

BMJ Open Associations among neuroticism, self-efficacy, resilience and psychological distress in freshman nursing students: a cross-sectional study in China

Xiaoxiao Mei , Huiyuan Wang, Xinqin Wang, Xiaona Wu, Jieyi Wu, Zengjie Ye

To cite: Mei X, Wang H, Wang X, *et al.* Associations among neuroticism, self-efficacy, resilience and psychological distress in freshman nursing students: a cross-sectional study in China. *BMJ Open* 2022;**12**:e059704. doi:10.1136/bmjopen-2021-059704

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2021-059704>).

Received 01 December 2021
Accepted 13 May 2022

ABSTRACT

Objectives The current study examines the mediating roles of resilience and self-efficacy and the moderating role of gender in the association between neuroticism and psychological distress in Chinese freshman nursing students (FNSs).

Methods A total of 1220 FNSs were enrolled from the Be Resilient to Nursing Career (ChiCTR2000038693) Programme and the following instruments were administered to them: NEO Five-Factor Inventory, General Self-Efficacy Scale, Connor-Davidson Resilience Scale and Kessler Psychological Distress Scale. A moderated mediation analysis and a generalised additive model analysis were performed.

Results The direct and indirect effects of neuroticism on psychological distress were significantly mediated by self-efficacy ($B = 0.200$, 95% CI 0.001 to 0.039), resilience ($B = 0.021$, 95% CI 0.007 to 0.038) and the interaction between self-efficacy and resilience ($B = 0.016$, 95% CI 0.005 to 0.028). The interactions between neuroticism and gender ($\beta = 0.102$, 95% CI 0.001 to 0.203, $p < 0.05$) and between resilience and gender were significant ($\beta = 0.160$, 95% CI 0.045 to 0.275, $p < 0.01$). A non-linear and positive association was confirmed between neuroticism and psychological distress.

Conclusions Self-efficacy and resilience significantly mediate the relationship between neuroticism and psychological distress. Gender moderates the relationships between neuroticism and resilience and between resilience and psychological distress.

INTRODUCTION

An estimated global shortage of 5.9 million nurses was reported by the WHO in 2018.¹ Nursing students, as future nurses, are receiving increasing attention from multidisciplinary researchers. However, the prevalence of depression and moderate to severe anxiety among Asian nursing students is 43% and 56%, respectively.²⁻³ Additionally, freshman students are 1.7 times more likely to experience psychological distress compared with senior students.^{4,5} Thus, the risk factors for psychological distress in nursing students, especially in freshman nursing students

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Serial multiple mediation model was used to explore the mediating role of self-efficacy and resilience in the association between neuroticism and psychological distress.
- ⇒ Moderation model was used to explore the moderating role of gender.
- ⇒ Generalised additive model analysis was performed to estimate the non-linear relationship between neuroticism and psychological distress.
- ⇒ Causal inferences cannot be drawn owing to the study's cross-sectional design.

(FNSs), should be identified to help improve their mental health. Neuroticism is a stable personality trait characterised by negative emotions, such as worry and guilt; individuals with neurotic traits are more prone to psychological distress.⁶⁻⁸ Additionally, self-efficacy, defined by Bandura's self-efficacy theory as a sense of control over one's environment and behaviour, has been confirmed as a protective predictor of psychological distress.⁹⁻¹² Moreover, resilience, defined as the ability to bounce back from adversity, has also been identified as a protective predictor of psychological distress in general population.¹³ In our previous study, a positive association between self-efficacy and resilience was confirmed among FNSs.¹⁴ Based on Kumpfer's Resilience Framework, neuroticism-based stress can be efficiently buffered by resilience, resulting in adequate adjustment.¹³ Gong *et al* found that neuroticism was positively associated with depression; additionally, depressive symptoms were lower in the higher resilience group than in the lower resilience group.¹⁵ Although neuroticism, self-efficacy and resilience have been identified as independent predictors of psychological distress in various populations, to the best of our knowledge, the associations of these four variables among FNSs have not been fully explored. Moreover,



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

School of Nursing, Guangzhou University of Chinese Medicine, Guangzhou, Guangdong, China

Correspondence to

Dr Zengjie Ye;
zengjieye@qq.com



it may be worthwhile to examine whether gender plays a role in the associations among neuroticism, self-efficacy and resilience. Therefore, the current study explores the following:

(1) The associations among neuroticism, self-efficacy, resilience and psychological distress based on a serial multiple mediation model, (2) the potential non-linear association between neuroticism and psychological distress using generalised additive model analysis (GAMA) and (3) the moderating role of gender. We hypothesise that (figure 1):

1. Neuroticism is negatively associated with self-efficacy and resilience and positively associated with psychological distress.
2. Self-efficacy and resilience significantly mediate the association between neuroticism and psychological distress.
3. Gender moderates the associations among neuroticism, resilience and psychological distress.
4. Neuroticism is positively and non-linearly associated with psychological distress.

METHODS

Participants and procedure

A total of 1220 FNSs were enrolled from the Be Resilient to Nursing Career (ChiCTR2000038693) Programme between September and November 2020. The inclusion criteria were as follows:

(1) being a newly enrolled FNS in 2020, (2) ability to communicate fluently in Mandarin and (3) agreement to participate in this study. The exclusion criterion was a present or past diagnosis of a mental disorder. All participants were approached by trained researchers and informed consent was obtained before the formal investigation. The study has been described in detail elsewhere.^{14 16}

Instruments

Demographic characteristics

Based on previous research,^{17 18} we collected data on FNSs' demographic characteristics (eg, age, gender, residence) and profession-related information (eg, role model, medical staff as relatives).

NEO-Five Factor Inventory

The NEO-Five Factor Inventory (NEO-FFI) is a 60-item self-report scale used to assess personality traits on five dimensions, including neuroticism, extraversion, openness, agreeableness and conscientiousness.¹⁹ The current study focused only on the neuroticism dimension (12 items); higher scores indicated higher levels of neuroticism. The NEO-FFI demonstrated good internal consistency among Chinese adolescents.¹⁵ The Cronbach's alpha coefficient for FNSs was 0.821 in the present study.

General Self-Efficacy Scale

General Self-Efficacy Scale (GSES) was developed by Zhang and Schwarzer.²⁰ The reliability of the Chinese version of GSES has been confirmed.²¹ The scale comprises 10 items

with higher scores indicating higher levels of self-efficacy. The Cronbach's alpha for GSES was 0.898 in the present study.

10-item Connor-Davidson Resilience Scale

While the 25-item Connor-Davidson Resilience Scale (CD-RISC) was developed by Connor in 2003, a 10-item version was later developed by Campbell-Sills and Stein.^{22 23} It is a unidimensional scale and uses a 4-point Likert scale; higher scores indicate higher levels of resilience. The reliability of the Chinese version of 10-item Connor-Davidson Resilience Scale (CD-RISC-10) has been established.²⁴ This scale has been successfully administered in previous studies.^{14 16} The Cronbach's alpha was 0.875 in the present study.

Kessler Psychological Distress Scale

The Kessler Psychological Distress Scale (K10 measures the frequency of symptoms related to non-specific psychological distress such as anxiety experienced in the past 4 weeks.^{25 26} It comprises 10 items, with the total score ranging from 10 to 50. In China, the K10 has been widely used to screen psychological distress among the general population.^{27 28} The Cronbach's alpha was 0.885 in this study.

Data analysis

First, descriptive statistics were used to analyse the demographic characteristics and Pearson's correlation analysis was performed to estimate the associations among neuroticism, self-efficacy, resilience and psychological distress. Second, serial mediation analysis was used to establish the mediating model. Since the data were self-reported, common method variance (CMV) was checked using Harman's single factor test.²⁹ Neuroticism and psychological distress were identified as the independent (X) and dependent (Y) variables, respectively. Self-efficacy (M1) and resilience (M2) were recognised as the mediators. The total, direct and indirect effects were estimated and 95% CI were calculated with 5000 bootstrapping resamples. Third, a moderation analysis was performed to examine the moderating role of gender on the associations among neuroticism, resilience and psychological distress. Fourth, GAMA was employed to estimate the non-linear association between neuroticism and psychological distress.³⁰ Fifth, psychological distress was classified into binary data (high as 1 and low as 0 based on a cut-off of 24),³¹ while neuroticism was classified into quartiles titled as 'low neuroticism', 'medium neuroticism', 'high neuroticism' and 'very high neuroticism' to further examine the association between neuroticism and psychological distress. SPSS (V. 26.0) and Empower Stats (V. 2.2) were used for all statistical analyses.

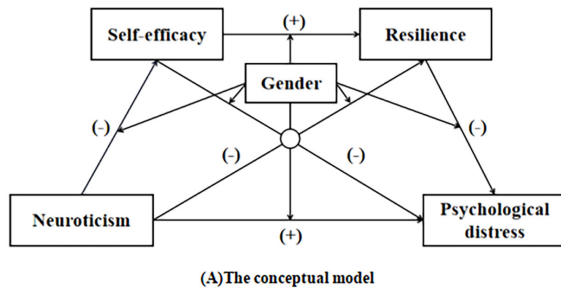
Patient and public involvement

No patients were involved in this study.

RESULTS

Sample characteristics

A total of 1220 FNSs were enrolled in the present study; 21 participants were excluded due to missing data, resulting in



(A) The conceptual model

Variables	M±SD	Overall sample (N=1199)	P value
Gender			0.072
Female	19.18±6.60	237(19.8%)	
Male	20.01±6.30	962(80.2%)	
Academic degree			0.437
Junior college degree	19.99±6.62	620(51.7%)	
Bachelor degree	19.70±6.08	579(48.3%)	
Only children			0.870
Yes	19.78±6.72	191(15.9%)	
No	19.86±6.30	1008(84.1%)	
Place of residence			0.640
Country or town	19.73±6.31	411(34.3%)	
Countryside	19.91±6.40	788(65.7%)	
Income/year			0.028
Low	20.33±6.64	612(51.0%)	
Moderate	19.32±5.77	502(41.9%)	
High	19.54±7.48	85(7.1%)	
Do you have nursing role model			0.042
Yes	19.39±6.10	483(40.3%)	
No	20.16±6.53	716(59.7%)	
Are there any medical staffs as relatives			0.549
Yes	19.68±6.68	350(29.2%)	
No	19.92±6.24	849(70.8%)	

(B) Univariate analysis of psychological distress in FNSs

Figure 1 The conceptual model and univariate analysis. FNSs, freshman nursing students.

a final sample of 1199 (98.3%). The gender ratio of male to female participants was 1:4.06. Demographic and profession-related characteristics are described in figure 1B.

Associations among neuroticism, self-efficacy, resilience and psychological distress

The common method bias test indicated a total of seven factors with eigenvalues greater than 1. The first factor accounted for 28.4% of the total variance and the common method bias was negligible. Psychological distress was

significantly correlated with neuroticism, self-efficacy and resilience ($r = 0.64, -0.35, -0.41$, respectively; $p < 0.01$).

Other results from Pearson's correlation analysis are given in figure 2A.

Figure 2B shows that neuroticism was negatively associated with self-efficacy ($\beta = -0.280, p < 0.001$) and resilience ($\beta = -0.214, p < 0.001$). Both self-efficacy and resilience had a significant impact on psychological distress (self-efficacy, $\beta = -0.068, p < 0.05$; resilience, $\beta = -0.101, p < 0.01$). Figure 2C shows that the indirect effect of neuroticism through self-efficacy and resilience on psychological distress was significant ($B = 0.016, 95\% \text{ CI } 0.005 \text{ to } 0.028$).

The moderation model

The results of the moderation analysis are depicted in figure 3. In Model 1 (neuroticism → psychological distress), the interaction of neuroticism and gender was not significant ($B = -0.075, 95\% \text{ CI } -0.172 \text{ to } 0.022, p = 0.131$), indicating that gender did not moderate the relationship between neuroticism and psychological distress. Similarly, in Models 2, 3, 4 and 7, the moderating effect of gender was not significant ($B = 0.047, 95\% \text{ CI } -0.050 \text{ to } 0.143, p = 0.342$; $B = 0.123, 95\% \text{ CI } -0.013 \text{ to } 0.0260, p = 0.260$; $B = -0.067, 95\% \text{ CI } -0.163 \text{ to } 0.030, p = 0.177$; $B = -0.058, 95\% \text{ CI } -0.184 \text{ to } 0.069, p = 0.371$, respectively). In Model 5 (neuroticism → resilience), the significant moderation effect of gender was recognised and visualised in the simple slopes test ($\beta_{\text{male}} = -0.45, p < 0.01$; $\beta_{\text{female}} = -0.35, p < 0.01$, figure 4A). In Model 6 (resilience → psychological distress), as shown in figure 4B, gender could moderate the association between resilience and psychological distress ($\beta_{\text{male}} = -0.26, p < 0.01$; $\beta_{\text{female}} = -0.10, p < 0.01$).

Generalised additive model analysis

Figure 4C indicates a non-linear and positive relationship between neuroticism and psychological distress by GAMA. Figure 4D demonstrates that FNSs with low, medium and high neuroticism were 0.006, 0.061 and 0.173 times, respectively, as likely to have psychological distress as those with very high neuroticism.

Variables	Neuroticism	Self-efficacy	Resilience	Psychological distress
Neuroticism	—			
Self-efficacy	-0.41**	—		
Resilience	-0.49**	-0.64**	—	
Psychological distress	0.64**	-0.35**	-0.41**	—
Mean	33.19	23.73	24.86	19.85
Standard deviation	7.59	5.35	5.91	6.37
Skewness	0.144	0.417	0.155	0.966
Kurtosis	-0.016	0.339	0.155	1.269

Note: ** $P < 0.01$

(A) Levels and association of FNSs' psychological distress with neuroticism, self-efficacy and resilience

Model pathways	Effect	Boot SE	Boot LLCI	Boot ULCI
Neuroticism→self-efficacy→psychological distress	0.020	0.010	0.000	0.039
Neuroticism→resilience→psychological distress	0.021	0.008	0.007	0.038
Neuroticism→self-efficacy→resilience→psychological distress	0.016	0.006	0.005	0.028
Total indirect effect of neuroticism on psychological distress	0.057	0.013	0.032	0.083
Direct effect of neuroticism on psychological distress	0.474	0.022	0.432	0.516
Total effect of neuroticism on psychological distress	0.531	0.019	0.494	0.568

(C) Bootstrapping indirect effects and 95% confidence intervals (CI) for the final mediation model

Outcome variables	Predictor variables	Biased regression coefficient					
		beta	SE	t	P	LLCI	ULCI
Self-efficacy	Constant	31.598	0.769	41.096	<0.001	30.090	33.107
	Income/year	0.732	0.227	3.223	<0.05	0.287	1.177
	Role model	0.700	0.288	2.432	<0.05	0.135	1.265
	Neuroticism	-0.280	0.019	-15.031	<0.001	-0.317	-0.243
Resilience	Constant	18.086	1.055	17.140	<0.001	16.016	20.156
	Income/year	-0.032	0.201	-0.158	0.874	-0.426	0.363
	Role model	0.483	0.255	1.893	0.059	-0.018	0.983
	Neuroticism	-0.214	0.018	-11.900	<0.001	-0.249	-0.178
Psychological distress	Self-efficacy	0.578	0.026	22.618	<0.001	0.528	0.628
	Constant	8.496	1.336	6.362	<0.001	5.876	11.116
	Income/year	-0.158	0.228	-0.693	0.488	-0.605	0.289
	Role model	-0.043	0.290	-0.149	0.882	-0.611	0.525
Psychological distress	Neuroticism	0.474	0.022	22.018	<0.001	0.432	0.516
	Self-efficacy	-0.068	0.035	-1.951	<0.05	-0.136	-0.000
	Resilience	-0.101	0.033	-3.067	<0.01	-0.165	-0.036

(B) Regression analysis of the relationship between variables in the serial-mediation model

Figure 2 The serial-multiple mediation model. FNSs, freshman nursing students.

Variables	Estimate	SE	t	P	LLCI	ULCI
(Outcome variable: Psychological distress)						
Constant	4.571	1.819	2.513	<0.05	1.002	8.139
Gender	2.525	1.639	1.541	0.124	-0.691	5.740
Income/year	-0.154	0.229	-0.666	0.505	-0.601	0.296
Role model	-0.108	0.291	-0.370	0.712	-0.679	0.463
Neuroticism	0.557	0.046	12.146	<0.001	0.467	0.647
Self-efficacy	-0.124	0.029	-4.268	<0.001	-0.181	-0.067
Neuroticism × Gender	-0.075	0.049	-1.509	0.132	-0.171	0.022
Increase of R ² with interaction	R ² 0.001		F 2.277		P 0.132	
Conditional direct effects of neuroticism on psychological						
Gender	effect	SE	t	P	LLCI	ULCI
Male	0.557	0.046	12.146	<0.001	0.467	0.647
Female	0.482	0.022	21.856	<0.001	0.439	0.526

(A) Model 1 (neuroticism → psychological distress)

Variables	Estimate	SE	t	P	LLCI	ULCI
(Outcome variable: Self-efficacy)						
Constant	33.137	1.534	21.600	<0.001	30.127	36.147
Gender	-1.964	1.629	-1.206	0.228	-5.161	1.233
Income/year	0.729	0.223	3.216	<0.05	0.284	1.174
Role model	0.733	0.289	2.539	<0.05	0.167	1.300
Neuroticism	-0.317	0.045	-7.091	<0.001	-0.404	-0.229
Neuroticism × Gender	0.047	0.049	0.950	0.342	-0.050	0.143
Increase of R ² with interaction	R ² 0.001		F 0.903		P 0.342	
Conditional indirect effects of neuroticism on psychological distress						
Gender	effect	SE	LLCI	ULCI		
Male	0.040	0.011	0.020	0.064		
Female	0.034	0.009	0.018	0.052		

(B) Model 2 (neuroticism → self-efficacy)

Variables	Estimate	SE	t	P	LLCI	ULCI
(Outcome variable: Psychological distress)						
Constant	9.143	1.894	4.828	<0.001	5.427	12.859
Gender	-2.868	1.721	-1.667	0.096	-6.244	0.510
Income/year	-0.180	0.229	-0.786	0.432	-0.630	0.269
Role model	-0.116	0.291	-0.397	0.691	-0.686	0.455
Neuroticism	0.494	0.020	24.167	<0.001	0.454	0.534
Self-efficacy	-0.227	0.064	-3.528	<0.001	-0.353	-0.101
Self-efficacy × Gender	0.123	0.070	1.770	0.077	-0.013	0.260
Increase of R ² with interaction	R ² 0.002		F 3.133		P 0.077	
Conditional indirect effects of neuroticism on psychological distress						
Gender	effect	SE	LLCI	ULCI		
Male	0.064	0.020	0.024	0.103		
Female	0.029	0.010	0.011	0.047		

(C) Model 3 (self-efficacy → psychological distress)

Variables	Estimate	SE	t	P	LLCI	ULCI
(Outcome variable: Psychological distress)						
Constant	5.784	1.894	3.054	<0.05	2.069	9.499
Gender	2.159	1.639	1.317	0.188	-1.057	5.375
Income/year	-0.192	0.228	-0.842	0.400	-0.638	0.255
Role model	-0.068	0.291	-0.235	0.814	-0.639	0.502
Neuroticism	0.535	0.047	11.502	<0.001	0.444	0.627
Resilience	-0.134	0.028	-4.829	<0.001	-0.188	-0.079
Neuroticism × Gender	-0.067	0.049	-1.351	0.177	-0.163	0.030
Increase of R ² with interaction	R ² 0.001		F 1.826		P 0.177	
Conditional direct effects of neuroticism on psychological						
Gender	effect	SE	t	P	LLCI	ULCI
Male	0.535	0.047	11.502	<0.001	0.444	0.627
Female	0.469	0.023	20.580	<0.001	0.424	0.513

(D) Model 4 (neuroticism → psychological distress)

Variables	Estimate	SE	t	P	LLCI	ULCI
(Outcome variable: Resilience)						
Constant	39.891	1.611	24.770	<0.001	36.731	43.051
Gender	-4.564	1.710	-2.668	<0.01	-7.920	-1.208
Income/year	0.384	0.238	1.614	0.107	-0.083	0.851
Role model	0.976	0.303	3.219	<0.05	0.381	1.571
Neuroticism	-0.455	0.047	-9.700	<0.001	-0.547	-0.363
Neuroticism × Gender	0.102	0.052	1.980	<0.05	0.001	0.203
Increase of R ² with interaction	R ² 0.002		F 3.918		P 0.048	
Conditional effects of the focal predictor at values of the moderator (Gender)						
Gender	effect	SE	t	P	LLCI	ULCI
Male	-0.455	0.047	-9.700	<0.001	-0.547	-0.363
Female	-0.353	0.022	-16.387	<0.001	-0.395	-0.311
Conditional indirect effects of neuroticism on psychological distress						
Gender	effect	SE	LLCI	ULCI		
Male	0.062	0.017	0.031	0.095		
Female	0.048	0.012	0.025	0.071		

(E) Model 5 (neuroticism → resilience)

Variables	Estimate	SE	t	P	LLCI	ULCI
(Outcome variable: Psychological distress)						
Constant	10.938	1.774	6.165	<0.001	7.457	14.419
Gender	-4.136	1.551	-2.666	<0.01	-7.179	-1.100
Income/year	-0.203	0.227	-0.896	0.370	-0.649	0.242
Role model	-0.065	0.290	-0.224	0.823	-0.634	0.504
Neuroticism	0.480	0.021	22.529	<0.001	0.438	0.521
Resilience	-0.261	0.054	-4.883	<0.001	-0.366	-0.156
Resilience × Gender	0.160	0.058	2.737	<0.01	0.045	0.275
Increase of R ² with interaction	R ² 0.004		F 7.492		P 0.006	
Conditional effects of the focal predictor at values of the moderator (Gender)						
Gender	effect	SE	t	P	LLCI	ULCI
Male	-0.261	0.054	-4.883	<0.001	-0.366	-0.156
Female	-0.101	0.030	-3.346	<0.001	-0.161	-0.042
Conditional indirect effects of neuroticism on psychological distress						
Gender	effect	SE	LLCI	ULCI		
Male	0.098	0.022	0.056	0.140		
Female	0.038	0.013	0.013	0.064		

(F) Model 6 (resilience → psychological distress)

Variables	Estimate	SE	t	P	LLCI	ULCI
(Outcome variable: Resilience)						
Constant	7.834	1.493	5.249	<0.001	4.906	10.763
Gender	0.205	1.591	0.129	0.897	-2.917	3.328
Income/year	0.055	0.212	0.259	0.796	-0.361	0.471
Role model	0.699	0.269	2.599	<0.01	0.171	1.227
Self-efficacy	0.741	0.058	12.711	<0.001	0.627	0.855
Self-efficacy × Gender	-0.058	0.064	-0.895	0.371	-0.184	0.069
Increase of R ² with interaction	R ² 0.001		F 0.801		P 0.371	
Conditional indirect effects of self-efficacy on psychological distress						
Gender	effect	SE	LLCI	ULCI		
Male	-0.249	0.041	-0.335	-0.173		
Female	-0.230	0.030	-0.290	-0.173		

(G) Model 7 (self-efficacy → resilience)

Figure 3 Analysis of moderating effects.

DISCUSSION

The associations among neuroticism, self-efficacy, resilience, psychological distress and gender have not been sufficiently explored in FNSs. First, the current study found that neuroticism is positively associated with psychological distress, which is consistent with previous findings.^{32, 33} FNSs with high neuroticism scores were sensitive to external stressors and more prone to psychological distress. However, as neuroticism is a

stable personality trait, efficient intervention has not been possible. Therefore, identifying FNSs with high neuroticism may be the first step to help improve their mental health. Second, the mediation model showed that self-efficacy and resilience significantly mediated the relationship between neuroticism and psychological distress, indicating the important pathway of neuroticism → self-efficacy → resilience → psychological distress, which was also partially confirmed in

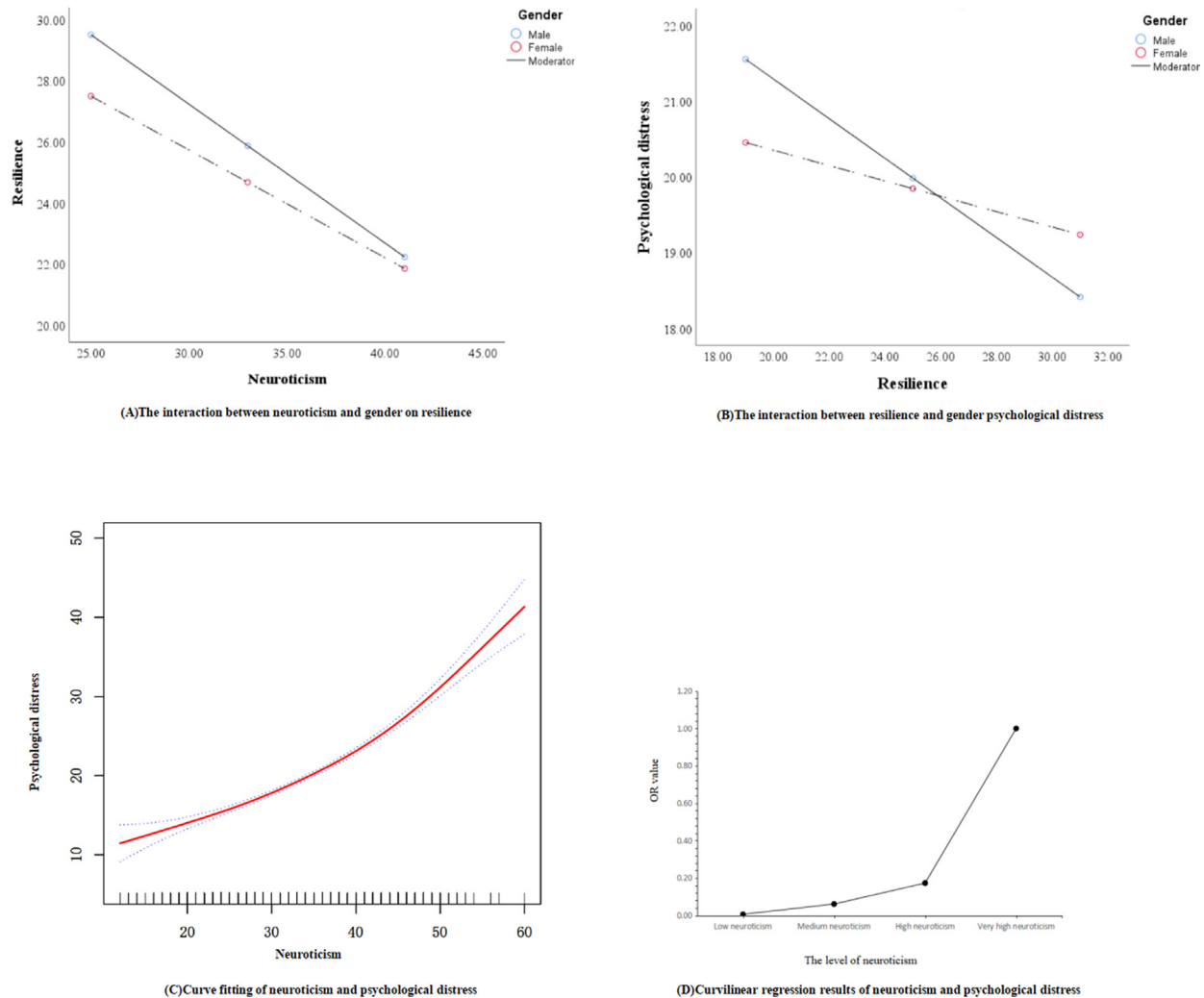


Figure 4 Simple slopes test and curvilinear regression.

a previous study.¹⁴ According to this pathway, theoretically, increasing self-efficacy and resilience could help reduce the impact of neuroticism on psychological distress.³⁴ Self-efficacy and resilience can be enhanced through specific programmes. For example, for resilience, Ye developed a programme called Be Resilient to Breast Cancer to promote breast cancer patients' resilience resulting in increased quality of life.^{35–38} Such successful programmes could be adapted and used for FNSs. Based on these findings, more attention should be paid to FNSs with high levels of neuroticism and low levels of resilience and self-efficacy, which makes them prone to psychological distress.

Third, gender moderated the associations among neuroticism, resilience and psychological distress, which is consistent with existing literature.^{39–41} However, gender moderated only the associations between neuroticism and resilience and resilience and psychological distress. This indicates that the pathway of neuroticism → resilience → psychological distress was different for male FNSs compared with their female counterparts, which is consistent with previous

research,^{42 43} and contributes to the gender difference in the model.

Fourth, a non-linear relationship between neuroticism and psychological distress was identified via GAMA, contributing valuable insights to the existing literature linking neuroticism with psychological distress.⁴⁴

In summary, FNSs with high neuroticism and low self-efficacy or resilience are more likely to experience severe psychological distress, which should be addressed through early identification and intervention.

Limitations

Several limitations should be considered. First, the FNSs from the four universities included in this study may not be representative of the general FNS population; thus, these findings should be further validated with a larger sample comprising participants from diverse cultural backgrounds. Second, due to the cross-sectional nature of this study, causal relationships could not be established, and a longitudinal study should be conducted to replicate these findings. An ongoing 2-year follow-up assessment of this cohort (BRNC Programme) will provide additional insights in the future.

Third, as medical students are quite different from other professionals, the instrument used to measure resilience in the current study may not have captured some characteristics of resilience. Therefore, new resilience instruments specific to medical students should be developed, which has been highlighted in other resilience-based studies.^{45–50} Fourth, several potential confounders, such as social support, hope and family function were not considered in the moderated mediation model due to heavy scale burden; this may have had an impact on the association estimation.

Conclusions

Self-efficacy and resilience mediate the relationship between neuroticism and psychological distress. Gender moderates the relationships between neuroticism and resilience and between resilience and psychological distress.

Acknowledgements The authors would like to thank the directors from the participating universities for supporting data collection and the newly graduated nurses who were involved in this research.

Contributors XM: conceptualisation, data curation, methodology, software, writing—original draft. HW: funding acquisition, investigation, software, methodology. XW: methodology, software. XWu: investigation, resources, software, validation. JW: investigation, resources. ZY: funding acquisition, supervision, writing—review and editing.

Funding This research was funded by grants from National Natural Science Foundation of China (No. 71904033), Young Elite Scientists Sponsorship Program by CACM (2021-QNRC2-B08), Humanity and Social Science Youth Foundation of Ministry of Education of China (No. 19YJCZH227), Humanity and Social Science Foundation of Department of Education of Guangdong Province (No. 2020WTSCX009), Humanity and Social Science Foundation of Guangzhou (No. 2021GZGJ57), and Humanity and Social Science Foundation of Guangzhou University of Chinese Medicine (No. 2020SKXK01, 2021SKYB07).

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval The present study is part of the Be Resilient to Nursing Career program (BRNC, Registration number: (ChiCTR2000038693)) and was approved by the Ethics Committee of the First Affiliated Hospital of Guangzhou University of Traditional Chinese Medicine (No: ZYEC-ERK [2020] 132). The participants were reassured that their personal data would remain confidential and would be reported anonymously. All instruments used in the current study were used after obtaining the original authors' permission.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iD

Xiaoxiao Mei <http://orcid.org/0000-0003-2721-5784>

REFERENCES

- World Health Organization. State of the world's nursing 2020: investing in education, jobs and leadership, 2020. Available: <https://www.who.int/publications/i/item/9789240003279> [Accessed 2 Nov 2021].
- Savitsky B, Findling Y, Erel A, et al. Anxiety and coping strategies among nursing students during the covid-19 pandemic. *Nurse Educ Pract* 2020;46:102809.
- Tung Y-J, Lo KKH, Ho RCM, et al. Prevalence of depression among nursing students: a systematic review and meta-analysis. *Nurse Educ Today* 2018;63:119–29.
- Salvarani V, Ardenghi S, Rampoldi G, et al. Predictors of psychological distress amongst nursing students: a multicenter cross-sectional study. *Nurse Educ Pract* 2020;44:102758.
- Tesfahunegn TB, Gebremariam EH. Mental distress and associated factors among Aksum university students, Ethiopia: a cross-sectional study. *BMC Psychiatry* 2019;19:71.
- Luciano M, Hageaars SP, Davies G, et al. Association analysis in over 329,000 individuals identifies 116 independent variants influencing neuroticism. *Nat Genet* 2018;50:6–11.
- Allen TA, Carey BE, McBride C, et al. Big five aspects of personality interact to predict depression. *J Pers* 2018;86:714–25.
- Liao A, Walker R, Carmody TJ, et al. Anxiety and anhedonia in depression: associations with neuroticism and cognitive control. *J Affect Disord* 2019;245:1070–8.
- Shahrour G, Dardas LA. Acute stress disorder, coping self-efficacy and subsequent psychological distress among nurses amid COVID-19. *J Nurs Manag* 2020;28:1686–95.
- Xiong H, Yi S, Lin Y. The psychological status and self-efficacy of nurses during COVID-19 outbreak: a cross-sectional survey. *Inquiry* 2020;57:46958020957114.
- Bandura AFreeman WH, ed. *Self-Efficacy: the exercise of control*. New York, 1997.
- Chen X, Qiu N, Chen C, et al. Self-Efficacy and depression in boxers: a mediation model. *Front Psychiatry* 2020;11:00791.
- Kumfer KL. 1999. *factors and processes contributing to resilience: the resilience framework M*. New York: Kluwer Academic, 1999.
- Mei XX, Wang HY, Wu XN, et al. Self-Efficacy and professional identity among Freshmen nursing students: a latent profile and moderated mediation analysis. *Front Psychol* 2022;13:779986.
- Gong Y, Shi J, Ding H, et al. Personality traits and depressive symptoms: the Moderating and mediating effects of resilience in Chinese adolescents. *J Affect Disord* 2020;265:611–7.
- Mei XX, Wu XN, Wang HY, et al. Heterogeneity in psychological resilience and mental health among newly graduated nursing students: a latent profile and generalized additive model analysis. *Psychol Res Behav Manag* 2022;15:597–606.
- Mussi FC, Pires CGdaS, Carneiro LS, et al. Comparison of stress in freshman and senior nursing students. *Rev Esc Enferm USP* 2019;53:e03431.
- Xie J, Liu M, Zhong Z, et al. Relationships among character strengths, self-efficacy, social support, depression, and psychological well-being of hospital nurses. *Asian Nurs Res* 2020;14:150–7.
- Costa PT, McCrae RR. Domains and facets: hierarchical personality assessment using the revised Neo personality inventory. *J Pers Assess* 1995;64:21–50.
- Zhang JX, Schwarzer R. Measuring optimistic self-beliefs: a Chinese adaptation of the general self-efficacy scale. *Psychologia* 1995;38:174–81.
- Zhang X, Zhan Y, Liu J, et al. Chinese translation and psychometric testing of the cardiac self-efficacy scale in patients with coronary heart disease in mainland China. *Health Qual Life Outcomes* 2018;16:43.
- Connor KM, Davidson JRT. Development of a new resilience scale: the Connor-Davidson resilience scale (CD-RISC). *Depress Anxiety* 2003;18:76–82.
- Campbell-Sills L, Stein MB. Psychometric analysis and refinement of the Connor-davidson resilience scale (CD-RISC): validation of a 10-item measure of resilience. *J Trauma Stress* 2007;20:1019–28.
- Ye ZJ, Qiu HZ, Li PF, et al. Validation and application of the Chinese version of the 10-item Connor-Davidson resilience scale (CD-RISC-10) among parents of children with cancer diagnosis. *Eur J Oncol Nurs* 2017;27:36–44.
- Kessler R, Mroczek D. An update of the development of mental health screening scales for the US National health interview study. *Survey Research* 1992.
- Kessler R, Mroczek D. Final versions of our non-specific psychological distress scale. *Psychology* 1994.
- Bu X-Q, You L-M, Li Y, et al. Psychometric properties of the Kessler 10 scale in Chinese parents of children with cancer. *Cancer Nurs* 2017;40:297–304.
- Jing Z, Li J, Fu PP, et al. Physical multimorbidity and lifetime suicidal ideation and plans among rural older adults: the mediating role of psychological distress. *BMC Psychiatry* 2021;21:78.
- Podsakoff PM, MacKenzie SB, Lee J-Y, et al. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol* 2003;88:879–903.

- 30 Hastie T, Tibshirani R. Generalized additive models for medical research. *Stat Methods Med Res* 1995;4:187–96.
- 31 Peltzer K. Decline of common mental disorders over time in public primary care tuberculosis patients in South Africa. *Int J Psychiatry Med* 2016;51:236–45.
- 32 Aguilar-Agudo A, Herruzo-Cabrera J, Pino-Osuna MJ. Factores de riesgo y de protección que predicen el malestar psicológico del cuidador de personas con enfermedad de Parkinson avanzada [Protective and risk factors predicting caregiver psychological distress in people with advanced Parkinson's disease]. *Rev Neurol* 2021;72:145–50.
- 33 Fernández RS, Crivelli L, Guimet NM, et al. Psychological distress associated with COVID-19 quarantine: latent profile analysis, outcome prediction and mediation analysis. *J Affect Disord* 2020;277:75–84.
- 34 Scholten EWM, Ketelaar M, Visser-Meily JMA, et al. Prediction of psychological distress among persons with spinal cord injury or acquired brain injury and their significant others. *Arch Phys Med Rehabil* 2020;101:2093–102.
- 35 Ye ZJ, Liang MZ, Qiu HZ, et al. Effect of a multidiscipline mentor-based program, be Resilient to breast cancer (BRBC), on female breast cancer survivors in mainland China-A randomized, controlled, theoretically-derived intervention trial. *Breast Cancer Res Treat* 2016;158:509–22.
- 36 Ye ZJ, Qiu HZ, Liang MZ, et al. Effect of a mentor-based, supportive-expressive program, be Resilient to breast cancer, on survival in metastatic breast cancer: a randomised, controlled intervention trial. *Br J Cancer* 2017;117:1486–94.
- 37 Ye ZJ, Zhang Z, Zhang XY, et al. Effectiveness of adjuvant supportive-expressive group therapy for breast cancer. *Breast Cancer Res Treat* 2020;180:121–34.
- 38 Ye ZJ, Zhang Z, Tang Y, et al. Resilience patterns and transitions in the be Resilient to breast cancer trial: an exploratory latent profile transition analysis. *Psychooncology* 2021;30:901–9.
- 39 Xiao X, Xiao J, Yao J, et al. The role of resilience and gender in relation to Infectious-Disease-Specific health literacy and anxiety during the COVID-19 pandemic. *Neuropsychiatr Dis Treat* 2020;16:3011–21.
- 40 Zhang M, Zhang J, Zhang F, et al. Prevalence of psychological distress and the effects of resilience and perceived social support among Chinese college students: does gender make a difference? *Psychiatry Res* 2018;267:409–13.
- 41 Iimura S, Taku K. Gender differences in relationship between resilience and big five personality traits in Japanese adolescents. *Psychol Rep* 2018;121:920–31.
- 42 Dévieux JG, Malow RM, Attonito JM, et al. Post-Traumatic stress disorder symptomatology and alcohol use among HIV-seropositive adults in Haiti. *AIDS Care* 2013;25:1210–8.
- 43 Nygaard E, Heir T. World assumptions, posttraumatic stress and quality of life after a natural disaster: a longitudinal study. *Health Qual Life Outcomes* 2012;10:76.
- 44 Lee S-A, Jeon JY, No S-K, et al. Factors contributing to anxiety and depressive symptoms in adults with new-onset epilepsy. *Epilepsy Behav* 2018;88:325–31.
- 45 Ye ZJ, Liang MZ, Li PF, et al. New resilience instrument for patients with cancer. *Qual Life Res* 2018;27:355–65.
- 46 Ye ZJ, Liang MZ, Zhang HW, et al. Psychometric properties of the Chinese version of resilience scale specific to cancer: an item response theory analysis. *Qual Life Res* 2018;27:1635–45.
- 47 Ye ZJ, Zhang Z, Tang Y, et al. Development and psychometric analysis of the 10-item resilience scale specific to cancer: a multidimensional item response theory analysis. *Eur J Oncol Nurs* 2019;41:64–71.
- 48 Ye ZJ, Zhang Z, Zhang XY, et al. State or trait? measuring resilience by generalisability theory in breast cancer. *Eur J Oncol Nurs* 2020;46:101727.
- 49 Ye ZJ, Zhang Z, Tang Y, et al. Minimum clinically important difference for resilience scale specific to cancer: a prospective analysis. *Health Qual Life Outcomes* 2020;18:381.
- 50 Liang MZ, Tang Y, Chen P, et al. New resilience instrument for family caregivers in cancer: a multidimensional item response theory analysis. *Health Qual Life Outcomes* 2021;19:258.