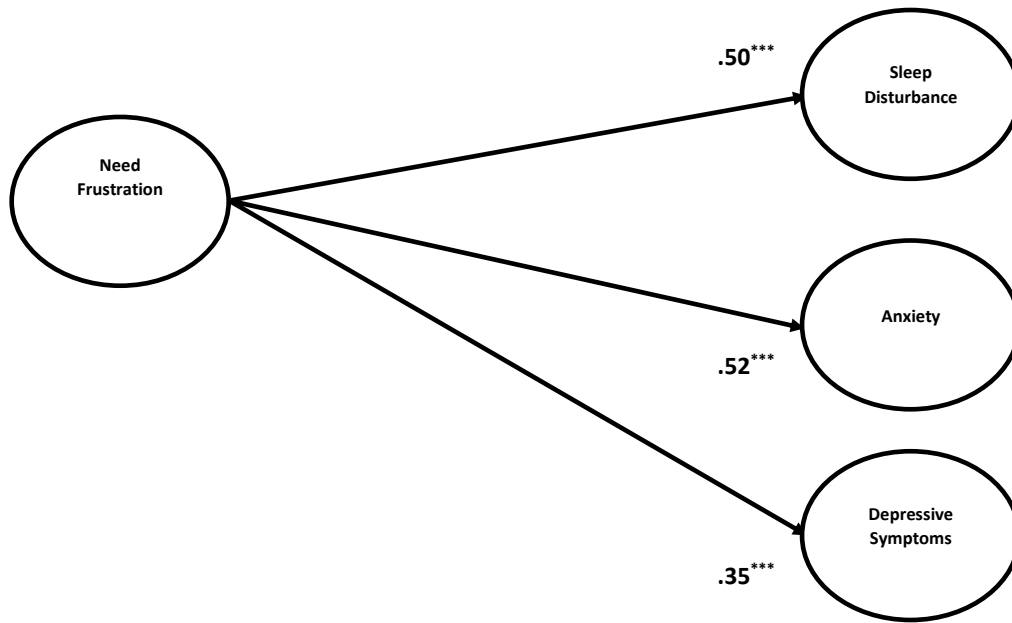


Figure 3. The structural equation model, with standardized parameter estimates, examining the associations among changes in basic psychological need frustration, sleep disturbance, anxiety, and depressive symptoms from baseline to 15 months while modeling gender, age, smoking status, alcohol use, physical activity, and weight as auxiliary variables. $^+p < .10$, $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$.

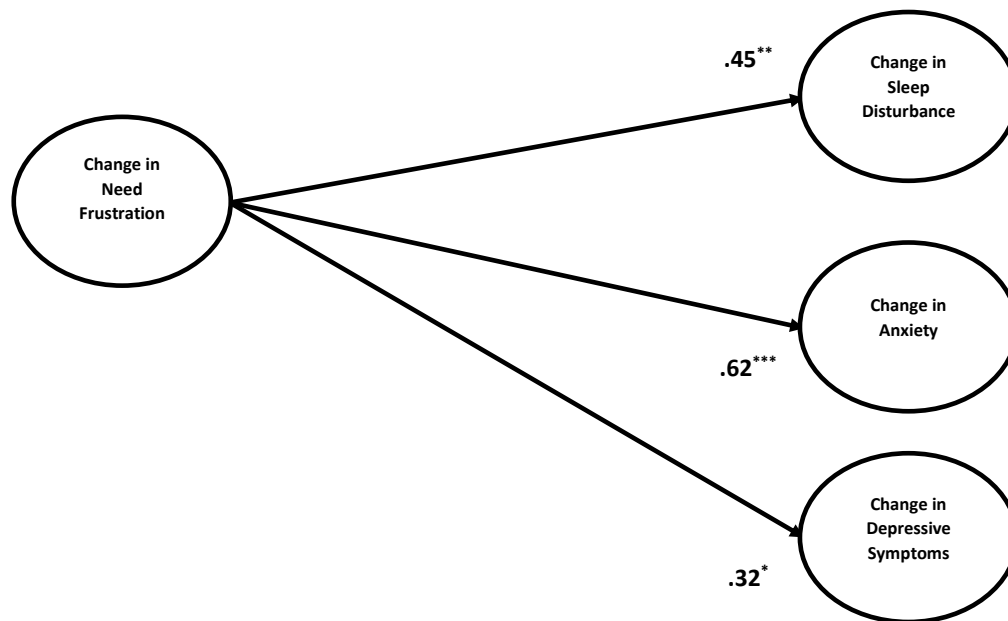


Figure 4. The structural equation model, with standardized parameter estimates, examining the indirect effect of change in basic psychological need frustration on changes in anxiety and depressive symptoms through change in sleep disturbance from baseline to 15 months while modeling gender, age, smoking status, alcohol use, physical activity, and weight as auxiliary variables. [†] $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

