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Public Health System and Socio-Economic Development Coupling Based on Systematic Theory: Evidence from China

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Abstract: This paper focus on the quantitative measurement of public health systems and its mismatch with socio-economic development. Based on systematic theory, we divide the public health system into four sub-systems: resource inputs, planning in decision-making, operations, and service outputs. We also provide a method to analyse the ability to match between the public health system and social-economic development by using the grey correlation and coupling method. Then we introduce data from China as a case of empirical research. The main findings are as follows: (1) China's public health system has progressed from 2012 to 2019, and the development of China's public health system is typically "input-driven". Second, the level of public health management in China lacks sustainability. (2) The main reason for this problem is the mismatch between the central and local governments in China in terms of public health management authority. (3) Third, the coupling between China's public health system and socio-economics development has shown a decreasing trend, which indicates an increasingly significant mismatch problem between public health and economic growth, urbanization, and population aging. Our study will enrich the understanding of the relationship between the public health system and socio-economics development.

Keywords: public health system; coupling; systematic theory; China

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1. Introduction

Nowadays, environmental pollution, disease epidemics, and other emergencies pose great challenges to human health and sustainable development, and a public health system is an important tool in addressing these challenges [1–4]. Especially after the COVID-19 pandemic, public health systems worldwide are undergoing a major shock [5–7]. As a result, it has become a growing concern for researchers and policymakers how to build an effective public health system.

However, there is still a lack of clarity in the evaluation of the effectiveness of public health systems. One traditional approach is to select one or several specific indicators as a proxy variable for public health, such as daily cases, death rate, case fatality rate (CFR), intensive care unit (ICU) admissions, and national measures taken for dissemination, etc. [8–11]. This approach is indeed an easy one to use but hardly reflects the overall status of the public health system. Some scholars suggest that facing the complex shock in the real world, evaluating the effectiveness of public health systems requires a more comprehensive approach [12–14]. To deal with the problem of comprehensiveness, a systematic theory has been introduced to the measurement of public health systems. The basic principles of Systematic Theory (ST) were described by von Bertalanffy (1969) [15], aiming to handle multiple data modules in computer science. Systems theory focuses on the interaction and connectedness of the factors and sub-systems in a system and is increasingly being applied to describe non-linear relationships in management science. Theoretical models applied on systematic theory can hint toward a holistic approach for healthcare-related issues

and problems, including those in hospital management, pharmacology, and psychology healthcare [16,17]. In recent years, scholars have attempted to use systematic theory on public health issues [18–20], but this research is still descriptive. In particular, there is a lack of systematic quantitative research on public health systems at a regional or national level [21,22]. In order to fill this research gap, we introduce the systematic theory to construct an evaluation method for the level of public health development.

Public health systems are not isolated but are embedded in socio-economic development. The development of the public healthcare system is influenced by the level of economic development, community culture, policies, and laws [23,24]. In turn, the level of development of the public healthcare system has an impact on economic growth, urbanization, political elections, and other social activities [25]. As an example, the mismatch between public health care and socio-economic development is widespread in developing and even developed countries [26–28]. The inequality of public healthcare resources between regions [29–31], inefficiencies in public hospitals [32–34], and the dilemma of community hospitals [35,36], etc.

A major lesson that the COVID-19 pandemic has taught people is that public health systems are tied to social, political, economic, and moral factors [37,38]. In order to respond to the problems of human health caused by the COVID-19 pandemic, the relationship between socio-economic development and public health systems needs to have a more in-depth study. There have been studies on the relationship between socio-economic development and public health systems from the micro-perspective of cases, communities, and cities [25,39,40], while studies based on a macro-perspective are still limited. Thus, we provide an empirical analysis of public healthcare systems and socio-economic development as a whole by using country-level date from China. China, as a developing country with significant public health problems [41,42], is an ideal sample for discussing the relationship between the public health system and socio-economic development.

Facing these gaps in the existing research, this paper attempts to explore a quantitative study of public health systems and their relationship to socio-economic development. Specifically, this paper addresses the following three questions: (1) How to provide a systematic measurement of public health care? (2) How to measure the adaptability of public health systems to socio-economics development? (3) For China, is there any mismatch between socio-economic development and the public health system? If the answer is yes, how can we measure this mismatch?

We will introduce quantitative studies based on systematic theory and coupling that will answer these questions more precisely. The novelty of this paper is reflected at two levels. For the theoretical aspect, this study will enrich the understanding of the relationship between the public health system and socio-economics development, and for applications, this paper measures the coupling between China's public health system and socio-economic development, which can harmonize public health with socio-economic development and provide policy insights for policymakers.

2. Theory and Methodology

2.1. The Measurement of Public Health System Based on Systematic Theory

So far, there has been no single or dominant approach to evaluating a public health system, nor is there a consistent model [43,44]. Given that it is difficult for a single or a few variables to reflect the development of a public health care system in an integrated manner, we introduced a systematic theory to construct a framework for evaluating public health care systems. Systematic theory suggests that public health systems can be divided into a number of interrelated sub-systems, and this viewpoint has been widely applied to study the issue of health management. Studies have been conducted on public health issues under systems theory, and these are often based on qualitative research and micro-questionnaires. For instance, Mahamoud et al.'s (2013) research was based on a large-scale community health survey from Canada that provided over 2300 factors that may influence public health effectiveness [36]. Littlecott et al. (2019) are based on structured and semi-structured

interviews with individuals to analyse the public health system from the perspective of individual perceptions and behaviours [45]. Recently, Haghi et al. (2022) evaluated the functioning of the public health system during the COVID-19 pandemic through a questionnaire on medical participation [46].

With the enrichment of public health practice, scholars began to focus on public health system issues from a macro perspective. However, these macro-level studies are often qualitative. From a macro perspective, we divide the process of running a public health system into four parts: first, raising of funding and other resources, then, public health planning and decision-making. In other words, how public health resources are allocated and used. Next, the operation of public healthcare facility. Finally, provding the healthcare services to the public. Based on these processes of public health systems, we construct a systematic measure method for public health systems, including the following four sub-systems (see Figure 1).

(1) Resources input sub-system. Public health systems require a certain amount of resources to support them, mainly including human, financial, social, and technical recources. Generally speaking, a greater investment of resources means that the public health system can provide a richer range of health services to people. However, unlike private healthcare services, public health services often have a low price or are even free in some countries, so that excessive investment in public health resources may increase the financial pressure on the government.
(2) Planning and decision sub-system. There is a key problem in the effective allocation and use the public health resources. According to the WHO report in 2007 (WHO, http://www.who.int/healthsystems/strategy/everybodys_business.pdf., accessed on 25 July 2022), public health systems should have seven main functions (service delivery, health workforce, information, medical products, vaccines and technologies, financing, leadership/governance), these functions can be summarised into three aspects: first, disease control and second, health care—this is the most basic function of the public health care system. The third is health education. With knowledge playing an increasingly important role in health management, health education has become a key factor in evaluating public health performance. The government should consider above three aspects in the process of making public health policies and programmes.
(3) Operating sub-system. In reality, the level of cooperation between the multiple agencies determines whether the public health plans or policies can be implemented effectively. Firstly, the government plays the role of leader and manager in the public health care system. Secondly, public hospitals are health institutions that are funded by the government, including both large-scaled hospitals and small healthcare institutions such as community clinics and family doctors. Public hospitals are the micro direct providers of public health services. Third, other medical institutions, such as universities, public laboratories, and epidemiological institutions, are becoming increasingly active in the public health system because knowledge, technology and management become new types of factors affecting the efficiency of public health systems.
(4) Service output sub-system. The ultimate aim of a public health system is to provide sustainable public healthcare for the public. Therefore, public health performance is an important element in the evaluation of public health systems. In addition to daily healthcare services, the capacity to deal with public health emergencies, medical care for vulnerable groups, health awareness development, and training of medical talents are also dimension of the evaluation of the output of public health services.

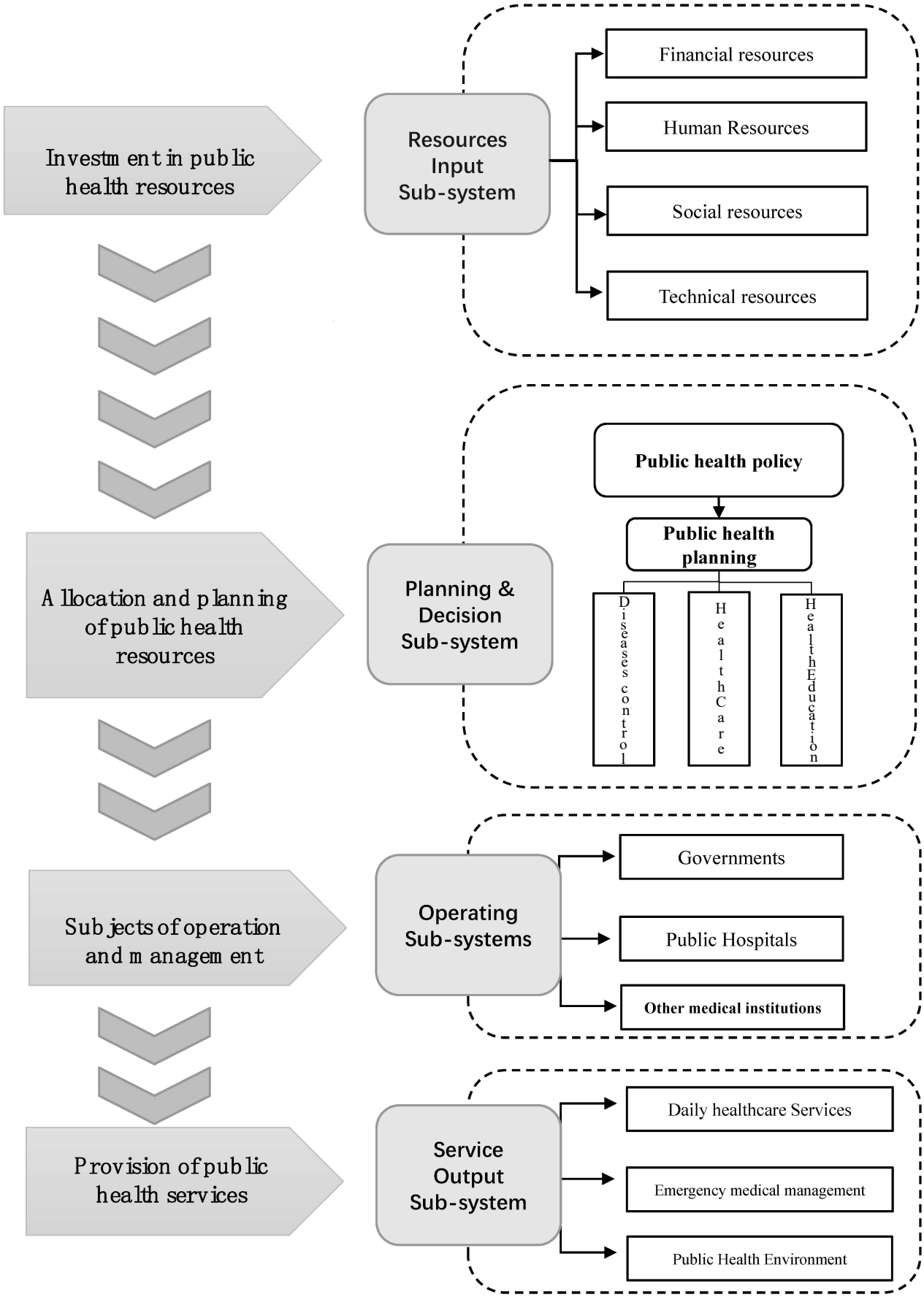

Figure 1. Public health systems based on systematic theory.

Based on the above theoretical analysis and with reference to Ahirwar et al. (2021) [47] and Khan (2022) [48], we introduce the information entropy method for the systematic measurement of the public health system. Details of the mathematics approach are as follows.

We collect a total of n evaluation indicators, each indicator being time series data for m years. Firstly, the raw data should be normalized using the "max–min" method. For positive indicators, Equation (1) is used for normalization and Equation (2) for negative indicators. In the equation, X_{ij} denotes the value of the *j*th (*j* = 1,2,3, . . . ,n) indicator in the *i*th (*i* = 1,2,3, . . . ,m) year, $min\{X_j\}$ and $max\{X_j\}$ are the minimum and maximum values of the *j*th indicator in all years, respectively.

$$X_{ij} = \frac{X_{ij} - min\{X_j\}}{max\{X_j\} - min\{X_j\}} \tag{1}$$

$$X_{ij} = \frac{max\{X_j\} - X_{ij}}{max\{X_j\} - min\{X_j\}} \tag{2}$$

Secondly, we need to calculate the weight of *j* evaluation indicator in the *i* year's scoring.

$$Y_{ij} = \frac{X_{ij}}{\sum_{i=1}^{m} X_{ij}} \tag{3}$$

Third, we can calculate the information entropy (e_j) and information redundancy (d_j) of the jth evaluation factor as in Equations (4) and (5), respectively, where parament $k = 1/\ln(m)$.

$$e_j = -k\sum_{i=1}^{m}(Y_{ij} \times lnY_{ij}) \tag{4}$$

$$d_j = 1 - e_j \tag{5}$$

According to entropy theory, if the information entropy redundancy is a larger proportion of the total redundancy, it represents a greater degree of changes in the system brought by variation of that factor. Therefore, we can use the proportion of information redundancy of the total redundancy as weights for evaluating (W_i) the public health system (see as Equation (6)).

$$W_i = d_j / \sum_{j=1}^{n} d_j \tag{6}$$

Ultimately, we can obtain a weighted average of evaluation factors (S_{ij}) as the systematic measurements of the public health system (see Equation (7)).

$$S_{ij} = W_i \times X_{ij} \tag{7}$$

2.2. The Coupling of Public Health System and Socio-Economic Development

Based on the evaluation of the level of the public health system, the next question is how to quantitatively measure its adaptability to socio-economic development. In the light of existing research [23–25], economic development, urbanization, migration, and ageing are the population issues on the research frontier of public health. We select four aspects to reflect the socio-economics development from the macro perspective. First, we choose GDP as the variable that reflects economic growth. Second, we calculate the share of urban population in the total population as a proxy variable reflecting the urbanization rate. Third, we select the number of migrant people as a proxy of labour migration status. Fourth, ageing is one of the major social challenges in East Asia [49–51], and we also analyse the relationship between the public health system and ageing population. We chose the proportion of the population aged over 65 in the total population as a variable to reflect the ageing of the population.

Coupling can be used to measure the degree of association among the various parts of a complex system. As mentioned above, public health systems are embedded in a complex socio-economic environment, so we introduce the concept of coupling to measure the level of matchability between the public health system and socio-economic development. This paper uses the grey correlation method to measure the coupling between the public health system and socio-economic development. The specific calculation method of coupling is as follows.

First, calculate the grey correlation coefficient. Grey relational analysis is to determine whether the relation between the reference data column and several comparison data columns is close by determining the similarity of the geometric shapes of the reference data column and several comparison data columns. For two number columns $x_i = \{x_i(1), x_i(2), \cdots, x_i(k)\}$ and $x_j = \{x_j(1), x_j(2), \cdots, x_j(k)\}$, the grey correlation coefficient is:

$$\varepsilon_{ij} = \frac{\min_i \min_j |x_i(k) - x_j(k)| + \rho \max_i \max_j |x_i(k) - x_j(k)|}{|x_i(k) - x_j(k)| + \rho \max_i \max_j |x_i(k) - x_j(k)|} \tag{8}$$

In Equation (8), $|x_i(k) - x_j(k)|$ represents the absolute difference between the x_i and the x_j at the kth point, and $\rho \epsilon (0, 1)$ is the resolution coefficient.

Then, the formula for calculating the degree of coupling as Equation (9).

$$C(k) = \frac{1}{m \times n} \sum_{i=1}^{m} \sum_{j=1}^{n} \varepsilon_{ij}(k) \tag{9}$$

According to the coupling degree of the two systems, we can measure the level of matchability between the public health system and socio-economic development. The coupling degree is divided into the following levels: when $C = 0$, the two systems are not coupled; when $0 < C \leqq 0.4$, the system belongs to low-level coupling; when $0.4 < C \leqq 0.5$, the system belongs to antagonistic coupling; when $0.5 <$ When $C \leqq 0.8$, the system belongs to running-in coupling; when $0.8 < C < 1$, the system belongs to high-level coupling; when $C = 1$, the system is fully coupled.

3. Data

3.1. Data on China's Public Health System

According to the theoretical framework in Section 2.1 and taking into account data availability and time continuity, we collected data from China Health Statistical Yearbook (2012–2020) (http://www.nhc.gov.cn/zwgk/tjnj1/ejlist.shtml, accessed on 10 June 2022) and the official website of the China's Ministry of Health (NHCOC, http://www.nhc.gov.cn/, accessed on 1 July 2022). The specific indicators were selected as follows:

(1) Resources input sub-system. First, the human resource mainly selects the number of health technicians per 1000 population, the number of professionals in professional public health institutions and the number of primary medical and health institutions per 1000 population, which are used to measure the health personnel engaged in medical and scientific research, public health institutions, and primary medical institutions respectively. Second, government health expenditure is mainly used for measuring the level of financial security of public health services. Third, technology mainly chooses the number of equipment over 10,000 yuan in medical and health institutions to measure the technical level of public health services. Fourth, social is mainly selected per thousand the number of beds in medical institutions is used to measure the capacity of medical supplies.

(2) Planning and decision sub-system. This paper chose the number of infectious disease prevented, the number of health supervision and punishment cases in public places, and the number of public health education activities to measure the ability of public health planning and decision.

(3) Operating sub-system. First, the government usually does not directly participate in public health services. However, they provide public health services indirectly through human, financial, and material investment in medical institutions and public health institutions. Therefore, we select the scale of public health insurance in China to reflect the level of government participation in public health operations. Second, medical institutions mainly choose the number of hospitals and primary medical and health institutions, which are used to measure the situation of conventional medical institutions and primary medical institutions, respectively. Third, public hospitals mainly select the number of public health institutions.

(4) Service output sub-system. First, we select the qualification rate of regular hygiene monitoring in public places to measure daily healthcare services. Second, the effective prevention and control of public health emergencies is mainly based on the incidence of notifiable infectious diseases in Class A and B. Class A and B notifiable infectious diseases are high-risk infectious diseases, and the lower the incidence rate indicates a lower probability of an outbreak. The third is to measure the increase in public health awareness by the number of health education programmes and people trained.

For reasons of brevity, we display the weights of secondary-level indicators according to Equation (6) (see Table 1), and details of all the bottom variables are shown in Appendix A.

Table 1. The evaluation indicators system of the public health system in China, 2012–2019.

First-Level Indicator	Secondary-Level Indicators	Weights
Resources input sub-system	Human resources	0.1441
	Financial resources	0.0506
	Technical resources	0.1511
	Social resources	0.1286
Operating sub-system	Government	0.0412
	Public hospitals	0.0608
	Other medical institutions	0.1047
Planning and decision sub-system	Public health policy	0.0626
	Medical care	0.0358
	Disease control	0.0492
	Health education	0.0320
Service output sub-system	Daily healthcare services	0.0434
	Increased public health awareness	0.0538
	public health emergency management	0.0421

3.2. Data on Socio-Economics Development in China

According to Section 2.2, we select four proxy variables representing economic growth, urbanization, labour migration, and ageing population, respectively. These data are from China Statistical Yearbook (2012–2020, http://www.stats.gov.cn/tjsj/ndsj/, accessed on 10 June 2022). Table 2 displays these variables of socio-economics development and their rate of change rate between 2012 to 2019 in China.

Table 2. Variables of socio-economics development and their change rate from 2012 to 2019.

Year	Economics Growth (Unit: CNY)		Urbanization Rate (Unit: %)		Labour Migration (Unit: 100 Million People)		Population Aging (Unit: %)	
	Scale	Change Rate	Scale	Change Rate	Scale	Change Rate	Scale	Change Rate
2012	39,771	7.1	53.1	2.45	2.36	2.61	9.4	3.30
2013	43,497	7.1	54.49	2.62	2.45	3.81	9.7	3.19
2014	46,912	6.8	55.75	2.31	2.53	3.27	10.1	4.12
2015	49,922	6.4	57.33	2.83	2.47	−2.37	10.5	3.96
2016	53,783	6.2	58.84	2.63	2.45	−0.81	10.8	2.86
2017	59,592	6.3	60.24	2.38	2.44	−0.41	11.4	5.56
2018	65,534	6.2	61.5	2.09	2.41	−1.23	11.9	4.39
2019	70,328	6.0	62.71	1.97	2.36	−2.07	12.6	5.88

4. Analysis of Measurement Results

4.1. Measurement of Public Health System in China

The results of the systematic measurement of China's public health from 2011 to 2019 are shown in Table 3. According to the results, we have three findings about China's public health system.

Table 3. Results of the systematic measurement of China's public health.

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Resources input sub-system	0.4743	0.5274	0.6151	0.6659	0.7108	0.7548	0.8189	0.8784	0.9452
Operating sub-system	0.1726	0.1709	0.2309	0.2484	0.2517	0.2469	0.2501	0.2670	0.2810
Planning and decision sub-system	0.2007	0.2244	0.2051	0.2435	0.2823	0.2722	0.2804	0.3256	0.3527
Service output sub-system	0.2259	0.2372	0.2624	0.2751	0.2874	0.3242	0.2973	0.3141	0.2812
Total	1.0735	1.1599	1.3135	1.4329	1.5322	1.5981	1.6467	1.7851	1.8601

First, overall, China's public health system has progressed from 2012 to 2019. The total score of the public health system increased from 1.0735 in 2011 to 1.8601 in 2019, with an average annual growth rate of 7.16%. However, the growth rate public health system has slowed down since 2015. After 2015, the total score grew at a slower than average rate. The trend in total scores is consistent with changes in public health expenditure in China. As shown in Figure 2, although Chinese government healthcare expenditure has increased year on year, there has been a significant decline in the growth rate of healthcare expenditure after 2015.

Second, by comparing the score of various sub-systems, we find that the development of China's public health system is typically "input-driven". The resource input sub-system scores the highest and is much higher than the other three sub-systems, which is consistent with the first point about government spending on healthcare. In contrast, the service output sub-system has the lowest average annual growth rate, indicating that public health care inputs in China are inefficient. The consequence of this is that people still have difficulty accessing better healthcare services while China's government has spent a large amount of money on the public healthcare system.

Third, the operating sub-system and the planning and decision sub-system has shown a negative growth rate for some years, indicating that the level of public health management in China has a lack of sustainability. The main reason for this problem is the mismatch between the central and local governments in China in terms of public health management authority. In China, the central government formulates most public health policies, such as managing the public health insurance fund and formulating health care resource allocation plans. However, public health care is mainly funded by local governments rather than the

central government. For example, in 2017, local governments spent 1434.1 billion CNY on public healthcare, while the central government spent only 10.76 billion CNY. This mismatch makes it difficult for the central government to adjust the actual situation of local regions when making public health planning and decisions.

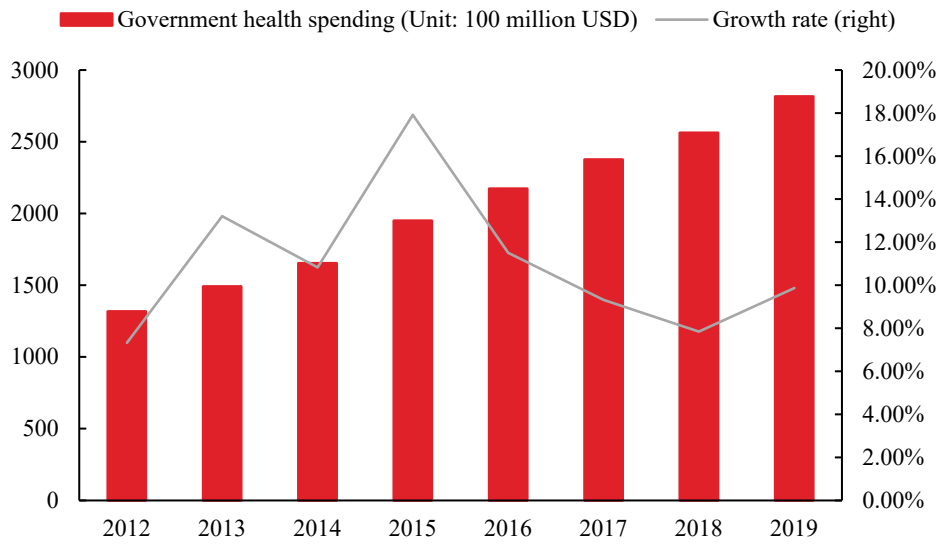

Figure 2. Scale and growth rate of government healthcare expenditure in China.

4.2. Mismatch between Public Health System and Socio-Economic Development in China

Using the method in Section 2.2, we calculated the couplings of the total score of the public health system in China with variables on socio-economic development mentioned in Section 3.2, and the results are shown in Figure 3. In total, the coupling between China's public health system and socio-economics development has shown a decreasing trend, which indicates an increasingly significant mismatch problem between public health and economic and social development. The mean coupling has decreased from 0.6963 in 2012 to 0.5614 in 2019. Except for the coupling of labour migration, other couplings decreased over the years.

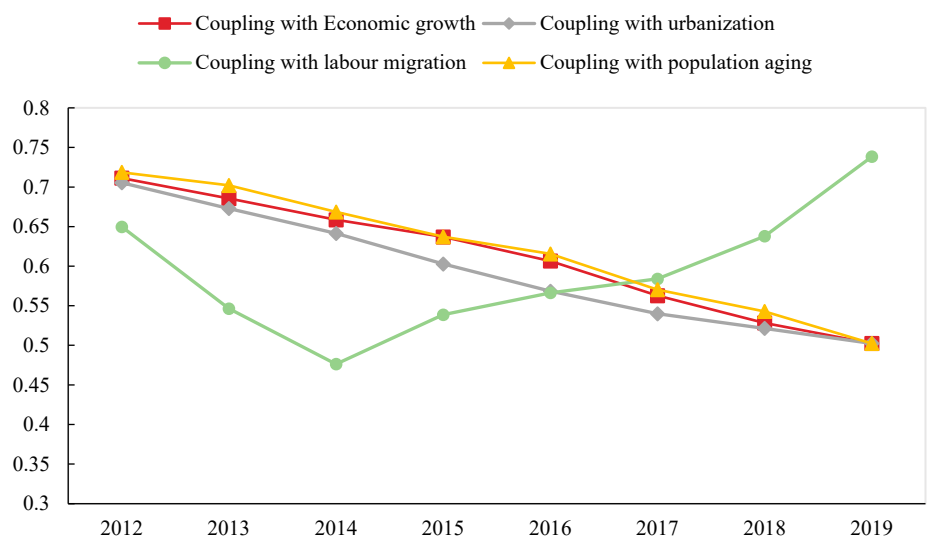

Figure 3. The couplings of the public health system with socio-economic development in China.

First, the mismatch between economic growth and the public health system. From 2012 to 2019, the coupling between the public health system and economic growth declined from 0.7114 to 0.5025, and are currently in a phase of grinding coupling. As seen in Figure 4,

the share of Chinese health expenditure on GDP in 2019 was only 5.3%, which is not only lower than the 8.8 of the average level in OECD countries but even lower than some emerging market like Brazil, the average of 45% in emerging market countries (date source: OECD Health Statistics 2022, https://stats.oecd.org/Index.aspx?ThemeTreeId=9, accessed on 20 September 2022).

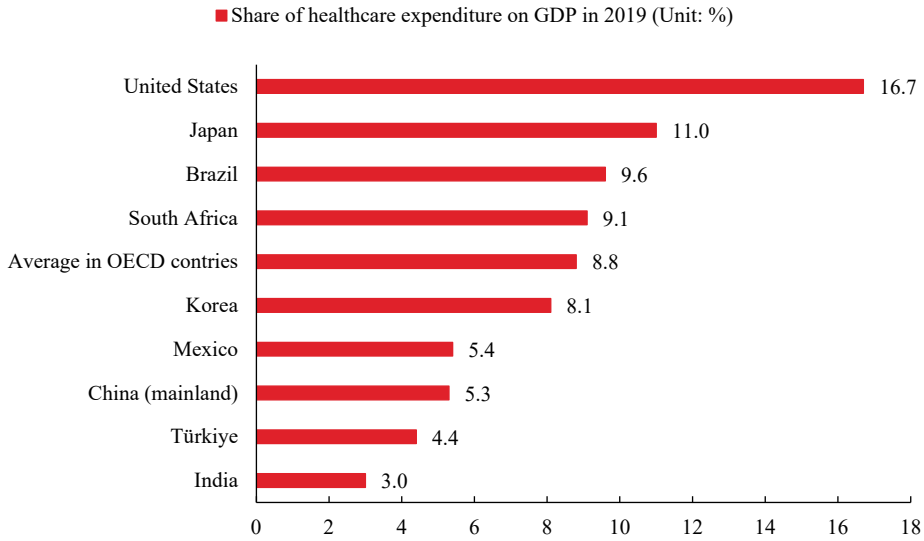

Figure 4. Share of healthcare expenditure on GDP in 2019.

Second, a mismatch between urbanization and the public health system. The coupling between the public health system and urbanization declined from 0.7054 to 0.5025 from 2012 to 2019. The reasons for the declining trend are mainly two hands. On the one hand, the increasing level of urbanization means that the resident population in urban areas is increasing, which inevitably puts pressure on the supply of public health services in China's cities and towns. On the other hand, there is an urban–rural inequality in China's public health system. For example, in 2018, the per capita cost of public hospitals in urban China was 132.2 CNY/per visit, compared to only 71.5 CNY/per visit in rural areas. Rural residents have lower incomes than urban residents, but received less public health care payments, which makes health inequalities worse.

Third, a mismatch between population aging and the public health system. The coupling between the public health system and the population declined from 0.7187 to 0.5025. The continued downward trend in the coupling is mainly due to the fact that the ageing population has a higher rate of illness and is more likely to be severely ill, and their healthcare costs are also higher. The Fourth Sample Survey Report on the Living Conditions of the Elderly in Urban and Rural China (Ministry of Civil Affairs of China, http://www.gov.cn/xinwen/2015-01/25/content_2809782.htm, accessed on 25 June 2022) shows that 38.1% of the elderly need treatment for chronic diseases, 11.3% need rehabilitation and care services, 10.6% need psychological counselling. Thus, as the ageing of China's population continues to increase and is on a rapid rise, its demand for public health services is rising significantly.

Fourth, labour migration is the only aspect of coupling that has risen, suggesting that China's public health system has become more adaptable to the labour flow. The reason for this phenomenon is the cross-regional medical settlement reform that the Chinese government began implementing in 2014 (Ministry of Human Resources and Social Security of China, http://www.mohrss.gov.cn/SYrlzyhshbzb/shehuibaozhang/zcwj/yiliao/201412/t20141224_147142.html, accessed on 15 June 2022). Before the reform, only the local workforce was able to use their public health insurance but not across the prefecture-level city. After 2015, China started to provide health insurance services across prefecture-level

regions, and from 2022, China is experimenting with a national health insurance service. This reform of the public health system promotes health protection for migrant workers.

5. Conclusions

Based on the systematic theory, this paper provides a quantitative study of public health systems and its coupling with socio-economic development. The main findings of this research are as follows: First, China's public health system has progressed from 2012 to 2019, and the development of China's public health system is typically "input-driven". Second, the level of public health management in China lacks sustainability. The main reason for this problem is the mismatch between the central and local governments in China in terms of public health management authority. Third, the coupling between China's public health system and socio-economics development has shown a decreasing trend, which indicates an increasingly significant mismatch problem between public health and economic growth, urbanization, and population aging.

The conclusions of this paper could provide some policy implications in order to enhance the matching with the public healthcare system and socio-economic development. On the one hand, from a systematic theory perspective, the development of the public health system is measured by multiple dimensions, and policymakers need to set public health policies from multiple perspectives, including healthcare investment, policy implementation, and operational performance. For China, in particular, the findings of this paper suggest that the public health system is "input-driven" but lacks performance, and this mode is not sustainable. On the other hand, the external environment, including various factors of socio-economic development, is important for the development of public health systems. Policymakers need to improve the coupling between the public health system and economic and social development, so that the public health system can contribute more to economic development and social welfare.

There are two main limitations of our study that can be enhanced in future studies. On the one hand, due to a lack of data, we are unable to compare the relevant indexes for China with other developing countries by using our method. But this article provides a way to measure the level of development of public health systems. With the abundance of data from other countries, we can make cross-country comparisons under the same evaluation standard in the future. On the other hand, the COVID-19 pandemic has shocked the public healthcare system. Due to the lack of data, we are not yet able to measure the recovery and development of the public healthcare system in the post-COVID-19 era perfectly. The development of the public healthcare system in the post-COVID-19 era will be a key concern in the future.

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Appendix A

Table A1. Details of all the bottom variables.

First-Level Indicator	Bottom Variables	Weights
Resources input sub-system	X1: Number of health technicians per 1000 population	0.0441
	X2: Personnel in professional public health institutions per thousand population	0.0512
	X3: Number of staff in primary medical and health institutions	0.0488
	X4: Government health spending	0.0506
	X5: The number of medical and health institutions more than 10,000 yuan of equipment	0.0484
	X6: Number of professional public health institutions with equipment of more than 10,000 yuan	0.0496
	X7: Number of units of equipment above 10,000 yuan in primary health institutions	0.0531
	X8: Number of beds in medical institutions per 1000 people	0.0443
	X9: Number of hygienic beds in primary medical institutions	0.0426
	X10: Number of beds in professional public health institutions	0.0417
Operating sub-system	X11: Number of hospitals	0.0504
	X12: Number of primary medical and health institutions	0.0543
	X13: Number of professional public health institutions	0.0608
Planning and decision sub-system	X14: Number of Infectious Disease Prevention Supervision and Punishment Cases	0.0626
	X15: Number of visits to medical and health institutions	0.0358
	X16: The number of public places health supervision and punishment cases	0.0492
	X17: Number of public health education activities	0.0320
Service output sub-system	X18: Class A and B notifiable infectious disease mortality	0.0434
	X19: Qualification rate of regular hygiene monitoring in public places	0.0412
	X20: Number of health education trainees	0.0538
	X21: Incidence of Class A and B Notifiable Infectious Diseases	0.0421

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