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Survey on Career Planning Awareness and Readiness Among Freshman Medical Students in the Context of Digital Medicine

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Abstract: *Objective*: To understand the current situation of career planning awareness and readiness of freshman medical students with a background in digital medicine, and to provide references for optimizing the medical education system and career guidance. *Methods*: A cross-sectional study was conducted on freshman medical students at a university in Yunnan Province using questionnaire survey. *Results*: A total of 272 questionnaires were distributed and 264 valid questionnaires were returned, yielding an effective response rate of 97.10%. The average score of digital medical awareness of freshman medical students was (70.50 ± 8.81), and 63.63% of the students had a high awareness (score ≧ 70); The average score of career planning awareness and readiness of freshman medical students was (91.76 ± 14.87), and 60.63% of students had high awareness and readiness (score ≧ 90). Pearson correlation analysis showed that the total score of digital medical awareness was positively correlated with the total score of career planning awareness and readiness ($r = 0.13$, $P < 0.05$). *Conclusion*: Freshman medical students' career planning awareness and readiness are generally good, but their practical application of digital medical-related skills still needs improvement. It is suggested that schools strengthen the integration of interdisciplinary curriculum, introduce digital vocational training modules, and formulate differentiated guidance strategies for different majors to enhance students' professional competitiveness in the digital medical era.

Keywords: Digital healthcare; Career planning; Medical students; Awareness; Preparedness

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1. Introduction

With the in-depth application of digital technologies such as artificial intelligence, big data, and cloud computing, the global medical industry is undergoing profound changes with digital transformation as the core. During the outbreak of COVID-19, digital medical technologies such as medical big data, telemedicine, and artificial intelligence-assisted diagnosis and treatment played an important role in virus screening, disease analysis, patient treatment, and vaccine research and development [1]. In this context, medical education faces

the dual challenges of reconstructing knowledge systems and upgrading ability requirements. Digital literacy and technical ability will become the core competencies of future clinicians, including understanding and using digital medical systems, analyzing medical data, and the ability to work collaboratively with artificial intelligence systems [2].

In response to this trend, various governments have also introduced corresponding policies, such as the European Union's "Health Data Space Plan" in 2022; Japan launched the "Digital Medical and Health Service Industry Cultivation Strategy" in 2022; China issued the "Opinions on Promoting the Development" of "Internet plus Medical and Health" in 2020, and the "14th Five-Year Plan for Digital Economy Development" in 2022 [3]. However, despite increased policy support, the popularization of digital healthcare still faces challenges, especially in terms of talent pool. The doctor-patient environment makes it difficult to effectively unify medicine and engineering. Doctors cannot solve problems after clinical discovery, and engineers who can solve problems are not proficient in relevant medical knowledge [4]. In this context, the career planning cognition (that is, the understanding of future career roles and development directions) and readiness (including knowledge reserve and interdisciplinary collaboration ability) of medical talents are directly related to the training quality of digital medical talents. In particular, the knowledge gap between medicine and engineering essentially reflects the lack of interdisciplinary vision in the dimension of vocational cognition and the lack of compound abilities in professional preparation. Therefore, understanding the career planning cognition and readiness of freshman medical students is of great practical significance for breaking the bottleneck of digital medical talents.

This study used the Career Adapt-Abilities Scale (CAAS) and the Digital Health Literacy Instrument (DHLI) as the main measurement tools to explore the occupational adaptability of freshman medical students in the context of digital medicine, digital health literacy level, and the relationship between them. Combined with the questionnaire survey, this paper systematically analyzes the current situation of occupational cognition, provides an empirical basis for vocational enlightenment education and curriculum reform in medical colleges and universities, and helps the supply-side reform of medical talent training.

2. Data and methods

2.1. Information

From January 2025 to February 2025, the freshman medical students of a university in Yunnan Province were selected as the survey objects by convenience sampling. The inclusion criteria of the subjects were full-time students who voluntarily participated in the study.

The sample size was calculated according to the cross-sectional survey sample size calculation formula, $n = (Z^2 \times P \times (1\text{-}P))/e^2$, where Z is the Z value corresponding to the confidence level, P is the expected prevalence, and e is the tolerance error. Let $Z = 1.96$, $P = 0.5$, $e = 6\%$, then $n \approx 264$, and finally 264 copies are included. This study conforms to ethical principles and is reported to the school ethics committee.

2.2. Methods

2.2.1. Research methods

A cross-sectional survey method was used to conduct a stratified sampling of freshman medical students in colleges and universities in Yunnan Province who met the inclusion and exclusion criteria. The questionnaire star was used to conduct a questionnaire survey online, and descriptive statistics and correlation analysis were carried out according to the survey results of the questionnaire. The survey tools are as follows.

2.2.1.1. General Information Questionnaire

The content includes gender and specialty.

2.2.1.2. Digital Health Literacy Scale

This questionnaire is woven from the Chinese and revised Digital Health Literacy Instrument (DHLI) of the School of Nursing, Fujian Medical University [5]. Using the Likert 4-level scoring method, the items under the information navigation skill dimension and privacy protection skill dimension are assigned 1 ~ 4 points from "never" to "always," and the items in the other dimensions are assigned 4 ~ 1 points from "very easy" to "very difficult." It includes seven dimensions: operation skills, information navigation skills, information search skills, determining information relevance, evaluating information reliability, adding content, and privacy protection skills, with a total of 21 subheads. Cronbach's alpha was 0.84 and construct validity was 0.87.

2.2.1.3. Career adaptation scale

This questionnaire is compiled from the (Career Adapt-Abilities Scale, CAAS) [6] international scale, including four dimensions: career attention, career control, career confidence, and career curiosity, with a total of 24 items. The questionnaire uses the Likert 5-scale scoring method. From 1 to 5, it represents very inconsistent, inconsistent, general, consistent, and very consistent respectively. The corresponding scores are 1, 2, 3, 4, and 5, with a total score of 120 points. The higher the total score, the stronger the career adaptability. Cronbach's alpha was 0.97 and construct validity was 0.96.

2.2.2. Data collection method

In this study, the questionnaire star platform was used to distribute questionnaires. Before the implementation of the survey, the researcher explained the purpose, significance, and confidentiality principle of the research to the participants in detail, and filled out the questionnaire anonymously after obtaining informed consent. To ensure the authenticity of the data, all questionnaires are required to be completed independently on-site and collected immediately.

2.3. Statistical processing

SPSS 27.0 software was used for data analysis in this study. Measurement data are measured as mean ± standard deviation (SD) indicates that the count data is described in frequency (n) and percentage (%). The correlation between the total score of digital medical cognition (a total score) and the total score of career planning cognition and readiness (b total score) was tested by Pearson's r, and the significance level was set as two-tailed $\alpha = 0.05$. Categorical variables such as specialty and gender distribution were presented by descriptive statistics to reflect the structure characteristics of the sample.

3. Results

3.1. General situation of research objects

A total of 272 questionnaires were distributed by questionnaire star, and 264 valid questionnaires were returned. The effective rate of this questionnaire was 97.10%. The sample population of this questionnaire study is mainly medical students in the first year of undergraduate courses. Among them, there are 102 men and 162 women, and the proportion of women is higher than that of men. The majority of students majoring in nursing, accounting for 33.71% of the sample size, and the rest include comprehensive medical disciplines such as basic

medicine, clinical medicine, pharmacy, and traditional Chinese medicine. See **Table 1** for details.

Table 1. General situation of study subjects (n = 264)

Variable	*n*	%
Gender		
Male	102	38.64%
Female	162	61.36%
Profession		
Nursing	89	33.71%
Basic medicine	25	9.47%
Rehabilitation therapy	22	8.33%
Clinical medicine	51	19.32%
Pharmaceutical	32	12.12%
Medical technical inspection	22	8.33%
Chinese medicine	23	8.71%

3.2. Medical students' awareness of digital medicine

The highest score dimension is operational skills, with a score of 10.79 ± 1.40 points, and the lowest score dimension is privacy protection skills, with a score of 9.47 ± 2.61 points, with an average score of 70.50 ± 8.8 points. Assuming that the data distribution is ideal, it is about 63.63% greater than 70.50 ± 8.8 points. Among them, the operational skill dimension has the highest score, the privacy protection skill dimension has the lowest score and the most obvious differences among students. The specific scores of each dimension are shown in **Table 2**.

Table 2. Digital medical awareness scores of medical students

Dimension	Score
Operational skills	10.79 ± 1.40
Information navigation capabilities	10.31 ± 1.70
Information search capability	9.91 ± 1.96
Determine information relevance	10.21 ± 1.76
Assess information reliability	9.96 ± 1.94
Add content	9.83 ± 1.95
Privacy protection skills	9.47 ± 2.61
Total score	70.50 ± 8.81

3.3. Medical students' career planning awareness and readiness

The highest score is 120 points, the lowest score is 24 points, and the average score is 91.76 ± 14.87 points and 57.20% of the people are higher than the average score. The specific scores of each dimension are shown in **Table 3**.

Table 3. Scores of medical students' Career Planning Awareness and Readiness Questionnaire

Dimension	Score
Career concerns	22.79 ± 3.94
Career control	23.01 ± 4.01
Career confidence	22.93 ± 3.96
Career curiosity	23.00 ± 3.99
Total score	91.76 ± 14.87

3.4. Correlation

Pearson correlation analysis was used to explore the relationship between A total score (digital medical awareness score) and B total score (career planning awareness and readiness score), which was normally distributed, and Pearson correlation was 0.13, indicating that there was a weak positive correlation between them. At the significance level of 0.05, the correlation between A total score and B total score was not caused by random factors, and there may be differences in data records or special circumstances. See **Table 4** for details.

Table 4. Correlation between career planning score and digital medical score

		A total score	B total score
A total score	Pearson correlation	1	0.129*
	Significance (two-tailed)		0.036
	No. of cases	264.00	264.00
B total score	Pearson correlation	0.129*	1
	Significance (two-tailed)	0.036	
	No. of cases	264	266

*At grade 0.05 (two-tailed), the correlation was significant.

4. Discussion

4.1. Awareness of digital medical care

Freshman medical students' awareness of digital medicine is at an upper-average level, and the overall situation is good. However, there are still deficiencies in some dimensions (privacy protection skills, information search capabilities), with room for improvement. This result reflects that the current digital medical-related content in basic medical education has not been systematized, and there is still a disconnect between traditional curriculum settings and digital medical curriculum. Zhang and Wu [7] found in a study on the digital literacy of medical students that the extensive use of various digital technologies, resources, and platforms to manage and expand knowledge and abilities related to future careers is also one of the contents that medical students need to strengthen urgently to improve their digital literacy level. Among medical students' digital medical awareness scores, the operation skills score is the highest, followed by information navigation ability and determining information relevance. From the data, students can use digital medical tools well, and can locate and screen the required information more efficiently. However, students' privacy protection skills and information search ability scores are low, and students may have insufficient ability to screen and critically analyze digital medical information. This requires schools to set up professional courses to lead students to learn specialized laws (such

as the Personal Information Protection Law and the Medical Data Security Guide), intuitively understand the risks of medical data leakage, and teach students how to use professional medical databases (such as PubMed, CNKI, UpToDate) correctly and efficiently.

4.2. Awareness and readiness of career planning

According to the result, the career planning awareness and readiness of freshman medical students are at the upper-middle level, but there are significant individual differences. Nearly half of the students have lower scores than the average, which shows that nearly half of the students need to further improve their career planning abilities, especially in emerging fields such as digital medical technology applications and industry trend awareness. This echoes the results of a survey conducted by Cui *et al.* [8] on college students' employment cognition under the background of artificial intelligence. The survey shows that college students' professional employment direction cognition shows an obvious gradient distribution: only 51.65% of the students understand it, and the remaining 48.35% of the students are in a state of half-knowledge or completely ignorant. All show that students still have great shortcomings in career planning. Students can make career planning from the triple dimensions of "industry cognition + self-exploration + action landing." Industry cognition requires students to break the information gap. First, schools can offer career planning courses for college students, interpret the trends of the medical industry, and introduce medical policy interpretations (such as the impact of DRG reform on the doctor's profession). Secondly, students can use alumni resources to understand their future careers (if you can ask the teacher, senior, and senior sister), the school can also invite clinicians, nursing staff, scientific researchers, public health practitioners, and medical company executives to give lectures.

Self-exploration requires students to make scientific self-orientation. First, students can use professional evaluation tools (such as MBTI and Holland Career Interest Test) to make scientific self-orientation. Secondly, a special "career planning consultation room" is set up for teachers to provide one-on-one consultation according to the orientation.

Action requires students to set achievable goals in stages and adjust them in time to reduce blindness and determine the general direction of future career development. Therefore, students should set short-term career goals (clarify the goals to be achieved in freshmen, sophomores, juniors, and seniors) and long-term career goals, and use winter and summer vacations to practice in different hospital departments, accumulate clinical experience, and realize the integration of teaching and learning.

4.3. Correlation

There is a weak but significant positive correlation between "A" (digital medical awareness) and "B" (career planning awareness and readiness) between them. It can be concluded that the correlation between digital medical care and career planning is weak. This suggests that the improvement of digital healthcare awareness may indirectly promote the initiative and directionality of students' career planning by enhancing their understanding of industry technology dynamics. A survey shows that in the face of the professional competitiveness that AI brings to medical students, 68.65% of medical students are willing to work hard to improve themselves and learn AI-related technologies, 16.33% will look for positions that AI cannot replace within a certain time, and 15.02% of medical students will choose to maintain the status quo [9]. With the continuous development of digital technology and AI, this means that these 15.02% of medical students must make changes, or else their future career development will bring huge risks. These students can consult on the online psychological platform, reduce the negative mentality caused by psychological distress, and deal with

stress correctly. Secondly, it stimulates students' internal motivation and clarifies their professional identity. Teachers can help students disassemble long-term goals into actionable short-term goals, and reduce slack caused by ambiguous goals. Students can also participate in short-term practical activities to stimulate interest through real nursing scenarios, and at the same time realize the integration of nursing scenarios and digital medical care, to avoid the disconnection between what they have learned and reality, and at the same time experience the convenience brought by digital medical care.

4.4. Summary

4.4.1. Summary of digital medical awareness

Freshman medical students' awareness of digital medical care is at the upper-middle level, but there are still weak dimensions, which need to be optimized in combination with specific dimensions. The lack of information ethics and critical thinking is related to the incomplete system of digital medical care itself and the possibility of information leakage. In 2017, Patient Home Monitoring, a company that provides home medical care for patients in the United States, suffered a cloud configuration error, resulting in 47.5 G data leakage, exposing the medical records of 150,000 patients in the United States [10]. Studies have shown that nurses can understand their digital health literacy level through DHLI, improve online health information behavior, and use reliable information to guide clinical practice and improve nursing quality [11].

4.4.2. Summary of career planning readiness

The overall career planning readiness of freshman medical students is above average, but the individual differences are significant, and the skills and practical abilities related to digital medicine need to be strengthened urgently. Student source control and student source curiosity are dominant dimensions, while student source attention and student source self-confidence need to be continuously optimized in combination with industry dynamics. Career planning stays at the stage of "fuzzy interest," lacks specific path dismantling, fails to systematically analyze the matching degree between one's advantages and the target occupation, and lacks understanding of the integration opportunities of medicine and interdisciplinary occupations.

4.4.3. Correlation summary

There is a weak but significant positive correlation between digital medical awareness and career planning awareness and readiness. Career planning has strong autonomy, but its integration with emerging technologies is insufficient, which further shows that the current medical education has not yet fully realized the organic connection between digital skills and career development.

4.5. Countermeasures and suggestions

4.5.1. Strengthening the curriculum setting

For majors with low awareness and preparation (such as clinical medicine and pharmacy), the curriculum setting related to digital medicine can be strengthened to improve students' cognitive level. At the same time, students of nursing, traditional Chinese medicine, rehabilitation therapy, medical technology laboratory, and basic medicine will strengthen the popularization of digital medicine.

4.5.2. Interdisciplinary integration

Digital medical industry cases should be introduced into career planning courses, invite cross-disciplinary experts to give lectures, and broaden students' understanding of the career path of "integration of medicine and

industry". Recently, Yang *et al.* [12] pointed out that interdisciplinary cooperation and teamwork are important means for medical students to improve their information literacy.

4.5.3. Practicing strengthening

Students improved operational skills through virtual simulation platforms (such as digital diagnosis and treatment simulation) and at the same time combined professional role-playing activities to enhance their career confidence. Students need to fully understand the employment prospects of the selected major, carefully study the theoretical and practical skills that the major needs to master, learn more and practice more, be down-to-earth and be willing to work hard, constantly strengthen the contact with society, and enhance the sense of professional belonging and identity [13].

4.5.4. Long-term tracking mechanism

A longitudinal database of digital medical skills and career development should be established, with continuous evaluation of the effect of educational intervention, and provide an empirical basis for policy formulation.

4.5.5. Concerns about gender differences

Although girls' cognitive readiness is slightly higher than boys', it is still necessary to pay attention to boys' career planning readiness and provide targeted guidance and support.

Disclosure statement

The authors declare no conflict of interest.

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