



An Analysis of Medical Cooperation in the Greater Bay Area

Based on the Case of The University of Hong Kong - Shenzhen Hospital

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Executive Summary

In February 2019, the “Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area” (hereafter the “Outline”) was officially released by the State Council of the Communist Party of China and ushered in new opportunities for the Greater Bay Area (GBA). With the development of GBA, there are more and more exchanges between Hong Kong and the Mainland. The core issue in GBA planning involves effectively implementing the strategy for regional development and fully leveraging the industrial economic advantages of individual cities through clustering. Taking the University of Hong Kong - Shenzhen Hospital (HKU-SZH) as an example, this study provided suggestions for medical cooperation in Greater Bay Area through in-depth study of the business model and performance of HKU-SZH.

We firstly introduce the background and client of this project, focusing on the significance of this project. After that, we explain our research theory and framework, including the national innovation system and the logic model. Then, we focus on the case study of HKU-SZH and evaluate its performance from four dimensions: personnel cooperation, capital cooperation, technology cooperation and policy and institution cooperation. We evaluate medical cooperation at HKU-SZH using a mix analysis. The four dimensions are assessed based on five criteria including availability, quality, ease of integration, involvement, and completeness. We give each dimension a score under each criterion and calculate the average to derive the final scores. Finally, we make conclusions and offer suggestions for the future development of HKU-SZH and the medical cooperation of GBA.

This study can not only help the hospital optimize the management plan by reviewing the development strategy and management status, but also provide suggestions for more cross regional medical cooperation in the future. In addition, the project also applied the research method of public policy, which provided a new idea for the research of regional cooperation strategy. We believe that the integration and development of GBA will be a trend, and the cooperation models of different regions will be continuously updated. We hope that HKU-SZH can continue to serve as a bridge and further deepen the cross regional medical cooperation of GBA.

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1. Overview

1.1. Problem Definition: Background and Context

1.1.1. Medical and Health Care System Reform in China

In 2009, China launched a new major health-care reform (2009-2019) and pledged to provide all citizens with equal access to basic health care with reasonable quality and financial risk protection. The government has since quadrupled its funding for health. The reform's first phase (2009-2011) emphasized expanding social health insurance coverage for all and strengthening infrastructure. The second phase (2012-2019) prioritized reforming its health-care delivery system through (1) systemic reform of public hospitals by removing mark-up for drug sales, adjusting fee schedules, and reforming provider payment and governance structures; and (2) overhaul of its hospital-centric and treatment-based delivery system.

Reforming public hospitals is the emphasis of the medical and health care system reform in the second phase. The government mandated the Zero-Markup Drug Policy for county-level hospitals in 2012, and for city-level hospitals in 2015 (the policy was introduced in PHC facilities in 2009). This policy eliminated the 15% mark-up allowance on prescribed drugs. By design, the Zero-Markup Drug Policy was to be coupled with a fee-schedule adjustment—increasing fees for more labor-intensive services, such as physician visits and nursing, and reducing fees for diagnostic tests—to compensate hospitals for lost revenue from drugs and to reduce incentives for diagnostic tests. To compensate financial imbalances for hospitals in transition, local governments were expected to increase fiscal subsidies to hospitals, and hospitals were expected to handle part of the drug revenue loss through efficiency improvements.

The central government issued guidelines for local governments to experiment with alternative payment methods (such as global budgets, diagnosis-related groups, case-based payments, and capitation) to replace the traditional fee-for-service scheme. Preliminary evaluations of pilot initiatives found that these alternative payment methods are associated with decreases in total medical expenditures, out-of-pocket costs, and length of stay, but results on quality measures were insufficient and mixed.

The central government published a set of national guidelines for local governments to use when designing their own public hospital reform. By 2015, over ten models of public hospital reform emerged. One of the models, HKU - SZH undertakes the role of public hospital reform in Shenzhen.

In April 2010, Shenzhen became one of the first 16 national pilot cities for public hospital reform. In this ten-year period, Shenzhen generated demonstrative effects around the country

in deepening medical and health care reform: (1) the total amount of medical resources in Shenzhen has doubled, getting rid of the shortage of medical resources. The number of medical institutions increased from 2597 to 4,406. The number of hospitals increased from 115 to 156, and the number of hospitals attained National 3A Hospital Accreditation increased from 5 to 18; (2) In order to solve the lack of high-quality medical resources in Shenzhen, Three Famous Projects with focuses on famous doctors, famous hospitals and famous clinics was launched in 2014, the goal of which was to invest 1,000 hundred million yuan by 2020. In the public hospital reform, the ownership and management rights were separated. Additionally, PKU, HKU, Sun Yat-sen University, Southern Medical University, Beijing University of Chinese Medicine, Guangzhou University of Chinese Medicine, and Shanghai University of Chinese Medicine were introduced to establish affiliated hospital and medical school; and (3) Shenzhen made full use of the legislative power of the Economic Special Zone and promulgated and implemented the Shenzhen Economic Special Zone regulations on Chinese medicine, mental health, tobacco control, unpaid blood donation, medical treatment, and medical emergency. Regulation of family doctor service was also pioneered by Shenzhen.

1.1.2. Peking University Shenzhen Hospital (PKUSZH)

The medical reform in Shenzhen was carried out with many pilots, PKUSZH was a typical example. In October 2000, Shenzhen Municipal Government signed a strategic cooperation agreement with Peking University and the Hong Kong University of Science and Technology, making the Shenzhen Central Hospital officially become PKUSZH. PKUSZH is also the first cross-regional medical cooperation institution of Peking University (PKU).

There are two types of affiliated hospitals: directly affiliated hospitals and non-directly affiliated hospitals. For directly affiliated hospitals, corresponding functional departments of universities implement vertical management of the hospital, and the hospital fully participate in the medical school's clinical teaching. While for non-directly affiliated hospitals, the university and the hospital agree to jointly develop the medical administration, education, and research of the hospital as partners. The university undertakes a small number of teaching assignments and research tasks in the hospital with little participation in administration issues (Zhao Yang, Li Lei 2010).

Table 1-1 Differences between Directly Affiliated and Non-Directly Affiliated Hospital

| Type | Relationship with the University | Management Mode | Example |
|---|----------------------------------|---|-----------|
| Directly affiliated hospital of the university | Belonging | Vertical management by the university | HKU - SZH |
| Non-directly affiliated hospital of the university | Cooperation | Remain independent leading system, affiliation relationship, and fund channel | PKUSZH |

As a non-directly affiliated hospital, PKU contributes mainly on brand as well as limited technical guidance. It does not the original role of participating in hospital management, daily diagnosis and treatment. Therefore the university's philosophy based on discipline development is not will transfer and implemented in the hospital, making little improvements for the hospital.

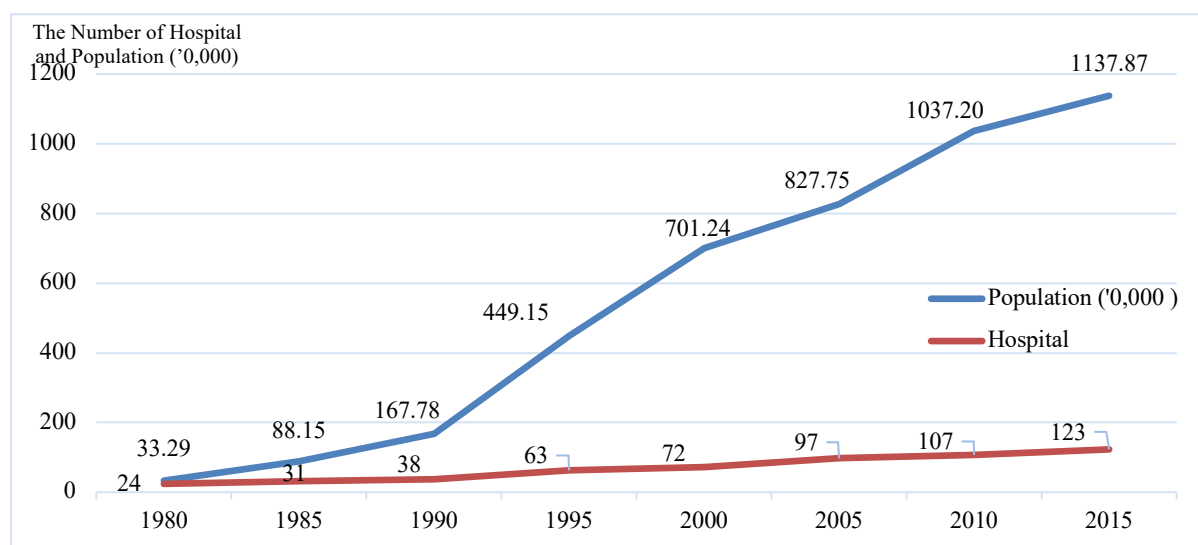
The not very successful and undesired cooperation mode in PKU-SZH made Shenzhen government more welcome HKU to establish its own affiliated hospital in Shenzhen. From the interview with Mr. TANG Jie, the former deputy mayor of Shenzhen Municipal Government who deeply participated into the establishment of HKU-SZH, the failure of PKUSZH offered lessons for the establishment and operation of HKU-SZH and made it a directly affiliated hospital. This has turned out to be another important mode in the medical reform and cooperation in GBA.

1.1.3. Establishment Background of HKU-SZH

In 2011, the Shenzhen government signed a contract with HKU, and HKU-SZH officially began its operation since 2012. The establishment of HKU-SZH met the common demands of both the University of Hong Kong (HKU) and the Shenzhen Government.

As the highest-ranked university in the GBA (25th in QS 2020) with strong programs in dentistry and medicine, HKU had long been wanted to build its own affiliated hospital to promote medical research and facilitate development in clinical medicine. However, the procedure in Hong Kong is very complicated to go through. Therefore, establishing an affiliated hospital in the Mainland would be a good alternative for HKU.

Figure 1-1 Growth in Population and the Number of Hospitals in Shenzhen (1980-2015)



Population figures for Shenzhen are measured in 10,000-person units

Source: Shenzhen Statistical Yearbook 2015

The Shenzhen government also proved to be very willing to cooperate with HKU on a hospital project. Shenzhen had been lacking a medical school even as it was seeking to introduce high-quality medical resources and meet the burgeoning city's increasingly urgent medical needs (see Figure 1-1). Being targeted as a high-tech hub by the central government, Shenzhen was experiencing urban development at a skyrocketing rate and a demographic boom as it became a destination for immigrants seeking employment. Figure 1-1 depicts the growing gap between the growth of Shenzhen's population and the growth rate of hospitals. To satisfy the city's medical needs, the Shenzhen government adopted the strategy of establishing a new hospital run by a university, which would become a university-affiliated hospital.

1.1.4. Research Questions

In view of the special and typical position of HKU-SZH in GBA medical cooperation, it is important to conduct in-depth research on this case, explore its experience and constraints in the operation process, so as to better improve the model of cooperative hospital and promote the development of medical cooperation in GBA.

Our research questions are as follows:

1. What is the current status of medical cooperation in GBA?
2. What is the current operational situation of HKU-SZH?
3. What constraints impede the fostering of medical cooperation?
4. What can we learn from the HKU-SZH case to improve medical cooperation in the GBA?

1.2. Client

The client of our project is the Arthur D. Little. As the world's first consultancy, Arthur D. Little has been at the forefront of innovation since 1886, offering innovative solutions to help clients deal with major disruptions.¹ Arthur D. Little is an acknowledged thought leader in linking strategy, innovation and transformation in technology-intensive and converging industries, playing a leading role in innovative projects, like pricing strategy redesign of high-speed train lines railways' offers in 2017, smart city strategy projects for Dubai & Stockholm in 2016 and IT transformation and master planning in key digital areas (Blockchain, Maintenance 4.0, Robotic process automation, broadband rollout, etc.) in 2015. The Guangdong-Hong Kong-Macao Greater Bay Area as an emerging bay area connecting the regions with different background of culture and polices presents the particular signification on region's cooperation, and this is in accord with the Arthur D. Little's focus on being innovation and delivering sustainable results to clients.

Mark Peacock is the Senior Manager responsible for business in Arthur D. Little including

¹ Information about the Singapore Heritage Society is taken from Arthur D. Little's webpage. See: <http://www.adlittle.com>

strategy & organization management, and technology & innovation management. Mr. Peacock helps to provide many suggestions and materials for our project, which are very valuable and instructive.

1.3. Research Method

For this project, we use a variety of research methods to study the medical cooperation in HKU-SZH as a case from different dimensions and put forward suggestions for promoting regional medical cooperation.

Firstly, the study uses the method of literature review. In order to summarize the development of existing research of HKU-SZH and explore the significance, the review focuses on the general medical cooperation models, medical cooperation in the GBA, and the role of HKU-SZH in the medical cooperation.

Secondly, the comparative analysis approach is adopted. As HKU-SZH is one of the Third-Class A Hospitals² in Shenzhen, the hospitals selected for horizontal comparison are general hospitals of the same level and size, including Shenzhen People's Hospital, Shenzhen Second People's Hospital, PKUSZH, Shenzhen Traditional Chinese Medicine Hospital and Shenzhen Maternal & Child Health Hospital, etc.

Thirdly, in terms of the data collection process, the data we used in this project includes both primary data and secondary data. Primary data is collected from in-depth interviews; Secondary data is collected from desk research including the official website of the HKU-SZH, the Hong Kong government and the Shenzhen government, as well as the official documents released by them. Relevant information and data are collected to show the whole picture of medical cooperation in the HKU-SZH.

Finally, the National Innovation System framework (NIS) and Logic model are applied in the data analysis stage. The Logic model guides us to target different factors across different evaluation stages. We focus on the resources the HKU-SZH has through the Input & Process evaluation, while the performance of the hospital is emphasized in the Output & Outcome evaluation. On the other hand, under the framework of NIS theory, the medical cooperation in the HKU-SZH is analyzed from four dimensions, personnel cooperation, capital cooperation, technical cooperation and policy cooperation. Five criteria, including availability, quantity, quality, sustainability and ease of integration, are used to evaluate each dimension with specific rating standards.

Based actors and dimensions from the two models above, we develop our own rating system

² Third-Class A Hospital is classified according to the current "Hospital Grading Management Measures" of China, which is the highest level in the classification of hospitals in mainland China. The main items for the application and assessment of the third-class A hospitals include medical service and management, medical quality and safety, technical level and efficiency.

to evaluate the cooperation performance. This rating system is used to identify the degree of completion of all the dimensions, and identify the best and worst performing dimensions so that we can provide targeted recommendations. By giving the score of each dimension in terms of different criteria, we can know the pros and cons of each dimension. As a consequence, each dimension will get a total score (average score) according to the analysis of five criteria. From the ranking of the four dimensions, deficiencies of the cooperation in the HKU-SZH, which is reflected with a low ranking, can be found and great significance should be attached to improve these dimensions. In the end, policy recommendations will be put forward according to the ranking of the four dimensions to make recommendations more focused.

2. Literature Review

Focusing on the medical cooperation in the GBA based on HKU-SZH, this study draws on, and contributes to, three streams of research that pertains to the following factors: the general medical cooperation models, medical cooperation in the GBA, and the role of HKU-SZH in the medical cooperation.

2.1. Medical Cooperation Models

There is no unified standard for the classification of medical cooperation model at present; a typical classification is to divide the types of domestic medical cooperation of into four categories: loose cooperation, hospital trusteeship, group hospital and joint-stock hospital (cf. Liu. 2014). (1) Loose cooperation puts much emphasis on technology and brand, including regularly providing professional guidance for partners, training medical staff, helping for remote consultation, sending experts to partners for operation guidance, etc. The operation mode of Peking University Shenzhen Hospital falls into this category. (2) Hospital trusteeship is essentially the separation of the ownership and management of the hospital. The property owner entrusts the management right of the hospital to the legal/natural person with management experience and management ability (cf. Tian et al. 2011). It can be further divided into "For-Profit Hospital Trusteeship" and "Supporting Hospital Trusteeship"(cf. Xu.2012). (3) The cooperation within group hospitals mainly includes six aspects: personal, capital, equipment, operation, supply, purchase and marketing cooperation (cf. Zhang.2007). The internal connection of the hospital group is either through branches or through connections of assets, technology, equipment and operation. At present, few hospital groups in China are linked by assets, but more by brand, technology and management (cf. Song.2001). (4) For the joint-stock hospital, different parties can share a certain proportion of the hospital through currency, technology or brand investment. The property right relationship of the hospital is clear and thus applies to the modern corporate governance structure. However, none of the above models is accurate for HKU-SZH. In terms of the relationship with Shenzhen municipal government, it can be considered as trusteeship; while for management mode, it has the characteristics of modern corporate governance structure to some extent; when it comes to the relationship with HKU, it can be classified as group operation. Therefore, the existing

experience of these single medical cooperation models cannot be directly applied to the research of HKU-SZH. The targeted in-depth research on this topic is still very inadequate.

2.2. Medical Cooperation in the GBA

At present, there are five modes of medical cooperation between Hong Kong and the mainland (cf. GAO et al.2019): (1) participating in the operation and management of public hospitals in the mainland. HKU-SZH is the only public hospital in the mainland that has participated in the operation and management of Hong Kong at present, which provides an example for the reform of public hospitals in the mainland; (2) Public private cooperation, including cooperation between private medical institutions or individuals in Hong Kong and public institutions or local governments in the mainland, to carry out various short, medium and long-term projects, such as personnel training and hospital management consulting services, which are conducive to the mainland's medical reform; (3) Private medical service refers to the extension of Hong Kong's private medical industry to the mainland. At present, several Hong Kong style medical institutions have successfully invested in the operation of 66 hospitals and clinics in the mainland; (4) academic exchanges, such as exchanges between doctors or medical professional institutions in the two places, including clinical technology and hospital management; (5) Other models include the business model of referring mainland patients to Hong Kong through Internet platform, but not directly providing medical services. Broadening the horizon, we put forward the more polices to the situation in GBA.

More detailed, the medical cooperation between Shenzhen and Hong Kong mainly includes the following three types: cooperative hospital, anesthesia crisis simulation training courses, and the study of the comprehensive community intervention mode of AIDS among high-risk groups (cf. Wang et al. 2016). (1) HKU-SZH is a typical example of medical cooperation, featuring a special medical service model based on Hong Kong's management experience, as well as a new governance structure that separates politics and affairs (cf. Yu. 2016). It was initially built to be a model for China's domestic public hospital reform (cf. Cui. 2016). (2) The anesthesia crisis management simulation training co-founded by Shenzhen and Hong Kong drew lessons from the mature courses and assessment system from the Chinese University of Hong Kong, filling in the gaps in domestic situation simulation training (cf. Feng et al. 2014). (3) A comprehensive community intervention activity for high-risk AIDs groups was jointly carried out by Shenzhen and Hong Kong. Series of publicity, education and intervention were carried out in the community to effectively prevent or reduce the spread of AIDS in both cities (cf. Zhang et al. 2010). Among these forms of medical cooperation, the cooperative hospital is most in-depth and typical. However, according to the existing literature, the research on HKU-SZH focuses more on factual description, and lacks analysis and discussion on its operating outcome, strength and weakness, as well as generalizability.

2.3. HKU-SZH in the Medical Cooperation

In our research, we found that many scholars put HKU-SZH in large backgrounds, such as the general practice attributes in Guangdong, the doctor-patient relationship in Chinese public hospital, and the regulation of the public hospital in China (cf. Liang et al. 2016; Yan 2015; Song 2012). In these studies, HKU-SZH is utilized as a small case with some facts, failing to analyze this case deeply. However, some studies closely related to the topic of HKU-SZH have paid some attention to the several parts of the operation of HKU-SZH, such as inpatient package charge on surgical diseases; patient safety culture and general practice system in HKU-SZH (cf. Li et al. 2017; Xu et al. 2017; Lin 2016). They explored different aspects of the internal operation in HKU-SZH, but little further analysis on the higher level including public hospital reform and cross-border medical cooperation was involved. As a result, these studies (1) apply oversimplified approach to analyze the case of HKU-SZH focusing too narrowly on certain medical management topic and (2) are limited in the advanced management method in the internal operation of HKU-SZH, missing the important lessons from HKU-SZH in terms of medical cooperation in GBA and public hospital reform in China.

The gaps detailed above motivated the present research. Our investigation demonstrates a comprehensive picture of the cooperative hospital by analyzing the current operation situation, advantages and constrains of HKU-SZH. We also shed light on the lessons that can be learnt to further promote the medical cooperation in GBA. Methodologically, our study fills the aforementioned gaps by breaking down the mid-level cross-regional cooperation into different factors to conduct separate evaluation.

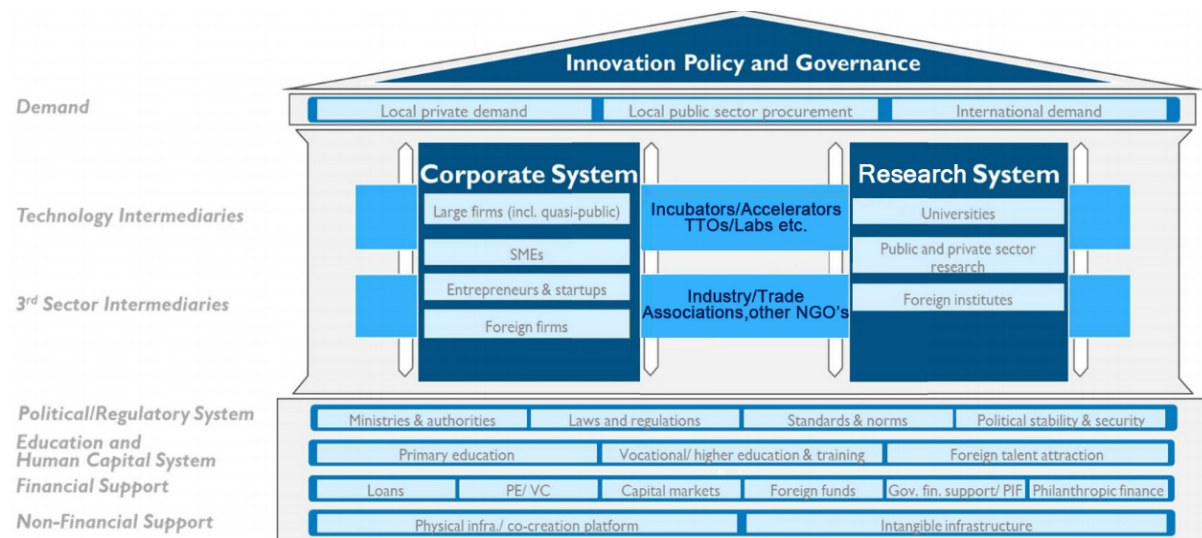
3. Analysis

3.1. Analytical Framework-The National Innovation System

Establishing HKU-SZH required extensive cooperation among a wide range of stakeholders, including HKU, the Shenzhen government, and the hospital itself. We apply the national innovation system (NIS) framework to study the interactions among identify factors that influence medical cooperation and the operation of the hospital.

Based on the innovation and entrepreneurship ecosystem, we focus on relevant innovation actors and the innovative flow between these actors. On the one hand, the NIS identifies key innovation actors and highlights their linkages. These actors are primarily organizations created with the explicit purpose of promoting or implementing innovation, including government agencies, universities, research and development (R&D) organizations, private sector organizations, and industrial and professional organizations. On the other hand, the innovative flow depends on innovative resources, including the political/regulatory system, the educational and human capital system, and both financial and non-financial support.

Figure 3-1 National Innovation System (NIS)



Source: Arthur D. Little

According to the NIS theory, we focus on four types of innovative flow—personnel, capital, technology, and policy/institution—as four dimensions with reference to which we can evaluate medical cooperation between three actors: HKU-SZH, HKU, and the Shenzhen government.

Personnel: Human resources, including doctors, nurses, and related researchers; represent a key element of hospital operations. Evaluation along this dimension involves investigating both the human resources needed to establish the hospital and interaction between personnel

among the three principal actors.

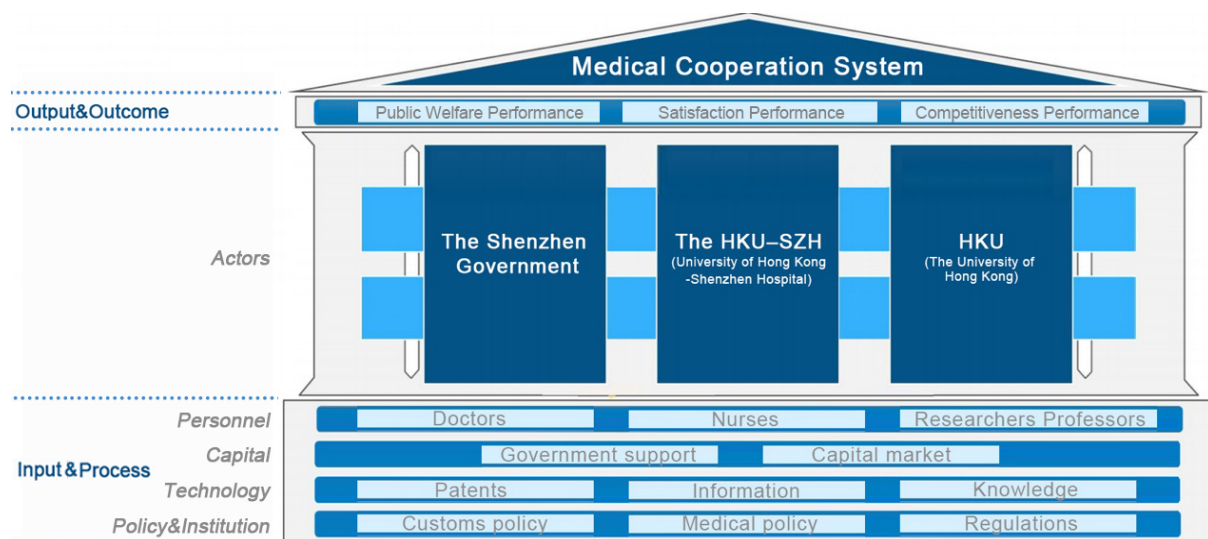
Capital: Capital is another key element of hospital operations. The evaluation of this dimension involves analyzing the funding required to establish the hospital, the capital required to maintain continuous operations, and the flow of funds between the three principal actors.

Technology: Technology plays a significant role in the future development of the hospital. Evaluation based on this dimension involves exploring both formal technology cooperation, including research results and patent sharing, and informal cooperation, such as flows of medical knowledge and information.

Policy/Institution: Evaluation based on this dimension involves analyzing the impact of policies and hospital regulations on medical cooperation between the three principal actors.

We focus mainly on evaluative research based on the case study of HKU-SZH. In analyzing each section, we rely on the four dimensions identified above - personnel cooperation, capital cooperation, technology cooperation, and policy/institution cooperation.

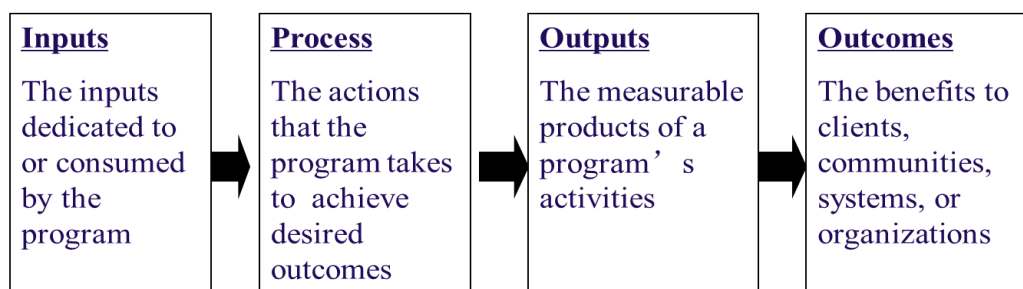
Figure 3-2 Medical Cooperation System



3.2. Analytical Model -The Logic Model

After applying the NIS framework to HKU-SZH, the study will evaluate relevant policies from the perspective of inputs, processes, outputs, and outcomes, based on the Logic Model. Evaluation means determining how successfully the project followed the strategy laid out in the Logic Model. During the policy evaluation, we stress process evaluation that monitoring the efficiency of the process from the inputs to the outputs.

Figure 3-3 The Logic Model



- Inputs comprise the various resources needed to run the program: money, facilities, clients, program staff, volunteers, etc.
- Processes determine how program services are delivered: clients are counseled, children are cared for, art is created, association members are supported, etc.
- Outputs equal units of service: the number of clients counseled, children cared for, artistic pieces produced, members enrolled, etc.
- Outcomes are the impacts on clients who receive the services, improved mental health, safe and secure development, richer artistic appreciation of and perspectives on life, increased effectiveness among members, etc.

3.3. Analytical Method

We evaluate medical cooperation at HKU-SZH using a mix analysis. The four dimensions of medical cooperation (personnel cooperation, capital cooperation, technology cooperation, policy/institution cooperation) are assessed based on five criteria (availability, quantity, quality, sustainability, ease of integration). This hybrid methodology enables us to measure the relationship between the status quo of medical cooperation and the desired state. We use the results of this phase to derive recommendations for action. The mixed-methods approach is also suitable for comparing distinct dimensions against chosen criteria to identify areas with potential for continuous improvement and guidance for action.³

We conduct our evaluation in part based on the following five criteria:

Availability: Ease of access to critical resources

Quantity: The quantity and adequacy of resources that HKU–SZH receives

Quality: The quality of resources, whether they are applicable and effective

³ Iondiau A, Cleven A, Rohner P. Towards a Hospital Cooperation Maturity Model-Construction and Evaluation of a Maturity Model and a corresponding Tool for the Identification of Challenges and Success Factors for Cooperation in the Hospital Sector [J]. International Journal of Health Information Management Research, 2013, 1(1): 4–14.

Sustainability: The sustainability of resource supplies

Ease of Integration: The ease with which resources are integrated by the three actors (HKU-SZH, HKU, the Shenzhen Government) and the smoothness of cross-border flows of resources

We analyze each cooperation dimension according to these five criteria to gauge the ability to cooperate and the degree of completion. We give each dimension a score under each criterion and calculate the average and derive the final scores. Relevant information is obtained through second-hand and first-hand data from desk research, and interviews. Figure 3-4 lists the five criteria that we have identified as necessary to improve the ability to cooperate. Figure 3-5 lists the detailed reference for rating.

Figure 3-4 Identified Criteria

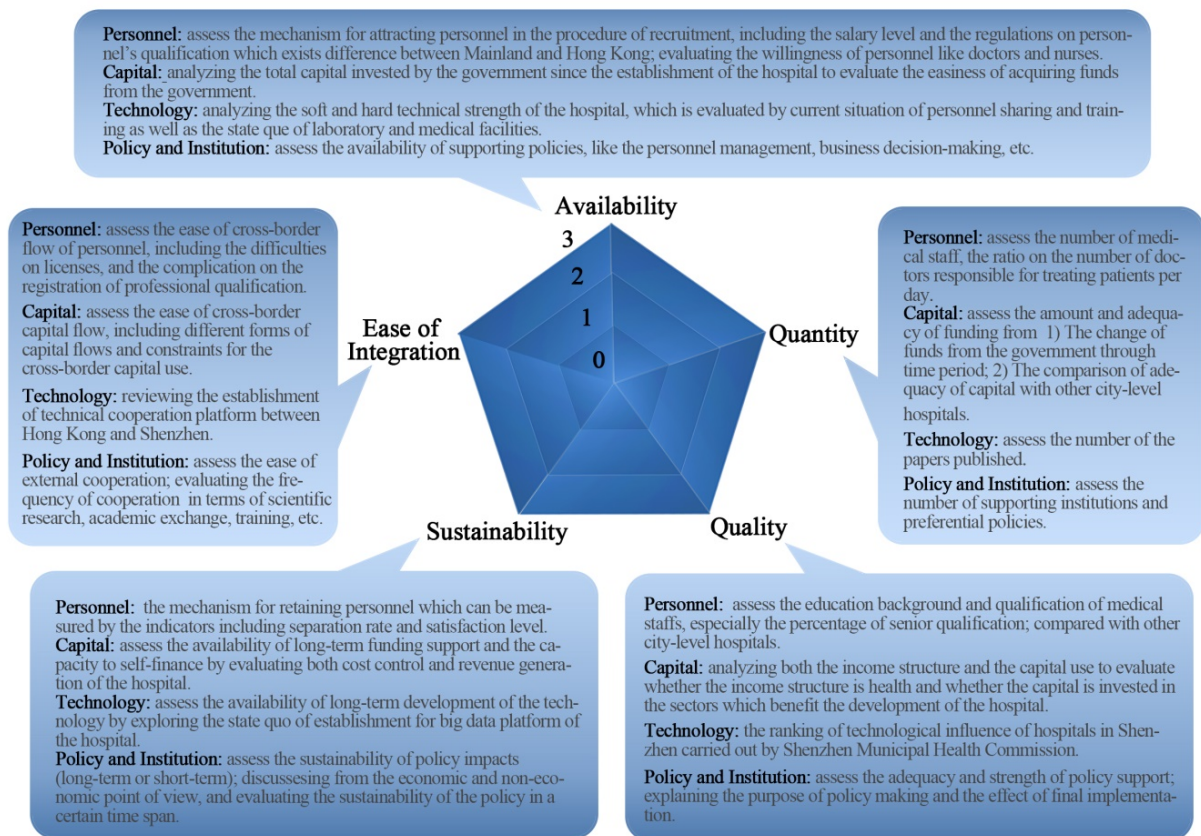


Figure 3-5 Rating Standard



3.4. Evaluation

3.4.1. Input & Process

3.4.1.1. Personnel Cooperation

The personnel refer to the staff in HKU-SZH including the doctors, nurses, medical technician and administrative staff, and the doctors are divided into five levels including senior consultant doctor, consultant doctor, deputy consultant doctor, senior doctor and resident doctor. The salary system is based on the position which means the doctor at the same position owns the same wages, and accompanied with the performance wage. More specifically, fixed salary accounts for 70% (basic salary accounts for 50%, post allowance accounts for 20%) and performance salary accounts for 30%. Referring to the salary system standards of Hong Kong and international public hospitals and considering the salary situation in mainland China, HKU-SZH sets up a salary scale for promotion for each post, in which doctors are divided into 24 salary levels, and each salary level corresponds to a fixed salary standard.

Availability

We measure the availability of the difficulties of recruitment. Firstly, the salary level. The University of Hong Kong - Shenzhen Hospital has referred to the model of hospitals in Hong Kong, where the staff is paid on the job qualification. Taking the doctors for example, they classified as consultants, associate consultants, and resident doctors. According to the survey by Geekheal⁴, the average annual income of doctors is 560,000 yuan, the highest level can reach 900,000 or 1 million, and the minimum number is 200,000 or 300,000 yuan. Meanwhile, the level of staff salary is overall rising from 246,000 yuan in 2016 to 277,100 yuan in 2018, reaching the rise of 12.64%.

Table 3-1 Personnel Expenditure in HKU-SZH (Thousand yuan)

| Indicators | 2016 | 2017 | 2018 |
|------------------------------------|------------|------------|------------|
| Payrolls | 530,950.00 | 600,157.00 | 738,024.00 |
| Social security expenditure | 52,440.00 | 61,428.00 | 67,781.00 |
| Housing fund expenditure | 27,910.00 | 31,793.00 | 33,778.00 |
| Spending on housing | - | 7,045.00 | - |
| Other expenditures | - | 4,066.00 | - |
| Salary in total | 611,300.00 | 704,489.00 | 839,583.00 |
| The total number of | 24,850.00 | 29,230.00 | 30,300.00 |
| Salary per person | 246.00 | 241.02 | 277.09 |

Source: Information Disclosure of HKU-SZH

⁴ Geekheal.com. (2020). 重度解密港大深圳医院：在中国办一所好医院很难吗？ - 奇点-链接全球创新医疗. [online] Available at: <http://www.geekheal.com/gangdashenzheniyuan/>.

According to Geekheal, the income of doctors in Hong Kong is 8-10 times the social average income, and the average salary of medical staff in HKU-SZH is 9 times the social average salary of Shenzhen, which is equivalent to more than 500,000 yuan. Although the salary seems charming and competitive in the labor market, the high tax rate makes the actual money in hand greatly reduced. In mainland public hospitals, some doctors may have a considerable amount of gray income, even in some elite Third-Class A Hospitals where the original income is far higher than the average level of public hospitals. This phenomenon is rare in HKU-SZH because the payment of doctors has nothing to do with prescribing and testing, making it possible for hospitals to operate more transparently without big prescriptions or "red packets". Therefore, the so-called "high salary" seems less attractive to talents, especially senior doctors.

Secondly, the qualification. Doctors in mainland public hospitals are mostly from public institutions and occupied the officially budgeted posts. Therefore, it is hard for them to get out of the system. For example, when establishing HKU-SZH, the government has arranged staff from the Shenzhen medical system, but most of them were eventually returned to their original units. Because the qualification in HKU-SZH is different from other mainland hospitals, the medical staffs are divided into consultant, deputy consultant, and resident doctor, which means the doctors have to give up the original professional title to work in HKU-SZH. It is a huge change for them because they are afraid of not being able to go back to the mainland system after leaving HKU-SZH.

In all, based on the less competitive salary due to high tax and complicated rules on qualification between the Mainland and Hong Kong, the mechanism to access the medical workers is slightly attractive. Therefore, we assign a score of 1 to the availability of personnel.

Quantity

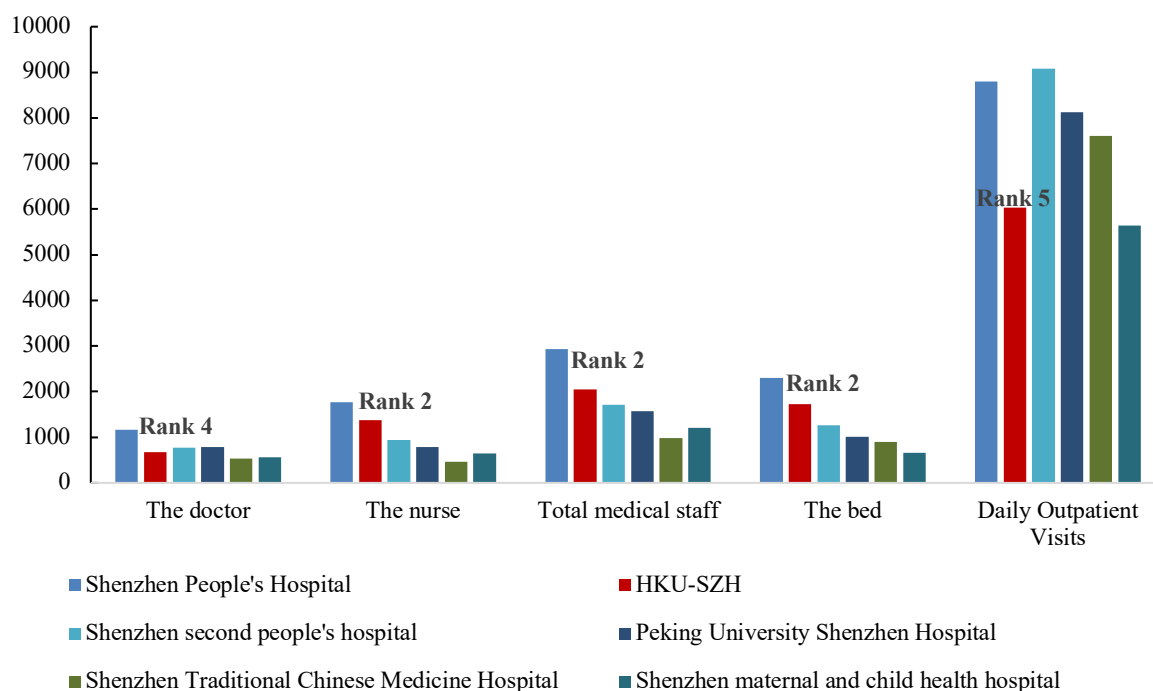
We choose the same size Third-Class A Hospitals in Shenzhen to compare with HKU-SZH. They are respectively PKUSZH, Shenzhen People's Hospital, Shenzhen Second People's Hospital, Shenzhen Traditional Chinese Medicine Hospital, and Shenzhen Maternal&Child Health Hospital.

Table 3-2 The Quantity of Medical Staff among Six Hospitals

| Indicators | HKU-SZH | PKUSZH | Shenzhen People's Hospital | Shenzhen Second People's Hospital | Shenzhen Traditional Chinese Medicine Hospital | Shenzhen Maternal & Child Health Hospital |
|--|---------------|--------------|----------------------------|-----------------------------------|--|---|
| Doctor | 667 | 784 | 1158 | 774 | 528 | 558 |
| Nurse | 1380 | 787 | 1773 | 939 | 461 | 652 |
| Total Medical Staff | 2047 | 1571 | 2931 | 1713 | 989 | 1210 |
| Medical Beds | 1720 | 1005 | 2300 | 1259 | 900 | 656 |
| Daily Outpatient Visits | 6029 | 8120 | 8800 | 9084 | 7600 | 5640 |
| Number of Doctors responsible for treating patients (per day) | 11.06% | 9.66% | 13.16% | 8.52% | 6.95% | 9.89% |

Source: Information Disclosure of Shenzhen Government Online

Figure 3-6 The Rank of HKU-SZH in Six Hospitals



We evaluate the six hospitals to find out whether the number of medical staff in HKU-SZH and the quantity of medical workers can meet the demand of patients. Through comparison, we find HKU-SZH occupies high rank on medical workers, especially nurses, ranking the second in six hospitals. While this hospital owns sufficient beds, ranking the second, but the daily outpatients' visit is relatively low, ranking the fifth. Therefore, owning the high number of medical staff and beds, and low number of patients, the number of doctors who are responsible for treating patients per day is 11.06%, occupying the second in the six hospitals. This proves that quantity of HKU-SZH is relatively high and enough to meet the demand of daily patients.

In all, those figures show greatly sufficient medical staff and highest number and percentage in HKU-SZH. Therefore, we assign a score of 3 to the quantity of personnel.

Quality

We evaluate the quality of personnel from the proportion of senior professional titles and education background of medical staff.

1) Educational background. According to the official record, the doctors and postgraduates in 2019, occupy 18% of all medical staff, the undergraduates account for 60%. The highly educated talents occupy more than two-thirds of all staff, which approves the high quality of the personnel in this hospital. Additionally, the hospital provides employees with planned continuous training. As of December 2018, the hospital has provided employees with 625 internal medical professional training sessions (72,073 person-times), 242 general training sessions (28,920 person-times), and 3,528 external medical professional training sessions of (7,417 person-times). With the help of the external exchange platform of the University of

Hong Kong, the hospital provides some employees with learning opportunities and medical training in Hong Kong and overseas, assisting them to obtain professional qualifications recognized from home and abroad.

2) Senior qualification. Shown in the table below, there are 45 chief physicians and 118 associate chief physicians in HKU-SZH, making up 24.44% of all doctors. For the other five hospitals, the proportion of senior physicians occupies from 40% to 60%, greatly higher than the proportion in HKU-SZH. In senior qualification, HKU-SZH ranks last.

Table 3-3 The Number of Senior Qualifications among Six Hospitals

| Indicators | HKU-SZH | PKUSZH | Shenzhen People's Hospital | Shenzhen Second People's Hospital | Shenzhen Traditional Chinese Medicine Hospital | Shenzhen Maternal & Child Health Hospital |
|----------------------------------|------------|------------|----------------------------|-----------------------------------|--|---|
| Chief Physician | 45 | 232 | 241 | 98 | 148 | 75 |
| Associate Chief Physician | 118 | 250 | 312 | 220 | 108 | 144 |
| Physicians in Total | 163 | 482 | 553 | 318 | 256 | 219 |
| The Doctors | 667 | 784 | 1158 | 774 | 528 | 558 |
| Proportion of Physicians | 24.44% | 61.48% | 47.75% | 41.09% | 48.48% | 39.25% |

Source: Information Disclosure of Shenzhen Government Online

However, since the Hong Kong doctors are not classified according to the professional titles of the mainland, we need to add about 100 Hong Kong doctors which are the general situation. Thus, the proportion of doctors can reach 39.43% (still at the end). Again, due to the differences in the system, doctors with high professional titles are reluctant to come to HKU-SZH.

Table 3-4 The Staff of Senior Qualifications in Six Hospitals

| Personnel | 2017 | 2018 |
|--|------|------|
| Doctors from HK | 118 | 110 |
| Doctors from the Mainland | 611 | 546 |
| Other Medical Staff from the Mainland | 2194 | 2374 |

Source: HKU-SZH official website

In all, based on the educational background with highly educated talents and proportion of senior professional titles which relatively low in HKU-SZH, the percentage of high position of education and qualification achieve the moderate level. Therefore, we assign a score of 2 to the quality of personnel.

Sustainability

We evaluate the sustainability of personnel from the separation rate and satisfaction level of medical staff. HKU-SZH continue to improve staff's salary and benefits by rising the scale and level of performance salary, that is, increasing subsidies and allowances such as subsidized meals and night shift transportation. These measures increase employee's income, as well as

stimulate their enthusiasm. Therefore, compared to 2017, the hospital year turnover rate decreased from 13.10% in 2017 to 10.20% in 2018, and employee satisfaction level increased to from 67.4% in 2017 to 71.8% in 2018.

Table 3-5 The Indicators of Separation Rate and Satisfaction Level

| Indicators | 2017 | 2018 |
|--------------------|--------|--------|
| Separation Rate | 13.10% | 10.20% |
| Satisfaction Level | 67.40% | 71.80% |

Source: Information Disclosure of HKU-SZH

Therefore, based on the decreasing separation rate and increasing satisfaction level of medical staff, the mechanism for retaining personnel relatively works, so we assign a score of 2 to the sustainability of personnel.

Ease of Integration

According to the Human Resource Report of HKU-SZH, there are about 100 doctors in Hong Kong. According to the Closer Economic Partnership Arrangement (CEPA)⁵, the professionals of the hospitals like HKU-SZH can be arranged to obtain the mainland license through the green channel, but the waiting time is longer than normal, and the procedure is more difficult to obtain the license. Also, in terms of talent introduction, Hong Kong doctors can only register one hospital or outpatient department in the Mainland, which needs to be re-registered once a year and does not support multi-point practice. Meanwhile, limitations and problems such as time for entry-exit customs clearance have reduced Hong Kong Doctors' willingness to practice medicine in the Mainland to a certain extent.

Therefore, based on the difficulties in the integration of personnel, the access of licenses and great obstacles on registration is slightly impeded, so we assign a score of 2 to the intergration of personnel.

3.4.1.2.Capital Cooperation

The operation model of HKU-SZH should be considered in the first place when evaluating the capital use in HKU-SZH. The establishment of HKU-SZH is similar to Operations & Maintenance (O & M) (Huazhen Huang 2017). O & M, a type of Public-Private Partnership, is a cooperation model between the government and private sector, in which the government entrusts the operation and maintenance of public assets to social capital or project companies, but the government retains ownership of assets. HKU-SZH was founded by the Shenzhen Municipal Government with a total original investment of 4 billion yuan. In the preliminary

⁵ CEPA is an agreement signed by China's Ministry of Commerce and the Hong Kong SAR on June 29, 2003. It mainly covers trade in goods, services and investment facilitation. The goal of the agreement is to eliminate tariff and non-tariff barriers and improve the level of economic and trade cooperation between the Mainland and Hong Kong to achieve common development.

period, the operating costs of the hospital are mainly subsidized by the Shenzhen Government with the introduction of the modern management model by the University of Hong Kong. HKU-SZH is operated by a management team jointly established by Shenzhen Municipal Government and the University of Hong Kong with ownership belonging to Shenzhen Municipal Government. Based on this model, funding for HKU-SZH mainly include three sources: 1) government fiscal allotment; 2) operating revenue; and 3) social donations. As the social donations account for a little part of the revenue, the report focuses on government fiscal allotment and operating income in terms of the analysis of capital. According to the Framework Agreement on Hong Kong/Guangdong Co-operation, the capital for HKU-SZH construction and preliminary operations (5 years) mainly comes from the Shenzhen Municipal Government. After a five-year term (starting from 2017), HKU-SZH will embark on the road of "financial subsidy self-financing" as other public hospitals in Shenzhen.

Availability

We focus on the funds from the Shenzhen Municipal Government in terms of the availability criterion to find out whether the capital input from the government in the medical cooperation is sufficient or not. The Shenzhen Municipal Government implements a "Special subsidies" financial subsidy mechanism for HKU-SZH. The basic construction, equipment purchase, and informatization construction of HKU-SZH are all included in the annual government fixed asset investment plan, and fully is guaranteed by the government. The start-up funds, initial operating funds, necessary medical service subsidies, essential subject funds, and public health funds are incorporated into the hospital's annual budget and the Shenzhen Municipal financial arrangements. The subsidies are provided according to the quantity, quality, and public satisfaction of basic medical and health services (including outpatient and inpatient) provided by the hospital, and link to the performance evaluation results of the hospital. According to the public information from Department of System Reform of the State Council, by the end of 2018, the Shenzhen Municipal Government had allocated 1.58 billion yuan in financial subsidies to HKU-SZH, including a start-up fee of 240 million yuan, an initial operating subsidy of 890 million yuan (including personnel, utilities, and property costs), and a basic medical service subsidy of 450 million yuan. Especially, in the early age of the operation, fiscal allotment accounts for a large part of the hospital's total income, the proportion of which is much higher than that of the same level Third-Class A hospital in Shenzhen (see Table 3-6).

Table 3-6 Ratio of Fiscal Allotment to Total Income of Third-Class A Hospitals in 2015

| Index | HKU-SZH | PKUSZH | Shenzhen People's Hospital | Shenzhen Second People's Hospital | Shenzhen Traditional Chinese Medicine Hospital | Shenzhen Maternal & Child Health Hospital |
|--------------|---------|--------|----------------------------|-----------------------------------|--|---|
| Ratio | 40.79% | 27.71% | 24.26% | 28.27% | 26.80% | 25.74% |

Source: Information Disclosure of Shenzhen Municipal Health Commission

Therefore, we assign a high score of 3 to the criterion of availability because it's easy for the hospital to get funds from the Shenzhen Municipal Government since its establishment.

However, the Shenzhen government adjusted the financial subsidy mechanism in the later period according to the Framework Agreement on Hong Kong/Guangdong Co-operation. We will clarify this situation when evaluating the sustainability criterion.

Quantity

First of all, we conduct a vertical comparison of the annual financial situation of HKU-SZH from 2015 to 2018 (see Table 3-7). From 2015 to 2018, the ratio of financial appropriations received by hospitals to total revenue has decreased year by year. In 2015, government fiscal allotment accounted for a large proportion of the total inflow of hospital capital, reaching 40.79%, which ranks at the forefront of the Third-Class A Hospitals. However, in 2017, the fiscal appropriation was almost halved in amount, and the proportion of total revenue also decreased significantly, compared with 2016. The reason for the decrease can be explained by the clause from the Framework Agreement on Hong Kong/Guangdong Co-operation that the government will reduce investment in HKU-SZH after five initial years of the hospital operation. Consequently, the hospital started to be responsible for its profits and losses, which make it more difficult to make ends meet. Although the operating revenue of HKU-SZH has been increasing year by year, leading to a slight increase of revenue. Overall, the total capital HKU-SZH can make use of increase gradually. But it depends heavily on the operation revenue of the hospital in the future.

Table 3-7 Annual Revenue of HKU-SZH 2015-2018 (Ten thousand yuan)

| Year | 2015 | 2016 | 2017 | 2018 |
|--------------------------|------------|------------|------------|------------|
| Fiscal allotment | 50,368.82 | 50,449.54 | 26,522.77 | 25,855.23 |
| Proportion | 40.79% | 33.03% | 15.76% | 12.88% |
| Operating revenue | 72,541.82 | 101,388.22 | 134,913.26 | 171,216.03 |
| Proportion | 58.75% | 66.38% | 80.16% | 85.30% |
| Other revenue | 557.71 | 903.13 | 6,872.88 | 3,655.35 |
| Proportion | 0.45% | 0.59% | 4.08% | 1.82% |
| Total | 123,468.35 | 152,740.90 | 168,308.91 | 200,726.61 |

Source: Information Disclosure of Shenzhen Municipal Health Commission

Next step, we conducted a horizontal comparison of Third-Class A Hospitals of the same level in Shenzhen. According to the latest data disclosed (see Table 3-8), the ratio of financial allocation to the total income of six hospitals in 2018 reached to 16.60% at an average level. The financial allocation obtained by HKU-SZH only accounts for 12.88% of total revenue, which is at a relatively low comparing with other hospitals. Nevertheless, the hospital still achieved a balance of payments through higher operating income for the first time in 2018. In conclusion, even though the Shenzhen government has invested a lot in the early-stage operations, HKU-SZH barely break even in recent year. Due to the innovative operational model, the future of HKU-SZH is full of uncertainty.

Table 3-8 Annual Revenue of Shenzhen Public Hospital Management Center in 2018 (Ten thousand yuan)

| Index | HKU-SZH | PKUSZH | Shenzhen People's Hospital | Shenzhen Second People's Hospital | Shenzhen Traditional Chinese Medicine Hospital | Shenzhen Maternal & Child Health Hospital |
|--------------------------|------------|------------|----------------------------|-----------------------------------|--|---|
| Fiscal allotment | 25,855.23 | 40,466.48 | 75,134.74 | 72,214.79 | 30,978.50 | 20,179.83 |
| Proportion | 12.88% | 12.33% | 17.65% | 23.95% | 18.37% | 14.39% |
| Operating revenue | 171,216.03 | 279,859.68 | 350,624.48 | 228,859.97 | 131,496.35 | 119,055.94 |
| Proportion | 85.30% | 85.28% | 82.35% | 75.91% | 77.96% | 84.87% |
| Other revenue | 3,655.35 | 7,828.75 | - | 419.83 | 6,188.47 | 1,040.81 |
| Proportion | 1.82% | 2.39% | - | 0.14% | 3.67% | 0.74% |
| Total | 200,726.61 | 328,154.90 | 425,759.22 | 301,494.59 | 168,663.33 | 140,276.58 |

Source: Information Disclosure of Shenzhen Municipal Health Commission

To sum up, we are slightly concerned about the sufficiency of capital in HKU-SZH with a low proportion of fiscal allotment. Thus, we assign a score of 2 to the quantity of capital.

Quality

First of all, we evaluate the quality of capital acquisition based on the source of funding to see whether it is a health income structure. Regardless of the government's financial allotment, the operating income of HKU-SZH has increased year by year with the increase of its proportion in total revenue. Although the Shenzhen Municipal Government has reduced its investment, HKU-SZH can still achieve a revenue and expenditure surplus in 2018. Secondly, from the perspective of the use of capital, where the hospital spends its revenue is a good indicator to evaluate whether the use of capital is of high quality. HKU-SZH invested most of its income in the medical and health sector and the proportion of investment always ranked first in other hospitals of the same level. The high investment in medical care indicates that the capital is used in the critical sector and the hospital pays attention to the development of hospital medical standards.

Above, the income structure is slightly unhealthy. Therefore, we assign a score of 2 to the quality of capital.

Sustainability

There exist certain challenges in the cost control of the hospital. HKU-SZH has high labor costs. Firstly, salary expenditure accounts for about 40% of the entire hospital expenditure at present. The average annual salary of a doctor in HKU-SZH is the highest one among the same level hospitals in Shenzhen. Secondly, the management training labor costs of Hong Kong experts in Shenzhen are also high. The high salary of doctors is a significant factor for the costs of hospital operation in the preliminary period. The above two factors lead to excessive cost burdens on the hospitals. On the other hand, the hospital tries to increase the hospital's operating revenue through the profit of special-need service from international medical centers. In Hong Kong, public hospitals managed by the Hong Kong Hospital Authority receive a large

amount of government funding each year. As a result, Hong Kong citizens pay very little to see a doctor in public hospitals. On the contrary, the subsidies from the government in Shenzhen account for 17% of the total revenue averagely of each hospital due to the universal medical insurance scheme. Consequently, patients need to pay most of the costs outside the social insurance scheme and are unwilling to afford the high price in HKU-SZH. As the government investment decreases, HKU-SZH tries to provide special-need medical services to patients with high income such as some international patients to subsidize the expenditure and research project. However, the relevant provisions of the new medical reform in 2009 assert that the special medical service provided by public hospitals should not exceed 10% of all medical services. Public hospitals with an excessively high proportion of special-need medical services have been widely criticized by society for crowding out public medical resources, which is considered to be contrary to public welfare.

We are concerned about the operation status of HKU-SZH in the future and it is slightly unavailable for long-term funding support and self-finance of the hospital. Thus, we assign a score of 1 to the criterion of sustainability of capital.

Ease of integration

The University Grants Committee (UGC) stipulates that UGC's funding for HKU cannot be used for HKU-SZH. Whereas, in order to realize the cross-border medical payment, the Hong Kong Elderly Health Care Voucher Scheme has been promoted in HKU-SZH. As a matter of fact, the cross-border circulation of healthcare vouchers is the cross-border of government financial funds. By the end of December 2018, there were more than 113,000 Hong Kong residents admitted to HKU-SZH. The Health Care Voucher Scheme benefited a total of 15,000 people.⁶ However, currently, healthcare vouchers can only be used for outpatients, not for inpatients and other hospitals opened by Hong Kong institutions in the Mainland, making it difficult for Hong Kong residents to see doctors in the Mainland. Moreover, Hong Kong older adults who live in the Mainland often choose to return to Hong Kong for medical treatment. First, they lack confidence in the Mainland medical system. Second, they pay less in a public hospital in Hong Kong.

Although the government has created different forms of cross-border capital, there are still some constraints for the cross-border flow of capital and patients, which impede the integration of capital. It's slightly difficult for cross-border of capital flow, thus we assign a score of 2 to the ease of intergration of capital.

3.4.1.3. Technology Cooperation

For hospitals, the application of technology to solve practical problems in clinical work is an

⁶ Finance.sina.cn. 2020. 大湾区圆桌第二期: “问诊”大湾区医疗: 要政策, 要人才, 还是要标准? . [online] Available at: <<https://finance.sina.cn/2019-08-07/detail-ihytcitm7365025.d.html>>

important means of discipline construction and talent training, and the most fundamental guarantee for the continuous, stable and rapid development of hospitals.

Availability

In terms of talent sharing, all department heads of the hospital are professors of the University of Hong Kong. Experts from HKU and Queen Mary Hospital of Hong Kong come to the hospital to participate in clinical diagnosis and treatment, teaching and strictly control the quality of teaching.

From the perspective of talent training, HKU-SZH provides a video link platform shared with HKU and Queen Mary Hospital to watch academic meetings, case discussions and skill operations in real time. By virtue of the platform advantages of HKU and Queen Mary Hospital, HKU-SZH will send outstanding resident doctors to study in Hong Kong to broaden their vision. HKU-SZH has jointly signed the "Shenzhen-Hong Kong Specialist Doctor Training Program" with HKU, the Hong Kong Academy of Medicine and the Shenzhen Municipal Commission of Health and Family Planning to jointly cultivate specialist medical talents and set up the "Shenzhen-Hong Kong Medical Specialist Training Center".

However, the recruitment of clinicians is dominated by mainland doctors, but the group is not included in the training system of HKU. According to the survey, it has been criticized so far because most people believe that Hong Kong's medical science and hospital's diagnosis and treatment level are not matched. Objectively speaking, doctors in HKU-SZH are mainly from Shenzhen or other areas of mainland, but they can't be included in the training system of HKU, so there are restrictions on the overall improvement of doctors' scientific research ability.

HKU-SZH has two municipal key laboratories and two municipal engineering laboratories. In 2018, the public service platform for drug clinical trials in Shenzhen was newly approved. The Shenzhen Clinical Medical Research Center for liver diseases was included in the first batch of municipal clinical medical center construction units in Shenzhen and became the core member unit of the West China Clinical Research Center for geriatrics in Sichuan Province. HKU-SZH is one of the research bases of HKU in Shenzhen. It can share the research facilities of the Li Kashing Medical College of HKU.

Taking the oncology department as an example, in January 2015, the cancer center added the radiotherapy department, equipped with the most advanced linear accelerator in Shenzhen and fully matched with the most advanced facilities after loading treatment machine, stereotactic treatment system, CT simulator, treatment plan and information management system.⁷

The availability of technology can be measured by software and hardware, which can be presented by the availability of personnel and facilities of the hospital. Due to the late

⁷ Source: HKU-Shenzhen Hospital web. Available at:

https://www.hkuszh.org/KindEditor/attached/file/20170704/20170704101512_2333.pdf

construction time of the hospital compared with the hospitals at the same level, the hardware facilities of HKU-SZH are complete and advanced. Due to the cooperative office system, doctors from Hong Kong and students participating in clinical study participate in scientific research cooperation to a relatively high degree. Due to the large number of mainland doctors recruited and the fact that these doctors are not included in the training system of medical school of HKU, there are certain obstacles in the access of personnel to science and technology. Therefore, we assign a rate of 2 to availability of technology cooperation.

Quantity

From 2012 to 2017, HKU-SZH published 318 papers, including 120 papers included in SCI and 198 papers published in domestic journals as the first author or corresponding author. The hospital has applied for 5 national utility model patents, including 5 authorizations; 9 national invention patents, 1 authorization and 1 software copyright.

During 2015 to 2019, PKUSZH has won more than 100 scientific research projects at or above the provincial level, published more than 1700 papers, including more than 470 papers included in SCI; more than 720 authorized patents; more than 10 awards at all levels, including one second prize of natural science of the Ministry of Education, one first prize of natural science of Guangdong Province, two third prizes of Guangdong science and technology progress award, and two Chinese medical science and technology awards.⁸

From 2016 to 2019, Shenzhen Second people's Hospital achieved fruitful results in basic medical research and translational medical research, published 19 professional papers in internationally renowned journals, 584 SCI papers, including 156 SCI papers in 2018; published a number of monographs with high academic value in well-known publishing houses; and obtained a number of provincial and municipal scientific research results and national invention patents.⁹

It can be seen that compared with the public hospitals of the same level, the output of academic achievements of HKU-SZH is not at the top of the pyramid, so we assign a rate of 1 to the quantity of technology.

Quality

According to Shenzhen Municipal Health Commission, academic impact rankings of hospitals in Shenzhen including 29 disciplines. The table below shows the 1st place of each discipline, HKU-SZH is not on the list. The influence of scientific research from Shenzhen People's Hospital (12), Peking University Shenzhen Hospital (4), The Second People's Hospital of Shenzhen (4) and The Third People's Hospital of Shenzhen (3) are outstanding.

⁸ Source: PKU-Shenzhen Hospital web, https://www.pkusz.com/yxgk/index_64.aspx

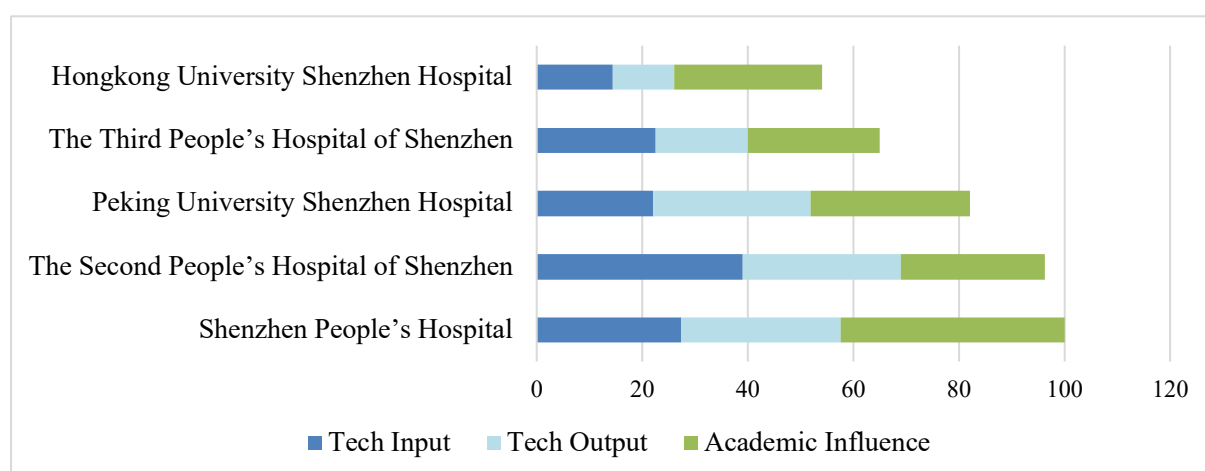
⁹ Source : The Second People's Hospital of Shenzhen, http://wjw.sz.gov.cn/xxgk/jgz/zsjg/201904/t20190412_16766736.htm

Table 3-9 Ranking of Technological Influence of Hospitals in Shenzhen 2018

| Discipline | Hospital |
|-------------------------------|--|
| Cardiology | Shenzhen People's Hospital |
| Respiratory | Shenzhen People's Hospital |
| Tuberculosis | The Third People's Hospital of Shenzhen |
| Gastroenterology | The Third People's Hospital of Shenzhen |
| Hematology | Shenzhen People's Hospital |
| Nephrology | Shenzhen People's Hospital |
| Endocrinology and metabolism | Shenzhen People's Hospital |
| Rheumatology and autoimmunity | Shenzhen People's Hospital |
| Allergy | Shenzhen Longgang otorhinolaryngology hospital |
| Infectious diseases | The Third People's Hospital of Shenzhen |
| General surgery | Shenzhen People's Hospital |
| Neurosurgery | The Second People's Hospital of Shenzhen |
| Thoracic surgery | Shenzhen People's Hospital |
| Cardiovascular surgery | Peking University Shenzhen Hospital |
| Urology | The Second People's Hospital of Shenzhen |
| Osseous surgery | The Second People's Hospital of Shenzhen |
| Burn surgery | Shenzhen Hospital of Southern Medical University |
| Plastic surgery | Shenzhen People's Hospital |
| Obstetrics and Gynecology | Shenzhen Maternity&Child Healthcare Hospital |
| Paediatrics | Shenzhen Children's Hospital |
| Ophthalmology | Shenzhen Ophthalmology Hospital |
| Otolaryngology | Shenzhen Longgang otorhinolaryngology hospital |
| Stomatology | Peking University Shenzhen Hospital |
| Dermatology | Peking University Shenzhen Hospital |
| Neurology | The Second People's Hospital of Shenzhen |
| Psychiatry | Shenzhen Kangning Hospital |
| Emergency medicine | Shenzhen People's Hospital |
| Oncology | Shenzhen People's Hospital |
| Nursing | Peking University Shenzhen Hospital |

Source: Information Disclosure of Shenzhen Municipal Health Commission

Figure 3-7 Ranking of Technological Influence of Hospitals in Shenzhen 2018



Source: Information Disclosure of HKU-SZH

Among the 57 hospitals evaluated for technological influence, HKU-SZH ranks the fifth, which is the top 10%. It shows that HKU-SZH is in the forefront of scientific research investment and output of Shenzhen overall hospital. The input and output scores of HKU-SZH are lower than those of the top hospitals. But the academic influence is the advantage of hospitals, which is in the second place. This shows that researchers in hospitals have a strong voice in the field of medicine and the quality of academic achievements is relatively good, which can be recognized by the industry. So we assign a rate of 2 to the quality of technology.

Sustainability

With the development of cloud technology, relying on the construction of information platform, medical institutions collect a large number of clinical diagnosis and treatment data, which provides a foundation for hospitals and doctors to carry out scientific research on big data for patients. The further mining of these data will help to build a scientific research and analysis platform for the hospital from the form production to the statistical analysis report, and also help to promote the development of translational medicine.

Table 3-10 Cloud and Big Data Construction of HKU-SZH

| Time | Detail | Effect |
|------------|--|---|
| 2013 | Optimized the clinical data center system, established a unique patient number and patient master index based on international standards, developed a central data dictionary, and integrated the hospital's medical system and medical services through the message platform. | Introduced the global IT system management mode scrum and hospital intelligent management platform, laying the foundation of hospital information system. |
| 2016 | Tablet computers and mobile applications were launched to provide patients with mobile payment, appointment registration and intelligent report review system. At present, the hospital has realized the electronation of outpatient and inpatient medical records, which has created a foundation for paperless hospital. | Developed an intelligent management platform for data unification and collaboration. |
| 2015 | Gathered the IT alliance of domestic and foreign hospitals to hold an international seminar to discuss the establishment of multiple big data research centers. | Preliminarily completed a comprehensive, safe and powerful computing environment, deployed network infrastructure to support future development. |
| Jun. 2017. | With Kingdee medical, established strategic cooperation. The two sides will further establish Internet hospitals, combine leading technology with advanced management culture, and make contributions to medical and health undertakings. | |
| Nov. 2017 | Planning to hold a global healthcare big data conference to share the latest hospital information strategy in the era of big data. | |

Source: Information Disclosure of HKU-SZH

Above all, HKU-SZH integrates hospital information and turns information impassability into communication; builds clinical data center on the basis of integration platform and integrates clinical operation information into information resources; builds hospital cloud platform on the basis of clinical data, so as to provide data and data analysis tools for clinical researchers, which is conducive to the sustainable development of hospital scientific research. Therefore, we assign a high rate of 3 to the sustainability of technology cooperation.

Ease of integration

As a joint hospital, HKU-SZH has unique policy advantages. As a public hospital reform pilot of Shenzhen-Hong Kong cooperation and the first batch of high-level hospitals in Guangdong Province, two training bases, Shenzhen Hong Kong medical training center and Guangdong general practitioner teacher training center, were listed in the hospital.

The center takes HKU-SZH as the first specialist training platform, uses the model and experience of Hong Kong Medical College for reference, and combines with the actual situation of the Mainland to explore and formulate a series of training systems, including qualification access, training program and detailed rules, assessment methods, etc. Besides, the hospital establishes a standardized training system for specialists that is in line with international standards and recognized domestically.

Also, the Guangdong General Practitioner Teacher Training Center was listed in HKU-SZH, which was jointly applied for establishment by HKU-SZH and Shenzhen health capacity building and Continuing Education Center, and was approved by Guangdong Health Committee at the end of May 2019. The base will undertake the relevant tasks of the training of general practitioners with teachers' qualification in the whole province, and train high-quality general practitioners in line with the international standards.

Above all, we assign a high rate of 3 to ease of integration of technology cooperation.

3.4.1.4.Policy and Institution Cooperation

To evaluate the dimension of policy and institution cooperation, we focus on the internal policies and external cooperation of HKU-SZH by comparing the inputs and outputs of various policies. In the following, each criterion is graded based on the relative facts and data.

Availability

This criterion mainly assesses the availability of supporting policies. Since the establishment of HKU-SZH, many innovative policies have been introduced by the hospital, which are quite different from those in mainland China. Although the hospital has not been in operation for very long, we rate the availability of policymaking with a high score according to the reasons below.

First of all, in terms of management system reform, the hospital has adopted innovative governance structure. The hospital not only enjoys full autonomy in operation and management, but also brings the national leadership into the hospital governance structure.

Secondly, in the external policy environment, HKU-SZH has reformed the financial investment mechanism as well as hospital charging system and improved the medical service

mode.

Thirdly, in the internal reform, the hospital has established a new post management and distribution system, and adopted a fixed salary scheme. Moreover, the policies and institution introduced by HKU-SZH cover a bunch of aspects in daily operation including cost control, special medical services provision, and medical technology level improvement. Besides, HKU-SZH established a hospital culture of mutual trust between doctors and patients.¹⁰

Based on the above discussion, we believe that the combination of hospital policy and hospital management demand is very close. Above all, we assign a high score to availability of policy and institution cooperation, which is 3.

Quantity

The evaluation of this criterion focuses on the number of preferential policies and supporting institutions. More than 20 new policies are issued in recent years, which mainly contain four aspects including management system reform, external policy environment, internal reform, and external cooperation.

- Management system reform:
 - Establish a governance structure with separate regulators from managers.
 - Entitle full autonomy in operation and management.
 - Integrate the party's leadership into the hospital governance structure.
 - Use the company's fixed articles of association to guide the operation of the hospital.
- Policy environment:
 - Reform the financial input mechanism and implement a financial subsidy mechanism of "fixed fees, purchase of services and special subsidies".
 - Reform the hospital charging system by introducing packaging charges and mobilizing the endogenous power of cost saving and cost control in hospitals.
 - Reform the medical service model by carrying outpatient full appointment diagnosis and treatment and stipulating the upper limit of the average number of visits per hour for each outpatient doctor.
- Internal reform:
 - Implement the post management and full employment system.
 - Establish a distribution system with fixed salaries.
 - Strengthen cost control.
 - Develop special medical services.
 - Improve medical technology and quality and safety.

Based on the above discussion, we believe that the number of policies of the hospital is excellent, and the policy release is timely and meticulous. Above all, we assign a high score of

¹⁰ “香港大学深圳医院建立健全现代医院管理制度取得明显成效”
[online] Available at: <<https://mp.weixin.qq.com/s/dZhBBYqh3w1NCRbJ96rhVA>>

3 to quantity of policy and institution cooperation.

Quality

This criterion tends to assess the adequacy and strength of policy support. In terms of the quality of hospital policy implementation, the performance of HKU-SZH is at an average level. Some of the policies introduced are effective while the others are obviously not suitable for the special situation in mainland China.

Comprehensive appointment & General diagnosis before specialty system¹¹: The hospital provided a variety of appointment methods through network, telephone, and on-site diagnosis. Patients can usually make an appointment with the number source on the same day, except for popular outpatient services such as weekends and diabetes clinics. Since the opening of HKU-SZH, the hospital has always implemented the mode of *general diagnosis first, then specialty*, which is accompanied by the "package charge" of the general practice clinic. Package items include registration, medical examination, basic examination, and basic medicine fee within seven days and the fee is 200 yuan. This approach adheres to the public welfare, but also faces the problem - there is no guarantee of profitability. Two years after its establishment, the hospital was still in financial deficit, which was criticized by society at that time. More troubling, the occupancy rate of the international medical center established for profit is not high. Besides, because mainland residents do not have the habit of making an appointment in advance, and the number of patients is very large, the implementation effect of the comprehensive appointment system is not ideal. At present, the hospital has changed to the on-the-spot appointment system, which is almost the same as the registration of other public hospitals.

Contract system: Since establishment, HKU-SZH has taken the lead role in exploring the reform of personnel system and salary system in Shenzhen, and "high salary and clean government" has become a halo on the top of the hospital. At present, there is about 2500 medical staff in the hospital. The annual turnover rate of doctors and nurses was 2.6% and 6%, respectively. However, according to the survey, doctors will pay more taxes under the new personnel management system, and their work is not stable compared with public hospitals. In addition, the potential income of doctors in public hospitals is large, so the system does not show a unique advantage.

Special services: Special needs services provision is also one aspect of the hospital reforms. 95% of the revenue of public hospitals in Hong Kong is from the government. However, the population of Hong Kong is only 7 million, and the population of the mainland is 1.3 billion, so it is impossible for public hospitals to have so many government subsidies. Therefore, HKU-SZH tries to explore whether they can use the profits from special services to cover the costs of basic medical care and return to public welfare. However, we find that the proportion of special services in the total income structure is very low. In 2018, the proportion of special

¹¹ 卸任在即，港大深圳医院首任院长邓惠琼的满意和遗憾
[online] Available at: <<https://mp.weixin.qq.com/s/inopYqaciwYlItso7QG8w>>

medical service income to hospital medical income reached 12%. Generally speaking, we think it is difficult for the special services to become a major part of income in the short term.

Team diagnosis and treatment: HKU-SZH carries out team diagnosis and treatment, and doctors will arrange surgery according to patients' conditions. Statistics show that from 2013 to 2015, the complaint rate of patients in the hospital has been declining, including outpatient service from 0.24% to 0.03% and inpatient service from 0.7% to 0.13%.

Based on the above discussion, we believe that the hospital has made great innovations in diagnosis, treatment and other aspects, and has received good results, but there are still many mismatches with the situation in Shenzhen. Above all, we assign an average score of 2 to quality of policy and institution cooperation.

Sustainability

This factor mainly focuses on assessing the sustainability of policy impact; long-term or short-term. At present, we think its sustainability is good, but there are still large risks. First of all, in terms of cooperation, the hospital has reached cooperation agreements with a number of mainland hospitals in recent years, which has a very good prospect in the linkage with local hospitals in Shenzhen. In addition, the hospital also helped other medical schools in Hong Kong to enter the mainland and reached cooperation with some local hospitals in the mainland. So we think hospitals are an important bridge for medical cooperation between Hong Kong and the mainland. However, at present, the profitability of hospitals is not good enough. Two years before its establishment, the hospital was still in deficit with financial support, which was once questioned. The occupancy rate of the international medical center established for profit is not high. Therefore, in the future, hospitals need to find ways to expand their income to improve their own profit.

The hospital has established a governance structure with separate management and management, and the hospital enjoys full autonomy in operation and management. The hospital establishes the board of directors, management team and board of supervisors to perform decision-making, implementation and supervision functions. The board of directors exercises the decision-making power on major issues of the hospital. The chairman of the board is the deputy mayor in charge of Shenzhen, and the other directors are composed of eight representatives appointed by Shenzhen and Hong Kong. The hospital management team carries out the decisions of the board of directors and is responsible for the operation and management of the hospital. The President shall be a medical professional recommended by the University of Hong Kong as the legal representative of the hospital. The Executive Vice President shall be appointed by the Shenzhen municipal government to assist the president in managing the daily affairs of the hospital. At the same time, 12 expert committees such as the academic affairs management committee were set up to assist the management team in decision-making and management. The board of supervisors is responsible for supervising the post behaviors of the directors and the hospital management team, which is composed of representatives sent by Shenzhen municipal government, Hong Kong University, and hospital

staff representatives. In the past seven years, the hospital has operated smoothly and established a governance mechanism of decision-making, implementation, supervision, mutual coordination, mutual checks and balances, and mutual promotion. After research, we found that the system is a reasonable model for mature hospitals in the world, and also the development direction of hospitals in mainland China. We think this system can give full play to the advantages of the hospital itself, which is very reasonable in the long run.

Based on the above discussion, we believe that the hospital has great sustainability in both management mode and governance mode. Above all, we assign a high score of 3 to sustainability of policy and institution cooperation.

Ease of Integration

This factor mainly focuses on assessing the ease of external cooperation. Based on our findings, HKU-SZH has performed well in cooperation with other local hospitals in Shenzhen. Other hospitals not only learn from Hong Kong's medical technology but also learn from the management policies of Hong Kong's hospital system.¹²

On the morning of July 2, 2019, "Shenzhen Hong Kong medical training center" and "Guangdong general practitioner Teacher Training Center (base)" were established in the hospital. In early 2018, Shenzhen Municipal Health Commission, Hong Kong Medical College, Li Ka Shing Medical College of Hong Kong University and HKU-SZH signed the memorandum of cooperation on Shenzhen Hong Kong specialist training project. At the beginning of 2019, the Hong Kong Medical College and Shenzhen Health Committee discussed the establishment of "Shenzhen Hong Kong medical training center". In January 2019, Shenzhen Health and Family Planning Commission, Hong Kong Medical College and Hong Kong University Medical College signed a cooperation agreement on the training project of Shenzhen Hong Kong specialists. Besides, HKU hospital and Pingshan hospital also cooperated to build a resident doctor training base. HKU-SZH has become a pilot unit of public hospital reform by virtue of 130 years' academic foundation inheritance of Hong Kong University. It is one of the two hospitals shortlisted in the "peak plan" of Guangdong Province. At the beginning of 2016, HKU - SZH established a counterpart cooperation relationship with Pingshan people's hospital. In the past three years, HKU-SZH has provided Counterpart Assistance in medical technology and hospital management in Pingshan people's Hospital by accepting medical staff for further study, experts' on-site consultation guidance, academic conference exchange, and training, etc.¹³

Based on the above discussion, we believe that there is a great possibility for the hospital to improve in this respect. We assign an average score of 2 to the ease of integration.

¹² 深港医学合作两大平台落户港大深圳医院

[online] Available at: <http://www.sznews.com/news/content/2019-07/03/content_22231032.htm>

¹³ 香港大学深圳医院：内地医疗改革的试验田和先行者

[online] Available at: <<https://baijiahao.baidu.com/s?id=1618788490788072423&wfr=spider&for=pc>>

3.4.2. Evaluation Results

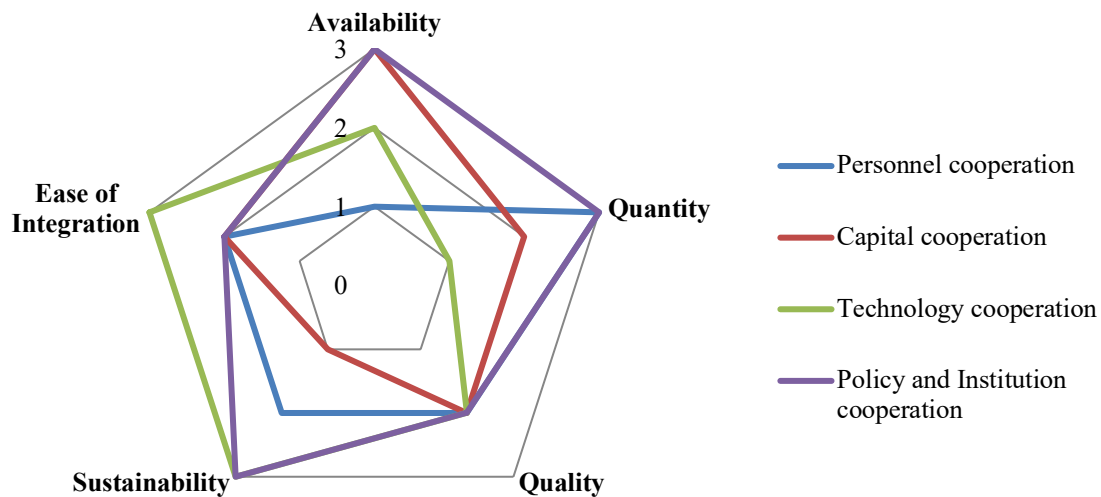
Table 3-11 Evaluation of the Cooperation Dimensions Based on Criteria

| Dimension \ Criteria | Personnel cooperation | Capital cooperation | Technology cooperation | Policy and Institution cooperation |
|----------------------|-----------------------|---------------------|------------------------|------------------------------------|
| Availability | Rating: 1 | Rating: 3 | Rating: 2 | Rating: 3 |
| Quantity | Rating: 3 | Rating: 2 | Rating: 1 | Rating: 3 |
| Quality | Rating: 2 | Rating: 2 | Rating: 2 | Rating: 2 |
| Sustainability | Rating: 2 | Rating: 1 | Rating: 3 | Rating: 3 |
| Ease of Integration | Rating: 2 | Rating: 2 | Rating: 3 | Rating: 2 |
| Total Score | 10 | 10 | 11 | 13 |
| Average Score | 2 | 2 | 2.2 | 2.6 |

Note:

1. Total Score of X Dimension = Rating of X Dimension under the Criterion of Availability + Rating of X Dimension under the Criterion of Quantity + Rating of X Dimension under the Criterion of Quality + Rating of X Dimension under the Criterion of Sustainability + Rating of X Dimension under the Criterion of Ease of Integration
2. Average Score of X Dimension = Total Score of X Dimension / 5

Figure 3-8 Comparison Based on Four Cooperation Dimensions



From the evaluation of four dimensions on medical cooperation, the policy and institution cooperation is scored 13 with average score of 2.6, ranking the first among the four dimensions. The policy and institution cooperation scores the highest under the criteria of availability, quantity and quality and sustainability (Availability, quantity and sustainability are full marks). Technology cooperation follows the policy and institutional cooperation closely, ranking the second with total score of 11 and average score of 2.2. However, there exists an obvious disadvantage on the quantity of technology. The personnel and capital cooperation acquire the

same total score of 10 with average score of 2. The personnel cooperation lacks the capacity of availability while the capital cooperation lacks the capacity of sustainability, and the average performance of personnel and capital cooperation is weaker than the other two dimensions.

3.4.3. Output& Outcome

In order to compare the overall performance of HKU-SZH, we refer to Comprehensive Evaluation Ranking of Public Hospitals in 2018 issued by the Shenzhen Municipal Health Commission in April 2019.

Table 3-12 Ranking of Shenzhen Public Third-Class A Hospitals (2018)

| Ranking | Hospital | Public Welfare Score | Competitiveness Score | Satisfaction Score | Comprehensive Score |
|---------|--|----------------------|-----------------------|--------------------|---------------------|
| 1 | Shenzhen People's Hospital | 91.39 | 87.68 | 87.62 | 88.78 |
| 2 | Shenzhen Second People's Hospital | 94.79 | 76.51 | 87.45 | 85.28 |
| 3 | Peking University Shenzhen Hospital | 90.97 | 74.43 | 86.40 | 82.98 |
| 4 | Nanshan People's Hospital | 96.97 | 56.49 | 83.79 | 76.82 |
| 5 | HKU-SZH | 88.10 | 58.82 | 87.74 | 76.28 |
| 6 | Luohu People's Hospital | 97.93 | 48.36 | 88.19 | 75.18 |
| 7 | Longhua People's Hospital | 91.04 | 54.63 | 84.76 | 74.59 |
| 8 | Baoan People's Hospital | 93.58 | 51.51 | 85.31 | 74.27 |
| 9 | Longgang Central Hospital | 95.25 | 50.71 | 83.70 | 73.97 |
| 10 | The Eighth Affiliated Hospital of Sun Yat-sen University | 93.05 | 49.41 | 87.43 | 73.91 |
| 11 | Longhua Central Hospital | 91.85 | 51.21 | 84.07 | 73.26 |
| 12 | Longgang People's Hospital | 95.09 | 47.41 | 85.20 | 73.05 |
| 13 | Shajing People's Hospital | 93.31 | 46.80 | 84.70 | 72.12 |
| 14 | Baoan Central Hospital | 90.26 | 46.48 | 86.39 | 71.58 |
| 15 | Songgang People's Hospital | 93.56 | 45.70 | 83.81 | 71.49 |
| 16 | Shekou People's Hospital | 87.20 | 47.11 | 87.66 | 71.30 |
| 17 | Shenzhen Yantian People's Hospital | 86.50 | 44.25 | 89.87 | 70.61 |

Data source: Information Disclosure of Shenzhen Municipal Health Commission

This ranking gave an evaluation of the diagnosis and treatment level of Public Third-Class A Hospitals in Shenzhen based on three aspects of performance: public welfare, competitiveness, and satisfaction. The comprehensive scores of each hospital are the weighted sum of the three aspects, weighting 30%, 30%, and 40% respectively.

➤ **Public Welfare Performance¹⁴:** Public welfare performance highlights the social benefits of

¹⁴ Organized by the Shenzhen Municipal Health Commission, with data collected from hospitals, the Shenzhen Medical Information Center, the Municipal Emergency Center and the Municipal Health Supervision Bureau.

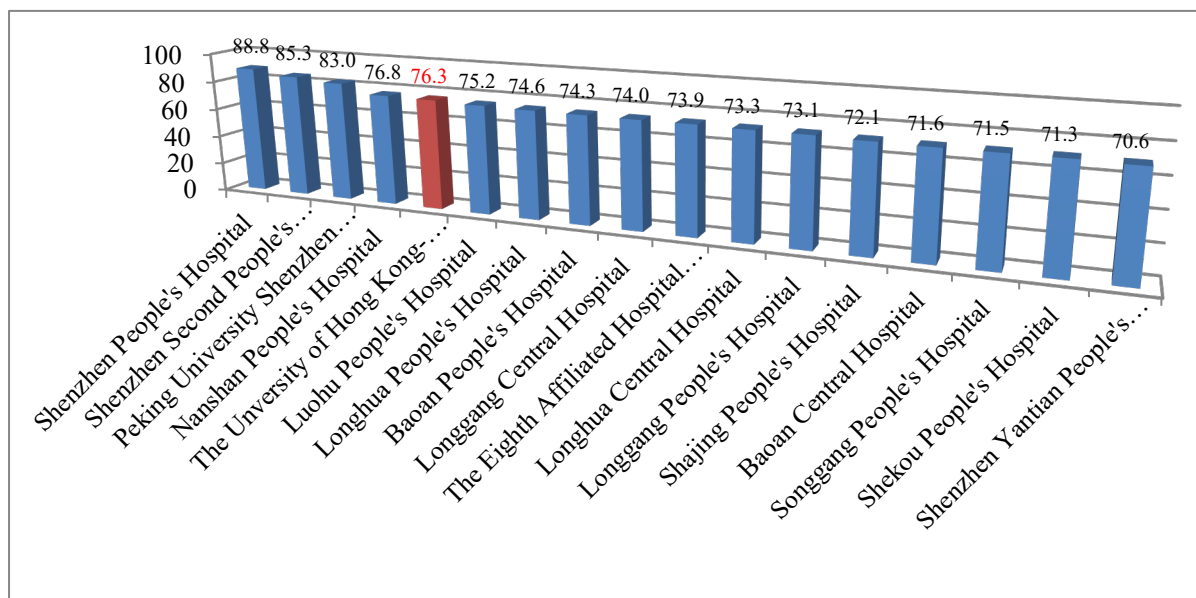
public hospitals, including the construction of a modern hospital management system, the implementation of functional orientation, and the provision of basic medical services that everyone can enjoy.

- **Competitiveness Performance¹⁵**: Competitiveness performance gives the information on the comprehensive medical strength and ability of sustainable development of the hospitals.
- **Satisfaction Performance¹⁶**: The evaluation of satisfaction reflects the feeling of hospital customers in medical technology and services.

3.4.3.1. Comprehensive Performance

For the comprehensive performance, HKU-SZH is scored 76.28, ranking fifth among the 17 Third- Class A Hospitals in Shenzhen. Except that the top three hospitals (Shenzhen People's Hospital, Shenzhen Second People's Hospital, and Peking University Shenzhen Hospital) which are above 80 points, the scores of the remaining hospitals were not significantly different (all between 70 and 77). Although the comprehensive evaluation score of HKU-SZH has entered the top 30% in Shenzhen, it should be noted that there is still a gap with the comprehensive score of the top-three hospitals (average 85.7).

Figure 3-9 Comprehensive Evaluation of Shenzhen Public Third-Class A Hospitals (2018)



3.4.3.2. Public Welfare Performance

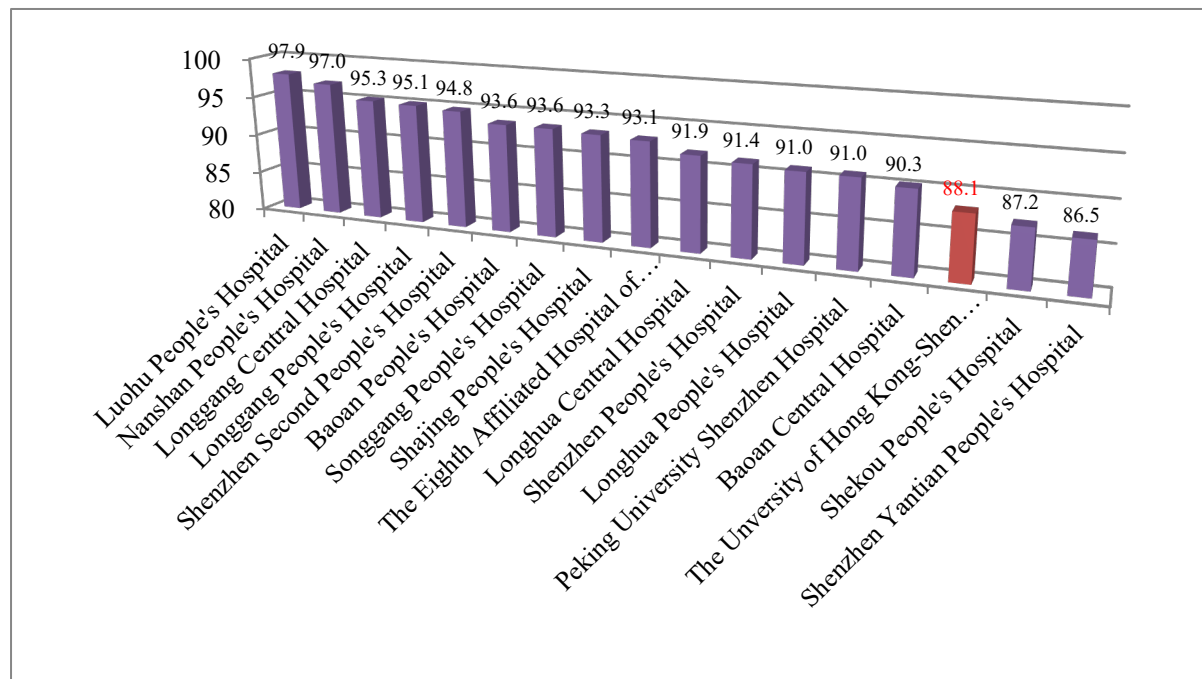
For the public welfare performance, HKU-SZH gets 88.1, ranking 15 out of 17. Public

¹⁵ The inspection of this indicator is completed by Elippi Management Consulting Co., Ltd., a third-party evaluation institution. The data used are mainly from the hospitals, the Shenzhen Medical Information Center and their own evaluation of the secondary scientific and technological influence of these hospitals.

¹⁶ Carried out by Shenzhen Medical Information Center, with data derived from short-message surveys and questionnaires.

welfare evaluation highlights the social benefits of public hospitals. On the one hand, the low ranking of HKU-SZH has its objective reason - although it has established a relatively complete hospital management system, the overall operation mode is completely different from other public hospitals in the Mainland. What's more, the management autonomy and loose environment gave by the government make it naturally vacant in fulfilling government mandatory tasks and supporting primary care. On the other hand, however, it also shows that HKU-SZH still has much room to improve in providing approved medical services.

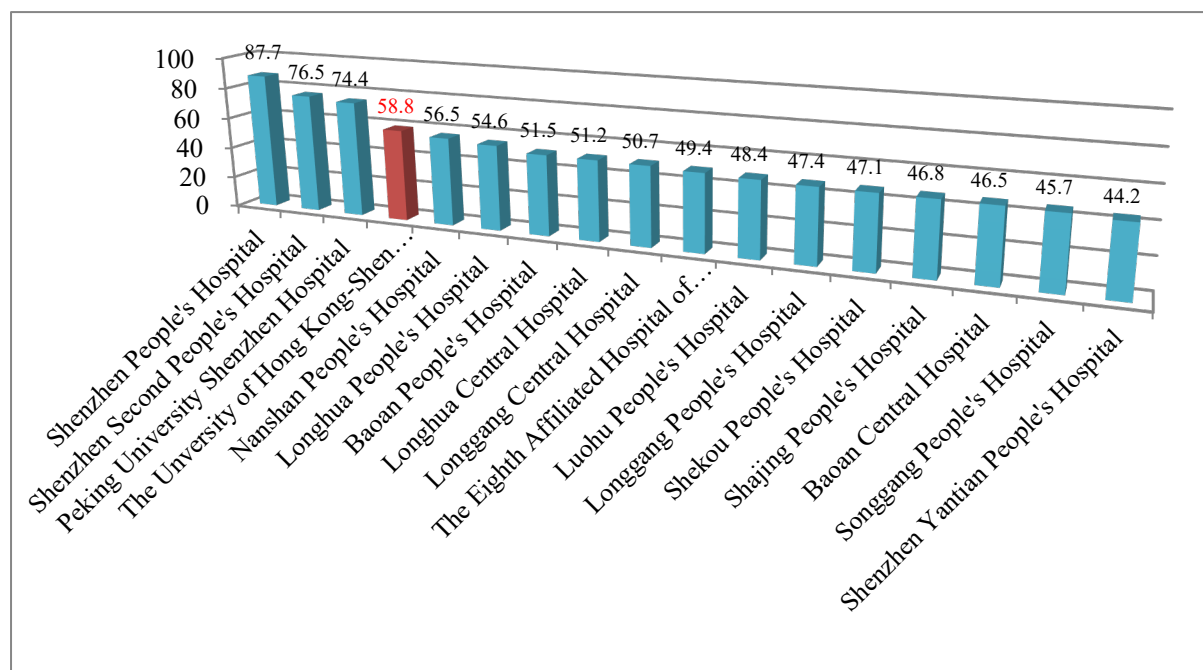
Figure 3-10 Public Welfare Evaluation of Shenzhen Public Third-Class A Hospitals (2018)



3.4.3.3. Competitiveness Performance

Competitiveness is the largest index in the calculation of comprehensive scores, and also the index with the greatest difference in scores of 17 hospitals, which means that there are obvious gaps in the important technical, resource and scientific and technological strength of these hospitals. From the competitiveness, HKU-SZH scored 58.8, ranking fourth among the 17. This ranking is even higher than the comprehensive ranking (No. 5), indicating that HKU-SZH still has an advantage in the competitiveness relative to the other two indicators. Similarly, there was a clear gap between its score and the top three (average score 79.5).

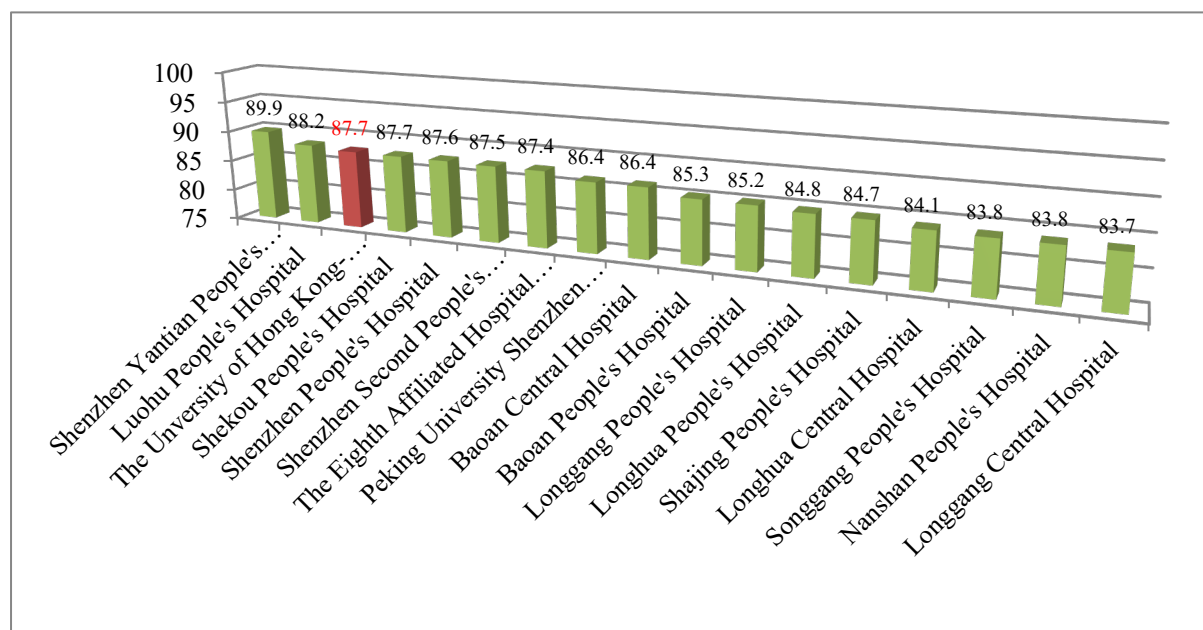
Figure 3-11 Competitiveness Evaluation of Shenzhen Public Third-Class A Hospitals (2018)



3.4.3.4.Satisfaction Performance

From the satisfaction performance, HKU-SZH ranked third with 87.7 points. Although the overall difference of satisfaction scores is not big, this ranking can still tell that the new management model, diagnosis and treatment mode and the overall level of HKU-SZH have been recognized by the general public.

Figure 3-12 Satisfaction Evaluation of Shenzhen Public Third-Class A Hospitals (2018)



Overall, the medical level and public recognition of HKU-SZH is of top-level among the Third-Class A Hospitals in Shenzhen. First of all, it has supplemented the medical team of Shenzhen medical system with advanced technology and provides high-level medical services to the residents of Shenzhen and even within the GBA. In January 2019, the second batch of the "High-Level Hospital Construction Project" list of Guangdong Province was released. And HKU-SZH was among the four hospitals that were selected. In the next three years, each hospital will receive financial support of 300 million yuan. The construction funds will be directly allocated by the Provincial Finance Department to the project hospitals, which can be and used by the independent budget of the hospitals for discipline construction, talent introduction, and R&D platform construction. Secondly, in addition to first-class management experience, HKU-SZH also carries out personnel system reform attempts, salary system reform attempts, public hospital subsidy reform attempts, which can provide experience for the reform and development of other public hospitals as well as cooperative hospitals in mainland China. In June 2015, the Shenzhen Municipal Government officially promulgated the Implementation Plan for Deepening the Comprehensive Reform of Public Hospitals in Shenzhen, which adopted much effective management and operational measures of HKU-SZH, making it a "sample of medical reform" in the reform of Shenzhen public hospitals. The advanced management concepts and systems of HKU-SZH are lacking in public hospitals on the Mainland. Explorations like packing fee system, implementing a shunting method for hospital emergency, and refining management system are all of great significance to other public hospitals in China.

4. Conclusion

HKU-SZH, a pilot for the reform of public hospitals in Shenzhen, has set an example in many aspects such as hospital management, medical service provision since its establishment. It combined the advantages of medical regulations from both Hong Kong and Shenzhen. The hospital not only tries to achieve the goal of non-for-profit of Hong Kong public hospitals but also is equipped with the market flexibility of public hospitals in the Mainland. However, there is still some distance to the original intention of building this hospital. The Shenzhen government regarded the establishment of HKU-SZH as a significant role in improving the overall medical level of Shenzhen and promoting internal public hospital reforms. It is undeniable that a single hospital has limited power to impact on the whole public medical system. More importantly, these innovative regulations introduced from the HKU are not ideal in line with the reality of China's national conditions, although they represent the direction of public hospital reforms to a certain extent. On the other hand, the HKU wants to have their affiliated hospital and a platform for medical cooperation between Hong Kong and the Mainland based on HKU-SZH. Nevertheless, the cross-border circulation of medical and health resources still hit some obstacles at this stage, and Hong Kong's high-end talents have a weak willingness for cross-border medical practice. There is still much room for medical cooperation in order to achieve the original intension of establishing HKU-SZH. Based on our analysis, among the four dimensions of medical cooperation, personnel cooperation and capital cooperation are the main shortcomings, even though technology cooperation and policy cooperation do not function very well according to some criteria. The constraints that impede the fostering of cooperation in HKU-SZH at this stage can be summarized into the three categories.

➤ **Lack of attraction for high-end talents from Hong Kong**

HKU-SZH is equipped with sufficient medical workers to meet the demand of patients including outpatients and inpatients but lacks senior professional doctors, especially compared to other Third-Class A Hospitals. Due to the high tax revenue brought by high salary and the inability to enjoy the official budgeted posts in HKU-SZH, the hospital faces certain difficulties in recruiting talents. However, the management of modern hospitals is becoming more and more complex and intelligent, which puts higher demands on the professionalism of hospital managers. Moreover, comparing with the mature training system for clinicians in Hong Kong, there is much room for improvement in the development of the training mechanism in the Mainland. In addition, doctors from Hong Kong can only register one hospital or outpatient department in the Mainland, and they need to re-register once a year. These limitations and inconvenience have reduced the willingness of Hong Kong doctors to work in the Mainland, leading to a lack of attraction for high-end talents from Hong Kong.

➤ **Insufficient capital in the long term**

For public hospitals in the Mainland, the main reason for over-prescription

andover-medicine is that public hospitals have an impulse to make profits instead of setting a goal of non-for-profit as the public hospitals in Hong Kong. After comparing the medical systems between Hong Kong and the Mainland, we found that the profitability of public hospitals in the Mainland is caused by insufficient government investment in medical and health services. According to the Framework Agreement on Hong Kong / Guangdong Co-operation, the government reduced fiscal allotment in 2017 and HKU-SZH had to be self-financing since then. More importantly, the government hopes that public hospitals can provide cheap and affordable medical services, but high quality of service contradicts with a low price of service. In addition, the cost control and income-generating mechanism of HKU-SZH are in a dilemma. Therefore, we have some concerns about the sustainable acquisition of future funds.

➤ **Cultural differences between the two places**

Hong Kong and the Mainland possess distinguishing characteristics in terms of medical treatment habits, the role of public and private medical institutions, social insurance and commercial insurance systems, and the management of medical drugs and devices. The differences not only impeded the introduction and acceptance of Hong Kong's medical model in the Mainland but also affected the participants of medical personnel from Hong Kong. In order to make the Hong Kong medical model more adaptive in Shenzhen, HKU-SZH had to make some adjustments in the management and operation system, resulting in the localization of the innovative regulations. Take the appointment system as an example. The on-line appointment system introduced by HKU, which aims at saving the time of patients, ended up at an on-site appointment system. This kind of adjustments damaged the advantages brought by the regulation innovation to some extent.

Although there are many constraints impede the development of HKU-SZH, there are still many experiences we can gain from the medical cooperation in HKU-SZH. On the one hand, the medical development in the GBA should take advantage of the leading roles of universities from Hong Kong in the medical field, such as the HKU, CUHK and HKUST. Relying on the national laboratories of Hong Kong and the medical market in the GBA, the government can build the regional consortium of universities from Hong Kong and Macao and the medical hospital in the GBA. The collaborative innovation pattern for medical treatment will give full play to the advantages of R&D outputs from universities in Hong Kong. On the other hand, the innovative system introduced from Hong Kong, such as package charges and innovative remuneration system, helps to overcome the shortcomings of public hospitals' excessive pursuit of economic benefits and return to the non-for-profit goal. Whether to stick to the non-for-profit goal of public hospitals is the core issue in the reform of China's medical system. Public hospitals in the Mainland should adhere to the principle of non-for-profit and change the situation in which they regard profit-making as the main operating goal.

5. Recommendations

5.1. The Medical Cooperation in HKU-SZH

Facing the constraints that the medical cooperation in HKU-SZH meets on the three aspects; this paper puts forward the relevant recommendations:

➤ **Broaden the HK doctors' license and building mechanism to attract talents**

In view of cooperation hospitals, the accreditation process can be simplified to give more flexibility and the time of waiting for license can be shorten, and the scope of hospitals' license can be expanded when hospital is qualified to conduct the relevant operation and research. Besides, in terms of period of doctors' license, it is suggested that the time limit for Hong Kong medical staff to engage in clinical diagnosis and treatment activities be extended from the original 3 years to 10 years, so as to reduce the complication of the registration procedure. As well as introducing a mechanism to smooth the difference on qualification between HK hospital and mainland hospitals. And considering the introduction of talents, more attention can be paid to the cultivating existing talents by conducting internal medical training, and attracting the external talents by relying on the national key laboratories in the medical field of Hong Kong, taking advantage of its characteristics as an international cooperation hospital to attract the international talents.

➤ **The integration of the doctor's professional title**

Since the disparity on professional title between Mainland and Hong Kong, which leads to the phenomenon that some mainland doctors worry that they will lose their professional titles when they come to the HKU-SZH, while some Hong Kong doctors worry that their working years will not be recognized when they come to the HKU-SZH, so there are exit barriers on both sides. Therefore, it is suggested that integration of the professional title between Mainland and Hong Kong according to the specific qualifications of doctors. For example, senior consultant doctors in Hong Kong and chief doctors in the mainland, as the top positions in the professional title system of doctors on both sides, can be connected. In this way, both sides can be integrated into one professional title system so as to remove the barriers for doctors to enter and increase the willingness of doctors to work in the joint hospital.

➤ **Loosen the restriction on capital and take full use of the elderly Health Care Vouchers**

The Shenzhen Municipal Government can loosen restrictions on special medical service for HKU-SZH, so that HKU-SZH can be better adaptive to the mainland market and present its advantages in order to make both ends meet. Besides, enable the Hong Kong elders the same

treatment in mainland cities on the aspects of family doctors, free medical examinations and subsidies for the elderly. Especially, the applicable scope of Elderly Health Care Vouchers should include inpatient services in HKU-SZH. Currently, health care vouchers can be used for the outpatient services in mainland China exclusively, so that the majority of Hong Kong elderly people choose to return to Hong Kong to receive the inpatient services. According to Survey Report of the Use of the Elderly Health Care Voucher in HKU-SZH in 2018, 64% of participants' habitual residence was Shenzhen, and 90% of participants hoped that inpatient services in HKU-SZH can be included into the Elderly Health Care Vouchers. Under the background of more elderly care cooperation in the GBA, it is expected that the number of the elderly moving to Shenzhen and other cities in GBA will increase. In order to facilitate the elderly to seek medical care, it is necessary to put the inpatient services in HKU-SZH into the applicable scope of Elderly Health Care Voucher so as to provide Hong Kong elders in mainland China comprehensive medical care and to promote cross-border capital cooperation further.

➤ **Relying on the advantage of HKU on family medicine to facilitate the spread of high-quality medical resource into communities**

Since there was almost no community general outpatient service system in Shenzhen about ten years ago, HKU-SZH had to put general outpatient services in the hospital. Establishing community general outpatient clinic can effectively avoid the patients seeking medical care in hospital just for some minor ailment like a cold with the risk of cross infection in hospital. In view of the mature operation experience of Huawei Lizhiyuan Clinic, HKU-SZH operating from 2018, HKU-SZH could set more community general outpatient clinics in Shenzhen, providing the high-quality medical services from Hong Kong to more communities, to respond to national hierarchical medical system policy. The setting of clinics should be based on the patients' need of different communities and the distribution of medical resources among communities. General practitioners from HKU-SZH can be assigned to community clinics to ensure the medical service quality of community clinics consistent with that of the hospital and the continuity of general practice services. Finally, family medicine will return to the community.

5.2. The Medical Cooperation in GBA

Broadening the horizon, we put forward the more polices to the situation in GBA.

➤ **Build the mechanism to accelerate the knowledge transformation**

HKU-SZH has conducted the regional medical consortium of "basic medical research of Hong Kong universities + Medical Hospitals in GBA + medical enterprises in GBA", therefore, it is suggested that the regional medical center of "University + Hospital + Research and Development Center" can be formed to accelerate the transformation of knowledge. Taking the medical industry development platforms as carries, such as Guangdong Macao cooperative

TCM science and Technology Industrial Park, World Health Organization traditional medicine cooperation center, Caroline Medical College Research Center, they make full advantage of Hong Kong as an international window, strengthen the connection with international standards, international technology, international talents and international market, and finally guide the medical enterprises in GBA to the markets of developed countries such as the European Union.

➤ **Loosen the restriction on importation of overseas drugs and medical devices**

The smooth flow of medical devices and drugs is the key factor affecting the medical cooperation in GBA. In view of the current strict control of overseas drugs and large-scale medical equipment of hospitals in the mainland, it is suggested that, under the premise of controllable risk, loosening the restriction on overseas drugs and medical devices which are urgently needed by medical institutions but have not been approved for registration, allowing these drugs and devices to be used in more designated medical institutions, and optimizing the approval process of large-scale medical devices.

➤ **Strengthen the policy support of hospital integration of Shenzhen and Hong Kong**

On one hand, establish a unified information system. In this information system, not only can the referral patients of the relevant hospitals make an appointment for registration, but also have the patient's electronic medical record. The patient's information is communicated to the doctor after referral through his account. The doctor can directly access the patient's information, which can make the patient's disease history clearer and give the patient a better diagnosis. It can not only improve the efficiency of medical treatment, but also facilitate both doctors and patients. In addition, the information system should integrate the medical information of both Hong Kong and Shenzhen hospitals, including the hospital system, departments, staff, etc. In order to let patients clearly know the information of each hospital, as well as the advantages of each hospital, so that they can better choose the hospital for medical treatment and believe in the medical institutions they choose. It can also make the efficient use of medical resources, without overcrowding in some hospitals and few patients in some hospitals, so as to achieve the purpose of sharing medical resources.

On the other hand, the medical security system of both regions should be combined and universal. In the Hong Kong and Shenzhen hospitals included in the scope, residents of the two places can receive medical insurance according to their insurance participation and hospital system, and directly reimburse for inspection fees and drug expenses. Through the establishment of relevant hospital system, universal medical insurance can be selected, and eligible residents can be reimbursed directly no matter which hospital they go to. Here, HKU-SZH can be used as a pilot in Shenzhen.

➤ **Establish a platform for epidemic exchange and notification**

In terms of disease monitoring, the GBA can further improve the system of notification and exchange of epidemic information of infectious diseases, and do a good job in epidemic

prevention and control at ports. After that, the two sides established closer ties and worked together to properly respond to public health emergencies.

For example, by introducing international project management tools and using the platform established by advanced cloud computing mode, the hospital in the GBA can openly and transparently plan, manage and monitor all projects of the hospital. Assign the responsibility of project implementation and management to each relevant project and task leader, and project related personnel at all levels can provide opinions on the platform. The process of all projects will be automatically stored in the knowledge base, which will become the experience treasure of the hospital and be easy to share with others.

➤ **Establish a cooperation system with the government as the leader**

We suggest that the main governments of GBA cooperate to reach a cooperation system. Under this system, the government can play a leading role in helping hospitals in Hong Kong, Shenzhen and other regions of GBA to hold regular academic exchanges, training and other activities. In terms of cooperation content, hospitals can cooperate in management mode, discipline construction and other aspects. Under this framework, Shenzhen Hospital of HKU can give full play to its role as a bridge.

5.3. The Cooperation in GBA

Based on the cases of medical cooperation, the paper extends the cooperation to the whole Greater Bay Area. The cooperation in GBA concludes cooperation among enterprises, companies and educational institutions within 11 cities. Therefore, similar to medical cooperation, it is suggested the cooperation in GBA should focus on the legal and regulatory systems, goods flows, finance and human mobility.

In terms of legal and regulatory system, the existence of different legal systems in Guangdong, Hong Kong, and Macao creates challenges associated with compliance with multiple systems. The implementation of laws and regulations across different cities need to be transparent to smooth the frictions in laws aspects. In terms of goods flow, there exist different tariffs in different customs territories where goods are subject to clearances when they cross between Guangdong, Hong Kong, and Macao. Tariffs in the region are low. Hong Kong and Macao are free ports with no tariffs on general imports. Mainland China has six different tariff rates for general imports. It is suggested that improving the efficiency of logistics in the GBA, connect the product standards and inspection and quarantine system, and simplify the import-export customs clearance to ensure the smooth of goods flow. Also, enhancing the transportation infrastructure, so as to improve the convenience of goods flow. In terms of finance, the Chinese Mainland, Hong Kong, and Macao have different financial systems and operate with different currencies. Funds can be transferred in and out of Hong Kong and Macao with relative freedom, but this is not the case in the Chinese Mainland, which runs a closed capital account. As an international financial center, Hong Kong has

played the role of connecting the mainland and overseas and the Chinese government will gradually relax the restrictions within certain limits. In terms of human mobility, the transfer of talents among different cities has a siphon effect, so each region should develop its own pillar industries to attract talents in this field. Meanwhile, the creation of the Leading Group on the GBA under the supervision of Vice-Premier and Politburo Standing Committee member Han Zheng, with members including the Chief Executives of the Hong Kong and Macao SARs, as well as representatives from Guangdong Province and the NDRC, should foster further interaction and cooperation between governments in the region, as should The Outline Development Plan. Therefore, it is encouraged that the substantial amount of interaction among government officials happens across the GBA, to strengthen the connection of the upper organization.

Reference

- Chu, P. and Pai, P., 2015. A new great wall: commissioning a new hospital in China. *Future Hospital Journal*, 2(1), pp.28-33.
- CUI Xia. (2016) ‘Shenzhen Hong Kong Cooperation Hospital Win-Win Situation’. *Shenzhen Business Daily*, (1)
- FENG Jiehua, LI Chaoyang, WEI Hong, et al. (2014) ‘A Preliminary Study on the Model of Domestic Medical Simulation Education -- An Overview of the Current Situation of Shenzhen Hong Kong Cooperative Anesthesia Crisis Management Simulation Training Course’. *China Continuing Medical Education*, (07): 1-3
- GAO Yongwen, Gong Xiawen, Lin Xiaoyan, Hong Kong's Role And Opportunities In Medical Development In the Greater Bay Area, 2019
- Huazhen Huang. Winning PPP--A Global Analysis of Financing and Construction[J]. *Chinese Lawyer*, 2017(05):91.
- Jin Chao. (2019) Shenzhen developed fast in modern hospital quality management, *China Quality*, 11: 83-86
- LI Hai-lei, FAN Jing-wen, FAN Wei-tian. (2017) ‘Feasible Research of Inpatient Package Charge on Surgical Diseases’, *Chinese Hospital Management*, 37(6): 11-13.
- LIANG Yuan, KUANG Li, MEI Jie, WANG Yu-tan, ZHAO Jing-ge, LiLi. (2016) ‘A Comparative Study of General Practice Attributes in Guangzhou, Dongguan and Shenzhen’, *Chinese Journal of Health Policy*, 9:27-33.
- LIU Lishuang. ‘Research on the Cooperation and Development Strategy of Public Hospitals under the Background of New Medical Reform’, *Beijing University of Posts and Telecommunications*, 2014.
- LIN Lujian. (2016) ‘Implementation of Hong Kong General Practice System in Hong Kong University Shenzhen Hospital’, *Chinese General Practice*, 19 (19): 2 239-2 240.
- Pan Hua-xin, Liang Pei-hua, Wang Hong, Wang Shuo, Cao Min. (2012) Practice and Thinking on the Construction of Non-directly Affiliated Hospitals of Higher Medical Colleges and Universities, *Journal of Jiangxi University of TCM*, 24/3: 91-94.
- Peking University Health Science Center. (2020) Cooperation Affiliated Hospital<<http://www.bjmu.edu.cn/ylfw/gjfsyy/index.htm>>
- PKUSZH. (2020) the Introduction of PKUSZH <https://www.pkuzsh.com/yvj/index_21.aspx> ‘Shenzhen Hospital of Hong Kong University -- A New Model Attracts People's Attention’. *Creation*, 2012, (09): 62-63
- Shenzhen Government Online Information Disclosure<<http://www.sz.gov.cn/hospital/bayy/baqrmmy/ywxx/>>
- Shenzhen Municipal Health Commission Information Disclosure of <<http://wjw.sz.gov.cn/xxgk/>>
- Shenzhen Municipal Health Commission. (2020) Three Famous Projects in Medical and Health Care <<http://wjw.sz.gov.cn/ztzl/smgc/>>
- Shenzhen Special Zone Daily. (2019) PKUSZH has been established for ten years <<http://gd.news.sina.com.cn/news/2009/12/08/747763.html>>
- Shenzhen Special Zone Daily. (2019) Ten Years of Medical and Health Care Reform in Shenzhen has achieved leapfrog development <<http://www.sznews.com/news/content>>

- /2019-02/09/content_21398199.htm>
- Shenzhen Statistics Bureau, NBS Survey Office in Shenzhen. (2015) Shenzhen Statistical Yearbook 2015 <http://tjj.sz.gov.cn/zwgk/zfxxgkml/tjsj/tjnj/201606/t20160607_3686823.htm>
- SONG Kewen.(2001) ‘The Foundation of Establishing Hospital Group and the Role of Government’, *Hospital Management in China*, (01):9-11.
- Song Lingxia. (2012) ‘A Research on the Regulation of the Public Hospital in China —Focused on Guangdong Province’, *Southern Medical University*, 46-47.
- State Council. (2009) Opinions of the CPC Central Committee and the State Council on Deepening the Reform of the Medical and Health Care System <<http://www.lawinfochina.com/display.aspx?lib=law&id=7416&CGid=>>
- The University of Hong Kong-Shenzhen Hospital official website<<https://www.hku-szh.org/Announcement.aspx?typeid=799>>
- TIAN Ke, XU Chongwei, LIAO Jingle. (2011) ‘Two Way Referral of Trusteeship Hospital Group and Its Positive Significance’, *Modern Hospital*, 11(1): 108.
- WANG Yan, LIAO Lizhen. (2016) ‘Exploring a New Mode of Cooperation in Shenzhen Hong Kong Medical System’. *Education and Teaching Forum*, (51): 28-31
- XU Xiaoping, DENG Dongning, KE Dongge, LIN Li, YU Qianhui, GU Yonghong, WU. Cuishan, ZHANG Xinshi, XU Jun, CAI Xiao, CHEN Zhiquan. (2017) ‘Research on patient safety culture in the University of Hong Kong’, *Shenzhen Hospital*, *Chinese Hospitals*, 21(7): 11-15.
- XU Zehua. ‘Research on the Countermeasures of Regional Medical Cooperation of Public Hospitals in Hunan Province’, *Central South University*, 2012.
- Yan Yuan. (2015) ‘Research on the Doctor-Patient Relationship in Chinese Public. Hospital Based on the F Hospital in Shenzhen’, *Yunnan University of Finance and Economics*, 32-35.
- YU Hailong, (2016) ‘Shenzhen Hong Kong Cooperation to Explore a New Way of Public Hospital Management’. *Shenzhen Special Zone News*, (3)
- ZHAO Yang, Li Lei. (2010) An Overview of the Management Mode of Affiliated Hospitals in Domestic and Foreign Comprehensive Universities, *Chinese Health Service Management*, 6:366-369
- ZHANG Hongze.(2007) ‘Six Cooperation of Hospital Group’, *Health Management in China*, (04):243-245.
- ZHANG Linghua, HU Xuhuai, ZENG Xuchun. (2010) ‘A Study on the Comprehensive Intervention Model of AIDS Community for High-Risk Groups in Shenzhen Hong Kong Cooperation’. *China Public Health Management*, (04): 359-361
- 范围. 港大深圳医院管理制度创新的探索与实践[J]. 中国医院管理, 2019, 39(1): 71-72.
- 郭斌. 从香港大学深圳医院管理模式看公立医院改革取向[J]. 医学与哲学 (A), 2016 (5): 19.
- 郭若溪.(2018)香港长者医疗券港大深圳医院试点 3 年 九成盼扩展住院服务 <<http://www.takungpao.com/news/232109/2018/1010/187346.html>>
- 李桦. 公立医院绩效考核制度的步骤和重点[J]. 中国人力资源开发, 2006, 4: 74.
- 罗力. 中国公立医院改革: 关注运行机制和制度环境[M]. 2010.
- 吕国营. 中国公立医院改革的逻辑[J]. 湖北社会科学(7):58-61.
- 王建秀. (2015) 重度解密港大深圳医院: 在中国办一家好医院很难吗?

<<http://www.geekheal.com/gangdashenzheniyuan/>>

王燕, 廖丽贞. 探讨深港医疗体系合作新型模式[J]. 教育教学论坛, 2016 (51): 28-31.

徐洁. 大医院进驻企业社区[J]. 中国医院院长, 2018, 7: 28-29

2022 Foundation. (2019) Creating the Greater Bay Area of the Future – Opportunities for Hong Kong, 43-57

Appendix

Appendix A: Interview Outline-Doctors

Interviewee

Doctors from The Hong Kong University-Shenzhen Hospital

Introduction

1. Self-introduction

- Introducing that the purpose of the interview is to have a general understanding of the working experience of the doctors who is from a cross-regional coadjutant hospital, explore
- Obstacles and solutions to medical cooperation.

2. Key point

- There is no right or wrong about your statement. We respect your personal opinion, and please don't worry about expressing personal thoughts.
- The privacy of the interviewee will be kept strictly confidential.

3. The interview will be last 30 minutes.

4. Self-introduction of the interviewee

- Age
- Education background
- Previous hospital working in

I. Regarding doctor him/her-self

- Which hospital did you work in before? What is the Department?
- How long have you worked in HKU-SZH? What is the Department?
- What are the considerations for you to choose to work in HKU-SZH? How do you make your decisions?
- What is your first impression of HKU-SZH? What ideas have emerged?
- How about working hours per week? What are the other work arrangements except for outpatient service and operation (if any)?

II. Regarding patient

- How many new patients per week do you have?
- What is the rate of return visits?
- What is the proportion of new patients from the Mainland and Hong Kong?
- Are there any obstacles in communication with patients? (e.g. language, culture)
- Will you take the initiative to know the medical insurance situation of your patients?
- Does medical insurance affect your prescription?

III. Regarding inter-doctor

- What is the proportion of doctors from the Mainland and Hong Kong in the department?
- Is there any communication with the doctors of the department and other departments? Please describe your feelings.
- What are the channels of communication with other doctors? E.g. activities such as seminars, social media APP like WeChat.

IV. Regarding hospital

- What are the main dimensions of the hospital evaluation system? Are these dimensions different from the hospital you worked before? What do you think is the biggest challenge in the evaluation system?
- Please describe the most unique, best implemented, and what is needed to be improved these three modules.
- What are your needs for career development and daily life? What kind of help do you expect the hospital to provide?

V. Regarding society

- Where is your daily residence?
- How often do you travel between Shenzhen and Hong Kong?

For Hong Kong doctors

- Does working in another city have a negative impact on your daily life and your family?
- Please evaluate your social integration in Shenzhen.

For mainland doctors

- Please comment on your social integration in Hong Kong. (if any)

Appendix B: Interview Outline - the Shenzhen Government

1. Does the government have minimum requirements for the number of Hong Kong doctors at HKU-SZH? Does the government provide convenient services for Hong Kong doctors working in HKU-SZH, for example, work visas or accommodation?
2. Is the amount of financial appropriation of HKU-SZH the same as other public hospitals in Shenzhen? If not, what level is HKU-SZH's subsidy?
3. Do you think the appropriation amount is over or underestimated? (To government); is there overspending or balance of this appropriation amount? (To hospital management)
4. Does the Shenzhen government provide further plans for the obstruction of cross-border circulation across the Mainland of Hong Kong (i.e. how will the government reform and simplify the procedures for the allocation of hospital equipment to address the supply of urgently needed medical equipment in the hospital)?
5. What was the original intention of the Shenzhen University Hospital, and whether the development of HKU-SZH has reached the original intention now?
6. Is there a continuing policy bonus for such cross-regional medical cooperation? (I.e. how will the Shenzhen government plan to better support the development of HKU-SZH in the future? Especially after the official release of the "Guangdong-Hong Kong-Macao Greater Bay Area Development Planning Outline" in February 2019.)
7. What do you think is the unique advantage of Guangdong-Hong Kong-Macao Greater Bay Area in supporting medical cooperation?

Appendix C: Interview Outline- HKU-SZH

Personnel:

1. In 2018, the total number of employees of HKU-SZH was 3030, including 656 doctors, 1531 nurses, 401 medical technicians, and 442 management and supporting personnel. Is this staffing sufficient? What is the qualification of doctors? Will the proportion of different employees be adjusted?
2. What is the working mode of Hong Kong experts? Are they required to satisfy a working hour requirement in the hospital? Are there any barriers to the cross-border movement of people? Is there any difference in the management and remuneration system between Hong Kong doctors and mainland doctors?
3. Is it difficult for the hospital to recruit people? Which positions are more difficult to recruit? Is employee turnover high? Are there any differences in turnover rates among different positions?
4. As a public hospital, how does the “separation of powers” governance structure (the board of directors, the board of supervisors and the hospital management team) help to improve the hospital management?

Capital:

1. At the beginning of the establishment of HKU-SZH, the total investment was about 4 billion yuan from the Shenzhen government. Is there any financial support from Hong Kong? How does HKU get involved in founding this hospital?
2. According to the online news, till now, HKU has provided advanced capital about 600 million for the hospital. What caused this situation, why did not the capital be paid off and how does the hospital deal with the capital?
3. Can the hospital make both ends meet now?
4. It is reported that one of the reasons for the delay in repayment of the advanced capital by HKU relied on the difficulty in remittances. Due to the tax system in the Mainland, about 20% of the outbound remittances will be taxed. Therefore, an additional tax of 120 million yuan will be collected on the basis of 600 million yuan. Is this really the case? From your perspective, are there some institutional issues that need to be addressed, such as cross-border capital flows and personnel exchanges, and what is the most important issue?
5. According to the government report, the Shenzhen Municipal Government has allocated financial subsidies of 1.58 billion yuan in total to HKU-SZH, including a start-up fee, personnel, utilities, property costs, and basic medical service subsidies. In 2018, the direct

subsidy revenue from the government accounted for 12.9% of total expenditure. ① what is the main component of the hospital revenue? ② in what areas are the funds invested? Staff salaries or R&D?

Technology:

1. What is the current status of hospital development in clinical and non-clinical technology? Is there any focus area?
2. How does the hospital do information management? How is cooperation with Sami Medical? What are the main responsibilities of the Hospital Digital Development and Management Committee? Do you have a plan to enter the Internet medical industry in the future?
3. In 2018, the HKU-SHZ broke through many core technologies. Do you have an innovation capability generating knowledge, working on strategy, implementing tech from other hospitals, running PoCs/testbeds? What is the composition of the hospital's scientific research team? What is the position of HKU in terms of personnel and technology? Can the research results of the HKU be transformed and commercialized through HKU-SHZ?
4. Are there any obstacles to cross-border intellectual property recognition?

Policy and Institution

1. According to the brochure, as the pioneer in medical reform, HKU-SZH has broken the traditional personnel system in mainland China by introducing a bunch of HK experience. So, what kind of experience was introduced and what is the most important institutional innovation in the personnel system or other management systems?
2. One of the goals for HKU-SZH is to build four centers: 1) the GBA international medical center; 2) the GBA international medical talent training center; 3) the GBA medical technology innovation center; 4) the GBA international hospital management innovation center. So, ①to realize this goal, does the hospital come up with some institutional innovations? ②What advantages or disadvantages come from the status of a joint hospital?
3. We find from the official website of HKU-SZH that the hospital introduced a group of outstanding medical talents at home and abroad to meet the urgent medical needs. So, is there some special talent introduction policy to attract talents especially talents from HK?
4. The hospital sets up a salary system by referring to the salary system standards of HK. Will the salary system treat HK doctors and Mainland doctors differently and implement different standards between them?
5. As we know, here is the pilot of The Elderly Health Care Voucher Scheme. ①How

effective is the implementation of the scheme? ②In light of the population aging background of HK, how will this plan promote the medical cooperation in GBA?③ Why is HKU-SZH the first pilot?

6. At the macro level, are there some policy systems constrain the further development of the hospital, especially in the cross-border of personnel, funds intellectual property and other factors? What areas do you think should the government (both the Shenzhen government and HK government) offer support to the hospital development?

Other General Questions:

1. What is the role of HKU in the establishment and operation of HKU-SZH?
2. Were there any experiences from other places on medical cooperation that we learned from when establishing HKU-SZH? (Silicon Valley has to deal with state and federal bodies/funding; the European Union has to deal with differences in social, cultural and legal factors)
3. Is the public satisfied with the hospital? Why did the packing fee rise from 180 to 255 yuan On May 12, 2018? What is the public's reaction? Are there any major reasons for the 74 complaint issues in 2018?
4. Why is the Shenzhen government so keen to promote the establishment of HKU-SZH? What challenges were encountered during the establishment of the hospital? (i.e. establish a link to basic research, health standards developed in HK/international, knowledge transfer, innovative medical techniques, etc.)
5. What are the advantages and disadvantages of developing medical cooperation in GBA? What kind of opportunities and challenges will the further integration of GBA bring about to HKU-SZH?

Appendix D: Annual Accounts of Shenzhen Public Hospital Management Center 2015-2018 (Ten thousand yuan)

| Index | HKU-SZH | PKUSZH | Shenzhen People's Hospital | Shenzhen Second People's Hospital | Shenzhen Traditional Chinese Medicine Hospital | Shenzhen Maernity&Child Healthcare Hospital | Shenzhen Kangning Hospital |
|--|------------|------------|----------------------------|-----------------------------------|--|---|----------------------------|
| Annual accounts of Shenzhen Public Hospital Management Center in 2015 | | | | | | | |
| Revenue | | | | | | | |
| Fiscal allotment | 50,368.82 | 72,736.63 | 86,452.45 | 68,145.91 | 38,903.01 | 29,991.45 | 16,040.33 |
| | 40.79% | 27.71% | 24.26% | 28.27% | 26.80% | 25.74% | 43.45% |
| Operating revenue | 72,541.82 | 189,187.98 | 269,929.67 | 172,474.49 | 105,332.51 | 86,278.24 | 19,835.50 |
| | 58.75% | 72.07% | 75.47% | 71.54% | 72.57% | 74.04% | 53.73% |
| Other revenue | 557.71 | 575.86 | | 471.01 | 905.41 | 264.55 | 1,041.86 |
| | 0.45% | 0.22% | | 0.19% | 0.62% | 0.23% | 2.82% |
| Total | 123,468.35 | 262,500.48 | 356,382.12 | 241,091.41 | 145,140.93 | 116,534.24 | 36,917.69 |
| Expense | | | | | | | |
| Medical and health service | 113,926.24 | 217,421.55 | 308,463.29 | 204,028.01 | 125,070.39 | 87,259.72 | 28,859.89 |
| | 99.62% | 88.59% | 88.03% | 82.92% | 86.47% | 80.35% | 79.58% |
| Other Expense | 435.62 | 27997.15 | 41944.48 | 42034.90 | 19570.43 | 21336.29 | 7405.84 |
| | 0.38% | 11.41% | 11.97% | 17.08% | 13.53% | 19.65% | 20.42% |
| Total | 114,361.86 | 245,418.70 | 350,407.77 | 246,062.91 | 144,640.82 | 108,596.01 | 36,265.73 |
| Annual accounts of Shenzhen Public Hospital Management Center in 2016 | | | | | | | |
| Revenue | | | | | | | |
| Fiscal allotment | 50,449.54 | 41,423.06 | 65,034.30 | 50,173.37 | 32,979.65 | 25,754.29 | 12,359.94 |
| | 33.03% | 16.16% | 17.84% | 20.37% | 22.35% | 20.33% | 34.70% |
| Operating revenue | 101,388.22 | 213,337.07 | 299,530.61 | 195,072.81 | 113,149.57 | 98,350.40 | 22,921.43 |
| | 66.38% | 83.21% | 82.16% | 79.21% | 76.67% | 74.04% | 64.35% |
| Other revenue | 903.13 | 1,635.86 | | 1,032.73 | 1,448.36 | 605.21 | 341.26 |
| | 0.59% | 0.64% | | 0.42% | 0.98% | 0.48% | 0.96% |
| Total | 152,740.90 | 256,396.00 | 364,564.90 | 246,278.91 | 147,577.57 | 124,709.90 | 35,622.64 |
| Expense | | | | | | | |
| Medical and health service | 167,243.54 | 247,831.29 | 352,829.09 | 230,436.63 | 141,427.06 | 113,541.19 | 33,197.04 |
| | 99.47% | 97.04% | 96.66% | 95.70% | 96.65% | 92.77% | 92.33% |
| Other Expense | 893.77 | 7561.14 | 12201.84 | 10363.60 | 4896.66 | 8850.59 | 2757.77 |
| | 0.53% | 2.96% | 3.34% | 4.30% | 3.35% | 7.23% | 7.67% |
| Total | 168,137.31 | 255,392.43 | 365,030.93 | 240,800.23 | 146,323.72 | 122,391.78 | 35,954.81 |
| Annual accounts of Shenzhen Public Hospital Management Center in 2017 | | | | | | | |

| Revenue | | | | | | | |
|--|------------|------------|------------|------------|------------|------------|-----------|
| Fiscal allotment | 26,522.77 | 49,851.42 | 57,605.38 | 69,917.02 | 45,562.38 | 29,056.03 | 33,204.24 |
| | 15.76% | 17.20% | 15.81% | 25.02% | 26.12% | 21.10% | 55.77% |
| Operating revenue | 134,913.26 | 231,160.20 | 306,684.08 | 203,427.73 | 127,006.07 | 105,922.83 | 25,464.26 |
| | 80.16% | 79.76% | 84.19% | 72.79% | 72.81% | 76.94% | 42.77% |
| Other revenue | 6,872.88 | 8,805.89 | | 6,143.66 | 1,865.19 | 2,697.16 | 865.01 |
| | 4.08% | 3.04% | | 2.20% | 1.07% | 1.96% | 1.45% |
| Total | 168,308.91 | 289,817.52 | 364,289.46 | 279,488.40 | 174,433.63 | 137,676.02 | 59,533.52 |
| Expense | | | | | | | |
| Medical and health service | 172,784.46 | 273,815.80 | 348,933.99 | 262,483.78 | 167,304.60 | 125,318.43 | 58,173.02 |
| | 99.69% | 95.55% | 95.40% | 93.86% | 95.82% | 91.48% | 94.42% |
| Other Expense | 540.83 | 12740.97 | 16833.10 | 17165.44 | 7301.94 | 11673.02 | 3435.24 |
| | 0.31% | 4.45% | 4.60% | 6.14% | 4.18% | 8.52% | 5.58% |
| Total | 173,325.29 | 286,556.77 | 365,767.09 | 279,649.22 | 174,606.54 | 136,991.45 | 61,608.26 |
| Annual accounts of Shenzhen Public Hospital Management Center in 2018 | | | | | | | |
| Revenue | | | | | | | |
| Fiscal allotment | 25,855.23 | 40,466.48 | 75,134.74 | 72,214.79 | 30,978.50 | 20,179.83 | 43,219.05 |
| | 12.88% | 12.33% | 17.65% | 23.95% | 18.37% | 14.39% | 56.57% |
| Operating revenue | 171,216.03 | 279,859.68 | 350,624.48 | 228,859.97 | 131,496.35 | 119,055.94 | 31,798.43 |
| | 85.30% | 85.28% | 82.35% | 75.91% | 77.96% | 84.87% | 41.62% |
| Other revenue | 3,655.35 | 7,828.75 | | 419.83 | 6,188.47 | 1,040.81 | 1,380.74 |
| | 1.82% | 2.39% | | 0.14% | 3.67% | 0.74% | 1.81% |
| Total | 200,726.61 | 328,154.90 | 425,759.22 | 301,494.59 | 168,663.33 | 140,276.58 | 76,398.21 |
| Expense | | | | | | | |
| Basic expenditure | 184,662.62 | 300,600.05 | 380,352.41 | 252,844.82 | 157,818.26 | 135,120.99 | 48,519.53 |
| | 96.93% | 93.17% | 90.47% | 87.44% | 93.63% | 96.48% | 64.12% |
| Project expenditure | 5,851.97 | 22,039.86 | 40,073.25 | 36,326.52 | 10,745.53 | 4,931.44 | 27,155.15 |
| | 3.07% | 6.83% | 9.53% | 12.56% | 6.37% | 3.52% | 35.88% |
| Total | 190,514.59 | 322,639.91 | 420,425.65 | 289,171.34 | 168,563.79 | 140,052.43 | 75,674.67 |

Source: Information Disclosure of Shenzhen Municipal Health Commission