



Quality of primary health care in China: challenges and recommendations

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For the Chinese translation see
Online for appendix 1

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China has substantially increased financial investment and introduced favourable policies for strengthening its primary health care system with core responsibilities in preventing and managing chronic diseases such as hypertension and emerging infectious diseases such as coronavirus disease 2019 (COVID-19). However, widespread gaps in the quality of primary health care still exist. In this Review, we aim to identify the causes for this poor quality, and provide policy recommendations. System challenges include: the suboptimal education and training of primary health-care practitioners, a fee-for-service payment system that incentivises testing and treatments over prevention, fragmentation of clinical care and public health service, and insufficient continuity of care throughout the entire health-care system. The following recommendations merit consideration: (1) enhancement of the quality of training for primary health-care physicians, (2) establishment of performance accountability to incentivise high-quality and high-value care; (3) integration of clinical care with the basic public health services, and (4) strengthening of the coordination between primary health-care institutions and hospitals. Additionally, China should consider modernising its primary health-care system through the establishment of a learning health system built on digital data and innovative technologies.

Introduction

As part of China's health-care reform effort to provide its citizens with universal and equitable access to

high-quality health care, primary health care (PHC) has received considerable attention (appendix 2 pp 1–2).¹ This focus is in recognition that the current hospital-centric delivery system is costly and does not serve the changing needs of the ageing population, which is undergoing an epidemiological transition.² China has introduced several policies to build integrated delivery system based on PHC to prevent and manage chronic diseases and infectious diseases. Meanwhile, and the government has increased its funding to these institutions by more than tenfold, from ¥19 billion in 2008 to ¥197 billion in 2018.^{3–5} The role of PHC is further reinforced by the Healthy China 2030 Plan announced in 2016,⁶ which introduces new directives for health development by prioritising prevention and primary

Key messages

- In China, there is evidence of widespread gaps in the quality of primary health care, which lead to suboptimal population health and a substantial economic impact.
- The shortfalls of the primary health-care system include the insufficient training and educational opportunities for the practitioners, the fee-for-service model that incentivises unnecessary testing and treatments, the shortage of integration between clinical care and the public health service as well as between different health-care sectors, and insufficient continuity of care throughout the entire health-care system.
- In addition to education for the family doctors, China could consider tailoring continuing training for the primary health-care workforce; online platforms could cover a vast number of professionals and facilitate adaptive programmes on the basis of individual abilities.
- At the primary health-care level, clinical care and public health services need to be integrated, with respect to provider payment, guideline recommendations, and performance assessment, to bring synergy in disease and health management.
- Coordination between primary care and hospital care can be incentivised through a population-based capitation payment system and an information technology platform to match the capabilities of different institutions with the comprehensive needs of the population.
- China needs performance measurement and accountability in its primary health-care system, with comprehensive indicators, reliable data, and in-depth analysis, as well as financial and non-financial incentive mechanisms.
- The primary health-care system should increasingly be configured to be a learning platform for knowledge generation and utilisation, which is built on digital data and innovative technologies, particularly for staff training, decision support, and quality control.
- The coronavirus disease 2019 outbreak shows that the primary health-care system could play an important role in screening, triage, and monitoring through functioning coordination with local hospitals and China Centers for Disease Control and Prevention.

Search strategy and selection criteria

We searched PubMed, MEDLINE, and CNKI (China National Knowledge Infrastructure) for papers in English and Chinese that were published up to Oct 1, 2019 (appendix pp 4–11), to identify relevant studies on seven domains of primary health care (structure, human resources, Electronic Health Record system, finances, insurance, medications, and quality of care) in China. In the PubMed and MEDLINE search, we used MeSH and free text terms in conjunction to increase sensitivity to potentially appropriate literature. The MeSH terms included "primary health care", "General Practice", "General Practitioners", "Physicians, Family", "Community Health Services", "Delivery of Health Care", and terms for each specific domain. Search terms and all their possible synonyms and spellings were identified and used in the search strategy. In the database of CNKI, we used similar strategy to include literature published in Chinese journals.

care. The recent coronavirus disease 2019 (COVID-19) outbreak brought to the fore the important role that PHC could play in screening and monitoring for COVID-19, and maintaining routine care on other health conditions.

The effectiveness of these directives depends on whether China can build a strong PHC system with good quality of care.⁷ Despite substantial financial investment and infrastructure building (appendix 2 p 3) in the past decade, however, evidence suggests that the quality of PHC in China is still suboptimal, which also contributes to missed opportunities to promote population health and to improve efficiency of service delivery.^{5,8}

In this Review, we summarise the evidence on the quality of PHC in China, analyse the causes for poor quality of care, and provide policy recommendations for improvement. We adopt the European Primary Care Monitoring System (EPCMS) assessment framework to guide our analyses (appendix 2 pp 21–23).^{9,10} This framework conceptualises that structural and process dimensions of a PHC system contribute to three outcomes for PHC: quality, efficiency, and equity. This Review focuses on quality because it is essential for improving health outcomes and gaining the trust of people. We base our analyses on a literature review and original data collection from the National Primary Health Care Survey (NPHCS).¹¹ To develop policy recommendations, we also interviewed key stakeholders, front-line health workers, and policy makers, and evaluated national and international examples.

Current quality of China's primary health care

The functions of PHC institutions in China include providing generalist care and implementing the National Basic Public Health Services Program (appendix 2 pp 4–11).⁵ The EPCMS framework specifies nine measures for quality of PHC. In this Review, we focus on quality of diagnosis and treatment, prescribing behaviour, and quality of chronic disease management, given the rising burden of non-communicable diseases in China and the priorities of its overall health-care reform for establishing a gatekeeping function of PHC. With respect to other measures covered by the EPCMS, China has already achieved maternal and child health outcomes that approach those of advanced economies,¹² and universal neonatal vaccination was estimated to have prevented 30 million chronic hepatitis B viral carriers.¹³ Unfortunately, evidence on quality of mental health care and health promotion in the PHC system is not generally available.

Quality of diagnosis and treatment

The quality of the diagnostic process and outcomes was evaluated to be low among PHC providers. A study including incognito standardised patients with common illnesses (dysentery and angina) in the western region

of China showed that village doctors asked patients 18% of the recommended questions and did 15% of the recommended examinations. Furthermore, these doctors addressed 36% of the essential questions or examinations necessary for a proper diagnosis and harm reduction, and correctly diagnosed 26% of the illnesses of these incognito standardised patients.¹⁴

In another study using incognito standardised patients with symptoms of classic pulmonary tuberculosis, proportions of correct management were significantly lower at township health centres (38%) and village clinics (28%) than at county hospitals (90%).¹⁵ A substantial variation of doctors' behaviour was observed within each group (township health centres or village clinics) as well,¹⁵ which was similarly found in other middle-income countries.¹⁶

Prescribing behaviour

Overuse of antibiotics is common in PHC institutions.^{17–19} Systematic reviews showed that the overall weighted average proportion of antibiotic use was over 50% in PHC institutions,²⁰ which is much higher than the standard recommended by WHO (<30%).²¹ A 2011 study based on a random sample of PHC institutions in six provinces of China also revealed that a quarter of outpatient antibiotics prescriptions and 68% of inpatient antibiotics prescriptions were inappropriate, and improper remuneration incentives were considered a key driver for these prescribing behaviours.²² Moreover, there was a preference for PHC doctors to use broad-spectrum antibiotics,²³ which is deemed to be a quality issue related to professional incompetence,²⁴ and could induce the emergence and spread of drug-resistant strains of microbes.²⁴

Non-communicable diseases such as hypertension are largely undertreated. The largest hypertension survey in China, the NPHCS, found that a third of patients with hypertension diagnosis did not take antihypertensive medication, and 42% took only one medication and their blood pressure was uncontrolled.²⁵ Meanwhile, it was found that approximately 8% of medications used were not recommended by guidelines,²⁶ and high-cost medications were more preferentially used than their evidence-based and cheaper counterparts.^{26–28} These results suggest that in addition to a medication supply defect, physicians' knowledge of and willingness to adhere to new hypertension treatment guidelines are issues that need to be addressed.²⁹

Chronic disease management

Evidence suggests shortfalls with respect to hypertension and diabetes, which are the most common chronic conditions encountered in PHC settings (appendix 2 pp 13–14).⁵ For hypertension, based on two nationally representative studies,^{30,31} the poor awareness (32% and 47%) and control rates (10% and 15%) indicated gaps in public health service (ie, population screening) and clinical care (ie, patient

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Panel 1: Hypertension control in primary health care, and the lifetime health and cost consequences in China

There are more than 270 million patients with hypertension in China. However, population-based studies of hypertension done after the launch of the National Basic Public Health Service Programme using large samples, nationwide or in specific regions of China,^{25,30,31} showed increased prevalence, low awareness, low treatment, and poor control of hypertension (appendix pp 15–16), as well as wide variation in the results among the studies because of differences in the methodologies (eg, differences in sampling and age groups included). According to findings from two reported national representative surveys, approximately one in four adults had hypertension in the period between 2012 and 2015.^{30,31} Awareness and treatment rates were low among patients with hypertension, which translated into poor control of blood pressure overall (9.7%³⁰ and 15.3%³¹).

Poor control of cardiovascular risk factors in the Chinese population could ultimately result in compromised health outcomes. On the basis of the findings from the largest study on hypertension management so far in China,²⁵ we used a state-transition simulation model to predict the lifetime health lost (appendix p 17). Among 1.7 million Chinese adults aged 35–75 years, gaps in awareness of hypertension result in an estimated 3 336 000 years of life lost and 3 829 000 quality-adjusted life-years (QALYs) lost; the treatment gap results in an estimated 6 318 000 years of life lost and 7 251 000 QALYs lost; and the control gap results in an estimated 24 914 000 years of life lost and 28 657 000 QALYs lost.

The suboptimal risk control and the lost opportunities to prevent or mitigate disease at the primary care level in China has also had tremendous cost consequences. In the same state-transition simulation model, the projected costs of antihypertensive drugs, cardiovascular disease event management, and productivity were predicted from the gaps in hypertension awareness, treatment, and control. It would cost ¥125 million per year (discounted at 3% per year) to fill the awareness gaps, but reaching that scenario would save ¥486 million annually in event costs averted (including acute and chronic care costs); it would further prevent a discounted productivity loss of ¥2691 million and monetised QALY losses of ¥2609 million per year. Overall, the annual economic losses would be ¥5661 million due to the gaps in hypertension awareness, ¥10 722 million due to the treatment gaps, and ¥35 331 million due to the control gaps.

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	Awareness gap	Treatment gap	Control gap
Decreased antihypertensive drug cost	151	286	1029
Decreased antihypertensive drug cost (discounted*)	125	237	854
Increased cardiovascular disease event cost	548	1039	3085
Increased cardiovascular disease event cost (discounted*)	486	920	2725
Productivity loss	3064	5802	18 230
Productivity loss (discounted*)	2691	5097	15 938
Monetised quality-adjusted life-years lost (discounted*)	2609	4942	17 521
Total economic loss	5661	10 722	35 331
*Discounted by 3% per year.			

Table: Economic effects due to gaps in hypertension awareness, treatment, and control (per year, in millions of 2015 yuan)

treatments), as well as poor integration between public health service and clinical care in PHC institutions. Under-performance of PHC might explain why China has a much

higher hospital admission rate for hypertension (490 per 100 000 population) than all countries from the Organisation for Economic Co-operation and Development (OECD; with an average of 95 per 100 000 population).^{32,33} Moreover, the poor performance in the management of hypertension is estimated to lead to compromised health outcomes and tremendous economic losses (panel 1; table).

For diabetes, a nationally representative survey in 2013 including 170 287 Chinese participants found that only 37% of those with diabetes were aware of their diagnosis, and just 32% were being treated.³⁴ Another nationwide longitudinal survey from 2011 to 2015 identified a decrease in health education coverage (from 76% to 70%) and persistent gaps in use of examinations and treatments (from 79% to 81%), accompanied by an increase in diabetes-related hospital admission (from 4% to 6%) and readmission (from 19 to 28%).³⁵ China's hospital admission rate for diabetes had reached 260 per 100 000 population in 2013, which was much higher than most OECD countries (with an average of 141 per 100 000 population).³²

Challenges in structure and process of primary health-care system

Using the EPCMS framework and drawing on existing literature, practitioner interview, and expert analyses, we identified two structural (workforce development as well as remuneration system and income of PHC providers) and two process (coordination of care and continuity of care) dimensions of China's PHC system as core contributors for gaps in quality of PHC.

Workforce development

The levels of education and qualification among PHC professionals in China are low. In 2018, 25% of PHC doctors in community health centres and 42% of those in township health centres had less than a junior medical college level of education (the requirement for a licensed assistant physician); this percentage represents an improvement, as the proportions have decreased from 41% in community health centres and 60% in township health centres in 2010.³⁶ Since the nationwide reform of graduate medical education was issued in 2011,³⁷ training for family doctors, including specific medical school education and in-service training, has been prioritised nationally. The number of qualified family doctors in China has tripled (from 100 000 to 300 000).^{4,38} However, these qualified family doctors still constituted only a small proportion (from 4% in 2011 to 13% in 2018) of all doctors practicing in China's PHC settings. Moreover, due to a shortage of qualified physicians, more than 20% of doctors practicing in community health centres, township health centres, and community health stations were not licensed (appendix 2 p 18).^{5,39} The shortage of diverse multidisciplinary PHC teams has persisted, as the doctor–nurse ratio is 2.6 compared with 1.5 in the UK,⁴

which limits a functional response to the needs of the community.⁴⁰

Substantial gaps exist in the in-service training of PHC professionals. PHC professionals in China are required to attend and earn a specific number of credits in the Continuing Medical Education programmes annually.⁴¹ However, the NPHCS reported that more than a third of physicians, nurses, and public health professionals in PHC institutions received no Continuing Medical Education in 2016.⁵ PHC professionals complained that they were too busy to attend training, and the training failed to meet their needs because of poor contents and unqualified trainers.⁴² Furthermore, although there is a plethora of guidelines and consensus statements issued by various academic and professional bodies (eg, for hypertension, there are at least five clinical guidelines and 13 consensus documents from 14 bodies), the absence of one authoritative, national guidance for each common condition has been an issue in a poorly-trained workforce.

Remuneration system and income of primary health-care providers

In China, PHC providers (and all other health-care providers) are primarily reimbursed by social health insurance and patients via the fee-for-service payment system method according to a fee schedule that was set by the government. This fee schedule charges higher than the usual cost for diagnostic test, and lower than the usual cost for labour-intensive services (such as consultation). PHC providers were also allowed to charge a 15% mark-up for prescription drugs. This payment system created financial incentives for diagnostic testing and prescription writing, irrespective of clinical necessity.¹⁸ Meanwhile, few incentives exist to improve quality of care. The NPHCS found that payments for PHC physicians did not reward quality and the bonuses for PHC physicians that constitute 30% of their income were most often determined by the quantity rather than the quality of care delivered.⁵

In 2011, the Chinese Government introduced the zero-mark-up drug policy, with the aim of removing providers' incentives to overprescribe. The removal of drug mark-up was designed to be coupled with a fee schedule adjustment—increasing fees for more labour-intensive services and reducing fees for diagnostic tests—to compensate providers for lost revenue from drugs and to reduce incentives for diagnostic tests. Local governments were expected to increase fiscal subsidies to providers as well. However, largely because of fragmented governance, simultaneous implementation of these policies has been difficult, and evaluation studies found that removal of drug mark-up had mixed effects on reducing the inappropriate use of drugs, especially antibiotics.⁷ Also, removal of drug mark-up has severely affected the revenue of PHC institutions, as more than 50% of the revenue typically comes from drug sales and the provider

bonuses depend on drug revenues.⁴³ Community and township health centres had a roughly 40% decrease in drug-related incomes since 2011 because of the removal of drug mark-up.^{44,45} As a result, some PHC institutions apparently made up for their revenue loss by using more intravenous treatments and diagnostic tests, and shifting outpatient care to inpatient care,^{44,46} whereas other institutions seek to reduce their amount of clinical care because of the small net revenue to be earned. Their lack of willingness to provide clinical care has contributed in some ways to an increase in patients presenting at hospitals with minor ailments.^{46,47}

Coordination of care

In China, usually PHC providers are neither the point of first contact, nor do they coordinate with specialty care. PHC institutions in China provided 53% (4.4 billion) of the outpatient visits in 2018, which had been declining notably from 62% in 2010,^{4,48} despite efforts to strengthen the PHC system in the 2009 health-care reform. In a survey covering 17 provinces, poor capacity and skills of the professionals were found to be the most common reasons for why patients bypassed PHC institutions when they needed clinical care (32%).⁴⁹ In a 2013 study, 26% of patients responded that they distrusted community health centres, compared with 6% for hospitals. Moreover, patients who knew or have seen doctors at community health centres were more likely to have a negative view of, and an unwillingness to use, community health centres than patients who have not seen these doctors.⁵⁰ As residents of the local community do not seek care at PHC institutions, the ability for PHC institutions to perform public health functions under the National Basic Public Health Service Program could be substantially compromised.

In 2015, the Chinese Government issued guidelines for building a so-called tiered health-care delivery system whereby each level of health-care facility (tertiary, secondary, and primary) would deliver care according to their designated functions;⁵¹ care across the levels was to be integrated and coordinated with bidirectional referral mechanisms through establishing medical alliance or integrated systems.⁵² Despite some positive pilot experiences in local areas such as Shanghai, Shenzhen, and Tianchang (Anhui),^{53–55} scaling up of these pilot implementations has been slow and hindered by several factors. First, as hospitals and PHC institutions are still primarily paid by fee-for-service, they compete for patients and have few incentives to coordinate. Second, the social health insurance programme, which covers 96% of the population,⁴ reimburses patients wherever they seek care without referral; thus, there is generally no defined coordinating process. In addition, reimbursement for hospital care is more generous than for care at PHC institutions considering the ceiling, and therefore encourages patients to bypass PHC facility, making it difficult for PHC providers to function as gatekeepers.

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See Online for appendix 2

Third, electronic patient records are not integrated and are seldom shared between PHC institutions and hospitals.⁵⁶ Therefore, even though partnerships between hospitals and PHC institutions are encouraged and have formed in many cities,⁵⁷ the association remains loose.

Within PHC institutions, the National Basic Public Health Service Program could in theory provide a basis for integration between clinical care and public health services. However, the integration was suboptimal in reality for two reasons. First, financing for public health services and clinical care of the same PHC institutions came from different sources. Although the government directly funds a defined package of public health services, clinical care is funded by social health insurance. Second, there is almost no coordination in monitoring, performance measurement, or management between the two programmes. Thus, as we observed as researchers and practitioners, there is little workflow interaction or information sharing between the programmes. For instance, in hypertension management visits under the National Basic Public Health Service Program, patients can have blood pressure measurement and lifestyle consultations by public health workers, but cannot get prescriptions of antihypertensive drugs without attending the clinics. Also, resident health records of public health services and medical records of clinical care are kept by two separate information systems even for the same visit of the same patient, without linkage between them. The poor care coordination is a hindrance particularly to managing non-communicable diseases. Similarly, for infectious diseases such as tuberculosis, complete sociodemographic and clinical information on individuals with presumptive tuberculosis cannot be linked across the Infectious Disease Reporting System and the Tuberculosis Information Management System because of the different identification numbers, even as both of the systems were developed by the China Centers for Disease Control and Prevention (CDC). Thus, analysis on characteristics of individuals who did not complete the referral is not feasible.⁵⁸ Finally, because many patients do not seek first contact care (eg, for acute self-limiting conditions) from PHC institutions, the opportunity of integrating clinical care and public health services is severely limited.

Continuity of care

PHC providers are in a central position to coordinate a person's care needs, from prevention to disease management to curative care. There are several barriers to overcome before this aspiration becomes a reality. The concept of continuity of care entails several dimensions. First, relational continuity encourages patients to enter into contractual arrangements with family doctors. However, China does not make it compulsory for patients to see PHC providers as their first contact. As the first step towards building a gatekeeping system, the government has introduced a family doctor registration policy

by which each resident would be registered with a team of family doctors.⁵⁹ However, this policy is still in an early stage and its potential has yet to be realised. Moreover, there is a general lack of patient awareness about the importance of continuity of care. In a study in Beijing, patients had a strong preference for free choice between general practitioners and specialists.⁶⁰

Second, there is inadequate informational continuity throughout the system. The electronic medical record system in PHC institutions is still commonly unavailable, fragmented, and isolated in its ability to integrate and analyse comprehensive information about individual patients.⁵ The establishment of the centralised resident health record system in the National Basic Public Health Service Program for the entire catchment populations potentially places PHC services in a position to take a life-course approach for managing health care. However, the potential to use these data goes unfulfilled.

Third, with respect to managerial continuity, there are barriers for ensuring consistency, coordination, and quality of care across sites of care because PHC institutions and hospitals are financed, governed, and managed separately.⁶¹ Thus, few opportunities exist for different health-care providers to maximise effectiveness of the joint efforts and minimise wastage from redundant actions and interventions.

Recommendations for improvement

To improve the quality of PHC in China, we propose recommendations for addressing the structure and process weaknesses in the system. Over time, China could modernise its PHC system through the establishment of a learning platform for evidence generation and training, as well as performance monitoring and promoting.⁶² These recommendations could guide China's action plans in terms of policy formulation and designing pilots to test the recommendations' effects and feasibility.

Enhance the quality of training for the new and current PHC workforce

The State Council issued the guidance on reform and development of training and incentive mechanisms for PHC physicians (appendix 2 pp 19–20).⁶³ Despite this guidance, a comprehensive range of detailed recommendations on the quality of training are needed to address the wide variation in standards of medical school education. First, the Ministry of Education should consider working closely with the National Health Commission to elevate and monitor the quality of training in medical schools and establish accreditation systems. In addition to training qualified PHC physicians, departments of general practice in medical colleges should also develop the academic discipline and nurture the next generation of teachers and leaders, who will drive the agenda of PHC development and generate the evidence that is needed to strengthen this field. Second, measures should be implemented to ensure that students attain an

appropriate level of clinical competence, and be exposed to PHC throughout the training. Increasingly, training should prepare students to work in interprofessional teams, and emphasis should be placed on the importance of doctor–patient communication, which for example includes empathy and shared decision making to build trust between patients and PHC providers. Third, the government could also consider setting targets for

the percentage of medical graduates who would pursue postgraduate training in general practice,⁶⁴ and develop strategies for inspiring students to work in PHC, such as exposing undergraduate medical students to PHC and community health service early in the curriculum.⁶⁵

In the training for the PHC workforce, clinical practice guidelines need to be tailored for PHC settings and contain feasible and affordable recommendations,

Panel 2: How has Shenzhen been reforming its primary health-care system?

Shenzhen, a megacity in southern China, is globally known for its rapid economic development and technological innovation. The average life expectancy for the 13 million permanent residents is 81 years, similar to that of the UK. There are 704 community health centres in Shenzhen, which provided 33.5 million clinical visits (about 32% of clinical visits in the entire system) in 2019. Since 2016, the municipal government of Shenzhen has implemented a series of policies to strengthen its primary health-care system by establishing primary care groups, which are networks of integrated management, shared responsibilities, and common interests.

Integrated management

To set up tight medical alliances, the Shenzhen municipal government has established a primary care group, as independent legal entities in each district, to integrate distribution of medical resources, care delivery, and information utilisation in primary health-care institutions and hospitals. As the core of a primary care group, the tertiary general hospital has full autonomy in personnel and financial management of all the public community health centres within this group.

Health-care professionals working in community health centres are employed by primary care groups and share the same salary standards and social insurance packages with their counterparts working in hospitals. Moreover, physicians in primary health-care institutions have extra benefits compared with their counterparts in hospitals, including special subsidies from the government and more opportunities for technical post promotion.

Similar to physicians in tertiary and secondary hospitals, doctors in community health centres can prescribe any medication from the social medical insurance medication list issued by the government, including 48 antihypertensive drugs and 15 antidiabetic drugs. Meanwhile, medication availability is ensured by the unified delivery system covering community health centres and hospitals throughout the city.

Primary care groups use the unified electronic health record system to ensure that information is interoperable across institutions. In addition, three databases at the municipal level have been consolidated to inform health-care management, including the electronic medical records across all levels of clinical care, digital health records with basic public health documents for every resident, and demographic information and vital statistics of the entire population.

Shared responsibilities

The primary care groups are responsible for the full range of clinical care needs of local residents, whereas tertiary hospitals mainly provide emergency and inpatient care and community health centres handle common clinical visits and basic public health services. To quickly strengthen the diagnosis and treatment capabilities of community health centres, a new pattern of tests in community health centres, diagnosed by the primary care group on the basis of telemedicine services within the group, has been introduced and validated. In addition, the prescriptions from each community health centre are centrally reviewed by the pharmacist team in the local tertiary hospitals.

Each individual resident has a contracted family doctor team that consists of specialists from tertiary hospitals and primary health-care physicians from community health centres, who are collectively expected to provide comprehensive and continuing care. Thus, establishing networks of teams has been a central function of primary care groups and a focus of health policies. Other sections of the health-care system, including public health agencies and nursing institutions, are also now participating in the routine work of teams.

Several policies have been implemented to tighten the connections between members of the primary care group in care delivery. Public hospitals have established specialty clinics in 432 (62%) of 704 local community health centres, which considerably improved the accessibility and quality of clinical care at the community level, with the price of services being 20% lower than in tertiary hospitals and the health insurance reimbursement rates 30% higher. Also, patients referred from community health centres have priority in outpatient visits, clinical tests, and hospital admissions in the hospitals, which has greatly promoted coordination within primary care groups.

Common interests

The government of Shenzhen has implemented a needs-based capitation approach in social health insurance reimbursement, accompanied with differentiated pricing policies, to incentivise primary care groups to save costs. Each patient's annual capitation, paid to the providers by the government, is mainly determined by their total health insurance payment during the previous year. If the actual reimbursement amount in the current year is smaller than the capitation, the surplus can be kept by the patient's contracted primary care group. As a result,

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in the primary care groups, hospitals and community health centres have been collaborating to develop and implement strategies that save cost through, for example, containing outpatient visits to the community health centres (where the price of services is 20% lower than in hospitals), prioritising risk control and disease prevention, or reducing unnecessary use of advanced facilities. Meanwhile, patients are also incentivised to go to community health centres, since their out-of-pocket payment there (about 10% of the total cost) could be substantially reduced compared with what they would pay at hospitals (about 30% of the total cost) because of the higher insurance coverage and lower price of services.

In the wake of the zero-mark-up drug policy, the municipal Health Commission intends to incentivise health-care providers to actively meet the clinical needs of the population via a subsidy system for medical services. Hospitals and community health centres can receive a ¥30 subsidy from the government for each outpatient visit, regardless of the actual charge during the visit. Thus, the mechanism encourages physicians to deliver more services, rather than to prescribe more testing or drugs. Since 2017, the subsidy for community health centres has increased to ¥40 per outpatient visit, so that the primary care groups are shifting their focus of outpatient care from hospitals to community health centres.

including a patient-centred perspective with integration of patients' goals.⁶⁶ These guidelines should focus on the use of cost-effective diagnostic approaches and treatment measures, rather than on, for example, disease aetiology or the pharmacology of medications. China would benefit from a body that oversees the development of disease management protocols, with involvement of PHC providers, which in turn could inform the training of PHC physicians on appropriate and contextualised use. Additionally, incentives would help to motivate PHC doctors to participate in the Continuing Medical Education and other in-service training programmes, such as providing certifications that are meaningful in their career development and ensuring incomes when they temporarily leave their posts for training.

In addition to doctors, the key role of nurses and other health workers in PHC should be recognised and promoted. Specifically, pilot projects on nurse practitioner training, including those that accept new graduates with bachelor degrees from school of nursing in medical colleges, and others that assign mid-career nurses to practise in a PHC institution, could be considered a promising way to strengthen the PHC workforce, particularly for chronic disease management.⁶⁷

Establish performance accountability to incentivise high-quality and high-value care

There is a need for national quality measurement and improvement systems that are linked with incentives to ensure that practices are monitored, outcomes are assessed, and providers are held accountable. Systematic quality improvement requires not only comprehensive indicators, reliable data, and in-depth analysis, but also financial and non-financial incentive mechanisms. These measures need to be timely, accurate, and actionable.

Relevant authorities, including the National Health Commission and the National Healthcare Security Administration, could consider strengthening the capacity of departments that are responsible for health-care quality

(eg, the division of medical management in different levels of Health Commissions and national and local Medical Quality Management and Control Centers). The departments could be tasked with monitoring the quality of care provision and provide feedback and support to address gaps in quality.

Payments from the social health insurance programmes to care providers should reward good performance and outcome. Meanwhile, publicly available data on care quality could increase accountability, engender trust, and drive improvement. Performance in the management of non-communicable diseases such as hypertension is a prime candidate for such initiatives. The newly established National Primary Health Care Hypertension Management Office in China is an example (appendix 2 pp 24–26).

Integrate clinical care with basic public health services

China should consider combining the public health budget with the social health insurance budget and shifting the payment of PHC teams from fee-for-service to a capitation payment method.⁶⁸ The capitation payment rate should be risk adjusted and the rate should cover costs for providing health promotion, prevention, management, and clinical care by the PHC physicians and teams. This payment method will encourage PHC physicians to coordinate preventive care with clinical care, thereby leading to improved management and better outcomes for the patients.

The National Basic Public Health Service Program should consider emphasising that clinical care, including appropriate prescribing of tests and medications, is essential to achieve the goal of health management and disease control. At the national level, in addition to the CDC, the leading professional institutions related to the major diseases covered by the National Basic Public Health Service Program could be involved in task definition, guideline development, implementation monitoring, and performance assessment of the services. At the county level, an alliance between the CDC and the county hospital could assume responsibility for the guidance and monitoring of

the National Basic Public Health Service Program. At the organisational level, PHC institutions should have full autonomy in personnel and financial management to optimise the resource allocation and payment incentive with the aim to integrate clinical care and basic public health services.

Most performance assessments of PHC institutions examine the quantity of public health services provided, but assessments should also include additional measures of clinical care processes (eg, availability of basic medications and proportion of appropriate prescriptions) and patient health outcomes (eg, avoidable hospitalisation, incidence of stroke, heart attack, and premature death).

Strengthen the coordination between PHC institutions and hospitals

To establish a medical alliance or integrated delivery system, as encouraged by the State Council of China⁶⁹ and recommended globally,⁷⁰ PHC institutions and hospitals need to closely coordinate their functions. In addition to vertical technical support provided by hospitals to the PHC institutions within the same catchment areas, deeper coordination between them should be implemented to best suit local contexts (panel 2), with integrated systems for staff training, medication supply, health information technology (IT) support, equipment procurement, and most importantly, alignment of economic interests.⁷¹

To encourage PHC institutions and secondary or tertiary hospitals to coordinate, it is essential to change the provider payment mechanism from one that pays each facility separately, such as by fee-for-service or diagnosis-related groups, to one that pays according to the size of the population served and the quality of care delivered. The aforementioned capitation payment methods should cover services at the primary care level and the secondary care hospitals, and eventually be extended to cover tertiary care level. The envisioned primary, secondary, and tertiary care team would jointly manage the capitated funds. If there were savings, they would be shared by the team. This payment method gives incentives to collaborate as a team, to invest in prevention and health maintenance, and to shift the locus of care to PHC institutions to reduce costs. However, outcome assessments are needed to ensure that people are not adversely affected by the rationing of services to increase profit margins.

When PHC institutions are strengthened with effective integration of clinical care and public health service, they could play an essential role of interface among hospitals, CDC, and the community, not only in the management of noncommunicable diseases, but also during outbreaks of infectious diseases. During the epidemic of COVID-19, PHC providers have been designated by the National Health Commission to do screening, triage, and home quarantine monitoring (panel 3).⁷⁴ A survey done in mid-February, 2020, on 3562 PHC institutions in 31 provinces found that 90% of

Panel 3: Examples of functions of primary health-care providers during the coronavirus disease 2019 epidemic

The multiple tasks of primary health-care institutions in Hubei province⁷²

In the battle against the coronavirus disease 2019 (COVID-19) epidemic, primary health-care institutions in Hubei province contributed to epidemic control and patient treatment. According to official statistics, more than 80 000 primary health-care professionals in the province formed the frontline team for mass screening. In areas where the epidemic was particularly severe, the entire workforce of township and community health centres was devoted to multiple tasks on control and treatment of COVID-19. For instance, among the 203 primary health-care institutions in Wuhan, 199 set up fever clinics to do screening and triage for people with suspicious symptoms, 201 monitored symptoms of the contacts, 173 provided clinical care and public health service for quarantined individuals, 147 were responsible for disinfection and sterilisation at targeted spots, and 101 were in charge of handling the remains of patients who died at home. Moreover, three community and township health centres served as designated hospitals for COVID-19, ten community and township health centres were tasked with providing in-hospital management for patients with confirmed or suspected diagnosis, and personnel from 70 primary health-care institutions were drafted to support these designated hospitals.

Neighbourhood management by primary health-care providers in Zhejiang province⁷³

Since the outbreak of COVID-19, the local government has prioritised prevention and control in the villages and communities. Several strategies were adopted to identify problems early and focus resources effectively. First, 361 500 local residents and migrants were categorised according to their risk since Jan 20, 2020, in Kaihua County. Family doctors identified 843 migrant workers in Hubei Province who wanted to travel home, and successfully contacted 99% of them. Second, 406 township and village doctors were mobilised to work on 392 inspection spots along the country roads to check temperature of and provide health education to drivers and passengers. Besides, general practitioners set up instant messaging and social network groups via WeChat within each village for health education and consultation, and telephone follow-ups were done twice daily for patients who were isolating at home. Third, village doctors interviewed COVID-19 patients and suspects on contact history and did a temperature check for every encountered patient. Patients with fever were transferred to the designated county hospitals at the earliest opportunities, where isolation wards were arranged beforehand to minimise the chance of contact with COVID-19 suspects.

community health centres and 92% of township health centres had done these efforts during the outbreak.⁷⁵ Thanks to the functioning coordination with the hospitals and CDCs, PHC providers can screen patients early on and give them proper training to self-isolate as well as to engage in community mobilisation and public education. The PHC providers can also triage patients to specialised hospitals or cabin hospitals to reduce overcrowding and to allow hospitals to focus their resources on more serious cases.

Improve information systems to build a learning PHC system

An integrated electronic health record system for each citizen is needed to improve the quality and efficiency in PHC institutions and the entire health-care system (appendix 2 p 27). China should address the challenges in the two core IT systems in PHC institutions—the Residents Health Record System for basic public health services and the Electronic Medical Record System for clinical care.⁵ First, clinical IT systems like Electronic Medical Records should be available in all PHC institutions, including village clinics. Second, the development and deployment of clinical IT systems in PHC institutions need to be centralised, with standardised data structures and definitions as well as appropriate classification systems such as International Classification of Primary Care,⁷⁶ to ensure integration and interoperability. Third, the Residents Health Record System that was implemented nationwide in the National Basic Public Health Service Program should be integrated with the delivery of clinical care, to ensure that the health data can be used to facilitate appropriate and efficient clinical practice. Fourth, the Electronic Medical Record systems in PHC should be linked with the systems used in secondary and tertiary hospitals to facilitate patient referrals.

Over time, China should aim to build a learning PHC system that is data driven and technology enabled, with a real-time, high-performance IT system that can capture, organise, and normalise data from many sources, maintain data securely, grant access to data selectively, and provide the computational power to rapidly analyse data. The system should be able to produce insights and discoveries about the quality of services, the comparative effectiveness of alternative strategies, and the underlying causal factors for the results being achieved, and be able to make these insights available to policy makers, researchers, clinicians, and patients.

Equally important, the system should ensure that professionals are practicing at the top level of their training, in accordance with the most up-to-date evidence, and with the IT support. Specifically, based on the integrated data platform, there could be three IT tools that apply innovative technologies for staff training, decision support, and quality control, working in synergy. One type could be in-service training tools that are

extended through the internet and mobile internet. Online training could be an efficient way to train millions of PHC professionals in a vast country with wide access to the internet.⁷⁷ Such digital learning could potentially facilitate adaptive and personalised courses based on individual abilities. A second type of IT tool could be decision support tools that are enhanced by artificial intelligence. In addition to the basic function of decision support tools, including guideline recommendations, dosage calculations, and contraindications alerts, artificial intelligence algorithms can enable these tools to generate new knowledge with designedly analysing data from the ongoing delivery of care. A third type of IT tool could be quality monitoring and feedback tools that are based on big data. On the one hand, technologies can facilitate data integration from multiple systems in quality monitoring, to provide a perspective on a broad array of the process and outcomes of care. On the other hand, technologies can enable targeted and timely analysis, with performance benchmarks determined in consideration with the local epidemiological profiles and PHC characteristics.

As in other countries, the COVID-19 epidemic has spurred the creative deployment of digital technology and platform to enhance the role of PHC in China. For example, PHC providers have been promoting virtual appointments, online consultations, and drug delivery recently,⁷⁸ which have played a significant role in ensuring access to care for the non-COVID 19 patients during the outbreak.

Conclusion

During the past decade of health-care reform, China has made building its PHC system a priority. However, the system is currently facing challenges in providing high-quality and high-value care to the population because of shortfalls in several dimensions. We suggest a series of recommendations for China to implement, or pilot tests, with the goal to improve quality of PHC. In time, these implementations would transform China's delivery system from a hospital-centric to an integrated system, anchored in PHC and enabled by the newest technology and data. A strong and high-quality PHC system will help China to respond to the current epidemiologic transition and future epidemic outbreaks more effectively, and to achieve the social benefits enshrined in the national Healthy China 2030 strategy.

Contributors

SH conceived the Review and took responsibility for all aspects of it. XL, HMK, and WY designed the study and wrote the first draft. KKC and JLu participated in and made crucial suggestions for interpreting the findings and generating the recommendations. JDM, QM, EM, CL, MS, QZ, DRX, LL, S-LTN, RP, JLi, ZW, HY, RGa, SC, XG, RGu, HJ, YK, ZP, XW, SX, XX, YZ, JZ, and SZ participated in discussions and provided comments in revision. All authors approved the final version of the Review.

Declaration of interests

We declare no competing interests.

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