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Fulfilling psychological needs predicts less sleep disruption and worry while awaiting uncertain news

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Abstract

Research on self-determination theory suggests that people have fundamental needs to feel autonomous, competent, and socially connected and that fulfilling these needs is critical for well-being. In the present study, we examined whether fulfilling psychological needs is associated with physical and psychological well-being—specifically sleep disruption and worry, two key indicators of well-being during waiting periods—while managing the unique stress of awaiting uncertain news. In a study of law graduates during the 4 months while they awaited their California bar exam (the exam one is required to pass before practicing law) results, personal increases in need fulfilment related to temporally congruent reductions in sleep disruption and worry. In addition, those whose needs were most fulfilled during the waiting period responded less negatively to failing the bar exam. The picture for need frustration was mixed; only autonomy frustration was associated with concurrent increases in worry, although those whose needs were more frustrated in general also experienced greater worry and sleep disruption on average. On the whole, our findings suggest that self-determination theory needs may be a fruitful target for interventions that can protect well-being while people wait and even once their uncertainty is resolved.

KEYWORDS

bar exam, self-determination, sleep, waiting, worry

1 | INTRODUCTION

Few people feel at their best when they are uncertain about an important future outcome (e.g., Sweeny & Falkenstein, 2015). Whether facing professional uncertainty (Will I get that job? Will I be laid off?), academic uncertainty (Will I pass that test? Did I get into my dream school?), health-related uncertainty (Do I have cancer? Is the treatment going to work?), or uncertainty in one's personal life (Will she call me back after our date? Will they accept our offer on the house?), people typically report high levels of anxiety and unpleasant, repetitive thoughts as they await uncertain news (Sweeny & Andrews, 2014; Sweeny & Falkenstein, 2015). Although these stressful experiences are typically temporary, they are quite common, and the worry that accompanies them can impair functioning, decrease well-being, and even disrupt health and sleep (Howell & Sweeny, 2016; Montgomery & McCrone, 2010; Sweeny, Reynolds, Falkenstein, Andrews, & Dooley, 2016). In the current study, we examined whether the fulfilment of fundamental psychological needs (i.e., autonomy, competence, and relatedness, Ryan & Deci, 2017) could buffer known ill effects of uncertainty and whether need frustration might exacerbate these ill effects. Specifically, we investigated whether fulfilment and frustration of autonomy, competence, and relatedness needs predicted key markers of waiting-related distress (i.e., worry and sleep disruption) among law graduates waiting to learn whether they passed the bar exam.

2 | THE RELATIONSHIP BETWEEN NEED FULFILMENT AND WELL-BEING

Self-determination theory (SDT) posits that three fundamental psychological needs are central to optimal human functioning (Ryan & Deci, 2017). First, people need a sense of autonomy, the feeling that they are in control of their behaviour and that their behaviour reflects their desires and values. Second, people need a sense of competence, the feeling of having mastery in important domains. Third, people need a sense of relatedness, the feeling of being connected to and supported by others. When these needs are fulfilled, people thrive; when they are frustrated, well-being—one's general physical and mental health—suffers (Ryan & Deci, 2017; Weinstein & Ryan, 2011).

In fact, a number of studies have empirically linked these three fundamental psychological needs to various markers of well-being. Broadly speaking, when people experience greater autonomy, competence, and relatedness, they also show better processing of stressful events, appraise stressors as challenging rather than threatening, use more adaptive coping strategies, and report greater vitality (see Weinstein & Ryan, 2011 for a review). At a day-to-day level, several studies have shown that fluctuations in the fulfilment and frustration of these needs are associated with fluctuations in general well-being, mood, physical symptoms, and vitality, such that greater need fulfilment on a given day predicted greater well-being on that day (Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Sheldon, Ryan, & Reis, 1996). These studies broadly suggest that need fulfilment promotes well-being in daily life, whereas need frustration undermines well-being—though fulfilment and frustration seem to operate through slightly different pathways (Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015). Our study goes a step further to investigate whether fulfilling SDT needs might buffer well-being during a period of stressful uncertainty and whether need frustration might exacerbate the ill effects of stressful uncertainty.

Fulfilment of the needs for autonomy, competence, and relatedness may be both particularly important and particularly challenging when people are uncertain about an important future outcome. Waiting periods like those described at the beginning of the article (e.g., waiting for news of lay-offs, waiting for a biopsy result) are distinct from many other types of stressors in that they are characterized by a unique combination of high uncertainty about and low control over an outcome (Sweeny, 2018). Some stressful events are largely out of the sufferers' control but provide a sense of certainty about the situation at hand. For example, after losing a loved one or receiving a diagnosis of cancer, the outcome is known but uncontrollable. Other stressful events entail a high degree of uncertainty about the outcome but allow people to exert control. For example, when preparing for an upcoming exam or job interview, the outcome is uncertain but people can take some action to control it. Waiting for important news poses a particular challenge for well-being because people can neither control nor gain certainty about the outcome (Howell & Sweeny, 2016; Sweeny & Falkenstein, 2015).

Furthermore, waiting periods likely frustrate fundamental psychological needs. When one lacks the ability to control an outcome, one necessarily lacks autonomy (Deci & Ryan, 1987). Additionally, during a waiting period, the time to demonstrate competence has often passed (e.g., after one takes an exam), creating a challenge to competence needs. Finally, recent evidence suggests that perceived relatedness is also frustrated in these moments, particularly towards the middle of prolonged waiting periods, presumably because those supporting others who are stuck in protracted waiting periods have few options for providing continued support regarding an uncontrollable and uncertain stressor (Dooley, Sweeny, Howell, & Reynolds, 2018).

We know of only one study that has addressed the role of need fulfilment in buffering against the stress of uncertainty. Professional dancers completed measures of autonomy, competence, and relatedness several weeks before a solo performance, and they then reported stress appraisals and anxiety and provided cortisol samples shortly before the performance. Dancers whose fundamental psychological needs were relatively fulfilled appraised the performance more as a challenge than a threat, reported less anxiety, and showed more resilient cortisol patterns compared with their less-fulfilled counterparts (Quested et al., 2011). Of course, preparing for a solo performance confers considerably more control than simply awaiting news from an important exam (the context for the present study), but this study provides initial evidence that maintaining high levels of need fulfilment in the face of uncertainty can buffer against the ill effects of stress.

3 | NEED FULFILMENT, WAITING, AND KEY MARKERS OF WELL-BEING

Two key markers of well-being that are particularly relevant during uncertain waiting periods are worry and sleep disruption (Howell & Sweeny, 2016; Sweeny & Falkenstein, 2015). In the present inquiry, we focus on these two key well-being markers. We operationalize worry as a combination of anxiety and repetitive thoughts about a feared future outcome (Sweeny & Dooley, 2017). Previous work established anxiety as the emotional hallmark of waiting periods (Sweeny & Falkenstein, 2015), and people report frequent perseverative thinking as they await news about an important outcome (Howell & Sweeny, 2016; Sweeny et al., 2016; Sweeny & Falkenstein, 2015). Worry is an uncertainty-specific experience, elicited by attention towards an unknown and thus uncertain future state, and thus, it serves as a proxy measure of the intensity of uncertainty in our study. By examining worry in our study, we extend work on the links between need satisfaction and stress more broadly to determine whether satisfaction of autonomy, competence, or relatedness needs buffer the particular form of distress associated with uncertainty.

Regarding sleep disruption, a previous study of law graduates awaiting bar exam results also documented considerable sleep disruption, and this disruption was particularly acute at times when people were feeling the most uncertain (i.e., at the start and end of the waiting period; Howell & Sweeny, 2016). Several studies have established links between both need fulfilment and frustration and

worry (e.g., in dental patients, Halvari, Halvari, Bjørnebekk, & Deci, 2010; in the general population, Johnston & Finney, 2010) and both need fulfilment and frustration and both sleep quality and quantity (Campbell et al., 2015); however, our study differs from previous work in its focus on an acute experience of stressful uncertainty.

4 | THE PRESENT INQUIRY

In the present study, we draw on SDT and prior work on awaiting uncertain news to examine whether experiencing greater fulfilment and less frustration of autonomy, competence, and relatedness during a waiting period is associated with a better subjective waiting experience and a less negative affective response to failure. Specifically, we investigated whether greater satisfaction of the three fundamental psychological needs was associated with less worry and sleep disruption and whether greater frustration of the three fundamental psychological needs was associated with increased worry and sleep disruption among law school graduates awaiting their bar exam results.

As noted earlier, waiting for uncertain news likely frustrates autonomy and competence needs, and previous research points to frustration of relatedness needs during waiting periods as well. Thus, it may be particularly important to find sources of need satisfaction in these moments of acute uncertainty. To this end, we employed longitudinal methods to examine whether personal fluctuations in need fulfilment and frustration predict personal fluctuations in worry and sleep disruption. We also examined whether need fulfilment and frustration during the waiting period predicted affective reactions to learning that one passed or failed the bar exam.

Examining the experience of law graduates while they await bar exam results is useful for three reasons. First, the waiting period for the bar exam starts and ends on the same day for every law graduate, providing a clear beginning, middle, and end of the waiting period, and it is the same length for all participants. Second, the wait for California bar exam results lasts 4 months, allowing us to examine longitudinal trends in the experience. Finally, the bar exam is a high-stakes context (failing the bar exam means one cannot immediately practice law), and therefore, participants are likely to experience levels of waiting-related distress that they might not experience in lower stakes waiting contexts (e.g., while waiting for class quiz results).

5 | METHOD

5.1 | Participants

Participants were 89 law school graduates (50 men, 39 women) participating in exchange for an Amazon.com gift card ($10 per questionnaire they completed). Participants were primarily White (61.4%), followed by multiple races/ethnicities (15.9%), Asian (11.4%), Black or African-American (5.7%), and Latins (4.5%); 1.1% declined to state their race. Participants ranged in age from 24 to 44 years (M = 28.2 years, SD = 4.0). All participants took the California bar exam in July 2014 and received their results in November 2014. We initially aimed to recruit 100 participants given our financial resources for the study. However, we stopped recruitment 2 weeks prior to the bar exam to ensure that all participants completed the initial measures well before the first day of the exam. All procedures were approved by the University of California, Riverside Institutional Review Board.

5.2 | Procedure

Participants completed a total of eight questionnaires. The first survey occurred just before participants took the bar exam (8 days before the exam on average), and the last survey occurred immediately after they received their results (an average of 22.5 hr after results was posted online). The middle six surveys and the final survey are the primary focus of the present inquiry. The middle six surveys occurred at approximately equally spaced periods during the 4-month waiting period, starting 1 week after participants completed the bar exam and ending just before participants received their results (an average of 6 min before results were posted). When we discuss time points in the present study, we refer to these waiting period time points as Times 1 through 6. We do so for ease of interpretation even though the surveys actually represent the second through seventh survey. Participation rates for each survey wave were approximately 100% (Wave 1), 88% (Wave 2), 83% (Wave 3), 83% (Wave 4), 78% (Wave 5), 81% (Wave 6), 77% (Wave 7), and 86% (Wave 8).

Participants were also assigned to one of two types of meditation strategies (mindfulness or loving-kindness). The effectiveness of these strategies is the topic of another inquiry using these data (Sweeny & Howell, 2017), so we do not report those results here. Importantly, however, the pattern of effects presented here occurred even when controlling for condition, and condition did not interact with psychological needs in predicting any of the outcomes. Tables S1 and S2 present the results of the analyses including condition's main effect and interactions with our variables of interest—none of which are significant. The findings presented here include all participants involved in the larger study; the broader study included the manipulation just described and additional measures not relevant to the present inquiry.

5.3 | Measures

Here, we focus on the five measures of interest: (a) psychological need fulfilment, (b) self-reported sleep disruption, (c) worry, (d) post news positive affect, and (e) post news negative affect. Cronbach's alphas, means, and standard deviations for all time-varying measures at each time point appear in Table 1. A full list of measures are available at https://osf.io/6a7sx/ and deidentified data are available upon request, per Institutional Review Board requirements. Analysis scripts and results are available https://osf.io/tnfv6/

TABLE 1 Cronbach's alphas, means, and standard deviations for all time-varying variables

	Relatedness				Competence				Autonomy				Sleep Disruption		Worry	
	Satisfaction		Frustration		Satisfaction		Frustration		Satisfaction		Frustration					
	α	*M (SD)*	α	*M (SD)*	α	*M (SD)*	α	*M (SD)*	α	*M (SD)*	α	*M (SD)*	α	*M (SD)*	α	*M (SD)*
Waiting 1	0.85	4.03 (0.76)	0.62	2.28 (0.92)	0.88	3.08 (1.04)	0.75	2.30 (0.98)	0.57	3.63 (0.73)	0.67	2.49 (0.95)	0.64	1.77 (0.44)	0.85	2.54 (1.05)
Waiting 2	0.83	3.99 (0.85)	0.67	2.36 (0.89)	0.86	3.19 (0.98)	0.80	2.52 (1.05)	0.73	3.57 (0.81)	0.54	2.83 (0.96)	0.78	1.81 (0.47)	0.85	2.26 (0.93)
Waiting 3	0.90	3.73 (0.87)	0.58	2.37 (0.85)	0.85	3.24 (0.89)	0.82	2.59 (1.03)	0.80	3.34 (0.88)	0.71	2.83 (0.93)	0.73	1.87 (0.48)	0.90	2.52 (1.07)
Waiting 4	0.86	3.72 (0.84)	0.70	2.33 (0.86)	0.87	3.27 (0.90)	0.73	2.56 (0.96)	0.72	3.30 (0.91)	0.66	2.73 (0.91)	0.75	1.83 (0.48)	0.93	2.51 (1.16)
Waiting 5	0.88	3.62 (0.79)	0.74	2.27 (0.89)	0.87	3.43 (0.96)	0.77	2.43 (0.96)	0.80	3.19 (0.92)	0.64	2.82 (0.94)	0.74	1.83 (0.47)	0.92	2.78 (1.19)
Waiting 6	0.84	3.69 (0.81)	0.58	2.39 (0.84)	0.80	3.30 (0.87)	0.76	2.56 (0.94)	0.81	3.25 (0.95)	0.63	2.90 (0.92)	0.86	1.98 (0.64)	0.92	3.64 (1.18)

5.3.1 | Psychological need satisfaction and frustration

We assessed the extent to which participants felt that their fundamental psychological needs were fulfilled and unfulfilled in each survey using the 18-item Balanced Measure of Psychological Needs Scale (Sheldon & Hilpert, 2012). Consistent with recommendations for scoring the scale, we computed separate scores for *need satisfaction* and *need frustration*. Participants indicated the extent to which they felt satisfied in relatedness (e.g., "I felt close and connected with other people who are important to me;" three items) competence (e.g., "I took on and mastered hard challenges:" three items), and autonomy (e.g., "I was free to do things my own way;" three items) in the past week (1 = *not at all* to 7 = *completely*). They also indicated extent to which they felt frustrated in relatedness (e.g., "I was lonely;" three items), competence (e.g., "I did something that made me feel incompetent:" three items), and autonomy (e.g., "I had people telling me what to do;" three items). We treated each of these indices separately for analyses.

5.3.2 | Sleep disruption

We measured subjective sleep disruption at each waiting time point with three items adapted from the Sleep Hygiene Index (Mastin, Bryson, & Corwyn, 2006) and five items adapted from the Pittsburg Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989), consistent with an earlier inquiry into sleep disruption while awaiting uncertain news (Howell & Sweeny, 2016). From the Sleep Hygiene Index, we used the items "I stay in bed longer than I should two to three times a week," "I go to bed feeling stressed, angry, upset, or nervous," and "I think, plan, or worry when I am in bed" (1 = *never*, 4 = *always*). From the Pittsburg Sleep Quality Index, we used the items "During the past two weeks, how often have you had trouble sleeping because…you cannot get to sleep within 30 minutes?" "…you had bad dreams?" "…you wake up in the middle of the night or early morning?" and "… of other reasons?" (1 = *not in the past two weeks*, 4 = *three or more times a week*), and "During the past two weeks, how would you rate the quality of your sleep overall?" (1 = *very good*, 4 = *very bad*).

5.3.3 | Worry

We measured participants' worry using a combination of three items that capture both the cognitive and emotional components of worry. One item assessed repetitive thoughts about the bar exam ("I can't seem to stop thinking about the bar exam"), and two assessed anxiety about the bar exam ("I feel anxious every time I think about the bar exam," "I am worried about my bar exam results;" 1 = *strongly disagree*, 7 = *strongly agree*; (Sweeny & Howell, 2017; Sweeny, Kwan, & Falkenstein, 2017; Tran, Dooley, Ramirez-Loyola, Andrews, & Sweeny, 2017).

5.3.4 | Positive and negative affect

Participants completed four positive emotion items (happy, pleased, joyful, enjoyment/fun) and five negative emotion items (worried/anxious, angry/hostile, frustrated, depressed/blue, unhappy) adapted from the Affect Adjective Checklist (Warr, Barter, & Brownbridge, 1983) at each time point (1 = *very slightly or not at all*, 5 = *extremely*). Here, we focus on positive and negative affect in response to learning they passed or failed the exam.

In the final survey, participants answered the question, "Did you pass the bar exam?" 22 participants reported failing (28.6% of respondents) and 55 reported passing (71.4% of respondents). We analysed the positive and negative affective responses of the two group separately (Cronbach's αs > 0.75; for participants who failed, $M_{positive}$ = 2.34, $SD_{positive}$ = 1.48, $M_{negative}$ = 3.48, $SD_{negative}$ = 1.52; for participants who passed: $M_{positive}$ = 5.82, $SD_{positive}$ = 1.11, $M_{negative}$ = 2.01, $SD_{negative}$ = 0.34).

6 | ANALYSES

We used multilevel modelling (via IBM's SPSS 24 Linear Mixed Models package) to investigate three questions: (a) What are the temporal trends in autonomy, competence, and relatedness? Specifically, do they show negative linear trends and positive quadratic trends observed in health and well-being in other research (Sweeny & Andrews, 2014; Sweeny & Falkenstein, 2015; Sweeny & Howell, 2017)? (b) Does experiencing relatedness, autonomy, and competence predict lower levels of worry and sleep disruption as people wait? and (c) Does experiencing relatedness, autonomy, and competence during the waiting period predict emotional reactions to passing and failing the exam?

First to examine change over time, we entered linear (centred around the midpoint) and quadratic (squared midpoint-centered linear) time predicting relatedness, autonomy, and competence. Next, we examined whether between-person differences and within-person variations in relatedness, autonomy, and competence predicted between-person differences and within-person variations in worry and sleep disruption. As the equation below shows, we entered two forms of relatedness, autonomy, and competence: (a) participants' average feelings of relatedness, autonomy, and competence—each as a predictor in a separate multilevel model—across the study (*between person*, grand-mean centred, b_{10}) as well a time-varying measure of feelings of relatedness, autonomy, and competence—each as a predictor in a separate multilevel model—at each time point of the study (*within person*, person-mean centred, b_{20}). A negative relationship between between-person need fulfilment (b_{10}) and worry/sleep disruption would indicate that people who felt more related, competent, and autonomous on average also experienced less worry and sleep disruption on average. A negative relationship between within-person need fulfilment (b_{20}) and worry/sleep disruption would indicate that when people experienced personally high levels of relatedness, competence, and autonomy, they also experienced personally low levels of worry or sleep disruption.

In addition to including between- and within-person need fulfilment in our model, we also included midpoint–centred linear and quadratic time and their interactions with the SDT predictors. We did so because prior research has demonstrated both linear and quadratic temporal trends in worry (e.g., Sweeny & Andrews, 2014) and sleep disruption (Howell & Sweeny, 2016). As such, including these time trends and their interactions ensures that any relationship between need fulfilment and sleep disruption or worry is not simply a spurious effect resulting from the synchronous time trends. Our final multilevel equation was as follows:

$$\begin{aligned} &\textit{Worry/Sleep Disruption} = b_{00} + (b_{10})\,(\textit{Average Need Satisfaction/Frustration}_{\textit{Grand-Mean Centered}}) + (b_{20})\,(\textit{time - varying Need Satisfaction/Frustration}_{\textit{Person-Mean Centered}}) + (b_{30} + u_{1j})\,(\textit{Time - 3.5}) + (b_{40} + u_{2j})\,(\textit{Time-3.5})^2 + (b_{50})\,(\textit{Time - 3.5} \times \textit{Personal Mean Need Satisfaction/Frustration}_{\textit{Grand-Mean Centered}}) + (b_{60})\,((\textit{Time-3.5})^2 \times \textit{Personal Mean Need Satisfaction/Frustration}_{\textit{Grand-Mean Centered}}) + (b_{70})\,(\textit{Time - 3.5} \times \textit{Time - Varying Need Satisfaction/Frustration}_{\textit{Person-Mean Centered}}) + (b_{80})\,((\textit{Time-3.5})^2 \times \textit{Time - Varying Need Satisfaction/Frustration}_{\textit{Person-Mean Centered}}) + u_{0J} + r_{ij} \end{aligned}$$

Finally, to examine whether experiencing relatedness, autonomy, and competence during the waiting period predicted emotional responses to passing and failing the exam, we averaged participants' relatedness, autonomy, and competence scores during the waiting period and correlated those values with their positive and negative affect after finding out their results. We analysed the responses of those who passed and failed separately and were particularly interested in whether fufilling SDT needs might buffer people from negative emotions after failure. For two reasons, we did not expect to see benefits among people who passed the exam. First, passing itself serves as an affirmation of competence—it suggests that one meets the requirements to be a lawyer—and promotes autonomy—people can continue on their chosen career course and do not need to take the bar exam again. Second,

and consistent with theorizing on SDT needs and stress (Weinstein & Ryan, 2011), we expected that SDT need fulfilment would primarily serve a stress-buffering function, which is largely irrelevant when people receive good news.

7 | RESULTS

7.1 | Changes across the waiting period

Table 2 shows the linear and quadratic trends of need satisfaction and frustration. Two negative linear trends emerged, indicating that people felt decreasingly satisfied in the domains of relatedness and autonomy as the wait continued. By contrast, a positive linear trend of competence emerged indicating that people felt increasingly satisfied in the domain of competence as the wait continued. Time was unrelated to need frustration. Table 2 also shows the linear and quadratic trends of worry and sleep disruption. Both worry and sleep disruption increased linearly across the waiting period. Worry also had a positive quadratic trend indicating that worry was highest at the beginning and end of the waiting period.

7.2 | Need fulfilment, worry, and sleep disruption

Table 3 (sleep disruption) and Table 4 (worry) provide a summary of the results of the full analysis. Our focus, however, was primarily the between- and within-person effects of need satisfaction/frustration on our two primary outcomes, controlling for temporal trends in the variables. As Tables 3 and 4 show, there were several between-persons effects of need satisfaction and frustration on sleep disruption and worry. Lower satisfaction and greater frustration of all three needs on average were associated with greater sleep disruption and worry on average (i.e., six between-persons effects), though the effect of relatedness frustration on sleep disruption had a p value above traditional criterion for significance of $p \leq 0.05$.

TABLE 2 Multilevel modelling estimates of temporal trends in relevant time-varying variables

	Linear Time	Quadratic Time
	b (CI 95%)	
Relatedness		
Satisfaction	−0.08 (−0.12, −0.05)**	0.02 (−0.01, 0.04)
Frustration	0.01 (−0.03, 0.05)	<0.01 (−0.02, 0.02)
Competence		
Satisfaction	0.05 (0.01, 0.09)*	−0.01 (−0.04, 0.01)
Frustration	0.03 (−0.02, 0.08)	−0.02 (−0.05, 0.00)
Autonomy		
Satisfaction	−0.09 (−0.13, −0.05)**	0.01 (−0.01, 0.04)
Frustration	0.05 (0.00, 0.10)	−0.02 (−0.04, 0.01)
Sleep	0.03 (0.01, 0.06)**	<0.01 (−0.01, 0.02)
Worry	0.20 (0.16, 0.24)**	0.10 (0.08, 0.13)**

*$p < 0.05$. **$p < 0.01$.

When it came to need satisfaction, the picture for within-persons effects was similar. There were within-person effects of satisfaction of all three psychological needs on sleep disruption and worry, though the coefficient for competence predicting worry had a p value above traditional criterion for significance of $p \leq 0.05$. Thus, at times when people felt their needs were most satisfied, they showed the least sleep disruption and worry. The findings for frustration were less clear: no significant within-person relationships emerged.

An examination of the interaction effects in the models suggested that these within- and between-person effects were largely unmoderated by time—with two exceptions, both in the context of sleep. First, an interaction emerged between linear time and the between-person effect of competence need satisfaction on sleep, indicating that people's linear sleep trajectories across the waiting period differed as a function of their competence need satisfaction. We examined the effects of linear time on sleep among those highest and lowest in competence need satisfaction using the same multilevel model but with competence satisfaction recentred at high and low levels (+/− 1SD). The results suggested that sleep disruption increased across the waiting period among those who experienced low competence satisfaction on average, $b(79.23) = 0.06$, $SE = 0.02$, $t = 3.68$, $p < 0.001$, but not among those who experienced high competence satisfaction on average, $b(74.46) = 0.01$, $SE = 0.02$, $t = 0.74$, $p = 0.46$.

Second, significant interactions emerged both linear and quadratic time and between-person relatedness satisfaction, indicating that people's sleep trajectories across the waiting period differed as a function of their relatedness need satisfaction. There was also an interaction between linear time and within-person relatedness satisfaction, suggesting that personal changes in relatedness satisfaction differentially predicted personal changes in sleep disruption at different points in the waiting period.

As with competence, we decomposed the between-person interaction by recentring between-person relatedness at high and low levels. The results suggested that sleep disruption increased across the waiting period among those who experienced low relatedness satisfaction on average, $b(83.62) = 0.06$, $SE = 0.02$, $t = 3.55$, $p = 0.001$, but not among those who experienced high relatedness satisfaction on average, $b(72.98) = -0.004$, $SE = 0.02$, $t = -0.28$, $p = 0.78$. By contrast, those who experienced low relatedness satisfaction on average showed no quadratic changes in sleep disruption over time, $b(93.29) = -0.01$, $SE = 0.01$, $t = -0.91$, $p = 0.37$, whereas those who experienced high relatedness satisfaction on average showed the typical positive quadratic trend (worse sleep at the beginning and end of the wait), $b(82.06) = 0.02$, $SE = 0.01$, $t = 1.99$, $p = 0.05$. Taken together with the main effects, these results suggest that people with low relatedness satisfaction experienced increasing sleep disruption throughout the waiting period, whereas those high in relatedness satisfaction experienced sleep disruption primarily at the beginning and end of the wait, less so in the middle—and relatively little sleep disruption overall compared with those with low relatedness satisfaction.

TABLE 3 Results of multilevel models predicting sleep disruption from need satisfaction and frustration

	Relatedness		Competence		Autonomy	
	Satisfaction*b* (CI 95%)	Frustration*b* (CI 95%)	Satisfaction*b* (CI 95%)	Frustration*b* (CI 95%)	Satisfaction*b* (CI 95%)	Frustration*b* (CI 95%)
Main Effects						
Between persons	−0.29 (−0.44, −0.15)**	0.13 (0.00, 0.27)$^{+}$	−0.23 (−0.36, −0.10)**	0.25 (0.13, 0.36)**	−0.25 (−0.39, −0.11)**	0.16 (0.02, 0.30)*
Within persons	−.012 (−0.21, −0.04)**	0.08 (0.00, 0.17)$^{+}$	−0.12 (−0.21, −0.04)**	0.02 (−0.04, 0.09)	−0.19 (−0.27, −0.10)**	0.02 (−0.05, 0.09)
Time	0.03 (0.00, 0.05)*	0.03 (0.01, 0.06)**	0.04 (0.01, 0.06)**	0.03 (0.01, 0.05)*	0.03 (0.00, 0.05)*	0.03 (0.01, 0.05)*
Time x time^2	<0.01 (−0.01, 0.02)	<0.01 (−0.01, 0.02)	<0.01 (−0.01, 0.02)	0.01 (0.00, 0.02)	<0.01 (−0.01, 0.02)	0.01 (−0.01, 0.02)
Interactions						
Between persons x time	−0.05 (−0.08, −0.01)**	0.03 (0.00, 0.06)$^{+}$	−0.03 (−0.07, 0.00)*	0.02 (−0.01, 0.05)	−0.02 (−0.06, 0.01)	0.02 (−0.02, 0.05)
Within persons x time	−0.04 (−0.08, 0.00)*	0.03 (−0.01, 0.06)	0.01 (−0.02, 0.04)	−0.01 (−0.04, 0.02)	−0.01 (−0.05, 0.02)	0.01 (−0.02, 0.04)
Between persons x time^2	0.02 (0.00, 0.04)*	0.01 (−0.01, 0.02)	<0.01 (−0.02, 0.02)	0.01 (−0.01, 0.03)	<0.01 (−0.01, 0.02)	0.01 (−0.01, 0.02)
Within persons x time^2	<0.01 (−0.02, 0.03)	<0.01 (−0.02, 0.02)	0.02 (0.00, 0.04)$^{+}$	0.01 (−0.01, 0.03)	0.02 (0.00, 0.04)$^{+}$	0.01 (−0.01, 0.03)

Note. The main effects are the primary effects of interest. The time trends and interactions are secondary and exploratory effects.

$^{+}p < 0.10$. *$p < 0.05$. **$p < 0.01$.

TABLE 4 Results of Multilevel Models Predicting Worry from Need Satisfaction and Frustration

	Relatedness		Competence		Autonomy	
	Satisfaction*b* (CI 95%)	Frustration*b* (CI 95%)	Satisfaction*b* (CI 95%)	Frustration*b* (CI 95%)	Satisfaction*b* (CI 95%)	Frustration*b* (CI 95%)
Main Effects						
Between persons	−0.50 (−0.83, −0.17)**	0.38 (0.07, 0.68)*	−0.67 (−0.94, −0.39)**	0.62 (0.36, 0.88)**	−0.54 (−0.86, −0.21)**	0.44 (0.12, 0.77)**
Within persons	−0.21 (−0.37, −0.04)*	0.11 (−0.05, 0.27)	−0.14 (−0.30, 0.02)$^{+}$	0.03 (−0.11, 0.16)	−0.23 (−0.39, −0.07)**	0.09 (−0.04, 0.23)
Time	0.19 (0.15, 0.24)**	0.20 (0.16, 0.24)**	0.21 (0.16, 0.25)**	0.19 (0.15, 0.24)**	0.19 (0.15, 0.24)**	0.20 (0.16, 0.24)**
Time x time^2	0.11 (0.08, 0.13)**	0.11 (0.08, 0.13)**	0.11 (0.08, 0.13)**	0.11 (0.08, 0.13)**	0.11 (0.08, 0.14)**	0.11 (0.08, 0.13)**
Interactions						
Between persons x time	0.02 (−0.05, 0.09)	−0.06 (−0.12, 0.01)$^{+}$	−0.02 (−0.09, 0.04)	0.01 (−0.05, 0.07)	−0.03 (−0.10, 0.04)	−0.03 (−0.09, 0.03)
Within persons x time	<0.01 (−0.07, 0.07)	−0.01 (−0.08, 0.06)	−0.02 (−0.09, 0.04)	−0.05 (−0.11, 0.01)$^{+}$	0.05 (−0.02, 0.12)	<0.01 (−0.06, 0.07)
Between persons x time^2	0.02 (−0.02, 0.06)	<0.01 (−0.04, 0.03)	0.02 (−0.02, 0.05)	<0.01 (−0.03, 0.04)	0.02 (−0.02, 0.06)	<0.01 (−0.04, 0.04)
Within persons x time^2	0.02 (−0.03, 0.06)	0.00 (−0.05, 0.04)	0.01 (−0.03, 0.06)	−0.01 (−0.05, 0.03)	0.03 (−0.01, 0.08)	0.00 (−0.04, 0.04)

Note. The main effects are the primary effects of interest. The time trends and interactions are secondary and exploratory effects.

$^{+}p < 0.10$. *$p < 0.05$. **$p < 0.01$.

To decompose the within-person interaction, we recentred time at the middle of the beginning (T2) and end of the waiting period (T5) so that we could examine when the moment-to-moment relationship between relatedness satisfaction and health was strongest. The results suggested that the relationship grew stronger over time. At the beginning of the waiting period, personal changes in relatedness satisfaction were unrelated to sleep disruption, $b(318.02) = -0.07$, $SE = 0.05$, $t = -1.33$, $p = 0.18$. By contrast, at the end of the waiting period, personal highs in relatedness satisfaction predicted personal lows in sleep disruption, $b(328.65) = -0.19$, $SE = 0.05$, $t = -3.46$, $p = 0.001$.

7.3 | Need satisfaction/frustration and responses to news

7.3.1 | Responses to failing

Table 5 shows the correlations between each type of need satisfaction/frustration (averaged over the waiting period) and positive and negative affective responses to failing the exam. Recall that 22 participants failed the bar exam; tests of reactions to failing only include these participants. Most of the correlations were sizable, excepting the correlation between competence frustration positive affect. Nevertheless, likely because of the small number of people who failed the exam, only four correlations reached the traditional level of significance: a negative correlation between relatedness satisfaction and negative affect, a positive correlation between competence satisfaction and positive affect, a positive correlation between autonomy satisfaction and positive affect, and a negative correlation between autonomy satisfaction and negative affect. Three other correlations were relatively large but fell above the traditional criterion for significance ($p \leq 0.05$): a negative relationship between relatedness frustration and positive affect, a positive relationship between relatedness frustration and negative affect, and a negative relationship between competence satisfaction and negative affect.

TABLE 5 Correlations between average need satisfaction/frustration across the waiting period and positive and negative affect after receiving bar exam results

	Failed		Passed	
	Positive affect	Negative affect	Positive affect	Negative affect
Relatedness				
Satisfaction	0.35	−0.49*	0.04	0.07
Frustration	−0.41^{+}	0.38^{+}	0.07	0.34**
Competence				
Satisfaction	0.47**	−0.41^{+}	0.06	−0.17
Frustration	−0.08	0.33	−0.10	0.20
Autonomy				
Satisfaction	0.54**	−0.51*	0.37**	0.19
Frustration	−0.34	0.23	−0.25^{+}	0.03

$^{+}p < 0.10$. $^{*}p < 0.05$. $^{**}p < 0.01$.

7.3.2 | Responses to passing

Table 5 shows the correlations between each type of need satisfaction/frustration and positive and negative affective responses to passing the exam. Recall that 55 participants reported passing the bar exam; tests of reactions to passing include only these participants. The effect sizes among passers were not as strong as they were among those who failed. Only two correlations emerged as significant, and both were smaller (though more precise due to sample size) than the comparable effects for those who failed: relatedness frustration during the wait was related to increased negative affect among after passing the bar exam and autonomy satisfaction during the wait was related to increased positive affect after passing the bar exam.

7.4 | Exploratory analysis: Need satisfaction and exam results

One alternative explanation for our findings regarding the links between psychological needs and waiting experiences is that people who failed knew in advance that they had done so and thus felt less need satisfaction during the wait for official exam results (and vice versa for those who passed). One might wonder whether having a hunch that one was going to pass/fail was related to need satisfaction/frustration—particularly in the domain of competence. An exploratory analysis of the bivariate correlation between general levels of need satisfaction/frustration during the wait and participants' outcome on the exam suggested that exam outcome was unrelated to satisfaction/frustration of any need during the waiting period, $|rs(68)| < 0.20$, $ps > 0.10$. As such, the alternative explanation that passing the exam somehow seeped into participant's need satisfaction/frustration as exam takers awaiting official results seems unlikely.

8 | DISCUSSION

We tested three questions about psychological need satisfaction and frustration during a stressful waiting period among a group of law graduates awaiting their bar exam result. First, we examined temporal trends in satisfaction and frustration of autonomy, competence, and relatedness needs. Our results indicated that people experienced declining satisfaction of autonomy and relatedness needs over the waiting period, consistent with other research showing that waiting becomes more difficult as the moment of truth draws near (e.g., Sweeny & Andrews, 2014). However, their need frustration did not change over time, and their satisfaction of competence needs surprisingly increased over time. Although speculative, we suspect that participants' sense of competence was intensely challenged by the experience of taking the bar exam, and thus competence needs recovered as the exam became an increasingly distant memory.

Second, we investigated the relationship between psychological need satisfaction/frustration and well-being. As hypothesized, greater satisfaction and lower frustration of autonomy, competence, and relatedness needs was associated with less worry and sleep disruption on average across the waiting period. Moreover, when people experienced their highest personal levels of need satisfaction, they simultaneously reported their lowest personal levels of worry and sleep disruption. Need frustration was not a strong of a within-person predictor with no significant effects emerging.

We also explored interactions between need satisfaction and time. We found that sleep disruption increased over time particularly among those who experienced lower satisfaction of competence and relatedness needs during the wait. Further, those whose relatedness needs were least satisfied during the wait did not show the signs of settling in to the waiting period in the middle—they displayed n quadratic trend in sleep disruption. We also found that as time went on, the relationship between increased moment-to-moment relatedness need satisfaction and decreased moment-to-moment sleep disruption grew stronger.

Third, we tested whether need satisfaction/frustration was associated with affective responses to good and bad news (i.e., passing or failing the bar exam). High satisfaction and low frustration of needs during the waiting period generally predicted less negative affect and more positive affect particularly among receiving bad news, though the small sample size, particularly of those who failed, limited our ability to precisely estimate effects.

8.1 | Implications and applications

The present study represents the first endeavour to examine whether satisfaction and frustration of psychological needs relates to sleep disruption and worry while awaiting uncertain news—a stressor that entails a high degree of uncertainty and little to no control over a key aspect of one's future, thus posing a distinct challenge to need satisfaction. Although correlational in nature, the data suggest that need satisfaction in particular might be an important part of both the waiting experience and dealing with bad news. That is, when need satisfaction is low, people concurrently have a difficult time waiting. On the other hand, when people feel competent, autonomous, and related, they concurrently have a relatively easy time waiting. Additionally, those whose needs were most fully satisfied during the waiting period also reacted to bad news (in this case, the highly consequential news of failing the bar exam) with less negative and more positive affect, suggesting that satisfying one's fundamental psychological needs during acute moments of uncertainty might prospectively protect people from the emotional blow of bad news, while also heightening their excitement over good news.

Because the data are not causal in nature, we are hesitant to prescribe any particular intervention to alleviate the stress of waiting. Nevertheless, future studies can investigate whether bolstering need fulfilment can reduce the worry and sleep consequences that stem from waiting. Several studies have examined interventions to increase need fulfilment from a SDT perspective. For instance, in a study of smokers attempting to quit, those randomly assigned to receive counselling that supported autonomy (by helping smokers make the choice to quit more personal) and competence (by helping smokers create a plan to quit) felt more autonomy and competence need fulfilment and were in turn more likely to quit smoking (Williams et al., 2006). Similar interventions have proved effective in promoting exercise (Silva et al., 2008), diabetes management (Williams, McGregor, Zeldman, Freedman, & Deci, 2004), and positive educational outcomes (Wehmeyer, Palmer, Shogren, Williams-Diehm, & Soukup, 2013). Of course, it is important that interventions do not create perceptions of controlling behaviour (Tilga, Hein, Koka, Hamilton, & Hagger, in press). As such, future studies aiming to test the causal role of self-determination in waiting experiences can identify interventions to help satisfy these needs. For example, interventions might help people establish autonomy and demonstrate competence in a domain outside that in which one is waiting (e.g., in one's home life and in one's health) and or provide a prompt to reach out to others for social support. Doing so might alleviate some of the ill effects of awaiting uncertain news.

8.2 | Caveats and open questions

We suspect that, consistent with a robust body of literature on SDT and coping (Mahoney, Ntoumanis, Mallett, & Gucciardi, 2014; Ntoumanis, Edmunds, & Duda, 2009; Quested et al., 2011; Skinner & Edge, 2002; also, see Weinstein & Ryan, 2011 for a review), the relationships between having one's needs satisfied and waiting with greater ease stems from the fact that feeling autonomous, competent, and related can help people to better cope with stressors. That is, need fulfilment leads to better coping, which protects people from worry and poor sleep. Moreover, despite the fact that their stressor is not objectively becoming any more controllable or certain, people might feel an increased sense of control and certainty when their autonomy, competence, and relatedness needs are met. We suspect that a similar dynamic explains the associations between need satisfaction and responses to news, such that people whose needs are met during a waiting period approach news with a metaphorical psychological armour against despair. Nevertheless, we recognize that poor coping or high levels of distress and disruption might instead interfere with need fulfilment, or the third variable might explain their relationship. As such, testing the causal link between satisfaction of psychological needs and better responses to waiting and news is a key goal for future research.

One curious pattern in our results was that need satisfaction appeared to be more important than need frustration in determining sleep disruption and worry. The findings for satisfaction are in line with other work showing that need satisfaction is associated with well-being, including low levels of symptomology that would indicate physical and mental distress (Ryan, Bernstein, & Brown, 2010). Indeed, these findings undergirded our initial hypothesis that need satisfaction might help alleviate the negative influence of waiting on physical

health and psychological well-being. However, the findings for need frustration are inconsistent with work suggesting that ill-being, in particular, results from need frustration (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011; Chen et al., 2015).[1] Given that worry and sleep disruption are markers of ill-being, we might have expected them to be particularly related to need frustration (Chen et al., 2015). Of course, waiting itself creates ill-being (Howell & Sweeny, 2016; Sweeny & Andrews, 2014; Sweeny & Falkenstein, 2015). It is possible that frustration was not related to ill-being because the experience of waiting conferred ill-being generally, leaving little space for need frustration to diminish physical and psychological well-being. Thus, need satisfaction was more fundamentally important to the well-being and ill-being of our participants. It is also notable that the scales addressing relatedness and autonomy frustration showed low internal consistency. Indeed, both often fell below the typical cut point of Cronbach's α = 0.70. Other research using this measure has found similarly low alphas (e.g., Chen et al., 2015), likely due to the fact that the scales are only comprised three items. As such, future research should employ more reliable measures of need frustration.

Future experimental work in this domain can test causal links between psychological needs and waiting experiences and also develop interventions to reduce the often-intractable difficulty of waiting. Prior work suggests that most strategies that people naturally use to try to stem the negative effects of waiting on physical and psychological well-being (e.g., distraction, emotional suppression, bracing for the worst, trying to remain optimistic) are ineffective, and may even interfere with well-being during a waiting period (Howell & Sweeny, 2016; Sweeny et al., 2016). The present results suggest that interventions that bolster the satisfaction of psychological needs might provide a unique way to aid the plight of those awaiting uncertain news and might even help buffer against the blow of bad news and elevate responses to good news.

Although a promising initial step in applying a SDT framework to better understand the experience of awaiting uncertain news, our findings require replication in other types of uncertain waiting periods and with other populations. The experience of law graduates awaiting their bar exam results provided an appropriate target for our inquiry in that it is a real-world context with a highly consequential outcome. However, this waiting period differs from other common waiting periods in a number of ways: People know the waiting is coming for months or even years in advance, the wait is relatively long, and the outcome is definitive yet provides an opportunity for a do-over (i.e., people can retake the exam). We highlight these limitations to encourage extension of the present work to other waiting contexts; however, we anticipate that our findings will generalize to other waiting experiences that induce high levels of stress. In fact, having one's needs satisfied may be even more important when the stakes are higher, the wait is unanticipated, and no do-over is available, such as with the wait for medical test results.

[1]Chen et al. (2015) used a measure different to that employed in the present study.

Future research can also investigate how other psychological needs might intersect with the effects of waiting on well-being. For example, recent work suggests that people have a need for novelty (González-Cutre, Sicilia, Sierra, Ferriz, & Hagger, 2016). Perhaps pursuing novel activities can help to break the patterns of repetitive thought that are inherent in waiting. Such an idea is consistent with findings that engaging deeply in a task—finding a flow state—alleviates distress while people awaiting uncertain news (Rankin, Walsh, & Sweeny, 2018).

Three important limitations of our study design also suggest a need to replicate these results in other samples and contexts. First, this study included an irrelevant experimental manipulation of mindfulness meditation. Although the experimental manipulation did not in any way interact with the results presented here (see Table S1 and S2 for more details), it is worthwhile to replicate the study without such a manipulation. Second, some of our most compelling results address affective responses to failure. We showed sizable relationships between meeting one's psychological needs during the wait and these affective responses; however, only 22 of our sample failed. This low failure rate was good news for our participants but does not provide us enough power to precisely estimate the size of the relationship between meeting psychological needs while waiting and subsequent responses to bad news. Third, and in a similar vein, our sample size was only 89 people. As such, our estimates were less precise than we might hope. Of course, 89 units exceeds rule-of-thumb recommendations of at least 50 Level 2 units in two-level multilevel models to achieve unbiased estimates (Maas & Hox, 2005). Still, future work can seek to replicate the present work with a larger sample size to achieve greater power to precisely detect all effects.

9 | CODA

This work is the first to implicate self-determination processes in physical and psychological outcomes while awaiting uncertain news, a common and distressing life experience that poses an inherent challenge to the fulfilment of fundamental psychological needs. The findings link deficits in the fufillment of psychological needs to temporally congruent increases in worry and sleep disruption during a significant and stressful waiting period, suggesting that these deficits may be at least partly responsible for ill effects of waiting on well-being. These findings also point to the possibility that need-fulfilment interventions may be effective for easing the largely intractable distress people experience during significant waiting periods (Sweeny et al., 2016). Although these findings are correlational and require replication in other waiting contexts, they provide initial support for the merit of viewing the stressful experience of awaiting uncertain news through a self-determination lens.

CONFLICT OF INTEREST

The authors have declared that they have no conflict of interest.

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SUPPORTING INFORMATION

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