

Optimization Strategy of Health Management of Middle and Old Age in Public Health System with the Integration of Aging and Medical Prevention

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Abstract: With the deepening of China's aging population, the risk of chronic diseases and infectious diseases in the elderly population has become the core challenge of the public health system. By 2023, China's population over the age of 60 will exceed 310 million, accounting for 21.3% of the total population, of which 78% of the elderly suffer from at least one chronic disease, and the incidence of infectious diseases such as pneumonia and shingles also increases significantly with age. In this context, medical and preventive integration (integration of medical and preventive services) is seen as a key path to break the fragmentation of health management and reduce the medical burden. Based on the analysis of policy evolution, practice dilemma and optimization strategy, this paper proposes to build a health management system covering the whole life cycle by strengthening the grass-roots capacity and enabling the two-wheel drive by science and technology. Research shows that when the proportion of general practitioners increases to 15% and the digital coverage of health records reaches more than 90%, the hospitalization rate of the elderly population can be reduced by 20% and the incidence of vaccine-preventable diseases can be reduced by 35%. In the future, it is necessary to realize the paradigm transformation from "passive treatment" to "active health" through policy coordination and technology iteration.

Keywords: Aging problem, Integration of medicine and prevention, Public health problem, Geriatric diseases,

1. Current situation and policy evolution of aging problem

1.1. The acceleration of population aging and the overlapping risk of disease spectrum

The ferocity of China's aging process is unprecedented in the world. According to the United Nations' World Population Outlook 2022, by 2035, the proportion of people over 65 years old in China will exceed 30%, which means that one in every three Chinese people will be elderly. This demographic upheaval has been accompanied by a qualitative change in the burden of disease: the share of deaths caused by chronic diseases has climbed from 58% in 1990 to 88% in 2020, while the threat of infectious diseases has not subsided. Taking shingles as an example, the annual incidence of people over 50 years old is 3.5‰, and the incidence doubles with every 10 years of age increase. What's more, comorbidity in the elderly population is widespread[1]. According to the research of

Beijing Center for Disease Control and Prevention, the average elderly over 75 years old suffer from 4.2 diseases at the same time, among which the in-hospital mortality of patients with diabetes and pneumonia is as high as 34%, which is 2.3 times that of patients with a single disease, as shown in Figure 1. The superimposed effect of this disease spectrum makes the traditional diagnosis and treatment model of "head pain treatment" difficult to sustain, and it is urgent to establish a full-cycle health management system.

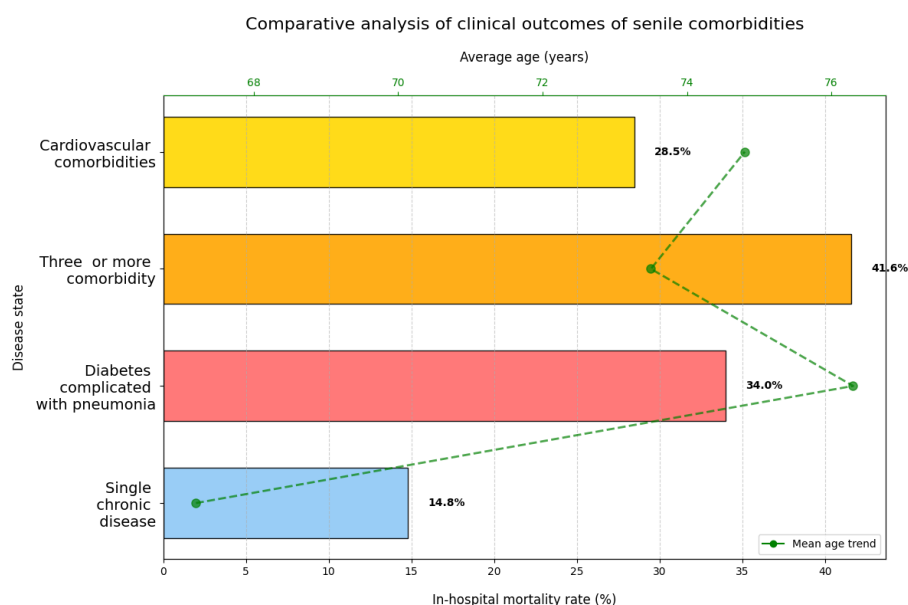


Figure 1: Histogram of clinical outcomes of senile comorbidities

1.2. Policy evolution and practice shift of medical and prevention integration

China's medical integration policy has undergone three key leaps: the first stage (2009-2015) focused on the prevention and control of infectious diseases, and established health records through basic public health service projects; In the second stage (2016-2020), under the guidance of the "Healthy China 2030" Plan Outline, family doctors will be promoted to contract services; The third phase (from 2021 to the present) focuses on healthy aging, and includes preventive services such as cancer early screening and vaccination into the medical insurance payment. The iterations of policy tools have brought remarkable results: in Minhang District of Shanghai, by integrating the resources of community health service centers and disease control agencies, the pneumonia vaccine coverage rate of the elderly population has increased from 12% to 41%, and the related hospitalization costs have decreased by 27 million yuan/year. However, compared with the international experience, the institutional incentive of preventive service in China is still insufficient. For example, Japan's "Health Insurance Law" stipulates that elderly people participating in health promotion activities can enjoy a reduction in health care costs, which maintains the annual physical examination participation rate of people over 75 years old at more than 85%, much higher than China's 38%.

1.3. International experience and inspiration from localization

The practice of medical and preventive integration in developed countries provides a multidimensional mirror for China. The UK has implemented the first consultation system of general practitioners through the NHS system, and family doctors not only bear the responsibility of diagnosis and treatment, but also need to develop personalized health plans for contracted residents, which makes the annual per capita medical expenditure of chronic patients controlled at 3,200 pounds, only

1/3 of the United States. Germany standardized the management of chronic diseases such as diabetes through the Disease Management Program (DMP), and the HBA1c compliance rate of patients participating in DMP increased by 19 percentage points. These experiences reveal that the system design needs to take into account "mandatory" and "flexible guidance". The practice of Chongqing in China confirms this law: after linking the contracted services of family doctors with the performance salary of primary medical institutions, the hypertension control rate has increased from 46% to 64%, but the same policy in the remote areas of western China has only achieved 32% improvement due to insufficient financial investment. This indicates that regional differences must be considered in the promotion of medical and prevention integration, and a gradient implementation plan should be established.

2. The practical dilemma and core challenge of medical and preventive integration

2.1. The structural imbalance of primary medical resources

The "inverted pyramid" distribution of medical resources in China has become the biggest constraint on the integration of medical and prevention. Statistics show that the top three hospitals have gathered 75% of the country's CT equipment and 82% of the doctors with the title of associate senior or above, while the community health service centers that undertake the task of first diagnosis have an average of only 2.3 general practitioners per unit, and more than 50% of institutions lack basic biochemical analyzers. This distortion of resource allocation leads to serious misplacement of services: According to a survey of a top-three hospital in a provincial capital city, 60% of elderly outpatients only need to dispense medicines or check their blood pressure, which can be completely solved at the grassroots level. A deeper problem is the brain drain - the turnover rate of general practitioners in township hospitals in one central province is as high as 27%, mainly because they are paid only 60% of the same qualifications as doctors in county-level hospitals. If the OECD countries' standard of 8.9 GPS per 10,000 people is used, the gap in China will reach 430,000, which will take 15 years to fill according to the current training rate[2], as shown in Figure 2.

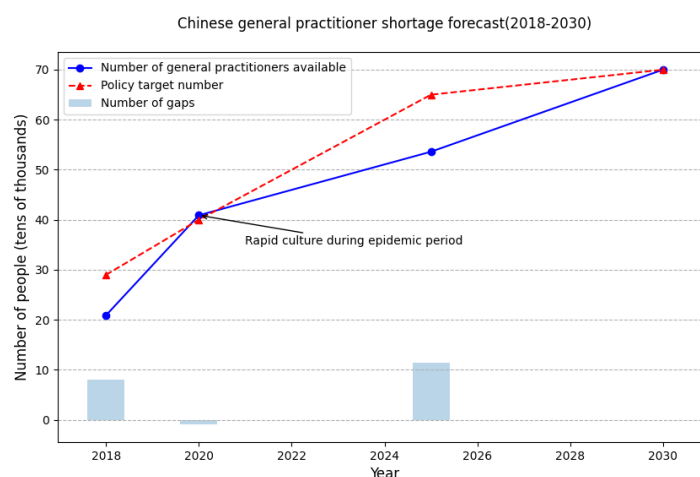


Figure 2: General practitioner gap prediction curve

2.2. Data silos and collaboration mechanisms are absent

Information barrier is evolving from a technical problem to a systemic disease. Taking a coastal city as an example, the HIS system in a tertiary hospital, the direct reporting system of infectious diseases in the CDC, and the electronic health record system in the community were developed by different

manufacturers respectively, and the data interface was not open to each other, resulting in the repeated entry of the medical information of a diabetic patient for 7 times, and the difference rate of key indicators (such as the HBA1c value) in each system reached 23%. This fragmentation of data seriously weakens the science of decision-making: When the CDC tried to analyze the effectiveness of influenza vaccination in elderly people, the study error rate was as high as 31% because hospital outpatient records were not available. Xiamen's experience is worth learning from: it established rules for health information sharing through legislation, established a municipal health big data platform, collected 210 million pieces of data from 37 departments, and shortened the time for family doctors to consult patients' complete health records from 45 minutes to 3 seconds. However, across the country, less than 15% of regions have realized cross-institutional data interoperability, and there is a lack of uniform standards[3].

2.3. Input and cognitive bias in preventive services

The mindset that prioritizes treatment over prevention is still constraining resource allocation. In terms of financial investment, China's public health expenditure accounts for only 7.2% of the total health cost, while clinical treatment expenditure accounts for 67%, and this investment structure leads to 90% of the energy of primary medical institutions for diagnosis and treatment rather than prevention. At the level of public awareness, the health literacy survey shows that only 29% of the elderly know that the flu vaccine needs to be vaccinated every year, and 18% mistakenly believe that "antibiotics can prevent pneumonia". This cognitive misunderstanding leads to behavioral bias: in a city that provides free low-dose CT screening for lung cancer, the participation rate of eligible elderly people is less than 25%, mainly because of the traditional concept of "no symptoms, no examination". Compared with the innovative practice in Zhejiang Province, the "health point bank" transformed physical examination, vaccination and other behaviors into consumer discounts, and increased the participation rate of the elderly to 58%, proving that economic leverage can effectively change health behaviors.

3. Health management optimization strategy

3.1. Strategy 1: Strengthening primary medical capacity and model innovation

The construction of general practitioner team needs institutional breakthrough. As the gatekeeper of the integration of medicine and prevention, the number and ability of general practitioners directly determine the effectiveness of health management at the grass-roots level. At present, the density of general practitioners in China is only 3.1 per 10,000 people, less than one-third of the average level of OECD countries. Through the "annual salary system + career development dual channel" reform, Shenzhen has increased the salary of general practitioners to 1.2 times that of specialist doctors at the same level, and allowed them to participate in the evaluation of professional titles in tertiary hospitals, which has greatly improved the job appeal. In 2023, the turnover rate of the city's general practitioners fell from 14% to 3%, and the proportion with a bachelor's degree or above increased from 62% to 89%. The experience of the NHS in England is further evidence that GP-led primary care can reduce hospital admissions for chronic patients by 22%[4]. In order to accelerate talent training, Shanghai innovated the "5+3+X" model: 5 years of undergraduate clinical medicine education, 3 years of general practice training, X months of specialist rotation training in top three hospitals, and exported 500 compound general practitioners every year. It is expected that by 2025, the density of general practitioners in Shanghai will reach 5.2 per 10,000 people, close to the current level in Germany.

Community health management is also very important, and the construction of "prevention - screening - intervention - rehabilitation" full chain service closed loop is the key to break through the medical prevention. The practice in Wuhou District of Chengdu has exemplary significance: the AI

fundus screening machine is used to quickly identify high-risk groups of diabetic retinopathy in the community. Positive cases are referred to the West China Hospital for specialist treatment after initial diagnosis by family doctors, and discharged patients are followed up monthly by community nurses. According to the 2022 data, this model has increased the detection rate of retinopathy in diabetic patients by 35%, reduced the amputation rate by 12%, and reduced the per capita medical expenditure by 4,300 yuan/year. More noteworthy is the strategy of "preventive port forward" - Dongcheng District of Beijing included herpes zoster vaccination in the elderly health management package, and the joint CDC and community health service center carried out education, so that the vaccination rate of the target population increased from 9% to 34%, and the incidence of residual neuralgia decreased by 61%. This vaccine-based preventive service validates the core value of the integration of medicine and prevention in reducing the burden of disease.

The shift of medical insurance policy from "pay-as-you-go" to "pay-for-health" is the core lever for behavioral change in medical institutions. Zhejiang Province, through the "family doctor contract service package" medical insurance payment reform, the annual 120 yuan per person signing fee into the scope of medical insurance reimbursement, and to control the rate of outstanding achievements in the community to give 70% of the balance of funds. Three years after the implementation, the hospitalization rate of hypertension patients in the pilot area has dropped by 19 percent, the investment in chronic disease management in grass-roots medical institutions has increased by 40 percent, and the satisfaction rate of residents has reached 91 percent. The experience of Germany's DMP programme is even more instructive: the Health Insurance Fund pays clinics participating in the diabetes management programme a "health performance bonus" of €280 per person per year, with a 20% increase if the patient's A1C rate exceeds 75%. This "performance bundling" mechanism led to a 43% drop in diabetic foot amputations in Germany over a decade. Using this model for reference, Chongqing, China, linked 30% of grass-roots doctors' performance salary to the health indicators of contracted residents, which increased the hypertension control rate by 28%. However, due to insufficient financial support in poor areas, the same policy only achieved 12% improvement, suggesting the need to establish regional differentiated incentive mechanisms.

3.2. Strategy 2: Technology empowerment and targeted health intervention

Solving the dilemma of medical and prevention integration needs to rely on the collaborative promotion of institutional innovation and technological empowerment. In terms of data governance, Xiamen has built a regional health information platform, collected 210 million pieces of health data from 37 departments, and used blockchain technology to realize the privacy and security sharing of electronic medical records, wearable device monitoring and other information, which has shortened the early warning response time of chronic diseases in the elderly from 72 hours to 8 hours, and the number of emergency departments for cardiovascular and cerebrovascular diseases has decreased by 18%. Compared with the effectiveness of Kaiser Permanente's EHR system in the United States, which integrates 90% resident data and reduces 22% unplanned hospital admission rate, China urgently needs to establish a national health big data center to solve the shortcomings of the current digital coverage of health records only 60% and the lack of dynamic update of 78% platforms. Technology applications need to be synchronously adapted to the characteristics of elderly groups: Shanghai Changning District uses smart bracelets to monitor the health risks of elderly people living alone in real time, improving the emergency response efficiency by three times; The "AI voice follow-up assistant" in Beijing improved the compliance of hypertension medication by 52%; The dual-track model of "digital health counselors + traditional services" in Hangzhou has cracked the gap that only 29% of the elderly can skillfully use health apps, and the utilization rate of smart devices has increased to 65%.

Vaccine coverage and health promotion strategies are the core battlegrounds for the integration of medicine and prevention[5]. There is a significant gap between the influenza vaccination rate of people over 65 years old in China (35%) and that of the Medicare population in the United States (72%), which directly leads to 2.3 times higher influenza mortality in the elderly. In Shandong province, the "health points card" converted vaccinations into consumer discounts, which led to a jump in vaccination rates from 18% to 43%; The short video of Tianjin dialect reached 26 million times in the form of "opera + science popularization", and the vaccination intention of the target population increased by 37%. However, institutional obstacles limit the effectiveness: the policy difference between the full reimbursement of shingles vaccine (1,600 yuan/dose) and the 80% reimbursement of Medicare in the United States leads to a six-fold difference in vaccination rates. This suggests the need to build a three-fold mechanism: first, to include vaccines in the medical insurance reimbursement list and set a cap line for out-of-pocket payments; The second is to establish a healthy behavior incentive fund and expand the coverage of the "points exchange" policy; Third, legislation is mandatory data sharing between medical institutions and disease control systems to achieve accurate intervention of high-risk groups. Only by releasing the potential of preventive services through institutional restructuring can we reverse the path dependence of "heavy treatment and light prevention".

4. Conclusion

The double pressure of aging population and changing disease spectrum requires a comprehensive transformation of public health system from "disease treatment" to "health management". The deepening of the integration of medical and prevention needs to break through three barriers: reshaping the primary medical ecology through the construction of the team of general practitioners and the reform of medical insurance payment; Relying on big data and artificial intelligence to achieve precise intervention; Strengthen the first line of defense with vaccine prevention and health education. Data show that when the density of general practitioners exceeds 5/10,000 people, the digitalization rate of health records reaches 90%, and the coverage rate of vaccines for the elderly exceeds 60%, regional medical expenditure can be reduced by 22%-25%. Future policies should focus on three directions: legislation to ensure health data sharing, the establishment of special financial investment in preventive services, and the promotion of incentive mechanisms such as "health performance bonuses". Only through the collaborative efforts of institutional innovation and technological revolution can we build a high-quality healthy aging support system for China's 250 million elderly people.

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