A triadic Affect Network Dysfunction (AND) model of nightmare distress

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Summary. The affect network dysfunction (AND) model attributes nightmare production and experience to both situational (affect load) and dispositional (affect distress) processes. However, the relationship between these two processes is not clearly specified in the AND model. Numerous studies have reported associations between nightmare phenomena and purported regulators of affect load (i.e., taxing life events). Drawing on triadic theory it was argued that exposure to taxing life events (i.e., daily hassles) is determined in large part by factors associated with affect distress (i.e., high neuroticism and early-life adversity). To test this theory, participants (N = 172) completed an online survey comprising questionnaire measures of neuroticism, early-life adversity, daily hassles, nightmare frequency and nightmare distress. In accord with the hypothesised model: neuroticism, early-life adversity and their interaction all explain unique variance in daily hassles; neuroticism and daily hassles both predicted unique variance in nightmare frequency; neuroticism and nightmare frequency both predicted unique variance in nightmare distress. While early life adversity correlated with nightmare distress in simple bivariate analysis, it was unrelated to nightmare distress after controlling for daily hassles. These results highlight the need to consider the influence of dispositional factors on situational factors when developing models of nightmare distress.

Keywords: Early-life adversity, daily hassles, nightmare frequency

1. Introduction

The *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM–5; American Psychiatric Association [APA], 2013, p. 404) defines nightmares as "… typically lengthy, elaborate, story-like sequences of dream imagery that seem real and that incite anxiety, fear, or other dysphoric emotions". Nightmares almost always occur during rapid-eye movement (REM) sleep, with nightmare sufferers demonstrating greater awake-like electroencephalographic patterns and signs reflecting autonomic hyperarousal, such as sweating, rapid breathing and elevated heart rate (APA, 2013).

Occasional nightmares are normative, with 83% of a large (n = 3433) college sample reporting at least one nightmare in the last year (Levin & Nielsen, 2007). However, routine nightmares are less common with 2-6% of the general adult population experiencing nightmares on a weekly basis (Levin & Nielsen, 2007). Nightmare frequency tends to be reduced in the elderly and females tend to report significantly more nightmares than males (Levin & Nielsen, 2007). Prevalence rates for nightmares are much higher for those suffering from psychiatric disorders such as post-traumatic stress disorder (PTSD), schizophrenia, mood, anxiety, adjustment and personality disorders (APA, 2013).

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Nightmares adversely impact subsequent wakeful functioning. For instance, increased psychological distress (e.g., tiredness, inattentiveness, irritability, anxiety) has been reported on the days following a nightmare compared to the days without a preceding nightmare (e.g., Lancee, & Schrijnemaekers, 2013). The waking distress evoked by nightmares has been termed *nightmare distress* (Belicki, 1992). Clinically significant levels of nightmare distress and impairment across occupational, social or other areas of functioning is a key criterion for the diagnosis of nightmare disorder (APA, 2013). Although there is a large body of evidence indicating that nightmare frequency and nightmare distress are positively correlated, the magnitude of the reported associations suggests that the two constructs are somewhat independent (Levin & Nielsen, 2007).

The most comprehensive model of nightmare development and expression is that of Levin and Nielsen (2009). Their affect network dysfunction (AND) model defines an affective network in which situational and dispositional factors produce a continuum of dysphoric dreaming ranging from normal levels (e.g., occasional bad dreams) to clinical levels (e.g., repetitive post-traumatic nightmares). The AND model places emphasis on two key processes: *affect load* and *affect distress*. Each of these processes will be described in turn.

Affect Load

The primary determinant of normal dysphoric dreaming is thought to be affect load, which is defined as a situational or state factor. Levin and Nielsen (2009) suggest that an individual's level of affect load is a consequence of daily variation in taxing negative events (i.e., major-life events, daily hassles) which they distinguish from traumatic events. Drawing on a "cross-state continuity" principle, Levin and Nielsen (2007) argue that we dream about those things that

we are emotionally preoccupied with in waking. In this context, normal nightmares are thought to serve the adaptive function of *fear memory extinction*.

In keeping with this general account there is now an extensive body of research linking stressful life events to disturbed dreaming. Numerous studies have reported fluctuations in nightmare frequency in the aftermath of a *specific* major-life event (see Nielsen & Levin, 2007). For instance, Cernovsky (1987) reported a higher prevalence of nightmares amongst recent refugees; with the frequency of nightmares declining with time after initial asylum. Furthermore, several studies have found small to moderate positive correlations (0.21 to 0.31) between scores on standardised major-life event inventories and both nightmare frequency and nightmare distress (Cernovsky, 1984; Cook et al., 1990; Zadra & Donderi, 2000; Picchioni et al., 2002; Roberts et al., 2009; Levin et al., 2011). A small number of studies have also considered the relationship between daily hassles and nightmares. Daily hassles are minor everyday life challenges such as losing things, financial worries, family arguments and so on. Many have argued that the cumulative demand of these micro-stressors is greater than the demand imposed on the individual by major-life events (e.g., Kanner et al., 1981; Lazarus & Folkman, 1984). Lazarus and Folkman (1984) go so far as to suggest that major-life events are demanding precisely because of all the daily hassles they generate. Picchioni et al (2002) included the Hassles and Uplifts Scale (Kanner, et al., 1981) in their study and found that mean scores significantly differed ($p < .05$) for low, medium and high nightmare frequency groups ($M = 45.39, 51.91, 56.85$; $\omega^2 = .03$) and low, medium and high nightmare distress groups ($M = 45.85, 49.57, 56.82$; $\omega^2 = .02$). In another study, Schredl (2003) administered a German daily hassles measure to a group of 444 mainly psychology undergraduate students. Daily hassles showed a significant positive correlation with nightmare frequency ($r = .29$; $p < 0.001$).

Research looking at the aftermath of a specific major-life event or using inventory measures of both major-life events and daily hassles provides consistent support for the affect load account of nightmare production. Overwhelmingly, researchers have reported small to moderate positive associations between taxing life events and measures of both nightmare frequency and nightmare distress.

Affect Distress

Affect distress, the other process in the AND model, is described as a trait-like tendency to experience events with high levels of negative emotional reactivity (Levin & Nielsen, 2007). This disposition is thought to be influenced by genetic factors and past trauma. Affect distress is hypothesised to impact both general waking-state function and nightmare phenomena: the waking state manifestations are argued to be the characteristic thoughts feeling and behaviours that define neuroticism; nightmare related manifestations are said to include higher nightmare frequency, greater nightmare distress and greater emotional distress within the nightmare itself. The AND model positions affect distress as the primary cause of clinical levels of nightmare distress.

Several lines of evidence support a dispositional element in nightmare aetiology. Research from the field of behavioural genetics, indicates that nightmare frequency and intensity both have a heritable component (Hublin et al., 1999; Coolidge et al., 2010). Furthermore, the lasting effects of adult, adolescent and childhood trauma on nightmare frequency and intensity are well established (see Levin & Nielsen, 2007). Nielsen (2017) though, has singled out a developmental window, from birth to approximately 3.5 to 4 years of age. Nielsen (2017) argues that adversity during this period alters normal emotion regulation circuitry in such a way as to promote exaggerated fear learning and relapse-prone fear extinction. Two studies provide some support for Nielsen's (2017) position. First, Csóka et al. (2011) conducted a study on a sample of 5,020 adults which examined the effects of retrospectively reported maternal separation (for at least 1 month) in the first year of life. Respondents who had experienced maternal separation reported significantly more nightmares than respondents who had not experience maternal separation ($\chi^2 = 4.77$, $p = .03$); a difference that remained statistically significant after controlling for gender, age, educational level, and financial status in multiple logistic regression. More recently, Nielsen et al. (2019) used the Traumatic Antecedents Questionnaire (Luxenberg et al., 2001) to retrospectively measure early-life adversity (0-6 years of age) in a group of adult nightmare sufferers and age- and sex-matched controls. Compared to the matched control group, the nightmare group had significantly ($eta^2 = .036$; $p = .025$) higher early-life adversity scores.

Levin and Nielsen's (2007) account of affect distress is further supported by studies linking neuroticism to both nightmare frequency and nightmare distress (e.g., Lang & O'Connor, 1984; Berquier & Ashton, 1992; Zadra & Donderi, 2000; Schredl & Goeritz, 2019). Schredl and Goeritz (2019) conducted one of the few multivariate studies in this area. They looked at neuroticism, nightmare distress and retrospectively measured nightmare frequency (current frequency and childhood frequency) in a sample of 2492 adults. Demographic variables (age, gender, education) and the dimensions of Costa and McCrae's (1992) Five Factor Model were entered into an ordinal regression analysis for current nightmare frequency. Neuroticism emerged as the best predictor (standardized estimate = .3966, $\chi^2 = 254.6$, $p < .0001$). In a similar ordinal regression for nightmare distress, both neuroticism (standardized estimate = .3312, $\chi^2 = 130.7$, $p < .0001$) and current nightmare frequency (standardized estimate = .3882, $\chi^2 = 179.2$, $p < .0001$) were found to independently predict nightmare distress. Schredl and Goeritz (2019) concluded that the two major factors affecting nightmare distress are nightmare frequency and neuroticism.

Affect load and affect distress: a triadic model.

One possible criticism of Levin and Nielsen's (2007) model is that it lacks a strong triadic framework. Triadic models of human conduct (e.g., Reis, 2008) emphasise that human behaviour is not simply a consequence of person-by-situation interactions; behaviour is also a contributing factor to the causal process. Behaviour can create environmental conditions as well as regulate their impact (Reis, 2008). The triadic approach suggests a mediated pathway by which the behaviours that define the waking state manifestation of affect distress (i.e., neuroticism) can lead to an increase in negative life events, thereby increasing affect load levels. In support of this mediated pathway a number of prospective studies have linked higher neuroticism to a greater frequency of negative life events including unstable unemployment, interpersonal conflict, divorce and separation and financial problems (e.g., Headey & Wearing, 1989; Bolger & Schilling,

1991; Magnus et al., 1993; Tucker et al., 1998). Individuals high on neuroticism have also been found to lack the coping behaviours to effectively regulate the impact of these taxing events (e.g., McCrae & Costa, 1986). In short, it is quite possible that many of the associations reported earlier between taxing life events and nightmare frequency/distress reflect, to some extent, the influence of neuroticism.

The place of early adversity within this triadic framework is less clear. In line with Levin and Nielsen's (2007) account, retrospective reports of early adversity have been found to correlate with neuroticism (e.g., McFarlane et al., 2005; Lou et al., 2021). Early adversity has also been linked to adult exposure to taxing life events (Lou, et al., 2021). However, Lou and colleagues (2021) found that early life adversity also moderated the relationship between neuroticism and taxing life events: neuroticism was more strongly related to taxing life events among those who experienced early adversity.

The aim of the current study is to evaluate the merits of a triadic account of the AND model of nightmare distress. The pathways that uniquely define the triadic version of the AND model are the ones that allow factors associated with affect distress (e.g., neuroticism, early-life adversity) to have an impact on taxing life events and thereby raise levels of affect load.

The hypothesised multivariate model is displayed in Figure 1. Drawing on this model it is hypothesised that:

- Neuroticism (a), early childhood adversity (b) and the interaction between neuroticism and early-life adversity (c) will all have a direct effect on daily hassles.
- Daily hassles (d) and neuroticism (e) will both have a direct effect on nightmare frequency.
- Nightmare frequency (f), neuroticism (g) and daily hassles (h) will all have a direct effect on nightmare distress.

2. Method

2.1. Participants

Participants for the online survey were recruited through posts to several social media pages and an undergraduate psychology student research participation website. While 196 respondents started the survey, 24 of these respondents were excluded due to non-completion. The remaining participants (N = 172) consisted of 30 males and 142 females, ranging from 18 to 78 years of age, with a mean age of 44.66 years (SD = 15.84).

2.2. Materials and Procedure

The survey was conducted online with a mean testing time of 55 minutes. Each participant responded to a short demographic questionnaire (age and sex), after competing scales measuring neuroticism, nightmare frequency, nightmare distress, daily hassles, and early-life adversity. The instruments used to measure the various constructs under investigation are described below in order of administration.

Neuroticism: The Eysenck Personality Questionnaire-Revised (EPQ-R; Eysenck, Eysenck & Barrett, 1985) is a 100-item self-report questionnaire that includes 3 personality scales (psychoticism, extraversion and neuroticism) as well as a lie scale for measuring dissimulation. To minimise test-taker fatigue only the 24 dichotomously scored (yes/no) items that make up the neuroticism scale were employed in the present study. This scale showed good internal consistency in the current sample (α =.89).

Nightmare frequency: was retrospectively measured using the Mannheim Dream Questionnaire (MADRE) English version (Schredl et al., 2014). Respondents were asked to indicate how often they had experienced nightmares in the "past several months". Nightmares were defined as "dreams with strong negative emotions that result in awakening from the dreams. The dream plot can be recalled very vividly upon awakening." Responses were recorded on an 8-point scale anchored by the options 0 = "never" and 7 = "several times a week". This item shows acceptable test-retest reliability (r = .751) over an average interval of approximately 2 weeks (Schredl et al., 2014). The item has also been found to correlate highly (r = .662) with the LISST nightmare frequency scale (Schredl, 2003).

Nightmare distress: was measured using the Nightmare Distress Questionnaire (NDQ; Belicki, 1992). The NDQ is comprised of 13-items relating to the distress caused by nightmares and nightmare related symptoms, including sleep detriment and impact on daytime reality perception.

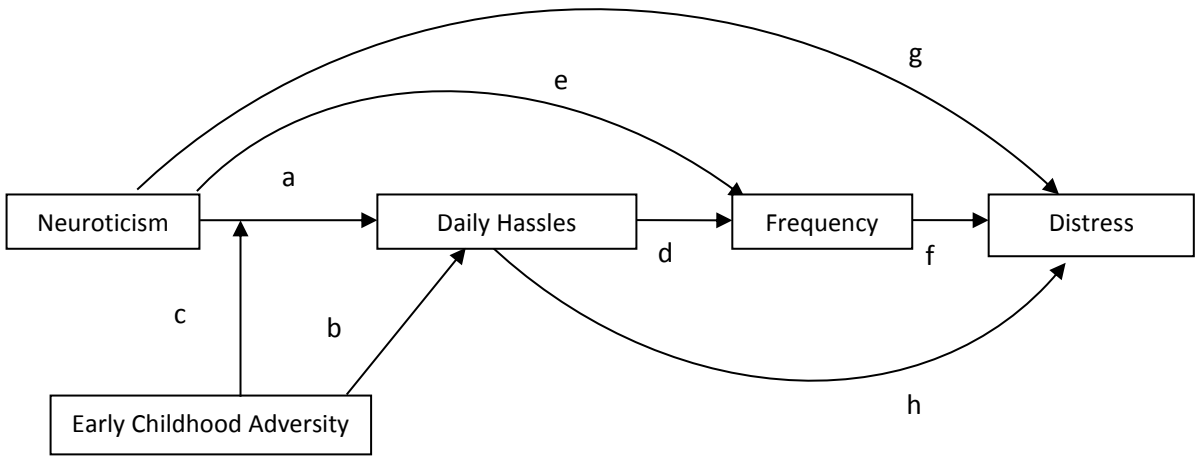

Figure 1. The hypothesised conditional process (mediated-moderated) paths model of nightmare distress.

Table 1. Means, standard deviations (SD), correlation coefficients and 95% confidence intervals (95% CI) for all study variables (N = 172)

Variable		Mean	SD	EA	DH	NFq	ND	Age	Sex[a]
Neuroticism (N)		10.86	5.83	.211**	.696***	.403***	.485***	-.486***	.223**
	95% CI			064: .350	610: .766	.270: .521	.362: .592	-.592: -.363	.076: .361
Early Adversity (EA)		20.91	10.12		.339***	.075	.187*	-.078	.099
	95% CI				.200: .465	-.075: .223	.038: .327	-.225: .072	-.051: .245
Daily Hassles (DH)		89.58	22.82			.405***	.473***	-.388***	.093
	95% CI					.272: .523	.348: .582	-.508: -.253	-.058: .239
Nightmare Frequency (NFq)		3.35	1.91				.659***	-.355***	-.089
	95% CI						.565: .736	-.479: -.217	-.235: .062
Nightmare Distress (ND)		11.19	8.10					-.333***	.102
	95% CI							-.460: -.193	-.048: .248
Age		44.66	15.84						-.071
	95% CI								-.218: .079

*p < .05; **p < .01; ***p < .001.

Respondents are required to endorse the frequency of each item on a 5-point Likert type scale anchored by 0 = "never" and 4 = "always". Internal consistency for the total scale score was high for the present sample (α =.90).

Daily hassles: were operationalised using the Survey of Recent Life Experiences (SRLE; Kohn & Macdonald, 1992). This 51-item scale purports to measure an individual's exposure to micro-stressors that derive from a range of situational contexts including social and cultural difficulties, work, time pressure, finances, social acceptability and social victimisation. For each item on the scale respondents are required to indicate level of exposure (over the past month) on a 4-point scale that ranges from 1 = "not at all part of my life" to 4 = "very much part of my life". The SRLE was found to have high reliability in the present sample (α =.95).

Early-life adversity: was measured using the Traumatic Antecedents Questionnaire (TAQ; Luxenberg, et al., 2001). The TAQ comprises 40-items which assess exposure to both traumatic adverse experiences (e.g., "I was in a situation in which I was convinced that I would be physically injured or lose my life") and non-traumatic adverse experiences (e.g., "not really being good at anything"). In the standard administration of the TAQ, respondents are asked to indicate their exposure to these adverse experiences over 4 different age ranges: 0-6 years; 7-12 years; 13-18 years and 19 years or older. In the current study, respondents were asked to reflect only on adversity within the 0-6 age period. The scale uses the same 5-point response format for each item: 0 = "never or not at all"; 1 = "rarely or a little bit"; 2 = "occasionally or moderately"; 3 = "often or very much"; DK = "don't know". A total adversity score for the 0-6 age range was calculated using the standard threshold-based scoring system, whereby only raw scores of 2 and 3 on any of the 40-items are summed. Based on data from the present study, internal consistency for the TAQ (0-6) total score was acceptable (α = .79).

2.3. Statistical Analyses

To evaluate the relationships between nightmare distress, nightmare frequency, affect load and affect distress related measures, simple bivariate correlational analyses (Pearson's) as well as linear regression analyses were performed. Standard statistical assumptions were checked prior to these analyses. Four variables showed distributions that departed from normality. Daily hassles, nightmare frequency and nightmare distress were normalised through a log natural transformation. Early-life adversity scores were normalised using an exponential transformation.

Table 2. Regression estimates for the hypothesised conditional process (mediated-moderated) paths model of nightmare distress (N = 172)

	Daily Hassles					Nightmare Frequency					Nightmare Distress				
	ß	s.e.	p	CI_{95}		ß	s.e.	p	CI_{95}		ß	s.e.	p	CI_{95}	
Constant	.000	.052	1.000	-.103	.103	.000	.069	1.000	-.136	.136	.000	.054	1.000	-.107	.107
Neuroticism	.656	.054	< .001	.550	.763	.235	.096	.016	.045	.425	.177	.077	.024	.024	.329
Early Adversity (EA)	.167	.056	.003	.057	.278										
Neuroticism x EA	.119	.055	.032	.011	.227										
Daily Hassles						.241	.096	.013	.051	.431	.134	.077	.084	-.018	.287
Nightmare Frequency											.533	.061	< .001	.414	.653
R^2	.537					.192					.501				
adj R^2	.528					.183					.492				

3. Results

Descriptive statistics and correlation coefficients for all variables used in this study are presented in Table 1. Nightmare distress was strongly correlated with nightmare frequency (r = .659, p < .001), neuroticism (r = .485, p < .001) and daily hassles (r = .473, p < .001). Neuroticism (r = .403, p < .001) and daily hassles (r = .405, p < .001) were also strongly correlated with nightmare frequency. Consistent with past research, age showed significant negative correlations with both nightmare distress (r = -.333, p < .001) and nightmare frequency (r = -.355, p < .001).

The hypothesised multivariate model was tested using 3 separate regression analyses: (1) daily hassles was regressed on neuroticism, early-life adversity and the interaction between neuroticism and early-life adversity; (2) nightmare frequency was regressed on neuroticism and daily hassles; (3) nightmare distress was regressed on neuroticism, daily hassles and nightmare frequency. The results from the 3 regression analyses are presented in Table 2. Daily hassles were significantly associated with neuroticism (ß = .656, p < .001), early-life adversity (ß = .167, p = .003), and the interaction between neuroticism and early-life adversity (ß = .119, p = .032). The interaction was such that: at low levels of neuroticism (-1.5 *SD*), early-life adversity and daily hassles were uncorrelated, whereas at high levels of neuroticism (+1.5 *SD*), early-life adversity and daily hassles were positively correlated. In the second regression analysis, neuroticism (ß = .235, p = .016) and daily hassles (ß = .241, p = .013) were both significant predictors of nightmare frequency. In auxiliary regression analyses, early-life adversity was found to be unrelated to both nightmare frequency (ß = -.070, p = .349) and nightmare distress (ß = .030, p = .680) after controlling for daily hassles. In the final regression analysis, neuroticism (ß = .177, p = .024) and nightmare frequency (ß = .533, p < .001) were both significant predictors of nightmare distress, while daily hassles fell just short of significance (ß = .134, p = .084). This model explained 50% of the variance in nightmare distress. Coefficients for the mediated-moderated pathways model are presented in Figure 2.

The Sobel Tests on the significance of the mediations indicate that neuroticism has a distal effect on nightmare frequency via daily hassles (z = 2.4584, p = .014). Daily hassles indirectly effects nightmare distress via nightmare frequency (z = 3.6679, p < .001). However, the serial mediation from neuroticism to nightmare distress (via daily hassles and then nightmare frequency) is not statistically significant (z = 0.12804, p = .449).

4. Discussion

The AND model in its triadic form posits mediated pathways in which affect distress factors can increase exposure to taxing life events and thereby increase levels of nightmare distress. As hypothesised higher neuroticism and greater early-life adversity were both uniquely associated with a greater number of daily hassles. Nielsen (2017) has argued that early adversity makes one vulnerable to nightmares as it creates dysfunction in emotion regulation circuits that, during sleep, normally serve the adaptive function of fear memory extinction. However, in the present study, auxiliary regression analyses revealed that early-life adversity was unrelated to both nightmare frequency and nightmare distress after controlling for daily hassles. It appears then that the influence of early adversity on nightmare phenomena follows more indirect paths than that posited by Nielsen (2017); it seems that early adversity exerts its influence on nightmare phenomena via the creation of daily hassles (and greater affect load).

Also as predicted, neuroticism moderated the relationship between early-life adversity and daily hassles: at low levels of neuroticism, early-life adversity and daily hassles were uncorrelated, whereas at high levels of neuroticism, early-life adversity and daily hassles were positively correlated. Greater threat sensitivity has been linked to both early adversity (Nielsen, 2017) and neuroticism (Eysenck et al., 1985). Neuroticism has also been shown to have a substantial heritable component (Realo, et al., 2017). The significant interaction reported in this study suggests that the experience of early-life adversity in combination with a genetic vulnerability to neuroticism might underpin a threat sensitive

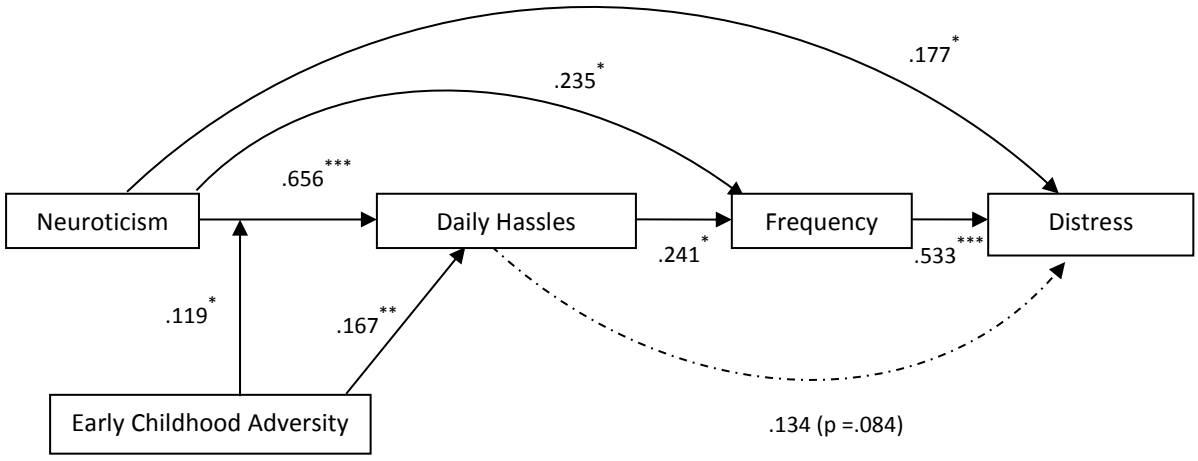

Figure 2. Standardised coefficients for the hypothesised conditional process (mediated-moderated) paths model of nightmare distress (N = 172). *p < .05; **p < .01; ***p < .001.

style that is particularly prone to experiencing daily hassles in later adulthood.

As predicted, neuroticism and daily hassles were both unique positive predictors of nightmare frequency. In the final stage of the mediated pathway model, neuroticism and nightmare frequency were found to positively predict unique variance in nightmare distress. Counter to prediction, daily hassles was not a significant predictor of nightmare distress after controlling for neuroticism and nightmare frequency. This latter finding is, however, in accord with Leven and Nielsen's (2007) position that the primary determinant of nightmare distress is affect distress rather than affect load.

5. Limitations and Future Research

There are two main limitations with the current study. First, the sample was predominantly female, which limits the generalizability of the findings. Second, the study relied entirely on retrospective self-report measures of nightmare frequency, nightmare distress, early adversity and daily hassles, making it impossible to draw any strong conclusions around causation. The latter limitation can only be addressed through more demanding longitudinal research designs. In the context of less demanding cross-sectional research, two potential areas for future research stand out. First, the nature of the various pathways linking early adversity to taxing life events may depend on the type of early adversity studied. Nielsen et al (2019), for example, found that in the 0-6 age strata, non-trauma adversity was associated with the nightmare related phenomena to a greater extent than trauma adversity. If this is the case, the pathways running between early adversity and taxing life events (depicted in Figure 1), might also differ depending on whether early adversity is trauma related or not. Second, in operationalising recent taxing life events, the present study focused on daily hassles and did not include major-life event measures. The rationale for this focus comes from Lazarus and Folkman's (1984) observation that major-life events create demand on the individual primarily because of the daily hassles they generate. Future research though is needed to ascertain whether inventory-based measures of recent major-life events can explain unique variance in nightmare distress after the variance explained by daily hassles has been partialed out.

6. Conclusions

Nielsen and Levin (2007) have argued that two key processes underpin nightmare formation and experience: affect load and affect distress. They have also pointed out that further research is needed to clarify the exact nature of the relationship between these two processes. Drawing on a triadic model, the present research found that factors associated with affect distress (i.e., neuroticism and early-life adversity) may influence exposure to recent taxing life events (i.e., daily hassles) and thereby regulate affect load levels. The present findings reinforce the importance of Schredl and Goeritz's (2019) call for a greater focus on multivariate research designs. Studies examining the relationship between affect load regulators (e.g., daily hassles, major-life events) and nightmare distress, need to control for the possible influence of factors associated with affect distress.

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