

Exploring the Symptom Patterns of Depression and Anxiety among Teachers during COVID-19: A Latent Profile Analysis¹

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Abstract

Objective: The present study used the latent profile analysis (LPA) approach to explore the symptom patterns of depression and anxiety among Chinese teachers during COVID-19 and its relationship with fear of COVID-19 and suicidal ideation.

Method: A sample of 6121 teachers from primary and secondary schools in a district-level administrative unit in southern China was used. The LPA was employed to identify different symptom patterns of depression and anxiety. We subsequently used logistic regression to analyse the effects of demographic variables on the different profiles. The BCH method assessed the relationships between each profile and fear of COVID-19 and suicidal ideation.

Results: The study identified five significant latent profiles and two subtypes in the moderate psychological disorder group (MPDG). we also found that gender, professional title, and age significantly influenced the distribution of the profiles. The risk for both *fear of COVID-19* and *suicidal ideation* was highest in the severe psychological disorder group (SPDG). The high anxiety subtype had a significantly greater fear of the new coronavirus epidemic than the high depression subtype, which had a significantly higher level of suicidal ideation than the high anxiety subtype.

Conclusion: The profiles we identified have distinct features that confirm their unique patterns of symptom endorsement. Our study may have important implications for early warning and intervention in teacher mental health.

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Keywords: depression; anxiety; latent profile analysis (LPA); COVID-19; suicidal ideation

Clinical Impact Statement

This study explored five symptom patterns of depression and anxiety among Chinese teachers during the COVID-19 pandemic and indicate that gender, professional title, and age influence the distribution of these profiles, with the severe psychological disorder group exhibiting the highest risk for fear of COVID-19 and suicidal ideation. These results highlight the importance of tailored interventions to address the unique needs of different teacher populations. Policymakers should consider these findings when developing strategies to support teacher mental health, including the use of online platforms to provide targeted psychological treatment and resources for coping with stressors related to the pandemic.

1. Introduction

Depression and anxiety are among the most prevalent mental health disorders, placing a significant burden on patients and society² (Organization, 2017). These disorders not only affect individuals but also have wider societal implications. In the context of education, teachers' mental health is an essential factor that directly impacts the quality of education provided. However, despite the critical role teachers play in shaping the future of society, their well-being and mental health are often overlooked (Yang et al., 2019). According to the DSM-5 diagnostic criteria, anxiety and depression are considered two distinct disorder units (American Psychiatric Association and Association, 2013), yet co-morbidity of anxiety and depression is common. Approximately 85% of people with depression experience significant symptoms of anxiety. Similarly, up to 90% of anxious patients present with

² It is estimated that more than 13.1 million adults experience depressive episodes and 40 million adults experience anxiety episodes each year (Kessler et al., 2012).

depressive symptoms (Gorman, 1996). Moreover, **WHO data** indicate that 41.6% of people with 12-month major depression also suffer from 12-month anxiety disorder (Kessler et al., 2015). Although patients with co-morbidities meet the criteria for specific anxiety and depression disorders, co-morbid symptoms are often more severe than the disorders that occur alone (Moscati et al., 2016). Co-morbidity causes more significant distress, poorer treatment outcomes and a higher risk of suicide (Lei et al., 2022) as well as higher levels of impaired social and occupational functioning (Adams et al., 2016) and a higher rate of relapse. In addition to high co-morbidities, the two disorders also share similar neuroendocrine features, such as dysregulation of adrenocorticotrophic hormone-releasing factor (Boyer, 2000) and hypothalamic-pituitary-adrenocortical (HPA) axis hypofunction (Camacho, 2013).

Structural models of depression and anxiety are derived from the *tripartite model* based on symptom dimensions which proposes that although depression and anxiety share general distress factors (e.g., restlessness, insomnia, irritability and feelings of irritability), anxiety is characterised by symptoms of physiological overanxiety, such as rapid heartbeat, shortness of breath, somatic tension and dizziness, whereas depression is characterised by low positive affectivity, namely, a lack of positive emotional experiences, such as a lack of joy, enthusiasm and pride (Clark and Watson, 1991).

1.1 Co-morbidity of anxiety and depression associated with fear of COVID-19 and suicidal ideation

The COVID-19 pandemic beginning in late 2019 is a public health crisis that continues to threaten the world (Cucinotta and Vanelli, 2020), with a range of negative impacts on people's mental health (“Psychological impact of COVID-19,” n.d., p. 19) . Fear, one of the adverse outcomes of COVID-19, is often understood as a negative emotional response or persistent worry when individuals are aware of a threat to themselves or their environment (Chi et al., 2022) and is an adaptive response to the environment. However, it can be maladaptive when it is out of proportion relative to the actual threat (Steimer, 2022). A meta-analysis suggesting that COVID-19 caused a significant increase in fear levels worldwide (Luo et al., 2021).

Suicide is a public health issue of global concern, while suicide prevention and intervention are very large challenges for society. Studies have shown that approximately 60% of people who die from suicide suffer from depression (Cavanagh et al., 2003), and the presence of anxiety disorders also significantly increases the risk of suicide (Chang et al., 2016). Other studies have shown that patients with a combination of depression and anxiety disorders are at greater risk of suicide than those with either disorder alone (Stringer et al., 2013). Suicidal ideation is an essential indicator for assessing the risk of suicide. It refers to the thought of ending one's life but not yet acting on it. Many studies now show that suicidal ideation in people with depression or anxiety disorders is the most crucial risk factor for suicidal behaviour (Nepon et al., 2010; Stringer et al., 2013). One study conducted during the pandemic suggested that the COVID-19 pandemic heightened anxiety, depression, and fear of infection, which in turn increased suicidal behaviour and suicide rates (Sher, 2020).

1.2 Latent profile analysis

Latent profile analysis (LPA) is an emerging human-centred approach to statistical analysis that achieves local independence between exogenous variables by explaining associations between continuous external variables through latent category variables. In recent years, the LPA approach has contributed greatly to addressing the comorbidity of depression and anxiety. For example, Rhebergen and Graham applied the LPA method to explore the presence of heterogeneity in dysthymia in a US patient population (Rhebergen and Graham, 2014); Hettema et al. applied this approach to investigate the prevalence of mixed anxiety–depression in a US twin sample (Hettema et al., 2015); and Magson et al. applied the use of latent transition analysis to explore patterns of social anxiety and depressive symptoms in a Swedish adolescent cohort (13-19 years) (Magson et al., 2022). Subgroups of individuals suffering from both high levels of depression and anxiety have been consistently identified in previous studies. Such evidence provides strong support for revealing that symptoms of depression and anxiety exist in the same individual (Lei et al., 2022).

Despite the considerable progress that has been made in understanding the subtypes of depression and anxiety, there are several shortcomings. First, there are gaps in the applicability of findings to different cultural contexts.

There is a paucity of research on subtypes of depression and anxiety in the Chinese context. Second, there is a lack of understanding of depression and anxiety subtypes in specific occupational groups, especially among teachers. Due to the unique nature of the profession, psychological well-being is crucial for teachers (Chandola, 2010; Chandola et al., 2010). Teachers' mental health can further affect students' academic achievement and social adjustment through their teaching. Teachers at risk of burnout may respond to students more punitively and harshly, which may exacerbate students' irrational behaviour (Jennings and Greenberg, 2009). Accurate identification of subtypes of depression and anxiety in the teacher population is essential to develop appropriate policies and provide effective interventions for this population (O'Brennan et al., 2017).

1.3 The present study

This study aimed to explore the presence of depression and anxiety subtypes in the Chinese teacher population. We first used LPA to identify subtypes of anxiety and depression based on each item on the Depression, Anxiety, and Stress Scale (DASS-21) (Antony et al., 1998). The predictive effect of demographic variables on subtypes was then examined using multinomial logistic regression. Finally, the BCH method was used to compare whether there were significant differences in scores for fear of COVID-19 and suicidal intention between subtypes.

2. Method

2.1 Participants

Data were collected from selected secondary and primary schools³ in a district-level administrative unit in southern China. In early 2022, the local government issued an administrative order to survey teachers and various school personnel (including those in nonteaching positions such as administration and finance) on their mental health status during the COVID-19 pandemic. Therefore, as a government-commissioned research institute, all 42 schools we approached agreed to participate in the survey.

³ The Chinese education system divides secondary schools into junior high schools and senior high schools. These two school types are also included in the study.

Overall, 11,127 people participated in the study. The exclusion criteria were as follows: school administrators, part-time teachers and those who did not fill in or specify their duties in the school (4312 were excluded), those with missing values on the DASS questionnaire (405 were excluded), and finally those with more than 30% incomplete on other scales (289 were excluded). Information on the demographics of the sample can be found in Table 3. The sociodemographic characteristics of the sample (age, years of teaching experience and title) are generally consistent with the current structure of teachers in China (Ao and Lin, 2020; Gao et al., 2016; Zhu and Hu, 2014).

2.2 Procedure

The study has been approved by the authors' institution's human experimental ethics review committee. and authorised by each participating school. Questionnaires were distributed directly to teachers through the school administration. The questionnaire contained an informed consent form, demographic information, information on the teacher's profession (e.g., the teacher's title, subject and grade level), DASS-21, FCV-19S and PHQ-9.

Before completing the questionnaire for this study, teachers were informed of the nature and purpose of the study through written format. Teachers were also informed that their participation would be voluntary, that they could withdraw from the study at any time, that their decisions and responses would not affect their status in the school, and that all of their personal information would be kept strictly confidential.

If the participant finally agreed to the study, then he or she signed the informed consent form and submitted the completed questionnaire to the school administration. The school administration then placed all completed questionnaires in a sealed envelope and mailed them to the researcher. Teachers who agreed to participate in the study were asked to submit the questionnaire to the school administration within three days. The entire study process strictly adhered to the ethical standards of the APA (Association, 2016).

The study was approved by the Human Experimentation Review Committee of Guangzhou University, College of Education (Ethical approval number: GZHU202202).

2.3 Measures

Depression, Anxiety, and Stress Scales-21: The DASS-21 was used to assess teachers' psychological disorders (Lovibond and Lovibond, 1996; Wang et al., 2016). The DASS is a widely used mental health assessment. It aimed to supply clinical diagnosis with psychometric indicators and serve as a rapid, efficient measurement instrument for emotional disorders. It has been found to be a reliable and valid tool for measuring the mental health among Chinese primary and middle school teachers (Cao et al., 2023). One advantage of the DASS-21 scale is its specific focus on measuring depression and anxiety symptoms in the same time. Unlike generic mental health scales, the DASS-21 scale provides a more targeted assessment of these particular disorders. The DASS-21 consists of three subscales, each with seven questions, with each of the three subscales corresponding to three negative mood dimensions. These are depression (e.g., "I found it difficult to work up the initiative to do things"), anxiety (e.g., "I was aware of dryness of my mouth") and stress (e.g., "I tended to overreact to situations"). Responses were scored using a 4-point Likert scale, ranging from 0 ("Did not apply to me at all") to 3 ("Applied to me very much or most of the time"). Higher scores represent more severe affective disorders experienced by the respondent in the past week. The DASS-21 scale was shown to have good reliability in China's general and clinical populations (Wang et al., 2016). In this study, *Cronbach's α* coefficients for the total scale and the three subscales were 0.939 (total scale), 0.845 (stress), 0.836 (anxiety) and 0.859 (depression). Meanwhile, *the mean interitem correlations (MICs)* were all between 0.15 and 0.50, which were acceptable levels (Cohen et al., 1996). We have provided English and Chinese versions of the DASS-21 questionnaire (S1-S2) and the mean scores on each item (S3) in the Supplementary material.

Fear of COVID-19 Scale: The Chinese version of the FCV-19S scale translated by Chi et al. (Chi et al., 2022), which was first developed by Ahrosu et al. (2022), was used to assess teachers' feelings of fear during COVID-19. It has seven items and is composed of two factors, including four items that measure fearful thoughts about COVID-19 (e.g., "I am most afraid of coronavirus-19.") and three items that measure physical reactions to COVID-19 (e.g., "My hands become clammy when I think about coronavirus-19."). The FCV-19S is calculated using a 5-point Likert scale ranging from 1 ("totally disagree") to 4 ("completely agree"). The Chinese version of

this scale has been validated in the general population of China and has shown good reliability and validity (Chi et al., 2022). *Cronbach's α* coefficient for the FCV-19S in the current study reached 0.921 (MIC = 0.437).

Suicidal ideation: The last item on the PHQ-9 scale was used to assess teachers' suicidal ideation in the past two weeks (Kroenke et al., 2001; Xu et al., 2007). The PHQ-9 was revised based on the diagnostic criteria of the DSM-IV and is considered the most reliable screening tool for depression (Costantini et al., 2021). The first eight items of the scale ask about the frequency of depressive symptoms, such as feeling depressed or hopeless. The last item (Item 9) of the PHQ-9 measures participants' suicidal ideation ("thoughts that you would be better off dead, or thoughts of hurting yourself in some way"). Item 9 has good predictive validity and has been shown to strongly predict suicide attempts (Rossom et al., 2017). Responses to the PHQ-9 are on a 4-point Likert scale, with response options for each item being "Not at all" (0), "Several days" (1), "More than half of the days" (2) or "Nearly every day" (3). *Cronbach's α* coefficient for the PHQ-9 in this study reached 0.887 (MIC=0.473).

2.4 Data analysis strategies

In this study, the R language was used to perform descriptive statistic calculation, tests of variance, and missing value imputation (Team, 2013). Missing values in the data were imputed using multiple imputations of chained equations from the MICE library (van Buuren and Groothuis-Oudshoorn, 2011). Mplus 8.3 was used for a range of LPA and covariate analyses (Muthén and Muthén, 2017).

We first performed LPA to identify different subtypes based on the scores of each DASS-21 item. For the selection of the model estimator, the study followed the recommendation of Spurk et al. (2020) to use the MLR estimator. To avoid the LPA model going to a local optimum and thus producing incorrect estimates, we set the random starting group to 7000 and performed 300 iterations per random start (Hipp and Bauer, 2006).

To determine the optimal number of profiles, we used several fit metrics: the *Akaike Information Criterion (AIC)*, the *Bayesian Information Criterion (BIC)*, the *adjusted Bayesian Information Criterion (aBIC)*, the *Lo-Mendell-Rubin test (LMR)* and the *Bootstrap Likelihood Ratio Test (BLRT)* (McLachlan, 1987). The lower the AIC, BIC and aBIC are,

the better the model fits (Nylund et al., 2007), while the LMR and BLRT are used to assess whether the N class model fits better than the $N - 1$ class model. Since aBIC is considered a more accurate fit indicator, the steep slope of aBIC for different numbers of profiles was also plotted. The model tends to converge if there is an inflexion point in the plot (Masyn, 2013). Finally, we used entropy to assess classification accuracy, and when entropy was greater than 0.80, the classification was more than 90% accurate (Lo et al., 2001; Lubke and Muthén, 2007). We followed the majority principle in selecting the models, which means that the model had to perform optimally on most, but not all, metrics (Dahling et al., 2017). The final model was also required to be explanatory to avoid *profile discrimination issues* (Spurk et al., 2020).

After determining the optimal model, we conducted ANOVAs and post hoc tests on the DASS-21 dimensions and item scores to examine differences between groups. Then, we calculated descriptive statistics for the demographic covariates for the different subgroups. Since our covariates were categorical, chi-square tests were used to test for differences in covariates between groups.

We then conducted regression analysis using the robust three-step approach (R3STEP) (Vermunt, 2010), with covariates as independent variables and subgroups as dependent variables. Additionally, to facilitate explanation (Ranganathan et al., 2015), we transformed the raw coefficients into odds ratios (ORs). Last, we used the BCH method to assess the association of each subgroup with two continuous distal outcomes, *fear of COVID-19* and *suicidal ideation* (Asparouhov and Muthén, 2014).

3. Results

3.1 Latent profile determination

The fitted statistical metrics for profiles 1 to 7 are summarised in Table 1, while Figure 1 gives the aBIC steep slope plot.

Table 1: Model fit indices for patterns 1 through 7 from the latent profile analysis of DASS-21 ($n=6121$)

Mod el class	K	AIC	BIC	aBIC	Entrop y	LMR (p)	BLR T (p)	Prop
1	42	228208. 6	228490. 8	228357. 3	-	-	-	1
2	64	186258. 3	186688. 4	186485	0.967	0	0	0.761/0.239
3	86	173228. 3	173806. 1	173532. 9	0.964	0.002	0	0.679/0.036/0.284
4	10 8	165664. 6	166390. 3	166047. 2	0.941	0.02	0	0.556/0.279/0.145/0.20
5	13 0	156486. 8	157360. 4	156947. 3	0.943	0.04	0	0.532/0.261/0.085/0.105/0.017
6	15 2	153251. 1	154272. 5	153789. 5	0.953	0.480 3	0	0.554/0.175/0.101/0.060/0.101/0.009
7	17 4	147916. 9	149086. 1	148533. 2	0.953	0.487 8	0	0.020/0.460/0.187/0.123/0.060/0.140/ 0.009

Note. The values in the LMR and BLRT columns are the p values related to LMR and BLRT in comparing the fit between models. K = the number of free parameters; AIC = Akaike information criterion; BIC = Bayesian information criterion; aBIC = adjusted Bayesian information criterion; LMR = Lo-Mendell-Rubin; BLRT = bootstrapped likelihood ratio test; DASS-21 = Social Anxiety Scale for Adolescents.

Overall, the 5-profile solution is the best, with a lower AIC, BIC and aBIC than the previous four profiles, while Figure 1 shows that the aBIC has an inflexion point at $N = 5$, after which the change plateaus. Although the entropy for the 6-profile solution is higher than that of the 5-profile solution, the LMR test result is nonsignificant, which means that it does not fit significantly better than the previous model (We have analysed the plausibility of two other solutions in section S4 of the Supplementary material). We therefore chose the 5-profile solution, which performed better on the basis of all fit indices, as our final model.

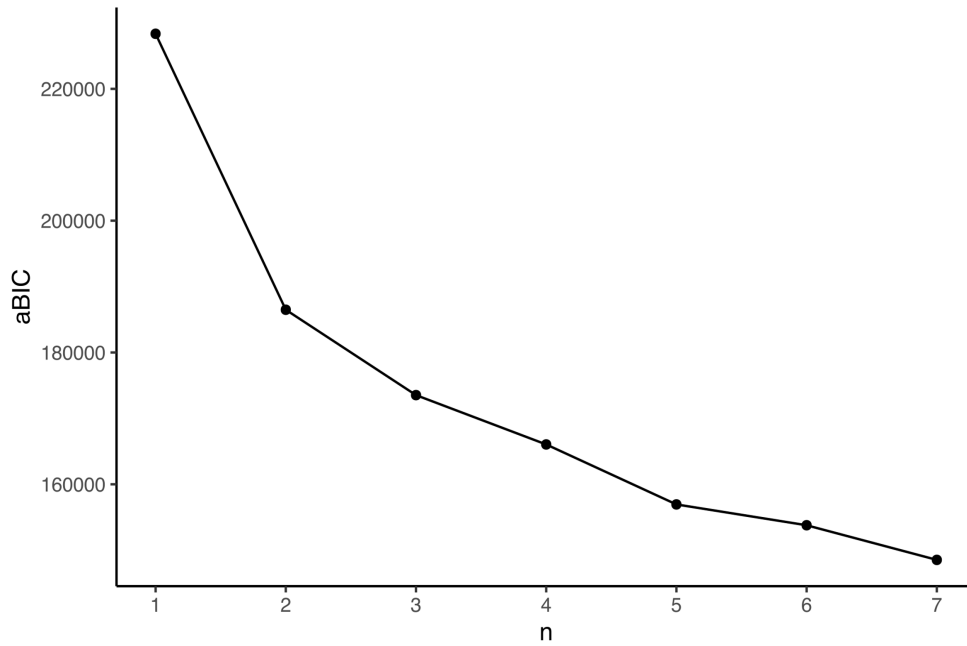


Figure 1: The steep slope of aBIC.

Note. aBIC = adjusted Bayesian Information Criterion

Figure 2 shows the distribution of responses for each subgroup of the 5-profile LPA model for each item. Profile 1 (N=3257, 53.21%) was the largest group in the study, and it scored the lowest on all DASS-21 items, with a score of 0.5 or less; hence, we named it the **Healthy group (HG)**. Profile 2 (N=1595, 26.08%) scored higher than Profile 1 on essentially all items but lower than the other three profiles, with scores between 0.5 and 1 on each item; hence, we named it the **Light Psychological Disorder Group (LPDG)**. Interestingly, the scores of Profile 3 (N=523, 8.54%) and Profile 4 (N=641, 10.47%) were similar, with Profile 3 consistently scoring higher than Profile 4 in the stress and anxiety dimensions. However, Profile 4 scored much higher than Profile 3 in the depression dimensions of D17 and D21, where D17 ("felt that I wasn't worth much as a person.") tested the **Self-deprecation symptom** while D21 ("I felt that life was meaningless.") tested the **Devaluation of life symptom**. Both symptoms are important diagnostic criteria for major depressive disorder in the DSM-5 (diagnostic criteria A7 and A9) (American Psychiatric Association and Association, 2013). Notably, these two symptoms are also significant predictors of suicidal ideation. Based on the above analysis, we named profile 4 the **moderate psychological disorder group (high depression)** (abbreviated as **MPDG-D**). For Profile

3, the scores in the anxiety and stress dimensions (e.g., A2: "I was aware of dryness of my mouth.") were higher than those of Profile 4, so we named it the **moderate psychological disorder group (high anxiety)** (abbreviated as **MPDG-A**). Finally, Profile 5 was the smallest but most severely anxious and depressed group (N=105, 1.72%), with scores between 1.5 and 2.0 on all items, and we named it the **severe psychological disorder group (SPDG)**.

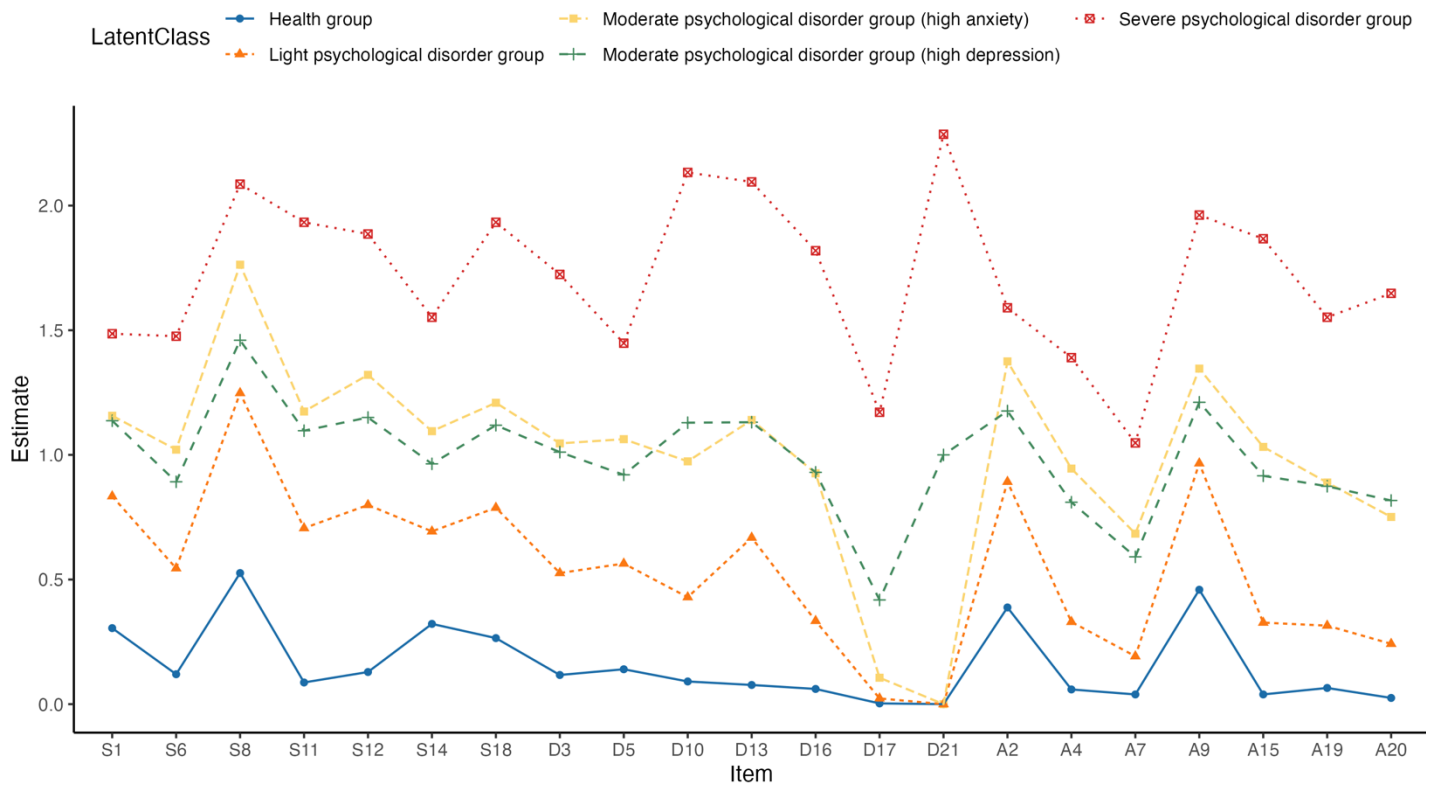


Figure 2: Five-latent-profile model of participants based on responses to DASS-21 items.

Note. The specific content of each item can be found in S1-S2 of the Supplementary material

We then performed ANOVAs and post hoc tests for the five subgroups on each dimension and item to further investigate the differences between the groups. Table 2 gives the descriptive information and the results of the significance tests for the five subgroups on each dimension, while the results for each DASS-21 item can be found in the Supplementary material (S3). The ANOVA results showed significant differences between the subgroups

in terms of total score, stress, anxiety and depression. Further post hoc analyses revealed that the **SPDG** scored highest in all dimensions. In contrast, the **LPDG** and **HG** scored at the second-to-last and first positions. It is notable that for the two subtypes of **MPDG**, there was no significant difference between the two groups in terms of total scores. However, regarding specific dimensions, the **MPDG-A** scored higher for anxiety and stress than the high depression subtype. The **MPDG-D**, on the other hand, scored higher for depression than the high anxiety subtype. Overall, the statistically significant test results suggest that the 5-profile solution is more reasonable.

Table 2: ANOVA and post hoc test results between different profiles

	N	Total score	Stress	Anxiety	Depression
Healthy Group (HG)	3,257	3 (2) ¹	1.7 (1.5)	1.07 (1.01)	0.48 (0.79)
Light Psychological Disorder Group (LPDG)	1,595	11 (3)	5.6 (1.6)	3.28 (1.47)	2.57 (1.34)
Moderate Psychological Disorder Group (high anxiety) (MPDG-A)	523	21 (5)	8.8 (2.3)	7.07 (2.09)	5.28 (1.96)
Moderate Psychological Disorder Group (high depression) (MPDG-D)	641	21 (7)	7.8 (2.9)	6.39 (2.94)	6.54 (2.26)
Severe Psychological Disorder Group (SPDG)	105	36 (12)	12.4 (4.3)	11.06 (4.65)	12.68 (3.71)
F		4717***	2935***	2143***	2737***
Post hoc Test ³		<i>HG<LPDG<MPDG-A=MPDG-D<SPDG²</i>	<i>HG<LPDG<MPDG-D<MPDG-A<SPDG</i>	<i>HG<LPDG<MPDG-D<MPDG-A<SPDG</i>	<i>HG<LPDG<MPDG-A<MPDG-D<SPDG</i>

Note. ¹Mean (SD),²">" means that there is a significant difference between groups, with the latter group showing a significantly larger value than the former group, while "=" means there is no significant difference between groups. ³Post-hoc test is the Games–Howell test.

3.2 Descriptive statistics of demographic characteristics across profiles

The descriptive statistics for each profile for the demographic variables are given in Supplementary material(S5), and we also tested for differences between profiles. The chi-square test results show that the characteristics of the profiles for the different demographic variables are significantly different. The p values for all tests were less than 0.001, except for “*Whether have children.*”

3.3 Covariate analysis

As the chi-square test did not help us capture the specific differences in demographic factors between each profile, the R3STEP method was used to fit a multinomial logistic model to examine the effects of demographic variables on each profile. Because of space constraints, we put the table in Supplementary material(S6). Here we mainly show the results of coefficient plot (Figure 3).

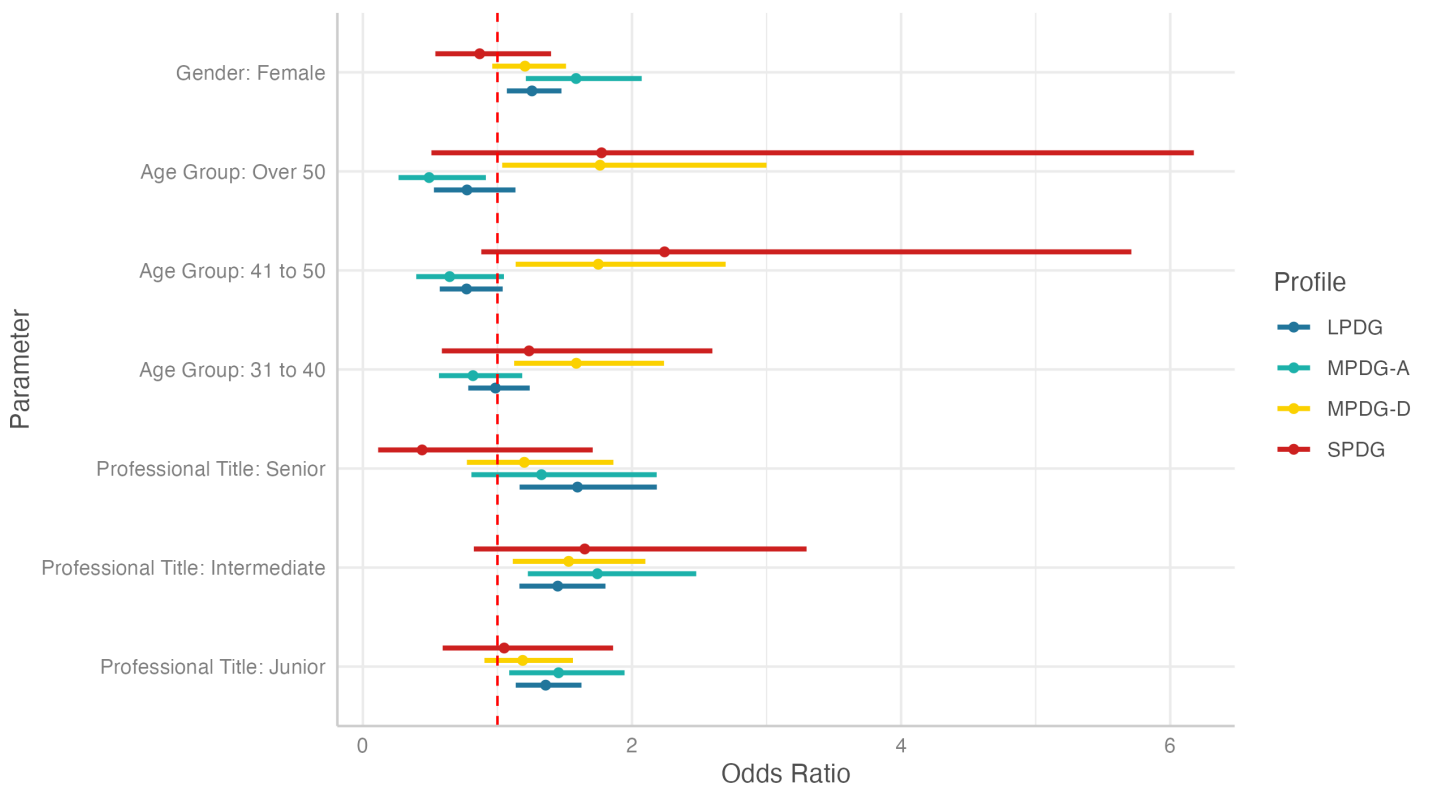


Figure 3: Coefficient plot for multinomial regression result

As most ORs were nonsignificant, we selected a few notable results for illustration. **Gender effects** were observed in the LPDG and MPDG-A. Relative to men, women were 1.26 times (OR=1.26, 95% CI=1.08 to 1.48) and 1.58 times (OR=1.58, 95% CI=1.21 to 2.07) more likely to be in these two profiles than in the HG (reference group). However, gender effects were not observed in the other two profiles.

The **professional title effect** cannot be ignored either, as we observed a positive title effect (i.e., title rank exacerbates disorder) in all three profiles, namely, LPDG, MPDG-A and MPDG-D. Interestingly, the largest OR in the LPDG was for senior titles. However, the results were the opposite in the two MPDGs, where the OR for intermediate titles was the largest in both groups, with some nonlinear relationship. This means that teachers with intermediate titles were 74% (OR=1.74, 95% CI=1.23 to 2.48) and 53% (OR=1.53, 95% CI=1.11 to 2.09) more likely to be in MPDG-A and MPDG-D than teachers with no professional titles.

Finally, a significant relationship between age and the two MPDG subtypes was also revealed. Longitudinally, the three groups of middle-aged and older teachers had an increased likelihood of being in MPDG-D by 59% (OR=1.59, 95% CI=1.12-2.23), 75% (OR=1.25, 95% CI=1.13-2.69) and 76% (OR=1.76, 95% CI=1.03-2.99), respectively, compared to young teachers. Horizontally, the OR for each age group of the MPDG-D subtype was greater than 1 compared to the age group of the MPDG-A subtype, where the ORs were all less than 1. This suggests that the risk of depression increases further with age in the primary and secondary school teacher populations. In contrast, the risk of anxiety may not change much or even decrease.

3.4 Fear of COVID-19 and suicide intention as distal outcomes

Finally, we explored the relationship between **fear of COVID-19** and **suicide intention** with each profile. We conducted BCH analysis with those two as outcome variables; the results are shown in Table 3.

Table 3: Anger and suicidal ideation by profile of psychological disorder

	BCH χ^2	Post hoc test	HG	LPDG	MPDG-A	MPDG-D	SPDG
Fear of COVID-19	1166.3 12***	<i>HG<LPDG<MPDG-D<MPDG-A <SPDG</i> ²	17.124 (4.212) ¹	19.821 (5.122)	25.124 (5.721)	23.452 (3.211)	28.124 (6.322)
Suicide intention	914.32 5***	<i>HG<LPDG<MPDG-A<MPDG-D<SPDG</i>	0.013 (0.115)	0.074 (0.267)	0.163 (0.418)	0.571 (0.582)	1.248 (0.875)

Note. Healthy group (HG) is the reference group, LPDG = light psychological disorder group, MPDG-A = moderate psychological disorder group (high anxiety), MPDG-D = moderate psychological disorder group (high depression), SPDG = severe psychological disorder group, ¹Mean (SE), ²">" means that there is a significant difference between groups, where the latter group has significantly larger values than the former group, while "=" means there is no significant difference between groups,

The profiles differed significantly in scores between the two outcome variables (χ^2 of 671.102 in fear of COVID-19 and χ^2 of 914.325 in suicide intention). Further post hoc tests indicated that teachers in the SPDG had the highest risk of both **fear of COVID-19** and **suicide intention** (mean=28.124, SE=6.322 and mean=1.248, SE=0.875, respectively). In contrast, the risks in the LPDG and HG were in the second-from-bottom and bottom positions, respectively.

Notably, there was a significant difference in **fear of COVID-19** between the two MPDG subtypes, with the MPDG-A subtype having a significantly higher level of fear (mean=25.124, SE=5.721) than the MPDG-D subtype (mean=23.432, SE=3.211). However, the opposite was observed for **suicide intention**, where the risk was significantly higher for the MPDG-D subtype (mean=0.163, SE=0.418) than for the MPDG-A subtype (mean=0.074, SE=0.267).

4. Discussion

Understanding the heterogeneity of different anxiety and depression subtypes is vital for psychiatric research and clinical diagnosis. In this study, we used the LPA approach to identify latent profiles of five significant comorbidities of anxiety and depression in a sample of Chinese teachers. Subsequent BCH analyses revealed significant differences between psychopathic profiles on key outcome variables (i.e., fear of COVID-19, suicidal

ideation). The high anxiety subtype had a significantly greater fear of the new coronavirus epidemic than the high depression subtype, which had a significantly higher level of suicidal ideation than the high anxiety subtype.

To the best of our knowledge, this is the first study to address potential profile types of anxiety disorders, depressive disorders and their co-morbidities in a Chinese teacher population. The findings of the study support a five-profile model. Specifically, the HG (53.21%), the largest group in the study, scored the lowest on all DASS-21 items, and the LPDG (26.08%) scored higher than *Profile 1 (HG)* on essentially all items, but lower than the other three profiles. This study also identified two subtypes present in MPDG and labelled them MPDG-A (8.54%) and MPDG-D (10.47%). The former scored higher than the latter in the stress and anxiety dimensions, while the latter scored significantly higher in the depression dimension; we also named the group with the smallest number of people and the highest scores on each item the SPDG (1.72%). Consistent with these unique patterns of symptom onset, we found that each category had a different psychological profile and was associated with different risk factors. In the study, each profile showed a unique pattern for the severity of anxiety disorders and depressive disorders. This supports the theory that anxiety disorders and depressive disorders can be viewed as a ***continuum***, with each dimension existing at different levels between individuals (Hettema et al., 2015).

Identifying high anxiety and depression subtypes strongly supports the tripartite model proposed by Clark et al. (Clark and Watson, 1991). This model suggests that depression and anxiety share common features but differ in some key symptoms. Notably, the differences between the high anxiety and high depression subtypes stem largely from items in the two depression dimensions, D17 and D21, where D17 ("felt that I wasn't worth much as a person.") tested the ***self-deprecation symptom*** and D21 ("I felt that life was meaningless.") tested the ***devaluation of life symptom***. Both symptoms are important diagnostic criteria for major depressive disorder in the DSM-5 (diagnostic criteria A7 and A9) (American Psychiatric Association and Association, 2013). The ***stress-vulnerability model*** states (Bakhtiari et al., 2017) that low self-esteem is a risk factor for future depression. Low self-esteem may lead to depression through interpersonal relationships. Self-deprecation and

devaluation of life are important components of low self-esteem, which supports the vulnerability model. Importantly, these two symptoms are also significant risk factors for suicidal ideation (Lew et al., 2019).

4.1 Demographic differences in profile

There were significant gender effects, title effects and age effects across the profiles in this study. We found that women were more likely to have mild and moderate anxiety disorders and depressive disorders than men, which is consistent with the findings of previous research. Previous research has shown that gender affects social anxiety disorders and depressive disorders (Asher et al., 2017; Faravelli et al., 2013). This may be related to the fact that women have more significant cyclical fluctuations in hormone levels than men, which in turn affects brain regions involved in emotion and behavioural regulation (Faravelli et al., 2013).

We also found that the effect of professional titles on teachers' mental health are significant. Our study shows that job title rank increases teachers' overall risk of developing anxiety disorders and depressive disorders. One potential explanation might be China's *unique teacher promotion system* (Karachiwalla, 2010). Teachers enter this *tenure-track-like* system once they have obtained a junior title, at which point they become part of the national civil service. In China, a teacher's career can be significantly enhanced by advancing their title. The level of their title is directly linked to their salary and welfare benefits (Li et al., 2017). However, the promotion of a Chinese teacher's title has extremely demanding requirements, which can put tremendous pressure on teachers. Teachers are required not only to demonstrate outstanding performance in their teaching proficiency, which is reflected in their classes achieving top-ranking scores in competitions, but also to stand out in scientific research or teaching skills competitions. *The culture of favouritism* in Chinese society means that even if a teacher's ability is outstanding, they may sometimes have to give way to competitors with ties. This creates a high-pressure, and arguably toxic, competitive environment that exacerbates the mental health of *tenuring* teachers (Karachiwalla, 2010; Liu and Onwuegbuzie, 2012). However, the increase is not simply linear; teachers with intermediate titles have a higher

risk of being in the MPDG than not only those with lower titles but also those with higher titles⁴. According to the above theory, in China, Teachers in the intermediate status are often asked to take on the heaviest and most difficult teaching tasks - that is, the teaching of graduating classes. They are also often asked to serve as head teachers(Banzhuren), a position that means not only focusing on students' academic performance but also on their daily lives, often dubbed as babysitting. This means that they have to spend much more time on student affairs than ordinary teachers(Walker and Dimmock, 2000; Weiqi, 2007). From the perspective of society, in the Chinese civil service society, work and life are closely linked. The level of the job title will become the standard for society to measure whether a person is successful or not. Teachers with senior titles receive enormous social capital, being admired by people, praised by relatives, and even gaining an advantage in the marriage market. However, teachers who have been in a intermediate title for a long time are considered to have no prospects(Aguinis and Roth, 2005).

Our study reveals an age effect. The risk of depression increases further with age in the teacher population; however, the risk of anxiety may not change much or even decrease. There is a certain commonality between the occurrence of the title effect and the age effect: teacher titles increase to a large extent with age. Berliner, based on differences in teachers' professional knowledge and skills (Berliner, 1988), divides the progression of teachers from novice to expert into five stages: the novice stage, the advanced novice stage, the competent stage, the skilled stage, and the expert stage. Empirical research from China corroborates that teachers' development of well-being is in line with the five-stage model of teacher development (Guo et al., 2019; Lin et al., 2017; Zhu et al., 2020). Teachers with low titles and young ages are mostly novice young teachers with high enthusiasm and motivation. Teachers with middle titles and ages may subsequently lose motivation and enthusiasm due to heavy workloads, title evaluation and other pressures. Teachers with higher titles and ages, on the other hand, are primarily expert teachers who have reached the pinnacle of their professional competence and title status. They tend to internalise

⁴ All groups except the SPDG group showed significant and largest ORs. Due to the small sample size of the SPDG group, its statistical power is not sufficient to test for significance. If we only look at the estimates, the SPDG group has the largest OR for the intermediate title.

teaching as their life value and maintain a high sense of professional identity, a positive attitude towards work and total commitment to their work. The present study showed that teachers with the intermediate title had the highest percentage of high anxiety subtypes and high depression subtypes, which further supports Berliner's five-stage model of teacher development (Berliner, 1988).

4.2 Fear of COVID-19 and suicidal ideation in different profiles

The current study also compared differences in fear of COVID-19 and suicidal ideation across profiles. Post hoc tests showed that teachers in the SPDG had the highest risk for both fear of COVID-19 and suicidal ideation. Results suggest that those with higher levels of anxiety and depression co-morbidity are at greater risk of developing fear of COVID-19 and suicidal ideation, consistent with the findings of Liu et al (Liu et al., 2021).

Meanwhile, the extent of fear of COVID-19 was significantly higher in the MPDG-A subtype than in the high MPDG-D subtype, which supports previous findings. A meta-analysis found that the correlation coefficient of fear of COVID-19 with anxiety symptoms was greater than that with depression (Şimşir et al., 2022) and identified the generalisation of fear as a key diagnostic feature of anxiety disorders (Dymond et al., 2015). Previous studies have revealed that fear of COVID-19 is a significant predictor of depression and anxiety (Belen, 2022; Tasso et al., 2021).

For suicide intention, on the other hand, the risk was significantly higher for the MPDG-D subtype than for the MPDG-A subtype. This result supports previous findings (Wiebenga et al., 2021): suicidal intention is highest in patients with co-morbidity of anxiety and depression, second highest in single-dimensional depressive disorders and lowest in single-dimensional anxiety disorders. Thus, depressive symptoms were more likely to be a predictor of suicide than anxiety symptoms. Another meta-analysis (Dong et al., 2019) noted that the risk of committing suicide is five times higher among people with depression than in the general population. Future research should focus on the different mechanisms by which anxiety and depression impact suicidal ideation.

5. Implications

Several theoretical and clinical implications arise from this study. First, this study establishes that the heterogeneity of anxiety disorders and depressive disorders varies across gender and cultural contexts. Previous studies have focused on Western clinical patient samples and used variable-centred research methods. The current study fills this prominent gap and extends these studies to the Chinese school teacher population.

We further found that title effects, age effects, and gender effects were distributed differently across the profiles and that severe anxiety disorders and depressive disorders increased teacher fear of COVID-19 and suicidal ideation. This is important for prevention, assessment, diagnosis, and intervention for anxiety disorders and depressive disorders in teachers. The relationships between demographics and their associated characteristics and specific disorder subtypes will help clinicians develop and tailor therapeutic or psychotherapeutic interventions to reduce teachers' depression and anxiety levels.

The results of our study indicate that schools should pay full attention to the mental health issues of primary and secondary school teachers. Firstly, schools have a responsibility to provide a relaxed, inclusive, and respectful working environment, improve the transparency of professional title evaluation, and reduce implicit thresholds. This will help alleviate teachers' anxiety, depression, and other negative emotions. Secondly, schools should establish a comprehensive system for monitoring and supporting the mental health of in-service teachers and strengthen timely interventions for teachers at high risk of anxiety, depression, suicidal ideation, and those applying for intermediate professional titles. At the same time, the teacher union in schools should also fully address the mental health issues of teachers. For instance, during major public health emergencies such as COVID-19, the union can organize group counseling activities and platforms for addressing psychological distress, enhancing teachers' psychological resilience and overall mental well-being. The government should promote public awareness of teachers' mental health issues through relevant policies and regulations. Additionally, the government should strengthen the management and supervision of teachers' professional title promotion in schools, reducing any adverse effects on teachers' mental health caused by the evaluation process. Lastly, the

government should enhance cooperation with schools and teacher unions, provide necessary funding and expert resources, and collaborate in establishing a robust system for the detection and support of teachers' mental health, truly elevating their mental well-being.

Our findings provide new insights into the aetiology and outcome of depression, anxiety disorders and their co-morbidities. These findings have important implications for the understanding of disease heterogeneity and treatment.

6. Limitations

Despite the many strengths of this study, some limitations should be noted. First, we used a cross-sectional data, and the transformational status of the profiles is unknown due to the lack of baseline data from before the pandemic. Future designs could address these limitations by using a longitudinal design to explore the causal relationship between COVID-19 and teachers' mental health. Second, the sample belonged to a specific group—teachers whose economic status and education are at a higher level in Chinese society. They may not represent the general community in China; hence, there is a need for caution in generalising our results.

7. Conclusion

The current study used the LPA approach to investigate different symptoms and characteristics of anxiety disorders and depressive disorders among Chinese teachers. Our findings provide new insights into Chinese teachers' aetiology and the impact of anxiety and depression disorders. They have important implications for early warning and intervention mechanisms for teachers' mental health. Future research should further focus on the factors influencing teachers' mental health and their impact on teachers' psychological, motivational, and emotional outcomes.

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