Benefit or Surveillance?
A Study on the
Potential Application of Social Credit System in
Hong Kong and Shenzhen Hospitals

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by

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Abstract

The thesis describes an emergent topic of capitalism surveillance in the networked sphere of the era. The surveillance in the Hong Kong Special Administrative Region of the People's Republic of China (HK) and the implementation of Social Credit System (SCS) in mainland China have come under the spotlight. SCS is one of the latest and largest executions of mainland China to be fully operational on 1.4 billion citizens in mainland China in 2020. Being raised in the HK, there is an acute pressure in facing this situation as increasingly powerful governance of mainland China is coming into a new territory. The way HK will react to the power of mainland China remains unknown, but the complexity of the situation is essential to understand.

Coming from an architectural background, this has aroused the author's interest in using SCS as a primary lens in manifesting the influence and feasibility of surveillance in the built environment of the healthcare systems in HK and mainland China and more specifically, Shenzhen (SZ). For easier comparisons, SZ, as one of the typical cities in mainland China, is used for the investigation and thus the healthcare system of mainland China also applies to SZ. Case studies of Hong Kong Children's Hospital (HKCH) and Shenzhen Children's Hospital (SZCH) are taken as a secondary lens to unpack differences of both hospitals in data collection spatially. Roles of architects are also reassessed as their design decisions can influence the extent of barriers in unnecessary data collection indirectly.

The thesis has separated into two main parts. In Chapter 2, the importance of capitalism surveillance in mainland China is explored. In Chapter 3, SCS's feasibility in HK's and mainland China's healthcare Systems are analysed with the focus in data collection followed by case studies of HKCH and SZCH for the investigation on applications of data collection in the built environment. Resources are gathered from official websites and academic publications for the research. Several illustrative examples are presented in the chapters to demonstrate the convenience, proficiency and centralisation of data collection.

Based on the studies and analyses aforementioned, major conclusions can be obtained. The research proposal investigated the data collection of SCS and manifestation in the healthcare system. As a person with close experience to HK, any subject of this nature needs scrutiny to the existing system. Strategies of extending power are complicated, and due to strong identities in HK, various parameters of data collection mentioned in the research need to be considered. With reduce in standardisation and increase of convenience and centralisation in architectural design, the efficiency of data collection can be enhanced.

Major contributions have been made by much effort of investigation and analyses aforementioned. It is crucial to acknowledge that there will be responses from societies and people and that enough time needs to be given in a retrospective for the responses. The responses of a society are unpredictable as it depends on the bigger social-economic and political situation of the place. Due to context-specific interests between societies, one cannot assume that the idea of surveillance which worked for one region would work for another. As future architects, there are ways that architects can actively influence the extent of data extractions indirectly. Similar research methodology can also be used to investigate the same aspect of surveillance in different systems of a society as well as in varying contexts.

For further research, relevant studies will be done with more comprehensive evidence on healthcare systems of HK and mainland China, particularly SZ. Further investigations can also be undertaken on two or more different systems in other regions that may not be complied or applicable to embrace SCS applications. Attention shall also be paid to future applications of SCS at SZCH to justify the findings of this thesis.

Keywords: Social Credit System, Sesame Credit, Data Collection, Digital Era, Healthcare System, Hospital, Children's Hospital, Architectural Design

Nomenclature

Abbreviations	
EHR/ eHR	Electronic Health Records
eHRSS	Electronic Health Records Sharing Systems
FHB	Food and Health Bureau of Government of Hong Kong
HA	Hospital Authority
HK	Hong Kong Special Administrative Region of the People's Republic of China
HKCH	Hong Kong Children's Hospital
PRC	People's Republic of China
SC	Sesame Credit
SCS	Social Credit System
SZ	Shenzhen
SZCH	Shenzhen Children's Hospital
UK	United Kingdom

The Definition

Capitalism Surveillance

1. a new data science collected from human and markets their experience as valuables for unrevealed commercial practices of prediction

2. a computational power with algorithmic system under a surveillance economy

3. a series of automated platforms imposing new collective orders based on certain standards

(Zuboff, 2019; Naughton, 2019)

Social Credit

1. A sense of trustworthiness including honour, trust and confidence of a person in society

2. A kind of moral courage which results in honest and trustworthy behaviour in a wide range of activities

(Chorzempa et al., 2018)

Data Collection

1. a one-way process of making big data typical occur in the absence of consent

2. a way of extracting intimate and immediate technological trajectories that can accumulate under examination

(Zuboff, 2015)

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Chapter 1 Introduction

Background and Literature Review

As we enter the digital era, capitalism surveillance has been an unprecedented global topic since big data innovation becomes an emerging strategic resource across both the private and public sectors in various countries. It is seen as a 'future petroleum resource' for socio-economic and political development (Du et al., 2014). At the same time, it is a new economic order that markets human experience as valuables for unrevealed commercial practices prediction (Zuboff, 2019). Capitalism surveillance redefines privacy and breaks down barriers of 'private' and 'public' information in various sectors to expand surveillance capacities.

As a significant new technology to human nature in the twenty-first century, the inevitable digital realm overtakes and redefines our lives. Information and communication technologies are increasingly widespread nowadays, with roots run deep through various necessities of daily lives and mediate different forms of social participation (Zuboff, 2015). Social media platforms like 'Facebook' and 'Instagram' are prevalent around the world now, and they are about getting to know one's habit, social circle, education level and affordability. Thus, they can target users with intentions. As the networked world enriches our capabilities, a predictable future slip away, and at the same time new territories of emotions of people from every social stratum, generations and societies are birthed (Zuboff, 2019).

The surveillance in the Hong Kong Special Administrative Region of the People's Republic of China (HKSAR, 'HK' used below for simplification) and the implementation of Social Credit System (SCS) in mainland China have come under the spotlight as they became debatable topics in the past few months. As a powerful capitalism surveillance system, SCS is the latest and largest pilot project for data collection and software development for personal social credit scoring in mainland China. Although there are people who find it acceptable whereas others feel unsure navigating in this unknown territory without bearings, it is on track to be fully operational on 1.4 billion citizens by 2020 (Kobie, 2019). It aims to create a comprehensive and centralised database for a big data-enabled surveillance infrastructure that can manage, monitor and predict the trustworthiness including honour, trust and confidence of citizens in mainland China (Chorzempa et al., 2018). Instead of using Alipay Domestic, which serves mainland China users, HK has also adopted using AlipayHK in 2017 (Chan, 2018). This infrastructure initiative's nature has consisted of benefit and surveillance that exist at the same time.

Scope and Significance

Although societies' responses take time and are unpredictable, it is vital to understand the complexity of the situation that this thesis presents. Being raised in the HK, there is an acute pressure in facing this situation as increasingly powerful governance of mainland China is coming into a new territory. The research responds to this significant change in our society by investigating healthcare systems of two regions- HK and mainland China, and more specifically, Shenzhen (SZ). For easier comparisons, a typical city in mainland China, SZ is used to compare with HK. SZ is close to HK geographically but is under the control of mainland China. The healthcare system of mainland China also applies to SZ.

In the context of SZ and HK, capitalism surveillance might not comply with each other because their culture, habits, social-economic system and political systems vary. Favourable incentives of SCS may not apply to both regions at the same time due to their differences in priorities. HK has more protection of personal data and privacy, and thus the citizens might not be used to be exposed to surveillance. They might resent putting themselves with others as they never did culturally. In contrast, in mainland China, the word for privacy in Chinese, Yinsi, did not appear in popular Chinese dictionaries until the mid-1990s (Zuboff, 2019). It is believed that SZ's society has been saturated with surveillance in different ways in the past decades, so some citizens get used to it and tend to find the new surveillance tool acceptable (Zuboff, 2019).

Data collection is a one-way process of generating big data often in the absence of consent. It is the first step on the conveyor belt of surveillance and is seen as the most critical step which can simulate the following spread of information in different extents. Thus, the focus of the research is mainly on factors affecting data collections. Two very different sets of contexts and spatial conditions will be considered in the thesis. The architectural design does not affect data collection directly but has an impact on its efficiency.

Uniqueness and Objective of the Research

Coming from an architectural background, this has aroused the author's interest in using SCS as a primary lens in manifesting the influence and feasibility of surveillance in the built environment. The thesis studies SCS applications in a physical and spatial context from an architectural perspective to unpack parameters affecting data collection in a tangible sense.

With the support of statistics and design considerations, the thesis aims to explore the different interests of both HK and SZ and reassess the roles of architects. Although data collection algorithms are often not the primary intention at the design stage, due to differences in design ethos and ideologies, they are context-specific and can be affected by the built environment indirectly. Based on this indirect link, case studies of HKCH and SZCH are used as a secondary lens to study the design applications of SCS spatially. The relationship between SCS and architecture is investigated, and how it influences architecture spatially is analysed. With reduce in standardisation and increase of convenience and centralisation in architectural design, the efficiency of data collection can be enhanced.

Major Challenges of the Research

The primary research challenges of the thesis are presented as follows:
1. A strategic approach for optimal understanding
At the planning stage, relationships of HK, SZ, HK protests, SCS, HKCH and SZCH are investigated. The strategies in approaching these topics in the thesis are tested for a more comprehensive research flow. As the thesis has a limited length, a series of selective processes of materials are taken to present a clear focus of the research. The processes facilitated the author in studying the healthcare systems in HK and SZ as well as HKCH and SZCH with specific lenses of SCS.

2. Variety of materials for quality of comparisons
At the research stage, there is a hierarchy in the amount of information gathered for HKCH and SZCH in different aspects. Compared to HKCH, only limited information on the design of SZCH is available

online. One of the reasons could be that comparing with the efficiency measures that SZCH adopts, hospital designs are relatively not as crucial in SZCH. In contrast, spatial features of HKCH are widely advertised, and this could be due to the design being one of the most important parameters in HKCH for the user-friendliness in the hospital. At the same time, information of digitalisation of HKCH is not as comprehensive as that in SZCH. This could be due to the limited usage of data collection tools to maximise the protection of personal data of patients. Therefore, the thesis is structured with comparison points which are supported by different types of evidence from HKCH and SZCH. This research has used a variety of resources in a flexible way for a better quality of comparisons.

Outline and Methodology of the Thesis

The thesis has separated into two main parts, referring to Fig. 1. In Chapter 2, the importance of capitalism surveillance in SZ is explored. Tangible and intangible links of HK and SZ are evaluated, followed by responses towards the surveillance from HK. Then, SCS's application in SZ and its coverage in the healthcare system of SZ are studied. In Chapter 3, SCS's feasibility in HK's and SZ's healthcare Systems are analysed with the focus on data collection. Case studies of HKCH and SZCH are undertaken for the investigation on the applications of data collection spatially.
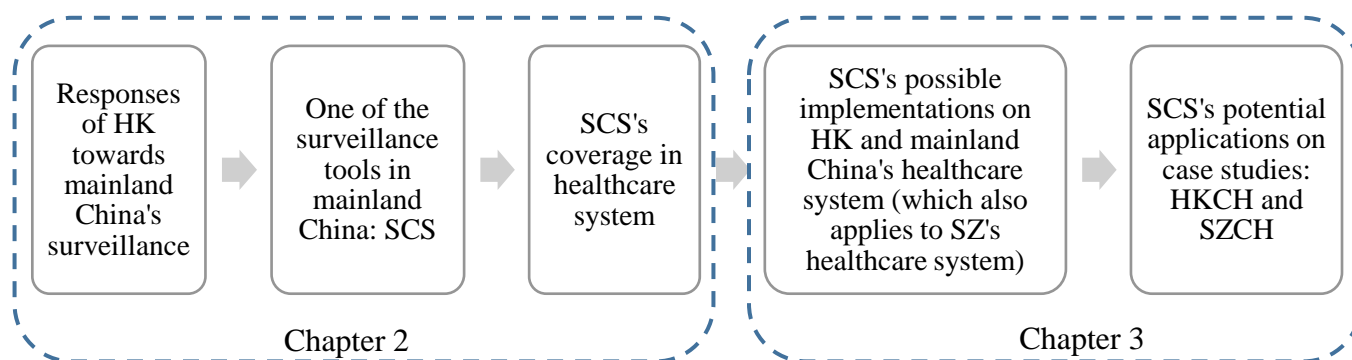
Fig. 1 Research Framework

Resources are gathered from different media for the research. The thesis starts with exploring the surveillance and its applications of SCS in SZ through academic articles and news publications. Mobile interfaces are also downloaded and tested for better understanding of the operations of SC. Information about HK 2019- 20 protests are generally gathered from various news agencies as they were relatively recent events. Regarding the healthcare system in HK and SZ, the analyses are based on information assembled from official websites and academic journals for better validity of materials. As an intern, the author has assisted in the architectural design and facilitated the mock-up of HKCH in 2015. Thus, the author has gained some insights into the architectural designs of the hospital. For a more comprehensive understanding of HKCH's features, an interview was carried out with Dr Zou, a senior professional engineer, who once worked on this large-scale project (Zou, 2020). For HKCH and SZCH, majority of its facts, figures, plans and design features are extracted from official websites and academic publications for the analysis.

When SCS (a new system for HK) is assumed to be applied in HK, would it be benefit or surveillance for local citizens? A study on the potential application of SCS in HK and SZ hospitals has been made mainly in Chapters 2 & 3. With the studies and analyses carried out, a clearer answer can be given at the end of this thesis.

Disclaimer: Extra materials are placed in the Appendices A to E at the back, which can contribute to the understanding of the research topic, but it is not part of the study.

Chapter 2 Importance of Capitalism Surveillance in Mainland China

2.1 Tangible and Intangible Links Between HK and Mainland China

HK's royal colony was officially reverted to Chinese sovereignty from the United Kingdom (UK) in 1997. It retains its own economic, administrative and governance system under the constitutional principle "One country, two systems" for 50 years until 2047 (Basic Law Full Text - chapter (1), n.d.).

Although HK and mainland China complement each other economically, the century-long separation between two regions has created political, cultural, economic gaps in various systems that are complicated to bridge. The differences of two regions have added barriers to mainland China wheeling its power to HK.

As the political power of mainland China extends and permeates into HK, some HK citizens see this as surveillance coming into an independent system and react rigorously while some find it acceptable. Protests are one of the ways for the citizens to express their disagreements.

2.2 Responses from HK citizens

In June 2019, protests are sparked by the introduction of an extradition bill that would allow suspected or accused criminals to send to mainland China from HK, referring to Fig. 2. Protesters believe HK should not be surveilled by mainland China and should retain its judiciary and a separate legal system before 2047.

The current intrusions on citizen's freedom and democracy have been an increasing concern for protesters as they think it implies that city is impending its return to mainland China's control and are worried that the city will be surveilled (Davidson, 2020). They are feared that this could risk exposing local citizens to future unfair dissidents, hurt the city's judicial protection from the mainland China and allow the government of mainland China to be more influential over governance of HK (Hong Kong Protests Explained, 2019). The waves of demands then morphed into a broader anti-government campaign seeking democratic reforms. The bill was withdrawn in September 2019 by HK Chief Executive Carrie Lam but not before the protests escalated as a resentment against police brutality and late withdrawal (Yu, 2019). The unrest has raised questions about HK's brand positioning as a politically independent city and weakened the trust of the citizens to the governance of HK and mainland China.

Fig. 2 HK 2019- 20 Protests
(SCMP Reporters, 2019)

2.3 SCS's Application in Mainland China

Mainland China has been adopting capitalism surveillance for decades that the citizens have accepted national ID cards with biometric chips, birth permits and the SCS as the society is saturated with surveillance (Zuboff, 2019). Due to trust-keeping being insufficiently rewarded and costs of breaking trust continue tending to be low, SCS is seen as the latest surveillance technology in the region (Creemers, 2014). It has drawn considerable academic and public attention not only because of its 'top-level design' under central coordination, but also because the involvement of comprehensive and centralised database for a big data-enabled surveillance infrastructure (Creemers, 2014). This technology is created for data collection, mining and analysis of citizens.

Apart from having artificial intelligence and facial recognition feeding the SCS, Alibaba, a financial and high-tech company, initiated regional trials of Sesame Credit (SC) on its Alipay Domestic interface in 2015 (Zhong, 2019b). It is an interface that can manage, monitor and predict the trustworthiness of citizens and present a holistic rating of them (Liang, 2018; Vanderklippe, 2018). This technology platform starts with data collection from more than 400 million registered users that have transactions with Alibaba Group marketplaces through Alipay Domestic (Zuboff, 2019). Then it rates individuals according to preselected behaviour standards that are desirable to the government of mainland China. The top-down power thus acts on people from the government. Referring to Fig. 3, The score of each user generally depends on the credit history (35%), fulfilment capacity (25%), personal characteristics (15%), behaviour and preference (20%) and interpersonal relationships (5%) (Develle, 2019). The trustworthiness scores in the ranking range from 350 scores to 950 scores and one is counted as a trustworthy person when 600 scores are obtained (Develle, 2019). The reward-punishment system based on the credit scores determines one's accessibility of various aspects in daily life, for instance medical services, education, travelling and tax deductions. However, the algorithmic learning in SC goes far beyond the timely payments users make as it also evaluate and bank purchases, education levels and social circles (Zuboff, 2019).
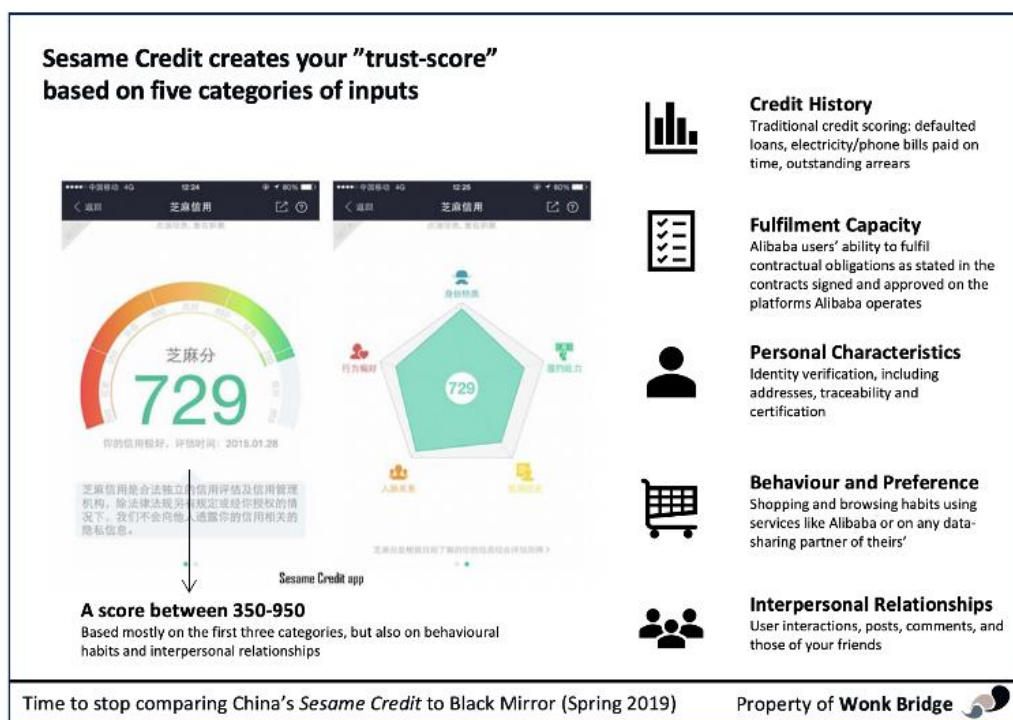
Fig. 3 Parameters of An Individual's SC Rating
(Develle, 2019)

SC is advertised as an interface to encourage trust and sincerity in social interactions. However, the shadow text means it can be a digital dossier, with every Chinese citizen being able to be trailed by a file comprises of data from public and private sources that are searchable by fingerprints or other biometric characteristics (Hvistendahl, 2017). As users are not told how much of their data are collected, stored and used in the system, there can be a large disparity between the propaganda and reality. By summer 2018, the blacklist has swelled to 7.49 million names (Liang et al., 2018). They are publicly shamed on the official website with names and national ID card number partially revealed, referring to Fig. 3. They are also barred from paying for hotel rooms, buying rail and flight tickets. Although Alibaba has assured that all data is gathered upon knowledge and authorisation of the users, it has been found that the company has access to all public documents from the government of mainland China due to close business collaborations with the government.

This is seen as an intangible way in manipulating public behaviours according to specified standards of appropriateness, with muted algorithms of data collection and analytical parameters. This is believed to be the episode 'Nosedive' in Black Mirror Season 3 in 2016 coming true, where ratings affect one's home, transport and social circle. SC is also believed to be 'an automation of society through tuning, herding and, conditioning people to produce preselected behaviours judged as desirable by the state' (Zuboff, 2019). Citizens' existences can be subordinated as their privacy are replaced by computational certainty for the benefit of data collection (Zuboff, 2019).

Further benefits and penalties of SCS can be found in Appendix A- Applications of SCS in Mainland China.

Fig. 4 Public Shaming for Blacklisted Persons
(Supreme People's Court, n.d.)

Although SCS is not implemented in HK yet, this system can be one of many ways of mainland China permeating its political power into HK. It is crucial to acknowledge that there are always responses of a region to new changes, and there can be many ways of a region responding to this change. Thus, people need to give enough time for it. Alipay, being increasingly influential in and outside of mainland China nowadays, is now used in HK. Instead of using Alipay Domestic, which serves mainland China users, HK has adopted using AlipayHK in 2017, referring to Fig. 5 (Chan, 2018). It was the first extension of Alipay outside mainland China that offers cashless services to HK residents. Alipay HK is said to be separated with Alipay Domestic and mainly serves HK citizens, although the scope of data transfer between both apps remains unknown.

Fig. 5 Alipay Domestic (left) and AlipayHK (right)
(Shutterstock, 2020; Alipay Payment Services (HK) Limited, 2017)

2.4 Surveillance Coverage in Healthcare System

The healthcare sector is one of the utmost important development focuses in both HK and mainland China as the global ageing trend is a huge concern for future generations. Due to declining fertility and increasing longevity, more than 30% of the population is expected to be age 60 or above in 2050 in the People's Republic of China (PRC) (United Nations, 2017). The SCS has now covered the healthcare systems in mainland China, particularly in SZ, yet its credibility and digital surveillance extent have brought to question.

With the strategy 'All in Mobile E-Commerce' set in 2014, the Alibaba's digital wallet, Alipay has launched a programme called 'Future Hospital' aiming to liaise between patients and hospitals on a wider scale. This is already in use in 63 hospitals in most of mainland China's largest cities, including SZ, Beijing, Shanghai, Guangzhou and Zhejiang with up to 5 million patient users (Zhao, 2014; Cadell, 2015). Alipay can connect to hospital databases and provide personal data that integrates patients' medical records to its financial technology platform- Ant Financial as this app is used (Pymnts, 2014). At the same time, acts of generosity on people around are also recorded, for example, taking an elderly to the hospital twice a month is one of the 'Codes of good conduct' and can contribute to a better score (Raphael and Xi, 2019).

In 2017, taking the previous strategy as a reference, SC is launched by Alipay and is penetrated in the medical system of SZ (Koetse, 2018). 'Credit Medical Treatment' is the first cross-hospital consolidated patient databases services that target people with a score over 650 (Cadell, 2015). This scheme was set to expand to more hospitals in 10 other cities in mainland China and it is believed that SZCH is one of the next batch of hospitals joining this programme (Rollet, 2018).

One of the measures of this scheme is to solve the problem of time inefficiency in hospitals. Alibaba argued that by slashing medical waiting times at over-crowded facilities, the new service provides a much more efficient alternative for patients through in-app credit functions (Pymnts, 2014). This is because the normal procedure in SZ hospitals requires more than two hours, which is very time-consuming, referring to Table 1. This 'Credit Medical Treatment' in SC uses time saving as an incentive to reduce the whole process to less than an hour and thus saves 60% waiting time of patients. To attract new users, Alibaba has granted users RMB 1,000 ($\approx$GBP 115) in SC so they can pay medical fees incurred in the hospital (Mo, 2017).

	Normal procedure	**The procedure with SC**
Duration	≥ 2 hours	≤ 1 hour
Registration	±60 min (at hospital)	±3 min (by phone)
Waiting for Consultation	±20 min	±10 min (get a registration number automatically)
Doctor's consultation	±20 min	±10 min
Queuing for Check-up Payment	±20 min	N.A.
Check-up	±20 min	±20 min
Queuing for Medication Payment	±10 min	N.A.
Medicine Pick Up	±10 min	±10 min

Table 1 Ordinary and New Consultation Procedures
(Koetse, 2018)

There are other medical-related benefits and penalties that can affect one's healthcare experience in SZ. For instance, patients with SC score over 600 are eligible for renting a wheelchair in hospitals without deposit, using preferential treatments at hospitals and enjoying free health check-ups etc. (Kostka, 2019; Koetse, 2018). In contrast, people who are violent against medical workers or wear illegal plastic surgery outfits would be blacklisted and suffer from medical inconveniences (Rollet, 2018).

Healthcare system is the focus of examining the implementation of SCS in HK and SZ in the following chapter. The two regions adopt very different medical systems due to their social-economic and political developments. Therefore, the extent of feasibility in implementing SCS varies.

Chapter 3 Feasibility of SCS in HK's and Mainland China's Healthcare Systems

3.1 Convenience of Data Collection and Data Transfer

Due to historical reasons, healthcare systems in both HK and SZ have been shaped differently. One of the main factors is the level of governance in both regions. Public hospitals in HK are run by the local Food and Health Bureau of Government of HK (FHB) whereas that in SZ are run by the state. As FHB is an independent bureau in HK, data of patients collected in Electronic Health Records (eHR) is not sharable with the government of HK, this adds barriers in information transfer for SCS implementation, referring to Fig. 6. In contrast, as both SCS and public hospitals are under the control of the central government of mainland China, data collected from public hospitals can be transferred for SCS smoothly and efficiently.

Fig. 6 eHR Sharing System (eHRSS) in HK
(E Health, 2019a)

HK runs on a dual-track basis encompassing the private and private sectors separately with public sector managed by FHB, which is responsible for health services policies and resource allocations for Hospital Authority (HA), referring to Fig. 7 (GovHK, n.d.). HA then arranges all 43 public hospitals providing 28.9 thousand beds, which contribute to 90% of inpatient beds in HK, into seven geographical clusters spread across in HK to serve the local population (Hospital Authority, 2019).

In SZ, hospitals are managed by the central government's National Health and Family Planning Commission (NHFPC) and Ministry of Education which also include management of local government, referring to Fig. 8 (Kong et al., 2015). In 2014, there are 13,314 public hospitals in total, contributing to 90% of hospital beds in mainland China (Deng et al., 2018; Fang, 2016a). All of these are under the control of the central government.

With differences in governance, the feasibility of SCS implementation in both regions varies. As both SCS and public hospitals in SZ are under the control of the state, inter-department data transfer is believed to be more efficient and effective than that in HK.
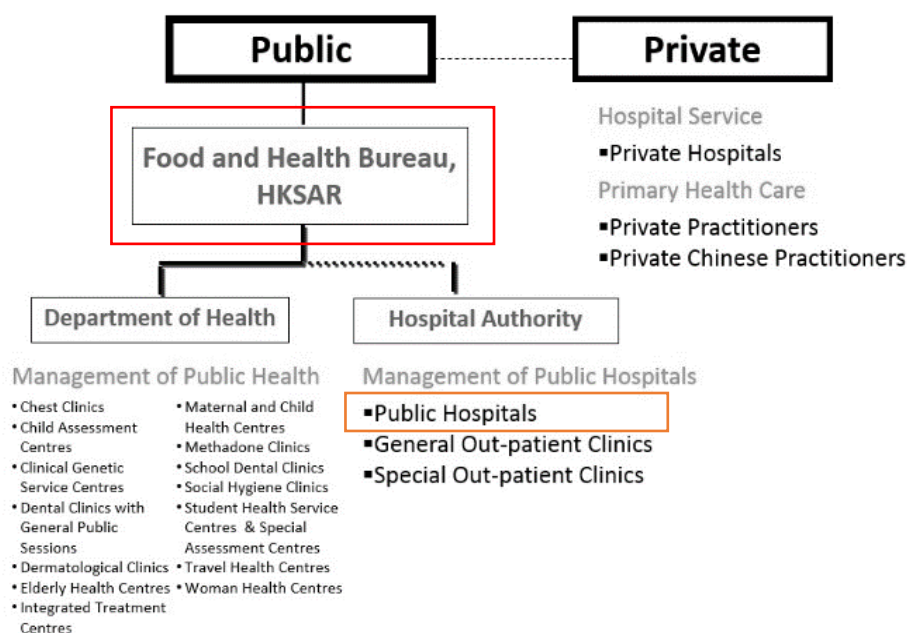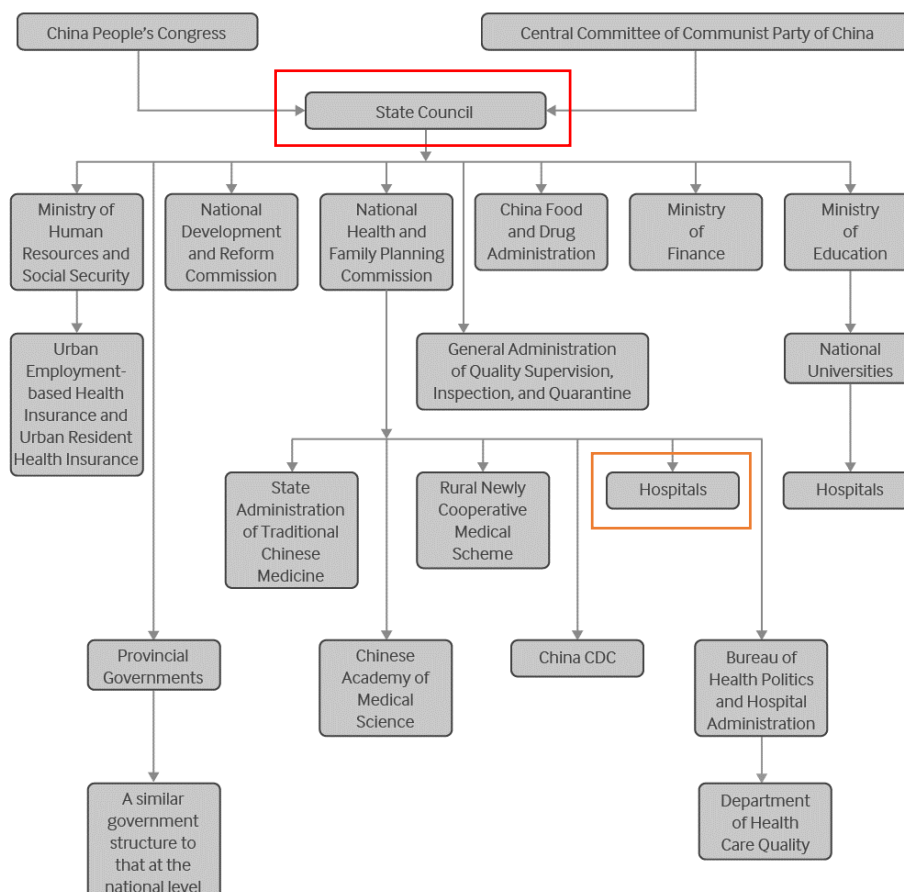

Fig. 7 Structure of Health System in HK
(GovHK, n.d.)

Fig. 8 Structure of Health System in Mainland China
(Fang, 2016b)

3.2 Effectiveness of Data Collection

The amount of government healthcare investment and areas of spending determine the flow of patients in HK and SZ. With sufficient government funding and adoption of preferential treatment in HK, citizens tend to stay in the region for services. HK also has widespread community health care services in the region, which allows patients to be treated locally within a short amount of time. However, HK's system could be less attractive and efficient in collecting data for SCS.

Adoption of Preferential Treatment

HK citizens tend to use medical services in the region instead of travelling to mainland China. The local government's fund increases with the needs of the medical sector throughout the years, referring to Fig. 9. The government adopts a preferential treatment which subsidies 95% of eligible patients' medical fees in public hospitals. At the same time, although eligible persons in HK can receive treatments in mainland China, the medical charges are 5.2 and 7.7 times more expensive for outpatient and inpatient services, respectively, in SZ than in HK, referring to Fig. 10 (Shenzhen Municipal Health Commission, 2017). Eligible persons include holders of Hong Kong Identity Card, children who are HK residents and under 11 years of age, or other persons approved by the Chief Executive of the HA and this applies to all public hospitals (Hospital Authority, 2020).
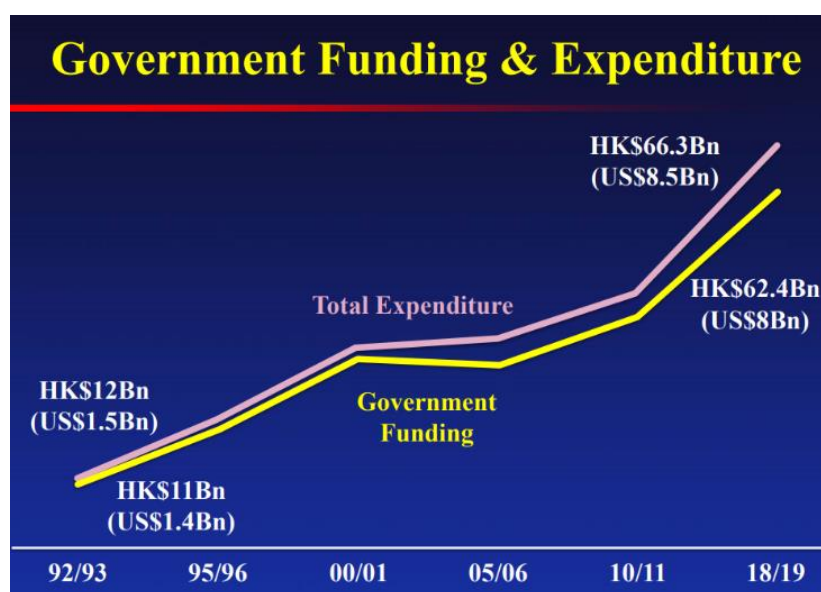

Fig. 9 Government Funding and Expenditure in HK
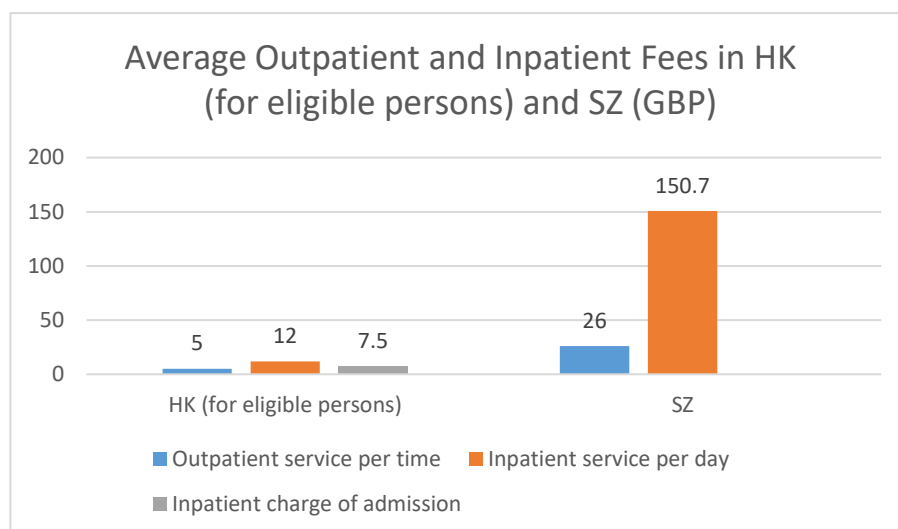(Leong, 2018)

Fig. 10 Average Outpatient and Inpatient Fees per Day in HK for
Eligible Persons and in Mainland China
(Hospital Authority, 2020; Shenzhen Municipal Health
Commission, 2017)

In order to protect HK's local resources for the eligible persons and provide a promising environment for users, HK public hospitals aim to limit the admissions of patients by maximising the price differences of service fees of eligible and non-eligible persons. Using financial disincentive in medical charges, this is seen as preferential treatments to ensure that eligible persons are favourable for their services. There is a huge difference in medical fees with the standard fees for eligible persons is HKD 50 (≈GBP 5) for outpatient, HKD 75 (≈GBP 7.5) for inpatient admission and HKD 120 (≈GBP 12) for inpatient services per day. This includes a package of all medicines, treatments and meals.

Non-eligible persons in HK need to pay HKD 445 (≈GBP 44.5) for outpatient services and HKD 5100 (≈GBP 510) for inpatient services per day (Hospital Authority, 2020). Most mainland China citizens are counted as non-eligible persons in HK public hospitals, so they need to pay 1.7 times and 3.4 times more for outpatient consultation and inpatient services respectively than HK residents in HK, referring to Fig. 11. As they are less favourable under this arrangement in HK, the number of patients from mainland China getting treatments in HK are limited. This prioritises medical services for the local persons but limits the amount of data that can contribute to the SCS.
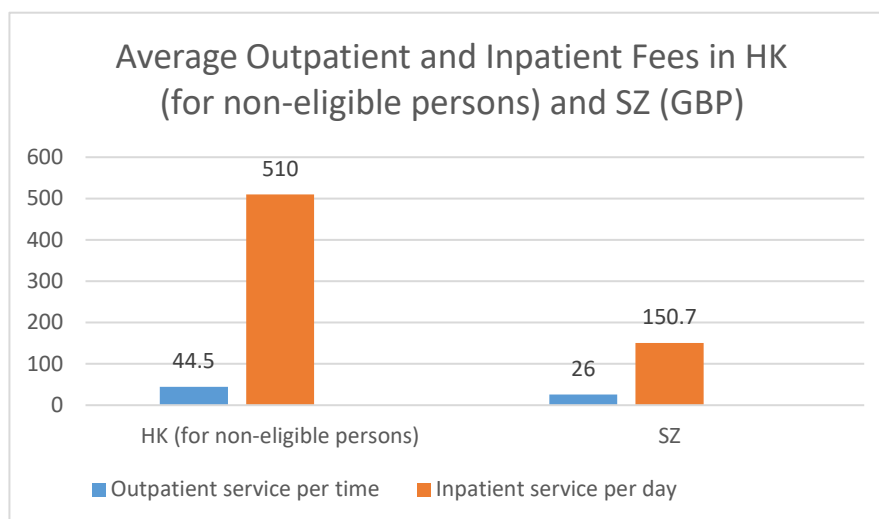
Fig. 11 Average Outpatient and Inpatient Fees per Day in HK for
Non-eligible Persons and in Mainland China
(Hospital Authority, 2020; Shenzhen Municipal Health
Commission, 2017)

Due to the efficiency and comfort in community clinics, typically HK citizens would visit clinics for common illnesses and visit hospitals for more serious diseases. As it was once a British colony, the healthcare system in HK has loosely mirrored the traditional National Health Service (NHS) system's public hospital care in the UK (Kong et al., 2015). There are 102 non-profit making medical clinics registered under the Medical Clinics Ordinance in HK at the end of 2015 (Information Services Department, 2016). The clinics are dispersed to serve the local people, and this is designed to divert the flow of patients in society. However, the collection of medical data for SCS can be difficult due to the widespread of users with no obvious hierarchy in the number of patients across different areas of the city. At the same time, as consultations are not time-consuming in HK clinics, the time-saving feature in 'Credit Medical Treatment' from the SC is less attractive in HK.

Further information about the charges of HKCH can be found in Appendix C- HKCH.

In mainland China, when patients can only receive limited healthcare services at their place of residence, they tend to visit hospitals in more developed cities, like SZ, for proper care. Public hospitals in SZ targets the general public without geographical restrictions, and at the same time, standard fees apply to all within hospitals. This is because there is a large amount of needs from the mass population in mainland China and preferential treatments cannot be applied. The hospitals need to prioritise in accommodating the needs of the mass patients efficiently and effectively. The public hospitals in SZ adopt a dense layout design as they are designed to accommodate a large number of patients. Therefore, the SCS data collection can be more centralised and efficient in SZ.

Although citizens are covered with medical insurance, healthcare investment is not enough in mainland China with out-pocket payment often more than government funding, referring to Fig. 12. At the same time, as less developed cities receive limited healthcare funding from the central government, the trend of travelling for treatments is more prominent.
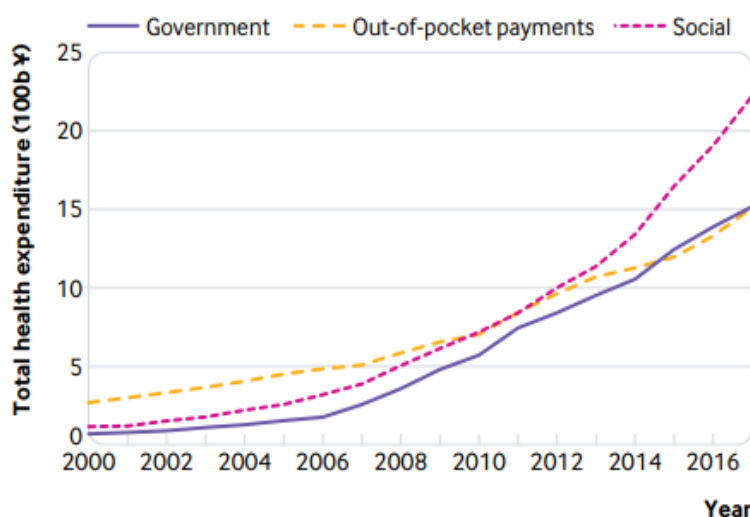
Fig. 12 Overview of Total Medical Expenditure in Mainland China
(Meng, et al., 2019)

Although the medical insurance coverage is low and out-of-pocket payment is high in mainland China, for patients who can afford to pay more for better treatments in developed cities, this is not a big concern. In mainland China, about 95% of the population are entitled to basic health insurance which only covers 48% and 44% of medical costs for urban residents and rural residents respectively in 2009 (China Today, 2019; Liu, 2011; Le Deu et al., 2012). In 2014, out-of-pocket spending per capita was RMB1,306 (≈GBP 149) and CNY754 (≈GBP 86) in urban and rural areas, respectively, which represents around 32% of total health expenditures (Fang, 2016a).

The government medical funding in HK is used for both public hospitals and general clinics, whereas that in SZ has a hierarchy geographically. Thus, the patients in HK are dispersed territory-wide but that in mainland China are accumulated in developed cities like SZ. The widespread of patients in HK could lead to limitation and inefficiency in the data collection of SCS.

Further information about outpatient and inpatient services charges can be found in Appendix B- Healthcare System in HK and Mainland China and Appendix D- SZCH.

3.3 Applications of Data Collection in HKCH and SZCH

The tangible implementation in the built environment is investigated using HKCH and SZCH as case studies and justifying with spatial-related reasons. Children's Hospitals have long played a significant role in caring for socially disadvantaged children. HK and SZ are two metropolises in the PRC with 7.5 million and 13 million populations, respectively (United Nations, 2019). They are separated by a river and an international border, referring to Fig. 13. SZ is under the administration of the government of mainland China whereas HK is under the control of the government of HK. Although the two cities are close geographically, they share different healthcare systems. For the research, HKCH and SZCH are used for comparisons.

HKCH and SZCH are chosen to represent in children hospitals in both regions. HKCH, being the first and only children hospital in HK, encourages multi-disciplinary, cross-speciality collaboration, effective and flexible use of facilities and resources (Hong Kong Children's Hospital, n.d.). It aims to provide a world-class clinical practice with a children-friendly and home-like environment. SZCH is the largest children's hospital in mainland China with Phase 1 built in 1997 and Phase 2 in 2014. For the purpose of the research, Phase 2 of SZCH is used for the main analysis due to its comparable size and volume with HKCH.
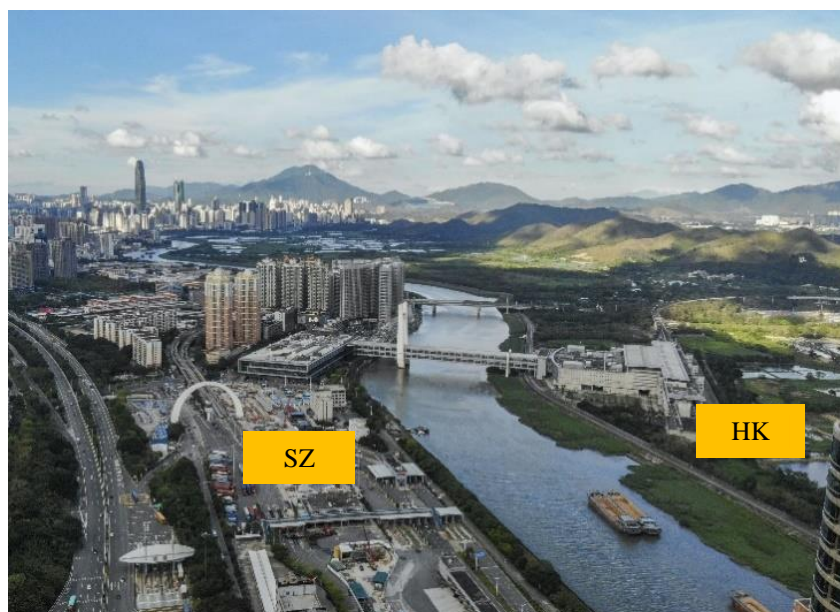
Fig. 13 SZ-HK- Border
(Leitner Interns Blog, 2011)

3.3.1 Convenience

As medical data of patients and navigation in hospitals become increasingly digitalised, users can enjoy the convenience that technologies have brought to them. HKCH and SZCH have different focuses on user experiences with the former more on children's comfort and latter more on the extent of convenience for users. This has an impact on the accessibility of services and data collection in hospitals.

Digital Platforms in Services

Digitalisation in medical data has been an increasing trend in the healthcare sector to provide convenience and efficiency for patients and their families. HKCH, referring to Fig. 14, have used regional Electronic Health Records (eHR) and Electronic Health Records Sharing Systems (eHRSS). Besides the national Electronic Health Records (EHR) system in mainland China, SZCH, referring to Fig. 15, has also included online registration, consultation and navigation in partner websites and mobile interface. With fewer available channels and more restricted data content in HKCH, the efficiency of SCS could be limited.

Fig. 14 Bird Eye View of HKCH
(Healthy Matters, 2020)

Fig. 15 Bird Eye View of SZCH
(Shenzhen Children's Hospital, n.d.)

The government of HK has funded and launched eHR and eHRSS to foster collaboration between public and private medical sectors in 2016 (The Government of HK, 2019; Schoeb, 2016). This territory-wide information infrastructure allows registered healthcare providers (HCPs) from both sectors that have informed consent of registered patient and authorisation to view and share the eHR with authorised stakeholders. The scope of patient's data is limited to the listed information and are only sharable with classified HCPs, which does not include the government of HK, referring to Fig. 16.
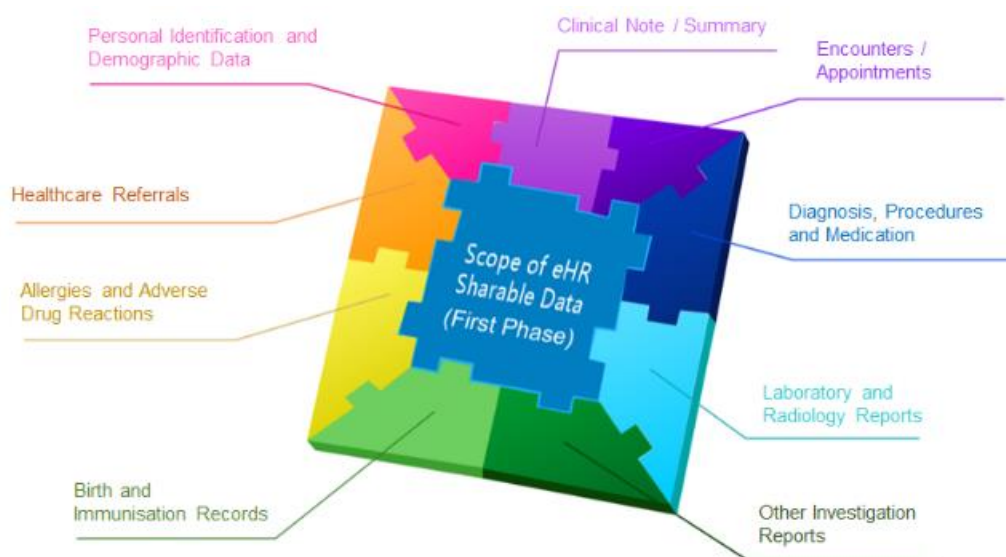

Fig. 16 Scope of eHR Sharable Data in HK
(E Health, 2019b)

In mainland China, all healthcare providers have their EHR which links to health insurance systems for payment of claims according to their identifiers using insurance ID or citizen ID in mainland China (Fang, 2016a). However, as the organisations of EHR vary between hospitals, they are not integrated nor interoperable. Accessibility and the sharable scope of EHR also remain unknown.

SZCH has incorporated the use of online registration and consultation services, self-service machines and digital nursing in the hospital. The online medical services system can be accessed through their partner website- 'Health 160' for online registration and outpatient services (Health 160, n.d.). Data including the doctor's quote, availability, rating and publications are all shown on the website, referring to Fig. 17. Apart from 'Health 160', self-service machines have been installed in the SZCH lobby to facilitate families of patients to register and pay for consultations, referring to Fig. 18. It has also adopted digital nursing where scanners are used to scan the hospitalised children's print bracelets. All of the digital data are then stored in the data cloud of SZCH. On top of this, SZCH's has accomplished Level 5 in the electronic health record and is aimed to reach Level 6 in 2019, referring to Fig. 19 (Zhong, 2018). The ambition of SZCH in digitalisation is obvious. However, access to patients' records has brought to question as users are not told how their data will be stored in SZCH's cloud computing.

Respiratory Medicine   SZCH

Schedule   Booked by 851,836 people

Doctors	Speciality	Feedback		04/25	04/26	04/27	04/28	04/29	04/30	05/01	
Wenjian Wang	Application of children's bronchoscope, treatment in chronic cough	Booked by 18,477	Morning						Book	Book	
		658 Positive feedback	Afternoon								
Luyan Gao	Diagnosis and treatment of paediatric medical diseases esp. respiratory diseases	Booked by 133,733	Morning	Full					Book	Book	
		1,745 Positive feedback	Afternoon	Full					Book	Book	

Fig. 17 Registration for Outpatient Service Online in SZCH
(Health 160, n.d.)

Fig. 18 Self-service Machine in SZCH
(Zhong, 2018)
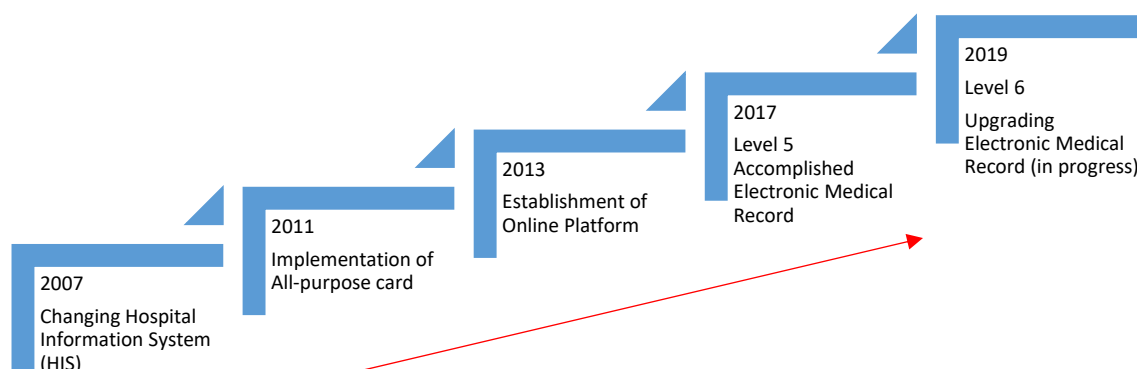
Fig. 19 Electronic Medical Record Goal in SZCH
(Zhong, 2018)

SZCH has more established digital structures than HKCH, and with more comprehensive data tailored for the hospital that can be used to collect data from patients, the more inclusive and extensive the data bank is. All the digital features aim to improve patients' experience from arrival to departure in the hospital. As data privacy and consents are one of the top concerns of HK citizens, only eHR and eHRSS with restricted accessibility and scope of sharing are available in HKCH. Therefore, the collated data from SZCH can be used to contribute to SCS more effectively than HKCH.

SZCH can provide a helpful database foundation for future implementation of SC in the medical sector using the established online systems it already has. The Alipay's SC tie-up has added more complex links from various hospital databases to insurance service providers to facilitate billing, which then feeds Alipay's core (Pymnts, 2014). However, as a lot of data specifications and usages are muted in mainland China, the digitalisation in hospitals have aroused increasing concerns internationally about private data collection and ownership problems. At the same time, technology is not convenient for disabled or mentally ill patients. There is a large difference in the focus of HKCH and SZCH in digitalisation, with the former emphasises on data privacy of all patients, whereas the latter focuses on user convenience using big data collection.

Further details on SZCH's digital features can be found in Appendix D- SZCH.

Navigation in Hospitals

SZCH has adopted GPS navigation on their mobile interface, which can detect patients' location and generate possible routes for them in hospital as the primary navigation strategy in hospital. Instead of having GPS navigation in HKCH, much effort was placed on the graphics of signage design for better wayfinding in HKCH.

Careful planning can be seen in the flow design in HKCH, to achieve a user-friendly hospital. For better wayfinding in HKCH, the concept 'A Habitat for Life' is applied to all floors of the hospital featuring animal characters, habitat graphics and theme extensions in HKCH (Zhong, 2019a). These signage designs facilitate navigations in hospital in an intriguing way and provide a sense stimulating narrative for hospitalised children. They can be found in all main spaces, for instance, wall-mounted

directory, ward signs and staircases etc. A series of 8 animal characters are designed specifically for the 1st to 8th floor of clinical tower according to their specified function on each floor. Staircases and walls are designed to match the animals' habitats and facilitate wayfinding at the same time. Possible routes and visual journeys of users from arriving at the hospital to designated service areas are also tested to maximise the user-friendliness in hospital. The holistic signage designs in the hospital aim to ensure user-friendliness in wayfinding and provide an amiable environment for all children.

In order to facilitate wayfinding in SZCH, a mobile interface with GPS navigation is developed which can locate people and generate high-resolution 3D indoor digital routes for their destinations, referring to Fig. 20 (Zhejiang Ipsmap Information Technology Co.,Ltd., n.d.). All the locations in the hospital, such as registration offices, pharmacies, toilets, various convenience facilities and departments can be displayed on this app. Users can opt for travelling through elevator, lift, stairs or wheelchair accessible routes in the interface. Then it will display virtual routes to facilitate wayfinding in hospital. It is now compatible with Google Maps, Apple Maps, Tencent Maps and Baidu Maps and can show possible routes from users' locations to the hospital as well as possible transportations that they can take. The signage designs in SZCH are rather basic, which suits the fundamental needs of users and are not tailored for this hospital. They are located on the main spaces in the hospital, for instance, floors, walls, ceilings, lifts and toilets.

All the digital features aim to improve patients' experience from arrival to departure in the hospital. As users benefit from the convenience the interface brings, they are also being surveilled as their navigation, or possible social gathering are checked by the developer and SZCH.

Fig. 20 GPS Navigation in SZCH Interface
(Zhejiang Ipsmap Information Technology Co.,Ltd., n.d.; Zhong, 2018)

3.3.2 Standardisation

In the design of architecture, it is essential to match the requirements of design codes and end-users. HKCH and SZCH follow different design criteria with former passed international, HK and HA's specifications and latter passed the national design code of mainland China. HKCH is also relatively more affordable than SZCH in the personalisation of inpatient facility for higher proficiency in hospital. The standardisations adopted in hospitals, thus influence data collection indirectly.

Proficiency in Designs

SCS can be easier to be implemented in hospitals which collect standardised and less personalised data from patients for better accurateness. Both international standards of the UK and Europe, as well as local standards of HK, are followed in the design of HKCH, whereas the design SZCH solely follows the national design standards of mainland China.

HK's hospital construction standards are widely recognised as a benchmark for high-quality hospital construction worldwide, refer to Fig. 21. The laws and building regulations in HK are the upmost important requirement to obey, followed by UK regulatory code (BS) and European regulatory standard (EN) by British and Europe Standards Institutions. Then the design needs to refer to Health Technical Memoranda (HTM) and Health Building Notes (HBN) by the Department of Health and Social Care of UK when needed and other supporting guidance by Electrical and Mechanical Services Department, Water Supplies Department and Fire Services Department etc. in HK. The hospital proposal then needs to meet the client- HA's requirements in the end (Zhong, 2019a).
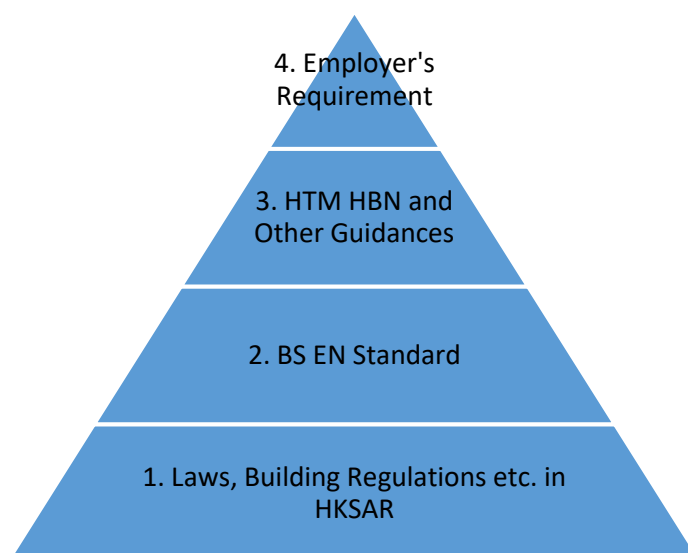

Fig. 21 HK Hospital Design Standards
(CSCEC., n.d.a)

In contrast, the benchmark for hospital design in mainland China is solely based on the Code of Design of General Hospital, refer to Fig. 22 (GB National Standard). It is developed by the Chinese Hospital Association Hospital Architecture System Research Branch, Planning and Information Bureau of National Health and Family Planning Commission of the PRC (GB 51039-2014 Code for Design of General Hospital, 2014).
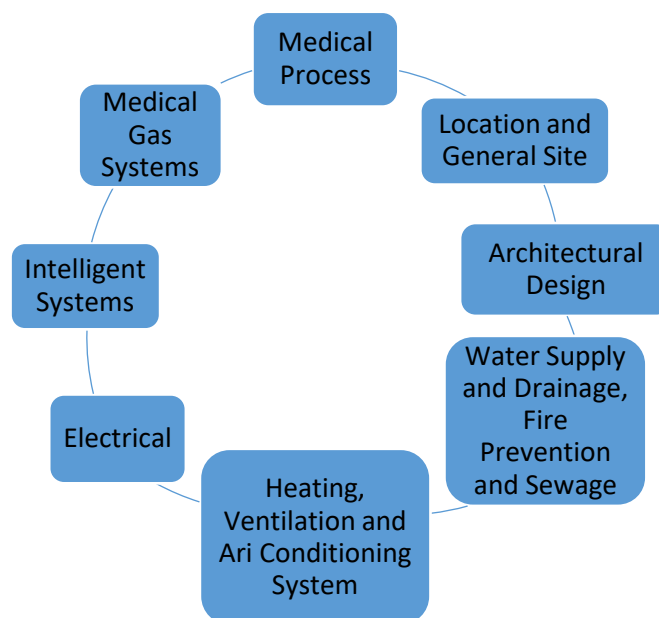

Fig. 22 Mainland China Hospital Design Standard
(GB 51039-2014 Code for Design of General Hospital, 2014)

Compared with HK, SZCH does not have a comprehensive pre-planning and elaborated system in stakeholder consultations. For HKCH, in order to ensure the needs of stakeholders, as well as, international and local design criteria are met, consultations on hospital design and studies of the establishment have started in 2007. A steering committee, which is a group of professionals from various disciplines invited by the government of HK, was set up to examine the scope of services, operational model and physical infrastructure of the project as well as incorporate opinions of more than 1,000 users (Hong Kong Children's Hospital n.d.). These measures are helpful for the initial planning of HKCH, as they facilitate the mutual communication of both clients and users to ensure personalised needs on function, aesthetics and environmental afforestation are fulfilled as much as possible. Therefore, the design in HKCH is more universal and accomplishes higher requirements. The committee of Hospital Authority Ordinance Order 2018 also visited HKCH in March 2018 to inspect and review the latest progress of HKCH's development (Legislators inspect Hong Kong Children's Hospital, 2018). The committee provided their opinion over the design and arrangements, especially on ward facilities and the environment in the hospital. In contrast, limited information can be found on the preparation and post-completion feedback system of SZCH's design. As SZCH has fewer tailor-made features in the hospital, it is easier for the accurateness of data transfer and storage in SCS.

Affordability in Personalisation

Design of urban infrastructure is often affected by economists instead of the intentions of architects. Mainland China might not be economically viable to accommodate the mass of its population on the personalisation level that HK is able to achieve for HKCH. The amount of investment on each inpatient bed in HKCH and SZCH reflects the level of affordability in personalisation for patients, refer to Fig. 23. In terms of project cost per inpatient bed, HKCH comprises 468 inpatient beds in the total project cost of GBP 13 million, which contributed to around GBP 27.8 thousand per inpatient bed in average (Hong Kong Children's Hospital, 2020). For SZCH, 1,100 inpatient beds were built within the total project cost of GBP 11.4 million, which leads to GBP 10.4 thousand per inpatient bed on average (Shenzhen Municipal Health Commission, 2019). The cost per inpatient bed in HKCH is 2.67 times higher than that in SZCH. Comparably, there are more financial resource per inpatient beds in HKCH than SZCH and therefore can be allocated for using better equipment and creating more comfortable environments in the hospital.
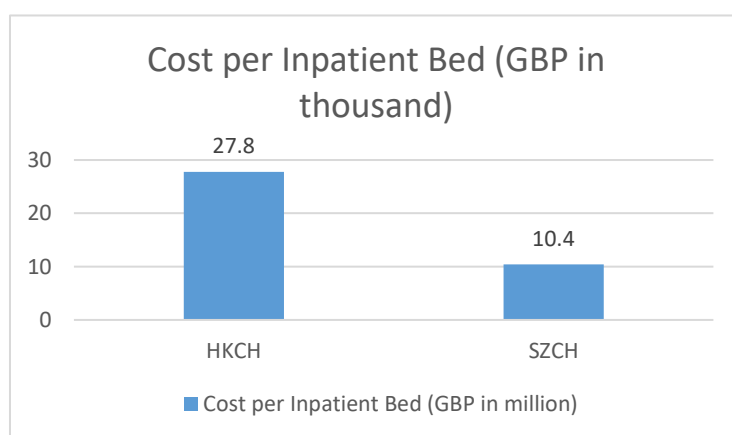

Fig. 23 Cost per Inpatient Bed in HKCH and SZCH
(Hospital Authority, 2020; Shenzhen Municipal Health
Commission, 2019)

The level of accurateness of design at HKCH and SZCH varies due to the differences in design criteria, initial planning and investment on inpatient facilities. With more personalised features tailored for HKCH. The implementation of SCS in HKCH could be less accurate as data are collected, transferred and categorised under overall SCS data classifications. At the same time, due to differences in culture, habits of patients vary as HK patients might not be exposed to surveillance. As they never did culturally, they might resent putting themselves with others.

3.3.3 Centralisation

The form designs are one of the most critical factors affecting the centralisation of data collection. Both HKCH and SZCH adopts similar massing on clinical floors but are very different in the spread of facilities and circulation controls internally. Their applications cannot be fully appreciated without the analysis of the spatial arrangement of the layouts.

User-Friendliness in Form Designs

Different design principles are applied in the form designs of HKCH to provide a better environment for users instead of maximising the overall density in the hospital. The twin towers are built about 45m apart with a central landscaped courtyard designed to enclose an entrance pavilion to enhance airflow, building permeability and pedestrian environment (Zhong, 2019a). Horizontal bridges are then added to link Tower A, which is for internal support, and Tower B, which is a clinical tower. Two recesses are carved out from the floor plans to break down the building mass, referring to Fig. 24. Tower B then adopts a H-shaped design with two large atria in the middle of towers to maximise building perimeter for the optimal internal views and daylight intake as well as providing a semi-outdoor experience for patients. This creates four wings extending out from the central building core. After that, in order to enhance public accessibility, openness and connectivity to a 285m long frontage waterfront as well as providing a pedestrian-friendly environment, visual and building permeability are maximised through the 'podium-free' design. Terraces are also carved out, and roof gardens are designed to maximise the site greenery coverage and to create amiable urban and leisure spaces for users. Greenery on GF is then added at the end to enhance the connectivity to the waterfront. All the iterations facilitate efficient planning, operation of clinical areas and user-friendliness of the environment.
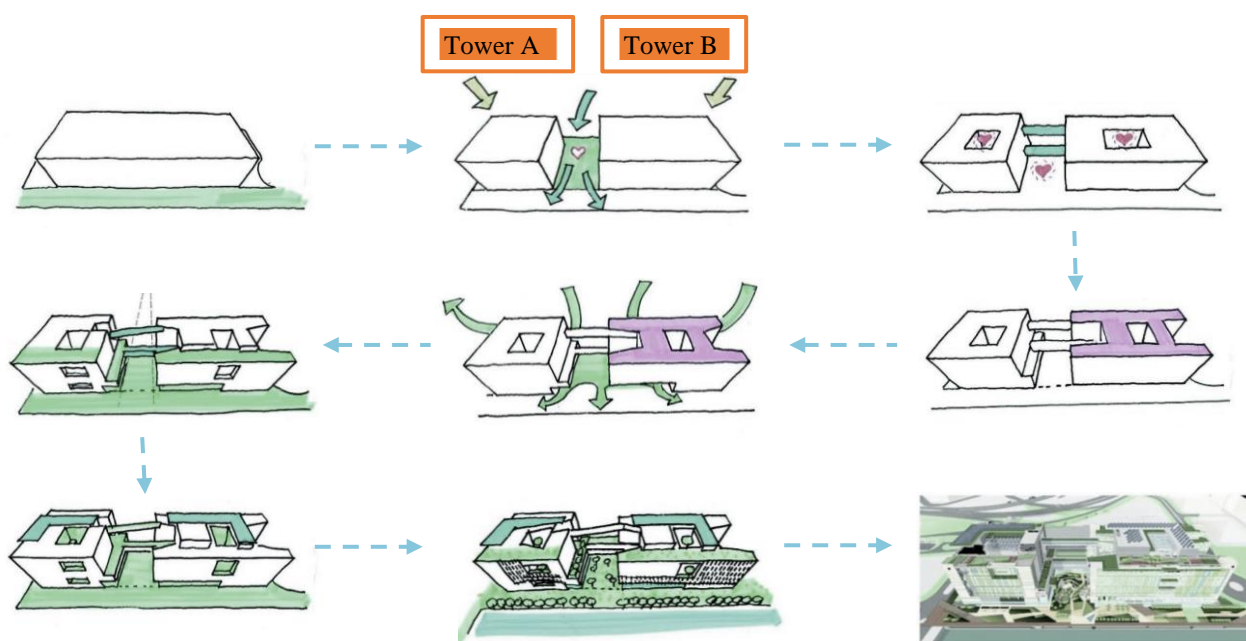

Fig. 24 Mass Iterations of HKCH
(Zhong, 2019a)

There are several design features that reduce the overall density of wards in HKCH but enhance user experiences. For families living far away from hospitals, the architects have designed 20 Parents' Quarters for parents to stay over so that they can take care of their children in hospital. As part of inpatient care designs for children patients, some wards are reserved for parents' beds with baby bath at most en suite washrooms. The spaces in other general wards are also relatively large with ward facilities such as foldable bed so that the family members of the hospitalised child can keep vigil beside a sick child (Development Bureau, 2018). Communal dining and family pantry are also provided for parents to take care of their children (HKCH- Child-centred and Family-friendly, 2018). Contagious wards are dispersed and located away from busy passengers. They are arranged at two ends of the building for infection control to align with requirements from 04-01 in HBNs and HA.

With a large site area, instead of building more wards to maximise the density of wards, HKCH has incorporated approximately 40% of greenery with a large central rehabilitation landscape, vertical green wall and extensive green roof, referring to Fig. 25. This is to enhance patient's staying experience, improve air quality, reduce heat island effect and provide good visual amenity to the neighbourhood (HKGBC BEAM Plus, 2020; HKCH- Child-centred and Family-friendly, 2018).
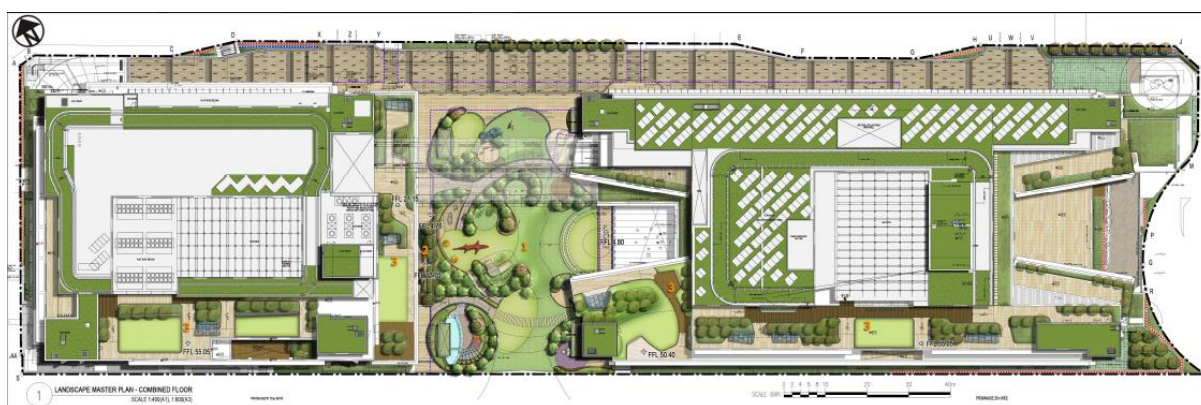

Fig. 25 Roof plan of HKCH
(HKGBC BEAM Plus, 2020)

Centralisation in Facilities- Connections

By comparing the floor plans of both HKCH and SZCH, HKCH adopts a more dispersed layout than SZCH. The 23 lifts are allocated to segregate public flow, patient flow, staff flow and goods flow to suit different users' needs, avoid cross-contamination and protect the privacy of users. They are classified under staff lifts, visitor lifts, patient lifts and goods lifts which are designated for a certain group of users only and are spread out in 11 location on the plan, referring to Fig. 26. The disperse vertical connections in HKCH were designed to be user-friendly and intended to serve peoples with different needs.

There are also two towers in HKCH with Tower A for research and training and Tower B for clinical services. Three horizontal footbridges are designed between two towers for better user-friendliness and convenience in hospital. As the privacy, contamination and comfort of users are considered as the focuses in HKCH, quick and widespread of vertical and horizontal connections are designed to serve the purposes.

The main vertical connections of SZCH are more centralised on the plan, with 14 lifts located next to one another, referring to Fig. 27. This allows concentrated travel but also created problems of inconvenience for users as people with mixed needs are using the same lift. Exposure of privacy and increase of possible contamination could also be potential concerns. However, with less widespread of circulations in the hospital, the data collection for SCS is easier and more efficient.
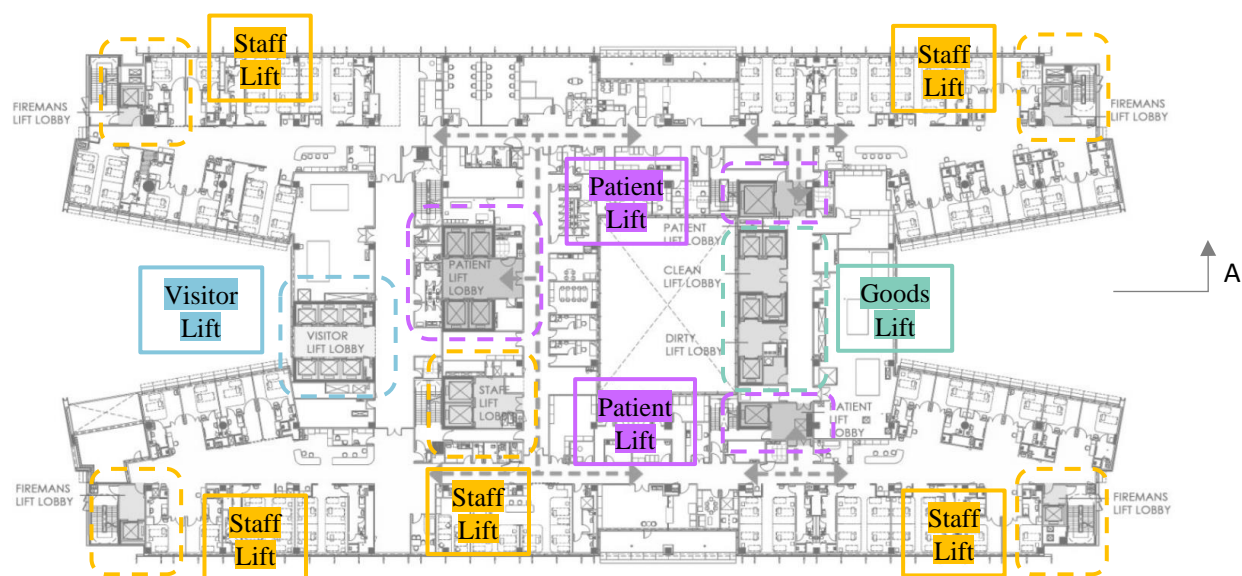
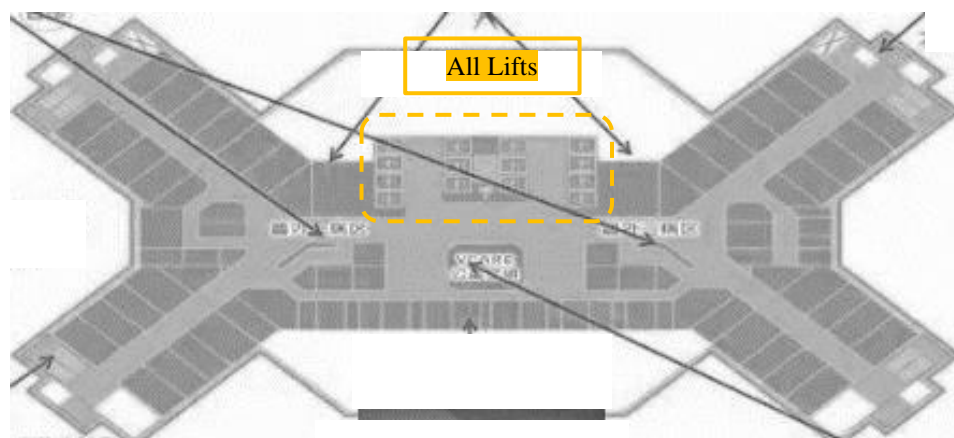Fig. 26 Arrangement of Lifts in HKCH Tower B
(Zhong, 2019a)

Fig. 27 Arrangement of Lifts in SZCH
(Zhong, 2018)

Centralisation in Facilities- Inpatient Facilities

The design focus of facilities in HKCH is to create an amiable environment for all users without emphasising on the density of users it can accommodate, which reduces the centralisation of data collection. To create a welcoming arrival node and to divert the flow of people to towers at each side, the central garden acts an entrance in-between the twin towers, referring to Fig. 28. Tower A houses Operational Theatres (OT), laboratories and training facilities whereas Tower B encloses inpatient wards. In order to facilitate recovery of patients, Tower B in HKCH adopts a H-shape plan on ward floors with all inpatient rooms arranged at building perimeter to allow more daylight penetration. The internal layout of inpatient wards is also designed to accommodate future changes. With the aim to provide direct supervision to wards on inpatient floors, four nurse stations are dispersed at each wing. They are strategically allocated at ward entrances from visitor lobby to allow supervision of visitor entry to ward areas, referring to Fig. 29. In addition, some mini nurse stations are located outside wards to enhance close supervision and monitoring.
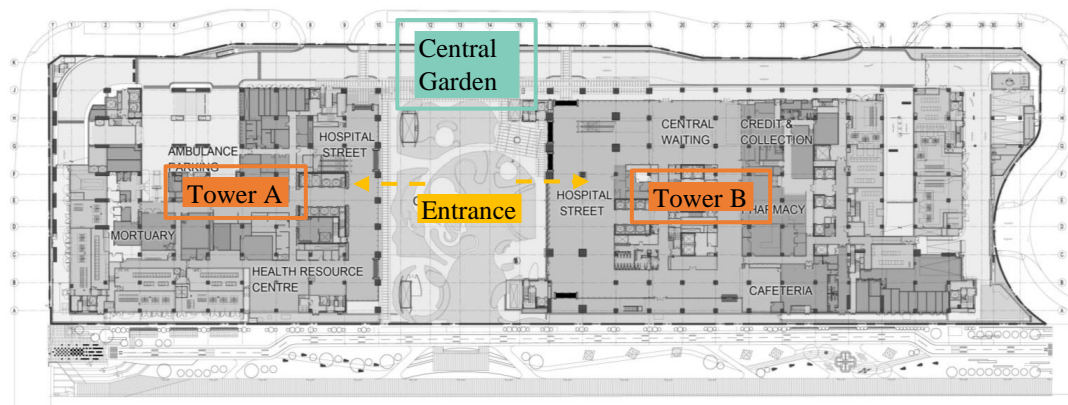

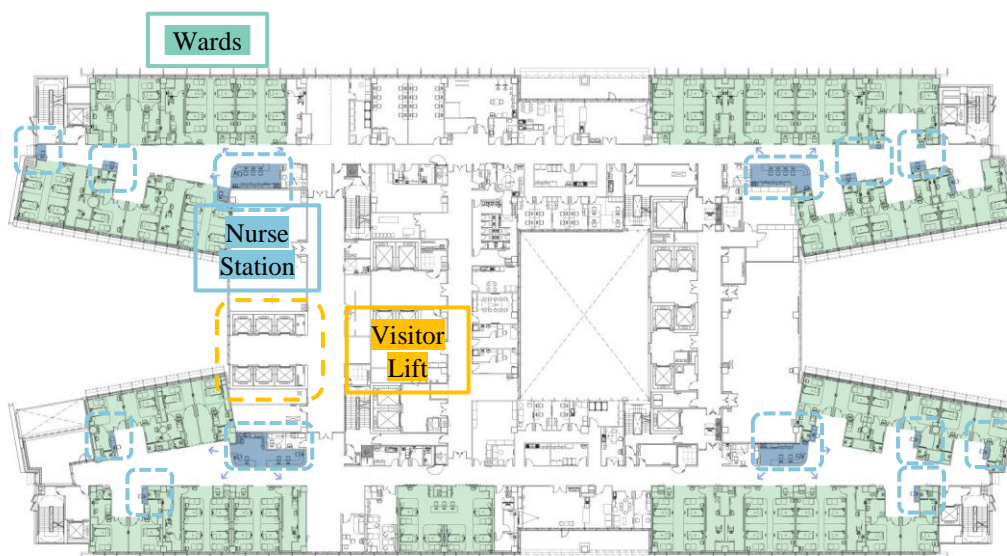Fig. 28 Entrance from Central Garden of HKCH on GF
(Zhong, 2019a)

Fig. 29 General Layout of Nurse Station in HKCH Tower B
(Zhong, 2019a)

With more patients that SZCH can accommodate, data collection is more centralised and can contribute to SCS more efficiently. In terms of spatial design, a typical ward floor in SZCH comprises inpatient wards, lifts, nurse stations, communal areas, doctor offices, balconies, and children activity area in a dense manner, referring to Fig. 30. There are two communal spaces for users on each floor for leisure activities with a children's activity space at the centre. Two offices for doctors are also arranged on each floor with generous size and daylight. This provides a comfortable space for consultations and check-ups. Two balconies are also designed at two ends of the plan for self-service washing machines and clothes hanging for families. The presence of clothes hanging balconies in SZCH reflects this specific cultural need of local families.
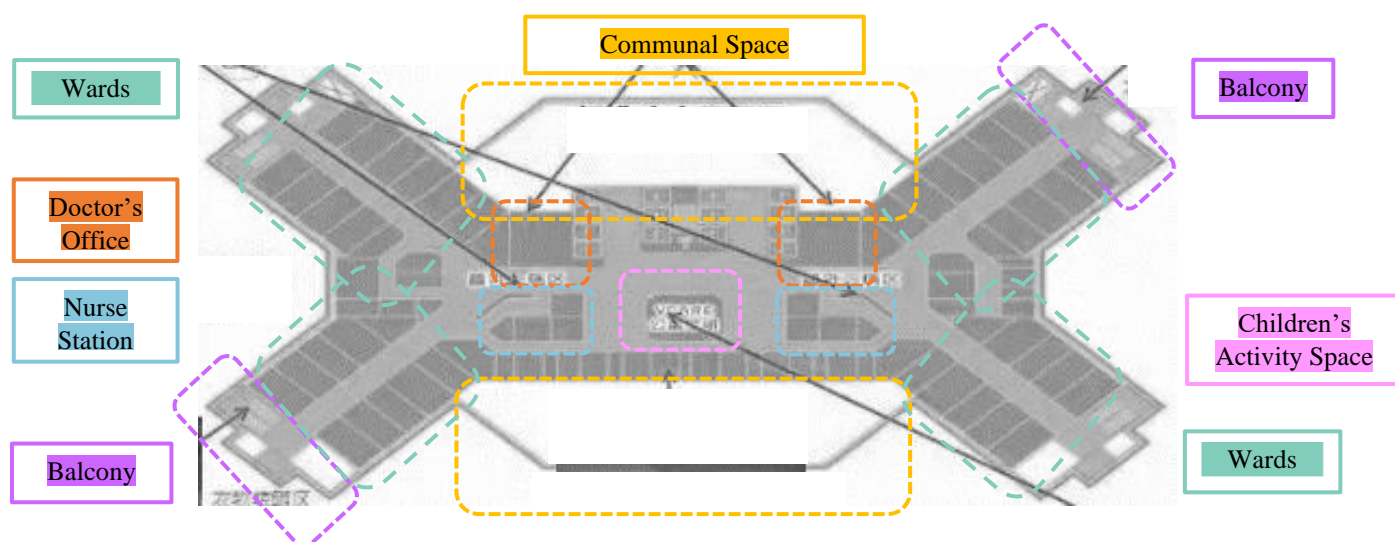
Fig. 30 General Layout of SZCH
(Zhong, 2018)

The density of vertical connections is an indicator for centralisation of circulation and considered as the key for user comfort in hospitals. Therefore, the scope of lift services can be compared between HKCH and SZCH. Tower B of HKCH, which serves as a clinical building, has 23 lifts including visitor lifts, staff lifts, and goods lifts and serves 7,207m^2 of each inpatient ward floors. In contrast, SZCH has 14 lifts serving 11,333m^2 of each ward floors. Therefore, each lift in HKCH serves 313.3 m^2, whereas that in SZCH serves 809.5m^2, referring to Fig. 31. With a smaller scope of services of each lift, users at each area of HKCH is less dense, and this reduces the centralisation of data collection.

Fig. 31 Scope of Services of Each Lift to Ward Floor Area
in HKCH and SZCH
(Hong Kong Children's Hospital, 2020; Shenzhen
Municipal Health Commission, 2019)

The Bed population ratio is a general indication of inpatient service availability in a region. HK ranks 31 in the world with 5.4 beds available for every thousand people, whereas mainland China ranks 50 and has 4.2 beds available (Central Intelligen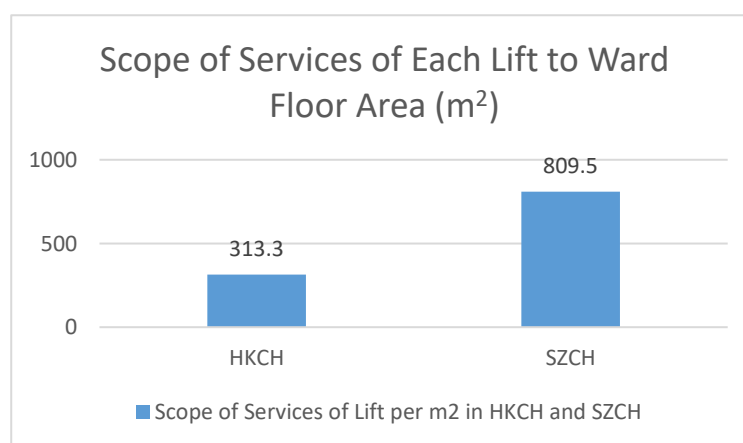ce Agency, 2019). This shows the inpatient service is generally more accessible in HK. This disparity in bed to floor area ratio aligns to that in HKCH and SZCH. HKCH and SZCH are very different in inpatient bed density although they have adopted a H-shape and butterfly-shaped plan, respectively, and arranged wards at the perimeter of the building to maximise the daylight access and ventilation in each ward. In HKCH, there are 468 inpatient beds in a total 165,000 m^2 of building area leading to 353 m^2 floor area per bed whereas in SZCH 1,254 beds are supplied in a total of 170,000 m^2 floor area resulting in 136 m^2 floor area per bed, referring to Fig. 32. With similar floor area, inpatient beds in SZCH are denser than that in HKCH by 260%.

Fig. 32 Inpatient Bed to Ward Floor Area in HKCH and SZCH
(Hong Kong Children's Hospital, 2020; Shenzhen Municipal
Health Commission, 2019)

SZCH has a less dense nurse stations arrangement on clinical floors to reduce the workforce of nurses and spares more space for optimal ward density. Instead of four nursing units in HKCH, SZCH has two nursing units on each floor instead to facilitate nurses from overseeing the wards and incoming flow from lifts. Each inpatient ward floor is 7,207m^2 in HKCH and 11,333m^2 in SZCH (Zhong, 2019a; Shenzhen Municipal Health Commission, 2019). Therefore, each nurse station is serving 1,802m^2 ward areas in HKCH and 5,666m^2 ward areas in SZCH, referring to Fig. 33. If the same number of nurses are working at each station, the working efficiency and effectiveness in HKCH are 3.14 times of that in SZCH, respectively. However, as nursing resources are more generously allocated in HKCH, it suffers from relatively low efficiency in data collection at a time.
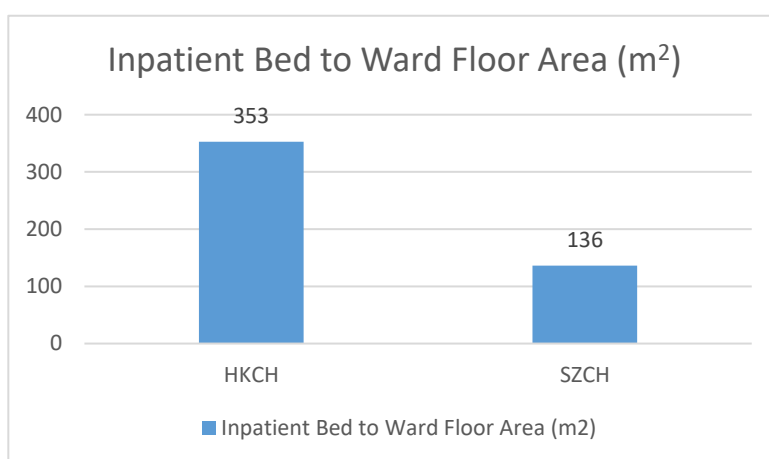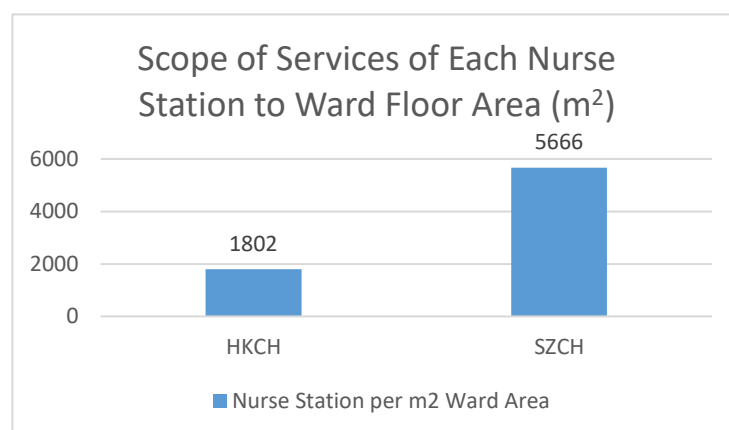
Fig. 33 Scope of Services of Each Nurse Station to Ward
Floor Area in HKCH and SZCH
(Hong Kong Children's Hospital, 2020; Shenzhen Municipal
Health Commission, 2019)

With reduced circulation and increased density of facilities SZCH, the floor layout design facilitates the collection of data in a more efficient and centralised way. In contrast, the effectiveness of data collection is limited in HKCH as facilities are widespread and inpatient beds are generously located in the hospital, although the level of user-friendliness and comfort can be promised.

Further information about the users' flow design and spatial features in HKCH can be found in Appendix C- HKCH.

Centralisation in Facilities- Research Facilities

Apart from basic hospital facilities, HKCH also allocates spaces for education and research purposes, referring to Figs. 34- 35. Tower A in HKCH has enclosed lecture theatre, research lab, core lab and general laboratory and library dedicated for teaching and research purpose. For better pioneer medical services, HKCH is affiliated with The Chinese University of Hong Kong and The University of Hong Kong, whilst SZCH is affiliated with Chongqing Medical University, Shantou University, Zunyi Medical University and Guangzhou University of Chinese Medicine.

However, although both hospitals are affiliated with universities for training purposes, there are limited resources online indicating spaces that are dedicated for training purposes in SZCH. From SZCH's layout, the majority of spaces are used for inpatient and outpatient services. Spaces that could potentially be used for training purposes are current communal areas and doctors' offices. From the allocation and layout, it reflects that HKCH values further education and research as well as consultation and treatment for pioneer services in the foreseeable future. At the same time, SZCH prioritised its current medical services for the general public.

The allocation for research facilities has reduced the optimal ward availability in HKCH and thus decreases the amount of centralised data collected. For HKCH, as it only targets a limited number of

patients at a time and adopts a less dense floor plan layout, it can spare spaces for further research and training. In contrasts, SZCH needs to accommodate a large amount of medical needs from the mass population, and with its focus on density and efficiency, research facilities are limited in the building.

1F   8F   9F

Lecture Theatre

Research Lab

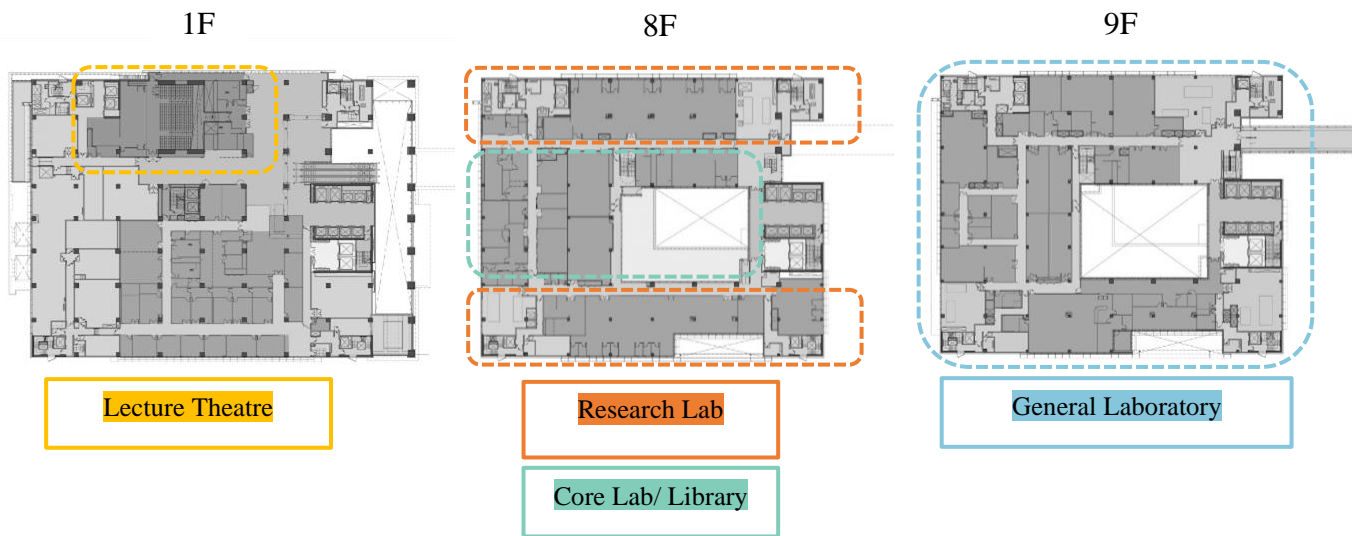Core Lab/ Library

General Laboratory

Fig. 34 Teaching and Training Facilities in HKCH Tower A
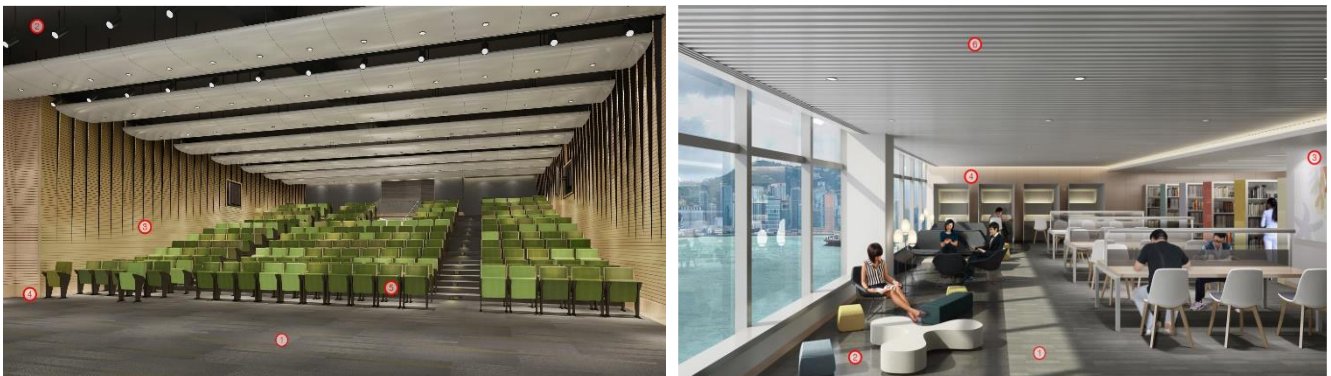(Design and Construction of Centre of Excellence in Paediatrics, 2015)

Fig. 35 Lecture Theatre (left) and Library (right) in HKCH Tower A
(Zhong, 2019a)

3.3.4 Overall Effect

With efficiency in data collection differs in both HKCH and SZCH, this has resulted in varying levels of feasibility in SCS implementation in different aspects, referring to Table 2. The design and digital considerations of SZCH have assisted the collection of centralised patients' data for SCS as they can help to trace patients accurately and efficiently in the hospital. In contrast, data collection can be less efficient in HKCH due to its priority of user-friendliness and user comfort in the hospital. The differences in the aims of both hospitals shape the massing, floor layout and its use of digital resources.

Further details on the comparison of HKCH and SZCH can be found in Appendix E- Comparisons Between HKCH and SZCH.

Healthcare System Data Collection Comparisons:				
			HK	**SZ**
3.1	Convenience		Less direct	More direct and smooth
3.2	Effectiveness			
	Adoption of Preferential Treatment		Yes	No
3.3	Application in Hospitals		**HKCH**	**SZCH**
3.3.1	Convenience			
	Digital Platforms in Services		Use of eHR and eHRSS	Use of EHR and Hospital 160
	Navigation in Hospitals		N.A.	Use of GPS navigation
3.3.2	Standardisation			
	Proficiency in Designs		Higher requirement in design: Design follows international and local design standards as well as HA's requirements	Lower requirement in design: Design only follows national design standards
	Affordability in Personalisation		Cost per impatient bed: GBP 27.8 thousand	Cost per impatient bed: GBP 10.4 thousand
3.3.3	Centralisation			
	User-Friendliness in Form Designs		Iterations are made to maximise user comfort and user-friendliness in hospital	N.A.
	Centralisation in Facilities-Connections		23 lifts dispersed in 11 locations and use of 3 footbridges	14 lifts centralised in the centre with no use of footbridge
	Centralisation in Facilities-Inpatient Facilities		Relatively widespread	Relatively dense
	Centralisation in Facilities-Research Facilities		Allocated in Tower A	N.A.

Table 2 Summary of Comparisons of Healthcare System in HK and SZ

Chapter 4 Conclusions

Summary

The thesis investigated the data collection of SCS and manifestation in the healthcare system. SCS is used as a primary lens in manifesting the influence and feasibility of surveillance in the built environment of the healthcare systems in HK and mainland China and more specifically, SZ. For easier comparisons, SZ, as one of the typical cities in mainland China, is used for the investigation, and thus the healthcare system of mainland China also applies to SZ. It uncovers the complexity that needs to be understood when a system tries to incorporate in another context. The research sees SCS as a soft landing of this tendency of incorporation with a muted algorithm. The research then discusses healthcare system and case studies of HKCH and SZCH, which are used as a secondary lens of investigating SCS implementations.

In Chapter 2, the conclusion can be drawn from the widespread of SCS that it has an increased possibility of applying to HK. There are tangible and intangible links between HK and mainland China, and HK has used protests to respond to surveillance from the government of mainland China. Within mainland China, SCS is introduced and applied in various aspects to enhance the social credit of citizens. The application of surveillance has also covered the healthcare system in SZ, which are further investigated in Chapter 3.

In Chapter 3, comparisons on the governance of public hospitals, government's medical funding, medical fees, the accessibility of community healthcare facilities are carried out to investigate healthcare systems of HK and SZ. The systems are different in the convenience and effectiveness of data collection. These macro factors have influenced the application of data collection in HKCH and SZCH in the convenience, standardisation and centralisation of data collection. The use of digital platforms in services, GPS navigation for wayfinding in SZCH have contributed to convenient experiences of users but have enhanced the effectiveness of data collection from patients. In terms of standardisation, the design codes of hospitals and cost per inpatient facility are compared. SZCH has more standardised hospital design and a limited budget for personalisation for inpatient facilities. These factors have enhanced the efficiency of overall data collection. For centralisation, the deign of SZCH has less focus on user-friendliness, widespread facilities and protection of user privacy. With centralised circulations in the hospital layout, the efficiency of data collection can be enhanced.

All in all, the healthcare system as well as hospital spatial design of SZ and SZCH, respectively, have a positive effect on the efficiency of data collection which can contribute to the future adoption of SCS significantly. In contrast, HK and HKCH focus more on user-friendliness and protection of privacy and therefore, have limited the efficiency of data collection.

Main Contributions

Based on the studies in Chapters 2 and 3, it is essential to acknowledge that in the era when the networked world has birthed new territories of surveillance, it has prompted changes to our lives. As the future becomes unpredictable and before this becomes the new normal, we must not overlook the fact that different systems come from specific contexts. Although SCS is not applicable in HK now, there is an increasing possibility that this could happen in the future.

When SCS, as a new system for HK, is assumed to be applied in HK, would it be benefit or surveillance for local citizens? Obviously, there is no fixed answer to this. When a system comes into a new territory, the first response of a new territory is often resistant to it. It can then develop to be either protective and reject the system, directed to develop their own system or to merge with the new system. In the case of Alipay, HK was able to afford to develop their own payment system Alipay HK rather than merging with the existing Alipay Domestic. It is believed that there are always responses to new systems and that enough time needs to be given in a retrospective for the responses, although they are unpredictable as they depend on the bigger social-economic and political interests of the place.

Furthermore, due to varying interests between regions, one cannot assume that the idea of surveillance which worked for one region would work for another. As a person with close experience to HK, any subject of this nature needs scrutiny to the existing system. Coming from a bigger healthcare system in SZ, SCS may not be easily implemented in HK. As HK and SZ adopt different systems with varying social-economic and political systems, the SCS could encounter problems in HK, which is not found in SZ. It is believed that the benefits that SCS provide for SZ users might not be attractive to HK users, and thus the implementation of power needs to be localised to suit the context. Strategies of extending power are complicated, and due to strong identities in HK, various parameters of data collection mentioned in the research need to be considered. HK 2019- 20 protests were the first and foremost responses at such a large scale to this topic and effectiveness of resisting power extending to HK is also open to interpretation. The current SCS is believed not a universal strategy of control and would need to localise to suit the contexts in HK. This can thus influence the physical and spatial design of local hospitals.

Finally, architects can actively have an influence on how the data is collected and influence the efficiency of the surveillance indirectly. Design of urban infrastructure is believed to be very much affected by economists instead of the intention of architects. In this case, SZ might not be economically viable to accommodate the mass of its people on the personalisation level that HK is able to achieve for HKCH. However, design outcomes can have indirect impacts on data collection as they are based on the ethos and ideologies of places. Like many other urban infrastructures, hospitals have their own algorithms of data collection which are not intended at the design stage. In the design field, architects' decisions can affect the context-specific digital systems. In HKCH, architects consciously design the hospital to be more personalised and protective, which adds barriers to unnecessary data collection from patients. When architects approach design propositions, instead of only aiming to treat a mass of patients efficiently, they also need to consider local socio-economic factors as well as user habits. All these factors link to the overall levels of data collections and influence them indirectly. Similar research methodology can be used to investigate the same aspect of surveillance in different systems of a society as well as in varying contexts.

Further Research

Relevant studies will be done with more comprehensive evidence on healthcare systems of HK and SZ, particularly SZ. Further investigations can also be undertaken on two or more different systems in other regions that may not be complied or applicable to embrace SCS applications. Attention shall also be paid to future applications of SCS at SZCH to justify the findings of this thesis.

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    5%9C%B0%E5%9C%96-%E5%BE%AE%E4%BF%A1%E4%B8%8A%E7%B7%9A-%E5
    %85%AC%E7%9C%BE%E5%8F%AF-%E9%87%8E%E7%94%9F%E6%8D%95%E7%8D
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Appendix A- Applications of SCS in Mainland China

The procedure and the effect of SCS and SC applications in mainland China are explored. There are various benefits as well as penalties assigned for users at different SC scores. This has enhanced my understanding of the variety of surveillance under SCS.

Fig. A1 Benefits of Having High Score on SC:
Able to Use a New Phone Without Deposit for 30 days
(Koetse, 2018)

Fig. A2 Benefits of Having High Score on SC:
No Deposit on Shared Bikes
(Koetse, 2018)

Fig. A3 Benefits of Having High Score on SC:
Open Access to Libraries
(Koetse, 2018)

Fig. A4 Benefits of Having High Score on SC:
Open Access to Lounges
(Koetse, 2018)

Fig. A5 Benefits of Having High Score on SC:
Better Reputation on Dating Apps
(Koetse, 2018)

a.: SC Blacklisted Persons Scanning at the Bartlett School of Architecture in London
b-d.: SC Blacklisted Persons Scanning at The Hebei Province in Mainland China

Table A1 Penalties of Having Low Score on SC:
Becomes a Warning to Others Located Within 500m;
Undergoes Public Shaming with Name and Reasons Published
(Cheng, 2020; Untrustworthy Person (LaoLai) Map, 2019)

Appendix B- Healthcare System in HK and Mainland China

As HK and mainland China adopt different healthcare systems, their outpatient and inpatient service charges are investigated. Compare and contrast are carried out to unpack and understand the differences of healthcare systems in two regions.
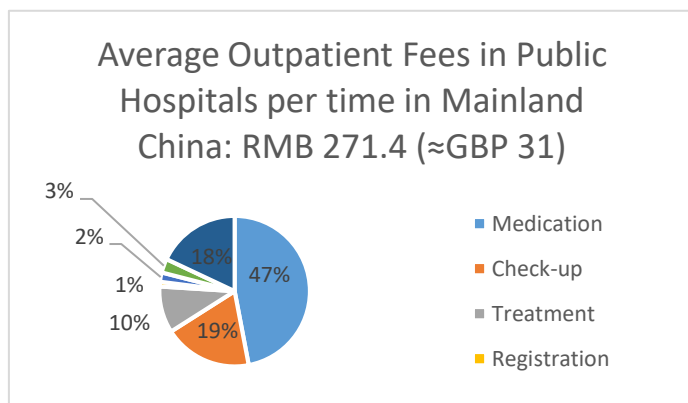
Average Outpatient Fees in Public Hospitals per time in Mainland China: RMB 271.4 (≈GBP 31)

3%
2%
1%
10%
18%
47%
19%

- Medication
- Check-up
- Treatment
- Registration

Fig. B1 Average Outpatient Fees in Public Hospitals in Mainland China (Zhang, 2018; Kknews, 2018)

Average Inpatient Fees in Public Hospitals per time in Mainland China: RMB 9291.9 (≈GBP 1061)

13%
16%
6%
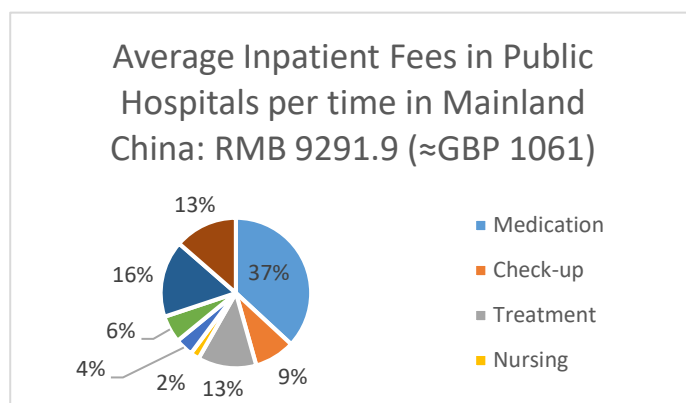4%
2%
13%
9%
37%

- Medication
- Check-up
- Treatment
- Nursing

Fig. B2 Average Inpatient Fees in Public Hospitals in Mainland China (Zhang, 2018; Kknews, 2018)

Distribution of Average Outpatient Expenses in Public Hospitals (GBP)

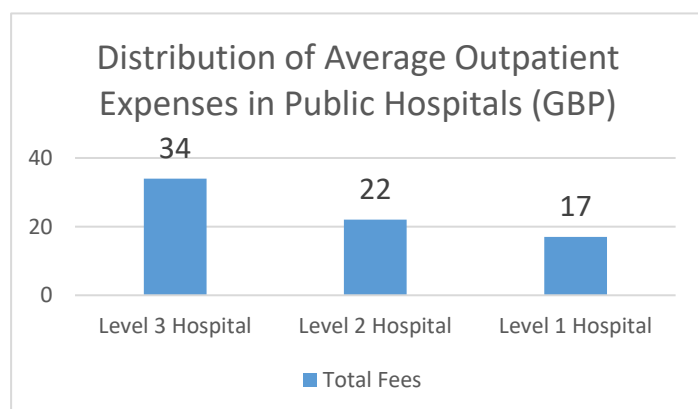|	Level 3 Hospital	Level 2 Hospital	Level 1 Hospital
Total Fees	34	22	17

Fig. B3 Distribution of Average Outpatient Expenses in Public Hospitals in Mainland China in GBP (Zhang, 2018; Kknews, 2018)

Distribution of Average Inpatient Expenses in Public Hospitals (GBP)

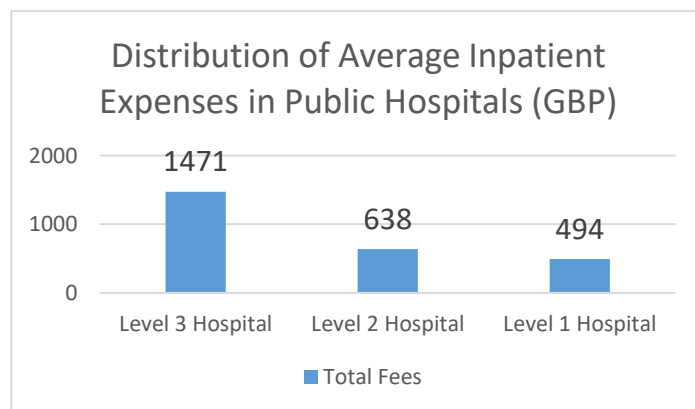|	Level 3 Hospital	Level 2 Hospital	Level 1 Hospital
Total Fees	1471	638	494

Fig. B4 Distribution of Average Inpatient Expenses in Public Hospitals in Mainland China in GBP (Zhang, 2018; Kknews, 2018)

Appendix C- HKCH

HKCH is used as one of the case studies in investigating the possible application of SCS. The feedback system, charges, users' flow design, spatial features and environmental considerations in HKCH are explored. Understanding of factors affecting design decisions has enhanced after exploring following materials.

<div style="border:1px solid black; padding:10px;">

Hong Kong Children's Hospital (HKCH)

Type of Hospital: Public Hospital (tertiary referral centre)

Commence of Service: March 2019

Total Cost: HKD 13 billion (≈GBP 1.36 billion)

Inpatient Bed: 468

Operating Theatres (OT): 12

Staff Member: 900

Target Patient: Children age 0- 18 with complex and rare paediatric cases

Site Area: 21,700 m^2

Gross Floor Area (GFA): 166,000 m^2

Number of Tower: 2 (A and B)

Number of Storeys: 11

Number of Lift: 23 in Tower B (Clinical Tower)

Surgical Procedure per year: 150,000

Clinical Department: 12

Client: HA of HK

Affiliation: The Chinese University of Hong Kong and University of Hong Kong

Network: Kowloon Central Cluster

</div>

Table C1 Background Information of HKCH
(Hong Kong Children's Hospital, 2020; DrivenxDesign, 2020; The Government of HK, 2019; Shen, 2018; Simon Kwan & Associates Ltd, n.d.)

Fig. C1 Hospital Authority Inspection for Feedback on HKCH
(Legislative Council of Hong Kong, 2018)

Service	Fee / HK Dollar
Accident & Emergency	$180 per attendance
Inpatient (acute general beds)	$75 admission fee, $120 per day [N1,N2]
Inpatient (convalescent / rehabilitation, infirmary & psychiatric beds)	$100 per day [N1,N2]
Specialist outpatient (including allied health clinic)	$135 for the 1st attendance, $80 per subsequent attendance, $15 per drug item [N5]
General outpatient	$50 per attendance
Dressing or injection	$19 per attendance
Psychiatric day hospital	$60 per attendance
Geriatric day hospital	$60 per attendance
Rehabilitation day hospital	$55 per attendance
Day procedure and treatment at Clinical Oncology Clinic or Renal Clinic	$96 per attendance
Day procedure and treatment in ambulatory facility	$195 per attendance
Community nursing service (general)	$80 per visit
Community nursing service (psychiatric)	Free
Community allied health service	$80 per visit

Fig. C2 Charges for HKSAR Public Hospital for
Eligible Persons
(Hospital Authority, 2020)

Service	Fee / HK Dollar
Accident & Emergency	$1,230 per attendance
Inpatient (general hospitals)	$5,100 per day [N1]
Inpatient (psychiatric hospitals)	$2,340 per day [N1]
Intensive care ward/unit	$24,400 per day [N1]
High dependency ward/unit	$13,650 per day [N1]
Nursery	$1,340 per day [N1]
Obstetrics package charge For booked cases, includes • one antenatal checkup; • delivery / delivery care service; and • three days (two nights) hospitalization in a public general ward related to the delivery / delivery care service	$39,000 [N6]
Obstetrics package charge For non-booked cases or patients who have not undergone any antenatal checkup provided by HA during the pregnancy concerned, includes • delivery / delivery care service; and • three days (two nights) of hospitalization in a public general ward related to the delivery / delivery care service	$90,000 [N6]
Specialist outpatient (including allied health clinic)	$1,190 per attendance
General outpatient	$445 per attendance
Dressing or injection	$100 per attendance
Day procedure and treatment for Haemodialysis at a Renal Clinic/Centre or other ambulatory facility	$3,000 per attendance (Chronic), $6,000 per attendance (Acute)
Day procedure and treatment at Clinical Oncology Clinic	$895 per attendance
Day procedure and treatment at Ophthalmic Clinic	$725 per attendance
Day procedure and treatment in ambulatory facility	$5,100 per attendance
Psychiatric day hospital	$1,260 per attendance
Geriatric day hospital	$1,960 per attendance
Rehabilitation day hospital	$1,320 per attendance
Community nursing service (general)	$535 per visit
Community nursing service (psychiatric)	$1,550 per visit
Community allied health service	$1,730 per visit

Fig. C3 Charges for HKSAR Public Hospital for
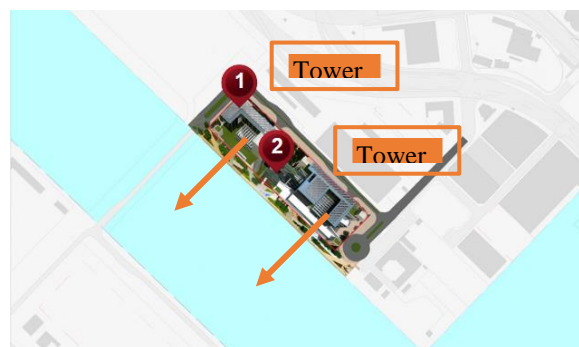Non-eligible Persons
(Hospital Authority, 2020)

Fig. C4 Original (left) and Proposed (right) Site Plan
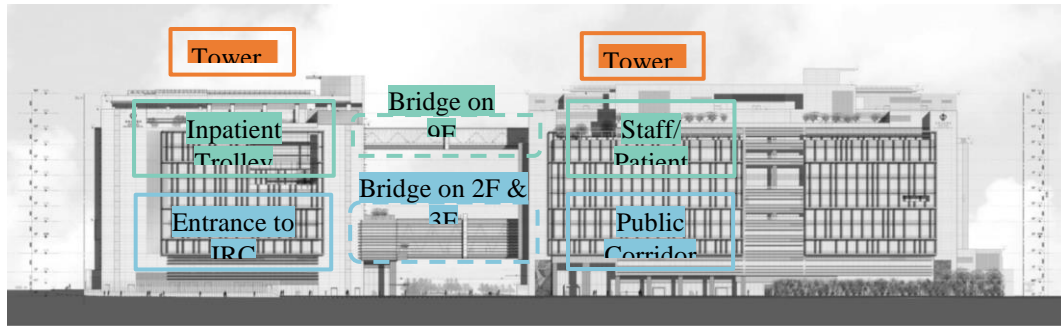(Hospital Authority, 2020b)

Fig. C5 Link bridges between Tower A and Tower B
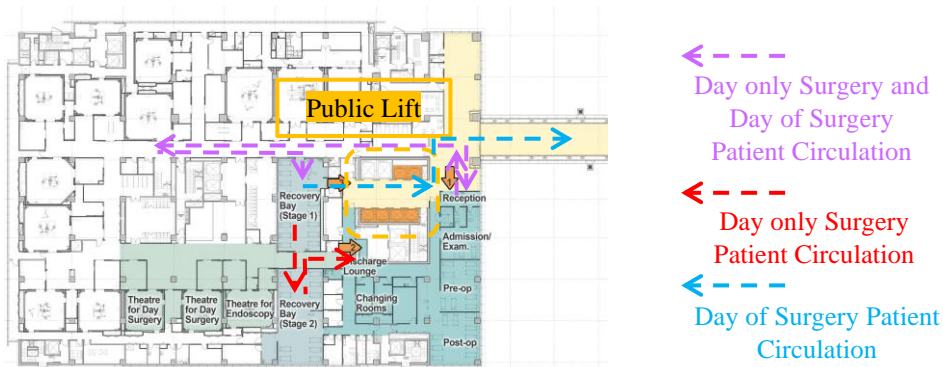(Zhong, 2019a)

Fig. C6 Outpatient Surgery Patient Circulation for Optimal Privacy of 3 Types of Users
(Zhong, 2019a)

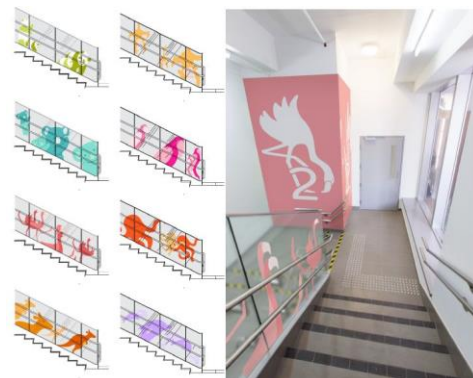
Fig. C7 Animal Character Designs
(Zhong, 2019a)

Fig. C8 Staircase Design
(Zhong, 2019a)

Fig. C9 Sun Path Study
(Zhong, 2019a)

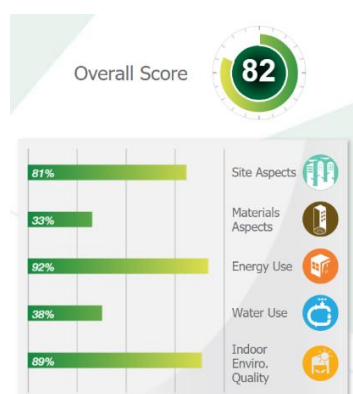Fig. C10 Façade Shading Mock-up
(Cheung, 2019)

Fig. C11 Provisional Platinum Rating
(HKGBC BEAM Plus, 2020)

Appendix D- SZCH

SZCH is another case study carried out for the purpose of this research. Its online interfaces, charges, flow design and navigation features are explored for more comprehensive understanding of the scheme.

<div style="border:1px solid black; padding:10px;">

<u>Shenzhen Children's Hospital (SZCH) Phase 2</u>

Type of Hospital: Public Hospital (specialist hospital)

Completion: 2014

<u>Total Cost: RMB 13 billion (≈GBP 11.4 million)</u>

<u>Inpatient Bed: 1,100</u>

<u>Operating Theatres (OT): 17</u>

Staff Member: 1,700

Target Patient: Children age 0- 18

Site Area: 103,000 m^2

Gross Floor Area (GFA): 170,000 m^2

Tower: 1

Storeys: 15

<u>Lifts: 14</u>

Out-patient per year: 2,304,000

In-patient per year: 76,800

<u>Surgical Procedure per year: 22,000</u>

<u>Clinical Department: 39</u>

Client: National Health and Family Planning Commission of mainland China

</div>

Table D1 Background Information of SZCH
(Shenzhen Municipal Health Commission, 2019; Wspid, 2016; Foreigner
CN, 2012; Shenzhen Children's Hospital, n.d.a; Government of Shenzhen,
n.d.; Shantou University Medical College, n.d.)

Fig. D1 Mobile Interface of SZCH for Online Services
(Shenzhen Children's Hospital, n.d.b)

Fig. D2 Mobile Nursing in SZCH
(Zhong, 2018)

Lift lobby

Toilet

Floor (top), wall (middle)
and ceiling (bottom)

Fig. D6 Signage Design for Space Navigation
(Zhong, 2018)

Average Outpatient Fees per time in
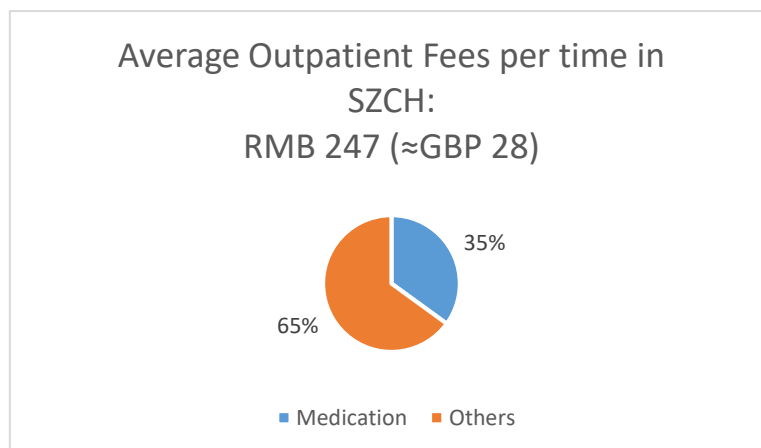SZCH:
RMB 247 (≈GBP 28)

35%

65%

■ Medication ■ Others

Fig. D3 Average Outpatient Fees per time in SZCH
(Shenzhen Municipal Health Commission, 2017)

Average Inpatient Fees per time in
SZCH:
RMB 7,587 (≈GBP 866)

15%

85%

■ Medication ■ Others
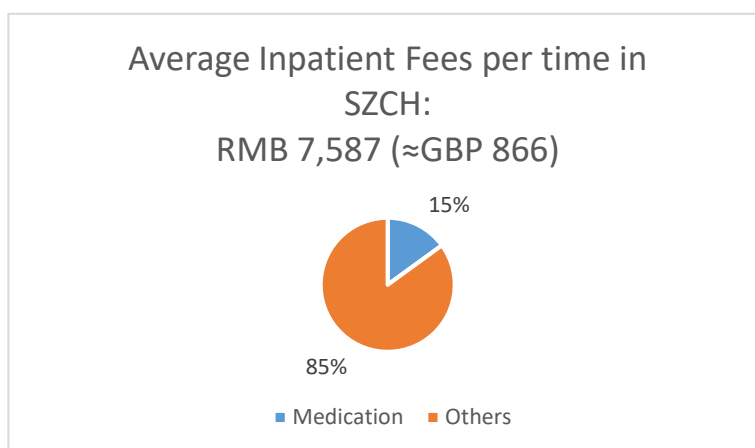
Fig. D4 Average Inpatient Fees per time in SZCH
(Shenzhen Municipal Health Commission, 2017)

Average Inpatient Fees per day in SZCH
:
RMB 1,322 (≈GBP 151)
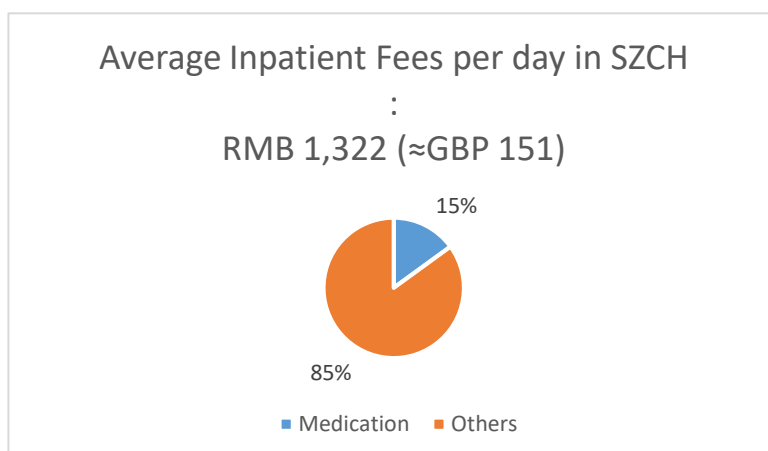
15%

85%

■ Medication ■ Others

Fig. D5 Average Inpatient Fees per day in SZCH
(Shenzhen Municipal Health Commission, 2017)

Appendix E- Comparisons Between HKCH and SZCH

Comparisons between two case studies of HKCH and SZCH are made for better understanding the differences of design decisions of two hospitals. The author has made comparison table and graphs for better understanding of the disparities in-between.

		HKCH	SZCH
1.	Design Criteria	Meets international and local standards	Meets national standards
2.	Government Funding per Capita (GBP)	2247	487
3.	Medical Service Fees (GBP)		
	-Outpatient	5 (Eligible Persons) 44.5 (Non-eligible Persons)	28
	-Inpatient (First Day)	19.5 (Eligible Persons) 510 (Non-eligible Persons)	151
	-Inpatient	12 510 (Non-eligible Persons)	151
4.	Main Target Patient	Eligible Persons of HKSAR	General Public
5.	Digitalisation	eHR and eHRSS	EHR, Health 160, SZCH app and potentially SC
6.	Early Planning	Yes; Prepared for 11 years before construction	No information can be found
7.	Flow Design	More strategic and comprehensive	Relatively simple; basic needs can be accomplished
8.	Signage Design	More design features can be seen	Relatively basic
9.	Spatial Design	User-oriented designs can be seen	Basic needs can be accomplished
10.	Bed to Ward Floor Area (m^2)	353	136
11.	Nurse Station to Ward Floor Area (m^2)	1802	5666

Table E1 Main Differences of HKCH and SZCH

31 Hong Kong   5.4
50 China   4.2

Fig. E1 Number of Hospital Beds per 1,000 People in HKSAR
and Mainland China
(Central Intelligence Agency, 2019)
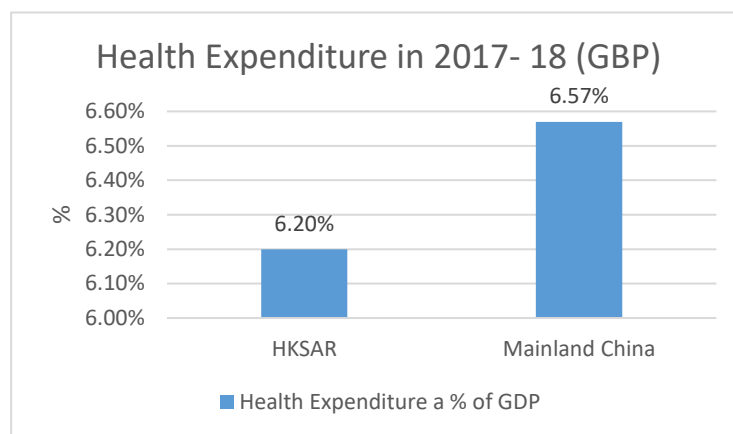

Health Expenditure in 2017- 18 (GBP)

Fig. E2 Health Expenditure of GDP in 2017- 18
(Food and Health Bureau, 2018; Zhang, 2018)

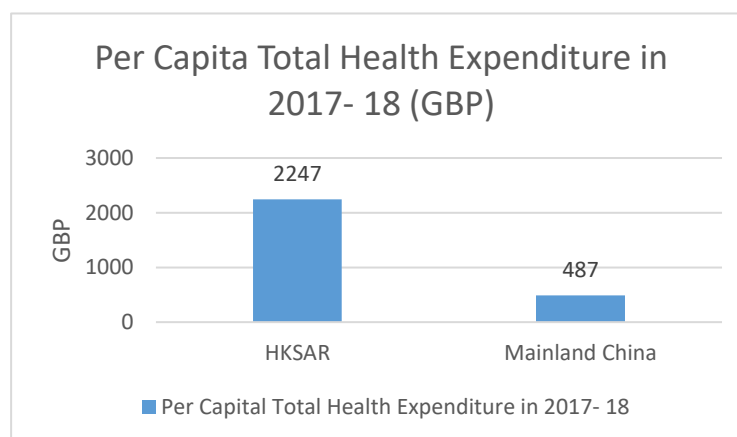**Per Capita Total Health Expenditure in 2017- 18 (GBP)**

Fig. E3 Per Capita Total Health Expenditure in 2017- 18 (GBP)
(Food and Health Bureau, 2018; Zhang, 2018)

Lift Lobby

Washroom

Washroom Basins and Cubicle

Fig. E4 Signage Designs of HKCH (left) and SZCH (right)
(Zhong, 2019a; Zhong, 2018)