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The Moderation Role of Neuroticism for Anxiety among Burdened Dementia Caregivers: A Study on Care Giver-Recipient Dyads

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ABSTRACT

Caregiving burden proves to be a risk factor of anxiety disorders and anxiety affection. The current study investigates how an endogenous personality dimension – neuroticism – moderates the association between caregiving burden and anxiety affection. Between 2015 and 2017, the study deployed a cross-sectional survey of 674 (response rate = 89%) older adults who were hospitalized for dementia at two hospitals. From all primary caregivers of these patients, 661 agreed to participate in the survey which yielded 661 matched dyads as the final sample. Caregiving burden, neuroticism, and anxiety affection were each measured by established assessment instruments. We employed multivariate OLS regression to test the moderator and regressor effects. We found that care burden is a significant risk factor of higher levels of anxiety affection ($\beta = .17$, $p < .001$), and accounts for 4.6% of the variance in anxiety. Neurotic personality is also significantly associated with a greater level of anxiety ($\beta = .26$, $p < .001$). Neurotic personality moderates the association between anxiety and care burden ($\beta = .24$, $p < .001$). Our findings suggest that social and healthcare workers should assess caregiver personality and burden as well as provide support, resources, and coping strategies to those with neurotic personality traits or high care burden in an effort to reduce anxiety among caregivers.

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Caregiving; dementia; elder abuse; neuroticism; care burden

Introduction

Anxiety disorders are a major public health issue worldwide. Approximately one-third of the world's population is expected to be impacted by an anxiety disorder at some point in their lifetime (Bandelow & Michaelis, 2015). The prevalence of anxiety has indeed justified the appellation of "the century of anxiety" well beyond the 20th century and into the new millennium (Twenge, 2000). In China, researchers have observed an uptick of lifetime prevalence of anxiety disorders, going up from less than 2% in the pre-2010 era (Guo et al., 2016) to 7.6% in 2018 (Huang et al., 2019). More conservative estimates of

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lifetime prevalence of any anxiety disorders, according to a meta-analysis (Guo et al., 2016), hover around 2.4% to 4.1%. Still, many people are left undiagnosed for generalized anxiety disorder due to lack of awareness or the fear of stigma (W. Yu et al., 2018).

Anxiety disorders substantially interfere with daily activities, incapacitating many from holding stable positions in the economic, social, and familial spheres (Norberg et al., 2008; Yohannes et al., 2011). In addition to the individual costs, anxiety disorders also cause tremendous economic costs on the health care system. For example, US data collected on the use of health care and lost work associated with General Anxiety Disorder estimated the three-month total costs run up to $1208 per patient, approximating a nationwide cost of $42.3 billion in 1990 (Hoffman et al., 2008). Although no studies have systematically estimated the health care burden of anxiety disorders in China, we may infer from a Shanghai study on the costs of depression that the total health cost of anxiety disorders could be ¥6100 ($770) per person annum and ¥396 million ($50 million) in the city of Shanghai alone (Chen et al., 2006).

In an aging society, anxiety disorders among caregivers have important implications for the wellbeing of older adults. As a society ages, the number of geriatric diseases is expected to increase as will the need for caretaking for the older population. Against this backdrop, there is a renewed interest in studying how caregiver burden contributes to mental health issues (Liu et al., 2017; MacNeil et al., 2010; Rosen, 2014; Yan & Kwok, 2011). Literature shows that living with chronic diseases causes anxious affections and may lead to anxiety disorders (Clarke & Currie, 2009; DeJean et al., 2013). Caregiving for older adults can be a major stressor, characterized by consistently high demand for both physical labor and emotional engagement (Norberg et al., 2008). These unique challenges may place caregivers at a higher risk for anxiety disorders, particularly if the caregivers are family members with little formal training. A recent review found that approximately 25% of dementia caregivers manifest clinically significant symptoms of anxiety (Cooper et al., 2007). A study using the Mini-Mental State Exam and Cognitive Examination found dementia caregivers scored significantly worse on mental and cognitive functioning (Stagg & Larner, 2015).

To elucidate how anxiety affections among caregivers arise from caregiving burden and, more importantly, whether the detriment of caregiving burden can be mitigated, this study introduces caregiver personality as a new explanatory outlook. Specifically, we examined the relationship between caregiving burden and caregivers' anxiety and whether neuroticism moderates this relationship in a community sample of Chinese older adults and their caregivers. Guided by the diathesis-stress model, we argue that the personality traits of caregivers, specifically neuroticism, may differentially affect how caregiving

burden impacts anxiety. Understanding anxiety among caregivers can help identify individuals at higher risk of developing anxiety who may need additional resources and support to provide care for older adults better.

Literature review

Caregiver burden and anxiety

The mental health consequences of caregiver burden are well documented. Caregivers experience substantially more stress and are at higher risk for poor mental health (Bookwala et al., 2000). Whereas most research examining the effects of caregiver burden and mental health has focused on depression, recent findings suggest that anxiety is more prevalent among caregivers than depression (Mahoney et al., 2005). A Chinese study indicated that anxiety is correlated with caregiver burden by a coefficient of 0.32 (Wu et al., 2020). In another study, anxiety symptoms are present among 44% of the caregivers of stroke patients (Hu et al., 2018).

Caregiver burden may arise due to deleterious labor condition, role conflicts, and strenuous moral directives. Long-term caregivers in modern societies, whether as unpaid family members or paid professional service workers, face the double-uphill challenge of economic precarity and relational hardship that may manifest as anxiety disorders (T. Daly & Armstrong, 2016). Caregivers of older adults with mental or neurological degradation often expressed the quandary of being trapped at a juncture between an uneasy anticipation of disease prognosis, the distressing workload, and a moral imperative of caregiving (Daly, 1987; Park, 2012). In return, anxiety damages a caregiver's interpersonal interactions and abilities to perform such laborious and cognitive-intensive work (Norberg et al., 2008); deteriorating mental health conditions of the caregivers may also give way to more incidences of elder abuse and neglect (MacNeil et al., 2010; Rosen, 2014; Yan & Kwok, 2011).

Neuroticism and anxiety

Neuroticism is a relatively stable tendency to respond with negative emotions to threat, frustration, or loss (Lahey, 2009). Although neuroticism as a personality trait consists of multiple facets that may be phenomenologically distinct in their own rights, such as anger, irritability, and excess worries, the personality tendency as a whole has been associated with a higher likelihood of developing psychopathological conditions, including anxiety disorders (Kendler & Prescott, 2007; Khan et al., 2018; Kotov et al., 2010; Ormel et al., 2013). People who score higher on neuroticism tend to be more easily aroused by stimuli and to deploy defensive psychological mechanisms to ward off the perceived threats. Thus, neuroticism increases susceptibility to

psychopathology by accelerating intense and overt reactions to stimuli, augmenting the perceived severity of external stressors, and weakening coping effectiveness (Klein et al., 2011). The vulnerability hypothesis contends that neuroticism can make an individual more vulnerable to a mental health disorder by enhancing the effect of a risk factor, like stressful life events (Ormel et al., 2013). Thus, individuals with a high neuroticism level may suffer an increased risk of anxiety disorders under strain. Consistent with the vulnerability hypothesis, we conceptualize the relationship between anxiety and neuroticism in terms of the diathesis-stress model, where neuroticism represents a moderating diathesis for caregivers.

The diathesis-stress model of anxiety

The diathesis-stress model of mental health posits that the effects of stress on mental health are contingent on a diathesis, i.e. a preexisting vulnerability, that may consist of phenotypic types and at-risk psychological traits such as a high level of neuroticism (Belsky & Pluess, 2009; Monroe & Simons, 1991). The diathesis predisposes an individual to a mental health disorder and a stressor can activate that predisposition. Individuals with the vulnerable diathesis may display good functioning in the absence of environmental stressors but their mental health condition deteriorates when significant stress is present. In this sense, the relationship between the diathesis and stress is interactive, meaning that the diathesis can produce qualitatively heterogeneous susceptibility for stressors – that is, differential susceptibility (Belsky & Pluess, 2009). The Orchid-Dandelion Hypothesis argues that for individuals with a susceptible diathesis, the presence of stressors may be more detrimental to their mental health, but they enjoy better wellbeing when stressors are absent (Mitchell et al., 2015). Adapting the diagram drawn by Rioux et al. (2016), the diathesis-stress model expects a linear and interactive relationship between the diathesis, presented as neuroticism for the present study, and the stressor as shown in Figure 1.

The diathesis-stress model of mental health offers an appropriate framework to structure the relationships between caregiving burden, caregiver anxiety affections, and caregiver personality. Fitting the focal interest of the current study in the framework of diathesis-stress model, caregiving burden constitutes the production of stress, caregiver anxiety affection is an indicator of potential psychopathology, and neurotic personality is an example of diathesis, or more specifically, the underlying predisposed vulnerability. In the case of neuroticism, several studies have indicated that stressors can interact with neurotic personality traits to affect psychiatric conditions, pointing to a diathesis-stress model(Coyne & Whiffen, 1995; Enns et al., 2005; Tackett & Krueger, 2005). As a major axis of personality types, neuroticism entails several distinctive patterns in terms of thinking, feeling, and behaving.

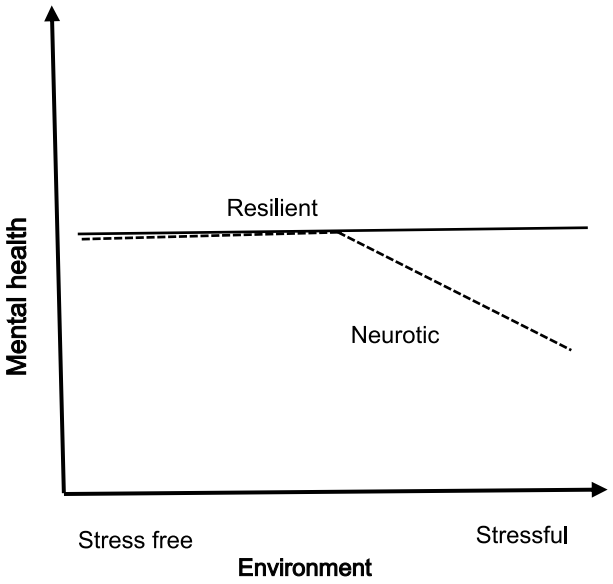

Figure 1. Conceptual diagram for the diathesis-stress model. Adapted from Rioux et al. (2016).

Individuals with a neurotic personality type or those situated at relatively advanced levels of neuroticism may be more irritable to negative stimuli and maladaptive in responding to them (Barlow et al., 2014). Thus, personality type such as neuroticism functions as a promising example of diathesis that takes the form of psychological constituents.

Using personality inventories or modes of interpersonal relationships, scholars have found that personality typologies are a diathesis for depression risk (Blatt & Zuroff, 1992; Coyne & Whiffen, 1995; Franche & Dobson, 1992). In Barlow's triple vulnerability model, neuroticism belongs to the conjoint diatheses that lead to anxiety and mood disorders (Barlow et al., 2014). Neuroticism is found to aggravate the impact of arduous life events on depression (Brock & Lawrence, 2014; Enns et al., 2005; Kendler & Prescott, 2007). Within the framework of the diathesis-stress model of mental health, we expect that the mental health effects of stress from caregiving are contingent on neuroticism.

The current study

By 2050, the percentage of Mainland Chinese above the retirement age is expected to reach 39%. With concerns about the health of state pension and assistance for elderly care already mounting, the burden of caring for older adults with deteriorating health has become a closing-in reality (Glass et al., 2013). Thus, China provides a unique opportunity to study the mental health consequences of caregiving burden within a context of an aging society since China has the largest aging population.

Informed by the scholarship on neurotic personality and the neuroticism diatheses-stress thesis, we present in this study a hypothesis that there exists an impact heterogeneity on anxiety by the level of neuroticism: the association between caregivers' burden and their anxiety affection is exacerbated by higher levels of neuroticism. We expect to see a statistically significant interaction with a positive magnitude between caregivers' burden and neuroticism on anxiety. The present study examines these relationships using a dyadic sample of Chinese older adults and their caregivers.

Methodology

Sampling

The present study utilizes data from a cross-sectional sample of dyads of Chinese older adults and their caregivers from Guangdong and analyzes these dyadic data in a retrospective manner. The survey design employs cross-sectional, retrospective sampling to ascertain the burden experienced by families providing care to an older family member with dementia and the impact of care burden on a range of physical and mental health outcomes of the caregivers. From January 2015 to December 2017, consecutive, purposive sampling was used at the neurological and geriatric departments of two Grade-A hospitals to recruit dyads of older patients with dementia and primary caregivers. Hospitals as the primary sampling units were purposefully sampled based on existing collaboration. Within each hospital, all qualified patients and their caregivers were sampled. This strategy resulted in *de facto* cluster sampling.

To meet the inclusion criteria for studying caregiver burden among individuals caring or older adults with dementia, initial eligibility screening was performed by registered nurses within 24 hours of hospitalization based on the following inclusion criteria: (1) older patients aged ≥60 years with a clinically valid diagnosis of dementia but without other psychiatric disorders or somatic symptoms; (2) primary family caregivers who provided care for ≥4 hours/week in the past three months. The initial screening process identified 758 eligible dyads, of which 674 were successfully recruited after being briefed on the purpose of the study, confidentiality, and informed consent. Several responses were excluded due to the presence of missing data and inconsistent responses. Eventually, the final sample included 661 patient-caregiver dyads. No significant differences were noted between the participating (n = 661) and nonparticipating (n = 97) older patients in terms of age, gender, and relationship to family caregivers. All the in-person interviews with the older patients and their family caregivers were separately conducted by a research team consisting of one attending physician, two residents, and three geriatric nurses within one week of enrollment.

Measurements

We adopted several established scale instruments to assess the physical and mental health conditions of both caregivers and the older patients. Scales for caregivers included the Zarit Burden Interview (ZBI), the Hospital Anxiety and Depression Scale (HADS-A), and the neuroticism subscale of the Neuroticism-Extraversion-Openness (NEO) Five-Factor Inventory. For controlling background health conditions, the study deployed the Charelson Comorbidity Index (CCI), the Neuropsychiatric Inventory (NPI), the Mini-Mental State Examination (MMSE), and the Lawton Instrumental Activities of Daily Living (IADL).

Anxiety affection of the caregiver: The study outcome variable of anxiety was measured using the 7-item anxiety subscale from the HADS-A. Family caregivers rated the severity of their anxiety symptoms on a 4-point scale from "absence of symptoms" to "severe symptoms" for questionnaire items such as "I feel nervous," "I can calmly sit and relax," "I have a hunch something terrible is going to happen," "I am often worried," etc. The HADS-A had an internal consistency (α) of 0.679 in the present study.

Care burden of the caregivers: Care burden was evaluated using the ZBI. This self-reported instrument includes 22 items assessing the perceived burden of caregivers on a 5-point Likert scale for each item, ranging from 'never' (0) to 'nearly always' (4). Responses were summed to generate a total score for care burden. On a potential score from 0 to 88, a higher score indicates graver care burden. A score of ≥21 represents the presence of moderate care burden (Stagg & Larner, 2015). In our sample, Cronbach's alpha was 0.768.

Neurotic personality trait of the caregiver: This variable was assessed using the neuroticism subscale of the NEO Five-Factor Inventory (Costa & McCrae, 1992). Caregivers rated each item on a five-point scale with a higher score indicating a higher level of neuroticism. The scale in our sample has demonstrated good internal reliability (α = .842).

To control for physical and mental health conditions that may generate undirected influence to confound the tested relationships, we controlled for multiple medical comorbidities, neuropsychiatric symptoms, as well as physical and cognitive impairment of the care recipients. The older patients were assessed using the CCI (Charlson et al., 1994; Sundararajan et al., 2004). This scale is a weighted measure that incorporates age, gender, disease classes, and the number and severity of the following medical conditions in addition to dementia: diabetes mellitus (complicated or not), myocardial infarction, peripheral vascular disease, congestive heart failure, liver disease, cerebrovascular disease, chronic obstructive pulmonary disease, connective tissue disease, long-term kidney disease, hemiplegia, peptic ulcer disease, metastatic solid tumor, malignancy including leukemia and lymphoma, and acquired immunodeficiency syndrome.

Each condition is assigned a score ranging from 1 to 6 according to its individual weighted prognostic value. The scores were summed to yield a final score indicating the risk of mortality and adverse health outcomes across a broad spectrum of conditions. The CCI in our sample has an internal reliability of 0.723.

Neuropsychiatric symptoms of the care recipients were assessed using the NPI. Caregivers rated on a four-point scale the frequency at which the older patients demonstrated each of the listed symptoms in the surveyed month, with a higher score indicating a more frequent display of neuropsychiatric symptoms. This scale shows an internal reliability of 0.649 in our sample. Cognitive impairment of the care recipients was assessed using the MMSE. Physical impairment of the care recipients was measured using the Chinese version of the Lawton IADL. In this study, both the MMSE ($\alpha = 0.871$) and IADL ($\alpha = 0.959$) had excellent internal consistency reliability.

Data analysis

Caregiver and care recipient characteristics were summarized as frequencies and percentages for categorical variables and means with standard deviations for continuous variables. Outliers detected from the IADL and cognitive impairment scales were transformed by logathrim. There were no missing data for the study variables.

Since this investigation is interested in how caregivers' anxiety affection is a function of caregiving burden net of potential confounders, regression analysis identification strategy requires an assessment of how independent variables share a common source of influence with the dependent variable. Therefore, we examined bivariate associations between each independent variable and caregiver anxiety levels. Subsequently, multivariate OLS regression was conducted to examine the impact of care burden, caregiver neuroticism, and their interaction on caregiver anxiety, controlling for variables that were found to be significantly related to caregiver anxiety. To test whether neuroticism is a significant factor that moderates the association between caregiving burden and anxiety affection, we deployed the conventional test for a moderation effect by examining the significance of a multiplicative interaction between the variable of neuroticism and the variable of caregiving burden (Baron & Kenny, 1986). A significant multiplicative (interaction) term would suggest the effect of caregiving burden on anxiety is contingent on the levels of neuroticism. For all analyses, a P value of <0.05 was considered statistically significant. Variance inflation factors (VIFs) did not detect multicollinearity in the models. Statistical analyses were performed using SPSS 21.0 .

Results

Sample characteristics

Table 1 presents caregiver and care recipient characteristics. Within this sample, over half of the care recipients were 362 females (54.8%), with a mean age of 71.8 years (SD = 7.77). The mean scores on the MMSE, NPI, and IADL, and were 15.34 (SD = 4.78), 15.58 (SD = 1.94), and 18.23 (SD = 7.31), respectively, which indicates that the care recipients experienced a moderate degree of cognitive impairment, a low severity of neuropsychiatric symptoms, and a moderate level of physical impairment. Alzheimer's disease was the most common type of dementia in this group of care recipients, which comprises over 2/3 (70.0%) of the dementia cases.

Table 1. Descriptive statistics for major variables (N = 661).

	Total (N = 661)
Care recipient characteristics	
Age	71.80 (7.77)
Female	362 (54.8%)
Types of dementia	
Alzheimer's disease	456 (70.0%)
Other dementia	205 (30.0%)
Multiple chronic conditions, CCI [0.723]	6.86 (1.62)
Cognitive impairment, MMSE (range 3–27) [0.871]	15.34 (4.78)
Neuropsychiatric symptoms, NPI (range 12–24) [0.649]	15.58 (1.94)
IADL impairment (range 9–36) [0.959]	18.23 (7.31)
Caregiver characteristics	
Age	49.15 (11.32)
Female	306 (46.3%)
Presence of a secondary caregiver	191 (28.9%)
Education level	
Primary education or below	186 (28.1%)
Secondary education	286 (43.3%)
Tertiary education	189 (28.6%)
Living under local poverty line	60 (9.1%)
Anxiety (HADS-A) (range 7–28) [0.770]	13.40 (2.29)
Neurotic personality trait (range 12–45) [0.842]	21.53 (4.43)
Care burden (range 14–67) [0.704]	18.25 (4.36)

Note: Data presented as [internal consistency Cronbach's α], number (%), or median (range); mean (SD); CCI = Charlson Comorbidity Index MMSE = Mini-Mental State Examination; NPII = Neuropsychiatric Inventory; IADL = Instrumental Activies of Daily Living; HADS-A = Hospital Anxiety and Depression Scale.

The CCI score of 6.86 (SD = 1.62) indicated a moderate risk of mortality potentially caused by multiple chronic conditions among the care recipients.

Among caregivers, 306 (46.3%) were female and the mean age was 49.15 years (SD = 11.32). Most caregivers have completed either secondary (43.3%, n = 286) or tertiary education (28.6%, n = 189), with the rest having an education level of primary schooling or below (28.1%, n = 186). Less than 10.0% (9.1%, n = 60) reported living under the local poverty line. Most caregivers were screened to be positive for clinically significant anxiety (a cutoff score of >8) (Singer et al., 2009), as indicated by a mean score of 13.4 (SD = 2.29) on the HADS-A. A total score of 21 on the Chinese ZBI was considered a cutoff to divide caregivers into high-burden (≥21) and low-burden (<21) groups (Y. Yu et al., 2018). Care burden, as measured using the ZBI, has a distribution with a mean of 18.25 and SD of 4.36. This implies that, while an average caregiver has a ZBI below 21 and is not burdened, 26.8% of the respondents were clinically burdened on this distribution.[1]

Table 2 presents the separate bivariate regression models predicting caregiver anxiety. Caregiver anxiety was associated with care recipients' age (β = 0.143, $p < .001$), multiple chronic conditions (β = 0.174, $p < .001$), cognitive impairment (β = 0.148, $p < .001$), neuropsychiatric symptoms (β = 0.108, $p < .001$), and IADL impairment (β = 0.082, $p < .01$). The presence of a secondary caregiver was associated with decreased caregiver anxiety

Table 2. Bivariate regression of anxiety on each independent variable.

	Standardized coefficients (β)	z-statistics	R^2
Care recipient characteristics			
Age	.143	3.768***	2.6%
Female	.006	0.098	0.0%
Types of dementia	.026	0.874	0.1%
Alzheimer's disease			
Other dementia			
Multiple chronic conditions	.174	5.297***	5.5%
Cognitive impairment	.148	3.863***	3.8%
Neuropsychiatric symptoms	.108	3.018***	2.5%
IADL impairment	.082	2.041**	1.8%
Caregiver characteristics			
Age	.067	1.687	0.3%
Female	.036	1.287	0.2%
Presence of a secondary caregiver	−.238	−6.759***	6.6%
Education level	.047	1.892	0.5%
Primary education or below			
Secondary education			
Tertiary education			
Living under local poverty line	.029	0.985	0.1%
Neurotic personality trait	.257	7.036***	7.5%
Care burden	.168	4.026***	4.6%

*p < 0.05, ** $p < 0.01$, *** $p < 0.001$.

[1]Assuming normal distribution, the percentile of 21 on N(18.3, 4.4) is 73.2.

(β = −0.238, $p < .001$). Several of these correlated factors also overlap with the risk factors of care burden, validating our choice of controlling for these variables in order to minimize the confounded source of influence on the relationship between anxiety and caregiving burden.

Exacerbated detriment of care burden by neuroticism

In Table 3, multivariate regression models were estimated to determine the effect of caregiver neurotic personality trait and care burden, and their interactions on caregiver anxiety, adjusting for the covariates identified to be associated with caregiver anxiety in the bivariate analysis. As presented in Model 1, caregiver neurotic personality trait (β = 0.237, $p < .001$) and care burden (β = 0.146, $p < .001$) significantly predicted caregiver anxiety levels, independent of the care recipients' age (β = 0.088, $p < .05$), multiple chronic conditions (β = 0.122, $p < .001$), neuropsychiatric symptoms (β = 0.096, $p < .01$), and cognitive impairment (β = 0.128, $p < .001$) as well as the presence of a secondary caregiver (β = −0.163, $p < .001$).

In Model 2, an interaction term between the caregiver neurotic personality trait and care burden was added. The interaction term is significantly associated with the level of caregiver anxiety (β = 0.127, $p < .01$), independent of the care recipients' age (β = 0.093, $p < .05$), multiple chronic conditions (β = 0.123, $p < .001$), neuropsychiatric symptoms (β = 0.091, $p < .01$), and cognitive impairment (β = 0.121, $p < .01$) as well as the presence of a secondary caregiver (β = −0.159, $p < .001$). The interaction term indicates that the effect of the caregiver neurotic personality trait on caregiver anxiety was greater when the level of care burden was higher.). Figure 2 demonstrates how this divergence by neurotic levels would look for anxiety. Caregivers with a high

Table 3. OLS regressions predicting anxiety levels among caregivers.

	Model 1		Model 2	
	Standardized coefficients (β)	z-value	Standardized coefficients (β)	z-value
Care recipient (CR) characteristics				
CR age	.088	2.363*	.093	2.499*
CR female gender	.002	.054	.002	.065
CR multiple chronic conditions	.122	3.619***	.123	3.687***
CR neuropsychiatric symptoms	.096	2.780**	.091	2.660**
CR IADL impairment	.034	.948	.037	1.030
CR cognitive impairment	.128	3.989***	.121	3.452**
Caregiver (CG) characteristics				
Presence of a secondary caregiver	−.163	−4.980***	−.159	−4.877***
CG care burden	.146	4.290***	.068	2.047
CG neurotic personality trait	.237	6.635***	.076	1.984
CG care burden*CG neurotic personality trait			.127	3.866**
Adjusted R^2	.314		.358	
F change	64.359***		9.403**	

*p < 0.05, ** $p < 0.01$, *** $p < 0.001$.

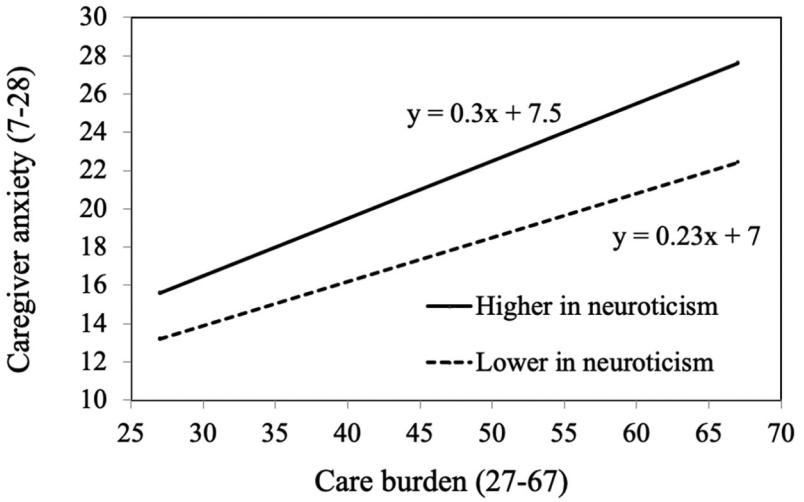

Figure 2. Effect of caregiver burden and neuroticism on anxiety.

level of neuroticism show a steeper increase in anxious affection when their caregiving burden increases, compared to caregivers with a low neurotic level. The moderated trend is similar to the conceptual depiction of the diathesis-stressor interaction as laid out in Figure 1.

Discussion

Due to changes in the demographic composition (Baxter et al., 2014) and a substantive increase in stress and uncertainty (Bandelow & Michaelis, 2015), anxiety has undergone rapid growth in the 21st century. The rapid growth of anxiety may be disproportionately experienced by individuals who routinely engage in labor-demanding and cognitively intensive routine tasks like caring for older adults with dementia and other cognitive impairments. Indeed, caregiving burden has been shown to lead to heightened anxious affection and, in some severe cases, to anxiety disorders (Chan et al., 2005; McGrath et al., 2003). In return, anxiety can undermine the quality of care delivered to patients in clinical and home settings (Hoffman et al., 2008; Yohannes et al., 2011). Worse mental health conditions, including anxiety disorders, are associated with greater levels of elder abuse and worse health prognosis among the care recipients (Zhang et al., 2019; Hoffman et al., 2008; Rosen, 2014; Yan & Kwok, 2011).

The present study investigated the level of anxiety affection among caregivers of dementia patients, their care burden, and their relational mechanisms. Anxiety, measured with the established HADS-A scale, registers highly among the caregivers. Consistent with prior research, we found that caregivers with higher care burden reported a significantly higher level of anxiety.

Building on prior research, we explored the moderating role of neuroticism in the relationship between care burden and anxiety among caregivers, finding that neuroticism rendered the relationship more pronounced. Our approach of investigating the direct and moderating influences of neuroticism within the context of caregiver burden and anxiety offers additional insights into the experiences of caregivers. First, neuroticism itself is a strong risk factor of anxiety. It is associated with a greater level of anxiety affect at a quite substantial magnitude, accounting for 7.5% of the variance in anxiety levels. Next, we found that the association between care burden and anxiety among caregivers is significantly moderated by neuroticism. Our results suggest that caregivers with less neurotic traits are more resilient to increased care burden and less likely to experience an anxiety disorder.

These findings provide evidence to corroborate the diathesis-stress model, which posits that individuals with the vulnerable diathesis adapt less well to external stressors. The diathesis may belong to different domains of pathological etiology depending on the focus of investigation. Often in the literature, vulnerable diathesis may reflect certain genetic disposition, phenotypes, personality or other psychological traits (Belsky & Pluess, 2009; Enns et al., 2005; Monroe & Simons, 1991; Rioux et al., 2016). Our findings provide evidence to existing studies that have considered neurotic personality a diathesis for differential susceptibility to stress (Barlow et al., 2014; Brock & Lawrence, 2014; Enns et al., 2005). Personality dimensions constitute an important set of latent characters that influence how people process information, react to signals, and behave in patterned regularities (Shaver & Brennan, 1992). Although neuroticism is associated with being cognitively alert and responsive in situations needing survival adaptation (Budaev, 1999), its evolutionary specialty appears to be a maladaptive trait in the case of caregiving for older adults. In our sample, neurotic personality is a risk factor that exacerbates the association between care burden and anxiety affection.

To be cautious, we are aware of the debate over the operating mechanism between anxiety disorders as a psychopathology and neuroticism as a personality dimension. In general, the causal direction between anxiety and neuroticism can go in three ways. The vulnerability model suggests that neuroticism personality renders individuals vulnerable to the stimuli that cause psychopathology (Ormel et al., 2013); the trait model suggests that neuroticism shares with anxiety disorders the same latent spectrum of psychopathology (Ebstein, 2006); the scar effect exists when the experience of mental illness alters a person's personality (Tang et al., 2009). Although previous studies have not reached a prevailing consensus, a systematic review by Ormel et al. (2013) suggests stronger evidence in favor of the vulnerability model in which neuroticism operates as a cause or moderator of anxiety disorder – a perspective consistent with our theoretical assumption based on

the diathesis-stress model. Given the prior theoretical and empirical evidence of the moderating role neuroticism plays in exacerbating levels of anxiety in tandem with the present study's findings, neuroticism appears to act as a diathesis, making caregivers more vulnerable to the mental health effects of care burden.

Limitations

Despite this study's contribution to unraveling personality dimension's heterogeneous relationship in the context of care burden and anxiety among caregivers, we acknowledge key limitations in this study that might limit the generalizability and inference of our research. Foremost, neuroticism is only one specific dimension of personality out of the big five personality types commonly brought up in the research. Simultaneously analyzing all dimensions of personality and their bearing on care burden and anxiety would be a qualitatively different project than the current one, and it requires a different multivariate approach to testing. The focus on neuroticism personality crystalizes the issue, but future studies should explore this thesis with other personality dimensions. Second, the cross-sectional retrospective study design thwarts the ability to draw causal inferences based on our findings, and we acknowledge the possibilities that the current association may feature additional causal pathways than currently discussed. Third, purposive sampling limits the generalizability of these findings to caregivers outside of this study. Future research replicating this study's design should use representative samples. Despite these limitations, a robust moderation effect is found for neuroticism, and scholars and practitioners may utilize this finding to advance understanding and policies regarding care burden and mental health among caregivers.

Policy implications

Uncovering the independent and joint effects of care burden and neuroticism on anxiety among caregivers can help guide social workers and healthcare providers in navigating care for older adults by implementing policies and practices for caregivers. Translating these findings to policy and practice, social workers can work in tandem with relevant healthcare workers to target both care burden and the mental health of caregivers. Working from a social work model, it would be important to initially identity vulnerable caregivers who are at-risk for experiencing high levels of anxiety. Specifically, personality screening tests could be used to identify caregivers who are at higher risk of anxiety, ideally identifying these individuals before care burden increases. Social workers and healthcare providers could use evidence-based practices that reduce anxiety, such utilizing mindfulness-based

intervention strategies as well as teaching and encouraging caregivers to engage in healthy coping strategies (e.g., exercise) and reducing or stopping unhealthy coping strategies that many exacerbate mental health (e.g., substance use). In addition to promoting health literacy among caregivers, social and healthcare workers could also provide caregivers with additional support and resources, such as individual or group therapy, formal caregiving training, and trained staff on a weekly basis to help caregivers take care of older adults. Providing trained staff for a few hours each week may be particularly effective since the presence of a secondary caregiver significantly reduced caregiver anxiety net of caregiver neuroticism, care burden, and care recipient covariates. At the same time, care burden increased levels of anxiety for all caregivers, so screening for care burden as well as providing training, support, and resources is critical for all caregivers of older adults with dementia, regardless of personality. After implementing these suggestions, social and healthcare workers should evaluate these policies and practices, including receiving feedback from caregivers, regularly to identify what is most effective and what needs to be modified. Since care burden and anxiety can affect quality of care, in-person assessment of care quality for older adults may also be useful to gauge care burden and determine the effectives of suggested policies and practices. Caregivers with a strong neurotic predisposition may require regular visits for in-home care.

Conclusion

Motivated by the anxiety epidemic in the 21st century, the current study set out to explore the independent and joint influences of care burden and neuroticism on anxiety levels among caregivers – a population that may disproportionately experience the rise in anxiety given the unique challenges caregivers experience. Guided by the diathesis-stress model of mental health, the current study proposed that the neurotic predisposition in caregiver personality may serve as a moderator to amplify the deleterious effect of care burden on caregiver anxiety. Utilizing a dyadic Chinese sample of older dementia patients and their caregivers, we employed established psychological scales and instruments to measure care burden, anxiety affection, personality dimensions among the caregivers, and a range of physical, psychological, and cognitive conditions of the older adults under care. We found that neuroticism is both an independent risk factor for higher levels of anxiety affection and a significant moderator on care burden. Caregivers with stronger neuroticism displayed a greater level of anxiety affection under the same level of care burden as those with lower levels of neuroticism. The findings herein can inform policy and practices, such as screening vulnerable caregivers and equipping them with better coping skills, to improve the mental health of caregivers and possibly the care quality for older dementia patients.

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Institutional review

This study was approved by the ethics committee of Hong Kong University (ref EA1707030).

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