MIS Quarterly

RESEARCH ARTICLE

RURAL-URBAN HEALTHCARE ACCESS INEQUALITY CHALLENGE: TRANSFORMATIVE ROLES OF INFORMATION TECHNOLOGY[1]

Yu Tong
School of Management, Zhejiang University, and Center for Research on Zhejiang Digital Development and Governance,
Hangzhou, CHINA {tong_yu@zju.edu.cn}

Chuan-Hoo Tan
Department of Information Systems and Analytics, School of Computing, National University of Singapore,
SINGAPORE {chtan@comp.nus.edu.sg}

Choon Ling Sia
Department of Information Systems, College of Business, City University of Hong Kong,
HONG KONG SAR {iscl@cityu.edu.hk}

Yani Shi
School of Economics and Management, Southeast University
Nanjing, CHINA {yanishi@seu.edu.cn}

Hock-Hai Teo
Department of Information Systems and Analytics, School of Computing, National University of Singapore
SINGAPORE {teohh@comp.nus.edu.sg}

Rural-urban healthcare access inequality refers to a disparity between rural and urban people with severe medical ailments in gaining access to the high-quality healthcare services they need. Although much hope has been pinned on the use of health information technology (HIT) to alleviate this critical and enduring societal challenge, the realized societal impact of HIT is unclear. Anchoring on both social transformation theory and affordance actualization theory, we conducted an in-depth qualitative study with two rounds of data collection in China. In addition to investigating how the societal challenge has triggered transformative HIT interventions, our analysis contributes to a theory on an HIT solution for the rural-urban healthcare access inequality challenge by establishing a link between HIT affordances and HIT interventions. This is done by examining how microlevel HIT effects escalate to macrolevel HIT effects through societal-level affordance actualization, which can affect this healthcare access inequality challenge. Along with providing policy implications on introducing HIT solutions to address intricate and complex societal challenges, this study extends existing theories by revealing the adaptation of the HIT intervention and differentiating the effects of collective and shared affordances.

Keywords: Healthcare IT, healthcare inequality, social transformation theory, affordance actualization.

Introduction

"Of all the forms of inequality, injustice in healthcare is the most shocking and inhumane."

– Martin Luther King, Jr. (1966)

Healthcare is a basic human right, yet the inequality in accessing it remains rampant and a critical societal challenge (FRA, 2013; Meyer et al., 2013). Healthcare inequality, also termed health disparity or inequity (Carter-Pokras & Baquet, 2002), refers to the disparity in one's access to healthcare, the likelihood of being affected by certain diseases, and/or health outcomes (Health Resources and Services Administration,

---

[1] Jason Bennett Thatcher was the accepting senior editor for this paper. Chee-Wee Tan served as the associate editor.

DOI:10.25300/MISQ/2022/14789

2000). While all three aspects of health inequality are important, addressing the access dimension is most critical because it provides a pathway toward better health outcomes (e.g., Carter-Pokras & Baquet, 2002; Spencer & Grace, 2016; Starfield et al., 2012). In many countries, this access inequality manifests in the form of *rural-urban healthcare access inequality*. Rural-urban healthcare access inequality (hereafter *healthcare access inequality*) refers to the disparity between rural and urban people with severe medical ailments in gaining access to the high-quality healthcare services they need, such as seeking medical consultations with senior physicians[2] and obtaining appropriate medical treatments (Braveman & Gruskin, 2003).

Reducing *healthcare access inequality* is challenging, especially in large countries. For instance, top-ranking hospitals in China are disproportionally located in city centers. Urban patients have geographical advantages over rural patients in gaining access to high-quality healthcare services. Although people in rural areas can travel to large city centers for quality healthcare services, traveling is associated with financial strain and inconvenience. In China, the healthcare structure and policies such as patients' autonomy to choose physicians of any rank for consultations and the first-come, first-served principle (He, 2010) make patients overwhelmingly gravitate toward senior physicians at top-ranking hospitals. The intense competition for consultation slots puts rural patients at a relative disadvantage compared with urban patients. The healthcare access inequality between people living in rural and urban areas might result in different health outcomes. The challenge in accessing high-quality healthcare services may contribute to medical disputes and general social discontent manifesting in protests, the destruction of medical facilities, and the harassment of medical caregivers (Table A1 in Appendix A).

To address the *healthcare access inequality* challenge, the Chinese government has encouraged healthcare sectors to leverage information technology (IT) (Table A2 in Appendix A). One example of this is the Chinese government's nationwide 13th Five-Year Plan (Article 38 in Appendix A). Consequently, the market for health IT (HIT) in China has increased rapidly (Tables A3, A4, and A5 in Appendix A). HIT systems, such as electronic medical record systems, clinical administration systems, online registration systems, online health portals, and online health communities, are considered potential solutions for this major societal challenge. Despite such initiatives, it remains unclear whether IT has played an effective role in alleviating this challenge, likely because the *healthcare access inequality* challenge is an intricate and complex societal challenge involving multiple actors and is shaped by interdependent factors (Gardner, 2011). Addressing this challenge thus requires concerted effort from diverse actors, including patients, healthcare professionals, and health bureau officials (Meyer et al., 2013; van Ryn & Burke, 2000). In this regard, research needs to go beyond focusing on specific HIT systems and actors, such as healthcare professionals, and instead focus on multiple actors and their different goals and values.

However, our review of extant HIT studies reveals that their scope of investigation has been limited mainly to specific types of actors or institutions in regard to the HIT adoption/assimilation issue (Table B1 in Appendix B). Research on this issue has generally focused on certain characteristics rather than the full spectrum of the existing social challenge at a macrolevel. Several studies have used IT as a partial solution to address specific healthcare issues—for example, studies investigating healthcare professionals' adoption and assimilation of HIT (Aanestad et al., 2014; Goh et al., 2011; Jensen & Aanestad, 2007; Koppel et al., 2008; Mishra et al., 2012; Sherer et al., 2016; Venkatesh et al., 2011); patients' use of health management systems (Lau et al., 2012, 2013; Gilbert et al., 2008; Ralston et al., 2007; Sarkar et al., 2011); and the online healthcare community's role in facilitating the transfer of knowledge from urban to rural populations (Goh et al., 2016). However, a wide gap in the literature remains because addressing the *healthcare access inequality* challenge requires taking a societal perspective. In particular, this requires establishing a theoretical understanding of how the effects of HIT at the microlevel could be escalated to address the *healthcare access inequality* challenge at the macrolevel. We establish such an understanding by building on social transformation theory (Wright, 2010) and affordance actualization theory (Strong et al., 2014) as our theoretical foundation. Specifically, we aim to explore how different HIT-transformative interventions through the enactment of societal-level affordances by different groups of actors could enable a path towards addressing *healthcare access inequality* in China.

Social transformation theory, which is a societal-level theory, provides macrolevel guidance for understanding the intricate healthcare structure, the focal challenge, and the effects of different types of transformative interventions on this societal challenge. This theory has advantages over other social theories, such as institutional theory, as well as using ecosystem lens, because it provides theoretical guidance on the impact of interventions (Srivastava et al., 2016). Affordance actualization theory provides a granulated understanding of IT and facilitates theorizing of the escalation of microlevel HIT effects, which are introduced to mitigate specific healthcare issues, to macrolevel

---

[2] Senior physicians refer to experienced specialists, who are usually at the top-level positions in a hospital ranking system. These physicians have practiced medicine for many years and have established themselves in the field with specialist qualifications.

HIT effects, which together can address the societal access challenge. Looking at the macrolevel rooted in microlevel phenomena can help to triangulate the causes of access inequality, which could reveal the root causes of this inequality and facilitate a more systematic and effective manner of proposing a *theory of a solution* for this complex societal issue (Majchrzak et al., 2016). In doing so, this study extends social transformation theory by proposing an adaptation of transformative intervention and explicating how it can be generated. The findings of this study also extend affordance actualization theory to the societal level.

Theoretical Foundations

Social Transformation Theory

Social transformation theory views societal challenges as rooted in social structure and explains how a societal challenge occurs and can be addressed via *transformative interventions* (Turner, 2013). The theory conceives of a *social structure* as an ecosystem with multiple groups of actors with distinct roles, traits, and perspectives; various institutions and governing mechanisms in the form of socially determined rules; and structural systems such as institutional rules, government policies, and beliefs[3] (Burns et al., 1987). When the interactions among actors, institutions, and governing mechanisms create obstacles or impediments that impose difficulties on society, a societal challenge occurs. In terms of our context, the key groups of actors in the healthcare structure include physicians, nurses, and healthcare administrators (henceforth collectively referred to as "healthcare professionals") as the elite group that provides services, patients as receivers of the services, and health bureau officials as providers of healthcare policies. Representative institutions include hospitals, healthcare bureaus, and private firms. Governing mechanisms include healthcare policies, insurance policies, hospital rules, patients' societal beliefs, and the healthcare system.

The *healthcare access inequality* challenge is a societal challenge in China. The root of this challenge can be understood according to four aspects. First, the asymmetric healthcare resource allocation creates disparity. Patients from rural areas experience spatial remoteness in access to high-quality healthcare services because most of these services are provided by healthcare professionals affiliated with 3-A public hospitals,[4] which are predominantly situated in urban areas. Second, policies related to outpatient healthcare access in China are typically based on first-come, first-served registration, rather than on disease severity or economic resources (He, 2010). Moreover, patients can choose physicians of any rank for their first and subsequent consultations. In other words, patients can choose, at their own will, to seek care from a physician who works at a community hospital with average-quality healthcare services or a senior physician working at a 3-A hospital with high-quality healthcare services. This implies that patients will overwhelmingly gravitate toward senior physicians at 3-A hospitals rather than average-quality physicians at community hospitals. Third, China has publicly financed health insurance coverage nationwide, and fees for consultation and medical tests at different levels of public hospitals do not vary greatly. As a result, patients are naturally inclined to seek the best care by opting for senior physicians working at highly ranked public hospitals (such as the 3-A hospitals) even for less severe illnesses (Hougaard et al., 2011; Yip et al., 2012). Fourth, senior physicians in China are hospital employees engaged in different types of outpatient, inpatient, and research work. They typically spend one or two days per week on outpatient consultations. Queueing for senior physicians' consultation tickets (i.e., appointment times) typically starts one week before the consultation day. Without the help of HIT, urban patients have overt advantages over patients in rural areas. To illustrate, if a rural patient with severe heart disease wants treatment from a senior physician at a top hospital, the patient typically needs to spend time and money commuting to a nearby city several times. To obtain the consultation ticket, patients need to compete with urban patients who are more familiar with the hospital's work processes and senior physicians' outpatient work schedules, regardless of disease severity. The process for rural patients to obtain a consultation ticket may take several days. Upon successfully obtaining a consultation ticket, the rural patient must travel to the city again for the actual consultation. Depending on the diagnosis, the patient may need to stay for several days to get the necessary medical tests done because of the long queues for the limited testing capacity.

According to social transformation theory, societal challenges can be potentially addressed through social reproduction, which comprises two interconnected processes: passive and active social reproduction. Social reproduction refers to "the processes that reproduce the underlying structure of social relations and institutions of a society" (Wright, 2010, p. 192). In passive social reproduction, the social structure is reproduced through mundane routine activities performed by actors without conscious effort. For instance, healthcare

---

[3] Institutional rules refer to the procedural rules for a society. Beliefs cover the conscious and nonconscious aspects of subjectivity residing in a society.

[4] Public hospitals in China can be generally classified into three levels. Level 1 hospitals focus on providing primary care in one community, while Level 2 hospitals typically provide healthcare services across several communities. Level 3 (particularly Grade A of Level 3, termed 3-A) hospitals are highly reputable, located in large cities, and enjoy high-quality healthcare resources. The number of private hospitals has increased in recent years, but they are typically small and account for less than 10% of the total hospital revenue (Research and Markets, 2017). None of the top 100 hospitals in China are private hospitals (Ailibi, 2018).

professionals such as nurses do their job every day caring for patients by following the rules and routines for delivering services. In this way, they reproduce their status as nurses in the social structure. Through this process, the roles of actors, beliefs, and institutional rules inherited from the previous structure generate social inertia in a society. However, obstacles from the previous structure impose real harm because societal challenges are unsustainable over time, as they frequently inspire some actors to disrupt certain parts of the existing structure via deliberate *transformative interventions*. This is when active social reproduction occurs. Transformative interventions refer to efforts exerted by institutions to actively reproduce the underlying social structure; the interventions are designed with specific purposes to address a societal challenge (Wright, 2010). As a result, transformative interventions could alter social structure through their intended and/or unintended consequences, thereby alleviating or aggravating the targeted societal challenge (Wright, 2010). Social transformation theory suggests three types of transformative interventions:

Symbiotic transformation addresses the societal challenge by focusing on the elite group of actors in the social structure and solving operational and practical issues faced by the group. This type of transformative intervention is frequently initiated by conventional institutions and often results in extending and deepening the existing social structure (Wright, 2010).

Interstitial transformation focuses on addressing the societal challenge by building "new forms of social empowerment" (Wright, 2010, p.211) in niches or margins of the social structure. This intervention does not impose an immediate threat to dominant classes or elites (Wright, 2010). Exercising this type of intervention—for example, through worker-owned cooperatives, which are a typical form of interstitial organization in a capitalist society—can help prevent immediate confrontations and propose alternative solutions for a societal challenge (Wright, 2010).

Ruptural transformation denotes the creation of new institutions as a sharp break from the conventional means of a legacy social structure, such as a regime change led by the working class in a revolutionary manner (Wright, 2010). Through ruptural transformation, existing obstacles related to social challenges embedded in the existing social structure are resolved and new institutions are established.

Building on the above theoretical foundation, we deduce that in the healthcare context, via a passive social reproduction process, the healthcare structure, including the roles of key actors, institutions, beliefs, and institutional rules, is maintained. Rural and urban patients compete for limited high-quality healthcare services offered by reputable public hospitals. This *healthcare access inequality* challenge triggers an active social reproduction process, in which HIT transformative interventions (hereafter *HIT interventions*) occur. HIT interventions refer to HIT-related efforts deployed by institutions to address the societal challenge in the healthcare structure by benefiting healthcare actors and/or changing certain parts of the structure itself. In the context of the *healthcare access inequality* challenge, healthcare professionals in top-tier hospitals have a very high workload and are in short supply. Considered the elite group of actors in the healthcare context, they hold more resources and power than patients.

Prior literature provides some evidence of the effects of HIT interventions. For example, some studies have focused on HIT used by healthcare professionals to solve work challenges related to symbiotic HIT intervention. Tong et al. (2015) demonstrated that healthcare professionals could use a closed-loop medication management system to improve work performance. Bhargava and Mishra (2014) found that the electronic medical record system has mixed effects on physicians' productivity, contingent on the physician's specialty. Others have examined HIT that empowers patients to solve difficulties, which is related to interstitial HIT interventions. For example, Rajan et al. (2013) found that telemedicine can deliver complementary care to chronically ill patients. However, not all patients prefer this form of HIT, particularly patients who live far from specialist hospitals. Prior studies have also suggested that HIT features offered by outside hospitals/organizations can help patients obtain support and can possibly alleviate the societal problem, which is related to ruptural HIT interventions. For instance, Goh et al. (2016) found that online health communities may moderately alleviate the societal problem of rural-urban health information disparities because urban users can provide online social support to rural participants. Yan and Tan (2014) examined online health sites and posited that social support exchanged in an online healthcare community can benefit patients' health conditions. Online health communities and online health sites are ruptural because they empower patients to exchange and obtain health information that bypasses the traditional elite group of actors (healthcare institutions and associated physicians in their formal roles). Patients are able to gain access to deeper knowledge that was traditionally held by these elite actor groups, enabling them to engage in health-related actions that were traditionally frowned upon, such as extensive self-medication or diagnosis.

An interesting observation from reviewing these prior studies is that various HITs exist, but their actual effects can turn out to be unintended; for example, they may not be beneficial for remote patients (Rajan et al., 2013) and the productivity increase is subject to the physician's specialty (Bhargava & Mishra, 2014). To better understand how HITs can address societal challenges, we need to close the loop to better understand how the microlevel effects of HIT systems on patients or healthcare professionals can enact macrolevel effects of HIT interventions on the societal challenge. To this end, although social transformation theory provides overarching theoretical support for the research, it needs to be complemented by a theoretical perspective that explicates the escalation of microlevel HIT effects and explains these effects on the *healthcare access inequality* challenge. Affordance-actualization theory serves this purpose.

Affordance-Actualization Theory

Affordance-actualization theory is a multilevel theory depicting how technology with multiple affordances employed by individual actors in an organization can be escalated to cause organizational impacts (Strong et al., 2014). Technology affordance is the potential for actors to utilize multifeature technology to achieve certain goals (Majchrzak & Markus, 2013). It is regarded as a relational concept rather than a property belonging solely to the technology or actors. A technology has inherent material properties such as features that can support multiple affordances. Actualization refers to "the actions taken by actors as they take advantage of one or more affordances through their use of the technology to achieve immediate concrete outcomes in support of organizational goals" (Strong et al., 2014, p. 70). Depending on the contexts or actors' goals, a technology's material property can afford diverse actor actions (Leonardi, 2011). Hence, the actual impact of technology hinges on actors enacting the technology affordances.

Affordance-actualization theory, which was originally developed in the context of the individual to organizational-level IT affordance-actualization, explicates that affordance can take place at both the microlevel and macrolevel. Microlevel actions can lead to long-term macrolevel impacts through the escalation from microlevel outcomes to macrolevel outcomes (Strong et al., 2014). There are two types of affordances at the macrolevel, namely collective affordance and shared affordance (Leonardi, 2013), which are elaborated on below.

First, a *collective affordance* is "an affordance that is collectively created by members of a group, in the aggregate, which allows the group to do something that it could not otherwise accomplish" (Leonardi, 2013, p. 752). Collective affordance is likely to be enacted when members of a group work on pooled or noninterdependent tasks, without the expectation of uniform behaviors in using the same technology among group members. For instance, when patients seek health knowledge through an online health portal, they have a limited degree of task interdependence and may utilize different system features. For example, if Patient A browses the portal to gather general health information and Patient B utilizes the search feature to obtain specific health knowledge, patients as a group enact a collective affordance of increasing healthcare knowledge beyond the hospital.

Second, a *shared affordance* "is an affordance that is shared by all members of a group" (Leonardi, 2013, p. 752). Shared affordances are likely to be enacted when members of a group work on interdependent tasks and employ a shared structure of technology use and outcomes (Strong et al., 2014). For instance, physicians in a hospital or across hospitals work interdependently to provide healthcare services because they often refer to previous medical records and coordinate with others to treat patients. When physicians utilize the same set of features of electronic medical records to do the work, these physicians enact a shared affordance.

Prior literature emphasizes that shared affordances rather than collective affordances are important to achieving organizational-level impacts (Leonardi, 2013). When actors in the same group enact shared affordances, they have the same understanding of the system. Thus, they can interact and coordinate with each other more effectively (Leonardi, 2013) and make the actualized outcomes compatible, thus reinforcing the ability to achieve an organizational impact (Strong et al., 2014).

As noted above, affordance actualization theory was originally conceived for the organizational context, in which the organization represented the macrolevel and employees represented the microlevel. However, it is also explicitly noted by Strong et al. (2014) that the theory should be generally applicable to a wider context. In this study, we adapt the theory to the societal level and define societal-level affordances as the potential for a group of actors to utilize multifeature technology to achieve goals at the societal level. Figure 1 depicts the overarching theoretical framework that integrates social transformation theory and affordance-actualization theory to guide the subsequent empirical investigation. Affordance-actualization theory supplements social transformation theory to theoretically study how different HIT interventions that encompass shared or collective societal-level affordances can alter the healthcare structure and address the focal societal challenge. In detail, we posit that the effects of HIT interventions hinge on the actualization of societal-level affordances. Through this actualization process, individuals within a social group enact the respective HIT features consistently or inconsistently and result in actions of a group, the latter of which lead to immediate concrete outcomes for the respective societal-level affordances. The collection of immediate concrete outcomes influences the effectiveness of the societal goal of reducing *healthcare access inequality*.

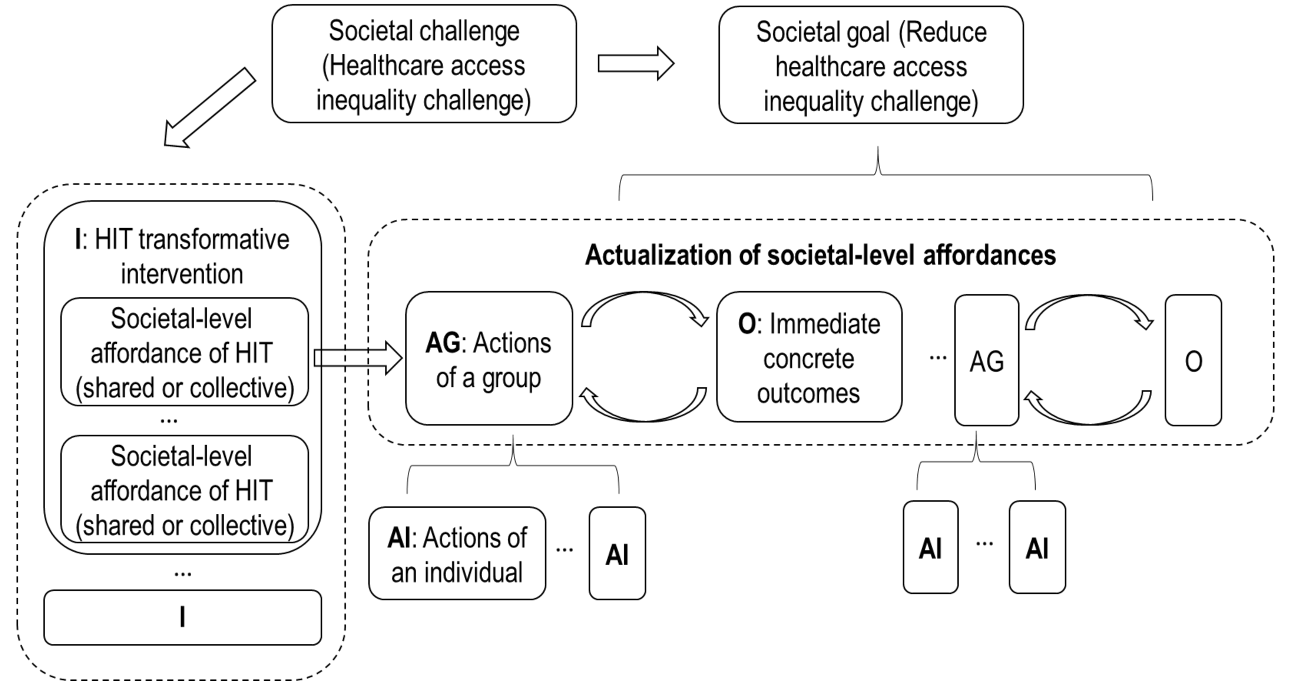

Societal challenge (Healthcare access inequality challenge)
Societal goal (Reduce healthcare access inequality challenge)
I: HIT transformative intervention
Societal-level affordance of HIT (shared or collective)
...
Societal-level affordance of HIT (shared or collective)
...
I
Actualization of societal-level affordances
AG: Actions of a group
O: Immediate concrete outcomes
...
AG
O
AI: Actions of an individual
...
AI
AI
...
AI

Figure 1. Theoretical Framework

Empirical Investigation

This study adopts a qualitative approach for its empirical investigation. Our focus is on the effect of HIT on the *healthcare access inequality* challenge in China. We value theories and empirical findings to interpret and theorize the focal phenomenon (Timmermans & Tavory, 2012). The theories provide a guide for us to initially make sense of the intricate phenomenon. The empirical data verify the theories' appropriateness and identify the surprising findings. That is, a recursive process is conducted between the theories and data to construct our understanding and generate propositions to our data (Timmermans & Tavory, 2012). This approach informs our data collection and analysis.

Data Collection

Our data were collected from two primary sources: archival data and interviews. Archival data, such as online articles, news, reports, and videos, provide a background understanding of the healthcare structure and related issues in China (Tables A1~A2 in Appendix A), and the development of the HIT interventions at the societal level (Tables A3~A5 in Appendix A). We searched online for archival data from January 2010 until January 2017; at the end of this period, we completed the second round of interviews. We primarily used the terms relevant to healthcare challenges in China and HIT interventions. We selected articles mainly from government websites and Alexa.com's list of the 500 most viewed websites in the world.[5] To assess the situation in different regions in China, we searched for articles from reputable local news websites. We collected 111 articles with 193 single-spaced pages of archival data.

The interviews provided an in-depth contextual understanding of the focal phenomenon, including evidence of individual and societal affordances, the link between microlevel and macrolevel impacts, and the effectiveness of HIT interventions. Interview data collection was conducted in two rounds. In the first round, we assessed the healthcare access inequality challenge and the effects of HIT systems. We selected interviewees with relatively diverse characteristics because the focal societal challenge and impacts of HIT interventions can influence different people in different ways. With this principle in mind, as research sites, we first selected two provinces in China that are approximately 500 km apart and differ in economic development status. We then selected interviewees using two criteria: (1) interviewees should represent the key types

---

[5] https://www.alexa.com/topsites/. Last accessed in January 2017)

of actors in the healthcare structure, including the public in rural and urban areas, healthcare professionals, and health bureau officers; and (2) the interviewees representing each type of actor should have relatively diverse backgrounds; for example, public interviewees should represent different locations, genders, occupations, ages, and health conditions; healthcare professional interviewees should represent different hospitals/institutions and position levels. However, we did not select people aged 18 or younger because this group of people typically do not have severe medical conditions and do not yet need access to high-quality healthcare. We also did not select people from rural areas who happened to be living in urban cities for work, as they do not represent the healthcare experience of rural populations. Based on these selection criteria, we sought to obtain a relatively rich view of the societal challenges experienced by different groups of people to identify commonalities and probe inconsistencies in the collected opinions of individuals. In total, 61 citizens and 20 Chinese healthcare-related professionals including 3 health bureau officials were selected by the researchers and local contacts.

We conducted the second round of interviews approximately 3.5 years after the first round of interview data collection. The purpose of the second round was to track the further development of HIT interventions at the macrolevel over time. This purpose was based on the emergent questions identified after the first round of data analysis, such as the unexpected consequences of HIT interventions on the focal healthcare challenge. Thus, we slightly adapted the previous interview protocols (see Figure C3 in Appendix C) and decided not to return to previous interviewees. We obtained an understanding of HIT development in all provinces in China by studying related government policy changes, collaborating with leading HIT vendors, and conducting roundtable discussions with experts at China's HIT-related conferences. We then selected one province at which to conduct interviews based on the following considerations. The chosen province thus traditionally exhibited salient healthcare access inequality challenges. Therefore, this province instituted various HIT interventions, which were identified in the first round of data analysis. A new HIT model emerged in this province, which offered insights into the changing and evolving nature of HIT interventions. We first obtained support from and then interviewed the director in charge of the related government sector. The director then acted as a liaison with the representatives of different types of HIT vendors for on-site visits and interviews. Table 1 presents the demographic data of our sample.

The interviews in both rounds were semi-structured and were conducted by two or three interviewers. The first researcher conducted the interview, while the second researcher took notes to facilitate the transcription. For certain public interviewees who spoke a local dialect, we recruited a local guide to ensure mutual understanding during the interview. Two sets of interview protocols were prepared to represent the public and healthcare-related professionals.

For public interviewees, the protocol (Table C1 in Appendix C) started with interviewees recalling recent healthcare events related to them or their immediate family members. This approach allowed the interviewees to share insights they were familiar with and increased their engagement in the interview. Based on social transformation theory, societal challenges are ills embedded in the obstacles of a social structure. To assess the focal challenge, we encouraged the interviewees to describe the process of each healthcare event and the associated challenge in detail, including (1) why the health behavior occurred, (2) how they sought healthcare, such as the channels they used, (3) the challenges they encountered during this healthcare-seeking process, and (4) the consequences of this process. Based on the interviewees' responses, the interviewers checked whether any type of HIT was used in health behavior. If the interviewees utilized a HIT but did not specifically elaborate its role during the previous conversation, then the interviewers further probed them to evaluate their experience in using the aforementioned HIT and the related features. If the interviewees did not utilize any HIT, then the interviewers identified the relevant HIT applications for their healthcare events and prompted the interviewees to evaluate the HIT applications and explain why they did not utilize HIT. The relevant HIT applications were identified based on the list of HIT applications consolidated after reviewing the archival data and the HIT literature. Based on the theories and HIT literature, we understood that healthcare-related events and HIT occurred both within and beyond the boundaries of conventional healthcare institutions. Thus, if the interviewees only recalled the healthcare events within the hospitals, then the interviewers prompted them to also recall some common events outside the boundary of conventional healthcare institutions. In the last part of the interview, the interviewers asked questions regarding the interviewees' demographic situations to obtain a better understanding of the interviewees' characteristics.

For healthcare-related professional interviewees including healthcare professionals, HIT vendors, and health bureau officials, in both rounds of data collection, four key research issues guided the interviews: (1) the current status of the healthcare structure and HIT development, (2) the roles of HIT applications in solving social challenges in the healthcare field, (3) the parties/entities who are or should be responsible for the operation of HIT applications, and (4) the future direction of HIT (Tables C2 and C3 in Appendix C). Based on the HIT literature, we assessed the interviewees' perspectives on HIT interventions developed by hospitals and private firms.

Table 1. Demographic Information of Interviewees and Interview Length

Interviewee(s)*	Job title	Residence	Gender	Interview length	Age	Internet usage
Public: Round 1						
P1/P2	Primary school teacher/primary school headmaster	Rural	F/M	48 min	50-60	Sometimes
P3/P4	Two traffic brigade officers	Rural	M/M	1 h 14 min	40-50	Everyday
P5	Traffic brigade captain	Rural	M	1 h 35 min	40-50	Everyday
P6	Company staff	Rural	M	1 h 35 min	30-40	Everyday
P7/P8/P9	Two primary school teachers/one secondary school teacher	Urban	F/F/M	1 h 23 min	30-50	Everyday
P10/P11/P12	Three restaurant owners	Rural	M/F/M	50 min	50-60	Often
P13	Self-employed Businessman	Rural	M	29 min	40-50	Often
P14	Factory director	Rural	M	1 h 24 min	60-70	Often
P15	Shop owner	Rural	F	37 min	40-50	Occasionally
P16	Factory owner	Rural	F	52 min	40-50	Occasionally
P17	Traffic brigade officer	Rural	F	26 min	30-40	Everyday
P18	Traffic brigade officer	Rural	F	37 min	30-40	Occasionally
P19/P20	Two traffic brigade officers	Rural	F/M	54 min	50-60	Everyday/ Occasionally
P21/P22/P23	Three farmers	Rural	F/F/F	27 min	40-50	Children help use the Internet
P24[+]	Farmer	Rural	F	09 min	60-70	No
P25/P26/P27	Three housewives	Rural	F/F/F	29 min	20-30	Occasionally
P28/P29/P30/P31	Four press editors	Urban	F/F/F/M	55 min	30-40	Often
P32/P33/P34	Three press editors	Urban	F/F/F	54 min	40-50	Often
P35/P36/P37	Junior school teacher, headwaiter, bank manager	Urban	F/F/M	1 h 10 min	25-35	Often
P38	Factory worker	Urban	M	50 min	40-50	Often
P39/P40	Two retirees	Urban	F/F	35 min	60-70	Sometimes
P41/P42	Accountant, retiree	Urban	F/F	44 min	25-50	Often/Sometimes
P43/P44	Software engineer, architectural consultant	Urban	F/F	54 min	20-30	Everyday
P45/P46/P47	Three staff members (in the marketing department of a hotel, the food and beverage department of a hotel, an exhibition staff)	Urban	F/F/F	1 h 08 min	20-30	Everyday
P48/P49/P50	Three staff members (in the housekeeping department of a hotel)	Urban	F/F/F	1 h	20-40	Everyday
P51/P52/P53	Three farmers	Rural	F/F/F	45 min	50-60	Seldom
P54/P55/P56	Three farmers	Rural	F/F/F	51 min	60-70	No
P57/P58/P59/P60/P61	Construction project manager/three labor contractors/construction worker	Urban	M/M/M/M/M	1 h 2 min	20-50	Often
Total number of people (public) interviewed = 61 *(30 people resided in rural areas + 31 people lived in urban areas)*						
Healthcare-related professionals:** Round 1						
M1	Physician	Rural	M	15 min	30-40	*Not applicable*
M2	Physician	Rural	M	41 min	30-40	
M3	Physician	Rural	M	42 min	30-40	
M4[+]	Physician (senior)	Urban	M	20 min	40-50	
M5/M6/M7	Three physicians (one senior)	Rural	M/M/M	44 min	30-50	
M8/M9	Two health bureau officials	Urban	F/M	26 min	30-40	
M10/M11	Two hospital medical informatics specialists (senior)	Urban	M/M	25 min	40-50	

M12$^+$	Physician (senior)	Urban	M	08 min	40-50	
M13	Physician (senior)	Urban	F	22 min	50-60	
M14/M15/M16	Hospital medical informatics specialist / president of the community hospital (senior) / health bureau director (senior)	Urban	M/M/M	1 h 36 min	30-60	
M17	Deputy president of the hospital (senior)	Urban	M	1 h 06 min	50-60	
M18/M19/M20	Director of the medical informatics center (senior) / two physicians (one senior)	Urban	M/M/M	45 min	30-60	
Healthcare-related professionals: Round 2						
M21	Director in 3-A hospital medical informatics department	Urban	F	50 min	40-50	*Not applicable*
M22	Health bureau vice director of a province (senior)	Urban	M	30 min	40-50	
M23	Director in 3-A hospital medical informatics department (senior)	Urban	M	32 min	30-40	
M24	Health bureau director in a province, in charge of internet healthcare services (senior)	Urban	M	1 h 20 min	30-40	
M25/M26	Regional director of a HIT vendor for internet hospital/senior consultant of a HIT vendor	Urban	M/F	55 min	30-40	
M27/M28/M29	CEO/CTO/director of a HIT vendor	Urban	M/M/F	1 h 50 min	30-40	
Total number of interviewees = 29						

Note: * When multiple interviewees are listed together, it indicates a group interview was conducted. $^+$The interview was removed from further data analysis because the interview was not completed. **Healthcare-related professionals are a group of actors who either directly provide healthcare services (healthcare professionals) or indirectly offer healthcare support in the healthcare ecosystem (such as HIT vendor, health bureau officials).

The interview protocol contained the interviewers' instructions, key research questions, probing questions, transition messages, and a list of major HIT images and examples. We utilized general ideas from the related theories when constructing the interview protocols, rather than strictly constraining our protocols by these theories. This allowed us space to generate new findings. Additionally, although the interviewers followed the interview protocols, the interviewees were not restricted to answering questions but were free to ask any clarification questions during the interviews. We also did not stop interviewees from sharing information that was not directly related to the protocol questions. The exact set of questions posed to each type of interviewee is documented in Appendix C. All the interviews were conducted in Mandarin and were recorded. We preserved the anonymity of our interviewees to encourage them to speak freely and provide candid statements. The average length of the interviews was approximately 48 minutes. Each interview was transcribed in Mandarin by three research assistants (Ras), with one RA conducting the first round of transcription and the two other Ras performing verification. Data from the transcribed interviews were recorded on approximately 900 single-spaced pages. We checked the transcriptions for relatively shorter interviews (< 30 mins) and found that the short interviews were held with people from rural areas who utilized the HIT to a limited extent. Hence, they were not able to share much information regarding HIT use with the interviewers, despite the prompts. We decided to retain this set of interviews for data analyses because their views and characteristics represent a type of public input and are relevant to the societal challenge. The same rules were applied when checking the short interviews for professional interviewees. Interviewees M4 (20 minutes) and M12 (8 minutes) did not complete the whole interview protocol due to a medical work interruption. We removed these two transcriptions from further data analysis.

Data Analysis

The transcribed interviews and field notes were independently coded in Mandarin by two Ras who discussed the codes to ensure interpretation consistency. The initial set of coding schemes was derived based on the main themes in the interview protocols and our theoretical lenses, such as categories describing interviewees' characteristics, health scenarios, HIT interventions, HIT affordances, and societal challenges. For each scenario mentioned by the public interviews, we coded the characteristics related to the illness, challenges encountered, consequences of the scenario, system and features used, and attitudes toward the HIT system. We used a four-step, iterative process for data analysis (Table 2):

Step 1: We coded the data to verify the characteristics of *healthcare access inequality* challenges in China and to identify the key groups of actors, institutions, and HIT systems.

Step 2: Based on the characteristics of transformative interventions, including key objectives, initiating institutions, and directly affected actors, as well as the HIT context identified in this study, we conceptualized HIT interventions in relation to the *healthcare access inequality* challenge. We then coded HIT systems into HIT-related features, initiating institutions and key actors and looking for evidence of their contributions to HIT interventions.

Step 3: With the HIT-related features, key groups of goal-oriented actors, and their task interdependence, we looked for evidence of how they lead to societal-level shared/collective affordances. It should be noted that a HIT system may contain multiple societal-level affordances and that an affordance can be shared by more than one HIT system. The list of societal-level affordances was compared with the key characteristics of three HIT interventions. Hence, we established links between societal-level affordance and HIT interventions.

Step 4: We next built on affordance actualization theory (Strong et al., 2014) to identify the mechanisms for HIT interventions via actualization process for each societal-level affordance. Individual-level actions and immediate concrete outcomes led to societal-level outcomes. Multiple individual-level outcomes related to the same societal-level goals were grouped.

We also searched for generalized patterns and built comparison tables (Wolcott, 1994) to understand how each of the HIT interventions individually and jointly addressed one or more characteristics of the *healthcare access inequality* challenge. The unexpected findings that could not be theorized triggered the development of a new understanding (Timmermans & Tavory, 2012). For example, we found that a new form of government-initiated HIT intervention did not fit well into the existing types of HIT interventions because it emerges from unexpected joint effects of societal-level affordances, which triggered our further theorization. Consequently, refined coding schemes were generated for the public and healthcare professionals, which can be found in Appendix D. Tables D1-D4 show the initial and final coding schemes, and Figure D1 and D2 demonstrate the coding process for shared and collective affordances as well as their actualization, respectively. This helped us formulate the propositions illustrated in the section discussing the theorization of HIT interventions.

We remained sensitive to potential biases in interviews and sought to triangulate data from multiple sources. At least two pieces of information were used to support each finding (Fetterman, 2010), such as corroborating quotes from more than one interviewee and finding a news article/report that corroborated an interview quote. We oscillated among the theories, related literature, and empirical data through multiple iterations to construct our understanding and propositions (Timmermans & Tavory, 2012). We ensured data consistency with coding categories and emerging categories in the data (Lofland & Lofland, 1995).

Contextual Findings

In this section, we present the contextual findings on the adoption and use of HIT systems by conventional healthcare institutions, unconventional healthcare institutions such as private firms, and the government. We also discuss the effects related to the *healthcare access inequality* challenge and the trajectory of how certain new forms of HIT are initiated by the government. These contextual findings contribute to our interpretation of the analysis results presented in our Data Analysis and Results section.

HIT Initiated by Conventional Healthcare Institutions (Hospitals)

Our interviewees acknowledged the *healthcare access inequality* challenge (P13, P57, M14, M17). Patients with severe medical conditions reported having trouble gaining access to high-quality healthcare services, especially those who live in rural areas.[6] Government authorities stated that they regard HIT as a potential solution to alleviating healthcare challenges and that they thus strongly support pursuing HIT systems, particularly those initiated by public hospitals (e.g., Article 1, Article 6, and Article 7 in Appendix A).

---

[6] Senior physicians in high-ranking public hospitals continued to have long consultation lists. Patients, particularly those from rural areas, experienced intense and asymmetric competition for limited high-quality healthcare services. For example, patients are required to line up in front of the registration counter to obtain consultation queue numbers for specific physicians. The difficulties for patients from rural and urban areas in obtaining the queue numbers differ. Interviewee P13 (public, rural) described the consultation access difficulty in top-ranking public hospitals: "I used to take my mother to Beijing [capital of the country] to see a physician. We spent 5,000 Chinese yuan to buy a queue number from a scalper." However, patients in urban areas perceive few difficulties in accessing the consultation slot. According to P57 (public, urban), "If I go to a hospital, I certainly would like to seek consultation from senior specialists. I can go to the hospital early in the morning to queue for the consultation slot."

Table 2. Stages of Data Analysis

Stage	Data	Tasks	Outputs
1. Code key characteristics of the healthcare societal challenge and HIT systems	The first round of interview data	Identify the key groups of actors, institutions, and characteristics for the focal societal challenge; list and categorize HIT systems.	A contextual background of healthcare access inequality challenges in China with the key HIT systems involved
2. Conceptualize HIT interventions	The first round of interview data	Conceptualize HIT interventions in relation to the healthcare access inequality challenge and code the associated HIT systems into HIT-related features, initiating institutions, and key actors.	HIT interventions and related HIT systems
3. Identify the societal-level affordance of HIT	The first round of interview data	Code the HIT features, actor's characteristics, and task interdependence; look for evidence leading to the identification of the societal-level affordance (shared/collective affordances).	6 societal-level affordances
4. Generate mechanisms for HIT interventions	First and second rounds of interview data	Identify the affordance actualization process for societal-level affordances; explore the mechanisms of how HIT interventions affect the focal societal challenge.	A set of propositions

In terms of policy, HIT systems, such as the electronic medical record system, are among the criteria for a public hospital to be continuously granted a 3-A ranking. The HIT systems in hospitals are centered around the electronic medical record system, which digitizes healthcare professionals' clinical work and serves as a cornerstone for electronically sharing and exchanging patients' medical information between healthcare institutions at all levels (M19). In this way, rural patients' medical history and records can be immediately viewed by high-quality urban hospitals. As acknowledged in our interview data (M17) and archival data (Article 51 in Appendix A), initial funding support is provided to help public hospitals implement HIT systems. The following statements from healthcare professionals illustrate this program and related HIT features that integrate the entire outpatient flow and that cover not only the consultation procedure but also administrative work, such as registration, payment, and dispensing medication.

> M17 (deputy president of a hospital): *The setup fees [for HIT in hospitals] are nearly entirely paid by the government. However, the latter part [after the setup stage] is excluded. The upfront investment in our hospital, which costs millions of Chinese yuan per year, is mainly from the government. The [follow-up] items cost us more than 10 million Chinese yuan.*

> M14 (hospital medical informatics): *[3-A hospitals'] main task is to set up hospital information construction based on electronic medical records. This plan is not only for inpatients but also for outpatients, and this plan will integrate everything, including test reports and radiological examination. The entire system is a major integration and essentially electronically streamlines the entire process from registration to diagnosis, physician advising, and medication dispensing.*

On the day of the scheduled consultation, HIT features of the clinical administration system are available to structure and systemize the patient's flow of services, such as digital patient consultation registration at the hospital and electronic viewing/printing of the results. Our interviewees described the HITs they experienced.

> P48 (public, urban): *If the big screen shows that the current queue number is 2 and my queue number is 8, then I can determine the number of patients ahead of me.*

> M14 (hospital medical informatics): *Large hospitals, they have integrated RIS [radiology information systems], which helps physicians check the laboratory results. Physicians do not need to wait for paper-based test results. In the past, after patients completed the consultation registration, they needed to use physical case notes to queue for the consultation. Some patients may jump the queue by inserting their case notes in front of others. You can barely prevent this situation from happening because you cannot simply stare at the queue of the case notes all the time. In most cases, a large group of people stood there to prevent queue jumping. With the system, such a situation will not happen. Everyone should sit and wait for the name to be called.*

Healthcare professionals acknowledged that with the related HIT features of electronic medical record systems, the process of recording, storing, and accessing patients' medical records improved. This helped alleviate the limited supply related to the healthcare access inequality challenge by improving physicians' work efficiency (M17, M18, M19).

> M17 (deputy president of a hospital): *We will use templates when inputting patients' records and related orders. In this way, the electronic patient records can help save some time. We, physicians, have a large amount of work every day. We can use the saved time to help more patients.*

> M18 (director of a medical informatics center): *This approach [electronic medical record] is certainly considerably easier than the previous handwriting method. [The system also helps] simplify the work process. Checking information as a reference for decision-making is easy because the data are linked together. This approach is certainly helpful.*

> M19 (physician, senior): *All the records, including the prescription, have been handwritten in the past. With this HIS, all tasks, including e-prescriptions and e-receipt, are computerized. The system also helps improve work efficiency and avoid mistakes.*

The digitized outpatient flow via the clinical administration system also helped physicians monitor the patient's status and eased the work of other healthcare professionals such as pharmacists and nurses (M3, M5, M14). With these HIT features, hospitals in the region can build a shared platform for the healthcare bureau to use as it consolidates all the data that center on electronic medical records in the future (M19). In this manner, hospitals work together to cope with the limited supply of healthcare services, which partially causes the *healthcare access inequality* challenge.

Unlike healthcare professionals who utilized HIT systems for their daily work, not all people (public interviewees) had direct experience with the related HIT systems. A few of them either had not yet visited top-ranking hospitals or had visited such hospitals years before the HIT systems were implemented. Public interviewees who had experience with HIT mainly recognized the benefits of the system features in improving the readability of the diagnosis, reducing the hassles of administrative tasks, and enhancing service quality, regardless of whether the interviewees were from rural or urban areas.

> P41 (public, urban): *Obtaining the test result usually takes half a day. At present, you can go to the self-test retrieval machine to obtain the result by scanning the barcode … I think this technology is very good. First, I can read medical records. Previous medical records were all handwritten and sketched all over the place. I had no idea what had been written. Second, the contents can be understood at a glance [concise]. [I] saw some physicians still wrote down details. They do not become careless only because of the computer.*

> P49 (public, urban): *[When obtaining] your test reports, the physicians may not be around, especially during noon. With this self-service [offered by the hospital IS], you can obtain your test reports at any time. This way is convenient.*

> P54 (public, rural): *When my [kidney) stone [test report] was produced, he [the physician] immediately asked me to go to the facility, saying "Madam, come and let me adjust and show you" Then, he showed me the result from the computer.*

In contrast to the abovementioned HIT features, which are salient for patients visiting the hospitals, the online registration feature is not familiar to all patients. The implementation of the online registration system enables patients to schedule consultation slots on the website or via mobile phones, alleviating the inconvenience of physically queueing for a consultation ticket at the hospital and helping to prevent the problem of scalpers. As acknowledged by the president of a community hospital (M15), most 3-A hospitals have implemented this HIT feature.

> M15 (president of a community hospital): *Regarding online registration, the current status is that nearly all the Level 3 hospitals in the city are relatively technologically mature. The system has been running for 2 to 3 years already.*

Our data indicated a considerable difference between people who reside in rural areas and those who live in urban areas. Urban patients who utilized this feature acknowledged the benefit of reducing unfair competition for healthcare access.

> P43 (public, urban): *In the past, if obtaining a queue number was difficult, we then had to line up as early as approximately 4 a.m. This [online registration system] ensures fairness. The time spent using the internet is fair and ensures convenience…. After obtaining a queue number online, you only need to organize your time and see a physician.*

The online registration system has been implemented and disseminated for several years, but only one rural interviewee had used the system. Interestingly, our interviews demonstrated a significant utilization gap that persisted between rural and urban areas even after removing interviewees without internet access. Interviewees from urban areas who had not used the system indicated that they used the internet to search for health information. Although they were aware of the online registration feature, they reported being reluctant to use it to book an appointment because they were used to the conventional way of queuing, indicating that this could be a mindset issue (P57-P60). Based on our interviews, rural patients generally surf the internet mainly to browse news sites, communicate with their friends, etc. They did not report utilizing specific applications such as healthcare-related applications. Rural patients commonly suggested that they did not know such a feature existed. When we introduced the online registration feature to them, rural interviewees recognized the convenience of this feature (reducing the need for queuing) (P5). However, one rural interviewee with high socioeconomic status (P14) raised concern about a widened divide in accessing high-quality healthcare services. In his opinion, utilizing this system would worsen access inequality for people living in rural areas.

> P14 (public, rural): *[The online registration system] is unfair. Many young boys and girls who know [about] this system can benefit from it. They can register all the numbers for specialists. If I take my grandma to the hospital in XX city and find that no queue number is left, then I will be very disappointed and angry. This registration method only benefits people who live in urban areas. Online registration is only for people who know how to use it. They can use this method to obtain early queue numbers. I get late queue numbers because I do not know how to use it. I feel that this situation is unfair. Those that are benefiting from the method are living in urban areas.*

Many healthcare professionals also acknowledged the concern of a widened divide. Knowledge was deemed a barrier, as indicated below.

> M5 (physician, junior): *A farmer does not use the system even if he has a computer. He has no chance of having this type of knowledge. Going to the hospital directly would be beneficial for him.*

> M17 (deputy president of a hospital): *Maybe people living in urban areas use the online registration system more often than those in rural areas. The reason is that they [urban people] have mastered this knowledge, unlike others [rural people].*

HIT Initiated by Unconventional Healthcare Institutions (Private Firms)

The rapid development of HIT in the economy has enabled the implementation of HIT systems by private firms in China (Article 10 and Article 11 in Appendix A). The interviewees highlighted several HIT systems, ranging from portals that provide health-related news such as www.163.com and www.qq.com (identified by P28) to dedicated healthcare systems that feature online physician consultations such as www.39.net and www.haodf.com (identified by P32/P33). A large gap was observed between interviewees from rural and urban areas. That is, few interviewees from rural areas stated that they had used or were aware of the online health portals, while the majority of the interviewees from urban areas reported searching for healthcare-related information online. Similarly, even after interviewees without internet access were removed, the significant utilization gap between rural and urban areas persisted.

We observed inconclusive views regarding how these HIT systems help address the focal societal challenge. This could be due to the very short history of HIT systems at unconventional institutions compared to the long history and maturity of HIT systems at conventional health institutions. Some urban adopters acknowledged that HIT systems implemented by private firms were an important alternative source of healthcare information from hospitals. Such systems could potentially reduce misunderstanding between physicians and patients and alleviate the overwhelming demand for high-quality healthcare services, which is a significant cause of the *healthcare access inequality* challenge.

> P32 (public, urban): *I usually search on Baidu. A large amount of information is available. I sometimes try out the information found online. If it works, then I do not need to go to a clinic. If I cannot find [information about] specific symptoms, then I will go to the hospital.*

> P8 (public, urban): *I did not expect much from them [physicians conducting online consultation], but they give me practical advice. Online consultation does not require queue numbers. The physician also asks several questions that can be easily answered. Talking to that physician is also as reassuring as talking to a friend on the Web.*

In terms of the negative feedback on HIT systems implemented by private firms, a critical concern was the credibility of information and advice. We noted an increased distrust toward online content on private firms' HIT systems.

> P11 (public, rural): *I do not think searching online for healthcare information is very useful. I feel that most websites contain unreliable information. If some diseases cannot be cured in hospitals, what more can the online platform provide? I do not browse the Internet for health information. If offline hospitals cannot do anything on certain diseases, then the chance*

> *that it can be done online is more limited. Online resources have no credibility. A patient with a serious illness has no other choice but to seek help from a physical doctor.*
>
> P18 (public, rural): *I do not trust consultants online. They do not seem to be real doctors. I talked to a physician through an online chat. The doctor only provided some general suggestions. I felt like he was not a doctor while talking with him. He provided incomplete information and recommended certain hospitals to visit. I think the website has an advertising nature. If he is a real doctor, then he will give you advice and teach you and not suggest things like that. I have tried the Internet two or three times but will not do it again.*

Some interviewees (public) mentioned the negative reaction of physicians in hospitals during face-to-face consultations when patients brought up the issue of online information related to their symptoms.

> P32 (public, urban): *When I communicated with the physician about the medical information that I found online, the physician became angry, saying, "you do not need to see me if you trust that information."*
>
> P35 (public, urban): *I usually seek confirmation from my physician regarding the knowledge I gained online. If the physician said I should not do these things, then I would stop immediately. I consulted once. He laughed when I told him that I used the internet to search for medical information. He said that the information online does not apply to all because everyone has different situations. My physician wants his treatment to be authoritative. He does not want me to use other methods. He disagrees with the hot packs and jumping ropes [treatments found online].*

Most of the healthcare professionals from conventional health institutions that we interviewed echoed this reaction. They seriously doubted the legitimacy of the information provided by HIT systems managed by private firms, as indicated in the two statements below.

> M18 (director of a medical informatics center): *Most [online] opinions are biased and not objective. Others want you to follow them blindly. Most websites have low credibility and can be ineffective.*
>
> M17 (deputy president of a hospital): *Some information on the website is given to promote a specific product. If [a company] made a new drug for high blood pressure, then the website may provide some basic knowledge about high blood pressure and the classification of high blood pressure medication. Do you trust the source after seeing this information? In this case, some differentiation should be made on the available information. Some ordinary people cannot differentiate this information. If a child is sick, then his parent will try any remedy he finds online until he obtains the information. He would be willing to spend a large amount of money and take counterfeit drugs rather than lose hope.*

Given the concerns, some interviewees suggested two possible albeit different directions for these HIT systems: (1) changing implementing institutions from private firms to legitimate institutions, and (2) promoting these HIT systems as a means to change conventional healthcare beliefs. The first opportunity was supported by interviewees (public) who agreed on the conventional ideology and norms, as well as by most of the healthcare professionals, who criticized the credibility of ruptural HIT interventions. As one physician noted:

> M19 (physician, senior): *Usually the [health] websites are not credible. In China, there is no third-party authorized institution to publish such information. Maybe 3-A hospitals are more credible.*

The second possibility aims to break the knowledge and power asymmetry between physicians and patients, as demonstrated in the following quote:

> M17 (deputy president of a hospital): *[Online medical consultation websites] are a kind of knowledge dissemination. This could reduce some misunderstandings. For example, when disputes occur, we can ask patients to come with us and have a look at our physicians and nurses and their daily works. From an understanding of our job, [they] may consider that we have fulfilled our responsibility. Furthermore, everybody is working very hard. Incidents happen, but they may not be our fault. Through this, we could be understood by society. Maybe this could reduce disagreement from some people in society.*

Later Development: HIT Initiated by Government

The second round of interviews was conducted approximately 3.5 years after the first round. Its purpose was to track further developmental updates to the HIT interventions longitudinally. As revealed by our second round of data collection, the Chinese Healthcare Bureau was aware of the HIT development status and the challenges associated with different types of HIT systems outlined above, such as information credibility and legitimacy of HIT systems implemented by private firms. The bureau realized how critical it was to introduce interventions that include not just policies but also actual HIT systems. A set of policies was released that mainly focused on internet-based HIT development since 2016. For example, "Internet + Healthcare" was listed as a strategic direction for future healthcare development in the "Health 2030 Plan" (A37). Grade 2 and 3 public healthcare institutions were required to implement up to 70% internet-based health services by 2018, aiming to reach 100% by 2020 (A8). HIT systems have continued to grow and emerge in new forms because of strong governmental support. One of the new systems was *internet hospitals*. As of November 2016, 36 internet hospitals were available in the country; 25 had been rolled out and provided either PC or mobile application versions, and 11 were in the implementation process (Tencent Research Center, 2017). A leading vendor described the typical flow for an outpatient at an internet hospital.

> M25 (director of an HIT vendor): *The internet hospital [officially endorsed] aims to shift most of the outpatients' activities to the online setting, such as online registration, consultation, payment, and pharmacy dispensing. By utilizing the app, a patient can communicate with physicians instantly or asynchronously. For example, our app has an option for "instant diagnosis," which ensures that a general physician will answer your question within 30 seconds. With electronic diagnosis, physicians can issue medications and necessary medical tests. After payment via the app, the medications are delivered to the patients' homes through a logistics company. The only offline activity is for the patients to go to a medical checkup center to perform the required test, such as taking a blood sample, ultrasound, CT scan, etc.*

While these new HIT policies and systems offer benefits to the patients, they also introduce risks such as misdiagnosis. To reduce potential risks, the government actively introduced various supporting steps. First, related regulations were implemented to reduce the risks associated with internet-based healthcare-related activities. A Health Bureau Director explained the government's efforts in this respect.

> M24 (health bureau director): *We require the notification to be shown before the start of each [internet-based] service to reduce medical disputes. We post all information before starting the services. Moreover, we mandate the registration [of those internet services] through the government to avoid risks. Relying on offline hospitals can also help physicians share some of the risks.*

Second, the Chinese Healthcare Bureau initiated online healthcare service platforms through several state-owned enterprises to legitimize internet services. Such officially endorsed platforms possess legitimacy and government resources, which provide advantages over platforms initiated by private firms. One of the benefits is to incorporate online consultation time into physicians' normal work schedules.

> M24 (health bureau director): *Online work scheduling can be conducted similarly to offline scheduling. Working online is safe for physicians because it can prevent offline medical disputes. Their outpatient hours are also the same as their normal working hours. The same salary is paid to the physician as well. Therefore, online work should not increase the workload.*

The challenges of seeking high-quality healthcare services in 3-A hospitals were still perceived as salient among interviewees, but the HIT systems initiated by the government were deemed to play critical roles in shifting patients' beliefs to reduce the overwhelming demand in 3-A hospitals.

> M24 (health bureau director): *We need to cultivate the habit of patients to be given a large percentage of online consultation and diagnosis. We must do something different from offline consultations to attract patients to achieve the abovementioned goal. For example, convenient operations, such as online payment, can be provided. Internet healthcare vendors (nonconventional) aim to provide a closed-loop service because traditional offline healthcare services cannot close the loop. For example, a patient can only communicate with physicians for 5 min in the offline setting, whereas the time increases to 10 min through the (official) internet channel. Then, the patient will be willing to use this service.*

Data Analysis and Results

Based on the qualitative data, we identified major groups of actors and institutions related to the HIT systems and the *healthcare access inequality* context in China. Three main groups of actors were identified: physicians, other healthcare professionals, and patients in rural and urban areas. Physicians and other healthcare professionals constitute the elite group in the healthcare structure, providing and supporting healthcare services. Patients from rural and urban areas constitute the group of actors who seek healthcare services. Our data also unveiled three types of institutions that are initiating HIT systems: hospitals and government as the conventional institutions in the healthcare structure and private firms as the unconventional institutions in the healthcare structure.

HIT Interventions

We utilized the characteristics of three transformative interventions (i.e., symbiotic, interstitial, and ruptural interventions) as the analytical lens to derive HIT interventions. Table 3 summarizes this mapping and relates the three types of HIT interventions to the *healthcare access inequality* challenge. Upon identifying HIT interventions and their characteristics, we then mapped HIT systems with key features and actors based on the qualitative data to the HIT interventions, as shown in Table 4. We elaborate on this procedure below.

Symbiotic HIT Intervention: When applying the characteristics of symbiotic transformation to the HIT context, symbiotic HIT interventions should be initiated by hospitals (as conventional institutions) with a focus on solving the operational and practical challenges faced by the elite group of actors, that is, physicians and other healthcare professionals. Examples of such HIT systems include electronic medical record systems and clinical administration systems.

Interstitial HIT Intervention: Interstitial interventions emphasize social empowerment and seek to empower a group of actors with relatively low power, such as patients, while not posing a threat to an elite group of actors, e.g., physicians. For instance, the online registration system was introduced with the hope of reducing healthcare services access inequality without substantially affecting the work of physicians. This type of HIT intervention targets the healthcare structure at its margins and does not pose an immediate threat to the elite group of actors. Hence, interstitial HIT interventions can potentially solve patients' challenges, such as spatial difficulty and intense competition in gaining access to high-quality healthcare services, without imposing an immediate threat to healthcare professionals. Examples of such HIT systems include online registration systems, self-service machines, and telemedicine devices and portals.

Ruptural HIT Intervention: Ruptural interventions create a sharp deviation from the conventional healthcare structure with the emergence of new institutions—for example, a new form of healthcare service initiated by private firms. Ruptural HIT interventions could potentially resolve the existing obstacles faced by all groups of actors, such as spatial disadvantages for rural patients and imbalanced supply and demand. Examples of such HIT systems include online health portals and online consultation systems.

Societal-Level HIT Affordances

Prior literature has suggested that shared and collective affordances are likely to emerge based on the nature of task interdependencies among actors of a group (Leonardi, 2013). Related to our study, physicians at a hospital or across hospitals work interdependently to provide healthcare services. Besides physicians, other healthcare professionals, such as nurses and pharmacists, work interdependently to carry out outpatient administrative work. Rural and urban patients have limited task interdependencies when acquiring online health information and competing for healthcare resources, such as consultation slots. However, when rural and urban patients are in a hospital, the workflows that involve them demand task interdependencies. That is, only when all patients follow the expected procedure can the workflow function smoothly. Based on the first round of qualitative data, we identified six societal-level affordances in relation to the *healthcare access inequality* challenge in China, including three shared affordances and three collective affordances. These societal-level affordances are derived based on key groups of goal-oriented actors, the nature of their task interdependencies, and HIT system features.

First, improve physicians' work efficiency (a shared affordance for physicians): The HIT features of recording and retrieving patients' records have the potential to reduce physicians' workload and operational challenges and hence could reduce the limited supply and operational challenges for high-quality healthcare professionals.

Second, streamline outpatient administrative work for other healthcare professionals (a shared affordance for other healthcare professionals): The HIT features of the electronic queuing feature and electronically updating the payment status have the potential to reduce the workload and operational challenges for other healthcare professionals and hence could reduce the limited supply and operational challenges confronting high-quality healthcare professionals.

Third, improve appointment distribution equality for patients (a collective affordance for rural and urban patients): The HIT feature of booking consultation slots online has the potential to reduce the spatial disadvantage for rural patients seeking access to high-quality healthcare services at hospitals.

Fourth, reduce hospital administrative process difficulty for patients (a shared affordance for rural and urban patients): The HIT features of digital scheduling, viewing/printing test results, and bill payment have the potential to ease the administrative process at hospitals for patients and hence could reduce the competition for all patients to gain access to high-quality healthcare services at hospitals.

Table 3. Situating Transformative Interventions in the HIT Context

Transformative interventions (key characteristics)

Transformative intervention	***Key objective(s)***	***Driving institution***	***Directly affected actors***
Symbiotic transformation	Solves operational and practical issues faced by the elite group of actors Extends and deepens the existing social structure	Conventional institutions	Elite group of actors
Interstitial transformation	Addresses niches or margins of the social structure and does not impose any immediate threat to dominant classes or elites. Supports empowerment in niches or margins of the social structure.	Conventional institutions	A less powerful group of actors Elite group of actors (unaffected)
Ruptural transformation	Creates new institutions beyond the conventional means of a legacy social structure	Unconventional institutions	A less powerful group of actors Elite group of actors (affected)

Transformative interventions in the context of the access inequality challenge in China

HIT intervention	***Key objective(s)***	***Driving institution***	***Directly affected actors***	***Characteristic(s) of healthcare access inequality challenge in China***	***Corresponding societal goal***
Symbiotic HIT intervention	Solves operational challenges in the healthcare setting; improves the efficiency and work capacity of healthcare professionals	Conventional healthcare institutions, such as hospitals	Healthcare professionals	Limited supply and operational challenges for high-quality healthcare professionals	Reduces the workload and operational challenges for high-quality healthcare professionals
Interstitial HIT intervention	Serves as the interface of the hospital and the public without threatening physicians' work	Conventional healthcare institutions, such as hospitals	Patients	A spatial disadvantage for rural patients; intense competition for all patients to gain access to high-quality healthcare service	Reduces the disadvantage for rural patients to seek high-quality healthcare services in hospitals
Ruptural HIT intervention	Provides a new channel for the public to seek health information and services	Unconventional healthcare institutions, such as private firms	Healthcare professionals and patients	A spatial disadvantage for rural patients; imbalanced supply and demand for high-quality healthcare services	Provides new service channel(s) for (rural) patients to alleviate the spatial disadvantage of imbalanced supply and demand for high-quality healthcare service

Table 4. HIT Systems and HIT interventions

HIT systems	Description/key features	Initiating institutions	Key actors	HIT intervention
Electronic medical record system	Viewing patients' records Inputting physicians' prescriptions and diagnosis	Hospitals as conventional institutions	Physicians	Symbiotic HIT intervention
Clinical administration system	Electronic queuing feature Electronically updating payment status Automating scheduling	Hospitals as conventional institutions	Other healthcare professionals such as pharmacists and nurses. The general public (patients)	Symbiotic HIT intervention Interstitial HIT intervention
Self-service machine	Printing test result Paying bill	Hospitals as conventional institutions	The general public (patients)	Interstitial HIT intervention
Online registration system	Booking consultation slot online	Hospitals as conventional institutions	The general public (patients)	Interstitial HIT intervention
Telemedicine devices and portal	Capturing and transmitting patients' health symptoms	Hospitals as conventional institutions	The general public (patients)	Interstitial HIT intervention
Online health portal	Storing and displaying health-related information online	Private firms as unconventional institutions	The general public (patients)	Ruptural HIT intervention
Online consultation system	Storing and displaying health-related information online Making online consultation appointments with physicians	Private firms as unconventional institutions (1st round of data collection); Government as conventional institutions (2nd round of data collection)	Physicians The general public (patients)	Ruptural HIT intervention

Fifth, reduce the need to acquire healthcare information from the hospital for patients (a collective affordance for rural and urban patients): The HIT features of storing and displaying health-related information online have the potential to provide new electronic service channel(s) for (rural) patients to acquire healthcare information beyond hospitals and can hence alleviate the imbalanced supply and demand for high-quality healthcare services.

Sixth, reduce the need to physically travel to the hospital for patients (a collective affordance for rural and urban patients): The HIT feature of providing online consultations with physicians has the potential to reduce the overall demand for patients to visit hospitals and could hence alleviate the spatial disadvantage for rural patients.

Table 5 lists the key groups of actors, HIT system features, and task interdependence for each societal-level HIT affordance. A HIT system can have multiple societal-level affordances. For example, a clinical administration system can "streamline outpatient administrative work for healthcare professionals" and "reduce hospital administrative process difficulty for patients." Likewise, an online consultation system can "reduce the need to acquire healthcare information from the hospital for patients" and "reduce the need to physically travel to the hospital for patients." In a similar vein, an affordance can be shared by more than one HIT system. For example, "reduce the need to physically travel to the hospital for patients" can relate to both online health portals and online consultation systems. We next mapped the six identified societal-level affordances to the HIT interventions, as shown in the last column of Table 5.

Table 5. Societal-level HIT Affordances to HIT interventions

Societal-level HIT affordance	Key group of actors	Common features (HIT system)	Task inter-dependence	Societal goal	HIT Intervention
Societal-affordance 1: Improve physicians' work efficiency (a shared affordance for physicians)	Physicians	Recording and retrieving patients' records electronically (Electronic medical record system)	High	Reduces the workload and operational challenges	Symbiotic HIT intervention
Societal-affordance 2: Streamline outpatient administrative work for healthcare professionals (a shared affordance for healthcare professionals)	Other healthcare professionals	Electronic queuing feature, electronically updating the payment status (Clinical administration system)	High		
Societal-affordance 3: Improve appointment distribution equality for patients (a collective affordance for rural and urban patients)	Patients	Booking consultation slot online (Online registration system)	Limited	Reduces the disadvantage for rural patients to seek high-quality healthcare services in hospitals	Interstitial HIT intervention
Societal-affordance 4: Reduce hospital administrative process difficulty for patients (a shared affordance for rural and urban patients)	Patients	Digital scheduling (Clinical administration system) Self-service functions such as viewing/printing test results and bill payment (Self-service machine)	High		
Societal-affordance 5: Reduce the need to acquire healthcare information from the hospital for patients (a collective affordance for rural and urban patients)	Patients	Storing and displaying health-related information online (Online health portal, online consultation system)	Limited	Provides new service channel(s) for (rural) patients to alleviate the spatial disadvantage of imbalanced supply and demand for high-quality healthcare service	Ruptural HIT intervention
Societal-affordance 6: Reduce the need to physically travel to the hospital for patients (a collective affordance for rural and urban patients)	Patients	Making online consultation appointments with physicians (Online consultation system) Capturing and transmitting patients' health symptoms (Telemedicine device and portal)	Limited		

Symbiotic HIT interventions are adopted by hospitals and can solve the operational challenges in healthcare professionals' work. Hence, they have the potential to increase the supply of healthcare professionals' services by improving work efficiency. Related technology features would be those that extend and broaden existing healthcare work via digitalization with no direct participation from external parties (e.g., patients) but only among healthcare professionals. Two shared affordances (Societal-Level HIT Affordances 1 and 2) fit well with these characteristics and are therefore mapped to symbiotic HIT interventions.

Interstitial HIT interventions address the niches or margins of the healthcare structure by serving as the interface between the hospital and the public, and they have the potential to empower patients by reducing unfair competition in seeking consultations. Societal-level HIT affordances, such as those that improve consultation distribution equality for patients and reduce hospital administrative process difficulty for patients do not pose any immediate threat to the dominant classes or elites (physicians)—that is, their jobs are not threatened. In this way, this type of intervention prevents immediate confrontations and can develop alternative solutions for alleviating access inequality among rural and urban patients. One collective affordance (Societal-Level HIT Affordance 3) and one shared affordance (Societal-Level HIT Affordance 4) fit well with these characteristics and are mapped to interstitial HIT interventions.

Ruptural HIT interventions offer new channels beyond the conventional means of a legacy healthcare structure and quickly disrupt existing healthcare services. Hence, they have the potential to reduce the demand for healthcare services in hospitals by providing alternative channels to the public. Two collective affordances (Societal-Level HIT Affordances 5 and 6) fit well with these characteristics and are mapped to ruptural HIT interventions.

We cross-checked the HIT literature (Appendix B) with the six identified societal-level HIT affordances. Prior literature on electronic medical records (e.g., Bhargava & Misihra, 2014; Mishra et al., 2012) and the clinical administration system (e.g., Kane & Labianca, 2011; Venkatesh et al., 2011) offers some evidence on the first and second societal-level HIT affordances but their impacts are at the individual and organizational levels. Similarly, prior studies have investigated the roles of the online healthcare community and social media in providing patients with additional information and support (Societal-Level HIT Affordance 6). However, there is less overt evidence on Societal-Level HIT Affordances 3-5 and their impacts on patients.

Actualization of Societal-Level HIT Affordances

Anchoring on the affordance actualization theory (Strong et al., 2014), we first paid attention to the system-related actions taken by actors and the individual immediate concrete outcome. We then looked for the extent and consistency among actors within the group to derive the societal immediate concrete outcome. For a societal-level affordance, it is possible to be actualized through the combination of multiple types of individual actions and outcomes. That is, a societal-level affordance can be related to multiple individual affordances. For instance, "improve physicians' work of recording patients' medical records" and "improve physicians' work of checking patients' information" are individual-level outcomes related to physicians' utilization of the electronic medical record system to accomplish their work. Hence, the related actions and outcomes fall into the actualization of the societal-level affordance of "improve physicians' work efficiency." Table 6 presents how societal-level HIT affordances (i.e., shared and collective affordances) are actualized. Figures D1 and D2 in Appendix D illustrate the coding process. Based on the analysis, the actualization of three shared societal-level HIT affordances resulted in the expected outcomes, and the actualization of three collective societal-level HIT affordances resulted in an unexpected outcome.

Actors in a group may utilize the system feature similarly or diversely, which results in the different actualization outcomes of societal-level HIT affordances. Regarding Societal-Level HIT Affordance 3 (improve appointment distribution equality for patients), for instance, our qualitative data revealed that patients exhibited diverse utilization manners such as direct use and indirect use when booking a consultation appointment, which resulted in different outcomes for rural and urban patients. Given that this is a collective affordance, the societal-immediate concrete outcome is to save time and reduce the trouble of queuing for a consultation slot for many urban patients. However, rural patients still generally experience increased difficulty in getting a consultation slot. Hence, the potential for this collective affordance is not fully actualized.

Theorizing the HIT Interventions

We have so far learned that the HIT interventions can result in different effects of addressing the *healthcare access inequality* challenge through the actualization of associated societal-level HIT affordances.[7] In this section, we put forward a set of propositions theorizing the mechanism for the effect of each type of HIT intervention including symbiotic (Figure 2), interstitial (Figure 3), and ruptural HIT interventions (Figure 4).

---

[7] Our findings are of interest because, with significant improvement in the IT infrastructure of China (Khan 2008), good Internet coverage is now available in rural and urban areas. In our interview data, only four interviewees had no internet access. However, public interviewees in rural areas are generally less tech-savvy and have less awareness of the HIT initiatives than interviewees from urban areas. The challenge of HIT interventions' effectiveness was particularly more prominent in rural areas than in urban ones. This view is in line with Khan's viewpoint in *Nature* (2008). Herein, the context is more important than the medium, such as IT access, in terms of achieving a revolutionary improvement in social well-being.

Table 6. Affordance: Actualization for Societal-Level HIT Affordances

Interior bureaucratic HIT intervention					
HIT features (*HIT system*)	**Actors (*goal and characteristics*)**	**Actualized Actions**	**Individual-level immediate concrete outcome**	**Representative Interviewee**	**Societal-level immediate concrete outcome**
Societal-Level HIT Affordance 1: Improve physicians' work efficiency (Shared affordance for physicians)					
Recording patients' records electronically (*Electronic medical record system*)	Physicians *- Goal: reduce the workload and provide good health care.* *- Characteristics: The majority of the physicians have the ability to operate the related system*	Physicians enter the records and orders in the electronic medical record system	Reduce physicians' workload (saving time) by eliminating manual input and using templates	M10, M17, M19	Improve work efficiency for physicians. Alleviate the limited supply and operational challenges for high-quality healthcare professionals.
Retrieving patients' records electronically (*Electronic medical record system*)		Physicians view patients' records in the electronic medical record system.	Improve physicians' work of checking patients' information	M14, M18	
Societal-Level HIT Affordance 2: Streamline outpatient administrative work for other healthcare professionals (Shared affordance for healthcare professionals)					
Electronic queuing feature (*Clinical administration system*)	Other healthcare professionals *- Goal: reduce the workload and provide good healthcare.* *- Characteristics: The majority of the healthcare professionals have the ability to operate the related system*	Nurses utilize the system to manage the patients' queue.	Efficiently handle nurses' outpatient-related workflow	M3, M15, M16	Streamline outpatient workflow. Alleviate the limited supply and operational challenges for high-quality healthcare professionals.
Electronically updating the payment status (*Clinical administration system*)		Pharmacists check the payment status on the system before issuing medicine.	Streamline pharmacists' work	M5, M14	
Societal-Level HIT Affordance 3: Improve appointment distribution equality for patients (Collective affordance for rural and urban patients)					
Booking consultation slot online (*Online registration system*)	Patients *- Goal: obtain a consultation slot conveniently* *- Characteristics: Many rural patients have less awareness of the related feature. Urban patients, in general, are aware and capable of the related system operations*	Urban patients generally utilize the system feature directly.	Reduce the hassles of booking a consultation appointment for patients	P28, P29, P43	Increase the chance and reduce the trouble of securing a consultation appointment slot for many urban patients. However, rural patients generally experience increased difficulty in obtaining an appointment slot.
		Few rural patients and some urban patients utilize the system feature indirectly through the help of others.	Reduce the need to book a consultation appointment offline but yield the need to seek help from an intermediate person.	P10, P44	
Societal-Level HIT Affordance 4: Reduce hospital administrative process difficulty for patients (Shared affordance for rural and urban patients)					
Automating scheduling (*Clinical administration system*)	Patients *- Goal: accomplish the administrative process conveniently* *- Characteristics: patients perceive high legitimacy for the hospital-initiated HIT.*	Patients follow the display of the clinical administration system for queuing. Help is available when patients encounter difficulties.	Digitally guide patients within hospitals	P48, M3	Allow patients to complete hospital administrative tasks in a timely and convenient manner. Alleviate the disadvantage for rural patients.
Self-service functions such as printing test		Patients utilize self-service machines in hospitals. Help is available when	Reduce the need to queue and travel to obtain results and make payment.	P29, P38, P41, P49	

results and making payment (*Self-service machine*)		patients encounter difficulties.	Enhance the clarity of patients' understanding of the prescription and results.		
Societal-Level HIT Affordance 5: Reduce the need to acquire healthcare information from the hospital for patients (Collective affordance for rural and urban patients)					
Storing and displaying health-related information online (*Online health portal, online consultation system*)	Patients - *Goal: obtain useful healthcare information* - *Characteristics: Many rural patients have less awareness of the related feature. Patients, in general, perceive low legitimacy of private firm-initiated HIT.*	Some urban patients browse health-related websites to gather information.	Gain a general understanding of some trendy topics.	P1, P2	Benefit proficient urban patients by helping them to better prepare and take care of themselves before and after the consultation. However, many patients do not enjoy the benefits (feel overwhelmed, feel disapproval of offline physicians, feel that online information is unreliable, lack the knowledge to verify the veracity of the online information, do not know how to find the right information). Many rural patients have less awareness of the related feature.
		Some urban patients just perform only a basic search.	Obtain some relevant healthcare information. However, some patients feel that such information is unreliable	P29, P32, P36	
Societal-Level HIT Affordance 6: Reduce the need to physically travel to the hospital for patients (Collective affordance for rural and urban patients)					
Making online consultation appointments with physicians (*Online consultation system*)	Patients - *Goal: obtain healthcare services conveniently.* - *Characteristics: Many rural patients have less awareness of the related feature. Patients, in general, perceive low legitimacy for the private firm-initiated HIT.*	Some urban patients generally have limited usage of the service and have low trust, particularly regarding platforms operated by private firms.	Question the benefits of this HIT	P8, P17, P18, P29, P31	Benefit proficient patients only as online consultation reduce their need to seek offline consultation. However, many patients are less aware of or question the benefits of online consultation services or telemedicine devices.
		Some urban patients utilize the service but feel that only using online consultation from private platforms is not adequate.	Receive some pre-consultation information	P7, P28-31, P35-36	
		Rural patients generally have limited usage experience.	Not receive benefit from this HIT for rural patient	P2, P25	
Capturing and transmitting patients' health symptoms (*Telemedicine device and portal*)	Patients - *Goal: obtain high-quality healthcare services conveniently.* - *Characteristics: The majority of rural and urban patients have low awareness of the related feature.*	Patients in rural and urban areas have limited usage experience.	Not receive benefit from this HIT for all patients	P43, P44, P54	

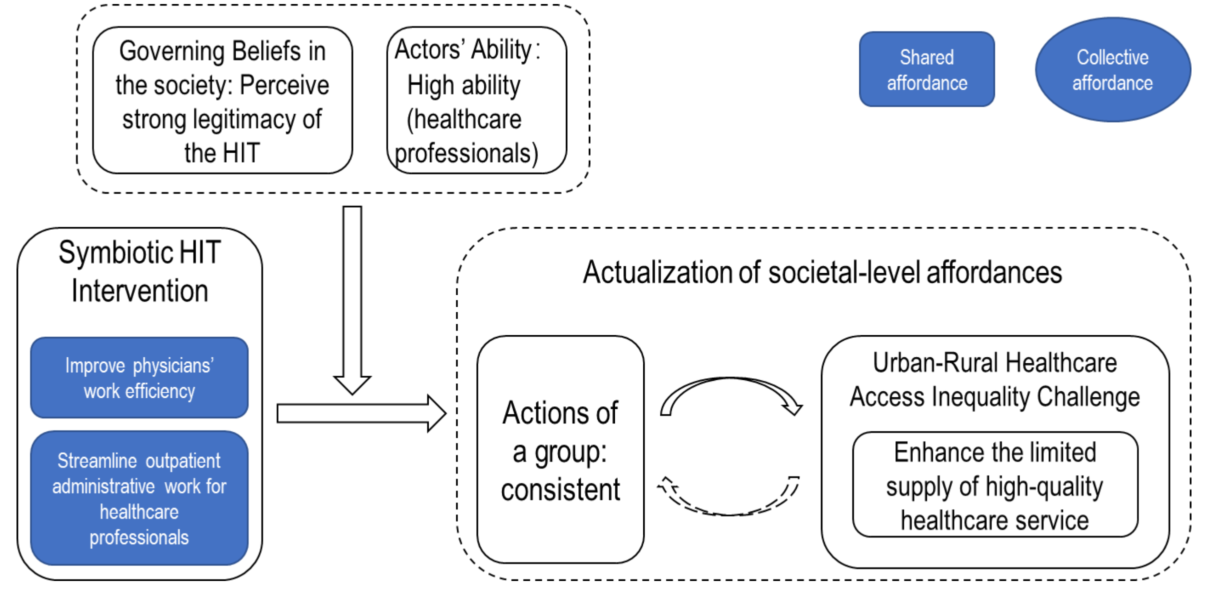

Governing Beliefs in the society: Perceive strong legitimacy of the HIT
Actors' Ability: High ability (healthcare professionals)
Shared affordance
Collective affordance
Symbiotic HIT Intervention
Improve physicians' work efficiency
Streamline outpatient administrative work for healthcare professionals
Actualization of societal-level affordances
Actions of a group: consistent
Urban-Rural Healthcare Access Inequality Challenge
Enhance the limited supply of high-quality healthcare service

Figure 2. Symbiotic HIT Intervention

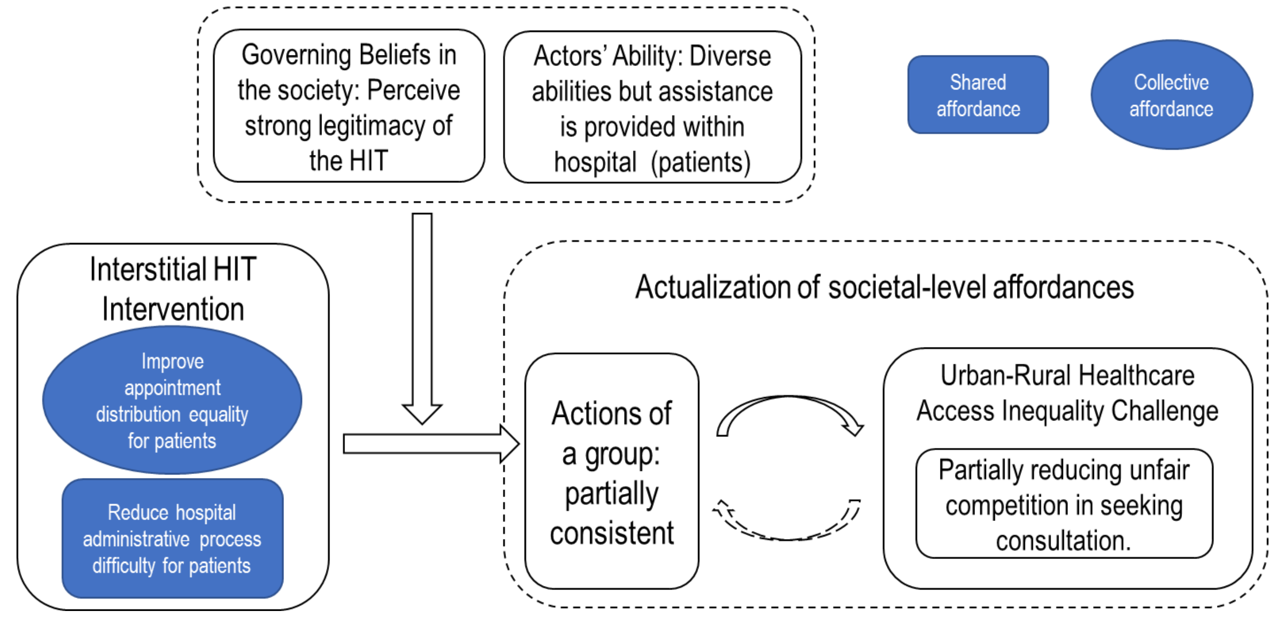

Governing Beliefs in the society: Perceive strong legitimacy of the HIT
Actors' Ability: Diverse abilities but assistance is provided within hospital (patients)
Shared affordance
Collective affordance
Interstitial HIT Intervention
Improve appointment distribution equality for patients
Reduce hospital administrative process difficulty for patients
Actualization of societal-level affordances
Actions of a group: partially consistent
Urban-Rural Healthcare Access Inequality Challenge
Partially reducing unfair competition in seeking consultation.

Figure 3. Interstitial HIT Intervention

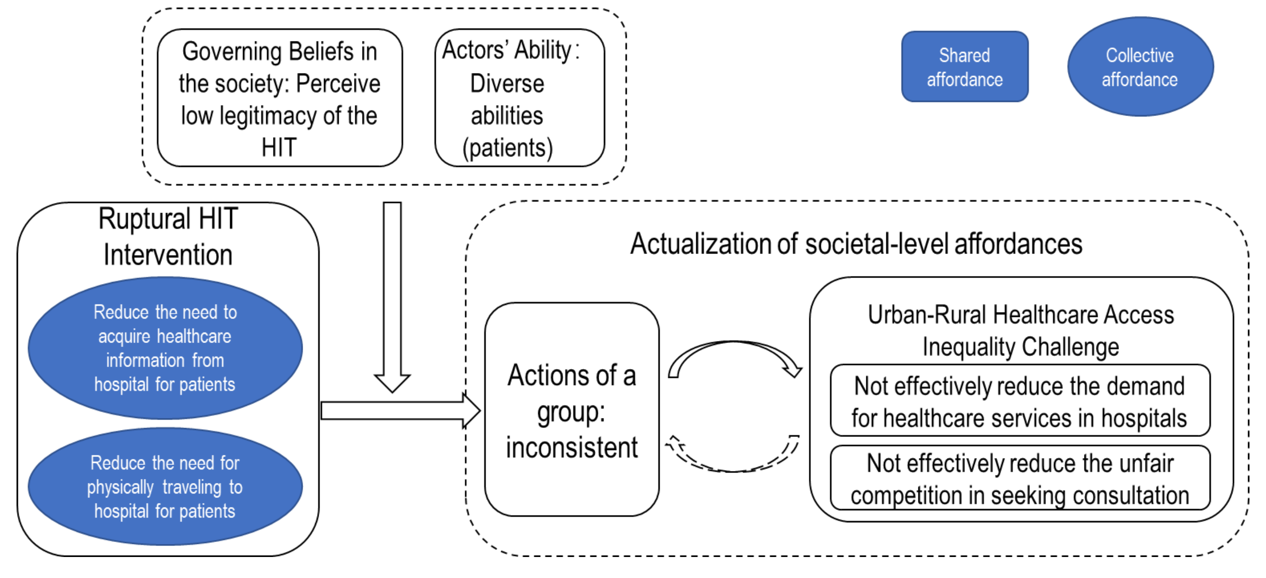

Governing Beliefs in the society: Perceive low legitimacy of the HIT
Actors' Ability: Diverse abilities (patients)
Shared affordance
Collective affordance
Ruptural HIT Intervention
Reduce the need to acquire healthcare information from hospital for patients
Reduce the need for physically traveling to hospital for patients
Actualization of societal-level affordances
Actions of a group: inconsistent
Urban-Rural Healthcare Access Inequality Challenge
Not effectively reduce the demand for healthcare services in hospitals
Not effectively reduce the unfair competition in seeking consultation

Figure 4. Ruptural HIT Intervention

HIT Interventions in the Addressing Healthcare Access Inequality Challenge

Relating to the *symbolic HIT interventions*, most key actors including physicians and other healthcare professionals in top-ranking hospitals have a relatively high level of computer literacy and recognize the legitimacy of hospital-initiated HIT systems (Figure 2). They utilize the features of the hospital-initiated HIT system in an expected manner to accomplish their job, which helps to improve physicians' work efficiency and streamline outpatient administrative work. The alignment between the requirements of HIT systems' associated affordances, the ability of key actors, and the governing beliefs lead to consistency in the actions of this group of actors, thereby actualizing the potential of Societal-Level HIT Affordances 1 (improve physicians' work efficiency—affordance realized through the electronic medical record system) and 2 (streamline outpatient administrative work for healthcare professionals—affordance realized through electronic queuing and updating payment status systems) (Table 5). With the improved work efficiency of healthcare professionals and streamlined outpatient administrative work, a key characteristic of *the healthcare access inequality* challenge—the limited supply of high-quality healthcare service—can be alleviated (Table 6).

Regarding *interstitial HIT interventions*, our interview results show that beliefs such as "hospitals are the legitimate sources for seeking healthcare" are rooted in the public mindset. Given that the related HIT systems are implemented by hospitals as legitimate institutions, the patients we interviewed largely acknowledged the potential value that such HIT systems can offer. However, rural and urban patients as intended actors exhibit diverse abilities when utilizing the associated HIT systems. Rural patients, in general, lack the ability to effectively utilize the system. Interestingly, we observed different utilization patterns for Societal-Level HIT Affordances 3 (improve appointment distribution equality for patients— affordance realized through online consultation slot booking system) and 4 (reduce hospital administrative process difficulty for patients—affordance realized through digital scheduling and self-service test viewing/printing systems) (Table 5). For the shared affordance (Societal-Level HIT Affordance 4), rural and urban patients seem to utilize the system features in a similar manner because help is offered by other healthcare professionals in the hospital when patients encounter difficulties using the features. With such assistance, rural patients can complete outpatient administrative tasks in a timely manner and as conveniently as urban patients. However, for the collective affordance (Societal-Level HIT Affordance 3), patients typically do not use the related system features in hospitals. Hence, no additional assistance can be provided for rural patients. Furthermore, rural patients generally hold beliefs about "queuing up for a consultation number without consciously seeking an available alternative." Having rural and urban patients with diverse abilities and beliefs results in different actions and outcomes (hence, the partial consistency among the group of users depicted in Figure 3). Our findings indicate that HITs help save time and reduce the inconvenience of queuing for consultation slots for urban patients. However, given that the number of available consultations is fixed, rural patients generally experience increased difficulty in acquiring a consultation slot, compared to urban patients. Consequently, we found that only the HIT systems utilized within the hospital's boundary, not those outside of the hospital's boundary, empower rural patients. In other words, unfair competition in seeking consultation slots is only partially reduced by HITs (Figure 3).

The affordances associated with *ruptural HIT interventions* are both collective affordances (societal-level HITs), i.e., Affordances 5 (reduce the need to acquire healthcare information from the hospital for patients—affordance realized through online health portals and online consultation systems) and 6 (reduce the need to physically travel to the hospital for patients—affordance realized through online consultation platform and telemedicine devices and portal) (see Table 5). The key actors associated are rural and urban patients who exhibit diverse abilities even though a common belief that "hospitals are the legitimate sources of healthcare services" is rooted in their minds. Given that the related HIT systems, such as online health portals and online consultation systems, are initially implemented by private firms, the key actors generally have inconclusive views regarding this type of HIT intervention. As a result, there are inconsistent actions among rural and urban patients. The actualization of this group of collective affordances neither effectively reduces the demand for high-quality healthcare services in hospitals nor reduces the unfair competition in obtaining consultations (Table 6). Figure 4 summarizes the findings related to ruptural HIT interventions.

Based on the above findings relating to the HIT interventions, we put forth the following proposition:

Proposition 1: *The effectiveness of HIT interventions in addressing the* ***healthcare access inequality*** *challenge is contingent on the actualization of associated societal-level HIT affordances, which are dependent on the alignment between the requirement of HIT systems, the abilities of the group of actors to utilize the system features, and the governing beliefs in the society. Specifically,*
a. Symbiotic HIT interventions *can alleviate the societal challenge in terms of the limited supply of high-quality healthcare services when the key actors possess a high level of ability and perceive a strong legitimacy of HIT systems and enact a group of shared affordances that improve physicians' work efficiency and streamline outpatient administrative work for other healthcare professionals.*
b. Interstitial HIT interventions *can partially alleviate the societal challenge regarding the unfair competition in obtaining consultations when the key actors possess diverse levels of abilities but perceive a high legitimacy of the HIT system and enact a group of shared and collective affordances for improving appointment distribution equality for patients and reducing the difficulty of the hospital administration process for patients.*
c. Ruptural HIT interventions *do not effectively alleviate the societal challenge in terms of overwhelming demand for healthcare services in hospitals and unfair competition in obtaining consultations when key actors possess diverse levels of abilities and perceive low legitimacy of the HIT system and enact a group of collective affordances for reducing patients' need to acquire healthcare information from the hospital and to physically travel to the hospital.*

Effects of Shared and Collective Affordances

Prior literature emphasizes that shared affordances rather than collective affordances are important for achieving high-level impacts (Leonardi, 2013). Based on our data analysis, we further explore and differentiate the effects of shared and collective affordances. As depicted in Figure 5, we deduce from our data that shared affordances play a more salient role in addressing the present *healthcare access inequality* challenge while collective affordances provide opportunities for the future evolution of HIT interventions, which we explain below.

Shared affordances: For shared affordances, the respective group of actors works interdependently. Hence, they are likely to influence each other, resulting in consistent actions when utilizing the respective HITs. As observed in our data analysis, Societal-Level HIT Affordances 1 (improve physicians' work efficiency) and 2 (streamline outpatient administrative work for healthcare professionals) are shared affordances and relate to symbiotic HIT interventions. Healthcare professionals work interdependently in hospitals and share the same goal of reducing workload and providing high-quality healthcare services. The actualization of these shared affordances yields consistent actions among the respective group of actors and effectively alleviates the limited supply of high-quality healthcare services. In contrast, the actors in collective affordances have limited task interdependency and less chance to observe or influence each other, resulting in diverse actions and pooled individualized outcomes. Both Societal-Level HIT Affordance 5 (reduce patients' need to acquire healthcare information from the hospital) and affordance 6 (reduce the need for patients to physically travel to the hospital) are collective affordances and represent ruptural HIT interventions. The actualization of these collective affordances yields diverse actions. The demand for high-quality healthcare services in hospitals is not effectively reduced.

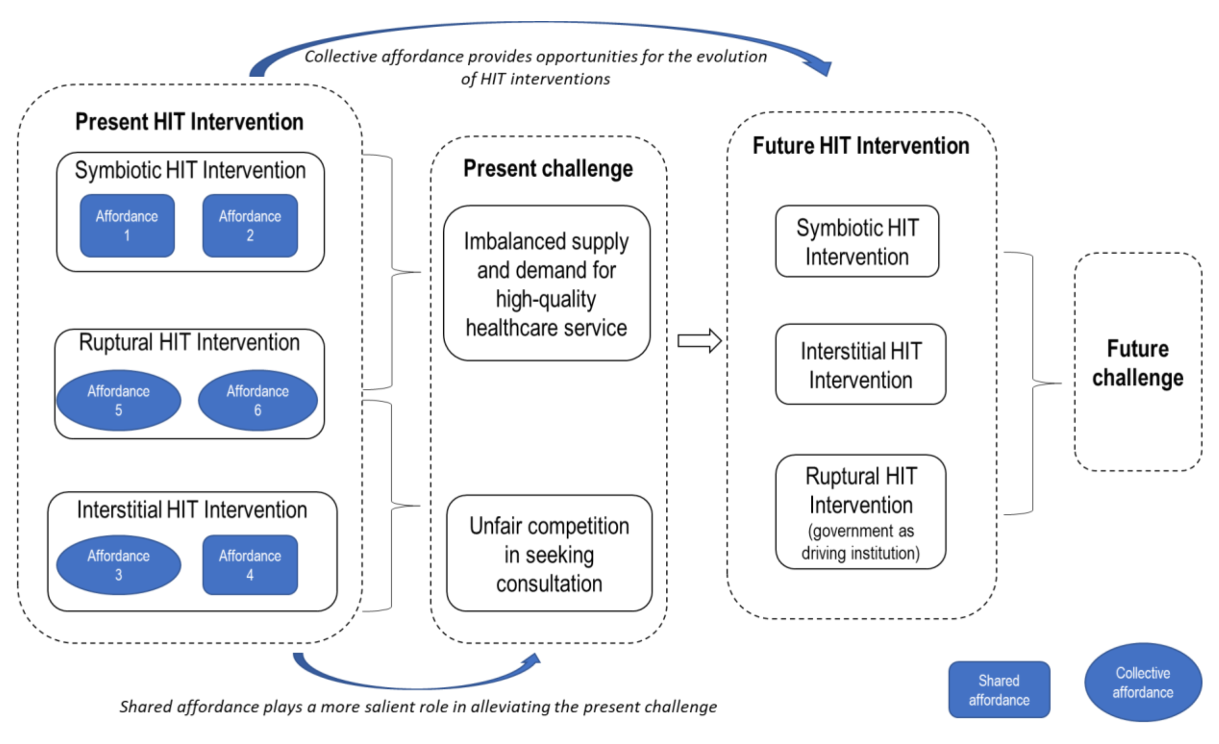

Collective affordance provides opportunities for the evolution of HIT interventions
Present HIT Intervention
Symbiotic HIT Intervention
Affordance 1
Affordance 2
Ruptural HIT Intervention
Affordance 5
Affordance 6
Interstitial HIT Intervention
Affordance 3
Affordance 4
Present challenge
Imbalanced supply and demand for high-quality healthcare service
Unfair competition in seeking consultation
Future HIT Intervention
Symbiotic HIT Intervention
Interstitial HIT Intervention
Ruptural HIT Intervention (government as driving institution)
Future challenge
Shared affordance plays a more salient role in alleviating the present challenge
Shared affordance
Collective affordance

Figure 5. Differentiated Effects of Shared and Collective Affordances

As a result, although both symbiotic HIT interventions and ruptural HIT interventions have the potential to address the imbalanced supply and demand for high-quality healthcare services, these two types of HIT interventions yield different outcomes in addressing the focal challenge. Based on these analyses, we deduced that the effects of HIT interventions on our societal challenge hinge on the extent and consistency of the actualization of shared affordances (not collective affordances) residing in the HIT interventions.

Collective affordances: Interesting findings are also observed when the cases of collective affordances are scrutinized. We observed from the data that the negative feedback on ruptural HIT intervention, such as low perceived legitimacy and information credibility, triggered opportunities to adapt the ruptural HIT intervention. The second round of data collection shows a trend of government as the initiator for ruptural HIT interventions. The government alleviates the misalignment during the affordance actualization process for ruptural HIT interventions by providing legitimacy and leveraging trust in existing conventional institutions. In this sense, the present HIT interventions characterized by collective affordances could present prospects for the adaptation of preexisting HIT interventions. Accordingly, we present the proposition below:

Proposition 2: *The effect of HIT interventions to potentially alleviate current challenges could vary with the extent of shared affordances, while the extent of collective affordances could potentially provide opportunities for the adaptation of HIT interventions.*

Theoretical Contributions

Contributions to the IS Field

This research aims to develop a theoretical understanding of HIT contributions and consequences to address the societal challenge of rural-urban healthcare access inequality. The recent theoretical discussion has contended that a *theory of solution* should be regarded as a legitimate theoretical genre for IS research when dealing with intricate societal issues (Majchrzak et al., 2016). A theory of solution was established on the assumption that IT alone is insufficient for solving substantive problems in society. Thus, the researchers looked for other complementary assets and identified the settings that are necessary to achieve success. A theory of solution should guide the understanding of "how and why information and communications technology (ICT) is expected to contribute to solving a particular organizational or societal problem, along with the additional (non-ICT) conditions necessary for the success of the ICT solution" (Majchrzak et al., 2016, p. 271).

This study is among the first to explore a theory of IT solution for the rural-urban healthcare access inequality challenge, as a response to the call for a comprehensive examination of the effects of IT on intricate societal challenges (Majchrzak et al., 2013). We propose a process to construct this theory, including decomposing the focal societal challenge, mapping characteristics of the challenge with components of a societal-level theory, linking the societal-level social transformation theory with the affordance actualization theory to construct the analytical framework, and applying the framework for interpreting the empirical data and theorizing the societal-level findings. Following this process, we provide a theoretical understanding of the individual and joint effects of different HIT interventions on the focal societal challenge and derive related propositions. In this way, we complement prior HIT literature, which has mainly focused on the outcomes of a specific type of actor or institution for a HIT adoption/assimilation issue (Appendix B). We do this by theorizing about the roles of IT from a holistic and societal perspective. Our contextual interest in HIT in the Chinese healthcare service sector, which exhibits different healthcare policies and institutional settings than Western countries, also enables us to respond to the call to develop theories and paradigms in the Asian context (Barkema et al., 2015).

Contributions to Theory

This study contributes to social transformation theory in several aspects. First, it moves beyond conventional sociological contexts of social transformation, such as migration (Castles, 2010; Milanovic, 2007), by depicting how transformative interventions in the form of HIT interventions address the rural-urban healthcare inequality challenge. This new context enriches the understanding of social transformation by explicating the intricate relationships between the healthcare structure, inequality challenge, and HIT interventions.

Second, social transformation theory proposes three types of transformative interventions and their characteristics (Wright, 2010). Our study provides value-added insights into social transformation theory as government serves as a driving institution for ruptural transformation. The newly identified form of ruptural HIT intervention is initiated at the layer of the governing mechanisms when unintended consequences from conventional HIT interventions are encountered. Therefore, this study contributes to the theory by explicating the interplay between transformative interventions and the process by which an adaptation of intervention can be generated. This is an example of social reproduction and points to the need during social transformation to proactively monitor the intended and unintended consequences of interventions introduced to address a societal challenge. The unintended consequences, such as persistent difficulty in accessing quality healthcare despite the existence of an online appointment system and the emergence of nonconventional means of addressing the challenge through private firms, could lead to the need to legitimize the innovative offerings of ruptural transformations. This research provides a path and a guide on how such reproduction has taken place in the context of addressing the rural-urban healthcare access inequality challenge in China.

This study also extends the work on affordance actualization theory—primarily, the theoretical development for affordance at the societal level. First, while prior related work has mainly recognized the importance of shared affordances in achieving high-level IT impact (Leonardi, 2013; Strong et al., 2014), our study proposes that collective affordances can also be valuable by theorizing that the actualization of the group of shared and collective affordances opens the opportunity to address the rural-urban healthcare access inequality challenge by forming a new type of HIT intervention.

Second, extant understanding has predominantly focused on the affordances of a single technology at the individual or organizational level (Leong et al., 2016; Miranda et al., 2016). This research provides a theorization of HIT affordances at the societal level, put forward in the form of the two derived propositions, and considers the affordances between different types of HITs. Our proposed many-to-many relationship between HIT interventions and HIT systems can guide future research seeking to identify the value of affordance.

Practical Contributions

This study provides policy makers, particularly but not only those in China, with an analysis of the focal societal challenge and the effects of various HIT interventions in addressing this challenge. The difficulties for rural patients to access high-quality healthcare services can induce negative social impacts such as protests, destruction of medical properties, harassment of medical staff, and even the death of healthcare professionals. Therefore, regulators need to understand the root of this prominent societal challenge before pertinently addressing related issues. This study is contextualized in China, but the associated challenges may be similar in countries with similar healthcare structures and policies. Thus, this study can also have implications for such countries. This study provides four practical suggestions for policy formulation and system implementation.

First, the results of this research suggest directions for policy makers to focus on. Among these three types of HIT interventions, symbiotic HIT interventions have the highest level of expected utilization and arguably are the most effective in addressing the focal challenge. The current support for this type of HIT intervention could be redirected to symbiotic HIT or government-initiated ruptural HIT interventions. For the latter types of HIT interventions, the policy should be adjusted to encourage utilization, such as providing financial support or linking HIT interventions to the ranking criteria of public hospitals (e.g., providing performance/intervention-linked financial support rather than purely to encourage initial implementation). In this regard, our study provides a regulator with a diagnostic apparatus for envisaging HIT with widespread societal repercussions.

Second, our findings highlight key factors for policy makers seeking to support and regulate HIT interventions. Efforts could be made to regulate HIT systems, especially those related to ruptural HIT interventions. Credibility concerns of the ruptural HIT interventions are salient among patients. Unlike other industries penetrated by IT interventions, such as mobile payments and the sharing economy, HIT services are sensitive to errors and require strict controls. A policy could be formulated to differentiate HIT features with varying levels of safety and sensitivity. In this way, the HIT market could be regulated and society could enjoy the benefits of disruptive interventions.

Third, we found that the affordance actualization divide in rural-urban areas is critical. Efforts should be made to enhance the awareness and digital literacy of rural communities. Societal complements, such as activities that support and complement the introduction of HIT, could be instituted in rural areas. For instance, the government could establish a bond between tertiary hospitals and community hospitals/clinics in rural areas. In this way, rural physicians could receive information about HIT systems in tertiary hospitals and they could assume the responsibility of introducing and educating rural people in their region to increase their awareness and digital literacy. Roadshows of HIT interventions could also be periodically conducted in rural areas.

Fourth, the government could establish mechanisms to collect, analyze, and monitor the use and performance data of different types of HIT interventions. As our study shows, collective affordances play an important role in the effectiveness of the HIT system in addressing the focal challenge and providing opportunities to develop new HIT interventions. The data needed to assess the societal issue are beyond the capability of a single (group of) healthcare institution(s). Hence, it should be the government's responsibility to build platforms to collect and monitor data from different types of HIT interventions. Data analytics could be applied to analyze and differentiate the effects of HIT interventions, while data mining and deep learning methods could be used to predict the occurrence of collective affordance at an early stage so that the necessary interventions can be implemented.

Limitations and Suggestions for Future Research

Like other research, this study has several limitations that gesture toward directions for future research. First, the findings of this study are based on qualitative data with guidance from social transformation theory and affordance actualization theory. Although we are confident in our results, given the methodical and analytical procedures that we followed, the selected interviewees might not precisely represent the composition of the social structure in China. Further development of the propositions into testable hypotheses and testing them against large samples in China would be valuable undertakings.

Second, this study was contextualized in the healthcare situation in China, which was the objective of our study—to address the healthcare societal challenge in China. However, rural-urban healthcare access inequality also prevails in many other countries, such as India, Brazil, and the United States. Although we acknowledge that not all of our findings can be generalized beyond the contextual background of this study, we are optimistic that future studies could be conducted on other healthcare structures and that a comparative analysis could be performed. The general thesis examining HIT interventions and their consequences related to societal challenges could also be theoretically refined and generalized. We hope that a series of studies/cumulative research can be conducted along these lines toward the development of a general theory of a "societal IT solution."

Third, this study focuses on HIT interventions to address rural-urban healthcare access inequality. However, we acknowledge the possibility of other non-IT interventions, such as healthcare insurance policies, which can play an important role in addressing inequality in accessing high-quality healthcare services. For example, the rural cooperative medical insurance that was recently implemented in China has already helped to improve rural patients' access to high-quality healthcare services. Future research could examine the interplay between non-IT and HIT interventions in affecting this societal challenge.

Conclusion

Rural-urban healthcare access inequality is a serious and enduring problem that threatens people's well-being. Governments have sought to embark on HIT interventions to provide equal access to affordable and high-quality healthcare services, but the unintended consequences of HIT interventions should not be overlooked. This study takes a significant first step toward developing an understanding of this complex societal challenge as well as the effects of possible HIT interventions by contextualizing our research in the Chinese healthcare context. Our findings call for a holistic coordinated approach by government agencies, researchers, and healthcare professionals to address this very important challenge.

Acknowledgments

We wish to thank the senior editor, Jason Bennett Thatcher, the associate editor, Chee-Wee Tan, and three anonymous reviewers who provided valuable critique and suggestions throughout the review process. This research is partially supported by the National Natural Science Foundation of China [Grant 72022017, 92146001, 72091312, 71821002, 71531004], the Zhejiang Qiantang River Talents Program C in China [Grant QJC1902009], the Research Grants Council of Hong Kong [RGC-GRF grant 9042571], and City University of Hong Kong [Grant 11504417]. The research is also supported by Dean Strategic Fund - Health Informatics Grant No. C-251-000- 068-001 from National University of Singapore.

References

Aanestad, M., Jolliffe, B., Mukherjee, A., & Sahay, S. (2014). Infrastructuring work: Building a state-wide hospital information infrastructure in India. *Information Systems Research, 25*(4), 834-845.

Ailibi. (2018). *2017 Top 100 Hospitals in China.* http://www.sohu.com/a/226300362_467288.

Al Bawaba. (2014). *India: Healthcare alliance recommendations presented to the president.* The Free Library. https://www.thefreelibrary.com/India+%3a+Healthcare+Alliance+Recommendations+Presented+to+the...-a0360624841.

Anderson, C. L., & Agarwal, R. (2011). The digitization of healthcare: Boundary risks, emotion, and consumer willingness to disclose personal health information. *Information Systems Research, 22*(3), 469-490.

Anderson, C., & Robey, D. (2017). Affordance potency: Explaining the actualization of technology affordance. *Information and Organization, 27*, 100-115.

Aschaffenburg, K., & Maas, I. (1997). Cultural and educational careers: The dynamics of social reproduction. *American Sociological Review, 62*(4), p. 573.

Ash, J. S., Sittig, D. F., Poon, E. G., Guappone, K., Campbell, E., & Dykstra, R. H. (2007). The extent and importance of unintended consequences related to computerized provider order entry. *Journal of the American Medical Informatics Association, 14*(4), 415-423.

Barkema, H. G., Xiao-Ping Chen, George, G., Yadong Luo, and Tsui, A. S. (2015). West meets east: New concepts and theories. *Academy of Management Journal, 58*(2), 460-479.

Braveman, P., & Gruskin, S. (2003). Defining equity in health. *Journal of Epidemiology & Community Health, 57*(4), 254-258.

Burns, T. R., Flam, H., & De Man, R. (1987). *The shaping of social organization*. SAGE.

Castles, S. (2010). Understanding global migration: A social transformation perspective. *Journal of Ethnic and Migration Studies, 36*(10), 1565-1586.

Chang, E. (2010). *Stampede for healthcare in China leaves many untreated.* CNN. http://edition.cnn.com/2010/WORLD/asiapcf/03/31/china.health.care.stampede/

Cleaver, F. (2005). The inequality of social capital and the reproduction of chronic poverty. *World Development, 33*, 893-906.

Deiaco, E. (2013). *China's healthcare system-overview and quality improvement* (No. 2013/012). Swedish Agency for Growth Policy Analysis.

DeSanctis, G., & Poole, M. S. (1994). Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science, 5*(2), 121-147.

Faraj, S., & Azad, B. (2012). Technology affordances. In P. M. Leonardi, B. A. Nardi, & J. Kallinikos (Eds.), *Materiality in organizing: Social interaction in a technological world*. (pp. 237-258). Oxford University Press.

Fetterman, D. M. (2010). *Ethnography: Step by step*. SAGE.

FRA. (2013). *Inequalities and multiple discrimination in access to and quality of healthcare.* European Union Agency for Fundamental Rights (FRA). http://fra.europa.eu/sites/default/files/inequalities-discrimination-healthcare_en.pdf

Gao, G. G., McCullough, J. S., Agarwal, R., & Jha, A. K. (2012). A changing landscape of physician quality reporting: Analysis of patients' online ratings of their physicians over a five-year period. *Journal of Medical Internet Research, 14*(1), Article e38.

Gardner, H. (2011). *Frames of mind: The theory of multiple intelligences*. Basic Books.

Gibson, J. J. (1986. *The ecological approach to visual perception.* Psychology Press.

Gilbert, M. R., Masucci, M., Homko, C., & Bove, A. A. (2008). Theorizing the digital divide: Information and communication technology use frameworks among poor women using a telemedicine system. *Geoforum, 39*(2), 912-925.

Goh, J. M., Gao, G. (G), and Agarwal, R. (2011). Evolving work routines: Adaptive routinization of information technology in healthcare. *Information Systems Research, 22*(3), 565-585.

Goh, J. M., Gao, G., & Agarwal, R. (2016). The creation of social value: Can an online health community reduce rural-urban health disparities? *MIS Quarterly, 40*(1), 247-263.

Harrison, M. I., Koppel, R., & Bar-Lev, S. (2007). Unintended consequences of information technologies in health care: An interactive sociotechnical analysis. *Journal of the American Medical Informatics Association, 14*(5), 542-549.

He, A. J. (2010). China's ongoing healthcare reform: Reversing the perverse incentive scheme. *East Asian Policy, 2*(3), 39-48.

Hougaard, J. L., Østerdal, L. P., & Yu, Y. (2011). The Chinese healthcare system. *Applied Health Economics and Health Policy, 9*(1), 1-13.

IBM. (2006). *Healthcare in China: Toward greater access, efficiency and quality.* IBM Business Consulting Services. https://www-935.ibm.com/services/us/imc/pdf/g510-6268-healthcare-china.pdf

Institute of Medicine. (2002). What healthcare consumers need to know about racial and ethnic disparities in healthcare. https://www.iom.edu/~/media/Files/Report%20Files/2003/Unequal-Treatment-Confronting-Racial-and-Ethnic-Disparities-in-Health-Care/PatientversionFINAL.pdf

Jensen, T. B., & Aanestad, M. (2007). Hospitality and hostility in hospitals: A case study of an EPR adoption among surgeons. *European Journal of Information Systems, 16*(6), 672-680.

Jha, S. K., Pinsonneault, A., & Dubé, L. (2016). The evolution of an ICT platform-enabled ecosystem for poverty alleviation: The case of Ekutir. *MIS Quarterly, 40*(2), 431-446.

Jonsson, J. O., David, B., Grusky, C., Matthew, D., Reinhard, P., & Mary, C. B. (2009). Microclass mobility: Social reproduction in four countries. *American Journal of Sociology, 114*(4), 977-1036.

Khan, A. W. (2008). It is the knowledge (not digital) divide that matters. *Nature, 456*(23), 23-23.

Klein, H. K., & Myers, M. D. (1999). A set of principles for conducting and evaluating interpretive field studies in information systems. *MIS Quarterly, 23*(1), 67-94.

Koppel, R., Wetterneck, T., Telles, J. L., & Karsh, B.-T. (2008). Workarounds to barcode medication administration systems: Their occurrences, causes, and threats to patient safety. *Journal of the American Medical Informatics Association, 15*(4), 408-423.

Krueger, R., & Savage, L. (2007). City-regions and social reproduction: A "place" for sustainable development? *International Journal of Urban & Regional Research, 31*(1), 215-223.

Lau, A. Y. S., Proudfoot, J., &rews, A., Liaw, S.-T., Crimmins, J., Arguel, A., & Coiera, E. (2013). Which bundles of features in a web-based personally controlled health management system are associated with consumer help-seeking behaviors for physical and emotional well-being? *Journal of Medical Internet Research, 15*(5), Article e79.

Lau, A. Y. S., Sintchenko, V., Crimmins, J., Magrabi, F., Gallego, B., & Coiera, E. (2012). Impact of a web-based personally controlled health management system on influenza vaccination and health services utilization rates: A randomized controlled trial. *Journal of the American Medical Informatics Association, 19*(5), 719-727.

Lee, J. K. (2016). Invited commentary: Reflections on ICT-enabled bright society research. information systems research, *27*(1), 1-5.

Leonardi, P. M. (2011). When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies. *MIS Quarterly, 35*(1), 147-168.

Leonardi, P. M. (2013). When does technology use enable network change in organizations? A comparative study of feature use and shared affordances. *MIS Quarterly, 37*(3), 749-775.

Leong, C., Pan, S. L., Newell, S., & Cui, L. (2016). The emergence of self-organizing e-commerce ecosystems in remote villages of China: A tale of digital empowerment for rural development. *MIS Quarterly, 40*(2), 475-484.

Lofland, J., & Lofland, L. H. (1995. *Analyzing social settings: A guide to qualitative observation and analysis.* Wadsworth.

Majchrzak, A., & Markus, M. (2013). Technology affordances and constraints theory (of MIS). In E. H. Kessler (Ed.), *Encyclopedia of management theory* (pp. 832-835). SAGE.

Majchrzak, A., Markus, M. L., & Wareham, J. (2013). ICT and societal challenges: *MIS Quarterly* Special Issue Call for Papers. https://misq.umn.edu/skin/frontend/default/misq/pdf/CurrentCalls/ICTChallenges.pdf

Majchrzak, A., Markus, M. L., & Wareham, J. (2016). Designing for digital transformation: lessons for information systems research from the study of ICT and societal challenges. *MIS Quarterly, 40*(2), 267-277.

Mangan D. (2016). *New pact to make electronic health records "work better."* CNBC. https://www.cnbc.com/2016/02/29/new-pact-to-make-electronic-health-records-work-better.html

Markus, M. L., & Silver, M. S. (2008). A foundation for the study of IT effects: A new look at DeSanctis and Poole's concepts of structural features and spirit. *Journal of the Association for Information Systems, 9*(10), 609-632.

Menon, N. m., & Kohli, R. (2013). Blunting Damocles' sword: A longitudinal model of healthcare IT impact on malpractice insurance premium and quality of patient care. *Information Systems Research, 24*(4), 918-932.

Meyer, P. A., Yoon, P. W., & Kaufmann, R. B. (2013). *Introduction: CDC health disparities and inequalities report—United States 2013*. CDC. https://www.cdc.gov/mmwr/preview/mmwrhtml/su6203a2.htm

Milanovic, B. (2007). Globalization and inequality in global inequality: Patterns and explanations. In D. Held and A. Kaya (Eds.), *Global inequality* (pp. 26-49). Polity.

Miranda, S. M., Young, A., & Yetgin, E. (2016). Are social media emancipatory or hegemonic? Societal effects of mass media digitization in the case of the SOPA discourse. *MIS Quarterly, 40*(2), 303-329.

Mishra, A. N., &erson, C., Angst, C. M., & Agarwal, R. (2012). Electronic health records assimilation and physician identity evolution: An identity theory perspective. *Information Systems Research*, *23*(3.1), 738-760.

Rajan, B., Seidmann, A., & Dorsey, E. R. (2013). The competitive business impact of using telemedicine for the treatment of patients with chronic conditions. *Journal of Management Information Systems, 30*(2), 127-158.

Ralston, J. D., Carrell, D., Reid, R., &erson, M., Moran, M., & Hereford, J. (2007). Patient web services integrated with a shared medical record: Patient use and satisfaction. *Journal of the American Medical Informatics Association, 14*(6), 798-806.

Research and Markets. (2017). China hospital industry report, 2016-2020. https://www.researchandmarkets.com/research/pv7t24/china_hospital

Sarkar, U., Karter, A. J., Liu, J. Y., Adler, N. E., Nguyen, R., López, A., & Schillinger, D. (2011). Social disparities in internet patient portal use in diabetes: Evidence that the digital divide extends beyond access. *Journal of the American Medical Informatics Association, 18*(3), 318-321.

Sherer, S. A., Meyerhoefer, C. D., & Peng, L. (2016). Applying institutional theory to the adoption of electronic health records in the U.S. *Information & Management, 53*(5), 570-580.

Spencer, K. L., & Grace, M. (2016). Social foundations of health care inequality and treatment bias. *Annual Review of Sociology, 42*(1), 101-120.

Strong, D. M., Volkoff, O., Johnson, S. A., Pelletier, L. R., Tulu, B., Bar-On, Trudel, J, and Garber, L. (2014). A theory of organization-EHR affordance actualization. *Journal of the Association for Information Systems*, *15*(2), 53-85.

Srivastava, S. C., Teo, T. S.H, and Devaraj, S. (2016). You can't bribe a computer: Dealing with the societal challenge of corruption through ICT. *MIS Quarterly, 40*(2), 511-526.

Tencent Research Center, and Vcbeat.net. (2017). *The 2016 white paper of Internet Hospital in China*. http://vcbeat.net/Report/getReportFile/key/NDU%3D.

Timmermans, S., & Tavory, I. (2012). Theory construction in qualitative research from grounded theory to abductive analysis. *Sociological Theory, 30*(3), 167-186.

Treem, J. W., & Leonardi, P. M. (2012). Social media use in organizations: Exploring the affordances of visibility, editability, persistence, and association. *Communication Yearbook, 36*, 143-189.

Turner, J. H. (2013). *Theoretical sociology: 1830 to the present*. SAGE.

van Ryn, M., & Burke, J. (2000). the effect of patient race and socio-economic status on physicians' perceptions of patients. *Social Science & Medicine, 50*(6), 813-828.

Venkatesh, V., Zhang, X., & Sykes, T. A. (2011). "Doctors do too little technology": A longitudinal field study of an electronic healthcare system implementation. *Information Systems Research, 22*(3), 523-546.

Volkoff, O., & Strong, D. M. (2013). Critical realism and affordances: Theorizing IT-associated organizational change processes. *MIS Quarterly, 37*(3), 819-834.

Warren, D. E. (2003). Constructive and destructive deviance in organizations. *Academy of Management Review*, *28*(4), 622-632.

Weingart, S. N., Rind, D., Tofias, Z., & Sands, D. Z. (2006). Who uses the patient internet portal? The PatientSite experience. *Journal of the American Medical Informatics Association, 13*(1), 91-95.

Wiersum, M. (2014). *Obamacare: Why Medicare and Medicaid drive government spending*. Yahoo!finance. http://finance.yahoo.com/news/obamacare-why-medicare-medicaid-drive-130011292.html.

Wolcott, H. F. (1994). Transforming qualitative data: description, analysis, and interpretation. SAGE.

Wright, E. O. (2010). *Envisioning real utopias.* Verso.

Yan, L., & Tan, Y. (2014). Feeling blue? Go online: An empirical study of social support among patients. *Information Systems Research*, *25*(4), 690-709.

Yip, W. C.-M., Hsiao, W. C., Chen, W., Hu, S., Ma, J., & Maynard, A. (2012). Early appraisal of China's huge and complex health-care reforms. *Lancet, 379*(9818), 833-842.

About the Authors

Yu Tong is an associate professor at Zhejiang University and vice director at the Center for Research on Zhejiang Digital Development and Governance. Her research interests cover health information technology, the use and management of information systems, and emerging forms of IT-enabled collaboration such as spontaneous virtual teams and open innovation. Her work has been published in journals such as *Information Systems Research, Journal of Management Information Systems, Journal of the Association for Information Systems,* and *Information & Management.* She has chaired several grants including the Outstanding Youth Fund from the National Natural Science Foundation of China and the General Research Fund from the Hong Kong Research Grant Council. She also received an Early Career Award from the Hong Kong University Grants Committee and several research and best paper awards.

Chuan-Hoo Tan is an associate professor and deputy head (administration and research) in the Department of Information Systems and Analytics at the National University of Singapore (NUS). Chuan Hoo conducts research in the area of the digital economy, digitalization and future of work with a range of organizations and institutions. His work has appeared in premium journals such as *MIS Quarterly, Information Systems Research, Journal of Management Information Systems, Journal of the Association for Information Systems, ACM Transactions on Management Information Systems, IEEE Transactions on Engineering Management, Journal of American Society for Information Science and Technology,* and *Long Range Planning*, among many others. He serves or has served on the editorial boards of leading journals including *MIS Quarterly* (associate editor), *Journal of the Association for Information Systems* (editorial board member), IEEE transactions on engineering management (editorial board members), among others. Chuan Hoo is the recipient of the INFORMS ISS Design Science Award (2013), *MIS Quarterly*'s Outstanding Associate Editor Award (2016), *Journal of the Association for Information Systems*'s Best Reviewer Award (2016), and the NUS School of Computing Faculty Teaching Excellence Award (2017). Chuan-Hoo Tan served as a corresponding author for this paper.

Choon Ling Sia is a professor at the City University of Hong Kong and an AIS Fellow (2015). He received his Ph.D. degree from the National University of Singapore. He served as the director of Center of Social Media Marketing and Business Intelligence at the City University of Hong Kong. He serves or has served on the editorial boards of *MIS Quarterly, Information Systems Research, Journal of the Association for Information Systems, IEEE Transactions on Engineering Management, Journal of Global Information Management, Information and Management,* and *Journal of Database Management.* His research interests include electronic commerce, healthcare IS, cross-cultural issues in information systems, knowledge management, distributed work arrangements, and computer-mediated communication. His research work has been published in *MIS Quarterly, Information Systems Research, Journal of Management Information Systems, International Journal of Electronic Commerce, IEEE Transactions on Engineering Management, Journal of International Business Studies, ACM Transactions on Computer-Human Interaction, Journal of the American Society for Information Science and Technology, IEEE Transactions on Systems, Man, and Cybernetics, Information and Management, Communications of the ACM, Decision Support Systems, International Journal of Human-Computer Studies, Internet Research, Information and Software Technology,* and *International Journal of Information Management,* among other outlets.

Yani Shi is an assistant professor in the School of Economics and Management at Southeast University. She received her Ph.D. degree in information systems from City University of Hong Kong, and a joint Ph.D. degree in management science and engineering from the University of Science and Technology of China. Her research interests include electronic commerce, health information technology, and supply chain management. Her work has appeared in the *International Journal of Information Management, Information & Management, IEEE Transactions on Systems, Man, and Cybernetics: Systems, Journal of Global Information Management*, and various conference proceedings, including ICIS. Yani Shi served as a corresponding author for this paper.

Hock-Hai Teo is the Provost's Chair Professor in the Department of Information Systems and Analytics, School of Computing at National University of Singapore. He is currently very passionate and focused on implementing three of his pet projects: (1) improving the healthcare service delivery models and outcomes through process improvement using healthcare Internet of Things (IoT) technology; (2) shaping the innovation capabilities of Singapore's small-medium enterprises in today's digital economy; and (3) enhancing the learning outcomes of pupils through better delivery of pedagogical content and building of competences via an adaptive, customizable learning platform.

Appendix A

Archival Data

Table A1. Healthcare Challenges

Category	Articles
Municipal government's website	A1. People (2015, 26 November). <Criminal Law Amendment (9)> No.290-1. http://npc.people.com.cn/n/2015/1126/c14576-27857512.html A2. China Court (2014, 24 April). <Involved medical illegal crime must be punished in accordance with the law to maintain normal medical order> Three processes to deal with medical dispute. http://www.chinacourt.org/article/detail/2014/04/id/1282084.shtml A3. National Health and Family Planning Commission (2016, 19 January). The notice on printing and distributing the health and family planning work points of 2016. http://www.nhc.gov.cn/bgt/s7692/201601/5372ab1bbd3247aabc9e2a7d5fa6fa3f.shtml A4. National Health and Family Planning Commission (2014, 21 August). The opinion about promoting telemedicine service in medical institution. http://www.gov.cn/gongbao/content/2014/content_2792664.htm A5. National Health and Family Planning Commission (2013, 20 Novermber). Guiding opinions on accelerating the construction of population health informatization. http://www.gov.cn/gongbao/content/2014/content_2600086.htm
News/ magazine articles	A6. The New York Times (2016, 3 May). China investigates Baidu after student's death from cancer. http://www.nytimes.com/2016/05/04/world/asia/china-baidu-investigation-student-cancer.html?_r=0 A7. Sohu News (2016, 7 May). The doctor cut with more than 30 knives resulted in death in Guangdong People's Hospital. http://news.sohu.com/20160507/n448138464.shtml A8. China Daily (2016, 18 January). Institutions clash over pregnant woman's death. http://www.chinadaily.com.cn/china/2016-01/18/content_23125089.htm A9. Global Times (2016, 15 March). After baby's death, family attack doctor not involved in treating child. http://www.globaltimes.cn/content/973933.shtml A10. BBC News (2016, 21 March). China Shandong illegal vaccine scandal sparks anger. http://www.bbc.com/news/world-asia-china-35859927 A11. The Daily Mirror (2015, 29 September). Nurse left in tears after grieving family force her to hold dead baby. http://www.mirror.co.uk/news/world-news/nurse-left-tears-after-grieving-6537236 A12. Daily Mail (2016, 5 May). Farmer shocked to find one of his kidneys is MISSING after undergoing a chest surgery at a Chinese hospital. http://www.dailymail.co.uk/news/peoplesdaily/article-3575359/Farmer-shocked-one-kidneys-MISSING-undergoing-chest-surgery-Chinese-hospital.html A13. Yahoo News (2016, 9 July). China launches drive to eradicate violence against hospital staff. https://www.yahoo.com/news/china-launches-drive-eradicate-violence-against-hospital-staff-082132853.html. A14. Sohu Health (2016, 24 May). Today, three medical violence and eight physicians are hospitalized because of being beaten. https://www.sohu.com/a/76987335_377326 A15. NetEase Finance (2016, 12 May). Thoughts on frequent hospital violences: Unfit structure, inappropriate treatment, lack of trust and physician-patient disputes. https://www.163.com/money/article/9LN1RCOC00254TI5.html A16. China Daily (2015, 2 April). The tragedy of doctors versus patient. http://www.chinadaily.com.cn/opinion/2015-04/02/content_19979314.htm A17. The New Yorker (2014, 25 August). UNDER THE KNIFE--Why Chinese patients are turning against their doctors. http://www.newyorker.com/magazine/2014/08/25/under-the-knife A18. The Telegraph (2013, 31 October). China doctor buried amid wave of hospital violence. http://www.telegraph.co.uk/news/worldnews/asia/china/10416828/China-doctor-buried-amid-wave-of-hospital-violence.html A19. The Guardian (2013, 29 December). Chinese hospitals plagued by violence as disputes grow. https://www.theguardian.com/world/2013/dec/29/chinese-hospitals-violence-disputes

	A20. People (2013, 29 October). People daily comment: How to build trust between doctors and patients. http://opinion.people.com.cn/n/2013/1029/c1003-23355659.html
	A21. CNN (2011, 17 October). Tensions rise between doctors and patients in China. http://edition.cnn.com/2011/10/14/world/asia/china-doctor-attacks/
	A22. China Daily (2016, 7 March) Smart healthcare changes Chinese lives, but challenges remain. http://www.chinadaily.com.cn/china/2016twosession/2016-03/07/content_23770719_2.htm
	A23. Hebei Ifeng (2016, 7 July). Unbalance chinese medical resources. http://hebei.ifeng.com/a/20160707/4733467_0.shtml (access date: January 2017)
	A24. The Beijing News (2016, 20 May). Sheng Xitai: Internet cannot resolve the problem of medical supply and demand. http://epaper.bjnews.com.cn/html/2016-05/20/content_635869.htm?div=0
	A25. Sina Weibo (2015, 21 November). The top hospital ranking at the national level indicates the unbalance of medical resources. How to fix it? http://www.weibo.com/p/2304181335e66970102w0zt?pids=Pl_Official_CardMixFeedv6__4&feed_filter=1
	A26. G-medon (2015, 17 March). The truth of the distribution of Chinese medical resources. https://www.gotfaux.com/Item/39153.aspx
	A27. Caixin (2014, 23 December). The success and problem toward the medical reform in 2014. http://china.caixin.com/2014-12-23/100766854.html
	A28. China News (2014, 14 March). Resolving uneven healthcare resource distribution can reduce physician-patient disputes. https://www.chinanews.com.cn/hb/2014/03-14/5951363.shtml
	A29. China Industrial Information Network (2016, 4 January). The supply and demand analyses of medical resources in 2015 in China. http://www.chyxx.com/industry/201601/375140.html
	A30. SSAP (2016, March). "The Chinese hospital competitiveness report (2016)" https://www.ssap.com.cn/c/2016-03-23/1033367.shtml
	A31. CCTV(2016, 30 January). "Ticket scalper Reason 1: Unbalance supply and demand in medical resources" http://news.cntv.cn/2016/01/30/VIDEyQAsim3aRXBJZwwwYLiS160130.shtml

Table A2. Development of HIT in China

Source	Articles
Municipal government's website	A32. Chinese Government Network (2015, 14 October). Adding informatization into healthcare reform. http://www.gov.cn/zhuanti/2015-10/14/content_2946688.htm
	A33. National Health and Family Planning Commission of People's Republic of China (2014). The technical guide of telemedicine information system construction. http://www.nhfpc.gov.cn/ewebeditor/uploadfile/2015/01/20150122103201839.pdf
	A34. National Health and Family Planning Commission of People's Republic of China (2015, 16 January). http://www.nhfpc.gov.cn/zhuzhan/zxfb/201501/e76ab4453b134c4481ab48d4365285de.shtml (access date: January 2017)
	A35. State Council (2015, 30 March). The Issuance about the outline of the national health service system planning. http://www.gov.cn/zhengce/content/2015-03/30/content_9560.htm
	A36. State Council (2015, 4 July). Guiding opinions of the state council on actively promoting "Internet +" actions. http://www.gov.cn/zhengce/content/2015-07/04/content_10002.htm
	A37. State Council (2016, 25 October). "Healthy China 2030" plan http://www.nhsa.gov.cn/art/2016/10/25/art_37_1167.html
	A38. National Health and Family Planning Commission of People's Republic of China (2017, 24 January). The 13th national five-year plan on population health informatization. http://www.nhc.gov.cn/cms-search/xxgk/getManuscriptXxgk.htm?id=ef9ba6fbe2ef46a49c333de32275074f
	A39. National Health and Family Planning Commission of People's Republic of China (2017, 9 May). Management of internet diagnosis (Exposure Draft). http://www.sohu.com/a/139754985_648425
News/ magazine articles	A40. Sohu (2016, 16 December). The development and current situation of chinese medical informatization in 2016 and trends prediction in 2017. https://www.sohu.com/a/121760280_468655

	A41. CNII (2013, 8 March). The new medical reform promotes the development of digital healthcare. http://www.cnii.com.cn/informatization/2013-03/08/content_1106049.htm (access date: January 2017)
	A42. NetEase Technology (2014, 12 December). The series of report about the Internet medical treatment (5): Where is the hospital revolution? http://tech.163.com/14/1212/09/AD8LJ17O000915BF.html
	A43. NetEase Technology (2014, 12 December). The series of report about the Internet medical treatment (1): Does the Bursting Point Come Yet? http://tech.163.com/14/1027/08/A9I4Q67L000915BF.html
	A44. The Telegraph (2016, 16 March). Internet-based smart healthcare changes Chinese lives. http://www.telegraph.co.uk/sponsored/china-watch/technology/12190285/smart-healthcare-China.html (access date: January 2017)
	A45. Sina Technology (2016, 22 January). Internet Healthcare: The industry chain is almost formed and users' customs are needed to be cultivated. http://tech.sina.com.cn/i/2016-01-22/doc-ifxnuvxh5125258.shtml
	A46. IFeng Finance (2015, 3 October). Medical Informatization—Golden ten year just started. http://finance.ifeng.com/a/20150310/13542114_0.shtml

Table A3. Symbiotic Transformation

Category	Articles
Municipal government's website	A47. National Health and Family Planning Commission of People's Republic of China (2010, 14 October). The notice about carrying out the experimental work of electronic medical records. http://www.gov.cn/gzdt/2010-10/14/content_1722508.htm
	A48. China National People's Congress (2016, 15 March). Zhu Liangyu: Proposal on integrating EMR nationwide. http://www.china.com.cn/lianghui/news/2016-03/15/content_38028346.htm
	A49. Ministry of Health (2010, 22 November). Meeting about taking electronic medical record as the core of hospital informatization construction. http://www.gov.cn/gzdt/2010-11/22/content_1750593.htm
	A50. CIRC-Xinjiang (2016, 26 April). The first EMR information platform began to operate in Xinjiang. http://www.circ.gov.cn/web/site37/tab2144/info4027466.htm (access date: January 2017)
	A51. Chinese Government Network (2012, 30 March). Beijing: Achieving interconnection of EMR within three years. http://www.gov.cn/govweb/fwxx/jk/2012-03/30/content_2103303.htm
	A52. Harbin Government (2016, 8 May). EMR will cover the whole province and enable information sharing. http://www.harbin.gov.cn/info/news/index/detail/430254.htm (access date: January 2017)
	A53. Hainan Government (2016, 4 August). Informatization construction in the second-level medical institutions was under processing. https://www.hainan.gov.cn/hainan/yiliao/201608/912bb1ae3e814b4784b830b1e7d93e79.shtml
	A54. The State Council (2015, 4 July). The guide about promoting "Internet +" operation. http://www.gov.cn/zhengce/content/2015-07/04/content_10002.htm
	A55. National Health and Family Planning Commission (2011, 22 April). The detailed standard about the three-level general hospital evaluation. http://www.nhc.gov.cn/wjw/gfxwj/201304/b98329ec713a4e8d812b23a56d13f94f.shtml
	A56. Henan Medical Administration Network (2016, 9 March). Ten indicators of the operation and the supervision in two-level and above hospitals. http://www.henanyz.com/uploadAttach/20160311/20160311105311_171.pdf (access date: January 2017)
	A57. The State Council (2015. 6 July). Guidance on actively promoting the "Internet plus" action. http://www.gov.cn/zhengce/content/2015-07/04/content_10002.htm
	A58. National Health and Family Planning Commission (2016, 26 January). The notice on printing and distributing the health and family planning work points of 2016. http://www.nhc.gov.cn/bgt/s7692/201601/5372ab1bbd3247aabc9e2a7d5fa6fa3f.shtml
	A59. HC31(2015, 18 August). Standardization of hospital information interoperability evaluation scheme. http://news.hc3i.cn/art/201508/34217_4.htm

	A60. Ministry of Health. Notice on carrying out the pilot work of EMR (2010, 14 October). http://www.gov.cn/gzdt/2010-10/14/content_1722508.htm A61. Ministry of Health (2010, 22 February). Notice on printing and distributing the basic norms of EMR (for Trial Implementation). http://www.gov.cn/zwgk/2010-03/04/content_1547432.htm A62. Ministry of Health (2011, 4 November). Notification on the evaluation standard on EMR function level classification. http://www.nhc.gov.cn/yzygj/s3593/201512/a335bd9490164b928f27276b0161daa9.shtml A63. National Health and Family Planning Commission (2011, 4 January). EMR system function norms (for Trial Implementation). http://www.gov.cn/gzdt/2011-01/04/content_1778059.htm A64. National Health and Family Planning Commission (2012, 15 June). State Administration of Traditional Chinese Medicine. Guidance on strengthening the construction of health informatization. http://www.nhc.gov.cn/wjw/gfxwj/201304/e1b9fd5596ce4a5e8123337552358b38.shtm
News/ magazine articles	A65. The Second People's Hospital of Nanning (2016, 29 July). The hospital improved electronic information system service. http://www.nn2yy.com/news_hos/2016/oeER6Na0.html A66. CNR (2016, 26 May). Intelligent healthcare information system was in test run in Xinqiao Hospital of Third Military Medical University. http://news.cnr.cn/native/city/20160526/t20160526_522248466.shtml A67. CNII (2015, 25 March). What should those unattractive medical information systems do? http://www.cnii.com.cn/informatization/2015-03/25/content_1551476.htm (access date: January 2017) A68. MhealthChina (2015, 18 September). China mobile of Guangdong built medical cloud platform to share EMR. http://www.mhealthchina.org/4909.html A69. 21wecan (2016, 19 August). The doctor-patient disputes because of EMR. http://www.21wecan.com/rczz/gqzz/2016/07/al/111ca886e5fc1ed7a2b64d57f648db2f.html (access date: January 2017) A70. China Youth Network (2016, 24 March). Using EMR to replace traditional medical records. http://pinglun.youth.cn/wztt/201603/t20160324_7772989.htm A71. Jiading News (2014, 26 December). Nanxiang hospital started electronic prescription system today. http://www.nanxiang.info/article/article_21995.html (access date: January 2017) A72. The Affiliated Hospital of Xuzhou Medical University (2013, 22 February). The features and trend of the informatization construction of Chinese healthcare system. http://www.jsxyfy.com/_s22/08/e7/c765a2279/page.psp (access date: January 2017) A73. Tencent Finance (2016, 28 July). Healthcare Industry: Benefit policies, medical informatization boosts. http://finance.qq.com/a/20160728/031418.htm (access date: January 2017) A74. Chengdu Evening News (2012, 9 August). 80% of three-A-grade hospitals in Chengdu will build EMR system in 2015. http://www.cdwb.com.cn/html/2012-08/09/content_1656477.htm

Table A4. Interstitial Transformation

Category	Articles
Municipal government's website	A75. Shanxi Provincial Health and Family Planning Commission (2015, 10 November). Three-A-grade hospitals in Shanxi Province further improved healthcare services. http://www.sxws.cn/bureau/MesIssueContentBeta2.asp?SubType=gzdt&ConID=14125&SubName=%B9%A4%D7%F7%B6%AF%CC%AC (access date: January 2017) A76. Wenzhou Municipal People's Government Office (2014, 18 December). [Healthcare] People's Hospital launched electronic guidance. http://www.lwnews.net/system/2014/12/18/011867202.shtml (access date: January 2017) A77. National Health and Family Planning Commission (2016, 20 April). The notice on printing and distributing the key work plan for further improvement for healthcare services in 2016. http://www.nhc.gov.cn/yzygj/s3593g/201604/d5a76213b7904bb380f1441fb8ff8981.shtml A78. National Health and Family Planning Commission (2016, 3 March). The notice on printing and distributing the special action scheme for regulating "ticket sellers" and "online Yituo." http://www.gov.cn/xinwen/2016-05/03/content_5070052.htm

	A79. National Health and Family Planning Commission (2016, 26 January). The notice on printing and distributing the health and family planning work points of 2016. http://www.nhc.gov.cn/bgt/s7692/201601/5372ab1bbd3247aabc9e2a7d5fa6fa3f.shtml
News/ magazine articles	A80. MedChina (2016, 30 Augest). Southwest Hospital and Pingan Good Doctor work together to build innovative Internet hospital. http://med.china.com.cn/content/pid/25420/tid/3
	A81. The Telegraph (2016, 16 March). Internet-based smart healthcare changes Chinese lives. http://www.telegraph.co.uk/sponsored/china-watch/technology/12190285/smart-healthcare-China.html (access date: January 2017)
	A82. Xinhua (2016, 11 March). Wang Jianye talks about the difficulty in medical treating: Uneven distribution is the main problem of medical resources in China. http://www.xinhuanet.com/politics/2016lh/fangtan/20160311c/index.htm
	A83. Hainan Daily (2016, 1 April). The first mobile Internet hospital in Sanya starts operation. http://hnrb.hinews.cn/html/2016-04/01/content_18_9.htm
	A84. Jingjiang Daily (2016, 24 August). People's hospital set up "network hospital" patients can appoint diagnose online. http://www.jsjjw.cn/tongyong/tupian/2016-08/24/content_462583.htm
	A85. Bayannaoer News (2015, 1 December). The hospital builds Internet telemedicine service platform for rural primary medical institutions. http://www.bynrnews.com/sites/main/article.jsp?KeyID=213769&ColumnID=13
	A86. The Second People's Hospital of Nanning (2016, 8 August). We add emergency self-service printers to improve patients' medical experience. http://www.nn2yy.com/news_hos/2016/BeXDkkey.html
	A87. Xinhua (2016, 15 April). Zhangping: Internet clinic helps relieve the difficulty in medical treating for rural residents. http://news.youth.cn/gn/201604/t20160415_7864134.htm
	A88. Hunan Daily (2016, 3 August). Breaking the difficulty in medical treating. Is it easier for medical treating using QR code? http://hnrb.voc.com.cn/article/201608/201608031021543648.html
	A89. China News-Guangxi (2016, 27 May). "Internet Hospital" starts being used in the district hospital. http://www.gx.chinanews.com/kjwt/2016-05-27/136110.shtml (access date: January 2017)
	A90. Zhejiang Online (2016, 23 March). Hangzhou intelligent medical services upgrade. Alipay can recharge citizen card and health card. http://biz.zjol.com.cn/system/2016/03/23/021078926.shtml
	A91. Zhejiang News (2016, 25 March). Diagnose on Alipay, medical drugs can be delivered to home. http://zjnews.zjol.com.cn/system/2016/03/25/021081073.shtml
	A92. Changjiang Times (2016, 20 January). The first "network hospital" in Hubei begins to be used. http://www.changjiangtimes.com/2016/01/523791.html

Table A5. Ruptural Transformation

Category	Articles
Municipal government's website	A93. Chinese Government Network (2016, 2 September). Heilongjiang: "Internet +" facilities "long healthcare." http://www.gov.cn/xinwen/2016-09/02/content_5104572.htm
	A94. The People's Government of Henan Province (2016, 6 September). Two large projects in "Internet + Medicine" field are signed. http://www.henan.gov.cn/jrhn/system/2016/09/06/010669508.shtml
	A95. National Health and Family Planning Commission (2016, 3 March). The notice on printing and distributing the special action scheme for regulating "ticket sellers" and "online Yituo." http://www.gov.cn/xinwen/2016-05/03/content_5070052.htm
News/ magazine articles	A96. CNR (2016, 5 September). Some "Internet + Medicine" companies start strategic transformation. http://health.cnr.cn/jkgdxw/20160905/t20160905_523111883.shtml
	A97. NetEase Technology (2016, 18 August). The prospect of Internet medicine is still optimistic. http://tech.163.com/16/0818/08/BUO42Q3F00097U7V.html
	A98. Sina Finance (2014, 28 October). China mobile Guangdong: 4G "intelligent medical treatment" builds green medical platform. http://finance.sina.com.cn/360desktop/roll/20141028/015320656298.shtml
	A99. South Daily (2014, 29 October). Is network hospital reliable? https://www.cn-healthcare.com/article/20141029/content-462802.html
	A100. South Weekend (2015, 30 April). Does the time for online medical treatment really come? The half-year evaluation on the first nation network hospital. http://www.infzm.com/content/109235

	A101. Sina News (2015, 18 March). A girl believes in network doctor to do gynecological surgery. Experts: Online medical treatment is not reliable. https://news.sina.com.cn/c/2015-03-18/052631618037.shtml A102. China News (2015, 3 November). Seeing doctors without leaving home is like a marketing farce. The "Internet +" medical treatment is not that reliable. http://www.chinanews.com/gn/2015/11-03/7603792.shtml A103. BBC (2014, 28 May). Trust your doctor, not Wikipedia, say scientists. https://www.bbc.com/news/health-27586356 A104. Health News (2014, 6 June). Determining whether online health topic is reliable. http://www.jkb.com.cn/healthyLiving/jkzs/2014/0606/342961.html (access date: January 2017) A105. CSTNet (2015, 19 March). Do not fully believe the disease sign self-looking table. http://www.wokeji.com/jiankang/jkfw/201503/t20150319_1001259.shtml (access date: January 2017) A106. CNR (2015, 12 April). Online medical diagnose is banned by National Health and Family Planning Commission. http://china.cnr.cn/ygxw/20150412/t20150412_518295267.shtml A107. Ifeng (2014, 10 April). Blindly believing in online doctor leads to the death of a new-born baby. http://news.ifeng.com/gundong/detail_2014_04/10/35638947_0.shtml (access date: January 2017) A108. People (2014, 6 August). The number of Ali "future hospital" would be expanded to 50 in this year. http://finance.people.com.cn/money/n/2014/0806/c42877-25410520.html A109. Reuters (2015, 13 January). Jack Ma fund, others to invest $1.6 bln in China drugmaker Baiyunshan. http://www.reuters.com/article/baiyunshan-investment-idUSL3N0US2TB20150113 A110. TechCrunch (2014, 1 September). Chinese Internet giant Tencent invests $70 million In healthcare group DXY. https://techcrunch.com/2014/09/01/chinese-internet-giant-tencent-invests-70-million-in-healthcare-group-dxy/ A111. The Wall Street Journal (2016, 22 February). Alibaba Health swallows bitter pill, as China halts drug-monitoring system. http://www.wsj.com/articles/ali-health-swallows-bitter-pill-as-china-halts-drug-monitoring-system-1456144563

Appendix B

Literature Review on HIT Literature

Table B1. Summary of Prior HIT Literature

Author	Focal HIT	Method	Level of analysis	Theoretical foundation	Theoretical assumptions of the HIT role	HIT intervention
Aanestad et al. (2014)	Hospital information infrastructure	Action research	Organization	N.A.	Positive	Symbiotic HIT intervention
Anderson and Agarwal (2011)	Personal health information	Survey	Individual (patient)	Privacy boundary theory and the literature on risk-as-feelings	Positive	Ruptural HIT intervention
Angst et al. (2010)	Electronic medical record	Econometrics	Organization	Social contagion	Positive	Symbiotic HIT intervention
Aron et al. (2011)	The automation of systems and medical errors	Econometrics	Organization	Medical informatics literature and principal-agency theory	Positive	Symbiotic HIT intervention
Balaraman et al. (2013)	Telemedicine	Modeling	Organization	N.A.	Positive	Interstitial HIT intervention
Bardhan et al. (2014)	Predict patient readmission rates	Econometrics	Individual (patient)	Literature on physician productivity, IT productivity, and task-technology fit theory	Positive	Ruptural HIT intervention
Bhargava and Mishra (2014)	Electronic medical record system	Econometrics	Individual (physician)	Literature on physician productivity, IT productivity, and task-technology fit theory	Neutral (the electronic medical record system implementation is proposed to have mixed effect on productivity)	Symbiotic HIT intervention
Chen et al. (2011)	Public health IS aimed at emerging infectious diseases containment	Econometrics & Case study	Individual (patient)	Loose coupling	Positive	Ruptural HIT intervention
Demirezen et al. (2016)	Healthcare information exchange	Modeling	Organization	Game theory	Positive	Symbiotic HIT intervention
Fichman et al. (2011)	N.A.	Research commentary	--	N.A.	Positive	Interstitial HIT intervention
Gang et al. (2015)	Clinical data repository system	Econometrics	Organization	Disseminative capacity	Positive	Symbiotic HIT intervention
Garfinkel et al. (2007)	Individually identifiable microdata	Econometrics	Individual (patient)	Literature on information security and confidentiality protection	Neutral (focus on security issues related to health information)	Ruptural HIT intervention
Goh et al. (2011)	Computerized documentation system	Narrative network	Organization	Organizational routines, adaptive structuration theory, affordances	Positive	Symbiotic HIT intervention
Goh et al. (2016)	Online health communities	Econometrics	Individual (patient)	Social support, health disparity	Positive	Ruptural HIT intervention
Idris et al. (2016)	Health information exchanges	Survey & Econometrics	Organization	Privacy regulation, incentives, and health information exchange efforts	Positive	Symbiotic HIT intervention
Kallinikos and Tempini (2014)	A web-based, medical research network	Case study	Individual (patient)	Patients network	Positive	Symbiotic HIT intervention

Kane and Labianca (2011)	Scheduling, laboratory, radiology, population registry, medical abstract, and conferencing system	Survey & Econometrics	Multi-level: individual (physician) and group	IS avoidance	Positive	Symbiotic HIT intervention
Kohli and Tan (2016)	Electronic health records	Research commentary	--	N.A.	Positive	Symbiotic HIT intervention
Mandelbaum et al. (2012)	Queueing system	Modeling	Organization	N.A.	Positive	Interstitial HIT intervention
Menon and Kohli (2013)	HIT expenditure in hospitals	Econometrics	Organization	IT value and literature on risk in management and IS	Positive	Symbiotic HIT intervention
Menon et al. (2000)	IT in healthcare industry	Econometrics	Organization	Production theory	Positive	Symbiotic HIT intervention
Miller and Tucker (2013)	Social media	Econometrics	Organization	Literature on usefulness to firms of user-generated content, often in social media settings	Positive	Ruptural HIT intervention
Mishra et al. (2012)	Electronic health record systems	Survey	Individual (physician)	Identity theory	Positive	Symbiotic HIT intervention
Mukhopadhyay et al. (2011)	Information technology enabled physician referral systems	Econometrics	Individual (physicians)	Nascent literature on healthcare	Neutral (focus on agents' learning curve with HIT)	Symbiotic HIT intervention
Oborn et al. (2011)	Electronic patient records	Case study & Econometrics	Multilevel: individual (clinical specialists) and group	Practice theory	Positive	Symbiotic HIT intervention
Ozdemir et al. (2011)	Electronic health records and personal health records platforms	Modeling	Organization	N.A.	Positive	Symbiotic HIT intervention
Rajendra et al. (2015)	Telehealth innovation	Case study & Econometrics	Organization	Path constitution theory	Positive	Symbiotic HIT intervention
Shirish and Shainesh (2015)	Telemedicine	Case study	Organization	Service-dominant logic and service science	Positive	Symbiotic HIT intervention
Torsten et al. (2015)	IS expenditure in hospitals	Econometrics	Organization	The behavioral theory of the firm and neo-institutional theory	Positive	Symbiotic HIT intervention
Venkatesh et al. (2011)	Electronic healthcare (e-healthcare) systems	Survey	Individual (physicians, paraprofessionals, administrative personnel, patients)	Social networks	Positive	Symbiotic HIT intervention
Yan and Tan (2014)	Online healthcare community	Econometrics	Individual (patient)	Social support, Patient-driven healthcare models	Positive	Ruptural HIT intervention
Yan et al. (2015)	Social network (online healthcare communities)	Econometrics	Individual (patient)	Social network	Positive	Ruptural HIT intervention
Yaraghi et al. (2015)	Health information exchange	Econometrics	Individual (patient)	Social network theory, service operations theory, and institutional isomorphism theory	Positive	Symbiotic HIT intervention
Yeow and Goh (2015)	Telemedicine	Case study & Econometrics & Survey	Organization	Theory of swift and even flow	Positive	Symbiotic HIT intervention

Appendix C

Interview Protocols

Table C1. Interview Protocols for People (Public): 1st Round

Nowadays, Information Technology (IT) is increasingly integrated into different healthcare-related activities. We want to understand your views on these HIT applications no matter whether you have used them before. The interview consists of two main sections. In the first section, we will ask you to recall some health-related events. In the second section, we will ask you some general questions about yourself. You are free to ask any questions during the interviews. We assure you that all your information is strictly used for the purpose of research.

Section 1: Health-Related Events

Please recall some recent health-related events related to you or your immediate family members. For each event, please describe the related processes in details.

- [Note: *Interviewers please encourage the interviewee to share (1) why the health behavior occurred, (2) how they sought the healthcare (e.g., the channels), (3) the challenges they encountered during this healthcare-seeking process, if any, and (4) the consequences of this process.*]

[*For those having utilized certain HIT applications in the specific health-related event*]
We noticed that you just mentioned the HIT in this process. Could you please describe the HIT related how you utilize it and view the effect?

[*For those having NOT utilized certain HIT applications in the specific health-related event, interviewers need to introduce the relevant HIT, if any*]

- How do you view this HIT? Do you think it can potentially help your health behavior?
- Could you please explain why you did not use this HIT application?

Thank you very much for the sharing. We understand that health-related activities can be within hospital or outside the hospitals. Besides what you have shared just now, there are some other common healthcare-related activities. We would like to get your opinion on them based on your own experience or the experience from your immediate family members. Please feel free to skip if you have not encountered such activities before.

[*Some types of healthcare-related activities within hospitals: getting consultation appointment; seeking medical consultation; making payment; getting medical test and medications*]
[*Some general types of healthcare-related activities outside hospitals: seeking healthcare information beyond physicians; self-diagnosis and treatment*]

Section 2: General Information

In this section, we want to understand some of your demographic information.

- What is your age range?
- What is your gender?
- Where do you live? In rural or urban area?
- Do you use Internet? How frequent is your Internet usage? What would you normally do when use the Internet?
- If you work now, what is your job title?
- If you do not work now, what is the most appropriate term to describe you?

Notes for interviewers:

1. *Words in [ ] are instructions/prompts for interviewers.*
2. *Interviewers should not restrict interviewees' answers and should not stop them from sharing information, even though not directly related to the questions in the protocols.*
3. *Interviewees are free to ask any questions during the interviews.*

Table C2. Interview Protocol for Healthcare Professionals and Health Bureau Officials: 1st Round

Nowadays, Information Technology (IT) is increasingly integrated into different healthcare-related activities. The related IT applications is termed health IT (HIT). We want to understand your views on this phenomenon. You are free to ask any questions during the interviews. We assure you that all your information is strictly used for the purpose of research.

First, we would like to understand the healthcare structure in China and some information about your institution/agency.

- Could you please provide some information related to the healthcare structure in China?
  [Prompts: *the roles of multiple actors, institutions*]
- Could you please provide some information related to the healthcare institution or healthcare agency that you are currently working with?
  [Prompts: *information about the institution: ranking, location, size, reporting health bureau and the relationship*]
- In your view, what are the key societal challenges related to healthcare in China?
  [Prompts: *the roles of multiple actors, institutions related to these challenges, rural vs. urban patients*]
- Are these social challenges somewhat related to your healthcare institution or your healthcare agency? If yes, how does so?

In the next section, we would like to solicit your opinions related to the HIT applications.

- Could you please share with us your view on the current HIT development in China?
  - What are the parties/entities responsible (or should be) for the operation of the HIT applications you mentioned just now? Why?
  - [Prompts: *within and outside conventional healthcare institutions*]
- Could you please talk about some specific HIT initiatives in your institution/agency, if there is any?
  - When did such initiatives start?
  - What are the reasons to launch such initiatives?
- Do these HIT applications influence the healthcare challenges you mentioned just now? The influence could be positive or negative. If yes, please elaborate on this.
- Could you please share with us, in your opinion, what the future direction of HIT would be?

Notes for interviewers:

1. *Words in [ ] are instructions/prompts for interviewers.*
2. *Interviewers should not restrict interviewees' answers and should not stop them from sharing information, even though not directly related to the questions in the protocols.*
3. *Interviewees are free to ask any questions during the interviews.*

Table C3. Interview Protocol: 2nd Round

Nowadays, Information Technology (IT) is increasingly integrated into different healthcare-related activities. The related IT applications is termed health IT (HIT). We want to understand your views on this phenomenon. You are free to ask any questions during the interviews. We assure you that all your information is strictly used for the purpose of research.

First, we would like to understand about your organization and a healthcare challenge in your perspective.

- Could you please provide some information related to the organization (health bureau, hospital or organization) that you are currently working with?
  [Prompts: *information about the institution: ranking, location, size, business nature*]
- How do you view the rural-urban healthcare access challenge in China?

In the next section, we would like to solicit your opinions related to the HIT applications and initiatives.

- Could you please share with us your view on the HIT applications/initiatives in China?
  - Are there any stages for the development of HIT applications/initiatives in China?
    [Prompts: *differences compared from past 3-4 years*]
  - What are the parties/entities responsible (or should be) for the operation of the HIT applications/initiatives you mentioned just now? Why?

- Could you please talk about the new HIT applications/initiatives in China, if there is any?

  - When did such new HIT applications/initiatives start?
  - What are the reasons to launch such applications/initiatives?

- Do these HIT applications/initiatives influence the rural-urban healthcare access challenge we discussed just now? The influence could be positive or negative. If yes, please elaborate on this.
- Could you please share with us, in your opinion, what the future direction of HIT would be?

Notes for interviewers:

1. *Words in [ ] are instructions/prompts for interviewers.*
2. *Interviewers should not restrict interviewees' answers and should not stop them from sharing information, even though not directly related to the questions in the protocols.*
3. *Interviewees are free to ask any questions during the interviews.*

Appendix D

Coding Scheme

Table D1. Initial Coding Scheme: Public

Actor demographics				Internet experience			Health scenario						
Gender	Job title	Age	Location	Internet usage frequency	Accessing device	Main activities	Main health-related activities	Type of health scenario	Type of the illness	Challenges encountered	Consequences of health scenario	Usage of HIT system	Attitudes toward the HIT system

HIT interventions		HIT affordances					Societal challenge		
Name	Characteristics	Group of actors	Actor's goal	HIT system	Type of affordance	Shared governing mechanisms	Characteristic	Key actor	Challenge

Table D2. Final Coding Scheme: Public

Societal challenge				HIT intervention						
Characteristic of the challenge	Key actor	Institution	Governing mechanisms	Type of intervention	Key objective	Initiating institutions	Directly affected actors	Actor's belief	Actor's ability	Outcome

HIT affordances (societal-level)												
Societal-level affordance	HIT system	HIT feature	Initiating institutions	Group of actors	Actor's goal	Actor's ability	Actor's beliefs	Task interdependence	Actualized action	Individual-level immediate concrete outcome	Societal-level immediate concrete outcome	Type of affordance

Table D3. Initial Coding Scheme: Healthcare Professionals

Hospital information						Healthcare structure		
Ranking	Location	Size	Reporting health bureau	Hospital-health bureau relationship	Party to decide HIT adoption	Supply of healthcare service	Demand for healthcare service	Competition for healthcare service

Healthcare challenge	HIT development				
Healthcare challenge	Type of HIT	Actors	Utilization status	Effect in solving challenges (intended)	Effect in solving challenges (unintended)

Future directions of HIT development	
Future direction of HIT	Future direction of HIT

Table D4. Final Coding Scheme: Healthcare Professionals

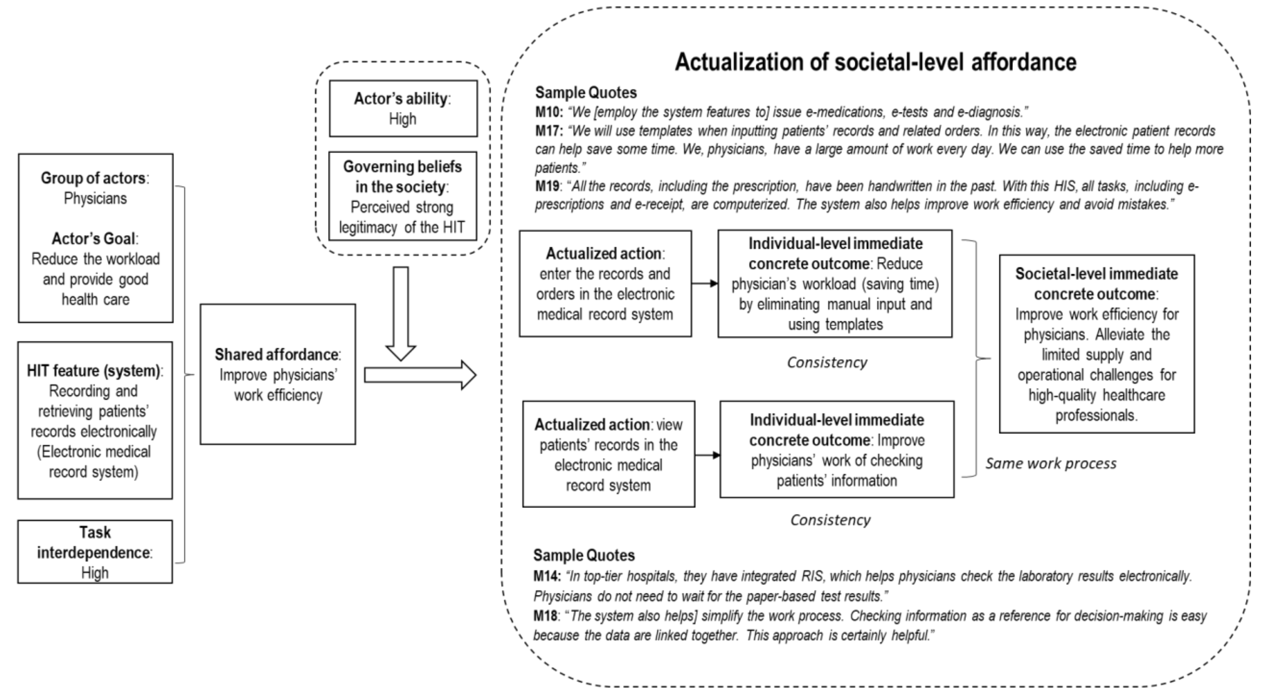
Information on healthcare institution						Healthcare structure				
Ranking	Location	Size	Reporting health bureau	Hospital-health bureau relationship	Party to decide HIT adoption	Actors	Institutions	Policies	Belief	Resource allocation

Societal challenge			
Characteristic of the challenge	Key actor	Institution	Governing mechanisms

HIT intervention						
Type of intervention	Key objective	Initiating institutions	Directly affected actors	Actor's belief	Actor's ability	Outcome

HIT affordances (societal-level)												
Societal-level affordance	HIT system	HIT feature	Initiating institutions	Group of actors	Actor's goal	Actor's ability	Actor's beliefs	Task interdependence	Actualized action	Individual-level immediate concrete outcome	Societal-level immediate concrete outcome	Type of affordance

Status of current HIT development				Future directions of HIT development		
Attitude of Health Bureau	Activity conducted by health bureau	Attitude of hospitals	Activity conducted by hospitals	Role of HIT in future healthcare industry	Future direction of HIT	Future challenges of HIT


Actualization of societal-level affordance
Group of actors: Physicians
Actor's Goal: Reduce the workload and provide good health care
HIT feature (system): Recording and retrieving patients' records electronically (Electronic medical record system)
Task interdependence: High
Shared affordance: Improve physicians' work efficiency
Actor's ability: High
Governing beliefs in the society: Perceived strong legitimacy of the HIT
Actualized action: enter the records and orders in the electronic medical record system
Individual-level immediate concrete outcome: Reduce physician's workload (saving time) by eliminating manual input and using templates
Consistency
Actualized action: view patients' records in the electronic medical record system
Individual-level immediate concrete outcome: Improve physicians' work of checking patients' information
Consistency
Societal-level immediate concrete outcome: Improve work efficiency for physicians. Alleviate the limited supply and operational challenges for high-quality healthcare professionals.
Same work process

Sample Quotes

M10: *"We [employ the system features to] issue e-medications, e-tests and e-diagnosis."*

M17: *"We will use templates when inputting patients' records and related orders. In this way, the electronic patient records can help save some time. We, physicians, have a large amount of work every day. We can use the saved time to help more patients."*

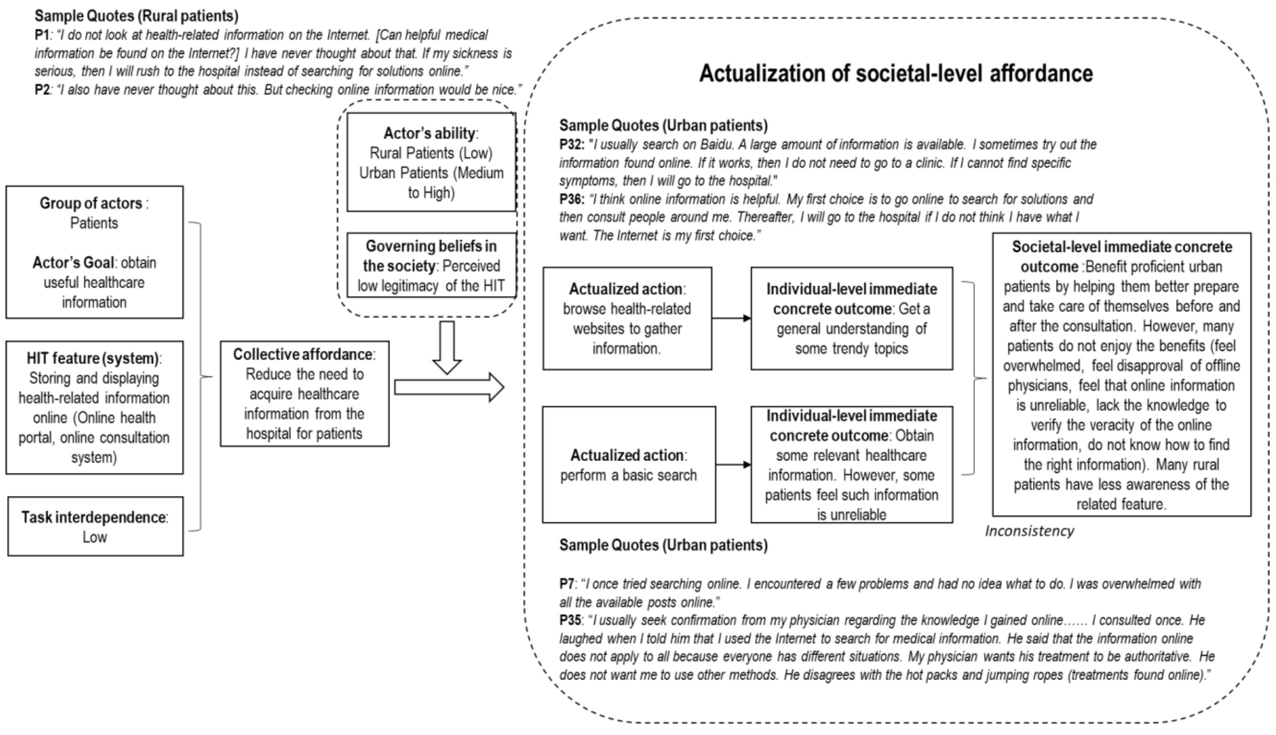
M19: "*All the records, including the prescription, have been handwritten in the past. With this HIS, all tasks, including e-prescriptions and e-receipt, are computerized. The system also helps improve work efficiency and avoid mistakes."*

Sample Quotes

M14: *"In top-tier hospitals, they have integrated RIS, which helps physicians check the laboratory results electronically. Physicians do not need to wait for the paper-based test results."*

M18: "*The system also helps] simplify the work process. Checking information as a reference for decision-making is easy because the data are linked together. This approach is certainly helpful."*

Figure D1. Coding Process for a Shared Affordance and its Actualization


Actualization of societal-level affordance
Group of actors : Patients
Actor's Goal: obtain useful healthcare information
HIT feature (system): Storing and displaying health-related information online (Online health portal, online consultation system)
Task interdependence: Low
Collective affordance: Reduce the need to acquire healthcare information from the hospital for patients
Actor's ability: Rural Patients (Low) Urban Patients (Medium to High)
Governing beliefs in the society: Perceived low legitimacy of the HIT
Actualized action: browse health-related websites to gather information.
Individual-level immediate concrete outcome: Get a general understanding of some trendy topics
Actualized action: perform a basic search
Individual-level immediate concrete outcome: Obtain some relevant healthcare information. However, some patients feel such information is unreliable
Societal-level immediate concrete outcome :Benefit proficient urban patients by helping them better prepare and take care of themselves before and after the consultation. However, many patients do not enjoy the benefits (feel overwhelmed, feel disapproval of offline physicians, feel that online information is unreliable, lack the knowledge to verify the veracity of the online information, do not know how to find the right information). Many rural patients have less awareness of the related feature.
Inconsistency

Sample Quotes (Rural patients)

P1: *"I do not look at health-related information on the Internet. [Can helpful medical information be found on the Internet?] I have never thought about that. If my sickness is serious, then I will rush to the hospital instead of searching for solutions online."*

P2: *"I also have never thought about this. But checking online information would be nice."*

Sample Quotes (Urban patients)

P32: "*I usually search on Baidu. A large amount of information is available. I sometimes try out the information found online. If it works, then I do not need to go to a clinic. If I cannot find specific symptoms, then I will go to the hospital.*"

P36: *"I think online information is helpful. My first choice is to go online to search for solutions and then consult people around me. Thereafter, I will go to the hospital if I do not think I have what I want. The Internet is my first choice."*

Sample Quotes (Urban patients)

P7: "*I once tried searching online. I encountered a few problems and had no idea what to do. I was overwhelmed with all the available posts online."*

P35: "*I usually seek confirmation from my physician regarding the knowledge I gained online…… I consulted once. He laughed when I told him that I used the Internet to search for medical information. He said that the information online does not apply to all because everyone has different situations. My physician wants his treatment to be authoritative. He does not want me to use other methods. He disagrees with the hot packs and jumping ropes (treatments found online)."*

Figure D2. Coding Process for a Collective Affordance and Its Actualization

Appendix E

Representative Interview Quotes

Table E1. Representative Quotes for HIT Interventions

Symbiotic HIT intervention	
HIT features	**Evidence of shared/common meanings across actors from our data**
Societal-Level HIT Affordance 1: Improve physicians’ work efficiency (Shared affordance for physicians)	
Record patients’ records electronically	**M10:** *“We [employ the system features to] **issue e-medications, e-tests and e-diagnosis**”.* **M17**: *“We will **use templates when inputting patients’ records and related orders**. In this way, the electronic patient records can help save some time. We, physicians, have a large amount of work every day. We can use the saved time to help more patients.”* **M19**: “*All the records, including the prescription, have been handwritten in the past. With this HIS, all tasks, including **e-prescriptions and e-receipt, are computerized**. The system also helps improve work efficiency and avoid mistakes.”*
Retrieve patients’ records electronically	**M14***: “In top-tier hospitals, they have integrated RIS, which helps physicians **check the laboratory results electronically**. Physicians do not need to wait for the paper-based test results.”* **M18**: “*[The system also helps] simplify the work process. **Checking information as a reference for decision-making** is easy because the data are linked together. This approach is certainly helpful.*”
Societal-Level HIT Affordance 2: Streamline outpatient administrative work for healthcare professionals (Shared affordance for healthcare professionals)	
Electronic queuing feature	**(M15-M16)** **M16**: “*The system is related to the outpatient workflow in hospitals.”* **M15***: “In the past, after patients complete the consultation registration, they need to use the physical case notes to queue for the consultation. Some patients may jump the queue by inserting their case notes in front of others. You can barely prevent this situation from happening because you cannot simply stare at the queue of the case notes all the time. In most cases, **a large group of people [nurses] stand there to prevent queue-jumping. With the system, such a situation will not happen. Everyone should sit and wait for the name to be called.***” **M3**: “***Through the system, who have and have not done the tests can be determined. Patients do not need to only wait besides the facility but can check and determine their position in the queue [electronically]**. Our hospital is located in a country town and thus do not have such a system to date. Such a system is needed for higher-level hospitals, such as those located in the city. The number of patients needs to be large to generate benefits from such a system.*”
Electronically updating the payment status	**M5**: “*All the information for a patient is stored inside a card. This approach is very good. The work becomes less than before for the physicians. Patients also do not need to queue for payment. They can simply swipe the card in the machine. Such a system helps reduce physicians’ workload and reduce the errors. After receiving the payment, a message will be sent to the pharmacy. **Pharmacists can check on the computer screen that this patient has made the payment. The pharmacists will then issue the medicine**. The entire process becomes very simple and convenient. Patients do not need to run back and forth.*” **M14:** “What we use here is [a system] to **digitize the work for outpatient flow**, including registration, diagnosis, prescription, payment and pharmacy”.
Interstitial HIT intervention	
HIT features	**Evidence of shared/common meanings across actors from our data**
Societal-Level HIT Affordance 3: Improve appointment distribution equality for patients (collective affordance for urban and rural patients)	
	Urban patients generally have the expertise to use the feature **P43** (public, urban): “*In the past, if obtaining a queue number was difficult, we then had to line up as early as approximately 4 am. **This [online registration system] ensures fairness. The time spent using the***

Book consultation slot online	***Internet is fair and ensures convenience****…. After obtaining a queue number online, you only need to organize your time and see a physician.*” **M17**: “*Maybe people living in urban areas use the online registration system more often than those in rural areas. The reason is that* ***they [urban people] have mastered this knowledge unlike others [rural people]***”
	Rural patients have less capability and awareness of this HIT initiative **P14** (public, rural): “*[The online registration system] is unfair. Many young boys and girls who know [about] this system can benefit from it. They can register all the numbers for specialists. If I take my grandma to the hospital in XX city and find that no queue number is left, then I will be very disappointed and angry.* ***This registration method only benefits people who live in urban areas. Online registration is only for people who know how to use it. They can use this method to obtain early queue numbers. I get late queue numbers because I do not know how to use it.*** *I feel that this situation is unfair. Those that are benefiting from the method are living in urban areas.*” **P13** (public, rural)*: “I used to take my mother to Beijing to see a physician. We spent 5,000 Chinese yuan to buy a queue number from a scalper. This situation hinders the use of [online registration].”* **M5**: “***A farmer does not use the system even if he has a computer. He has no chance of having this type of knowledge****. Going to the hospital directly would be beneficial for him.*” **P51** (public, rural): “*We* ***cannot use the self-registration system because we cannot read and write***.”
Societal-Level HIT Affordance 4: Reduce hospital administrative process difficulty for patients (shared affordance for urban and rural patients)	
Automate scheduling	**P48** (public, urban)*: “For example, if the* **big screen shows that the current queue number** *is 2 and my queue number is 8, then I can determine the number of patients ahead of me.”* **M3**: “*Through the system, who have and have not done the tests can be determined.* ***Patients do not need to only wait besides the facility but can check and determine their position in the queue [electronically]****. Our hospital is located in a country town and thus do not have such a system to date. Such a system is needed for higher-level hospitals, such as those located in the city. The number of patients needs to be large to generate benefits from such a system.*”
Self-service functions (such as viewing/printing test result and bill payment)	**P49** (public, urban)*: “[When obtaining] your test reports, the physicians may not be around, especially during noon. With this self-service [offered by the hospital IS], you can* ***obtain your test reports at any time****. This way is convenient.”* **P54** (public, rural)*: “When my (kidney) stone [test report] was produced, he [the physician] immediately asked me to go to the facility, saying ‘Madam, come and let me adjust and show you.’ Then, he* ***showed me the result from the computer****.”* **(P41/P42)** **P41** (public, urban)*: “Obtaining the test result usually takes half a day. At present, you can go to the* ***self-test retrieval machine to obtain the result by scanning the barcode.”*** **P42** (public, urban)*: “Having such a system is generally good. The benefits outweigh the costs.*”
Ruptural HIT intervention	
HIT features	**Evidence of shared/common meanings across actors from our data**
Societal-Level HIT Affordance 5: Reduce the need to acquire healthcare information from the hospital for patients (collective affordance for urban and rural patients)	
Storing and displaying health-related information online	**Some rural patients lack the mindset of searching healthcare information online** **P1** (public, rural)*: “I do not look at health-related information on the Internet. [Can helpful medical information be found on the Internet?]* ***I have never thought about that.*** *If my sickness is serious, then I will rush to the hospital instead of searching for solutions online.”* **P2** (public, rural)***:*** *“I also have* ***never thought about this****. But checking online information would be nice.”*
	Some urban patients have expertise in information seeking and knowledge on healthcare **P29** (public, urban)*: “The* ***papers that I search are scientific ones and related to my health condition****. They contain some core information on laser. My sickness came very fast, and I had delayed and unclear diagnosis. I have been given different kinds of antibiotics, including good and costly ones. I felt that I had*

	immune system disorder. Since then, I became conscious and paid close attention to my health. Knowledge obtained online is very helpful for me to communicate with physicians because it helps avoid numerous testing and discussion. It also hinders us from providing information that does not help with our disease, such as irrelevant symptoms." **P32** (public, urban): " ***I usually search on Baidu***. *A large amount of information is available. I sometimes try out the information found online. If it works, then I do not need to go to a clinic. If I cannot find specific symptoms, then I will go to the hospital.* " **P36** (public, urban)*: "Yes, I think online information is helpful.* ***My first choice is to go online to search for solutions*** *and then consult people around me. Thereafter, I will go to the hospital if I do not think I have what I want. The Internet is my first choice."* **P38** (public, urban)*: "**Online information can serve as a guide.** I will give the physician my typical symptoms to help him make the diagnosis. I usually browse diseases, such as diabetes and cerebral infarction, on Baidu. However, Baidu usually does not provide complete information. Thus, I still go to the hospital and maintain the medicine or the plan provided by the physician. I also seek the help of the physician in adjusting my insulin dose."*
	Some patients have basic skills of online information search but encounter difficulties in utilizing such information (feel overwhelmed, disapproved by offline physicians, feeling online information unreliable). **P7** (public, urban)*: "I once tried searching online. I* ***encountered a few problems and had no idea what to do****. I was overwhelmed with all the available posts online."* **P35** (public, urban)*: "I usually seek confirmation from my physician regarding the knowledge I gained online. If the physician says I should not do these things, then I would stop immediately. I consulted once. He laughed when I told him that I used the Internet to search for medical information. He said that* ***the information online does not apply to all because everyone has different situations****. My physician wants his treatment to be authoritative. He does not want me to use other methods. He disagrees with the hot packs and jumping ropes (treatments found online)."* **P11** (public, rural)*: "I do not think searching online for healthcare information is very useful. I feel that* ***most websites contain unreliable information****. If some diseases cannot be cured in hospitals, what more things can online platform provide? I do not browse the Internet for health information. If offline hospitals cannot do anything on certain diseases, then the chance online is more limited. Online resources have no credibility. A patient with serious illness has no other choice but to seek for a physical doctor."*
Societal-Level HIT Affordance 6: Reduce the need to physically travel to the hospital for patients (collective affordance for urban and rural patients)	
Making online consultation appoinments with physicians	**Rural patients generally have less awareness of this HIT initiative** **P25** (public, rural): "***I have not tried this technology*** *[online consultation] because I do not have Internet access."* **P3** (public, rural)*: "**I have not tried online consultation yet**. I feel this online consultation website [showed to me] is okay but not available in some places. I only know few people ask questions and browse health-related information on the Internet.* ***Nobody around me has tried this kind of application.****"*
	Patients' initial use experience is unsatisfactory and trust toward online healthcare consultation is low **P17** (public, rural)*: "I think this online consultation is* ***not as reliable as face-to-face consultation****."* **P18** (public, rural): "***I do not trust consultants online****. They do not seem to be real doctors. I talked to a physician through an online chat. The doctor only provided some general suggestions. I felt like he was not a doctor while talking with him. He provided incomplete information and recommended certain hospitals to visit. I think the website has an advertising nature. If he is a real doctor, then he will give you advice and teach you and not suggest things like that. I have tried the Internet two or three times but will not do it again."* **(P29, P31)** **P31** (public, urban)*: "I have tried online consultation with experts."* **P29** (public, urban)*: "**I do not think experts have time to answer patients' questions**."*

	P31 (public, urban)*: “If he is a good expert, I do not think he has the time to do online consultation.”* **P29** (public, urban)*: “**Real physicians do not have time for online consultation.**”* **P31** (public, urban)*: “Only some second-tier physicians can conduct online consultation. I think real experts are busy. If the physician is an expert in surgery, then he should be busy with operations. How can he have time to chat with you online?”* **P29** (public, urban)*: “I do not think physicians have time to be online.”* **P35** (public, urban)*: “I talked to an expert physician online. He described my symptoms and replied to me the next day. I do not remember what I asked. I think my question is related to gynecology. I was not satisfied with the replies I received because they provided only preliminary judgment. I still went to a hospital. **I think online consultation is unreliable.**”* **P41** (public, urban)*: “**Online consultation can be problematic** because you are only inputting your symptoms. By contrast, offline physicians ask every aspect related to the illness. I only provide the symptoms that I feel the strongest. I feel that offline physicians are more thorough and provide more accurate results than online consultants.”* **(P43-P44)** **P44** (public, urban)*: “I found through research that **80% of the questions are left unanswered during online consultation**.”* **P43** (public, urban)*: “I have never done online consultation.”* **P44** (public, urban)*: I have seen questions asked.* **P44** (public, urban)*: I believe those websites are run by people.* **P44** (public, urban)*: Some people ask way too simple questions.* **P44** (public, urban)*: **Online consultation has issue on confidentiality**.* **P44** (public, urban)*: I do not think online consultation is reliable.* **P44** (public, urban)*: I have never asked online because **I do not trust most websites**.* **P43** (public, urban)*: Only **vague and incomplete information can be provided in online consultation** because it does not have patients’ information, such as films.* **P43** (public, urban)*: Online consultants have **minimal information and provide inaccurate and ambiguous judgment**.*
	Patients feel that online consultation itself is not sufficient **(P28-P31)** **P28** (public, urban)*: “The reply from online physician is only one or two sentences. He also asks you to still consult offline.”* **P30** (public, urban)*: “Most consultants still suggest offline consultation.”* **P28** (public, urban)*: “**Offline consultation is still necessary**.”* **P31** (public, urban): ***“Offline consultation is necessary because online consultation has incomplete patients’ information**, such as various test results.**”*** **P29** (public, urban)*: “If they are good experts, then they will be very cautious. If you have reports not issued by their hospital, then they may still not believe them.”* **(P35-P36)** **P35** (public, urban)*: “**Most online consultations suggest going to the hospital by providing this information at the end of their reply.**”* **P36** (public, urban)*: “The conclusion is to go to the hospital.”* **P35** (public, urban)*: “If the online consultation thinks you have had such symptoms for a week or 3 months, then he will tell you which hospital to go and what help to seek.”* **P36** (public, urban)*: “**I have consulted online for a few times. They always suggest me to go to a hospital**. However, all I want to know is the severity of my symptoms. Then, I will decide whether to go to the hospital to have a comprehensive examination. They cannot suggest the best hospital. Thus, I stopped asking. Online consultation websites do not provide much information. However, I understand that some physicians cannot say anything casually if they are provided only a little evidence.”*