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Analysis of the Adequacy of Undergraduate Education in Preventive Medicine and Its Influencing Factors

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Abstract

Background and Aim: The cultivation of competencies among preventive medicine undergraduates is essential for developing high-quality public health professionals, especially in the context of China's Healthy China 2030 initiative. However, disparities in competency development persist due to factors such as gender, family background, and economic conditions. This study aims to assess the adequacy of competency cultivation among preventive medicine students in a local medical college, identify influencing factors, and provide insights for optimizing medical education strategies.

Materials and Methods: This study utilized data from the China Medical Student Training and Development Survey (CMSS), targeting 569 preventive medicine undergraduates. The structured questionnaire measured competency adequacy across four dimensions: scientific and academic ability (5 items), clinical/practical ability (3 items), health and social responsibility (3 items), and professional quality (9 items). Responses were collected using a 5-point Likert scale, with higher scores indicating greater adequacy. Data were analyzed using SPSS 26.0, employing descriptive statistics, independent t-tests, one-way ANOVA, and regression analysis to explore influencing factors.

Results: The overall competency adequacy scores ranked as follows: health and social responsibility (3.72) > professional quality (3.70) > scientific and academic ability (3.56) > clinical/practical ability (3.52). Male students scored higher in clinical/practical ability ($P < 0.05$), while urban students outperformed rural students in multiple dimensions. Students with medical family backgrounds, higher family income, and a career aspiration in medicine demonstrated significantly higher competency adequacy scores ($P < 0.05$). Economic pressure negatively affected competency development, and financial aid showed a limited impact on improving competency adequacy.

Conclusion: The findings highlight imbalances in competency development, particularly in clinical/practical ability. Gender, urban-rural disparities, financial conditions, and career aspirations significantly influence competency adequacy. To bridge these gaps, medical education reforms should enhance practical training, provide targeted support for disadvantaged students, and optimize interdisciplinary learning opportunities. Future studies should further explore tailored interventions to improve competency development in preventive medicine education.

Keywords: Undergraduate Students in Preventive Medicine; Ability Training; Current Situation; Influencing Factors

Introduction

The cultivation of college students' abilities is the enhancement of students' comprehensive qualities and professional skills through teaching activities and practical components during the higher education stage. Zhong (2013) pointed out that this kind of cultivation is crucial for individual growth and social development. It helps individuals adapt to changes, improve their competitiveness in the workplace, and gain development opportunities. Ability cultivation also enhances overall personal qualities, promotes independent thinking and problem-solving skills, contributing to the comprehensive development of individuals and social progress (Xiao et al., 2013). Moreover, it boosts confidence and self-efficacy, forming a virtuous cycle of learning improvement. For society, ability cultivation is key to sustainable development, capable of nurturing talents with strong innovation and practical capabilities, driving technological advancement and economic growth. Therefore, the cultivation of abilities is crucial for both individuals and society, helping individuals adapt to society, realize their value, and at the same time, promote social development.

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The Chinese Undergraduate Medical Education Standards (2016 edition) put forward the basic ability requirements that undergraduate graduates should meet. It includes four dimensions: clinical/practical ability, science and scholarship, professional quality, health, and society (Table 1).

Table 1 Basic ability requirements for Chinese medical graduates.

Ability dimension	Specific criteria
Clinical/practical skills	Practical hands-on skills First aid/emergency response capability Medical record writing ability
Science and academia	Knowledge of professional knowledge Critical thinking skills Experimental, data analysis, and interpretation application ability Ability to write academic articles (including English writing) Literature search and information management skills
professional quality	Basic teaching ability Communication skills empathy Ability to collaborate across specialties (with other health professionals) independent learning ability Teamwork ability The ability to put forward innovative ideas, new ideas, new ideas and new problems problem-solving ability leadership
Health and society	Promote a sense of responsibility for population health. Health education capacity International exchange and the global health concept

The changes in the spectrum of diseases and the outbreak of infectious diseases pose new challenges to public health education, and cultivating high-level public health talents is crucial for the development of global health. Although China's public health has developed rapidly, there are issues of insufficient quantity and quality in talent cultivation. The "Healthy China 2030" Plan emphasizes the importance of prevention-oriented approaches and the integration of prevention and treatment, and proposes to strengthen the construction of health human resources. The COVID-19 pandemic has exposed the weak links in China's public health response and the lack of high-level talent (2). To promote innovation in medical education, the General Office of the State Council and the Ministry of Education of China have respectively issued relevant guidelines and notices, emphasizing the importance of preventive medicine education and proposing to strengthen practical skills training and interdisciplinary knowledge integration to enhance students capabilities in etiological identification, infectious disease control, and public health emergencies. The Healthy China Initiative is a significant measure to advance the development of China's health sector, and medical education must provide talent support for the construction of Healthy China. The development of public health professionals is a crucial guarantee for ensuring the sustainable development of China's public health (3). Therefore, cultivating public health talents to meet the needs of China's Healthy China construction and the implementation of health policies is a key task.

This study adopted the China Medical Student Training and Development Survey (China Medical Student Survey, CMSS) initiated by the National Medical Education Development Center in 2023, selecting data from the survey results on the adequacy of competence cultivation for students in the Preventive

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Medicine specialty under the undergraduate program directory of a certain local medical college (hereinafter referred to as "the local medical college"). The following is the report of the results.

Objectives

1. To examine the overall adequacy of ability cultivation among undergraduate students in the Preventive Medicine program, assessing their competencies in clinical/practical skills, scientific and academic knowledge, professional qualities, and health and social responsibility.
2. To analyze the differences in competency cultivation based on students' demographic and socioeconomic backgrounds, including gender, family location, financial conditions, and career aspirations, identifying key disparities that impact their development.
3. To explore the influence of external factors, such as economic pressure, financial assistance, and family medical background, on students' competency levels, providing insights into potential areas for targeted support and curriculum enhancement.

Literature Review

Zhang (2022) pointed out that Public health, as a crucial cornerstone for maintaining national security and the health of the people, has always been a focal point of attention for the construction of its talent pool. With the rapid development of the social economy and science and technology, as well as the increasingly severe global public health situation, the demand for public health professionals has been growing. Therefore, strengthening research on the training of public health professionals and enhancing the quality and capabilities of the talent pool have become important tasks for the current and future periods.

In China, the model for training public health professionals must adapt to international requirements in terms of training objectives, educational concepts, and curriculum systems (Xiao et al., 2013). Wuhan University, for instance, leverages its comprehensive disciplinary strengths to strengthen international exchanges and cooperation, exploring a model of public health education and talent training that features internationally oriented, interdisciplinary, and innovative approaches. The construction of interdisciplinary curriculum systems has been a focus in improving talent cultivation, integrating successful international experiences with the domestic educational landscape (Fang et al., 2024). Strategies have been proposed to enhance the quality of public health education, including curriculum design, teaching practices, faculty development, evaluation mechanisms, and policy support. Furthermore, the development of curriculum systems for practical innovation in public health has played a substantial role in enhancing the practical skills of undergraduate students (Zhang et al., 2019). The adaptation of preventive medicine education to evolving public health demands has also been analyzed, emphasizing program establishment, student admissions, employment prospects, and job competency (Shao et al., 2024). Additionally, the public health talent training model based on the OBE theory, in collaboration with "government guidance, university organization, health institution support, and individual voluntary participation," explores new approaches for the comprehensive deepening of public health education reform (Jin & Zhou, 2023).

Internationally, undergraduate public health education places a strong emphasis on practice-based teaching reforms. The Applied Learning Experience (APLE), for example, was introduced to help students master public health competencies through coursework and experiential learning, fostering both foundational knowledge and interpersonal communication skills (Nelson-Hurwitz et al., 2017). Research on integrative learning has further demonstrated that students benefit significantly from applying classroom knowledge to real-world public health issues, with experiential activities such as service learning, community-based learning, and signature experiences enhancing personal insight and professional recognition (Armstrong-Mensah et al., 2019). In addition, the "Public Health Faculty/Agency Forum" identified six essential competencies for public health professionals trained in the United States: public health foundational skills, problem identification and analysis, policy and program implementation, information management and communication, implementation and evaluation skills, and financial and cultural competence (Public Health Faculty/Agency Forum, 2017).

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In summary, both domestically and internationally, research on the training of public health professionals has mainly focused on training models, curriculum settings, and practical abilities. Research on the adequacy of training for the competencies of undergraduate students in public health (including clinical abilities, scientific and academic abilities, health and social abilities, and professional competence) has not yet been reported. This study investigates and analyzes the factors affecting the adequacy of training for preventive medicine undergraduate students, providing data support and strategic recommendations for improving the quality of public health talent training.

Conceptual Framework

The framework of this study is shown in Figure 1.

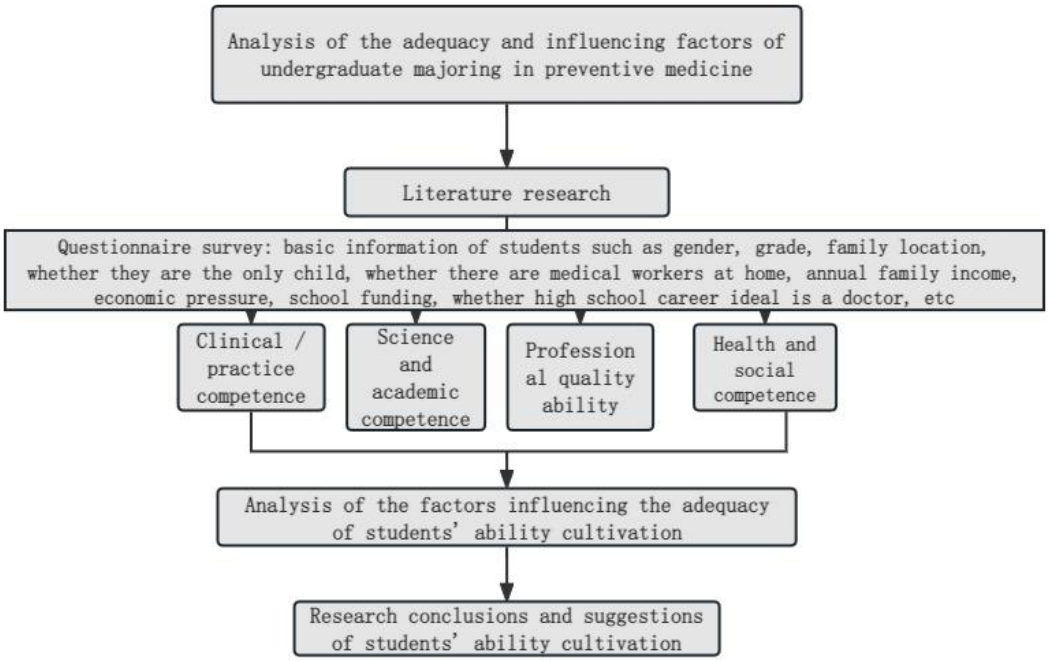

Figure 1 Conceptual Framework
Note: Constructed by the author

Methodology

1. Sample and Population

This study surveyed undergraduate students enrolled in the Preventive Medicine program at a local medical college in China. A total of 569 students participated, covering all academic levels: freshmen (14.94%), sophomores (23.55%), juniors (22.85%), seniors (15.11%), and fifth-year and above (23.55%). The sample included 196 male students (34.45%) and 373 female students (65.55%). Additional demographic variables such as family background, financial status, and career aspirations were considered to ensure a comprehensive analysis of competency cultivation adequacy.

2. Research Instrument

The study utilized the China Medical Student Training and Development Survey (CMSS) questionnaire, developed by the National Medical Education Development Center at Peking University. The questionnaire, approved by the Peking University Bioethics Committee (IRB00001052-20069), consists of four dimensions assessing competency adequacy:

Scientific and academic ability (5 items)

Clinical/practical ability (3 items)

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Health and social responsibility (3 items)

Professional quality (9 items)

Responses were measured using a 5-point Likert scale (1 = very insufficient, 5 = very sufficient), with higher scores indicating greater adequacy in competency cultivation.

3. Data Collection

The questionnaire was administered online through a unified survey platform and completed during a designated time slot. Investigators received standardized training to ensure consistency in data collection. Students provided informed consent before participation, and anonymity was maintained throughout the process.

4. Data Analysis

Data were analyzed using SPSS 26.0, applying descriptive statistics (mean, standard deviation, percentage) to assess competency adequacy. Comparative analysis was conducted using independent t-tests and one-way ANOVA to identify significant differences across demographic groups. Correlation and regression analyses were performed to explore the relationships between economic conditions, career aspirations, and competency development. Statistical significance was set at $P < 0.05$.

Results

1. General Situation

Among the undergraduate students of preventive medicine surveyed, there are 85 freshmen (14.94%), 134 sophomores (23.55%), 130 juniors (22.85%), 86 seniors (15.11%), and 134 students from the fifth year and above (23.55%); male students account for 196 people (34.45%), female students account for 373 people (65.55%); non-only children account for 470 people (82.60%), only children account for 99 people (17.40%); in terms of family location, divided by urban and rural areas, 348 students (61.16%) of this major live in rural areas, and 221 students (38.84%) live in urban areas; when asked if their family members have medical education or work in healthcare institutions, the survey results show that 163 people (28.65%) have family members working in medical-related fields, 406 people (71.35%) do not have medical personnel in their families; 473 people (83.1%) have an annual household income ≤80,000 yuan, 86 people (15.1%) have an annual household income between 80,000 and ≤300,000 yuan, and 10 people (1.8%) have an annual household income>300,000 yuan; 334 people (58.70%) of this major students report experiencing some economic pressure in their daily lives; 246 people (43.2%) of the students have received financial assistance from the school; 238 people (41.83%) of this major students reported that they set "doctor" as their career aspiration during high school.

2. Current status of the adequacy of student ability cultivation

The results of the survey on the adequacy of student ability cultivation show that in the four dimensions of basic requirements for student ability cultivation, health and society (3.72) has a relatively high score, followed by vocational quality (3.70), science and academic (3.56) and clinical/practical ability (3.52) (Figure 2).

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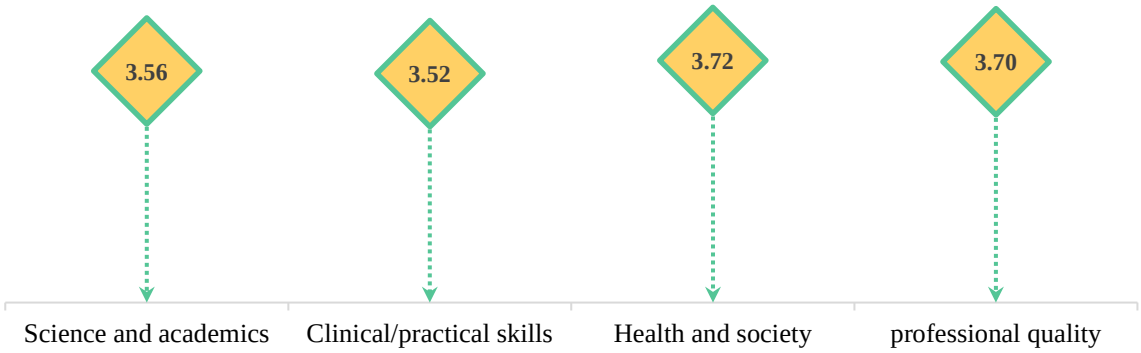

Figure 2 The scores of the adequacy of ability training in various dimensions for students interviewed in the field of preventive medicine
Note: Constructed by the author

3. Analysis Results of Factors Related to the Adequacy of Student Competency Cultivation

The results of the differential analysis of the survey data show that students whose gender is male, whose family residence is in an urban area, have family members working in the medical field, and whose high school career aspiration is to become a doctor have higher levels of competency cultivation adequacy, with all differences being statistically significant (all P <0.05). Among the four dimensions of competency cultivation adequacy, male students score higher in the clinical/practical dimension, students whose family residence is in an urban area score higher in the scientific and academic dimension, the health and social dimension, and the professional competence dimension. Students in their fifth year of university or above score higher in the clinical/practical dimension, scientific and academic dimension, health and social dimension, and professional competence dimension. Students whose family has medical personnel score higher in the health and social dimension and the professional competence dimension. Students with an annual household income of> 300,000 yuan score higher in the health and social dimension. Students without economic pressure and financial assistance score higher in the health and social dimension. Students whose high school career aspiration is to become a doctor score higher in the health and social dimension and professional competence dimension (Table 2).

Table 2 Comparison of the adequacy of undergraduate education in preventive medicine with different characteristics

Feature		The average score of each dimension of students' ability cultivation				
		Science and academics	Clinical/practical skills	Health and society	professional quality	grand average
sex	man	3.66±0.67	3.61±0.71	3.78±0.65	3.76±0.66	0.63±0.63
	woman	3.51±0.6	3.47±0.61[a]	3.68±0.61	3.67±0.54	0.54±0.54[a]
homeplace	rural area	3.51±0.62	3.48±0.63	3.67±0.61	3.66±0.58	0.56±0.56
	city	3.64±0.63[a]	3.57±0.68	3.79±0.65[a]	3.77±0.6[a]	0.59±0.59[a]
Whether they are only children	yes	3.6±0.64	3.5±0.74	3.71±0.68	3.73±0.64	0.63±0.63
	deny	3.55±0.63	3.52±0.63	3.72±0.62	3.7±0.58	0.56±0.56
grade	freshman	3.69±0.62	3.53±0.68	3.91±0.62	3.88±0.6	0.58±0.58
	sophomore	3.52±0.61	3.33±0.66	3.77±0.61	3.73±0.59	0.54±0.54
	Junior	3.43±0.66	3.55±0.6	3.65±0.63	3.61±0.58	0.57±0.57
	senior	3.56±0.66	3.58±0.66	3.62±0.67	3.66±0.6	0.62±0.62

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Feature		The average score of each dimension of students' ability cultivation				
		Science and academics	Clinical/practical skills	Health and society	professional quality	grand average
Whether there are medical workers in the home	5 or above	3.64±0.58[a]	3.62±0.63[a]	3.67±0.6[a]	3.68±0.57[a]	0.57±0.57
	yes	3.6±0.66	3.52±0.72	3.8±0.67	3.74±0.6	0.61±0.61
	deny	3.54±0.61	3.52±0.62	3.68±0.61[a]	3.69±0.59[a]	0.56±0.56[a]
Annual household income (10,000 yuan)	≤8	3.54±0.63	3.51±0.65	3.7±0.63	3.68±0.6	0.58±0.58
	(8,30)	3.59±0.59	3.5±0.63	3.78±0.63	3.76±0.54	0.54±0.54
	>30	3.96±0.55	3.83±0.65	4.17±0.39[a]	4.09±0.45	0.45±0.45
economic pressures	yes	3.53±0.62	3.49±0.63	3.67±0.62	3.66±0.59	0.57±0.57
	deny	3.59±0.63	3.56±0.68	3.79±0.64[a]	3.76±0.58	0.57±0.57
Financial assistance	yes	3.51±0.61	3.48±0.62	3.66±0.63	3.66±0.57	0.56±0.56
	deny	3.6±0.64	3.55±0.67	3.76±0.62[a]	3.74±0.6	0.58±0.58
High school career ideals	doctor	3.61±0.64	3.52±0.68	3.81±0.64	3.79±0.6	0.58±0.58
	Non-doctor	3.52±0.62	3.51±0.63	3.65±0.61[a]	3.64±0.57[a]	0.57±0.57[a]

Note: within groups, a was $P<0.05$.

Discussion

1. Analysis of the different scores of various dimensions of students' ability cultivation

Among the four dimensions of competence development, health and social ability had the highest scores, followed by professionalism and scientific/academic ability, while clinical / practice ability scored the lowest. The high scores in health and social competence may stem from the emphasis on public health, health education, and social medicine in the curriculum, and students can understand the multi-dimensionality of health issues (for example, socioeconomic, cultural, and environmental factors) and have strong communication skills. However, the weakness of clinical/practical ability indicates that there is a tendency to "emphasize theory over practice" in teaching. Students lack the training to transform knowledge into practice and need to strengthen practical skills by increasing simulation training and clinical practice.

2. Impact of students' background on ability cultivation

Gender differences showed significantly better clinical / practice ability in boys than girls, This may be related to more active participation in skill training, Girls may face the problem of self-confidence or insufficient opportunity in the clinical operation; The difference between urban and rural areas is reflected in the better performance of urban students in science, health, professional quality and other dimensions, Reflecting the uneven distribution of educational resources to rural students, Such as the lack of access to learning tools and health services; Grade differences show that senior students accumulate more clinical experience, Overall ability is higher than the lower grade students, Highlight the importance of phased training; Family background aspect, Students with medical staff have more advantages in health awareness and professional quality, While students with high annual family income and no financial pressure are more likely to have access to quality resources, Such as international communication and health activity participation, To improve the health and social capacity; Career ideal drive is manifested in the students who aspire to become doctors in high school due to their interest orientation, Outstanding performance in the dimensions of health and social and professional literacy, Suggesting the positive role of professional identity on learning motivation.

3. Regulation of economic pressure and funding

More financially stressed students had lower scores on the health and social dimensions and may have difficulty in undertaking additional expenses for social activities or health programs. School funding has not significantly improved this phenomenon, suggesting that the current funding mechanism needs to be optimized (e. g. targeted support practice participation fees).

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Conclusion

In the current field of education, the cultivation of students' abilities has always been a focal point of attention for researchers and educators. This study delves into two key characteristics of student ability development, revealing issues within the existing education system and proposing corresponding suggestions for improvement.

Firstly, the study points out that the development of student ability dimensions shows significant imbalances. Among the many ability dimensions, health and social abilities stand out due to the emphasis on curriculum, which is largely due to the importance placed on health education and social studies in school education. Students in these areas receive a more systematic knowledge transfer and ability cultivation. However, the cultivation of clinical/practical abilities appears relatively lagging. This may be because the cultivation of clinical/practical abilities requires more practical opportunities and resource support, which are often difficult to fully meet within school education. Consequently, students' development in this aspect of ability is restricted and urgently needs strengthening.

Secondly, the study finds that background factors have a significant impact on the development of student abilities. Variables such as gender, location of the family, economic conditions, and career aspirations affect ability development through resource allocation, opportunity acquisition, and psychological capital. For example, gender differences may lead to disparities in the development of certain ability dimensions, with females possibly excelling in language expression and social interaction, while males may have advantages in logical thinking and spatial imagination. The location of the family, especially the urban-rural divide, also has a significant impact on students' access to educational resources and ability development. Urban students often have access to richer educational resources and higher-quality educational environments, whereas rural students may face a shortage of resources and lower-quality education. Differences in economic conditions are also not to be overlooked, as students from better-off families often have more learning opportunities and access to higher-quality educational resources, while those from less affluent backgrounds may be limited in these areas. Career aspirations affect students' motivation and goal orientation, with students who have clear career plans often being more proactive in cultivating related abilities.

It is particularly noteworthy that the differences in urban and rural resources, as well as the "intergenerational transmission effect" of family backgrounds, may exacerbate the differentiation of abilities. The differences in educational resources between urban and rural areas are not only reflected in hardware facilities but also in the strength of teaching staff, educational philosophy, and teaching methods. Urban schools are often able to attract and cultivate more outstanding teachers, adopting more advanced educational philosophies and methods, while rural schools are notably deficient in this regard. In addition, the intergenerational transmission effect of family background cannot be ignored. For instance, students from medical families often show certain advantages in health knowledge and practical abilities, which are closely related to the family environment and parents' professional backgrounds. This intergenerational transmission effect may lead to the solidification of social classes, resulting in inherent inequalities in the development of abilities among students from different family backgrounds.

Recommendations

1. Optimize the curriculum and practice system

In the current education system, the importance of clinical and practical courses is increasingly highlighted. To cultivate more professionals with practical operation and emergency handling capabilities, we must reform and optimize the existing teaching model. First and foremost, increasing the proportion of clinical and practical courses is crucial. This means that in the curriculum, more practical sessions should be added, allowing students to learn and master necessary skills through practice. By simulating real work environments, students can better understand theoretical knowledge and apply it in practical operations, thereby enhancing their operational standards and their ability to respond to unexpected situations. To achieve this goal, implementing a phased teaching strategy is particularly necessary. For lower-grade students, the focus of teaching should be on the training of basic skills. Through systematic foundational courses, students can gradually establish a solid professional knowledge system, laying a solid foundation for subsequent learning. As students progress to higher grades, the teaching content should also be adjusted accordingly, focusing more on the practical application of complex cases. Senior students should have the opportunity to engage with more real-life cases, improving their ability to solve practical problems through case analysis and simulated drills. This phased teaching strategy helps students gradually enhance their

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professional skills, ultimately becoming professionals capable of independently facing various challenges. Moreover, achieving a balanced distribution of urban and rural educational resources is an indispensable aspect of educational reform. Rural students often face restrictions due to geographical and economic conditions, making it difficult for them to obtain the same educational resources as urban students. Therefore, providing academic support packages for rural students, including a rich online resource library, will greatly broaden their learning channels, allowing them to access more high-quality educational resources. Additionally, special subsidies for health education activities will help improve rural students' health awareness and quality of life, supporting their comprehensive development.

2. Targeted support for vulnerable groups

In contemporary society, gender-differentiated education has gradually become a focal point of attention in the field of education. To better meet the specific needs of female students in the medical field, clinical skills enhancement courses have been established. These courses aim to enhance the confidence and professional abilities of female students in clinical operations through targeted training and guidance. Through training that simulates real clinical environments, female students can master a variety of clinical skills more proficiently, allowing them to be more composed in future medical practice. In addition to the cultivation of professional skills, attention is paid to the impact of economic factors on students' learning and internships. By implementing a precise funding strategy, a "Practice Participation Fund" has been specially established. For students with poorer economic conditions, this fund helps to address issues related to transportation and material costs they may encounter during internships, reducing the financial burden on students and allowing them to focus more on learning and practice without worrying about financial pressures. Furthermore, many students come from non-medical backgrounds and may lack the necessary health knowledge and practical experience. To help these students better integrate into the medical field, a "Family Health Mentor Program" has been launched. Through this program, we have established close ties with medical institutions, providing students with a platform to understand and participate in the dissemination and practice of health knowledge. Under the guidance of mentors, students cannot only learn a wealth of health knowledge but also participate in actual medical activities, thereby gaining valuable practical experience.

3. Build a collaborative education mechanism

The integration of education and healthcare is becoming increasingly close, especially in the field of medical education. This collaborative model is crucial for cultivating high-quality medical talent. Through close cooperation with educational institutions and healthcare organizations, joint internship bases can be established, providing medical students with a learning environment that combines practice with theory. These internship bases not only offer students opportunities to engage with real healthcare settings but also allow them to apply their knowledge under the guidance of professionals, thereby deepening their understanding and mastery of medical knowledge. Furthermore, initiatives such as "Public Health Service Week" can broaden students' horizons, allowing them to understand the importance of public health and participate in community health promotion and disease prevention efforts. Through these practical activities, students can learn how to handle public health incidents and cultivate a sense of social responsibility and teamwork. In terms of mental health, integrating mental health resources and incorporating stress management and burnout prevention into the curriculum is particularly important for medical students. The study of medical professions is stressful and involves high work intensity, so learning how to cope with stress and prevent burnout is crucial for their future careers. Establishing dedicated psychological counseling channels to provide professional support and consultation services can help students address psychological issues encountered in their studies and daily lives promptly, maintaining a healthy mental state. Guiding students' career aspirations through the establishment of "Medical Career Exploration Workshops" can promote early exposure to clinical environments, thereby stimulating their enthusiasm for learning. In these workshops, students can communicate with experienced doctors and understand the characteristics and career development paths of different medical fields, which helps them make more informed career choices based on their interests and strengths. At the same time, through interactive forms such as simulated clinical operations and case discussions, students can more intuitively experience the appeal of medical professions, thereby enhancing their motivation and passion for learning.

4. Dynamic monitoring and feedback

Constructing a comprehensive database for the development of preventive medicine students' competencies is crucial for enhancing the professional skills of future healthcare workers and their ability to address public health challenges. This database should encompass various competency indicators

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throughout the entire learning cycle, from enrollment to graduation, such as mastery of theoretical knowledge, practical skills, clinical judgment, and communication and coordination abilities. By collecting and analyzing these data, educational institutions can gain a clear understanding of each student's development trajectory and thus develop personalized educational plans. To ensure the effectiveness of these interventions, regular assessment of their outcomes is indispensable. Through these assessments, educators can identify which interventions are most effective and which require improvement. Additionally, the assessment results can provide feedback to students, helping them understand their strengths and areas for improvement. Beyond monitoring individual student competencies, the database should also focus on analyzing changes in competencies across urban and rural areas, gender, and economic groups. Such analysis can help uncover potential inequalities, such as uneven resource distribution, gender biases, or urban-rural disparities. By identifying these differences, educational institutions can take targeted measures to narrow these gaps, such as offering more scholarships and internship opportunities to students from economically disadvantaged groups or providing special career development support for female students. Furthermore, with the continuous evolution of the public health field and the emergence of new diseases and health challenges, the educational content and methods for preventive medicine must also be updated regularly. Therefore, the construction and maintenance of the database should be flexible and capable of adapting to new educational needs and public health trends. Through ongoing monitoring and assessment, educational institutions can promptly adjust educational strategies to ensure that students acquire the latest knowledge and skills, preparing them for their future careers.

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