The Relationship between Supervisor Support and the Developmental Trajectories of Mental Health among Graduate Students in a Medical School

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Abstract: *To understand the developmental trajectories of the mental health of graduate students in medical schools in China over a 3-year period and explore relationships with supervisor support to provide a scientific basis for promoting the mental health of graduate students in medical schools. For the longitudinal study, 448 graduate students from different classes in the 2020 class in a medical school in China were selected via a cluster sampling method. The University Personality Inventory (UPI) scale was administered to the participants in September 2020, and the UPI scale and the supervisor support scale were administered again in June 2023. The developmental trajectories of mental health among graduate students in medical schools were categorized into four groups: the healthy group (78.35%), deterioration group (9.6%), improvement group (6.92%), and persistent underlying psychological symptoms group (9.13%). Supervisor support and type of specialty were significantly different among the four groups (p<0.05). The results of logistic regression revealed that graduate students in clinical specialties were more likely to experience deterioration (OR = 2.415; 95% CI: 1.257--4.643) or improvement (OR = 2.622; 95% CI: 1.238--5.553) in their mental health. Compared with high supervisor support, low supervisor support was more likely to lead graduate students in medical school to experience deteriorated mental health (OR = 3.622, 95% CI: 1.52--8.631) and persistent underlying psychological symptoms (OR=5.661; 95% CI: 1.556--20.591). From enrollment to graduation, the level of psychological symptoms of graduate students in medical school has shown an increasing trend. Low supervisor support can predict the developmental trajectory of their mental health status, and universities should develop effective measures to improve supervvisor support and alleviate the mental health problems of graduate students.*

Keywords: Supervisor support; Graduate students; Mental health.

1. Introduction

Graduate students are the future of the country, and their mental health directly impacts their personal growth and development, as well as the country's future. However, in recent years, the mental health problems of the Chinese graduate student population have become more prominent, with as many as 58% of graduate students suffering from psychological symptoms such as mild depression (Xia et al., 2019). According to some studies, the self-reported levels of depression and anxiety among graduate students are six times higher than those reported by their peers with undergraduate educational experience (Evans et al., 2018). The issue of psychological symptoms among graduate students is a global concern, and the mental health of this group is not optimal. Medical school students are unique in that they generally have a long training cycle and a long period of study, increasing their susceptibility to mental health problems (Dahlin et al., 2005). Medical school students tend to have higher rates of psychological symptom detection than their peers do (Schwenk et al., 2010; Thompson et al., 2010). Some studies have revealed that there is no significant difference in the mental health status of medical students and the general population at the time of enrollment, but the detection rate of psychological symptoms among medical students gradually

increases over time (Rosal et al., 1997). Therefore, it is crucial to study the development trajectory of mental health status among graduate students in medical schools.

The cultivation system of Chinese graduate students is based on the supervisor responsibility system, and the supervisor is the first person responsible for the cultivation of graduate students. Supervisors have an important effect on the mental health of graduate students in higher education (Gruzdev et al., 2020; White et al., 2024). In the process of graduate training, graduate students require all-round support from their supervisors, including academic support and life support (Crisp & Cruz, 2009). Some scholars have studied the relationship between the mental health of graduate students and the support of their supervisors. For example, supervisor support can reduce stu-dents' emotional exhaustion (Devine & Hunter, 2017), and supervisor support has a positive impact on doctoral student satisfaction (Dericks et al., 2019). However, most of these studies have been cross-sectional, and longitudinal studies are relatively rare. Therefore, this study analyses the developmental trajectories of men's health among graduate students in medical schools at two time points: enrollment and graduation. The relationships between different levels of supervisor support and the trajectories of mental health among graduate students in medical schools should be examined through follow-up surveys to provide a scientific basis for improving mental health work in universities and developing more targeted measures.

2. Materials and methods

2.1 Study sample

A total of 471 graduate students from a medical school in China who entered school in 2020 were selected for follow-up via the class-based cluster sampling method. In September 2020, 471 new graduate students were given the University Personality Inventory Scale (UPI) scale in the school's computer network laboratory. In June 2023, the UPI Scale and the Supervisor Support Scale were administered to the same cohort of graduate students via an online electronic questionnaire. Missing data and answers that did not make sense were removed from the data. After excluding the data lost to follow-up and data with inconsistent responses, a total of 448 valid samples were obtained, with a valid recovery rate of 95.17%. Informed consent was obtained from all participants for this study.

2.2 Measurement of variables

The UPI scale (Song et al., 2022) was designed to measure the mental health of graduate students at the time of enrollment and graduation. The UPI scale was introduced and revised by Fan Fuming in 1993 and consists of 64 items, including 56 general symptom items, 4 pseudotest items, and 4 auxiliary items. The general symptom items were scored as 1 point for "yes" and 0 points for "no", whereas the pseudo questions and auxiliary questions were not scored. The higher the score is, the more serious the psychological symptoms. On the basis of the scoring criteria, we categorized psychological symptoms into three types: (1) Category I, which refers to psychological problems, defined as a UPI scale score of less than 25 or a "yes" response for the 25th question or at least two auxiliary questions; (2) Category II, which refers to possible nonserious psycho-logical problems. A UPI scale score of 20–24 or "yes" for any of the questions "8, 16 or 26" or "yes" for only one of the auxiliary questions; (3) Category III, mental health problems are not apparent or do not exist. All categories except the first and second categories were categorized into the third category. According to the categorization criteria of the UPI scale and to improve the credibility of the results, graduate students who met the screening criteria of UPI category I were defined in this study as potentially positive for psychological symptoms and otherwise negative for psychological symptoms. The scale's Cronbach's alpha coefficients, measured twice in this study, were 0.916 and 0.93, respectively, indicating good scale reliability.

2.3 Supervisor support

Drawing on the Supervisor Support Scale developed by Overall et al. (Overall et al., 2011) and adapted by Ling Xu (Xu, 2023), the scale measures the degree of per-received supervisor support among graduate students in medical schools and consists of 13 items. For example, "My supervisor encouraged me to participate in discussions and respect my ideas". The variables were measured on a 5-point Likert scale ranging from 1 to 5, with scores ranging from 1–5 indicating complete noncompliance to complete compliance. Higher scores indicate that the student perceives more supervisor support. In this study, the scale's Cronbach's alpha coefficient was 0.967, indicating good scale reliability.

2.4 Control variables

The authors selected gender, place of residence, type of specialty and degree type of graduate students as control variables to reduce the interference of related variables and improve the scientific reliability of the study.

2.5 Data analysis methods

SPSS 27.0 was used to analyze the data statistically. Frequencies and percentages were used for descriptive analysis of the count data, and the chi-square test was used to test the relevant variables that might affect the developmental trajectories of mental health among graduate students in medical schools, followed by the inclusion of the screened relevant variables in the multinomial logistic regression to further explore the mechanism of the influence of graduate students' developmental trajectories of mental health. The significance level was set at $P < 0.05$.

3. Results

3.1 Basic information of the study subjects

The total number of study subjects was 448, including 137 males and 361 females; the total number of academic master's degrees was 250, and the total number of professional master's degrees was 198; the total number of graduate students in clinical specialities was 175, and the total number of graduate students in nonclinical specialties was 273; the total number of graduate students whose residences in the city were 298; and the total number of graduate students who lived in rural areas was 150.

Division of supervisor support type: To make the data distinguishable, based on the method of Kelley (Kelley, 1939), the research subjects were ranked according to the supervisor support data, and the first 27% of the research subjects at the high end of the scale were considered the high group. The next 27% of the research subjects at the low end of the scale were considered the low group. The supervvisor support group was classified into the high-support group, the general-support group, and the low-support group. There were 127 individuals in the high-support group, 199 individuals in the general support group, and 122 individuals in the low-support group.

3.2 The developmental trajectories of mental health among graduate students in medical school

Classification of the types of developmental trajectories of mental health: According to the results of the UPI assessment, the first group was regarded as having potential psychological symptoms, and the types of developmental trajectories of mental health were as follows: 1. Healthy group. The mental health status of 351 individuals, accounting for 78.35%, was healthy at both the time of enrollment and graduation. 2. Deterioration group. Mental health at the time of enrollment and some psychological symptoms at the time of graduation, a total of 43 people, accounting for 9.6% of the sample; 3. Improvement group. There may be some psychological symptoms at the time of enrollment and in a state of psychological health at the time of graduation, for a total of 31 people, accounting for 6.92% of the sample. 4. Persistent underlying psychological symptoms group. Some psychological symptoms may exist at both enrollment and graduation, with a total of 23 people, accounting for 5.13% of the sample. The results of the UPI scale revealed that the positive mental health detection rate of medical school graduate students at enrollment was 12.05%, and at graduation, the positive mental health detection rate was 14.73%.
Analysis of factors associated with the developmental trajectories of mental health

On the basis of the known types of developmental trajectories of mental health in the four groups, possible predictors were identified via the chi-square test, and differences were considered statistically significant at $P<0.05$. General information and types of different levels of supervisor support were included in the chi-square analysis, and the results revealed statistically significant differences between the four groups in the comparison of type of specialization ($\chi^2=13.246$, $P<0.01$), supervisor support ($\chi^2=27.261$, $P<0.001$), and nonsignificant differences between groups in the rest of the variables. The results are shown in Table 1.

Table 1. Analysis of factors influencing the developmental trajectories of mental health

Variables	Classification	Healthy group	Deterioration group	Improvement group	Persistent underlying psychological symptoms group	χ^2	P
Gender	Male	111(0.316)	11(0.256)	5(0.161)	10(0.435)	5.538	0.136
	Female	240(0.684)	32(0.744)	26(0.839)	13(0.565)		
Place of residence	Urban	230(0.655)	33(0.767)	20(0.645)	15(0.652)	2.247	0.523
	Rural	121(0.345)	10(0.233)	11(0.355)	8(0.348)		
Degree type	Academic	202(0.575)	19(0.442)	18(0.581)	11(0.478)	3.445	0.328
	Specialized	149(0.425)	24(0.558)	13(0.419)	12(0.522)		
Type of specialty	Clinical	122(0.348)	24(0.558)	18(0.581)	11(0.478)	13.246	0.004
	Nonclinical	229(0.652)	19(0.442)	13(0.419)	12(0.522)		
Supervisor support	Low Support	80(0.228)	22(0.512)	12(0.387)	13(0.565)	27.261	<0.001
	General Support	168(0.479)	13(0.302)	11(0.355)	7(0.304)		
	High support	103(0.293)	8(0.186)	8(0.258)	3(0.13)		

Notes: N=448; P < 0.05 indicates a significant difference.

3.3 Logistic regression analysis of the developmental trajectories of mental health

Using different levels of supervisor support as the independent variable and the developmental trajectory of mental health as the dependent variable, we constructed a multinomial logistic regression model, Model 1. After including the statistically significant variable of specialty type in the chi-square analysis, Model 2 was obtained, and the association was still statistically significant (P<0.05); the results are shown in Table 2.

Table 2: Logistic regression analysis of the developmental trajectories of mental health

Variables	Mental health as reference group					
	Model 1			Model 2		
	Persistent underlying psychological symptoms group	Improvement group	Deterioration group	Persistent underlying psychological symptoms group	Improvement group	Deterioration group
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
High support group	1.000	1.000	1.000	1.000	1.000	1.000
Low support group	5.579**(1.537-20.246)	1.931(0.754-4.949)	3.541**(1.498-8.37)	5.661**(1.556-20.591)	1.98(0.766-5.118)	3.622**(1.52-8.631)
General support group	1.431(0.362-5.655)	0.843(0.328-2.165)	0.996(0.399-2.486)	1.444(0.365-5.717)	0.856(0.331-2.214)	1.011(0.403-2.536)
Nonclinical specialties	-	-	-	1.000	1.000	1.000
Clinical specialties	-	-	-	1.763(0.745-4.169)	2.622*(1.238-5.553)	2.415**(1.257-4.643)

Notes: N=448; * P < 0.05, ** P < 0.01.

Compared with the healthy group, clinical graduate students are more likely to show improvement in their psychological status, which is 2.622 times more likely than nonclinical graduate students are, with a 95% confidence interval of 1.238–5.553. Compared with the healthy group, clinical graduate students are more likely to exhibit worsening psychological status, which is 2.415 times more likely than nonclinical graduate students are, with a 95% confidence interval of 1.257–4.643.

Compared with the healthy group, graduate students with low supervisor support are more likely to experience persistent underlying psychological symptoms, which is 5.661 times more likely than those with high supervisor support. The 95% confidence interval is 1.556–20.591. Compared with the healthy group, graduate students with low supervisor support are more likely to experience deterioration in their psychological status, which is 3.622 times more likely than those with high supervisor support, with a 95% confidence interval of 1.52–8.631.

4. Discussion

The results of the UPI scale revealed that the detection rate of potential psychological symptoms in medical students was 12.05% at the time of enrollment and 14.73% at the time of graduation, which were lower than those reported in the past for medical students (X. Wu et al., 2020). These findings indicate that the psychological health

of medical school graduate students is good. The finding that the detection rate of psychological symptoms among medical school graduate students shows an increasing trend over time is consistent with the findings of existing studies (Chen et al., 2022; Y. Wu et al., 2018). Graduate students need to invest considerable time and energy to complete their research tasks after enrollment, and factors such as "ability to balance research and life" and "mentoring relationships" may contribute to the decline in graduate students' mental health (Evans et al., 2018). Therefore, colleges and universities should improve the supervisor training system, help students balance research work and life, intervene in students' psychological symptoms in time, and pay more attention to the psychological health status of senior graduate students.

The results of the chi-square test revealed that there was no significant difference in the developmental trajectories of mental health in terms of gender, residence or degree type. The reasons may be that (1) graduate students in medical schools are physically and mentally mature, and gender generally has the greatest impact on an individual's mental health during adolescence (Salk et al., 2017). (2) Consistent with the conclusions of existing studies (Breslau et al., 2014). As graduate students enter universities, the influence of their upbringing diminishes, the influence of the cam-pus environment increases, and the mental health of urban and rural students converges, as they face similar difficulties in the research environment. (3) Professional graduate students are application-oriented talents with long training times; academic graduate students are academic research-oriented talents with higher research requirements and graduation requirements and long study times. Therefore, both professional and academic master's students in medical schools must dedicate a significant amount of time and effort to their training, potentially contributing to their similar psychology profiles.

The results of the multinomial logistic regression analysis revealed that although the type of specialty had no obvious effect on persistent underlying psychological symptoms, it significantly affected the improvement and deterioration of the psychosocial status of the graduate students. Graduate students in clinical specialties were 2.622 and 2.415 times more likely to exhibit improvement or deterioration in psychological status, respectively, than nonclinical medical school graduate students were. The results indicated that nonclinical graduate students were more likely to be in a state of psychosocial health than were clinical graduate students. This may be because nonclinical graduate students are generally less stressed to study (Dyrbye et al., 2006), are exposed to fewer patients and healthcare settings, and face less stress and challenges than clinical graduate students are.

There was no significant difference in the influence of general supervisor support compared with high supervisor support on the developmental trajectories of men's health among graduate students in medical schools. Inconsistent with the findings of existing studies, Li Chaoma et al. (Ma et al., 2024) concluded that supervisor support was negatively related to anxiety, i.e., the higher the level of supervisor support was, the healthier the students were psychologically. The reason behind the results of this study may be that the need for supervisor support from graduate students at this medical school is not very strong. According to Rankin et al. (Rankin et al., 2018), depression levels are lowest when individuals' needs are roughly comparable to the support they receive; depression levels are highest when individuals receive less support than they need; and when individuals receive more support than they need, depression levels increase slightly. Therefore, when students obtain a certain degree of supervisor support and meet their needs for scientific research support and life support, they do not show a significant improvement in mental health because they receive more supervisor support. Students' mental health is affected by many factors, and paying attention to other influencing factors, such as work–life balance and uncertainty, is necessary to have a more significant impact on students' mental health (Mackie & Bates, 2019; Woolston, 2022).

Compared with those with high supervisor support, students with low supervisor support were more likely to experience worsening psychological symptoms and persistent underlying psychological symptoms. This is consistent with existing research findings (Levecque et al., 2017). When students receive less supervisor support, their feelings of uncertainty and isolation are elevated (White et al., 2024), and they may experience psychological symptoms such as anxiety and depression or may experience more severe preexisting psychological symptoms.

On the basis of the results of the study, supervisors should increase the level of support for students in all areas to help medical school graduate students reduce the likelihood of deterioration and persistent psychological symptoms. Therefore, graduate student supervisors should be student oriented, respect students' subjectivity and individual differences, and provide research support and life support for graduate students. In addition, training units should strengthen the training of graduate student supervisors, help them improve their supervisory ability, and clarify the responsibilities and obligations of graduate student supervisors to train staff.

5. Limitations and prospects

First, the developmental trajectories of mental health in this study were categorized according to changes in the mental health status of the same study participants at the time of enrollment (2020) and at the time of graduation (2023), and the data were collected only 2 times. Therefore, the results of the study may be subject to error, and multiple subsequent measurements of the mental health status of medical school graduate students using more authoritative clinical scales are needed to increase the accuracy of the conclusions of the study. Second, all the data were collected from self-reported measurements of medical school graduate students, and there may be a degree of subjectivity bias leading to uncertainty in the study's results. Finally, the medical school graduate students in the present study were from one school in Wen-zhou, China, which may not be representative of graduate students in other medical schools. Larger-scale data surveys are needed to dynamically measure the trajectories and influences on the mental health status of graduate students in medical schools. Therefore, further validation of this study is needed to determine whether the findings can be extended to graduate students in other medical schools.

Acknowledgments

Declaration of interest statement

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