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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 mental health among graduate students in a medical school in China over a 3-year period, and explore the relationship with supervisor support, in order 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 of the 2020 class in a medical school in China were selected using a cluster sampling method. The UPI (University Personality Inventory) Scale was administered to the participants in September 2020, both the UPI Scale and the Supervisor Support Scale were administered again in June 2023. The developmental trajectories of mental health among graduate students in a medical school were categorized into four groups: 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 statistically significant between the four groups ($p<0.05$). The results of logistic regression analysis showed 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 to high supervisor support, low supervisor support was more likely to make graduate students in a medical school, to experience deterioration 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 enrolment to graduation, the prevalence of psychological symptoms among graduate students in a medical school showed an increasing trend. Low supervisor support can predict the developmental trajectory of their mental health status, suggesting that universities should develop effective measures to improve supervisor 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 Chinese graduate student population have been more prominent, with as many as 58% of graduate students suffering from psychological symptoms such as mild depression[1]. According to previous studies, the self-reported levels of depression and anxiety among graduate students are six times higher than those of their peers with undergraduate educational experiences[2]. The issue of psychological symptoms among graduate students is a global concern, and the mental health of this group is not optimistic. Medical school students are unique in that they generally have a long training cycle and a long period of study, making them more susceptible to mental health problems[3]. Medical school students tend to have higher rates of psychological symptom detection than their peers[4,5]. Some studies have revealed that while there is no significant difference in the mental health status of medical students and the general population at the time of enrolment, but the detection rate of psychological symptoms among medical students gradually increases over time[6]. Therefore, it is crucial to study the development trajectory of the mental health status among graduate students in medical schools.

The cultivation system of Chinese graduate students is based on the supervisor responsibility system, wherein supervisor is the first person responsible for the cultivation of graduate students. Supervisors have a significant impact on the mental health of graduate students in higher education[7,8]. In the process of graduate training, graduate students require comprehensive support from their supervisors, including academic support and life support[9]. Some scholars have studied the relationship between the mental

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health of graduate students and the support of their supervisors. For example, supervisor support can reduce students' emotional exhaustion[10], and supervisor support has a positive impact on doctoral student satisfaction[11], etc. But most of these studies have been cross-sectional studies, and longitudinal studies are relatively rare. Therefore, this study aims to analyse the developmental trajectories of mental health among graduate students in a medical school at two time points: enrolment and graduation, and examine the relationship between different levels of supervisor support and the trajectories of mental health among graduate student in a medical school through a follow-up survey, so as to provide a certain scientific basis for improving the 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 the school in 2020 were selected for follow-up by the class-based cluster sampling method. In September 2020, 471 new graduate students in grade 2020 were given the UPI Scale (the University Personality Inventory Scale) in the school's computer network laboratory. In June 2023, included both the UPI Scale and the Supervisor Support Scale, which were administered to the same cohort of graduate students via an online electronic questionnaire. Missing data and answers that didn't 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 in this study.

2.2. Measurement of variables

2.2.1. The UPI Scale[12]

The UPI Scale was used to measure the mental health of graduate students at both enrolment and graduation, and was based on the UPI Scale introduced and revised by Fan Fuming in 1993.The scale consists of 64 items, including 56 general symptom items, 4 pseudo-test items, and 4 auxiliary items. The general symptom items were scored as 1 point for "yes" and 0 points for "no", while the pseudo questions and auxiliary questions were not scored. And the higher the score, the more serious the psychological symptoms. Based on the scoring criteria, we categorized psychological symptoms into three types: (1) Category I, which refers to psychological problems, defined as the 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 non-serious psychological problems. The UPI Scale score of 20–24 or "yes" to any of questions “8, 16 or 26” or "yes" to 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 were categorized into the third category. According to the categorization criteria of the UPI Scale, and in order 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.

2.2.2. Supervisor support

Drawing on the Supervisor Support Scale developed by Overall et al.[13] and adapted by Ling Xu[14], the scale measures the degree of perceived supervisor support among graduate students in medical schools and consists of 13 items. For example, "My supervisor encourages me to participate in discussions and respects my ideas". Variables were measured on a 5-point Likert scale from 1 to 5, indicating a score of 1–5 from 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.

2.3. Control variables

The article 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 and reliability of the study.

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2.4. Data analysis methods

SPSS 27.0 was used to analyse 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 degree was 198; the total number of graduate students in clinical specialties was 175, and the total number of graduate students in non-clinical specialties was 273; the total number of graduate students whose residence was in the city was 298, and the total number of graduate students who lived in the rural area was 150.

Division of supervisor support type: in order to make the data distinguishable, based on the method of Kelley[15], the research subjects were ranked according to the data of supervisor support, and the first 27% of the research subjects at the high end of the scale were taken as the high group, and the next 27% of the research subjects at the low end of the scale were taken as the low group, and the supervisor support 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 a medical school

Classification of the type of the 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 the developmental trajectories of mental health are as follows: 1. Healthy group. The mental health status of 351 individuals, accounting for 78.35%, was in a healthy state both at the time of enrollment and graduation. 2. Deterioration group. Mental health at the time of enrollment and may have some psychological symptoms at the time of graduation, a total of 43 people, accounting for 9.6%; 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, a total of 31 people, accounting for 6.92%; 4. Persistent underlying psychological symptoms group. Some psychological symptoms may exist at both enrollment and graduation, a total of 23 people, accounting for 5.13%. The results of the UPI Scale showed that the positive mental health detection rate of graduate students in a medical school at enrollment was 12.05%, and at graduation, the positive mental health detection rate was 14.73%.

3.3. Analysis of factors associated with the developmental trajectories of mental health

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
	Non-clinical	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 significant difference.

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Based on the known types of the developmental trajectories of mental health in the four groups, possible predictors were identified using 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 showed statistically significant differences between the four groups in the comparison of type of specialization (χ^2=13.246, P<0.01), supervisor support (χ^2=27.261, P<0.001), and non-significant differences between groups in the rest of the variables. The results are shown in Table 1.

3.4. Logistic regression analysis of the developmental trajectories of mental health

Using different levels of supervisor support as the independent variable and the developmental trajectories 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, we obtained Model 2, and the association was still statistically significant (P<0.05), and the results are shown in Table 2.

"Healthy group" as the reference group, 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 non-clinical graduate students, 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 non-clinical graduate students, 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.

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)
Non-clinical 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.

4. Discussion

The results of the UPI Scale showed that the detection rate of potential psychological symptoms of graduate students in a medical school was 12.05% at the time of enrollment and 14.73% at the time of graduation, which were lower than those detected in the past for medical students[16]. It indicates that the psychological health of medical school graduate students is good. The finding that the detection rate of psychological symptoms among graduate students in a medical school shows an increasing trend with the increase of years is consistent with the view of existing studies[17,18]. Graduate students need to invest a lot of time and energy to complete their research tasks after enrollment, and factors such as " inability to balance research and life" and "mentoring relationship" may contribute to the decline in graduate students' mental health[2]. Therefore, colleges and universities should improve the supervisor training system, help students balance research work and life, intervene in students' psychological symptoms in

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time, and pay more attention to the psychological health status of senior graduate students.

The results of the chi-square test showed that there was no significant difference in the developmental trajectories of mental health in terms of gender, residence and 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[19]. (2) Consistent with the conclusions of existing studies[20]. As graduate students enter universities, the influence of their upbringing is diminishing, the influence of the campus environment is increasing, 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 time; academic graduate students are academic research-oriented talents with higher research requirements and graduation requirements, and long study time. 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 psychological profiles.

The results of multinomial logistic regression analysis showed that although the type of specialty had no obvious effect on the persistent underlying psychological symptoms, it significantly affected the improvement and deterioration of the psychological status of graduate students. Graduate students in clinical specialties were 2.622 and 2.415 times more likely to exhibit improvement or deterioration in psychological status than non-clinical medical school graduate students, respectively. The results indicated that non-clinical graduate students were more likely to be in a state of psychological health than clinical graduate students. This may be due to the fact that non-clinical graduate students are generally less stressful to study[21], exposed to fewer patients and healthcare settings, and face less stress and challenges than clinical graduate students.

There was no significant difference between general supervisor support compared to high supervisor support in influencing the developmental trajectories of mental health among graduate students in a medical school. Inconsistent with the findings of existing studies, Li Chaoma et al.[22] concluded that supervisor support was negatively related to anxiety, i.e., the higher the level of supervisor support, 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.[23], 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; When individuals receives more support than they need, depression levels increase slightly. Therefore, when students have obtained a certain degree of supervisor support and met their needs for scientific research support and life support, they will not show a significant improvement in mental health because they receive more supervisor support. Students' mental health is affected by many factors, and it is necessary to pay attention to other influencing factors to have a more significant impact on students' mental health, such as the work-life balance and uncertainty[24,25].

Students with low supervisor support had an increased likelihood of experiencing deteriorating psychological symptoms and persistent underlying psychological symptoms compared to those with high supervisor support. This is consistent with existing research findings[26]. When students receive less supervisor support, students' feelings of uncertainty and isolation are elevated[8], and may experience psychological symptoms such as anxiety and depression, or make their own pre-existing psychological symptoms more severe.

Based on 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 deteriorating 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 graduate student supervisors improve their supervisory ability, and clarify the responsibilities and obligations of graduate student supervisors to train students.

5. Limitations and Prospects

Firstly, the developmental trajectories of mental health in this study were categorized according to the changes in mental health status of the same study participants at the time of enrolment (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 subsequent multiple measurements of the mental health status of medical school graduate students using more authoritative clinical scales are needed to enhance the accuracy of

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the study's conclusions. Secondly, all data were collected from self-reported measurements of medical school graduate students, and there may be a certain degree of subjectivity bias leading to uncertainty in the study's results. Lastly, medical school graduate students in the present study were from one school in Wenzhou, 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.

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