Teleconsultation Landscape of Class A Tertiary General Hospitals in China: Insights from a National Survey

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Submitted to: JMIR Formative Research
on: February 14, 2024

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Abstract

Background: Telemedicine has emerged as a potential solution to address the uneven distribution of medical resources. The extent to which Class A tertiary general hospitals in China offer teleconsultation services after the COVID-19 pandemic remains unclear, as does the teleconsultation volume of these hospitals and its associated factors.

Objective: To provide insights into the status of teleconsultations in Class A tertiary general hospitals in China.

Methods: Data related to Class A tertiary general hospitals in China were obtained via the Baidu search engine, hospital official WeChat accounts and applets from October 15, 2023, to January 15, 2024. Monthly teleconsultation volumes of the endocrinology department were collected for each hospital. We categorized the hospitals into three levels: Level 1 (hospitals with beds above 2500 or those ranking in the top 100), Level 2 (hospitals with beds between 1500 and 2500), and Level 3 (hospitals with beds below 1500). Differences among groups were assessed using Chi-square tests or a rank sum test. In the evaluation of associations of teleconsultation volume with hospital levels and charge levels, analysis stratified by city location (metropolitan or micropolitan) was also performed.

Results: A total of 688 Class A tertiary general hospitals were included in the study. Of these, 69.5% (478/688) offered teleconsultation services. The proportion of hospitals providing teleconsultation services correlated with the hospital level and city location (both P<.001). Among the 380 hospitals with listed teleconsultation charges, 95 provided free teleconsultation services. Of the 285 hospitals charging for teleconsultation, the median charge was ¥15.0 (CNY ¥1=US $0.1398; IQR ¥8.0-¥25.0). Hospitals located in metropolitan areas charged higher than those in micropolitan areas (¥15.5[IQR ¥10.0-¥25.0] vs. ¥9.6[IQR ¥6.0-¥22.0], P<.001). The median monthly teleconsultation volume of endocrinology departments was 21.0 (IQR 3.0-101.5). Teleconsultation volume decreased with lower hospital levels (Level 1 vs. Level 2 vs. Level 3, 77.0[IQR 18.5-246.0] vs. 16.0[IQR 3.0-38.8] vs. 4.0[IQR 0-34.5], P<.001). Hospitals in metropolitan areas had higher teleconsultation volumes than those in micropolitan areas (58.0 [IQR 9.5-220.0] vs 12.0 [IQR 0.25-35.8], P<.001). Teleconsultation volume increased with charge levels (free group vs low charge group vs. higher charge group, 10.5[1.0-32.8] vs. 21.0[3.0-112.5] vs. 62.0 [8.0-199.0], P<.001). Stratified analysis showed that, regardless of metropolitan or micropolitan location, teleconsultation volume increased with hospital level (all P<.001). In metropolitan hospitals, teleconsultation volume increased with charge level (P<.001), while in the micropolitan group, no association was found between teleconsultation volume and charge level (P=.60).

Conclusions: Most Class A tertiary general hospitals in China provide teleconsultation services, often at low or no cost.

However, our study highlights a relatively low teleconsultation volume, especially in smaller hospitals, those located in micropolitan areas, and those with low consultation charges. Further research is essential to address these challenges and facilitate the widespread adoption of telemedicine on a larger scale.

(JMIR Preprints 14/02/2024:57326)
DOI: https://doi.org/10.2196/preprints.57326

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Conclusions: Most Class A tertiary general hospitals in China provide teleconsultation services, often at low or no cost. However, our study highlights a relatively low teleconsultation volume, especially in smaller hospitals, those located in micropolitan areas, and those with low consultation charges. Further research is essential to address these challenges and facilitate the widespread adoption of telemedicine on a larger scale.

Keywords: China; Telemedicine; Survey; Teleconsultation; Tertiary hospital

Introduction

Despite 40 years of rapid economic development, China continues to face significant challenges related to limited medical resources in rural areas[1]. With the shortage of licensed doctors nationwide, there were only 1.56 village doctors and assistants per 1000 rural residents on duty in 2020[2]. The uneven ratio of patients to doctors hampers access to proper healthcare. Telemedicine

emerges as a potential solution to address the imbalanced distribution of medical resources. The World Health Organization (WHO) defines telemedicine as a medical service provided where distance is a critical factor, and medical service providers apply different communication technologies to overcome these distance-related issues[3]. The goal is to share information necessary for diagnosis, prevention, and therapy of disease[3]. Through telemedicine, patients can access a doctor while avoiding access barriers, such as clinic wait times, less travel time, and time off from work. Prior to the COVID-19 pandemic, telemedicine was explored to overcome access barriers and patient travel issues in remote and rural areas[4]. It proved effective in screening, diagnosing, managing, treating, and long-term follow-up of chronic diseases[5,6], showing potential for enhancing time efficiency and cost-effectiveness[7-9]. With the development of mobile internet and the popularization of mobile payments, China is vigorously developing telemedicine to tackle the shortage and inequality of medical resources. The first internet hospital in China was launched at the end of 2014[10]. Various policies have been issued to encourage and regulate telemedicine[11]. One study found that as of May 2019, there were 158 internet hospitals affiliated with different medical institutions in China[10].

The COVID-19 pandemic necessitated social distancing, leading to a decrease in in-person outpatient consultations[12]. To combat the epidemic, restrictions on telemedicine were temporarily lifted[13]. Consequently, telemedicine experienced a significant global surge in usage[14]. However, post-pandemic, people's willingness to use telemedicine rapidly declined[15]. Since that peak, there has been a decline in telemedicine use[10,16]. There are three different sponsors in China: government-led integration, hospital-led, and enterprise-led internet hospitals[17]. Chinese patients showed different intentions to use telemedicine delivered by different sponsorship types of Internet hospitals[18]. One study found that 52.9% of Chinese patients' intention to use telemedicine was provided by public hospital-sponsored Internet hospitals, higher than 26.6% for government-sponsored and 13.0% by enterprise-sponsored Internet hospitals[18]. This preference might be attributed to the high reputation and social responsibility of public hospitals, especially Class A Tertiary hospitals, which cater to a diverse patient population and offer advanced medical technology and sophisticated health services[7]. The Class A tertiary hospitals are the leading providers of telemedicine services. Therefore, investigation of the implementation of telemedicine in Class A tertiary hospitals can help to understand the development of telemedicine in China. Telemedicine encompasses various services, including teleconsultation, telepathology, telediagnosis, remote surgery, and tele-education, with teleconsultation being the dominant service type [19-21]. Most surveys of telemedicine use in China were conducted before or during the COVID-19 epidemic[20-22]. It remains unclear how many Class A Tertiary general hospitals in China offer teleconsultation services post-pandemic. The teleconsultation volume of each hospital can reflect the actual levels of adoption by patients. Yet the teleconsultation volume of these hospitals and its related factors post-pandemic remain unclear. The future of telemedicine post-pandemic is yet to be determined, making these data crucial for policymakers shaping telemedicine policies.

Objective: We aimed to provide insights into the status of teleconsultations in Class A tertiary general hospitals in China.

Methods

Data collection The list of Class A Tertiary general hospitals was obtained through a Baidu search. We verified the hospitals' titer on the hospital's official websites and the official website of the National Health Commission of the People's Republic of China. Specialized and traditional Chinese medicine hospitals were excluded. We searched hospital WeChat accounts and applets for online consultation, and if unavailable, checked the hospital's official website and Baidu to confirm the launch of an internet hospital. Hospital bed capacity and city location were confirmed through official sources. Teleconsultation charges were collected, with the highest charge for different professional titles selected if there was a variation. Since physicians specializing in treating chronic

diseases such as diabetes are most likely to practice telehealth today[12], and studies have shown that telemedicine is effective on self-management processes and glycemic control in patients with diabetes[23,24], we collected the monthly teleconsultation volume for each endocrinologist and aggregated the monthly consultation volume for each endocrinologist to represent the total visit volume of the department in a month. From October 15, 2023, to January 15, 2024, two researchers collected and cross-verified the data. The study was approved by the ethics committee of the affiliated Changsha Central Hospital, Hengyang Medical School, University of South China (ID: 2022-S0217).

Data Analysis Hospitals were categorized into three levels based on medical resources: Level 1 (beds above 2500, top 100 rankings) [25], Level 2 (beds between 1500 and 2500), and Level 3 (beds below 1500). According to the tier of the cities where the hospitals were located[26], the cities were divided into two groups: metropolitan (first and second-tier cities), and micropolitan (third-tier and below cities). Teleconsultation charge levels were grouped into free consultation, low charge (below the median), and higher charge (above the median). Q-Q plots were used to check the normality of all the continuous variables, which are expressed as the means (SDs) or medians (interquartile ranges [IQRs]) where appropriate. Categorical variables are expressed as percentages (numbers, n). Differences among groups were assessed using Chi-square tests or a rank sum test. In evaluating associations of tele-consultation volume with hospital levels and charge levels, analysis stratified by city location (metropolitan or metropolitan) was also performed. Statistical Package for the Social Sciences (SPSS) version 23.0 was used to analyze the collected data. Statistical significance was indicated by $P<.05$.

Results: A total of 688 Class A Tertiary general hospitals were identified, with 69.5% (478/688) offering teleconsultation services. The distribution of hospitals offering teleconsultation services is shown in Figure 1. Among teleconsultations, 97.3% (465/478) were delivered via WeChat public accounts or applets, and 2.7% (13/478) through independent mobile applications. All WeChat-based consultations were delivered via image-text, with only 26 hospitals offering video consultations and 17 providing telephone consultations. As shown in Table 1, hospitals with higher levels showed a higher proportion of offering teleconsultation services (Level 1 vs. Level 2 *vs.* Level 3, 87.2% 184/211 vs. 72.2% 177/245 vs. 50.4% 117/232, $P<.001$). Metropolitan hospitals had a higher proportion of offering teleconsultation services compared to micropolitan (79.6% 242/304 vs. 61.5% 236/384, $P<.001$)

Figure 1. The distribution of Class A tertiary general hospitals in China offering teleconsultation services.

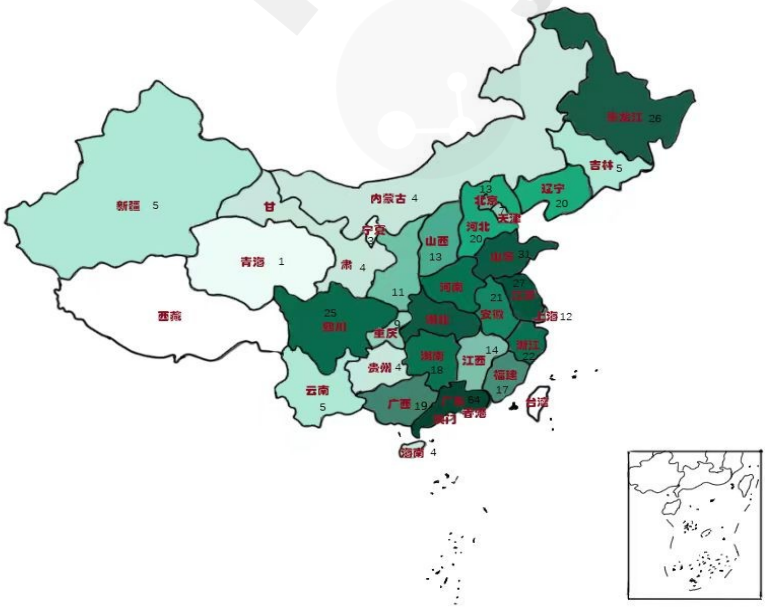

Table 1. Comparison of the proportion of hospitals providing teleconsultations among different groups.

Groups	Hospital (N=688), n (%)	Proportion, n (%)	*P*[a]
City level			*P*<.001
Metropolitan	304 (44.2)	242 (79.6)	
Micropolitan	384 (55.8)	236 (61.5)	
Hospital level			*P*<.001
Level 1	211 (30.7)	184 (87.2)	
Level 2	245 (35.6)	177 (72.2)	
Level 3	232 (33.7)	117 (50.4)	

[a] A Chi-square test was used to calculate the P values.

Of the 465 hospitals that provided teleconsultation services through WeChat public accounts or WeChat applets, 380 (81.7%) disclosed the charges for these services. Among them, 25.0% (95/380) offered teleconsultation services free of charge. The proportion of hospitals providing complimentary consultations was higher in smaller hospitals compared to larger ones (Level 1 vs. Level 2 vs. Level 3, 13.6% 20/147 vs. 29.9% 41/137 vs. 35.4% 34/96, *P*<.001) and higher in hospitals located in micropolitan areas than in metropolitan areas□36.0% 68/189 vs. 14.1% 27/191, *P*<.001). Of the 285 hospitals charged for teleconsultation, the median was ¥15.0 (CNY ¥1=US $0.1398; IQR ¥8.0-¥25.0). The majority (79.3%, 226/285) of hospitals did not impose charges for teleconsultation based on the doctors' professional titles. As shown in Table 2, hospitals located in metropolitan areas had higher charges compared to those in micropolitan areas (¥15.5 [IQR ¥10.0-¥25.0] vs. ¥9.6[IQR ¥6.0-¥22.0], *P*<.001). There was no significant correlation between teleconsultation charges and hospital levels (Level 1 vs. Level 2 vs. Level 3, ¥15.0 [IQR ¥8.0-¥25] vs. ¥15.0[IQR ¥8.0-¥30] vs. ¥12.0[IQR ¥7.0-¥25.0], *P*=.19).

Table 2. Comparison of the teleconsultation charges among different groups.

Groups	Hospital (N=285), n (%)	Teleconsultation charge, median (IQR[a])	*P*[b]
City level			P<.001
Metropolitan	164 (57.5)	¥[c]15.5 (IQR ¥10.0-¥25.0)	
Micropolitan	121 (42.5)	¥9.6 (IQR ¥6.0-¥22.0)	
Hospital level			*P*=.29
Level 1	127 (44.6)	¥15.0 (IQR ¥8.0-¥25.0)	
Level 2	96 (33.7)	¥15.0 (IQR ¥8.0-¥30.0)	
Level 3	62 (21.8)	¥12.0 (IQR ¥7.0-¥25.0)	

[a]IQR: interquartile range.

[b]A rank sum test was used to calculate *P* values.

[c]CNY ¥1=US $0.1398.

Of the total 465 hospitals, 64.7% (301/465) reported the teleconsultation volume for each doctor. The monthly teleconsultation volume was collected for a total of 2485 endocrinologists across all hospitals. The median number of doctors offering teleconsultations in the endocrinology department

of each hospital was 8.0 (IQR 4.0-11.0). The median monthly teleconsultation volume for endocrinology departments was 21.0 (IQR 3.0-101.5). As shown in Table 3, the teleconsultation volume decreased with lower hospital levels (Level 1 vs. Level 2 vs. Level 3, 77.0[IQR 18.5-246.0] vs. 16.0[IQR 3.0-38.8] vs. 4.0[IQR 0-34.5], *P*<.001). Hospitals located in metropolitan areas had a higher teleconsultation volume compared to those in micropolitan areas (58.0 [IQR 9.5-220.0] vs 12.0 [IQR 0.25-35.8], *P*<.001). Teleconsultation volume increased with charge level (free group vs. low charge group vs. higher charge group, 10.5[1.0-32.8] vs. 21.0[3.0-112.5] vs. 62.0 [8.0-199.0], *P*<.001). Stratification by city location revealed that, whether in metropolitan or micropolitan areas, teleconsultation volume increased with hospital level (both *P*<.001) (Table 4). In hospitals located in metropolitan areas, teleconsultation volume increased with charge level (*P*<.001). However, in the micropolitan group, no association was found between teleconsultation volume and charge level (*P*=0.60).

Table 3. Comparison of the monthly teleconsultation volume among different groups.

Variables		Hospital, n (%)	Teleconsultation volume, median (IQR[a])	*P*[b]
City level	Metropolitan	145 (48.2)	58.0 (9.5-220.0)	<.001
	Micropolitan	156 (51.8)	12.0 (0.25-35.8)	
Hospital level	Level 1	105 (34.9)	77.0 (18.5-246.0)	<.001
	Level 2	114 (37.9)	16.0 (3.0-38.8)	
	Level 3	82 (27.2)	4.0 (0.0-34.5)	
Charge level[c]	Free charge	74 (25.6)	10.5 (1.0-32.8)	<.001
	Low charge	114 (39.4)	21.0 (3.0-112.5)	
	Higher charge	101 (35.0)	62.0 (8.0-199.0)	

[a]IQR: interquartile range.

[b]A rank sum test was used to calculate *P* values.

[c]12 samples with missing data on charge level were excluded from the analysis.

Table 4. Comparison of the monthly teleconsultation volume among different groups stratified by city location.

Groups	Hospital, n (%)	Teleconsultation volume, median (IQR[a])	*P*[b]
Metropolitan			<.001
Level 1 hospital	63 (43.4)	141.0(55.0-350.0)	
Level 2 hospital	49 (33.8)	21.0(4.0-92.0)	
Level 3 hospital	33 (22.8)	12.0(2.0-103.0	
Micropolitan			<.001
Level 1 hospital	42 (26.9)	26.5 (6.3-135.3)	
Level 2 hospital	65 (41.7)	14.0 (3.0-25.6)	
Level 3 hospital	49 (31.4)	2.0 (0.0-15.0)	
Metropolitan[c]			<.001
Free charge	22 (15.7)	10.5 (1.5-26.0)	
Low charge	53 (37.9)	64.0 (11.0-214.0)	
Higher charge	65 (46.4)	96.0 (26.0-311.0)	
Micropolitan[d]			.60
Free charge	52 (34.9)	10.0 (1.0-34.3)	
Low charge	61 (40.9)	13.0 (0.0-34.0)	
Higher charge	36 (24.2)	11.5 (3.0-61.0)	

[a] IQR: interquartile range.
[b] A rank sum test was used to calculate P values.
[c]5 samples with missing data on charge level were excluded from the analysis.
[d]7 samples with missing data on charge level were excluded from the analysis.

Discussion: Our investigation reveals that a majority of Class A tertiary general hospitals in China offer teleconsultation services. Telemedicine has assumed a pivotal role in the battle against COVID-19 in China, showing its significance not only during the pandemic but also as a vital resource for future infectious outbreaks[27,28]. Notably, hospitals in economically developed cities exhibit a higher prevalence of teleconsultation services, likely influenced by factors such as local telemedicine policies and economic capacity. Moreover, higher-tier hospitals are more inclined to offer teleconsultation services. According to China's policy, hospitals need to obtain qualifications to offer telemedicine[17]. Implementing telemedicine demands substantial human and financial resources, with the cost of establishing such services reaching up to $256,000, as indicated by a study[29]. Larger hospitals, especially those in metropolitan cities, are better equipped to undertake telemedicine initiatives and are more likely to secure government authorization for such services. Given that high-quality medical resources are concentrated in these large metropolitan hospitals, extending telemedicine services from these hubs can significantly benefit patients in remote areas, granting them access to superior medical care.

While many hospitals, particularly smaller establishments and those in less economically developed cities, extend complimentary teleconsultation services, most hospitals providing paid teleconsultations offer these services at a nominal fee, often lower than standard outpatient consultation charges. The consultation fee tends to be associated with the city's development level rather than the size of the hospital. This may be attributed to the uniform pricing of teleconsultation services by the government within the same city, with charge levels potentially tied to the income levels of residents. The charge level was lower than a previous study in 2017, which showed that the median consultation fee per time in internet hospitals in China was ¥20[30]. The potential explanation is that the internet hospitals in the previous study were predominantly sponsored by internet enterprises, and the consultation price can be set by the doctors themselves[30].

Our study also highlights that, despite the high prevalence of hospitals offering teleconsultation services, the actual visit volume remains relatively low. Approximately half of the endocrinology departments recorded an average monthly teleconsultation volume of less than 21. To enable large-scale implementation of telemedicine, multiple challenges must be addressed [14], especially considering the decline in patient’s willingness to continue with telemedicine beyond the pandemic [31]. A Case Study of an internet hospital in China showed that most patients returned to offline treatment after the COVID-19 pandemic[10]. From the aspect of patients, barriers to the use of telemedicine include lack of access to internet services, low level of digital literacy, low income, confidentiality concerns, age, and health insurance coverage, et al[2,32,33]. From the aspect of hospital, factors influencing the service volume at each hospital include available funding, management competency, and the number of professional staff[19]. Some doctors think that medical safety can’t be guaranteed because physical examinations can’t be done in telemedicine[34], and they are concerned that personal connection through telehealth was inferior to office visits[12,35]. Our findings indicate that most hospitals in China primarily employ text-image teleconsultations, potentially proving insufficient for managing complex patient conditions. The effectiveness of this type of teleconsultation needs further investigation. Similar concerns have been voiced by other doctors as well[35] [36]. Margaret et al. found that patients using telemedicine alone had inferior glycemic outcomes compared to in-person or mixed care[37]. Therefore, we should do more research to explore the most effective mode of telemedicine. Policymakers and stakeholders should not only facilitate the implementation of telemedicine but also recognize and tackle drawbacks to maximize the likelihood of use success[5].

Our study reveals that teleconsultation volumes are higher in larger and more prestigious hospitals.

This may be attributed to top-tier hospitals' superior medical resources and reputation, instilling greater trust among patients. Additionally, hospitals in more developed cities exhibit higher teleconsultation volumes, aligning with findings from a U.S. study associating metropolitan locations with increased telemedicine usage.[38]. Our study found that more hospitals in metropolitan offer telemedicine services; thus the patients might have a higher awareness of telemedicine. Furthermore, patients in metropolitan may have higher levels of digital literacy and higher income. They choose remote healthcare more often in order to avoid time off from work or clinic wait times.

Interestingly, higher consultation charges correlate with increased visit volumes in metropolitan areas, while no such significant correlation is observed in micropolitan areas. This discrepancy may arise from generally low teleconsultation charges, with higher charges in metropolitan areas still within acceptable ranges for patients. One study has shown that response load did not affect patient satisfaction with free telemedicine service; However, it significantly reduced patient satisfaction with paid telemedicine services, suggesting that patients hold higher expectations for the quality of paid consultations.[39]. Cui et al.'s study has found that charging for consultation services could improve the teleconsultation effect[20]. Inadequate reimbursement for services may affect the enthusiasm of doctors and the impacts of teleconsultations, thereby affecting patient satisfaction. Moreover, most hospitals do not charge for teleconsultation according to professional titles, and the labor value of doctors may not be fully reflected. Nevertheless, there is controversy regarding the appropriate pricing for telemedicine, with some expressing concerns that its implementation may lead to an increase in overall medical expenses[40]. As such, further research is warranted to explore the intricate relationship between teleconsultation charges, service quality, medical costs, and patient satisfaction. However, there may also be other confounding factors. The relationship between teleconsultation charges and consultation volume needs further investigation.

Strength and Limitations: To our knowledge, our study was among the first to investigate the status of teleconsultation in Class A tertiary general hospitals nationwide after the COVID-19 pandemic. Previous research on the usage of telemedicine in China often failed to explore the actual consultation volume[21,30], which is a crucial indicator of the real activity of teleconsultation. Unlike previous studies, our research focused on Class A tertiary hospitals, which possess high-quality medical resources. Conducting teleconsultations in these hospitals is beneficial for patients in remote areas to access high-quality medical services. Our study also examined the forms of teleconsultation, the charges associated with it, and explored the differences in teleconsultation services among hospitals of different levels and regions. Furthermore, we investigated the relationship between teleconsultation volume and hospital levels, urban development levels, and consultation charges. Our study should provide meaningful value for policymakers and stakeholders to develop future telemedicine strategies.

However, our study had several limitations. Despite our efforts to collect data from the majority of Class A tertiary general hospitals, a small fraction may have been inadvertently omitted. Additionally, our investigation focused on hospitals with available visit records, potentially overlooking those without such records. The representation of visit volume through the endocrinology department may not be universally applicable, as some hospitals may offer teleconsultations in different departments, necessitating further investigation.

Conclusions In the post-COVID-19 epidemic era, most Class A tertiary general hospitals in China offer teleconsultation services, often at low or no cost. However, our study highlights a relatively low teleconsultation volume, especially in smaller hospitals, those located in micropolitan areas and those with low consultation charges. Further research is imperative to address these challenges and facilitate the widespread adoption of telemedicine on a larger scale.

Acknowledgments

This work was supported by the Clinical Technology Innovation Guidance Project of Department of Science and Technology, Hunan Province (number 2020SK53302) and the Natural Science

Foundation of Hunan Province (number 2023JJ70020).

Conflicts of Interest

None declared.

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Supplementary Files

Figures

The distribution of Class A tertiary general hospitals in China offering teleconsultation services.