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The development of urban community health centres for strengthening primary care in China: a systematic literature review

Harry HX Wang^{1,2,3}, Jia Ji Wang⁴, Samuel YS Wong^{2*}, Martin CS Wong², Stewart W Mercer³, Sian M Griffiths²

1. School of Public Health, Sun Yat-Sen University, Guangzhou 510080, P.R. China
2. JC School of Public Health and Primary Care, Faculty of Medicine, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong
3. General Practice and Primary Care, Institute of Health and Wellbeing, University of Glasgow, Glasgow G12 9LX, UK (Haoxiang.Wang@glasgow.ac.uk)
4. School of Public Health, Guangzhou Medical University, Guangzhou 510182, P.R. China

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***Correspondence address**

Professor Samuel YS Wong, MD, MPH, CCFPC, FRACGP, FHKCCM, FHKAM, FCFPC

Division of Family Medicine and Primary Health Care

School of Public Health and Primary Care, Faculty of Medicine, Prince of Wales Hospital

The Chinese University of Hong Kong, Shatin, NT, Hong Kong

Tel: +852 2252-8774; Fax: +852 2606-3500; E-mail: yeungshanwong@cuhk.edu.hk

1 **Abstract**

2

3 **Introduction:** This review outlines the development of China’s primary care system, with
4 implications for improving equitable health care.

5 **Sources of data:** Government documents, official statistics, and recent literature identified through
6 systematic searches performed on NCBI PubMed.

7 **Areas of agreement:** Community health centres (CHCs) are being developed as the major primary
8 care provider in urban China, with laudable achievements. The road towards a strong primary
9 care-led system is promising but challenging.

10 **Areas of controversy:** The effectiveness in improving equitable care through the expansion of
11 primary care workforce and redesign of the social medical insurance system warrants further
12 exploration.

13 **Growing points:** Health care disparities exist in the health system wherein universal health
14 coverage and gatekeepers have not yet been established.

15 **Areas timely for developing research:** Future prospective studies should aim to provide solutions
16 for strengthening the leading role of CHCs in providing equitable care in response to population
17 ageing and multimorbidity challenges.

18 (150 words)

19

20 **Key words:** Primary care, community health centres, service provision, patients’ experiences,
21 organisational models, multimorbidity, equitable care

22 **Introduction**

23 China, as the largest and most populous developing country in economic and demographic
24 transition, has been shaping its primary care system during the past several decades.^{1, 2} In the early
25 1950s right after Mao's Revolution, health stations with barefoot doctors carried out population-
26 based preventive health services and mass mobilisation health campaigns. They acted as the initial
27 point of contact in relation to the secondary care. The government owned most enterprises in urban
28 areas, and employees and their families were provided with free access to basic medical care.
29 Meanwhile, the cooperative medical scheme was operating in rural villages, covering over ninety
30 percent of the population. The massive subsidy granted by the government ensured a nation-wide
31 health care coverage in both urban and rural areas during the planned economy period. Starting
32 from the early 1980s, however, the health care system became market-oriented in tune with the
33 radical economic reforms and urbanisation. The government shrank its investment in primary care,
34 and health care was seen as free-market consumption activities instead of public good.³ Under-
35 trained doctors constituted the majority of general practitioners (GPs). The generalists were deemed
36 less competent than specialists at secondary care, where high-cost treatment-orientated care was
37 dominant. Health care relied heavily on user fees and drug revenues to maximise revenue. This has
38 led to an increasing proportion of individual out-of-pocket payments and inadequate healthcare
39 coverage for almost 20 years.⁴

40
41 In view of the dilapidated primary care infrastructure and health care inequity, promoting
42 community health service (CHS) has become a prioritised policy agenda, in line with the Chinese
43 government's overall goal of re-strengthening primary care networks based on community health
44 centres (CHCs) (**Figure 1**). As part of the comprehensive health care reform embarked on in 2009,
45 the social and medical insurance schemes have been improved, including 1) basic medical insurance
46 for urban employees (mandatory for employed individuals) and residents (voluntary at households;
47 including children, students, elderly, disabled, and other non-working urban residents); 2) new rural
48 cooperative medical scheme (NRCMS) for rural citizens (voluntary); and 3) medicaid system for

49 deprived populations.^{1,5} The "Healthy China 2020 Plan" depicted an equitable health care system
50 delivering safe, effective, convenient and affordable basic health care for all citizens by 2020.⁶

51

52 However, unlike primary care in the UK, primary care is currently still weak in China. Primary care
53 providers do not have a gate-keeper function and health care is not free at the point of access. Both
54 GPs at CHCs (primary care) and specialists at hospitals (secondary care) can be directly accessed
55 by walk-in patients. The social medical insurance, albeit being developed, offers limited benefits.
56 Patients' private out-of-pocket payment contributed 42% of total health expenditure in 2008⁵ as
57 most patients are currently served through a fee-for-service delivery system. However, China, like
58 other developed countries, is also facing numerous challenges such as an ageing population and
59 growing burden of chronic disease risk factors particularly in urban areas.⁷ In this review, we have
60 sought to outline China's primary care in urban areas where CHCs serve as the major primary care
61 provider. The review had a major focus on the development of CHCs under the national health care
62 policies and also the impact of primary care reform on key issues including service provision,
63 patients' experiences, service utilisation, emerging primary care organisational models, disease
64 management, and improvement of maternal and child care based on the most recent findings.

65

66 **Search strategy**

67 The search strategy was developed to identify literature on national policies on developing
68 community health care, and empirical findings relating to service provision, patients' experiences,
69 service utilisation, primary care organisational models, and health care management. Given the
70 nature of this review, we did not aim to perform a meta-analysis pooling results. A systematic search
71 was performed in September 2015, by a review panel consisting of one public health professional
72 (HHXW) and three primary care professionals (JJW, MCSW, and SYSW) to identify literature in
73 both English and Chinese (**Supplementary Figure S1**). In the first stage, a combination of terms
74 and synonyms pertaining to primary care, family medicine, general practice, and community health
75 centres were developed as text words to search potentially relevant literature published in NCBI

76 PubMed-indexed journals in the previous 36 months. In the second stage, full-text articles that
77 covered policy development, CHC structures, service utilisation, organisational models, patients'
78 experiences, disease management, as well as maternal and child care were included following the
79 inclusion criteria set after a panel discussion. A total of 79 articles were identified according to the
80 title and abstract by two investigators (HHXW and MCSW) independently. In the third stage, all
81 panel members conducted a selective review based on the full-text of publications retrieved in the
82 previous stage. The exclusion criteria were articles that conveyed no empirical evidence or
83 quantitative studies with small sample size (<800). If similar findings were presented from more
84 than one publication, only the more recent and informative full-text article was included. Reference
85 lists of selected articles were also examined. Given that a significant body of work regarding the
86 progress of the primary care reform has taken the form of official publications, the China Health
87 Statistics Yearbook series (from 2002 to 2015) and government documents (from 1997 to 2015)
88 were also reviewed by native Chinese speakers (HHXW and JJW). Disagreement were resolved by
89 consensus after discussion or, when necessary, by appeal to the senior investigators (SWM and
90 SMG). A total of 38 publications including 20 government official publications and 18 articles from
91 NCBI PubMed were reviewed. Five studies gathered data from nation-wide samples, while the
92 other thirteen studies were conducted regionally with widespread geographical distribution across
93 China (**Supplementary Table S1**).

94

95 **Policy development**

96 Primary care in urban areas has been re-strengthened step-wisely since early 1997 (**Table 1**),⁸⁻²⁷
97 where the conception of CHS was firstly mentioned in the national policy.⁸ In the following years
98 between 1998 and 2005, a series of policy documents and guidelines were issued to contextualise
99 CHCs and its subordinate health stations for primary care delivery.⁹⁻¹³ The establishment of a
100 functional and convenient CHS-based primary care system required the optimisation of healthcare
101 resource allocations. The Ministry of Health (MoH) also called for strategies to enrich front-line
102 GPs through CHS in-service training.¹¹ The concept of CHS was officially defined as -

103

104 *"part of the urban community construction. It is delivered predominantly by GPs as the cadre,*
105 *based at primary-level health care facilities, with an appropriate use of community resources and*
106 *health care techniques. The services should be centred on person within the family context, focusing*
107 *on the basic health care need of women, children, elderly, disabled and patients with chronic*
108 *conditions. It should integrate prevention, treatment, protection, rehabilitation, education, and*
109 *family planning, as a six-in-one care package, to maintain and improve population health. The CHS*
110 *is fundamental to the ultimate goal of achieving primary care for all".¹⁰*

111

112 Several policy regulations were further issued in 2006,¹⁴⁻¹⁹ covering the premises, registration,
113 operation, and pricing at the CHCs. Equity, efficiency, and accessibility were highlighted. These
114 plans laid CHCs in place in every neighbourhood within a 15-minute walking distance to ensure
115 close-to-home primary care. The government sector with public investment were required to play a
116 leading role in developing primary care, while investments from the social and private sector were
117 also encouraged.¹⁴ The academic discipline of GP began to emerge in medical universities with the
118 aim to build a cohesive undergraduate medical curriculum, a standardised postgraduate professional
119 training, and continuing education for GPs. The GP training scheme was structured, and included
120 class-based learning, clinical rotation, and community practice in primary care medicine.^{17, 19}

121

122 A series of detailed action plans were subsequently announced between 2009 and 2011,²⁰⁻²⁴
123 including the effort for improving the provision of public health care through a nation-wide
124 implementation of basic public health (BPH) service package.²³ The government subsidies on the
125 BPH service package were determined by the number of people served by the CHCs, with the
126 minimum amount increasing from ¥15 (£1.5) to ¥25 (£2.4) in 2011. The BPH services contained
127 eleven programmes covering – 1) establishment of health profiles and medical records; 2) provision
128 of health education; 3) disease prevention and vaccination; 4) health management for the elderly
129 (aged 65 years and above), pregnant women, children (aged 0-6 years), and patients with

130 hypertension, diabetes, or serious mental illness; 5) surveillance and control of infectious diseases
131 and public health emergencies; and 6) sanitation control and monitoring.²³ Since 2010, the adoption
132 of a national essential drug list (EDL) with government-imposed price control has been mandatory
133 at all primary care facilities.²⁵⁻²⁷ The implementation of EDL aimed to ensure the procurement,
134 pricing, financing, and quality of medicines to improve drug efficacy, safety, and cost-effectiveness.

135

136 The most recent policy stated by the central government in 2015 has re-depicted the structure of the
137 overall health care system to enhance the health care accessibility and equity, through a step-wise
138 manner with dual referral channels between primary care and secondary (tertiary) care (**Figure 1**).²⁷
139 Multiple organisational models of CHCs were encouraged. The construction of a nation-wide
140 "cloud" big data system has been in progress. It is expected to be completed by 2020 to support
141 chronic disease management at primary care with a dynamic picture of the nation-wide population
142 health profiles.²⁷

143

144 **Service provision and human resources**

145 Primary care facilities in urban areas are organised around CHCs. The national statistics have
146 revealed the expansion of CHCs and subordinate health stations policies in the past decade.

147 Compared to a 1.38-fold increase in hospital constructions between 2002 and 2013, there was a
148 dramatic increase by 3.30-fold in the number of CHCs from 2002 to 2007 (8,211 *versus* 27,069),
149 followed by a mild increase from 2010 to 2013 by which the number of CHCs exceeded that of
150 hospitals (33,965 *versus* 24,709) (**Figure 2A**). However, the national statistics on the healthcare
151 utilisation did not prove that CHCs care has been commensurately improved in response to the
152 increasing health care need of the population. The total million person-time of diagnosis and
153 treatment at the upper level remained far exceeding than that at CHC level (1,243 *versus* 75 million
154 in 2002; 2,742 *versus* 657 million in 2013), albeit the CHCs showed a remarkable pace of increase
155 (8.73-fold [657 /75] *versus* 2.21-fold [2,742 /1,243]) (**Figure 2B**).

156

157 The service provision at CHCs adheres to national guidelines, and all primary care providers are
158 regulated by the local health bureau to ensure the quality of services.^{10, 13, 15, 16, 23} This includes the
159 standard provision of both western and traditional Chinese medicine services that are available in
160 most CHCs. In general, all CHC health care staff are paid a fixed salary plus a CHC annual
161 income-related floating salary. Patients can walk in directly to see a doctor at CHCs after paying a
162 fixed one-off registration fee upon the visit. Health care personnel at CHCs include clinical
163 physicians, public health doctors, registered nurses, pharmacists, laboratory technologists,
164 managerial and assistant staff. Telephone access, as well as evening and weekend clinics are
165 commonly available. A novel concept of GP team-based service provision enrolling community
166 residents with the GP teams has been recently promoted since 2011.²⁸ This approach requires CHCs
167 to form GP-led team consisting of GPs, nurses, and sometimes public health doctors to provide
168 continuous and comprehensive services to residents enrolled, normally with a maximum of 2,500
169 registrations per team. It was reported that patients who contracted with GP team service had
170 greater satisfaction.²⁹ Another recent longitudinal study found that capitation payments and the
171 provision of services tailored to the local health priorities served as key factors associated with
172 beneficial long-term relationships between patients and CHCs.²⁸ It suggests that the reforms of
173 incentive structures should be reinforced to explore effective and viable payment methods for
174 improving primary care performance.

175

176 The enhanced service provision also resulted from the rising number of medical practitioners
177 working at CHCs (173,838 in 2013 *versus* 19,451 in 2002). Since 2002, the number of daily clinical
178 consultations per doctor at CHCs has increased by 25.6% (15.7 *versus* 12.5 in 2013). More than one
179 third (37.1%) of CHC medical practitioners had a bachelor's degree or above, in contrast with the
180 education level of CHC medical practitioners in 2002 when it was slightly over one in ten (13.0%)
181 who had completed undergraduate education (**Table 2**).

182

183 **Patients' experiences**

184 The Chinese version of Primary Care Assessment Tool-Adult Edition (PCAT-AE) has been used to
185 evaluate the process of primary care delivery measured by patients' experiences.³⁰⁻³² The concept of
186 patients' experiences was contextualised on the basis of the five core attributes of primary care, i.e.,
187 first contact, continuity, coordination, comprehensiveness and community centredness from an
188 international perspective.³³ The PCAT focuses on patients' experience of, rather than satisfaction
189 with, health care delivery, which could minimise subjective bias that is due to socio-demographic
190 variations and patient expectation.^{34,35} The PCAT items in each core domain are scored according to
191 a 4-point Likert-type scale, with higher scores indicating better primary care experiences.³¹

192

193 Generalists at CHCs were more likely to provide better primary care, compared to specialists at
194 out-patient department in hospitals.³⁰ In one large study conducted in seven geographical regions,
195 approximate one third (33.4%) of patients reported an optimum PCAT score (higher than the third
196 quantile of the score range) on the overall primary care experience. The proportion of subjects with
197 optimum scores in individual primary-care domains ranged from 62.1% in the comprehensiveness
198 of service attribute to only 16.6% in the community orientation attribute.³¹ This may be a reflection
199 of the current clinical practice where major attention is paid to disease treatment *per se*, and less to
200 patients' personal beliefs, health attitudes, and lifestyle changes. Accordingly, the outreach work
201 such as door-to-door visits, early screening and disease prevention are considered less cost-effective,
202 when compared with on-site physician treatment and drug prescriptions.

203

204 It was also found that patients with social medical insurance were more likely to have optimum
205 scores in most of primary care attributes and reported overall better primary care experience.³¹ The
206 rapid escalation of healthcare costs in recent decades and the incomplete coverage of health
207 insurance may partly contribute to the health care inequality. Uninsured patients, most of which
208 belong to internal migrants,³⁶ probably have poorer access to or can less afford comprehensive care
209 and appropriate investigations within primary care and between levels of care, resulting from being
210 less able to pay. The primary care experience was therefore substantially worsened for lower

211 income and vulnerable groups. This suggests an urgent need to understand and address how medical
212 insurance coverage may affect CHC service utilisation, as it also applies to those who are insured.
213 Outpatient costs in CHCs are usually deducted from the personal saving account, while only
214 inpatient costs can be claimed from the pooled insurance fund. The personal account, however, is
215 quite limited. Therefore, high out-of-pocket payments for health care are common, especially when
216 having chronic conditions that require long-term care such as diabetes and hypertension. It has been
217 reported that people with higher per capita household income tended to report slightly more chronic
218 conditions, probably as a result of unaffordability and inadequate use of healthcare.³⁷ This may
219 prevent the vast majority of more socioeconomically deprived populations from prevention and
220 treatment. One strategy being implemented in China is the expansion of social medical insurance
221 coverage and the reduction of co-sharing in the individual's contribution.^{25,26} In the UK, it has been
222 shown that greater investments in primary care and targeting poorer areas results in more equity. In
223 China, the reform on the financing mechanisms to optimise healthcare investment in primary care
224 requires long-term investigation on the relationships of primary care cost and patients' experiences
225 to inform healthcare decision making.

226

227 **Service utilisation**

228 The development of CHCs is expected to alleviate over-utilisation of secondary (and tertiary) care
229 through a primary care approach to tackle frequently encountered medical conditions, common
230 minor diseases and chronic conditions at the community level. A detailed service utilisation pattern
231 was shown in one large study conducted in southern China.³¹ Almost nine in ten (85.6%) patients
232 reported a moderate-to-strong affiliation with a regularly-visited CHC as their primary care provider.
233 However, as doctor-patient pre-registration is not mandatory, nearly two thirds of patients chose to
234 visit different doctors within the CHCs. Treatment of acute medical conditions was the most
235 frequent reason for clinic attendance, followed by diagnosis and follow-up of long-term conditions.

236

237 Unlike the UK, referral from primary care doctors to hospital specialists (secondary care providers)

238 is encouraged but not mandatory in China. Studies have shown that patients tended to seek services
239 directly at secondary specialist care^{37,38}, which is likely to be costly and duplicative, compared with
240 primary care. This implied a widened divide between primary care and secondary care in the past
241 decades in China, with secondary care played a dominant role in service provision. The challenge of
242 shifting health system development from specialist care towards generalist community based care is
243 momentous. The dichotomy between the dual referral channels between primary care and secondary
244 care should be bridged within a properly designed delivery system, such that hospitals could refer
245 patients back to the CHCs for prevention and rehabilitation, instead of keeping a high volume of
246 patients to generate revenue in competition with primary care facilities. Encouraging CHC
247 utilisation as the regular source of care through incentives on preferential reimbursement rate at
248 CHCs may serve as an immediate solution. However, a high level of service competency with
249 public trust in primary care is fundamental. Factors that could largely influence the willingness to
250 attending CHCs may also include the familiarity with health care staff, communication with doctors,
251 facilities and environment, as well as previous experiences of service utilisation.³⁹⁻⁴¹ This may also
252 require further improvement in CHC service provision within the wider environmental context of
253 personal and social care to address all aspects of wellness of patients' and their family members,
254 encouraging active community participation in the primary care management and priority setting.
255 Studies also indicated considerable room for improvement in job satisfaction with respect to career
256 development, peer recognition, as well as wages and benefits among CHCs workforce to ensure a
257 stable and sustainable development of primary care.^{42, 43}

258

259 **Primary care organisational models**

260 Given the diversified socio-economic background across urban areas, national policies^{14, 18, 26} have
261 encouraged local attempts to build up CHCs under different models of ownership and management.
262 Three main categories of CHC models have emerged, including 1) government-owned and
263 -managed CHCs (G-CHCs); 2) government-owned and hospital-managed CHCs (H-CHCs); and 3)
264 privately owned and managed CHCs (P-CHCs).^{2, 44} The government report showed that 36.5% of

265 the CHCs were G-CHCs, 35.7% were H-CHCs, and 27.8% were P-CHCs.⁴⁵ Details on the
266 organisational models were described in both quantitative and qualitative studies elsewhere.^{44, 46}
267 The G-CHCs are organised as part of the government sector. The typical G-CHCs operate in a way
268 that the revenue generated at the CHCs (mainly from medical treatment and drug sales) goes to the
269 local government finance, whereas the CHC expenditures (mainly on premises, equipments, and
270 staff remuneration) are paid directly by the local government. The H-CHCs are organised as an
271 affiliated outreach clinical department within the host hospital, in dependent of the government
272 sector. They receive limited subsidies from the government via the host hospital, and the CHC
273 revenue are self-retained and managed, acting as financially self-sufficient healthcare facilities.
274 P-CHCs are built upon social and private investment, managed by private organisations. They are
275 independent of either the government sector or the hospital system, and in general hardly receive
276 subsidies from government or hospitals. Financially self-sufficiency and profit-seeking are major
277 characteristics of P-CHCs. These primary care organisational models^{44, 46} reflect a varying extent of
278 government and hospital involvement, and their respective roles in delivering primary care.
279
280 The ownership and management models of CHCs and the impacts of this on quality of care have
281 been examined.^{44, 47} Patients with G-CHCs as the usual source of primary care had the highest
282 experience scores when compared with those visiting H-CHCs and P-CHCs, as a result of better
283 first-contact care and coordination of care. This suggests that the gate-keeping function of CHCs
284 could be positively enforced by giving preferential reimbursement rates for healthcare episodes for
285 which first attendance is at CHCs. The higher primary care experience score for the coordination
286 domain in G-CHCs implied that the government-dominant top-down approach to delivering
287 primary care was the most effective, particularly at making multi-sectoral service connections
288 between different levels within the health system. Thus, G-CHCs may be able to better solve the
289 problems of constructing primary care services as the first-contact point of care, one of the key
290 conundrums for China's health care reforms.⁴⁴ It was also reported that patients at G-CHCs were
291 more likely to have optimal blood pressure control, whilst those with P-CHCs were less likely to

292 achieve blood pressure control, irrespective of the prescriptions of antihypertensive drugs.⁴⁷ Thus
293 far, existing evidence suggests that G-CHCs may lead to better primary care process⁴⁴ and
294 outcomes,⁴⁷ as the model has strengths in that it reduces social-economic inequality and results in
295 better distribution of health resources. The recently proposed "cloud" big data plan by 2020²⁷ is
296 envisaged to illustrate the extent to which primary care physicians follow the clinical practice
297 recommendations and meet guideline targets.⁴⁸ To use this effectively will require greater
298 inter-department collaboration, interface exchange between systems, and a joint effort involving all
299 stakeholders across health care sectors. Further in-depth exploration of primary care organisational
300 models could ultimately lead to the elucidation of how the primary care workforce can be expanded
301 and made more effective in the delivery of primary care in China.

302

303 **Disease treatment and management**

304 Inappropriate and excessive drug use has been common in China, particularly the prescription of
305 antibiotics without guidance. Data exhibited that the antibiotics on average accounted for more than
306 one fifth (22.8%) of the total drug sales, and antibiotics were included in more than half of the
307 outpatient visit prescription records. However, only less than forty percent (39.4%) of these
308 prescriptions were deemed properly.⁴⁹ New and broad-spectrum antibiotics, combinations of
309 multiple antibiotics, prolonged antibiotic use, and intravenous antibiotic administration were
310 favoured, which may lead to many errors in antibiotic usage.⁴⁹ Another nation-wide survey
311 illustrated that patients attending G-CHCs were less likely to receive intravenous injection therapies
312 and antibiotics treatments, when compared to those receiving prescriptions at P-CHCs.⁵⁰ In the
313 G-CHC settings where physicians' salary and CHC revenue from consultations and prescriptions
314 are separate, it is possible that physicians are less likely to prescribe unnecessary drugs. Thus
315 pharmacotherapy may not be perceived as a must during patient encounters when elevation in blood
316 pressure was only marginal which could be managed with educational and lifestyle modification
317 counselling before drug treatment.^{47, 51} This may reduce the possibility of undesired side effects and
318 complications - and thus resulting in favourable clinical outcomes.

319

320 The provision of maternal and child care is one of the major functions of CHCs, and the utilisation
321 of CHCs instead of secondary hospitals for maternal and child care have been promoted. Most
322 CHCs require community residents to bring their newborn infants for CHCs attendance at
323 scheduled intervals for six months after birth, with regular reminders from the community
324 healthcare staff. In contrast, the formal follow-up procedure is generally unavailable at hospital
325 outpatient clinics. Longitudinal data showed that the CHCs could provide better health care, with
326 respect to higher breastfeeding rate and lower prevalence of lower respiratory tract infection, when
327 compared to hospital outpatient clinics.⁵² The concept of using CHCs as the platform for
328 hypertension management has also been put into practice. Studies have manifested the effectiveness
329 of programmes delivered by CHCs in achieving higher blood pressure control rate and reduced
330 10-year risk of cardiovascular diseases in community patient population.⁵³⁻⁵⁵

331

332 **Tackling long-term conditions**

333 China, like many other countries, is also undergoing an explosion in the burden of chronic diseases
334 due to unprecedented economic and environmental changes. Multimorbidity – defined as the
335 co-existence of two or more long-term conditions in one individual – is increasingly common in the
336 UK⁵⁶. Across the globe in China, similar challenges exist and CHCs are expected to be responsible
337 for tackling chronic diseases at the community level. A recent study examined the prevalence of
338 multimorbidity across a selection of 40 chronic morbidities in a large representative sample of the
339 Chinese population. Overall, more than one in ten of the general population of all ages have
340 multimorbidity, and its prevalence increased significantly with ageing.³⁷ Unhealthy lifestyle
341 behaviours including smoking, alcohol drinking, salty diet and physical inactivity were commonly
342 reported as risk factors, whilst ageing, urbanisation, and increase in prosperity may contribute as
343 underlying key drivers.⁷

344

345 Similar to western developed countries, the growing issue of multimorbidity in China also leads to

346 greater use of health care resources, as shown in a recently published multi-country analysis among
347 China, Scotland, and Hong Kong, where the health care systems are differently organised.⁵⁷ The use
348 of health care resources among multimorbid patients was clearly driven by the ability to pay in
349 healthcare system where universal coverage has not yet been established and primary care is still
350 being developed (such as China). The challenge of overcoming health care disparities requires
351 strategies which seek to strengthen CHCs and make the primary care universally equitable and
352 effective.^{2, 58} Developing and amplifying the effectiveness of the primary care workforce^{59, 60} should
353 be a top priority, as a properly trained and adequately resourced primary care system could
354 substantially reduce cardiovascular and other risks.⁵³ At this stage, however, CHCs in China are still
355 far from acting as a first-contact point and regular source of care. The need for a cadre of well
356 trained and motivated GPs who are qualified from a strong and contextualised education and
357 training system is substantial.^{38, 61, 62}

358

359 **Strengths and weaknesses of the review**

360 In this review, we outlined the development of urban CHCs under the national health care policies
361 with respect to the CHC structure and delivery models, and the impact of primary care reform on
362 key issues based on the most recent empirical evidence. There are several limitations. First, a
363 comprehensive meta-analysis synthesising quantitative data was not performed due to limited
364 number of studies included for each outcome in this review. Second, the information published in
365 Chinese language were only retrieved from central government documents and official statistics
366 wherein major progress of primary care was fully documented with high quality evidence. Third,
367 the complexity of China's healthcare system may affect the generalisability of the findings reviewed
368 as national policy implementation could be decentralised at provincial authorities. It is also worthy
369 of note that themes covered in this review were based on panel discussion, and thus selection bias
370 may exist, albeit the searches of literature were conducted in a systematic manner. Nevertheless, a
371 wide range of topics were highlighted, including CHC structures, human resources and financing,
372 service utilisation, primary care organisational models, patients' experiences, antibiotics use,

373 hypertension management, improvement of maternal and child care, where rapid development has
374 been observed.

375

376 **Conclusion**

377 The past decade has witnessed a journey of booming development in primary care and laudable
378 achievements in building the CHC infrastructure with sustainable policy support in China. The road
379 towards a strong primary care-led system is promising but challenging. The rapid escalation of
380 healthcare costs with incomplete coverage of medical insurance may partly lead to the inequality in
381 primary care experiences. The vast regional differences with substantial divides in health between
382 socio-economic strata require quality primary care to reduce health care disparities, especially in
383 light of an ageing population and emerging burden of multimorbidity. Despite progress, primary
384 care is still weak in China. The trade-off between governments and markets under China's
385 decentralised healthcare system will largely determine the extent to which primary care promotes
386 health equity and service cohesion. Enhancing CHCs as the first-contact point and regular source of
387 equitable care for patients with respect to the key quality attributes including first contact,
388 coordination, continuity, comprehensiveness, as well as family and community centredness would
389 appear to be a top priority.

390

391

392 **Conflict of Interest statement**

393 The authors have no potential conflicts of interest.

394

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410

411 **Author contributions**

412 SMG conceived this review and provided overall guidance. HHXW and JJW reviewed the Chinese
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References

- 1 Wang HHX, Wang JJ. Developing Primary Care in China. In: Griffiths SM, Tang JL, Yeoh EK, eds. *Routledge Handbook of Global Public Health in Asia*. Oxford, UK: Routledge publisher, 2014 April; 584-600. doi: 10.4324/9781315818719.ch40
- 2 Shani M, Wang HHX, Wong SYS, Griffiths SM. International primary care snapshots: Israel and China. *Br J Gen Pract* 2015;65:250-251
- 3 Daemrich A. The political economy of healthcare reform in China: negotiating public and private. *Springerplus* 2013;2:448
- 4 Wang Y, Wilkinson M, Ng E, Cheng KK. Primary care reform in China. *Br J Gen Pract* 2012;62:546-7
- 5 Barber L, Yao L. Health insurance systems in China: a briefing note. *World Health Report 2010*
- 6 Healthy China 2020: Strategic Research Report: Ministry of Health, P.R. China, 2008, Available at: <http://www.moh.gov.cn/mohbgt/s3582/201208/55652.shtml>.
- 7 Wong MCS, Zhang DX, Wang HHX. Rapid emergence of atherosclerosis in Asia: a systematic review of coronary atherosclerotic heart disease epidemiology and implications for prevention and control strategies. *Curr Opin Lipidol* 2015;26:257-69
- 8 Decision concerning public health reform and development. : State Council. P.R. China, 1997, Available at: <http://www.moh.gov.cn/wsb/pM30115/200804/18540.shtml>.
- 9 Decision on establishing basic medical insurance system for urban employees. No. 44 document. : State Council. P.R. China, 1998, Available at: <http://www.nhfpc.gov.cn/zhuzhan/wsbmgz/201304/ca9c5a7b37784dd2bc9e5a347c80a30e.shtml>.
- 10 Opinions on development of community health services in the cities. No.326 document: Division of Primary and Women's Health, Ministry of Health, P.R. China, 1999, Available at: <http://www.nhfpc.gov.cn/zhuzhan/wsbmgz/201304/198b4a75380c45dd9dd4ad486e206be5.shtml>.
- 11 Opinions on developing general practice education. No. 34 document. : Ministry of Health, P.R. China, 2000, Available at: <http://www.nhfpc.gov.cn/zhuzhan/zcjd/201304/545823f851f540abb26620e8be389a60.shtml>.
- 12 Guidance on pharmaceutical and healthcare system reform in urban areas. No. 16 document.: State Council, P.R. China, 2000, Available at: <http://www.nhfpc.gov.cn/zhuzhan/zcjd/201304/24de2a857e4b4425a2736c45c6e0390d.shtml>.
- 13 Guidance on accelerating the community health service development in urban areas. No. 186 document.: Ministry of Health, P.R. China, 2002, Available at:

- <http://www.nhfpc.gov.cn/zhuzhan/wsbmgz/201304/5d6de93afb4b45e0b180b0b47976f1a5.shtml>.
- 14 Guidance on development of community health services in the cities. No.10 document.: State Council. P.R. China, 2006, Available at:
<http://www.nhfpc.gov.cn/zhuzhan/wsbmgz/201304/df3e35e26b3a4f5987bd898ddce70404.shtml>.
- 15 Regulations on community health service organizations in urban areas. No. 239 document.: Ministry of Health. P.R. China, 2006, Available at:
<http://www.nhfpc.gov.cn/jws/s3581r/200804/3973b4620f154c5099bf9dcae721c215.shtml>.
- 16 Announcement of the construction standard of community health centres and community health stations in urban areas. No. 240 document.: Ministry of Health, P.R. China, 2006, Available at:
<http://www.nhfpc.gov.cn/zhuzhan/wsbmgz/201304/d63e8544efb046dd8055c32b0b134cb3.shtml>.
- 17 Guidance and opinions on strengthening healthcare professionals cadre for community health. No. 69 document.: Ministry of Human Resources and Social Security. Ministry of Health. Ministry of Education. P.R. China, 2006, Available at:
<http://www.nhfpc.gov.cn/zhuzhan/wsbmgz/201304/ef26dcf71a9644e2ba75d456aea51b9b.shtml>.
- 18 Guidelines and opinions on the establishment of community health service facilities in urban areas. No.96 document.: CCP Central Committee. P.R. China, 2006, Available at:
<http://www.nhfpc.gov.cn/jws/s3581r/200804/7fec238fd105426cbe66bc1dd09a4e0b.shtml>.
- 19 Opinion on strengthening the education and discipline construction for general practice and community nursing in tertiary medical universities. No. 13 document.: Ministry of Education, P.R.China, 2006, Available at:
http://www.moe.gov.cn/publicfiles/business/htmlfiles/moe/s3864/201010/xxgk_109616.html.
- 20 Opinions on deepening pharmaceutical and healthcare system reform. No.6 document.: State Council. P.R. China, 2009, Available at:
<http://www.nhfpc.gov.cn/tigs/s3576/201309/cc37d909af764f3da261894504d9de9a.shtml>.
- 21 Plan on recent priorities in carrying out the reform of health care system (2009-2011). No.12 document: State Council. P.R. China, 2009, Available at:
http://www.gov.cn/zwgk/2009-04/07/content_1279256.htm.
- 22 Guidance opinion on establishing general practitioner-based system. No. 23 document: State Council, P.R.China., 2011, Available at: http://www.gov.cn/zwgk/2011-07/07/content_1901099.htm.
- 23 National basic public health (BPH) service guidelines: Ministry of Health, P.R. China, 2011, Available at:
<http://www.nhfpc.gov.cn/zhuzhan/wsbmgz/201304/cb5978bb42814451a26e5c97dd855254.shtml>.
- 24 Guidance on evaluating the performance of community health service provisions. No. 83 document.:

- Ministry of Health, P.R. China, 2011, Available at:
<http://www.moh.gov.cn/zwgkzt/psqws1/201106/52203.shtml>.
- 25 Opinions on consolidating essential drug list system and exploring operational structure of primary health care facilities. No. 14 document.: State Council, P.R. China, 2013, Available at:
http://www.gov.cn/zwgk/2013-02/20/content_2335737.htm.
- 26 Announcement on priorities in deepening the reform of pharmaceutical and healthcare system. No. 24 document.: State Council, P.R. China, 2014, Available at:
<http://www.nhfpc.gov.cn/tigs/s9660/201405/c00c2f93f5b149fa85be7dd38f33dbab.shtml>.
- 27 Announcement of strategic plan on national health care service system (2015-2020): State Council, P.R. China, 2015, Available at: http://www.gov.cn/zhengce/content/2015-03/30/content_9560.htm.
- 28 Wei X, Li H, Yang N, et al. Changes in the perceived quality of primary care in Shanghai and Shenzhen, China: a difference-in-difference analysis. *Bull World Health Organ* 2015;93:407-16
- 29 Kuang L, Liang Y, Mei J, et al. Family practice and the quality of primary care: a study of Chinese patients in Guangdong Province. *Fam Pract* 2015;32:557-63
- 30 Wang W, Shi L, Yin A, Lai Y, Maitland E, Nicholas S. Development and validation of the tibetan primary care assessment tool. *Biomed Res Int* 2014;2014:308739
- 31 Wang HHX, Wong SYS, Wong MCS, et al. Attributes of primary care in community health centres in China and implications for equitable care: a cross-sectional measurement of patients' experiences. *QJM-An Int J Med* 2015;108:549-60
- 32 Yang H, Shi L, Lebrun LA, Zhou X, Liu J, Wang H. Development of the Chinese primary care assessment tool: data quality and measurement properties. *Int J Qual Health Care* 2013;25:92-105
- 33 Starfield B, Shi LY, Macinko J. Contribution of primary care to health systems and health. *Milbank Q* 2005;83:457-502
- 34 Wong SYS, Kung K, Griffiths SM, et al. Comparison of primary care experiences among adults in general outpatient clinics and private general practice clinics in Hong Kong. *BMC Public Health* 2010;10:397
- 35 McCollum R, Chen L, ChenXiang T, et al. Experiences with primary healthcare in Fuzhou, urban China, in the context of health sector reform: a mixed methods study. *Int J Health Plann Manage* 2014;29:e107-26
- 36 Li H, Chung RY, Wei X, et al. Comparison of perceived quality amongst migrant and local patients using primary health care delivered by community health centres in Shenzhen, China. *BMC Fam Pract* 2014;15:76
- 37 Wang HHX, Wang JJ, Wong SYS, et al. Epidemiology of multimorbidity in China and implications

- for the healthcare system: cross-sectional survey among 162,464 community household residents in southern China. *BMC Med* 2014;12:188
- 38 Mathers N, Huang YC. The future of general practice in China: from 'barefoot doctors' to GPs? *Br J Gen Pract* 2014;64:270-1
- 39 Zhang P, Zhao L, Liang J, et al. Societal determination of usefulness and utilization wishes of community health services: a population-based survey in Wuhan city, China. *Health Policy Plan* 2014 Dec 8. pii: czu128
- 40 Tang C, Luo Z, Fang P, Zhang F. Do patients choose community health services (CHS) for first treatment in China? Results from a community health survey in urban areas. *J Community Health* 2013;38:864-72
- 41 Tang L. The Chinese community patient's life satisfaction, assessment of community medical service, and trust in community health delivery system. *Health Qual Life Outcomes* 2013;11:18
- 42 Li L, Hu H, Zhou H, et al. Work stress, work motivation and their effects on job satisfaction in community health workers: a cross-sectional survey in China. *BMJ Open* 2014;4:e004897
- 43 Luo Z, Bai X, Min R, Tang C, Fang P. Factors influencing the work passion of Chinese community health service workers: an investigation in five provinces. *BMC Fam Pract* 2014;15:77
- 44 Wang HHX, Wong SYS, Wong MCS, et al. Patients' experiences in different models of community health centers in southern China. *Ann Fam Med* 2013;11:517-26
- 45 Centre for Health Statistics and Information, Ministry of Health. Research on Health Services of Primary Health Care Facilities in China. Beijing, P.R. China: Peking Union Medical College Press, 2009.
- 46 Wei X, Yang N, Gao Y, et al. Comparison of three models of ownership of community health centres in China: a qualitative study. *J Health Serv Res Policy* 2015;20:162-9
- 47 Wong MCS, Wang HHX, Wong SYS, et al. Performance comparison among the major healthcare financing systems in six cities of the Pearl River Delta Region, Mainland China. *PLoS One* 2012;7:e46309
- 48 Wang HHX, Wong MCS, Mok RY, et al. Factors associated with grade 1 hypertension: implications for hypertension care based on the Dietary Approaches to Stop Hypertension (DASH) in primary care settings. *BMC Fam Pract* 2015;16:26
- 49 Wang J, Wang P, Wang X, Zheng Y, Xiao Y. Use and prescription of antibiotics in primary health care settings in China. *JAMA Intern Med* 2014;174:1914-20
- 50 Yin X, Gong Y, Yang C, et al. A Comparison of Quality of Community Health Services Between Public and Private Community Health Centers in Urban China. *Med Care* 2015;53:888-93

- 51 Wong MCS, Wang HHX, Kwan MWM, et al. Dietary counselling has no effect on cardiovascular risk factors among Chinese Grade 1 hypertensive patients: a randomized controlled trial. *Eur Heart J* 2015;36:2598-607
- 52 Yu C, Binns CW, Lee AH. Comparison of breastfeeding rates and health outcomes for infants receiving care from hospital outpatient clinic and community health centres in China. *J Child Health Care* 2015 Jun 23. pii: 1367493515587058
- 53 Wang HHX, Wang JJ. Effects of community-based general practitioners-led care for 12,864 patients with hypertension: study of cardiovascular risk intervention - hypertension (SCRI-HTN) in China. *Eur Heart J* 2012;33 (Suppl 1):762-3
- 54 Chen XJ, Gao XL, You GY, et al. Higher blood pressure control rate in a real life management program provided by the community health service center in China. *BMC Public Health* 2014;14:801
- 55 Zou G, Wei X, Gong W, et al. Evaluation of a systematic cardiovascular disease risk reduction strategy in primary healthcare: an exploratory study from Zhejiang, China. *J Public Health (Oxf)* 2015;37:241-50
- 56 Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. *Lancet* 2012;380:37-43
- 57 Wang HHX, Wang JJ, Lawson KD, et al. Relationships of multimorbidity and income with hospital admissions in 3 health care systems. *Ann Fam Med* 2015;13:164-7
- 58 Mou J, Griffiths SM, Fong H, Dawes MG. Health of China's rural-urban migrants and their families: a review of literature from 2000 to 2012. *Br Med Bull* 2013;106:19-43
- 59 Stange KC. In this issue: developing and amplifying the effectiveness of the primary care workforce. *Ann Fam Med* 2015;13:102-103
- 60 Mercer SW, Watt GC. The inverse care law: clinical primary care encounters in deprived and affluent areas of Scotland. *Ann Fam Med* 2007;5:503-10
- 61 Wang HHX, Wang JJ, Zhou ZH, Wang XW, Xu L. General practice education and training in southern China: recent development and ongoing challenges under the health care reform. *Malays Fam Physician* 2013;8:2-10
- 62 Kong X, Yang Y. The current status and challenges of community general practitioner system building in China. *QJM-An Int J Med* 2015;108:89-91

Figure legends

Figure 1: Healthcare system and primary care providers in China

Figure 2: Number of healthcare facilities with total person-time of diagnosis and treatment between 2002 and 2013 in China

Supplementary Figure S1: PRISMA flow diagram of searches in NCBI PubMed

Table legends

Table 1: Twenty official guidelines and document milestones in China's primary care reform

Table 2: Ten-year development of primary care between 2002 and 2013 in China

Supplementary Table S1: Brief characteristics of selected articles

Table 1 Twenty official guidelines and document milestones in China's primary care reform

Year	Policy highlights
1997	The Central Committee of the Communist Party (CCP) of China and the State Council called for an initiative to re-strengthen primary care across China. The overall strategy aimed to reform the urban health care system, develop community health services (CHS), and establish a functional and convenient primary care network. ⁸
1998	The State Council pointed out that the allocation of health care resources should be optimised, with a priority in community health care, where items on essential treatment should be included in the basic medical insurance coverage. ⁹
1999	The Ministry of Health (MoH), together with nine other authorities, jointly announced the guidance on primary care reform through developing CHS. It put forward the concept of CHS, which included prevention, treatment, protection, rehabilitation, education, and family planning, i.e., a six-in-one care package. ¹⁰
2000	The MoH outlined the definition of general practice (GP). It called for multiple strategies of GP education with a focus on in-service training to enrich the front-line GP practitioners and develop a cadre of senior GP practitioners to provide CHS in primary care. ¹¹
2000	The State Council emphasised that there should be a well-coordinated division of labour among community health care facilities, large-scale comprehensive hospitals, and specialist hospitals. Attention should be paid to the role of primary care facilities in prevention, protection, education and psychological counselling. ¹²
2002	The MoH, together with ten other authorities, jointly regulated the structure of CHS provider, registration and operation of CHS facilities, as well as service pricing, regulation, and supervision. It aimed to accelerate the CHS development. ¹³
2006	The State Council re-announced the action plan of progressing urban CHS. It highlighted equity, efficiency, and accessibility in primary care. Multiple organisational models of community health centres (CHCs) were encouraged. The government should play a central role in building primary care, with the active participation from the social and private sector. ¹⁴
2006	The MoH regulated the public health service package and essential health care service items delivered by CHCs. ¹⁵
2006	The MoH regulated basic requirement of department, staffing, housing, equipment in CHCs and its subordinate health stations. ¹⁶
2006	The MoH and four other ministries jointly urged the integration of GP essential knowledge and expertise into the whole process of medical education to undergraduate-level medical students. The GP training scheme was structured, and included class-based learning, clinical rotation, and community practice in primary care medicine. Guidelines on GP workforce recruitment, evaluation, and retention were also developed. ¹⁷
2006	The MoH recommended that there should be at least one CHC per thirty-thousand populations. It also encouraged multiple providers including government, hospitals, and social investors. ¹⁸
2006	The document encouraged launching department of GP/Family Medicine in tertiary medical universities in order to build a cohesive undergraduate medical curriculum, a standardised postgraduate professional training and continuing education for GPs. ¹⁹

2009	The State Council pointed out the weakness in public health, rural medical care and urban community health care should be addressed. The urban healthcare network should be underpinned by primary care, and CHCs should deliver public health services and primary medical care for commonly- and frequently-seen disease, and long-term conditions with rehabilitation services. ²⁰
2009	The State Council highlighted that the improvement of primary care network and equitable health care for all citizens as priorities in the healthcare reform implementation. A three-year plan was launched to provide competent primary care workforce for rural village clinics, township health centres, and community health centres and stations. ²¹
2011	The State Council advised that GP practitioner system should be established gradually to provide first contact of care at grass-roots level. GP practitioners should receive 5-year undergraduate-level clinical medical education, followed by 3-year post-graduate GP standardised training. It also encouraged GP practitioners to deliver primary care in a team approach. ²²
2011	The MoH advised a comprehensive package of basic public health (BPH) services to enhance the capacity of disease prevention and health promotion in primary care settings. ²³
2011	The MoH formulated the evaluation of primary care service provisions at community healthcare facilities. Organisational management, BPH services, essential medical care quality were assessed. ²⁴
2013	The State Council advised the focus of ongoing healthcare reform on consolidating essential drug list system and exploring operational structure of primary health care facilities. It required active involvement from the government sector, and more benefits given to primary care workforce. ²⁵
2014	The State Council iterated the direction to carry forward the health care reform. It called for policies to encourage first contact of care at CHCs. Coordination between cares at different levels were highlighted. One goal was to build up a system structured in a step-wise manner with improved dual referral channels bridged between primary care and secondary (tertiary) care. ²⁶
2015	The State Council issued its most recent national healthcare policy. It aimed to establish a nation-wide primary care system, with regular updated "cloud" big data with respect to population demographics, electronic health profiles, and patient medical records available by 2020. It also highlighted the pivotal role of primary care in chronic disease prevention, treatment, and rehabilitation. ²⁷

Note: The long-existing Ministry of Health (MoH) and the National Population and Family Planning Commission (NPFPC) have been merged into, and reconstituted as, the National Health and Family Planning Commission (NHFPC) of the P.R. China in March 2013. The NHFPC is expected to strengthen the supervision of healthcare institutions and professionals to regulate service provisions, and deepen the current healthcare and primary care reform to address grass-roots health issues.

The reference numbers are in consistent with that in the manuscript text.

Table 2 Ten-year development of primary care between 2002 and 2013 in China

	2002	2005	2009	2011	2013
N, total population	1,284,530,000	1,307,560,000	1,334,500,000	1,347,350,000	1,360,720,000
Health personnel in the health system					
N, total personnel	6,528,674	6,447,246	7,781,448	8,616,040	9,790,483
N, medical practitioners	1,843,995	2,042,135	2,329,206	2,466,094	2,794,754
N, registered nurses	1,246,545	1,349,589	1,854,818	2,244,020	2,783,121
N, pharmacists	357,659	349,533	341,910	363,993	395,578
N, laboratory technologists	209,144	211,495	220,695	238,874	266,607
Health care facilities					
N, total hospitals (secondary/tertiary care)	17,844	18,703	20,291	21,979	24,709
N, total CHCs (primary care)	8,211	17,128	27,308	32,860	33,965
Health personnel in the CHCs					
N, medical practitioners	19,451	39,964	109,734	158,554	173,838
N, registered nurses	10,842	23,545	79,711	119,834	139,104
N, pharmacists	3,946	7,720	20,015	29,743	32,438
N, laboratory technologists	1,521	3,256	8,879	12,990	13,871
Education level of CHC medical practitioners					
%, bachelor's education or above	13.0	21.9	30.7	31.7	37.1
%, secondary (technical) school or junior college education	77.9	70.2	65.5	64.6	59.8
%, high school education or lower	9.1	7.9	3.8	3.7	3.1
Healthcare utilisation in the CHCs					
N, daily clinical consultations per doctor	12.5	13.7	14.0	14.0	15.7

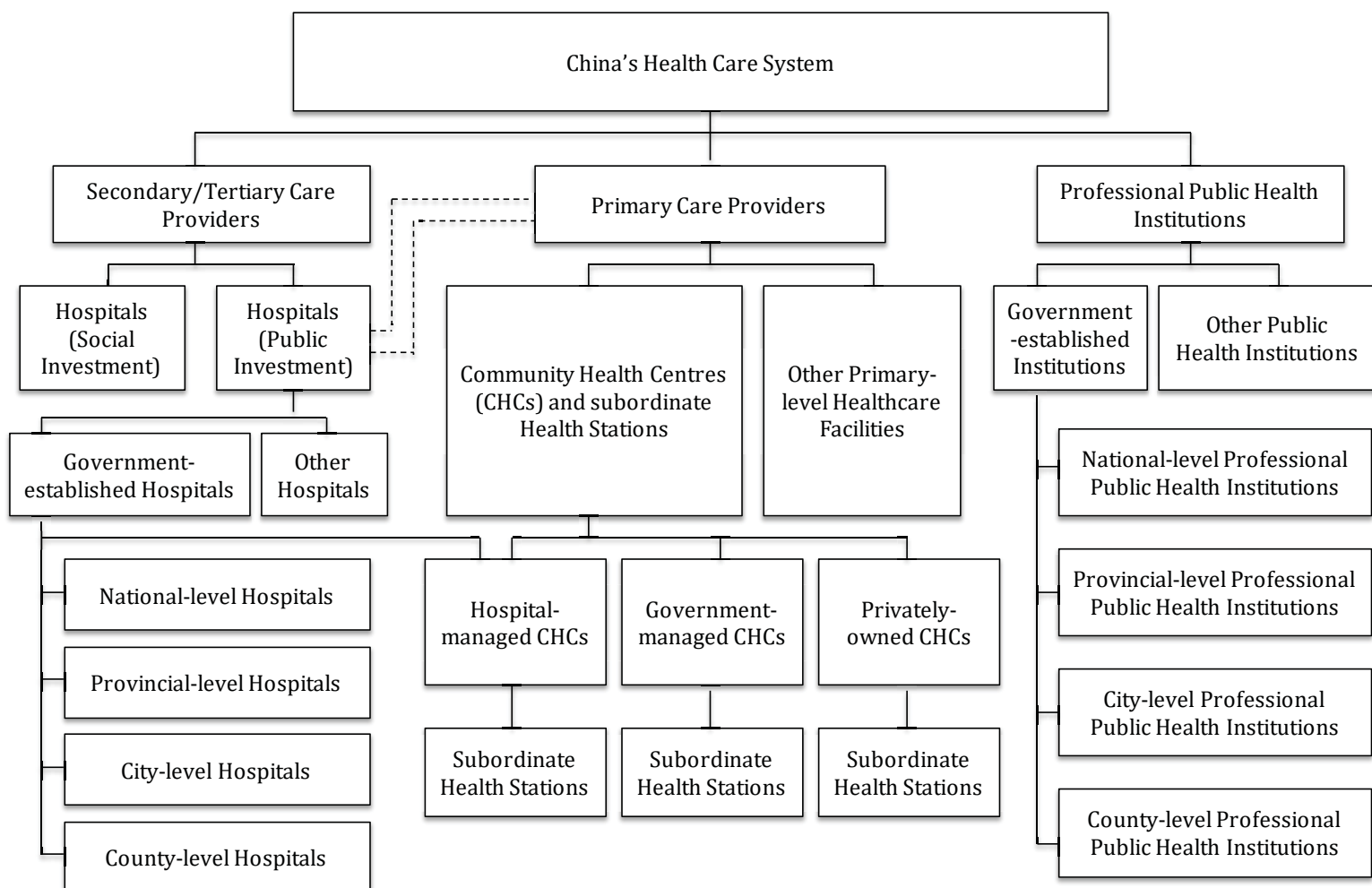
Note: All statistics were retrieved and calculated (when necessary) from the China Health Statistics Yearbook (renamed as China Health and Family Planning Statistics Yearbook, since 2013), which are official healthcare report series compiled by the National Health and Family Planning Commission (NHFPC), P.R. China. Historical statistics on the number of total community health centres and stations are only available from 2002. Abbreviations: CHCs, community health centres (including the subordinate community health stations).

Supplementary Table S1: Background characteristics of selected articles

Article ID	Geographic regions	Publication year	Sample size, N	Study design	Major outcomes
#28	Eastern and Southern China	2015	2,721	Longitudinal study	Service provision and human resources
#29	Southern China	2015	1,645	Cross-sectional study	Service provision and human resources
#30	Western China	2014	1,386	Cross-sectional study	Patients' experiences
#31	Southern China	2015	3,360	Cross-sectional study	Patients' experiences
#32	Central China	2013	2,532	Cross-sectional study	Patients' experiences
#37	Southern China	2014	162,464	Cross-sectional study	Chronic disease management
#39	Central China	2014	1,134	Cross-sectional study	Service utilisation
#40	Nation-wide sample	2013	865	Cross-sectional study	Service utilisation
#41	Nation-wide sample	2013	3,306	Cross-sectional study	Service utilisation
#42	Northern China	2014	930	Cross-sectional study	Service utilisation
#43	Nation-wide sample	2014	3,450	Cross-sectional study	Service utilisation
#44	Southern China	2013	1,440	Cross-sectional study	Primary care organisational models
#46	Southern China	2015	13 CHCs	Cross-sectional study	Primary care organisational models
#47	Southern China	2012	1,830	Cross-sectional study	Primary care organisational models
#49	Nation-wide sample	2014	10,199	Longitudinal study	Antibiotic prescriptions
#50	Nation-wide sample	2015	12,386	Cross-sectional study	Disease treatment
#52	Western China	2015	845	Cross-sectional study	Maternal and child care
#54	Western China	2014	3,191	Longitudinal study	Chronic disease management

Note: CHCs, community health centres.

Figure 1 Healthcare system and primary care providers in China



Note: The health care structure of is depicted according to the most recent national healthcare policy - Announcement of strategic plan on national health care service system (2015-2020): State Council, P.R. China, 2015. The dashed lines denote dual referral channels between primary care and secondary (tertiary) care providers. Other hospitals refer to hospitals established by the military, state-owned or collectively-owned enterprises. Other primary-level healthcare facilities include township health centres and stations, village clinics, and countryside infirmaries. Professional public health institutions include centres for disease control and prevention, regulatory and supervisory bodies, maternal and child health centres, first aid centres and stations, as well as blood donor centres. Other public health institutions refer to institutions established by the state-owned or collectively-owned enterprises.

Figure 2A Number of healthcare facilities between 2002 and 2013 in China

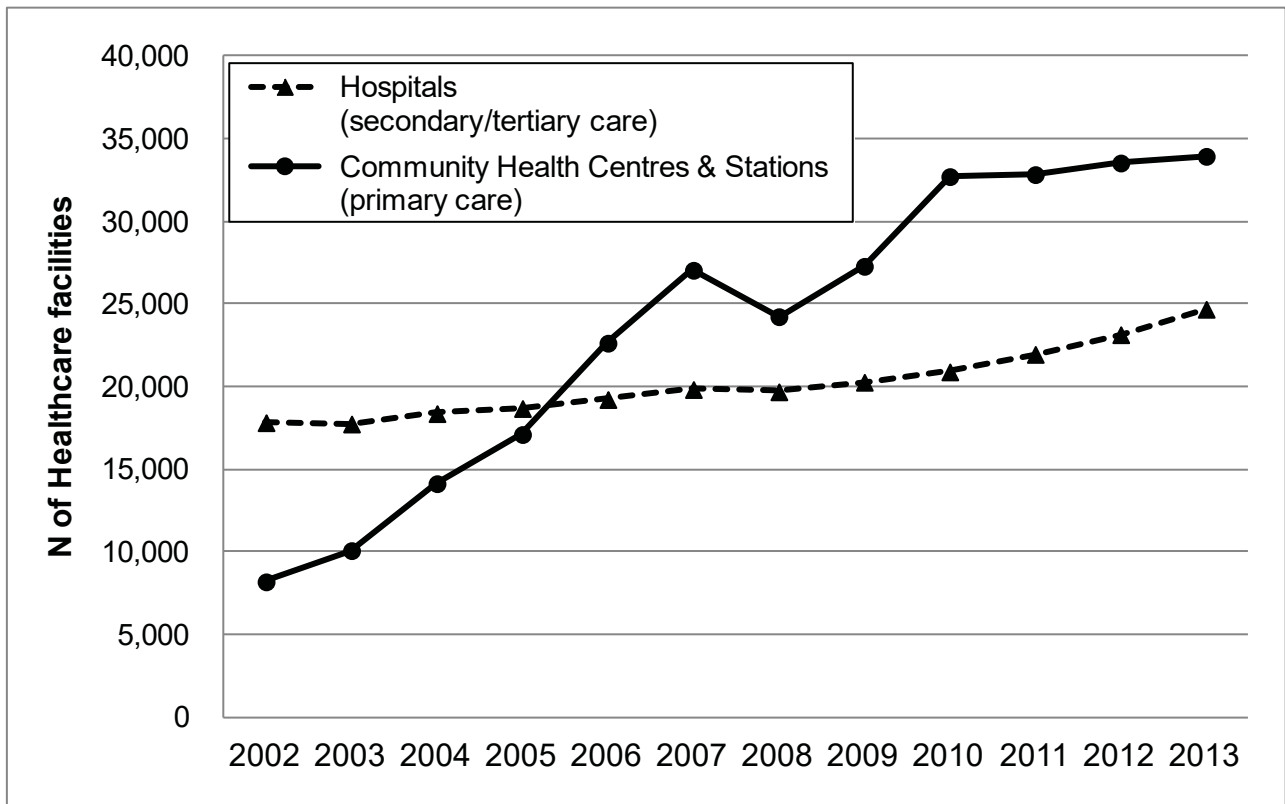
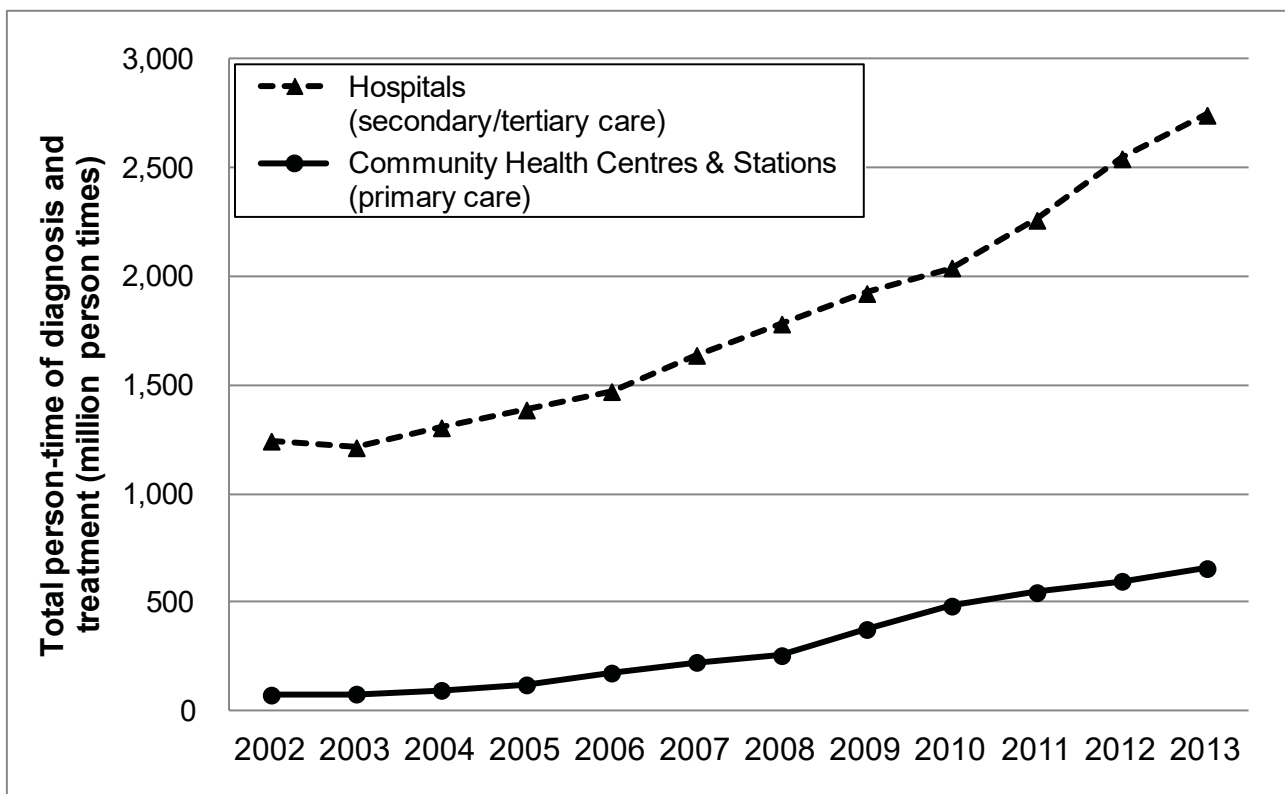


Figure 2B Total person-time of diagnosis and treatment at healthcare facilities between 2002 and 2013 in China



Note: All statistics were retrieved and calculated (when necessary) from the China Health Statistics Yearbook (renamed as China Health and Family Planning Statistics Yearbook, since 2013), which are official healthcare report series compiled by the National Health and Family Planning Commission (NHFPC), P.R. China. Historical statistics on the number of total community health centres and stations are only available from 2002.

Supplementary Figure S1: PRISMA flow diagram of searches in NCBI PubMed

