Understanding patient choice of health care facilities in China

Yun Liu

刘蕴

ISBN: 978-94-6423-266-0

Printed by: ProefschriftMaken || www.proefschriftmaken.nl

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Patientkeuze tussen zorgorganisaties in China

Thesis

to obtain the degree of Doctor from the
Erasmus University Rotterdam
by command of the
rector magnificus

Prof.dr. F.A. van der Duijn Schouten

and in accordance with the decision of the Doctorate Board.
The public defence shall be held on

Thursday 24 June 2021
at 10.30 hrs

by

Yun Liu
born in Beijing, China.

Erasmus University Rotterdam

Doctoral Committee:

Promotor: prof.dr. J.J. van de Klundert

Other members: prof.dr. J.M. Cramm

prof.dr. N.J.A. van Exel

prof.dr. Q. Meng

Copromotor: dr. Q. Kong

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Chapter 1

General introduction

Kai lives in Shanghai. His home is in a community called Yunhui residential community in the Mingcheng district, which is located 10km away from the city center. He had unusual fatigue and lost appetite for more than three days. He decided it was the time to visit the doctor the next day in the morning to have a check-up. He has three optional health care facilities for the visit: (1) Yunhui Community Health Center next to his place; (2) Mingcheng District Hospital which is 10 minutes' drive from his place; (3) Jianghe Tertiary Hospital nearby the city center which takes 30 minutes to drive during non-rush hours. He decided to visit Jianghe Tertiary Hospital, as he was quite anxious about the problem and found the tertiary hospital most capable to handle it. After the visit, Kai described his journey in the hospital on that day as below.

5:30 AM Kai got up early aiming to avoid the queue and to ensure an appointment with an expert on the same day, then he drove to Jianghe Tertiary hospital.

6:30 AM He quickly drove to the hospital in the early morning but was disappointed to lose 15 minutes in the parking just to find a place. After walking to the hospital entrance, Kai discovered that there was already a long queue of patients waiting for registration outside of the hospital. He had no other option than to join the queue and wait outside at dawn.

7:30 AM The queue had slowly brought him into the hospital and towards the registration desk. Now it was his turn. He was told to visit Doctor Xia, who was an expert level doctor at the department of endocrinology. The appointment was arranged for the same day and he went to the department immediately and started waiting outside of Doctor Xia's office.

9:30 AM Kai met Doctor Xia for a first consult. Doctor Xia asked some questions and made a few quick checks in 5 minutes, then asked Kai to take two lab tests. But he needed to pay for the tests first. Kai went to the payment desk.

10:00 AM After waiting in the queue for payment, Kai came to the department for the first test on the 9th floor, and again had to join a queue. After the first test, he had to go to the second test on 6th floor.

12:00 AM After finishing both tests and collecting the results, Kai went back to Doctor Xia for a second consult. Doctor Xia checked the test results, prescribed medicines, and made an appointment for a second visit in two weeks, all in less than 5 minutes. Kai finished the doctor visit and went to the hospital pharmacy to pay for the prescription and waited in a queue to receive the medication Dr Xia had prescribed.

1:00 AM Kai completed the visit and went back home.

The above story illustrates a typical trajectory of a patient visit in China, including the patient's choice among different levels of health care facilities and the patient journey experienced in a tertiary hospital. Why didn't Kai choose the nearby community health center (CHC), given that the symptoms were not too severe? Can such facility choice decisions be improved so that the system works more efficiently? What would be needed to make that happen? These are the types of questions that have motivated this thesis, which studies patient choice of health care facilities in China. Moreover, the thesis studies possible improvements to especially the primary care facilities which can redirect patient flow so that patients with severe conditions who really need tertiary care can be attended timely and as extensively as necessary.

The hospital and primary care system in China

China has a three-tier health system, which includes tertiary hospitals, secondary hospitals, and primary care facilities such as CHCs and township health centers [1]. The nationwide primary care system has rural and urban components, and each component has two tiers [2]. In rural areas for example, township health centers serve as the main providers of primary care supported by village clinics which provide the daily consultations for minor health complaints in satellite villages [2]. Until 2009 the system could be characterized as hospital-centered, and lacked a solid basis of primary care as a gateway to an integrated health system [3]. Since 2009, a new reform agenda has been implemented, in which the development of a strong primary care system is the key strategy [2]. Great efforts have been made by the government to improve the infrastructures and workforce in primary care facilities. The subsidies to primary care facilities increased tenfold from 2008 to 2018 [2].

Over 96% of the population in China are covered by social health insurance by the end of 2018 [4]. However, this insurance has limited coverage for primary care and for out-patient care [5]. With few exceptions, patients have the freedom to choose any level of health care facilities, as policy does not restrict access in level or place [5]. For example, patients from rural area can directly access tertiary facilities in urban areas. In addition, the difference in reimbursement rates for outpatient care between hospital care and primary care is small [3,5]. Patients tend to bypass primary care and directly choose hospital care for common primary care services [3].

Primary care is essential health care made universally accessible to all individuals, and it should work as the central function and the core of building an integrated health system [6]. Primary care providers bear the responsibilities of addressing main health problems in the community, and risk assessment on any underlying condition and referring appropriately when necessary [6,7]. However, directly accessing hospital care and bypassing primary care is reported frequently in literature in low- and middle-income countries including China, and it may lead to excessive costs, reduce equity, and hamper the development of an integrated care system [6,8].

Choice of health care facility

As illustrated by the story of Kai, patients may easily choose to visit higher level hospitals even when perceiving minor health issues [5]. Congestion in higher level hospitals is therefore widespread and known under the saying “long waits but short visit”. In 2018, the visits at primary care facilities account for 53% of the total outpatient visits in China, which declined from 62% of the total outpatient visits in 2010 [2]. Despite the multiple interventions implemented as part of the 2009 health care reforms, and subsequent reforms to strengthen the primary care system [2], the desired effect of shifting patient flow to primary care is yet to be seen [9]. Evidence has shown that the poor primary care system results in compromised health outcomes of the population and in unfavorable cost consequences [2], for example, the poor control of cardiovascular risk factors in primary care facilities [10].

These undesirable consequences call for a further analysis and understanding of the limited effectiveness of the reforms. Existing literature identifies various factors, such as the medical skills of the primary care workforce and the medical equipment available in primary care facilities [2]. Apparently, however, the patient perspective has not been effectively captured or addressed. A comprehensive scientific exploration and analysis to understand the health seeking behavior of patients, and more specifically the trade-offs between primary care and higher-level facilities have thus far not been conducted.

Study motivation and research questions

This thesis investigates the factors influencing patients’ choice of health care facilities in China. It investigates how these factors impact facility choice and the importance of the factors. In addition, it links this understanding to policy measures, with the objective to inform health reform designs which promote effective primary care.

The overall objective of this dissertation is to advance the scientific understanding of patient choice of health care facility levels in China. The following questions guided the research:

1. What are the factors influencing patient's health facility choice in China?
2. What is the process of decision making in which these factors are considered in rural and urban China?
3. Which facility attributes are considered by patients for first visits under different perceived disease severities and what is the importance of each of these factors, in rural and urban China?
4. How do patient choice and visit time interact? How do the interventions to improve primary care facilities influence visit time and facility choice in view of such interaction?

The next section presents the chapters of this thesis that answer these research questions.

Outline of this dissertation

Chapter 2

The first research question was addressed by a systematic review synthesizing the scientific literature on the factors affecting patient choice of health system access level in China. The specific aims were to identify the factors, to establish an evidence base for the effectiveness of the factors, and to inform policy measures which aim to direct patient flow towards lower-level facilities. To these purposes, we conducted a narrative synthesis to accommodate the heterogeneity of the included articles. We distinguished four evidence types: a revealed factor for a revealed choice, a stated factor for a revealed choice, a stated factor for a stated choice, and a revealed factor for a stated choice. We provide further insight into the workings of each factor by identifying whether it positively or negatively affected choice for a certain level. The review included 45 studies of patient facility access published in English or Chinese between 2009 and 2016. The work in this chapter has been published in Plos One [11].

Chapter 3

To answer the second research question, i.e., to understand the choice process of health care facilities and how the factors identified from Chapter 2 influence the facilities choices, we conducted eight semi-structured focus group discussions among the general population and the chronically ill in a rural area of Chongqing and an urban of Shanghai. The discussions consisted of two parts: (1) in the first part, the respondents were asked how they choose healthcare facilities and what factors they consider when seeking health service; (2) in the second part, the researchers checked the answers from question (1) against a list of factors obtained from Chapter 2. If certain factors were not mentioned by the respondents, the researchers asked if those factors also influence their choices, and if so, how these factors influence the choices. We identified a four-stage choice process. Moreover, we found that the processes and factors considered differed between the rural and urban populations and between the general population and the population of chronically ill patients. This chapter appears as a publication in BMJ Global Health [12].

Chapter 4

In pursuit of the answers to research question 3, Chapter 4 and Chapter 5 report on two discrete choice experiments (DCEs) carried out to elicit the quantified effects of the factors influencing the choices of health care facilities by the Chinese population. One experiment was conducted in a rural area of Chongqing, and the other DCE was conducted in an urban area of Shanghai. We used a Bayesian efficient design to construct the choice sets and each of the questionnaires contained 12 choice questions. Each question was assigned a hypothetical perceived severity scenario of either minor or severe disease and the questionnaires were administered by interviewers especially trained for this purpose. We used mixed logit models to analyze the choice data. We calculated the relative importance of each attribute and the predicted choice probabilities of each of the facilities and of opting out. We also analyzed the choice heterogeneity among the study population. Chapter 4 reports on the rural DCE and has been published in Social Science & Medicine [13].

Chapter 5

A second DCE was carried out in an urban area in China using the methods as described in Chapter 4. In addition to the relative importance of each attribute and the predicted choice probabilities of any facility over opting out, we also calculated the relative probabilities of choosing a CHC versus a secondary hospital or a tertiary hospital. These relative choice probabilities were determined for a reference CHC and for CHCs with more advanced equipment and better skilled doctors, as might result from policy interventions to improve primary care. In comparison to Chapter 4, Chapter 5 further advances the analysis to address research question 4. The work in this chapter was published in Health Policy & Planning [14].

Chapter 6

Visit time is found to be one of the attributes that influence choice probability of in previous chapters. In Chapter 6, we propose and explore a bidirectional relationship between visit time and choice probability, instead of considering visit time as a factor which unidirectionally influences patient choice. For instance, if the choice probability of a CHC increases, more patients arrive and queue up, thus increasing the visit time and in turn diminishing the choice probability. We developed a model which combines the discrete choice model with a queuing model to advance the understanding of this bidirectional relationship and to provide more accurate evidence than the previous DCEs to inform policy. The model was established on the findings from the urban DCE (Chapter 5), as tertiary hospitals are concentrated in urban areas and urban residents are particularly likely to prefer tertiary level facilities. We carried out intervention analyses with the combined model to assess the effects of improving primary care on choice probability and visit time. The work in this chapter has been submitted for publication.

Chapter 7

Chapter 7 is the general discussion which concludes our main findings. It provides answers to our research questions and reflections on the practical relevance of our research.

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Chapter 2

Factors influencing choice of health system access level in China: A systematic review

This chapter was published as:

Liu Y, Kong Q, Yuan S, van de Klundert J. 2018. Factors influencing choice of health system access level in China – A systematic review. PLoS ONE 13: e0201887.

Abstract

Objective: In China, patients increasingly choose to access already severely overcrowded higher-level hospitals, whereas the lower-level facilities often have low utilization rates. This situation undermines effectiveness and efficiency of the health system. Moreover, the situation tends to worsen despite policy measures aimed at improvement. We systematically review the factors affecting patient choice of health system access in China to synthesize scientific understanding. The review provides an evidence base for measures to redirect patient flow towards lower-level facilities, thus improving effectiveness and efficiency of the Chinese health system.

Methods: Peer-reviewed literature published from April 2009 to January 2016 that investigate Chinese patients' choice of health care facilities at different levels were screened and assessed. A total of 44 studies were included. Two structured forms were used to extract data regarding the study characteristics, methodology, and factors.

Results: The results identified four types of factors related to 1) patient, 2) provider, 3) context and 4) combinations of factors from multiple types. Patient factors are mentioned most, but the evidence on patient factors is mostly inconclusive. Evidence suggests that the provider factors drug variety and equipment, and composite factor perceived quality, "push" patients from lower levels towards higher levels.

Conclusion: The underuse of primary care facilities and overcrowding of higher-level facilities which are presently negatively impacting the effectiveness and efficiency of the Chinese health system, are likely to be amplified by current demographic trends. Evidence suggests that improving the drug availability, equipment and perceived quality of primary care services can improve the situation. Well-designed

experimental research, which considers interactions between factors, is called for to better inform future interventions.

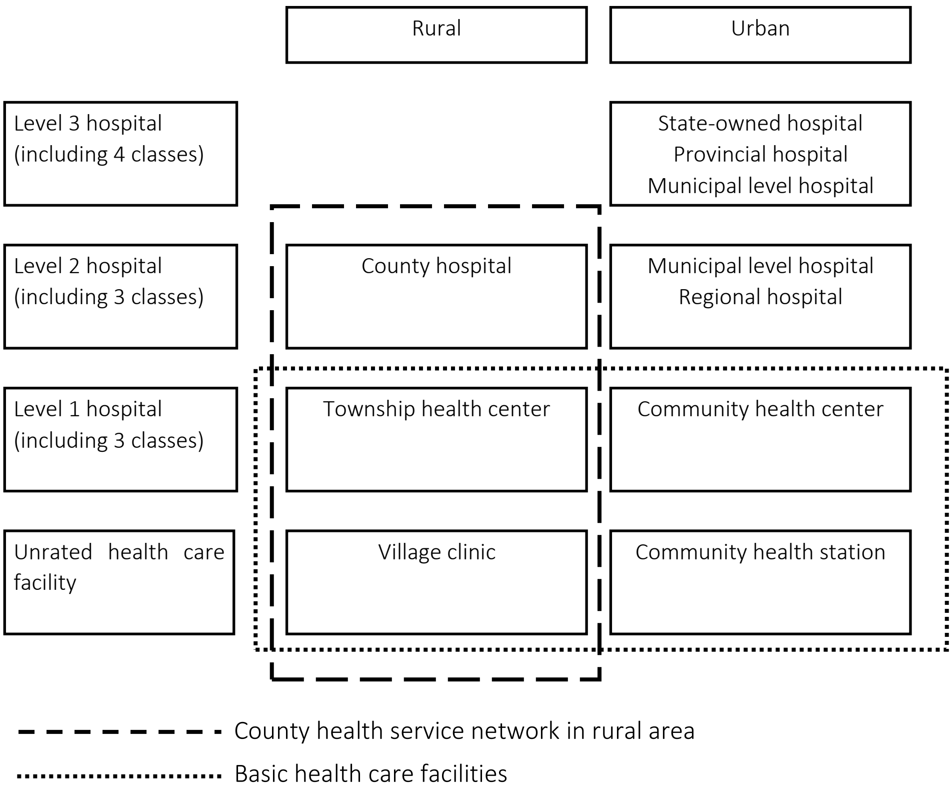
Introduction

Since the turn of the millennium, the Chinese government has made unprecedented investments to improve its health system. Government spending on health care has grown tenfold to a total budget of 1,243 billion RMB in 2016 [1]. The number of hospitals had increased to 29,000 and the number of primary care facilities had reached 930,000 by November 2016 [2]. The supply side growth, however, continues to be outpaced by the growth in demand, particularly for higher level hospitals [3]. The resulting crowding in higher level hospitals and low utilization of primary care facilities undermine the effectiveness and efficiency of the health system [4-6]. In this manuscript we review scientific evidence on factors influencing patient choice of health care access level, as a step towards developing evidence-based interventions to redirect patient flow, and to improve the efficiency and effectiveness of China's health system.

In the Chinese health system, hospitals are defined as "medical institutions having more than 20 beds", and are distinguished into "3 levels and 10 classes of hospital system" [7,8] as shown in Fig 1. In rural areas, grass roots primary care and public health services are offered by township health centers (THCs) and village clinics. These services are provided by community health centers (CHCs) and community health stations in urban areas [5,9]. Lacking a gatekeeping mechanism, patients in China can directly access hospitals of all levels [10].

In the first 11 months of 2016, the number of primary care visits decreased by 0.6% to 3.93 billion [11], thus sustaining the low utilization rates of lower level facilities [6]. Over the same period, the number of hospital visits increased by 5.6% compared to 2015, to a total of 2.89 billion [11]. Moreover, patients in China increasingly access the health system at level 2 and 3 hospitals [3]. This has particularly resulted in overcrowding of level 3 hospitals, as further illustrated by the "three longs and one short" phenomenon [12]: long waiting time for registration, long waiting time to prepay the charges, long waiting time for the doctor's appointment, but a short appointment time itself. This situation has generated great patient discontent [13] and caused deteriorating patient-doctor relationship [14].

Fig 1. The 3- level hospital system plus primary care facilities



The situation and the corresponding effectiveness and efficiency challenges may become more significant as increased welfare, expanded health insurance coverage, rapid urbanization, and aging of the population are likely to cause further growth in demand for high quality health services [15,16]. In order to develop towards a sustainable, cost-effective health system, ongoing Chinese health system reforms target to redirect patient flow towards primary care. Example reforms have been the introduction of gradient reimbursement schemes and competence building of primary care service providers [4,17].

Given the present problems and challenges, which are likely to be further amplified by future societal developments, it is of considerable societal importance to implement effective interventions to improve the situation. Unfortunately, scientific understanding of the effectiveness of such interventions in the Chinese context is limited [11-13]. In addition, given that the general population are free to choose health care facilities without being restricted by a gatekeeping role [10], a better understanding of the nature of the health-seeking behavior is important for implementing effective interventions to redirect patient flow. Thus, it is essential to investigate the factors that drive the choice, as a first step to understand the aforementioned health-seeking behavior. Some recent research has indeed started to advance systematic understanding of such behavior in China through empirical studies [18,19] and theoretical models considering patient, provider and contextual factors [20-22]. However, a study that provides a comprehensive review of evidence on these factors is lacking. We present a systematic review of the evidence on the factors influencing health system access level choice, embedded in existing theoretical models considering patient, provider and contextual factors, so as to advance scientific understanding and contribute to developing evidence-based interventions.

Methods

We conducted this systematic review in accordance with National Health Service Centre for Reviews and Dissemination Guidance for undertaking reviews in health care [23]. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [24] was used for reporting this review.

Searching strategy

Literature search was conducted using Embase, Medline, Web of Science, and PubMed for English language articles, and using the China National Knowledge Infrastructure (CNKI) for articles in Chinese. The search strategy aimed to identify articles that investigated Chinese patients' choice of health care access levels between April 2009 and January 2016, as the new round of health reform which started in April 2009 [4] brought considerable change. The detailed search strategies (see online Appendix S1) were executed in January 2016 by a medical librarian and the first author.

Study selection

The following inclusion criteria were applied during study selection:

(1) Primary empirical studies; (2) research aimed at identifying factors that influence patients' choice of health care facility access level, and how these factors affect the choice of level; (3) including data collected after April of 2009; (4) study population is Chinese residents; (5) written in English or Chinese language; (6) published in a peer-reviewed journal.

The screening of each record was conducted by two authors (YL and another author, either QK or SY) independently. The first round of study selection was to screen titles and abstracts of primarily identified articles based on the inclusion criteria. In case of disagreement between reviewers, the articles were included to the second level for further examination. In the second round, the full text of each remaining article was assessed for eligibility using the inclusion criteria. In the second step, discrepancies were discussed until consensus of selection was reached. In this step, we found twice that two articles used the same data. For both these cases, we combined the findings and present them under the earliest included article in the results (reducing the number of studies from 46 to 44).

Data extraction

We developed a first form to extract the characteristics of each study, and a second form to extract findings regarding factors in each study. The factors were further labelled by types (patient, provider and context factors). Moreover, we allowed introducing new factor types in addition to the existing ones. When including studies that have considered patient choice with respect to provider facilities rather than the level of the provider facilities, we considered the facility level only.

Some of the included studies use qualitative methods, others use quantitative methods, and a third subset of included studies uses mixed methods. We have therefore conducted a narrative synthesis, which is a systematic review methodology that appropriately accommodates this methodological heterogeneity among the included articles [23]. For the quantitative results, we only extract the information regarding associations reported as significant.

For each of the factors and choices reported, we extracted whether they were stated (e.g., via interviews) or revealed (e.g., via actual visits), as revealed factors and choices may be considered to provide stronger evidence than stated factors and choices [25]. In addition, we provide further insight into the workings of each factor by identifying whether it positively or negatively affected choice for a certain level. To this purpose, we speak of attraction when a factor is positively associated with choice for a certain level, and of repulsion when the association is negative.

Quality assessment

We appraised the methodological quality of the studies using the validated and widely used Method Appraisal Tool (MMAT) [26,27]. This tool has four specific criteria for each study type. The overall quality score of each article is presented by the number of criteria it meets [28].

2

Results

Characteristics of the included studies and quality assessment

As shown in Fig 2, a total of 10,379 records were initially retrieved. After removal of duplicates and application of the inclusion criteria, a final set of 44 articles remained [21,22,29-70]. The basic information of these articles and the results from the quality assessment are shown in Table 1.

Fig 2. PRISMA 2009 Flow Diagram

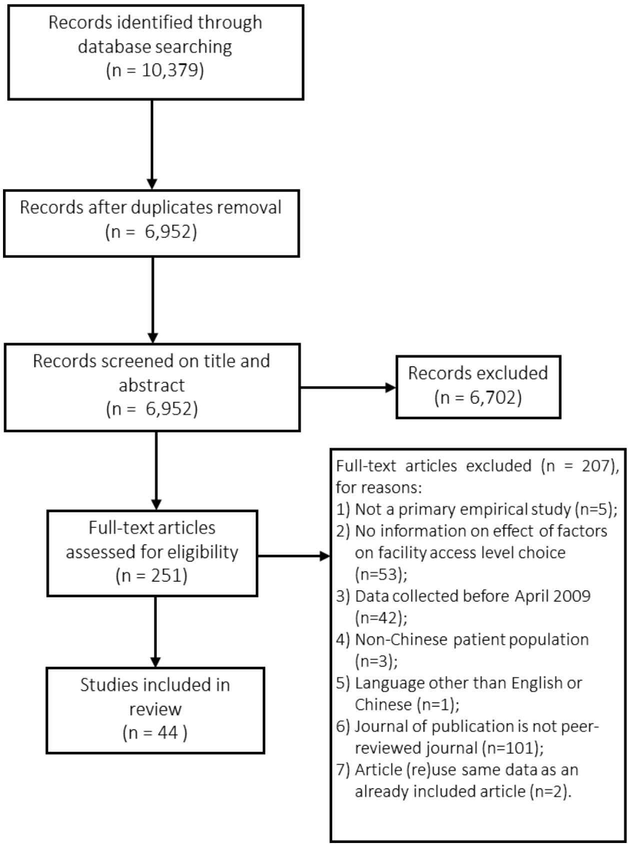


Table 1. Overview of included studies.

Study	Study design	Data collection method, respondents[a], sample site, and sample size	Study quality[b]	Evidence revealed or stated[c]
Cheng et al. 2015 [50]	Cross-sectional study using mixed methods	Interview. Respondents: P, O. Sample site: NA. Sample size: 1,917 Individuals.	**	SR
Jing et al. 2015 [30]	Longitudinal study using mixed methods	Patient registration data, questionnaire, focus group interview, literature review. Respondents: P, O. Sample site: Shanghai. Sample size: Registration data; questionnaires from 314 individuals; interview on 80 individuals.	**	RR
Jing et al. 2015 [31]	Cross-sectional study	Questionnaire. Respondents: P. Sample site: Shanghai. Sample size: 1,200 individuals.	****	SS, SR
Kuang et al. 2015 [62]	Cross-sectional study	Survey including PCAT questions. Respondents: P. Sample site: Guangdong. Sample size: 1,645 individuals.	***	RR
Liu et al. 2014 [63]	Longitudinal study	Survey. Respondents: P. Sample site: Sichuan. Sample size: 976 individuals.	***	RR
Tang 2012 [64]	Cross-sectional study	Residence household survey. Respondents: O. Sample site: Nationwide. Sample size: 4,853 individuals.	***	RR
Zeng et al. 2015 [65]	Cross-sectional study	Survey. Respondents: O. Sample site: Guangdong. Sample size: 736 individuals.	****	SR
Zhou 2014 [51]	Cross-sectional study using qualitative methods	Interview and patient registration data. Respondents: P, O. Sample site: Zhejiang and Yunnan. Sample size: 80 health workers; 80 service users.	****	SS
Dong et al. 2014 [32]	Cross-sectional study	Questionnaire and residence household survey. Respondents: P, O. Sample site: Nationwide. Sample size: 88,482 individuals.	***	RR
Yang et al. 2014 [66]	Cross-sectional study	Survey. Respondents: P. Sample site: Guangdong. Sample size: 51,501 individuals.	***	SS, SR
Zhou et al. 2014 [67]	Cross-sectional study	Survey. Respondents: O. Sample site: Guangdong. Sample size: 12,800 individuals.	***	SS, SR
Li et al. 2014 [33]	Cross-sectional study	Questionnaire. Respondents: P. Sample site: Guangdong. Sample size: 787 individuals.	***	RR
Wang et al. 2012 [52]	Cross-sectional study	Interview. Respondents: O. Sample site: Shandong, Shanxi, Henan, Shannxi, Gansu, Ningxia, and Inner Mongolia. Sample size: 15,698 individuals.	****	RR
Zhang et al. 2011 [53]	Longitudinal study	Interview and regular hospital reports. Respondents: P. Sample site: Beijing. Sample size: NA.	***	RR

Jiang et al. 2013 [54]	Cross-sectional study	Interview. Respondents: O. Sample site: NA. Sample size: 2,093 individuals.	****	SR
Powell-Jackson et al. 2015 [29]	Cluster randomized experiment embedded in quasi-experimental study	Questionnaire. Respondents: O. Sample site: Ningxia. Sample size: 54,143 individuals.	***	RR
Wang et al. 2014 [34]	Cross-sectional study	Questionnaire. Respondents: O. Sample site: Guangdong. Sample size: 162,464 individuals.	***	RR
Zhang et al. 2014 [60]	Longitudinal study	Patient registration data. Respondents: P. Sample site: Jiangsu. Sample size: 14,169 individuals.	***	RR
He et al. 2014 [35]	Cross-sectional study	Questionnaire. Respondents: P. Sample site: Jilin. Sample size: 12,862 individuals.	****	RR, RS
Bao 2013 [36]	Cross-sectional study	Questionnaire. Respondents: O. Sample site: Shanxi. Sample size: 668 individuals.	****	RS
Wang et al. 2011 [37]	Cross-sectional study	Questionnaire. Respondents: P. Sample site: Shandong. Sample size: 850 individuals.	***	SR
Ji et al. 2015 [38]	Cross-sectional study	Questionnaire. Respondents: P. Sample site: Beijing. Sample size: 2,632 individuals.	***	RR
Zhao and Zhang 2012 [68]	Cross-sectional study	Residence household survey. Respondents: O. Sample site: Beijing. Sample size: 2,556 individuals.	***	RR
Guo et al. 2012 [39]	Cross-sectional study	Questionnaire. Respondents: O. Sample site: Shandong. Sample size: 2,274 individuals.	**	SR
Chen et al. 2013 [21]	Cross-sectional study	Questionnaire. Respondents: P. Sample site: Beijing, Henan, Chongqing, Anhui. Sample size: 3,792 individuals.	***	SR
Jin et al. 2011 [40]	Cross-sectional study	Questionnaire. Respondents: P. Sample site: Shandong. Sample size: 3,500 individuals.	***	SS
Huang et al. 2012 [41]	Cross-sectional study	Questionnaire. Respondents: O. Sample site: NA. Sample size: 6,024 individuals.	****	RR, RS
Li et al. 2015 [42]	Cross-sectional study	Questionnaire. Respondents: O. Sample site: Guangdong. Sample size: 435 individuals.	***	SS, SR
He et al. 2011 [55]	Longitudinal study using mixed methods	Medical insurance registration data, focus group interview. Respondents: P, O. Sample site: Anhui. Sample size: NA.	**	RR
Zhou et al. 2011 [22]	Cross-sectional study	Interview. Respondents: P. Sample site: Guangdong. Sample size: 661 individuals.	****	RR
Xia et al. 2015 [43]	Cross-sectional study	Questionnaire. Respondents: O. Sample site: Sichuan. Sample size: 307 individuals.	***	SS, SR
Yao et al. 2014 [44]	Cross-sectional study	Questionnaire. Respondents: P. Sample site: Guangdong. Sample size: 1,464 individuals.	***	RS, SR

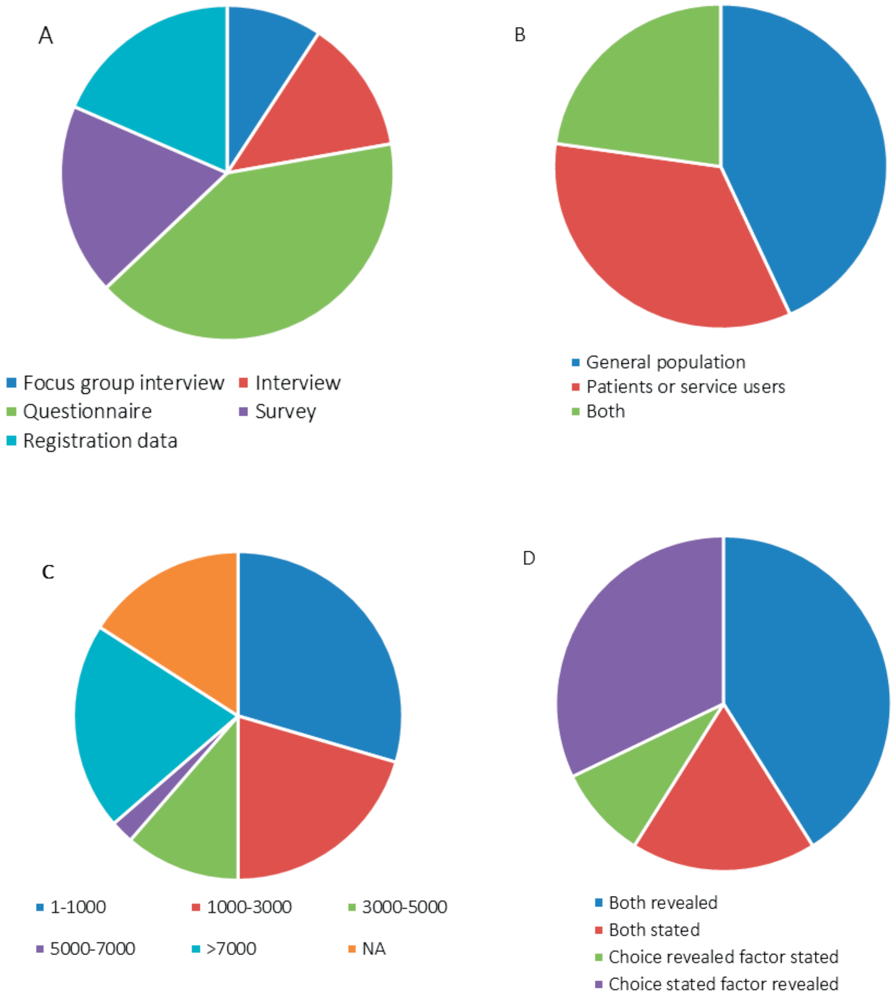
Gong and Cao 2011 [45]	Cross-sectional study	Questionnaire. Respondents: O. Sample site: Shandong. Sample size: 2,274 individuals.	****	SR
Zhang et al. 2014 [46]	Cross-sectional study	Questionnaire. Respondents: O. Sample site: Xinjiang. Sample size: 768 individuals.	***	SS, SR
Zeng et al. 2012 [61]	Longitudinal study	Patient registration data. Respondents: P. Sample site: Guangdong. Sample size: NA.	*	RR
Wang et al. 2012 [69]	Cross-sectional study	Survey. Respondents: O. Sample site: Zhejiang. Sample size: 274 individuals.	****	SS, SR
Wang et al. 2014 [47]	Cross-sectional study	Questionnaire. Respondents: O. Sample site: Sichuan. Sample size: 4,201 individuals.	****	RR, RS
Tian et al. 2012 [56]	Longitudinal study using mixed methods	Medical insurance registration data, focus group interview. Respondents: P, O. Sample site: Yunnan. Sample size: NA.	**	RR
Luo et al. 2015 [57]	Longitudinal study using mixed methods	Medical insurance registration data, focus group interview and literature review. Respondents: P, O. Sample site: Hubei. Sample size: NA.	**	RR
Xie et al. 2010 [48]	Cross-sectional study	Questionnaire. Respondents: O. Sample site: Jiangsu. Sample size: 397 individuals.	***	SS, SR
Guo et al. 2015 [58]	Longitudinal study	Medical insurance registration data, focus group interview. Respondents: P, O. Sample site: Heilongjiang. Sample size: NA.	***	RR
Chen et al. 2013 [59]	Longitudinal study	Medical insurance registration data, interview. Respondents: P, O. Sample site: Shandong. Sample size: 4,571 Individuals, 15 Medical Institutions.	***	RR
Wei and Xiao 2014 [70]	Cross-sectional study	Survey. Respondents: P, O. Sample site: Anhui. Sample size: 498 individuals.	***	SR
Zhuang et al. 2011 [49]	Cross-sectional study	Questionnaire. Respondents: O. Sample site: Guangdong. Sample size: 40,053 individuals.	****	SR

[a] "P" represents patients or service users; "O" represents general population.
[b] The MMAT score is 25% (*) when 1 criteria is met; it is 50% (**) when 2 criteria are met; it is 75% when 3 criteria are met (***); and it is 100% when 4 criteria are met (****).
[c] "RR" represents revealed factor for revealed choice; "RS" represent stated factor for revealed choice; "SS" represents stated factor for stated choice; "SR" represents revealed factor for stated choice.

For ease of exposition, the characteristics of the studies are summarized in Fig 3. Except for one quasi-experimental study, all studies are observational (n=43). The data are collected mostly from questionnaires (n=22). Other data sources include interviews (n=12), registration databases (n=10) and combinations of questionnaires and interviews (n=10). The number of studies that take the general population as respondents (n=19) is slightly larger than those with patients or service users as respondents (n=15). 10 studies have both types of respondents. The reported sample size varied from 80 to 162,464. 13 Studies have a sample size less than 1,000 individuals.

Fig 3. Summary of study characteristics.

(A) Distribution of data source. (B) Distribution of respondent type. (C) Distribution of sample size. (D) Types of evidence. (E) Distribution of quality assessment score.



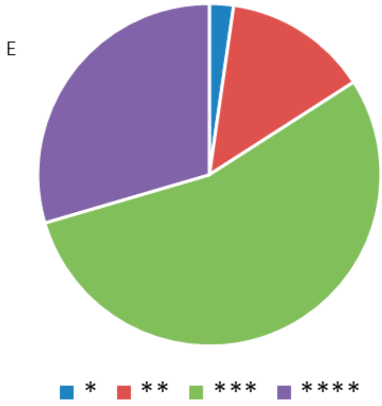
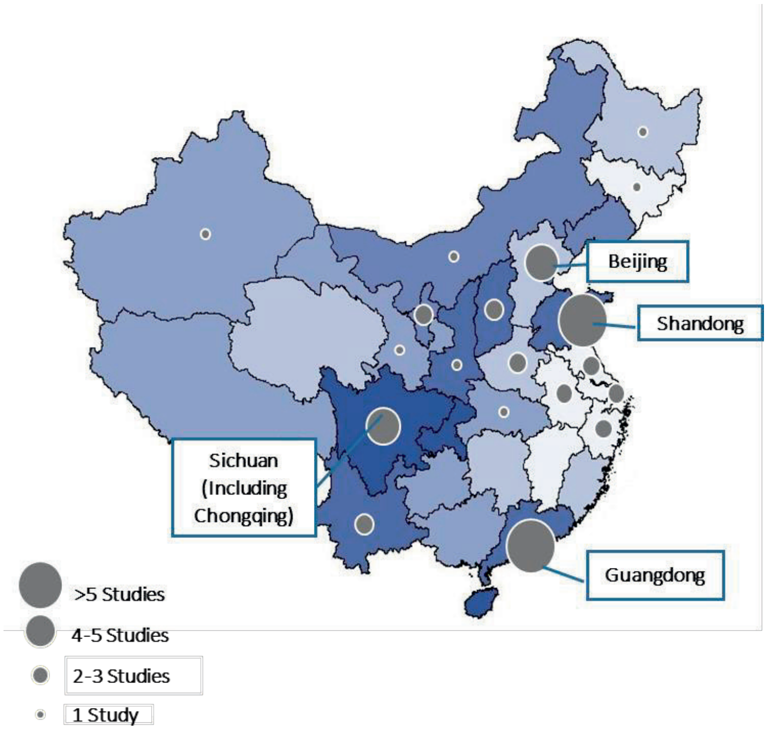


Fig 4. Geographic distribution of study sites except for the studies conducted nationwide (n=2) or without indication of location (n=4). Caption credit: The map of mainland China in Fig 4 was created using SAS software (SAS Institute Inc.), version 9.4.



The majority of studies report results on revealed factors, either for revealed choices (n=23), or for stated choices (n=18). Ten studies report stated factors for stated choices and five studies report stated factors for revealed choices. The most frequently studied provinces are Guangdong (n=11), Shandong (n=6), Beijing (n=4) and Sichuan (n=4; including Chongqing). The MMAT quality score was 100% for 13 studies, 75% for 24 studies, 50% for 6 studies and 25% for 1 study.

Identified factors influencing patient's choice

The factors identified from the included studies are presented in detail in Table 2 and online Appendix S2. We found 15 patient factors, 9 provider factors and 3 context factors. In addition, we also found 7 factors of a new type, which we call "composite factors". Composite factors combine characteristics of more than one of the other three types of factors.

Table 2-1. Overview of the patient factors found from the included studies.

Factor	Total number of studies that found this factor	Number of studies by evidence type[a]				Number of studies in each scoring category[b]			
		RR	SS	RS	SR	*	**	***	****
Age	18	9 [22, 32, 35, 41, 53, 59, 60, 62, 68]	0	0	9 [21, 31, 39, 44, 50, 54, 65, 69, 70]	0	2	9	7
Health insurance status	15	9 [22, 34, 35, 38, 41, 52, 57, 58, 68]	2 [51, 66]	0	4 [21, 39, 44, 65]	0	2	7	6
Income	13	6 [32, 34, 41, 47, 52, 59]	0	0	7 [39, 42, 44, 54, 66, 69, 70]	0	1	7	5
Education	11	4 [34, 35, 41, 68]	0	0	7 [31, 39, 42, 44, 66, 69, 70]	0	1	6	4
Pre-existing disease	8	4 [34, 35, 41, 62]	2 [41, 42]	0	3 [43, 65, 67]	0	0	5	3

Disease severity	7	3 [41, 53, 60]	3 [42, 43, 46]	0	1 [37]	0	0	6	1
Gender	4	3 [22, 58, 60]	0	0	1 [45]	0	0	2	2
Marriage status	4	2 [59, 68]	0	0	2 [54, 65]	0	0	2	2
Place of residence	4	1 [47]	0	0	3 [44, 54, 66]	0	0	2	2
Migration	3	2 [33, 62]	0	0	1 [65]	0	0	2	1
Occupation	3	1 [62]	0	0	2 [54, 70]	0	0	1	1
Health literacy	2	0	1 [69]	0	1 [66]	0	0	1	1
Ethnicity	1	0	0	0	1 [46]	0	0	1	0
Life style	1	0	0	0	1 [66]	0	0	1	0
Anxiety before seeing doctor	1	1 [64]	0	0	0	0	0	1	0

Table 2-2. Overview of the provider factors found from the included studies.

Factor	Total number of studies that found this factor	Number of studies by evidence type[a]				Number of studies in each scoring category[b]			
		RR	SS	RS	SR	*	**	***	****
Drug	13	4 [55, 56, 59, 61]	5 [46, 51, 66, 67, 69]	2 [36, 40]	3 [21, 45, 69]	1	2	6	4
Medical equipment	7	0	2 [66, 67]	3 [36, 40, 44]	2 [39, 45]	0	1	4	2
Service price/cost-effectiveness	6	1 [59]	3 [31, 51, 67]	0	2 [39, 69]	0	1	2	3
Service attitude	6	0	4 [31, 48, 66, 67]	1 [44]	1 [45]	0	0	4	2
Service scope	3	1 [22]	0	2 [36, 44]	0	0	0	1	2
Physical environment in facility	3	0	2 [66, 67]	1 [36]	0	0	0	2	1
Service convenience	2	0	2 [31, 67]	0	0	0	0	1	1
Medical staff	2	1 [59]	1 [48]	0	0	0	0	2	0
Applying of health information technology	2	1 [63]	0	0	1 [66]	0	0	2	0

Table 2-3. Overview of the context factors found from the included studies.

Factor	Total number of studies that found this factor	Number of studies by evidence type[a]				Number of studies in each scoring category[b]			
		RR	SS	RS	SR	*	**	***	****
Capitation/gatekeeping	2	1 [30]	1 [48]	0	0	0	1	1	0
Salary reform on health workers	1	0	1 [51]	0	0	0	0	0	1
Public campaign/interaction of social capital	1	0	0	0	1 [31]	0	0	0	1

Table 2-4. Overview of the composite factors found from the included studies.

Factor	Total number of studies that found this factor	Number of studies by evidence type[a]				Number of studies in each scoring category[b]			
		RR	SS	RS	SR	*	**	***	****
Perceived quality of care	15	0	6 [31, 48, 49, 51, 66, 67]	6 [35, 36, 40, 41, 44, 47]	3 [21, 39, 45]	0	1	6	8
Transportation convenience/distance	9	2 [53, 58]	4 [46, 48, 49, 66, 67]	1 [41]	1 [45]	0	0	6	3
Reimbursement rate/coverage from insurance	7	6 [29, 41, 57-60]	0	0	1 [45]	0	1	4	2
Freedom of service choice	2	0	2 [31, 48]	0	0	0	0	1	1
Previous medical experience	2	1 [47]	0	0	1 [43]	0	0	1	1
Awareness about the facility	2	1 [47]	0	0	1 [48]	0	0	1	1
Disease diagnosis	1	0	0	1 [40]	0	0	0	1	0

[a] "RR" represents revealed factor for revealed choice; "RS" represent stated factor for revealed choice; "SS" represents stated factor for stated choice; "SR" represents revealed factor for stated choice.

[b] The MMAT score is 25% (*) when 1 criteria is met; it is 50% (**) when 2 criteria are met; it is 75% when 3 criteria are met (***); and it is 100% when 4 criteria are met (****).

The most frequently indicated patient factors are age (n=18 studies), health insurance status (n=15 studies), income (n=13 studies) and education (n=11 studies). The provider factors that were most often found include drug availability (n=13 studies), medical equipment (n=7 studies), service price/cost-effectiveness (n=6 studies) and service attitude (n=6 studies). Context factors were reported less frequent: capitation/gatekeeping (n=2 studies), salary reform on health workers (n=1 study) and public campaign/interaction of social capital (n=1 study). The most frequently identified composite factors are perceived quality of care (n=15 studies), transportation convenience/distance (n=9 studies) and reimbursement rate/coverage from insurance (n=7 studies).

Effects of identified factors on patient's choice

Table 3 gives an overview of whether factors attracted or repulsed patients, and for which facility levels. The reader may firstly notice that the synthesized evidence on the working of the patient factors is often inconclusive. More specifically, this holds true for age, insurance status, income, pre-existing disease, disease severity, gender, marriage status, location of residence, migration.

Patient factors positively associated with lower-level attraction are lower education level, retired patients/working for governments/peasants, and patients of the Han ethnicity. Attracting lower-level provider factors are lower and unified drug price, service price, and good service attitude. Composite factors and context factors which cause lower-level facilities to attract patients are the short distance to home, transportation convenience, implementation of capitation and gatekeeping, previous experience, knowledge about CHC or THC, being exposed to publicity campaigns, and high social capital.

Repulsive patient factors for lower-level facilities are health knowledge, habit of seeking help from higher level facilities, regular physical exercise, and high anxiety level to seeing a doctor. The most repulsive provider factors for low level facilities are limited drug variety, obsolete medical equipment, and discomfort. The limited-service portfolio of lower-level facilities is another repulsing factor. The composite factor perceived poor quality is frequently reported to repulse patients, although some studies report patients to consider lower-level facility to be reliable. Repulsing context factors for level facilities are the complexity of the referral procedure, and the limitation of freedom of choice following from general practitioner contracts.

The implementation of salary reform at primary level facilities also repulsed patients at lower-level facilities.

The included studies provide little evidence on factors explicitly addressing access at higher level facilities. Patient factors that attract to higher levels are higher level of education, habit of seeking medical care at higher level facilities, employment at large enterprises. The purpose of seeking confirmation of disease diagnosis also stimulated patient flow towards higher level facilities. The most attractive provider factors are drug variety, medical equipment, and physical environment. Other than high price, patient crowding, and difficulty to see a doctor, we did not find evidence on repulsion regarding higher level facilities.

Table 3-1. Patient factors that attracted or repulsed patients during making choice between lower level and higher-level health care facilities.

Factor	Lower level facilities[a]		Higher level facilities[b]	
	Attract	Repulse	Attract	Repulse
Age	Older (11)		Older (5)	-
Insurance status	Having insurance or knowledge of insurance (6); having New Cooperative Medical Scheme insurance among other types of insurance (3)	Having insurance (4)	-	-
Income	-	High level (12)	-	Low level (1)
Education	-	-	Higher level (11)	-
Pre-existing disease	More onset of diseases in recent 3 months (1); chronic condition (2)	Chronic condition (5)	-	-
Disease severity	Perceived minor disease (6)	-	Perceived minor disease (1)	-
Gender	Female (1)	-	Female (3)	-

Marriage status	Married (1)	-	Married (2); widowed (1)	-
Place of residence	Rural area (2)	-	Rural area (1); central and western regions compared to eastern regions (1)	-
Migration	Migrates (2); migrates who did not have intention of permanent migration, or with residence for less than 5 years (1)	-	-	-
Occupation	Retired people (1); working for governments, worker or peasants (1)	-	Working at large enterprises (1)	-
Health literacy	-	Obtaining health knowledge (1)	Having habit of seeking help (1)	-
Ethnicity	Han (1)	-	-	-
Life style	-	Having habit of doing physical exercise (1)	-	-
Anxiety before seeing doctor	-	-	High level (1)	-

Table 3-2. Provider factors that attracted or repulsed patients during making choice between lower level and higher-level health care facilities.

Factor	Lower level facilities[a]		Higher level facilities[b]	
	Attract	Repulse	Attract	Repulse
Drug	Low or unified drug price under eml (5)	Limited drug variety (7)	-	-
Medical equipment	-	Obsolete equipment (3)	Better equipment than lower-level facilities (2)	-
Service price/cost-effectiveness	Lower price and more cost-effective (6)	-	-	-
Service attitude	Good attitude (5)	Bad attitude (1)	-	-
Service scope	-	Limited-service types (2)	-	-
Physical environment in facility	-	Uncomfortable environment (3)	-	-
Service convenience	Convenience in general and shorter waiting time than higher level facilities (2)	-	-	-
Medical staff	Personal connections with staff (1)	-	-	-
Applying of health information technology	Applying of community health report (2)	-	-	-

Table 3-3. Context factors that attracted or repulsed patients during making choice between lower level and higher-level health care facilities.

Factor	Lower level facilities[a]		Higher level facilities[b]	
	Attract	Repulse	Attract	Repulse
Capitation/gatekeeping	Implementation of capitation and gatekeeping (1)	Complicated procedure of referral (1)	-	-
Salary reform on health workers	-	Implementation of fixed salary policy on health workers (1)	-	-
Public campaign/interaction	Exposure to publicity	-	-	-

of social capital	campaign or high score in social interaction of social capital (1)			

2

Table 3-4. Composite factors that attracted or repulsed patients during making choice between lower level and higher-level health care facilities.

Factor	Lower level facilities[a]		Higher level facilities[b]	
	Attract	Repulse	Attract	Repulse
Perceived quality of care	Reliable skill (2)	Perceived low quality of care (13)	-	Perceived quality of care
Transportation convenience/distance	Short distance from home and convenient transportation to get there (7)	-	-	Transportation convenience/distance
Reimbursement rate/coverage from insurance	Enlarged reimbursement rate and expanded benefit package at lower level facilities (3)	Enlarged reimbursement rate at lower level facilities (4)	-	Reimbursement rate/coverage from insurance
Freedom of service choice	-	Sign contract of designated family doctor prohibits the freedom of service choice (2)	-	Freedom of service choice
Previous medical experience	Having previous experience at low level facilities (1)	No inpatient experience (1)	-	Previous medical experience
Awareness about the facility	Having knowledge of CHC or THC (1)	Having no knowledge of CHC or THC (1)	-	Awareness about the facility
Disease diagnosis	-	-	Trust higher level	Disease diagnosis

			facilities for this purpose (1)	

Numbers in the brackets represent the number of studies that found this effect.

[a] "Attract" represents the attribute that positively affected choice for lower-level facilities, in which case we speak of attraction; "Repulse" represents the attribute that negatively affected choice for lower level facilities, in which case we speak of repulsion. Empty space represents no evidence was found.

[b] "Attract" represents the attribute that positively affected choice for higher level facilities, in which case we speak of attraction; "Repulse" represents the attribute that negatively affected choice for higher level facilities, in which case we speak of repulsion. Empty space represents no evidence was found.

Discussion

Main findings and interpretations

A first main finding of our review is that it has yielded a new, frequently reported factor type, in addition to the three already known factor types: patient factors, provider factors, and context factors. The new type, "composite", covers factors relating to combinations of patient characteristics, provider characteristics and/or context characteristics.

Patients factors are reported most, in particular the factors age, health insurance status, income, education, pre-existing condition, and disease severity. The evidence on education strongly suggests that better education is associated with accessing higher levels (as is further supported by the association between health literacy and access at higher levels). For most patient factors however, the evidence was inconclusive. This holds particularly true for the most frequently reported factor age.

The evidence on income level and disease severity is almost conclusive. Most of the studies (12 out of 13) found that people with higher income are more likely to choose higher level facilities. These findings suggest that inequality in the health system access persists [4]. Geography may operate as an underlying factor, as patients from remote rural areas tend to have lower incomes and to live further away from higher level facilities [71-73]. The interactions between the factors have not been researched.

Five out of six studies investigating disease severity reported that people with perceived minor diseases preferred lower-level facilities, while people with more severe conditions preferred high access levels. This might be explained by the limited trust people attach to lower-level facilities and relate to the composite factor perceived quality discussed below.

The most frequently mentioned provider and composite factors are drug variety and perceived quality, followed by transportation convenience, reimbursement rate, equipment, service price, and service attitude. These findings echo earlier evidence that patients attach more importance to provider factors and composite factors believed to be associated with effectiveness, i.e., clinical outcomes, than to factors associated with convenience or low cost [20]. The evidence found shows that the most frequently reported factors drug price and perceived quality (as well as equipment) deter patients from lower levels and cause patients to access higher levels.

Although the evidence found appears to emphasize the importance of clinical outcomes, the corresponding factors are not outcome factors (see also [74]). In terms of the Structure-Process-Outcome model to explain quality of care developed by Donabedian [75], the provider factors limited drug variety and obsolete equipment relate to structures which patients appear to associate with poor outcomes, and hence cause lower levels to repulse. From a policy perspective, this suggests that interventions to improve the structure, e.g., by improving drug variety through extending the essential medicine list, or by investing in equipment may redirect patient flows towards the lower levels. The recent encouragement of health authorities to invest in independent regional diagnostic medical imaging centers [76] may result in similar effects. Among the few outcome indicators identified as provider factors and composite factors, are cost-effectiveness [31] and previous experience [43, 47].

Current reforms intend to redirect patient flows by changes in reimbursement and coverage [77], which form indeed another composite factor. Interestingly, we found that when the reimbursement rate or coverage became more generous, patients tended to more frequently choose higher level facilities, even when lower-level reimbursement changes were larger. Apparently, copayment reductions at higher levels have more effect than relatively higher reductions at lower-level facilities. This is congruent with patient factor findings where higher income and education are positively associated with access at higher levels. These results may suggest an underlying affordability factor to be at work, causing patients who can afford it to choose access at higher levels.

Several of the contextual factors that influence patient choice relate to gatekeeping policies and referral policies. The perceived high complexity of referral procedures, and limitation of freedom of access choice when registering with general practitioner form repulsions to primary care. This suggests that policy interventions to improve ease of referral can help redirect patient flows towards lower levels.

The Alma Ata declaration [78] explicitly mentions primary health care to “form an integral part of a country’s health system, of which it is the central function and main focus” and “first level of contact of individuals, the family and community with the national health system”. This declaration words agreement that primary care is the default health system access level. Our review reveals however, that for many Chinese citizens this is not the case. Our synthesis presents evidence on several factors which push patients away from the “first level of contact”, i.e., the lower levels (repulsion), and cause them to seek care at higher levels. Lack of drug variety, (obsolete) medical equipment, and perceived poor quality are the most important among such factors.

Bansal et al. [79] discuss push and pull factor theories to explain why people migrate from their origin (default) to other countries and from current service providers to competitors. In addition to push (repulse) and pull (attract) factors, their framework also includes mooring factors, such as personal or social factors [80]. These categories are reflected in the three categories identified in this review (provider, patient, and context), to which we have added composite factors. Herzberg's 2-factor theory [81], which in turn builds on Maslow's needs hierarchy [82], considers employee retention, and uses push and pull factors to explain why employees leave their job. It considers push factors to be more fundamental as they relate to basic needs in Maslow's hierarchy, e.g., regarding physiology and safety.

Building on these related theories, one may interpret the provider related factors, such as drug variety, equipment, and low perceived quality, to push patients away from the (default) primary care, because primary care facilities are not trusted to safely address basic patient needs. It may also explain why disease severity pushes towards higher level facilities, as more severe diseases form a larger threat to basic needs. Moreover, it might explain that any patient who can afford it, would choose access at higher levels, through the factors higher income, education, and reimbursement. Reasoning along these lines, one may deduce that further economic development, and more generous reimbursement, will increase the number of patients who can afford to access higher levels, thus pushing an even larger population away from primary care and to the overcrowded high-level hospitals. The evidence on 2016 patient flow data provided in the introduction supports these arguments. From a policy perspective, this stresses the importance of lower-level ability to provide safe health services for fundamental health needs, and reliably refer when required to address fundamental health needs. These findings support the present focus of the Chinese health reforms to strengthen primary care, and to improve referral mechanisms.

While the factors influencing patient choice may in part be operating independently, interactions among the factors are likely to exist. Current understanding of and evidence on these interactions is poor. While this identifies a relevant area for future research, it also calls for modesty when deriving policy implications.

Limitations

As the context of health policy changes rapidly in China [15,83] and new developments advance rapidly (e.g. encouragement of private hospital [84] and innovations such as e-consults [85,86]), the validity of some of the evidence provided by this systematic review reduces over time.

Second, most of the evidence is derived from observational designs without adjustment for confounders or considering interactions among factors. Hence, our review delivered little evidence which demonstrates causality of the relationships between factors and choice. Likewise, the designs of the included studies varied considerably, preventing us to present synthesized findings on effect sizes, as might be obtained through meta-analysis when sufficiently many high-quality quantitative studies are available. Obviously, the effect sizes form an important direction for future research as well.

Eastern China has been overrepresented in the included studies. This calls for caution when applying the findings nationwide, or in Western-Chinese contexts and other under-studied regions. In addition, it calls for further research in other parts of China.

Conclusions

The present problem in the Chinese health system of overcrowding in higher level hospitals and underuse of lower-level facilities is driven by patient access choices. However, current scientific evidence on the factors influencing patient access choices is limited. This systematic review reveals that higher income, higher education, and urbanization are associated with access at high levels. As urbanization and income are increasing in China, as is the education level, our results suggest that current problems may worsen, and further threaten the quality and efficiency of health services in China.

Patients are pushed towards higher level facilities by the perceived inability of lower-level facilities to address basic health needs. This inability is predominantly expressed by the factors lack drug variety, obsolete equipment, and perceived poor quality. From a policy viewpoint, our results suggest that improving lower-level structures and quality perceptions, in combination with an efficient and reliable referral system, likely promotes access at lower levels. This can help the primary care system to regain its intended central function and promote the efficiency and quality of the Chinese health system at large.

As the identified evidence is inconclusive for many identified factors, it is likely that contextual factors are not yet well understood, and that interactions between factors play a role. Yet, these interactions have not received attention. Moreover, effect sizes remain uncertain, and very little evidence exists for western China. Therefore, the scientific evidence base to support policy interventions aiming to promote the utilization of primary care facilities in China deserves extension.

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Chapter 3

Why patients prefer high-level healthcare facilities:

a qualitative study using focus groups in rural and urban China

This chapter was published as:

Liu Y, Zhong L, Yuan S, van de Klundert J. 2018. Why patients prefer high-level healthcare facilities: a qualitative study using focus groups in rural and urban China. BMJ Global Health 3: e000854.

Abstract

Introduction: Despite policy measure to strengthen and promote primary care, Chinese patients increasingly choose to access higher level hospitals. The resulting overcrowding at higher level hospitals and underutilization of primary care are viewed to diminish the effects of the continuing health system investments on population health. We explore the factors that influence the choice of health care facility level in rural and urban China and aim to reveal the underlying choice processes.

Methods: We conducted eight semi-structured focus group discussions among the general population and the chronically ill in a rural area in Chongqing and an urban area in Shanghai. Respondent's discussions of (evidence-based) factors and how they influenced their facility choices were analyzed using qualitative analysis techniques, from which we elicited choice process maps to capture the partial order in which the factors were considered in the choice process.

Results: The factors considered, after initial illness perception, varied over four stages of health service utilization: initial visit, diagnosis, treatment, and treatment continuation. The factors considered per stage differed considerably between the rural and urban respondents, but less so between the general population and the chronically ill. Moreover, the rural respondents considered the township health centers as default and prefer to continue in primary care yet access higher levels when necessary. Urban respondents chose higher levels by default, and seldom moved down to primary care.

Conclusions: Disease severity, medical staff, transportation convenience, equipment, and drug availability played important roles when choosing health care facilities in China. Strengthening primary care correspondingly may well be effective to increase primary care utilization by the rural population but insufficient for the urban population. The developed four stage process maps are general enough to

serve as the basis for (partially) ordering factors influencing facility level choices in other contexts.

Introduction

China has a three-tier hospital system, in which the health care facilities at level one and below are intended to act as the providers of primary care[1–3]. As there is no formal gatekeeper role however, patients may access the system at any level and facility of their choice[1]. Chinese patients often choose to directly access higher level hospitals, thus bypassing primary care facilities. As a result higher level hospitals are overcrowded, while primary care facilities remain underutilized[4]. The health reform initiated in 2009 has brought considerable investments to strengthen primary care, and a series of policies aimed at improving the utilization of the facilities at lower levels[1,5,6]. Still, the number of visits to primary care facilities continues to form a decreasing share of the total number of visits, while the share of visits to higher level hospitals continues to increase[7]. These developments are counter to the Declaration of Alma-Ata, which states that primary care facilities should serve as a first contact and provide access as close as possible to where people live and work[8].

The lack of efficient utilization of primary care is seen as a cause for the relatively modest improvements in health outcomes achieved for the Chinese population through the continuous and considerable health system investments made over the last decade[9]. This especially holds true for rural residents, resulting in worsening disparity in health service access and health outcomes between rural and urban residents[4,10]. Further, the overcrowding of higher level hospitals has contributed to deterioration of patient-doctor relationships[11,12] and quality of care[9]. Thus, it is important to understand which measures can more effectively direct the patient flow towards lower levels, and hence to advance understanding of health seeking behavior of the Chinese population.

Determinant models form a classical approach to understand decision making in health service utilization, by identifying the factors (determinants) which influence the choice[13]. There is a growing body of literature adopting this approach, especially from Western contexts[14–17], which includes the well-known Behavioral Model of Health Services Use by Andersen[16]. This model conceptualizes access to care in the U.S. using individual and contextual determinants[16]. The model can be viewed to be static, as it does not address how the dynamics of disease and heath service provisioning influence the choices and choice processes.

Another approach to advance scientific understanding of facility choice is to develop process models, which conceptualize patient responses to sickness as a dynamic behavioral process, e.g. in the form of as sequence of steps[13,18]. To the best of our knowledge, however, there is very little empirical research that has validated or adopted either of these models to understand choice of system access level since the new round of health care reform in 2009. This holds particularly true for the *processes* by which Chinese patients choose health system access levels.

As context attributes play important roles in decision making[18] and validity of such behavioral models cannot be assumed to remain valid when transferred from one society to another[19,20], empirical models in the Chinese context are called for. Systematic review of recent empirical research in China to elicit evidence on the determinants of facility level choice identifies four categories of factors influencing choice: patient, provider, context and composite factors[21]. Whether a patient is classified as ‘rural’ (as opposed to ‘urban’) is an example of a patient factor, while the travel distance from the patient home to the facility is an example of a composite factor (composed of patient attribute home location and provider attribute facility location).

While there is considerable Chinese evidence to support determinant models[21–24], there is little evidence on the choice process. Hence, it appears unknown whether patients consider factors simultaneously and weigh them against each other or, alternatively, whether (partial) orders exists in which the factors are considered. The answers to these questions may differ among socio-economic groups and depend on health conditions[24,25]. These differences regard the set of factors considered as well as the effect of factors on choice. For the Chinese context, there is evidence that such differences exist between rural residents and urban residents, and between patients with chronic diseases and the general population[21]. Little is known, however, about how these subpopulations differ in their considerations of these factors. Do they consider different factors, weigh them differently, in a different order, or at different occasions? Pursuing these unaddressed directions, our research questions are as follows:

1. What are the factors that influence choice of health care facility level for Chinese urban and rural populations, and specifically for the chronically ill?

2. What is the process of decision making in which these factors are taken into account by these Chinese populations?

Research design and methods

Design

Qualitative research can provide a vast amount of data to understand behaviors within a certain context and to generate theory [26,27]. Robust qualitative methods are especially useful in health service research to generate rich information on patient preferences and subsequently advance theory [17,26,27]. Given the explorative nature of the research questions, and the limited scientific understanding of the factors and choice process of health care facility level in China, we therefore adopt a qualitative approach. The qualitative method focus group discussion (FGD) is especially effective to answer open research questions as we have formulated [28,29]. FGDs allow respondents to express a variety of viewpoints, while at the same time enabling to interact, for example by reacting to viewpoints of other participants, advancing and refining them, or providing alternatives [28,30].

We organized two FGDs for each of the four subpopulations considered in first research question separately: the general population living in an urban area (Urban-general), patients with chronic diseases living in an urban area (Urban-chronic), the general population living in a rural area (Rural-general), and patients with chronic diseases living in a rural area (Rural-chronic) (see online Appendix 1 for information on the organization of the FGDs). From literature[28,31] and experts' opinion, the ideal size of a focus group is four to eight people. Thus, we aimed to recruit seven participants for each group. The following open questions served as starting points for the FGDs:

How do you choose health care facilities when you feel ill? What are the factors that you consider when seeking health service?

While the participants had a break after this open part, the interviewers briefly compared the findings with a list of evidence-based factors[21] (see online Appendix 2 for an overview of the list of evidence-based factors and short descriptions of each factor). In the second part of the FGD, interviewers addressed evidence-based factors not mentioned before the break in a semi-structured manner:

Does factor X influence your facility level choice? If yes, how does it influence your choice?

After these initial questions, the moderators asked follow-up questions to elicit further information and encouraged constructive discussion among participants.

For each of the questions and throughout the discussion, the study coordinators explicitly invited every participant to express her or his opinion.

At the end of the FGD, each participant received a small gift (with a value of 30 RMB, approximately 4 USD), as a token of compensation for time. The focus group interviews were conducted in May and June of 2017. All interviews were conducted by the first author, with the support of local health service staff. We report the result on this qualitative study following The Consolidated Criteria For Reporting Qualitative Research (COREQ) checklist[32].

Case study site selection and sampling method

We selected Nanpeng in Chongqing as rural area. Nanpeng is officially classified as rural[33] while not too far from higher level facilities for its population to consider them when choosing facilities. As urban area we selected Jiangwan in Shanghai, one of China's largest cities.

As the study targets patients with chronic conditions and the general population, selection of respondents was community-based: participants were selected from the community resident databases (in which prevalence of chronic conditions is registered). We selected respondents who are at least 18 years old, are able to provide information verbally, have health service experience, are permanent resident in the study site, and are involved in choosing health service facilities for one or more of their household members. Absence of chronic conditions was an extra criterium for respondents from the general population. For the groups of patients with chronic conditions, we selected patients with hypertension and/or diabetes who also met the aforementioned inclusion criteria. Among the set of chronic conditions, Diabetes and hypertension are particularly prevalent in China[34,35] and cause high burden of disease[35–37]. In addition, treatment, and management of these two chronic conditions are prioritized in the current health reform [28].

The participants were recruited by convenience sampling as is common in conducting FGDs[38]. However, in addition to the aforementioned individual selection criteria, we purposively recruited the sample to ensure that in each sub-population group both female and male respondents were presented, and respondents of age below 60 years old were included. The research coordinators contacted participants by phone and scheduled the group discussions.

The villages where the rural participants lived are scattered within the Nanpeng area. The rural focus groups took place at the Nanpeng Township Health Center. The urban focus groups were conducted in a residential office.

Transcription and analysis

Before starting the formal analysis, we considered the data collected for each of the four subpopulations Urban-general, Urban-chronic, Rural-general, Rural-chronic. We present the significant differences in the demographic variables between rural and urban respondents determined by Fisher's exact test. In case of inconsistencies between the data collected from the two FGDs per subpopulation, additional FGDs needed to be conducted.

The FGD transcripts were analyzed using Atlas.ti. We adopted a framework approach[17,39], in which the evidence based factors[21] served as our initial framework. In alignment with the open questions approach to the FGDs, the category development process included an open coding process and a thematic coding stage[39,40]). First, factors were openly collected from respondents' verbal description. Next, we considered whether these factors fit into the previously known categories obtained through systematic review of empirical research[21] but did not impose newly found factors into these categories. In this way, a comprehensive category system was developed. These methods enabled to answer the first research question.

To answer the second research question, we first record for each subpopulation how factor exerted its influence and in what condition. Next, we used process maps to structure these findings for each subpopulation separately. Two authors went back and forth to the findings against the transcripts, as well as the choice process maps, to solidify and refine the identified findings.

Ethical considerations

This study received ethical approval from Shanghai General Hospital Medical Ethical Review Committee [No.2017KY207]. Each participant provided informed consent and anonymous demographic information prior to each discussion.

Results

The sample

Each of the eight focus groups was composed of seven residents, except one rural area focus group which included eight participants. In total, there were 29 rural respondents and 28 urban respondents participated in the discussions. All rural participants joined the Urban–Rural Residence Basic Medical Insurance scheme (URRBMI) and all urban participants joined the Urban Employee Basic Medical Insurance scheme (UEBMI) or URRBMI. The participants' profile is summarized in Table 1 and Table 2. The average education level and family annual income level differed significantly (p=0.000) between urban and rural respondents. Rural respondents have lower education and annual family income. Urban respondents also had visited higher level facilities more frequently than rural respondents (p=0.02). As the urban respondents were recruited from the same residential community and the rural respondents from satellite villages of a same town, the distances from home to health facilities are similar among the respondents in each group. However, as displayed in Table 2 travel times of rural respondents to any level of health care facility are roughly twice the travel times of their urban counterparts.

Table 1. Participants' Profile (number, percentage)

	Rural groups					Urban groups					
Variable	CQ1	CQ2	CQ3	CQ4	Total	SH1	SH2	SH3	SH4	Total	p
Gender											0.96
female	5	5	6	5	21 (72.4%)	5	5	5	5	20 (71.4%)	
male	2	2	1	3	8 (27.6%)	2	2	2	2	8 (28.6%)	
Age											0.26
<30	0	0	0	1	1 (3.4%)	0	0	0	0	0	
30-45	0	0	0	1	1 (3.4%)	0	0	0	3	3 (10.7%)	
46-60	1	3	3	3	10 (34.5%)	0	2	2	1	5 (17.9%)	
>60	6	4	4	3	17 (58.6%)	7	5	5	3	20 (71.4%)	
Education level											0.000
primary school or lower	6	5	4	2	17 (58.6%)	0	1	1	0	2 (7.1%)	
middle school	1	1	3	3	8 (27.6%)	3	1	1	0	5 (17.9%)	
high school	0	1	0	3	4 (13.8%)	4	3	3	2	12 (42.9%)	
college or university	0	0	0	0	0	0	2	2	5	9 (32.1%)	
Family annual income (10,000 RMB)											0.000
<1	0	0	1	0	1 (3.4%)	0	0	0	0	0	
1-5	6	7	5	4	22 (75.9%)	0	0	0	0	0	
6-10	1	0	1	4	6(20.7%)	5	5	5	1	16 (57.2%)	
11-15	0	0	0	0	0	2	1	1	3	7 (25.0%)	
16-20	0	0	0	0	0	0	1	1	0	2 (7.1%)	
21-30	0	0	0	0	0	0	0	0	3	3 (10.7%)	

Table 1 (continued). Participants' Profile (number, percentage)

Variable	Rural groups CQ1	CQ2	CQ3	CQ4	Total	Urban groups SH1	SH2	SH3	SH4	Total	p
Family size (person(s))											0.16
1	0	0	2	0	2 (6.9%)	0	1	1	0	2 (7.1 %)	
2-3	6	4	4	3	17 (58.6%)	6	5	5	4	20 (71.4 %)	
4-5	0	3	0	2	5 (3.4%)	1	1	1	3	6 (21.4 %)	
>6	1	0	1	3	5 (3.4%)	0	0	0	0	0	
Hospital visit experience											0.02
primary care facilities only	3	3	4	4	14 (48.3%)	2	2	2	1	7 (25.0 %)	
higher level facilities only	0	0	0	0	0	1	1	1	2	5 (17.9 %)	
both	4	4	3	4	15 (51.7%)	4	4	4	4	16 (57.1 %)	

*CQ1, CQ2, SH1, SH2 = chronic groups; CQ3, CQ4, SH3, SH4 = general groups.
**Family annual income was defined as the total income by all family members that lived together with the participant.
***Family size was defined as the total number of family members that lived together with the participant.

Table 2. Distance from home to facility and average time consumed by transportation

Facility	Rural groups		Urban groups	
	distance (km)	time (min)	distance (km)	time (min)
Tertiary hospitals	55-80	120	8-10	50
Secondary hospitals	20-45	60	3-5	35
THC (rural)/CHC (urban)*	3-20	40	<1	15
VC/CHS**	<1	20	<1	15

*THC: township health center; CHC: community health center

** VC: village clinic ; CHS: community health station

The identified factors and the facility selection process

For each of the four identified subpopulations, the findings from the two FGDs largely overlapped, and we found no inconsistencies, indicating that the FGDs provided rich data. Hence, no additional FGDs were necessary.

Not all previously reported evidence based factors[21], were spontaneously mentioned by our respondents, nor considered to be of importance when explicitly mentioned to them. Taking urban and rural respondents together, the analysis revealed 10 factors relevant in the decision making. Brief descriptions of the factors are shown in Table 3. The factor facility design was not previously reported in literature systematically reviewing the evidence[21]. Together these 10 factors provide an answer to the first research question. The relevance of each of these factors however varied between urban and rural respondents, as further elaborated when addressing the second research question below.

Table 3. Revealed factors

Factor	Description
Self-assessment of illness	severity of illness, or if the disease is a special disease
Health literacy	the ability to understand basic health information and make appropriate decisions
Facility design	the layout and complexity of the facility
Service convenience	service procedure, waiting time or total time consumed for one visit
OOP cost	out-of-pocket cost per visit
Medical staff	the attributes that involve medical staff, including their medical skill, seniority of the medical personnel, or patient-doctor relationship
Drug	drug variety and availability
Equipment	the availability of enough medical equipment, especially the advanced equipment
Transportation convenience	transportation time from home to the facility
Self-evaluated clinical outcomes	self-evaluated clinical outcomes such as effectiveness or efficacy of care

The answer to the second research question is synthesized in Figures 1 and 2, which choice process maps resulting from analysis of the rural and urban FGDs data respectively. The maps distinguish four subsequent process stages. Per stage, respondents considered a different subset of factors. The choice processes can therefore be displayed as decision trees, where each of the nodes reflects the choice decision in the corresponding stage. Possible choices were no treatment; informal care (buying medicine from pharmacies, or self-care such as simple physical treatment); visit primary care facility; visit higher level facility.

Figure 1. The choice model of health care facilities among rural residents

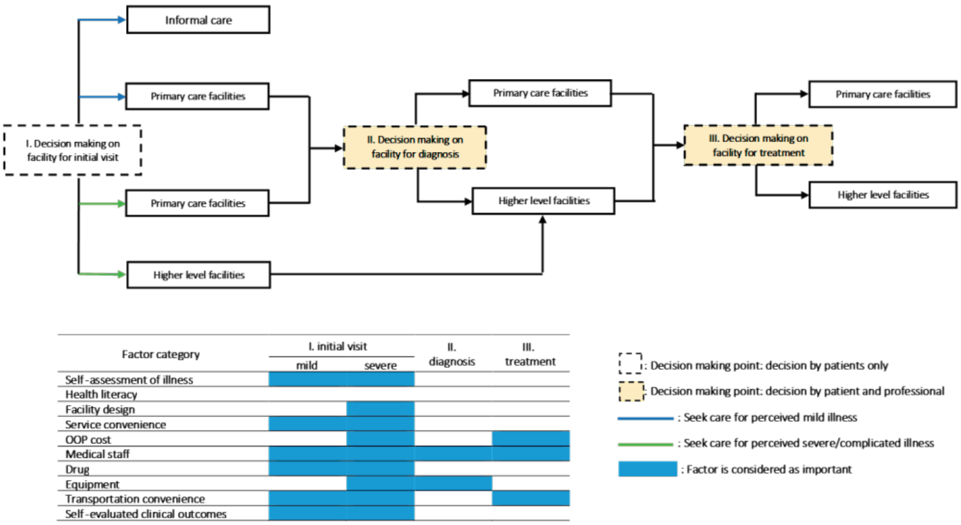
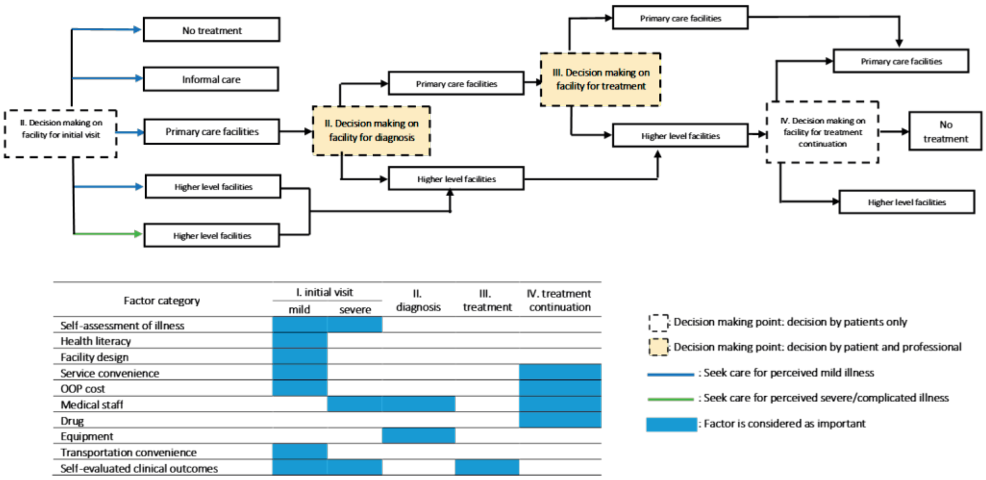


Figure 2. The choice model of health care facilities among urban residents



The narrative presentation of our research findings below is organized based on these process maps. The choice processes of urban and rural respondents differ essentially. While chronically ill patients may encounter different and more frequent choices than the general population, the underlying process differences between the two groups are limited and covered in the narrative.

As a general finding, the three sequential stages in the choice process by rural respondents were: initial visit, diagnosis, and treatment. Thus, rather than considering the purpose of diagnosis as a choice factor [21], our analysis reveals it as a process stage. For urban respondents, an additional fourth stage appeared relevant: treatment continuation.

Whether the patient self-assesses the illness as severe or minor has considerable consequences for the remainder of the choice process and the factors considered. The factor severity clearly has priority over other factors. For ease of presentation, the presentation below therefore differentiates depending on the initial self-assessed severity. In later stages, we coalesce these initially distinguished choice maps.

For compactness and ease of exposition, we present the findings on the choice processes as follows. First, we present findings on the factors that the respondents consider during all choice process stages. Subsequently, we present stage-specific factors, following the choice process stage order. Per stage, we address the differences between rural and urban respondents.

1. Factors influencing choice at multiple stages

(1) Medical staff

'Medical staff' was found to be an influential factor throughout all stages, for both populations, and with the same effects. Medical skill and Personal Relation were the two aspects of medical staff that particularly influenced the choice. Lack of competence (skill) of staff at lower-level facilities often caused respondents to choose higher level facilities.

"(CQ3-1&4) If there are more senior doctors at the township health center, it will be better. Then we do not have to visit the big hospitals outside of the town."

Some respondents even conversely avoided formal care and preferred self-care instead.

"(CQ4-1) ...What they can do at the village clinic (VC) is just a blood pressure test, without any further medical treatment. I do not go there voluntarily, but only go when they inform me of a blood pressure test. When I do not have serious problems for which I need to see doctor, I would rather buy some medicine at the drugstore myself to prevent flu or cold …even though the price is cheaper at VC."

Respondents expressed that the more familiar they were with certain medical staff, the more likely they were to choose to visit a facility. For rural respondents, such familiarity appeared to be more likely with lower-level staff.

"(CQ1-5)…After a fall at school, my grandson came to the township health center (THC) by himself to receive the treatment! They even didn't require the prepayment for the service and directly gave him treatment…the residents and the staff get along for many years and we are very familiar to each other."

Many rural respondents expressed that they felt helpless in higher level hospitals.

"(CQ1-3)…Everyone in the big hospital is just responsible for her/his own piece of work. The answers I received most is 'I don't know' when I looked for my doctor or consulted about something."

Urban respondents expressed with much higher volume and richness of information that the familiarity brought three advantages: better quality of care; better service attitude, and lower cost from skipping extra registration fees and tests. It was especially found as a key factor in the stage of treatment continuation for urban respondents, who seek treatment continuation by a same doctor. Likewise, they expressed to highly welcome a policy to facilitate consulting the same doctor for repeat visits.

"(SH3-1) I am well acquainted with the doctors there (HS hospital). They know everything about me when I step into the hospital… As long as I need to get the medicines, I go to HS hospital … In other hospitals I have to do the blood test and other examinations before I can ask for the drug prescription. In HS hospital I do not have to do those. They know my situation well as a long-term patient for already over 40 years."

Conversely, they might stop treatment after their doctor has left.

"(SH2-5) I used to visit Dr. Huang at CH hospital who was very nice to me and he prescribed the drug for my situation. But later he left the hospital. I do not know where to find him. So, I just stopped taking the drugs and B-scan examination."

(2) Transportation convenience

At various stages, transportation convenience acts as a strong factor for both the rural and the urban population, especially at the initial stage for conditions perceived as mild. Rural respondents consider transportation convenience as particularly relevant.

"(CQ4-1) my first option is the township health center because it is close to my home. Only if they cannot handle my situation, then I go to the higher-level hospital."

(3) Drug and equipment availability

The availability of drug or equipment strongly influences choice at various stages, for both populations. The unavailability of certain drugs or advanced equipment pushed respondents to higher level facilities, especially in the stage of diagnosis when certain advanced equipment is considered to be required:

"(CQ5-5) …If you have more advanced equipment at the township health center, we will rely on you more…We have no other choice but go to the big hospital."

The influence of drug availability was large for urban respondents at the stage of treatment continuation.

"(SH1-3) …It happens very often that if you want a certain drug, you can only get it from certain tertiary hospitals, or even certain doctors. So, you have to register to visit that doctor, and then get the drug."

"(SH3-3) …The drug I need (for cardio disease) is only available at a tertiary hospital and not at the community health center (CHC) or JW hospital (secondary). What is the most annoying, I need 7 types of drugs, but there is a maximum amount of prescription per visit of around 300 Yuan. So, I have to go to the CH hospital to get the drugs 3 times per 2 weeks. Very annoying!"

Urban respondents are most likely to choose lower-level facilities if they have the needed drugs available:

"(CQ1-3) I have special disease. Only if I need the prescription of some specific drugs and they are unavailable at township health center, I go to big hospitals."

"(SH4-3) …If I can get the same drug at lower level, for example the community hospital, then definitely I go there, because it is close to home, and cheaper."

2. Factors influencing choice of facility at each stage

2.1 Initial visit

The choice of initial facility starts from the self-assessment of illness:

"(SH1-5) …The sequence of my health seeking behavior is: firstly, I evaluate my illness situation. If the problem is mild, I go to primary level facilities. If it is severe, I go to big hospitals. Among the available big hospitals, I will choose the one that has the expertise to handle my situation...and if it is indeed a specific disease that needs treatment within a specialty department, then I go to the big hospital because CHC does not have such special department."

Subsequently, the decision process differs depending on whether the illness is perceived as minor or as severe/complicated.

(1) In case of perceived minor illness

Even in the case of perceived minor illness, respondents worded many factors which caused them not to access the system at the lower, primary level. For instance, both rural and urban respondents were likely to choose self-care instead of formal care, for reasons of service inconvenience and self-evaluated poor clinical outcomes.

"(CQ5-6) I won't bother going to see a doctor if it is just a minor disease such as a cold…I go to drugstore to buy some medicines…the most convenient way."

Urban respondents also explained their choice by health literacy.

"(SH4-2) I think we human beings have self-healing ability……I am afraid of overtreatment very much. When I visit a hospital, there are already a lot of medicines prescribed before I finish reporting my symptoms... Should I take them or not? All the medicines have huge side-effects…"

While most respondents indicated to avoid service at higher level facilities in case of minor illness because of cost and inconvenience, some urban respondents indicated to choose it nevertheless. For them, the higher quality of care outweighed the higher cost of transportation, service, and medication, as well as inconvenience of the complex physical environment.

"(SH3-5)…I always choose a big hospital when I have health care demand, no matter what the severity of the problem is. Even for teeth extraction, as I trust them, and they have better quality."

(2) In case of perceived sever illness or special care needed illness

Urban residents perceive the structural traits associated with big hospitals, such as hospital size and level, as indicators of quality of care. Because of the factor quality of care, they subsequently choose to attend higher level facilities:

"(SH4)…No matter how far away, even by taxi, we go there…for better outcome."

Rural respondents consider more factors in case of self-assessed severe illness. Despite the severity, cost and transportation convenience remain key factors that may cause them to choose lower-level facilities. Moreover, the complexity of the "big hospitals" was a negative factor.

"(CQ5-6) …I am always confused by the big hospital's lay out, the electronic display board, and the setting of the department. I hope the local hospital will be better and better, then we don't need to go to the big hospital anymore."

2.2 Choice of facility for diagnosis

The default choice after the initial phase is to stay at the same level. Hence, many urban patients will stay at the higher-level facilities. It does happen however that patients choose another, typically higher, level for diagnosis. Often such choices were directed by considerations regarding the two factors medical staff and availability of equipment. When in doubt about adequacy of medical skills and equipment, patients and doctors usually decide together about switching to a higher level.

"(CQ3-2) …Only when the local hospital cannot handle the condition, for example, problems with the lungs, liver, or cancer, and cannot confirm diagnosis … we have to escalate."

"(SH3-6) …After I got the results from the physical check-up, I asked the doctor at the community hospital. As they could not handle it, they advised me to go to the specialized hospital… I usually follow their advice."

2.3 Choice of facility for treatment

The decision in this stage was usually made by patients and doctors together as well. Urban respondents usually considered the self-evaluated clinical outcomes, which keeps them at or directs them to higher level facilities for treatment.

"(SH3-2) As long as the problem is solved, I don't care about the cost."

"(SH2-3) JW hospital is close by… But because it is not that big, I choose it only for the pre-test and diagnosis. I went to DF hospital (a higher-level hospital than JW hospital) instead to receive surgery if needed."

Rural respondents made trade-offs in the consideration of service price, medical staff, and transportation convenience. As a result, they might actually choose to switch towards a primary level facility:

"(CQ1-5) Two years ago I felt uncomfortable and I went to the district hospital first to have a check-up, and the hospital asked me to hospitalize. I was not very willing to stay there because it was too far away from home. So, I called the THC and asked if I could receive the treatment or surgery there. They said yes, so I came back from the high-level hospital per my own willingness."

2.4 Choice of facility for treatment continuation

In many cases, urban respondents would continue their treatment through repeat visits and/or prescriptions. While many respondents chose to continue at the same facility and level, those who were particularly sensitive to service convenience might choose to switch down from a high-level facility, or even stop treatment. There was no mentioning of this stage among the rural respondents.

"(SH2-1) …At first I got physical tests at XY hospital (a tertiary hospital). For treatment, every time you needed to make a reservation and wait in long queues to get a B-scan, which was so annoying! Later, I just gave up the test. Just let it go…I don't want to wait after 100 people to get a B-scan."

Discussion

In this study, we identified the factors that most influenced the choices of health care facility level in rural and urban areas of China and identified the underlying choice processes. To the best of our knowledge, this is the first attempt to present an understanding of these choice processes beyond the identification of factors influencing choice. As the title suggests, it provides qualitative evidence on how patients choose a health care facility to access, and hence when to bypass nearby primary care facilities. To reduce sample bias, we approached respondents from the general population, instead of from patient populations of certain facilities, as done by most previously reported studies and acknowledged as a limitation[21,41]. By conducting separate and multiple FGDs in rural and urban areas, with respondents from the general population and from the population of patients with chronic conditions, we explicitly distinguished subpopulations which are evidenced to choose differently.

Respondents confirmed the majority of previously reported evidence-based factors. Moreover, the analysis revealed a new factor: facility design. The complexity of tertiary hospitals especially pushed elderly patients towards lower levels.

Respondents considered the factors during a process consisting of four stages: initial visit, diagnosis, treatment, and treatment continuation. Respondents were able to provide rich insights in how the factors interact in each of the four stages. The thus arising model of health service behavior, as grounded in Chinese qualitative evidence, is essentially different from the model proposed by Andersen for the U.S. context in two ways[16]. First, the included 'Chinese' factors as confirmed and supplemented by our respondents differ from the factors distinguished by Anderson for the US. Second, Andersen's model includes choice processes as such but without elaborating them. Our results explicitly address these processes and reveal a staged partial order in which the factors are considered. The four stages resulting from our analysis are quite generic and may validly form a basis to identify the partial order of factors considered in facility (level) choice processes elsewhere.

Among all identified factors, self-assessment of disease severity played a special and important role in the choice process. It served as a prime factor to consider for the phase of initial visit. Other factors only started to weigh in after this self-assessment of severity. As the initially accessed level served as default for the subsequent stages, self-assessment of severity might well be the factor most influential to patient choice. The importance of the initial choice is also reflected in the fact that the number of factors being considered for the initial visit stage is larger than in later stages.

Transportation convenience and medical skill were considered important in all stages. Availability of drugs and equipment had particular large influence on choice at the diagnosis and treatment stages, where they often dominated other factors. Our findings thereby echo a previous study in which urban respondents indicated to prioritize organizational factors[41], and are also consistent with previous findings that the factor distance is of less importance as illness is more severe[24].

Some of our findings may reflect initial effects of reform implementation. For instance, the swift referral mechanism was mentioned by multiple urban respondents, and it usually appeared in the decision making in the stage of initial visit or diagnosis. Another example is the long prescription of specific drugs at lower-level facilities in the stage of treatment continuation, which was repeatedly confirmed by chronically ill respondents. These findings reflect the effectiveness of medical partnerships, which aim to direct patients flow towards primary care and improve health services utilization[42]. More generally, our findings confirm that medical resource sharing through partnerships between facilities of different levels can be effective as it enhances medical skill and equipment in primary care[42]. Moreover, our findings can help tailor further policy interventions to different subpopulations and process stages.

The choice processes of the rural and urban respondents differed considerably. The rural respondents were much more inclined to access nearby primary care facilities - as intended in the Alma-Ata Declaration[8] - than their urban counterparts. They considered transportation convenience and cost more, as well as the inconvenience of having to navigate the large hospitals. As a result, primary care often served as the default access level for rural respondents, where they developed relationships with the staff, and they actively considered referral from higher levels to nearby lower-level facilities. The default access level was often reserved for the THC, rather than the VC - the lower-level facility which was usually nearer by. The reasons to seek health services 'higher up' are lack of medical skills and equipment, and limitations in drug availability. Policy measures to improve the skills, equipment and drug availability of THCs may therefore enhance their utilization and exert their potential to act as gatekeepers.

For many urban respondents, the high level 'big hospital' served as the default access level. They developed relationships with the medical staff at these hospitals, and are less affected by distance, travel time, or cost barriers, nor are they scared away by the complexity of the higher-level urban hospitals. Only the long waiting times and poor attendance pushed them elsewhere, e.g., to self-medication. The most significant factor that caused them to choose higher levels was the competence of medical staff. Interestingly, and in contrast to earlier findings [Dan Wu], we found that a large number of respondents valued the patient-doctor relationship over facility related factors. This suggest that urban respondents may more frequently choose primary care facilities when the physicians with whom they have developed a relationship provide services in primary care facilities as well, and/or when the relationships with the primary care physicians has been improved.

Overall, our results indicate that more substantial changes in advancing primary care capacity and more compelling regulatory changes are required to incentivize the urban population to choose nearby primary care facilities as envisioned in the

Declaration of Alma-Ata [8] and attempted via the on-going health reforms[3,42]. The growth of the urban population adds further relevance to such policy measures. Let it also be noted that such policy measures may in turn bring (or form) new factors influencing patient choice (e.g., comprehensiveness) which will be worthy to be explicitly included in future research.

The differences between Chinese rural and urban residents confirm existing literature[24,43,44], and can be due to differences in income, education, health literacy, travel distance to higher level facilities, and to the relative importance attached to quality of care[20,45]. In addition, we did not find the stage of treatment continuation in the choice process of rural respondents, perhaps because they are less likely to choose long term treatment at higher level facilities anyway due to spatial access disparity[46].

Despite numerous differences between rural and urban, a common result was that the rural focus groups made very little mention of VCs whereas the urban focus groups never even mentioned the urban equivalent of the community health station (CHS). The role of these nearest grass roots institutions appears to be marginal and appears to be worthy of reconsideration by policy makers and other stakeholders.

Both rural and urban respondents mentioned self-care in the form of purchasing drugs without prescription from a pharmacy to adequately balance time and costs. It confirms the potential for pharmacies to play a role in addressing the health system pressures reported in literature[22,47].

Chronic patients may make more intensive use of heath service facilities, and typically consider treatment continuation decisions (the fourth stage), whereas the general population might more frequently consider initial visits and diagnosis (the first or second stage). Our results indicate however, that in a same stage (e.g., diagnosis), the factors considered differ little between the general population and the chronically ill. The only difference occurred for urban respondents in the treatment continuation stage, for whom the factor drug availability stood out. This may well be related to financial consequences, reimbursement policies, and prescription (in)conveniences for long term medication, as extensively addressed in literature on the on-going health reform[3,42,48].

This study had some limitations. Even when considering that China is too large to be fully covered when collecting data, a main limitation of our study is that data collection is only from two study sites. While the consistency of the FGDs data confirm internal validity, the external validity needs further research. Furthermore, the sampling methods implied participants were mostly female and elderly. Moreover, sampling of chronically ill was restricted to patients suffering from at least one of the two conditions Hypertension and Diabetes. While the samples thus include prioritized patient populations, further research may strive to address other subpopulations more explicitly, e.g., to more broadly cover the chronically ill. Progressing along these paths, our initial insights in, and modeling of the choice processes of the Chinese populations can be improved, extended, refined, and updated. Moreover, now that the factors and processes are better understood and mapped, future quantitative research into the factors is called for to clarify the trade-offs, and enable effective policy making in relevant contexts. Finally, we suggest further research to address revealed preferences, as opposed to the stated preferences we have collected, to strengthen the evidence base.

Conclusion

Besides individual disease severity and transportation convenience, the organizational factors of health care facilities, specifically medical staff, drug and equipment availability are important in the healthcare facility choice process of the rural and urban respondents. The role of the nearest grass roots institutions (VC and CHS) appears to be marginal and appears to be worthy of reconsideration by policy makers and other stakeholders. For the rural population, our results suggest that policy measures to improve the skills, equipment and drug availability of township health centers, and promoting the medical resource sharing by medical partnership may be effective in incentivizing the rural population to use primary care facilities. These measures are in line with the on-going reform. More substantial changes in advancing primary care capacity and compelling regulatory changes are likely to be required to direct access choices of the urban population towards nearby primary care facilities.

The novel four stage model to describe the health system access choice processes appears general enough to serve as basis for (partially) ordering factors influencing facility level choices in other contexts.

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Chapter 4

Public preferences for health care facilities in rural China: a discrete choice experiment

This chapter was published as:

Liu Y, Kong Q, de Bekker-Grob EW. 2019. Public preferences for health care facilities in rural China: A discrete choice experiment. Social Science and Medicine 237: 112396.

Abstract

To successfully tackle the problems with the underutilization of primary care in rural China, it is important to align resource allocation with the preferences of the rural population. However, despite growing interest in the factors influencing the rural population's choice of facility, it is unclear how much weight should be placed on these factors, especially under different scenarios of disease severity. In the first study to elicit quantified trade-offs among influential factors in choosing health care facilities, we carried out a discrete choice experiment (DCE) in rural China. We used a Bayesian efficient design to construct 36 choice sets, and then divided them into three blocks. Each block formed one version of questionnaire that contained 12 choice questions. Each question was assigned a hypothetical perceived severity scenario of either minor or severe disease. 559 Rural residents completed the DCE through face-to-face interviews in December 2017 – March 2018. We used mixed logit models to analyze the choice data. The factors regarding the availability and affordability of a facility, such as visit time, travel time, and out-of-pocket cost, were highly valued. When the facilities changed simultaneously from the worst to the best case, a huge increase (from 4.8% to 66.5%) in the predicted probability of visiting a facility was observed under perceived minor disease scenario, whereas there was no significant change under perceived severe disease scenario. Improvements to drug availability, medical professional skill and equipment in rural primary care system can induce potential medical care seeking, and redirect patient flow from higher level hospitals to primary level. Especially, township health centers, which provide service to the residents in rural communities, have great potential to be the ideal facilities for first-contact care.

1. Introduction

In China, health care facilities in rural areas are generally equipped with less qualified workforce and provide less comprehensive services compared to secondary or tertiary hospitals [1,2], which are mostly concentrated in urban areas [3]. Lack of competence is especially prominent in the rural primary care system. In this system, township health centers (THCs) act as the backbone, providing primary care and public health services to the population in rural communities (townships) [3,4]. In addition, they also provide technical training to the doctors at village clinics (VCs) [1,5]. A study shows that 10% of the surveyed THCs could not perform routine medical diagnostics, such as blood or urine tests, while the percentage of VCs was even lower [1]. In less developed regions, over 30% of the medical professionals at THCs were unlicensed. The situation is even worse in VCs, where only 24% of the staffs hold licenses [1]. The education level of the staffs at these primary care facilities is also inadequate in that a large proportion hold diplomas below the required level [1]. As a result, the rural population – usually characterized by lower literacy and worse-off economic status than their urban counterparts [6,7] – appear to benefit less from health services, especially primary care [8].

Literature has confirmed that a good primary care system is essential for the overall wellbeing of population health [9]. Indeed, rural residents may choose to travel further to seek medical care, including primary care, at higher expense, since there is no gatekeeping role [10]. Previous literature has shown that rural residents' visits to secondary and tertiary hospitals keep increasing over years, leading to low utilization of THCs and VCs [10]. As a result, the primary care system may lose its significance in availing people to address community health problems by bringing the first level of contact as close as possible to where people live [11]. Underutilization of primary care facilities and the increasing demand for hospital care not only impair the availability of primary care to rural residents, but also undermines system efficiency, which in turn exacerbates the problem of overcrowded tertiary hospitals [2].

To improve the capacity of rural primary care facilities and alter the patient flow, the Chinese government has rolled out numerous policies, such as increased investment in the infrastructure of primary care facilities [1,10] and financial incentives for both demand and supply sides [12,13]. Unfortunately, as yet these policies have not shown any significant effect on improving the utilization of these facilities [10,14].

A series of factors are reported to influence health services utilization [15]. The impacts of these factors is not necessarily homogenous, but may be conditional on individual and contextual factors [16]. Hence, scientific evidence to understand how influential factors exert an impact on rural residents' health-seeking behavior is essential for medical resource allocation to achieve the desired enhancement in utilization of rural facilities.

The issues regarding the influential factors and choice of care seeking have drawn considerable attention from researchers. Liu et al. synthesized such empirical studies on both rural and urban areas in a systematic review, which has shown that the factors influencing patients' choice can be categorized as individual, context, facility and composite factors [17]. Another study found that choice behavior also depended on perceived disease severity and stages in the health seeking process [18]. Various studies reported that both rural and urban patients regarded informal care or taking no action as alternatives to seeking medical care from a facility, especially for perceived minor disease [18]. Despite the growing recognition, the published studies have various limitations. First, no prior study is able to provide information on the relative weight of the factors that influence the rural residents' facility choices, although studies included both revealed and stated preference data (see Liu et al., 2018a for a summary of examples). Instead, respondents were asked only to evaluate the attributes independently [19,20]. With those data, researchers cannot investigate the trade-offs among the attributes, nor can they simulate choice trends triggered by modifying certain factors of health care facilities. In addition, many studies recruited patients who were visiting a certain facility as the study sample, which means that they had already made a decision. The literature has well recognized that such sampling method may lead to skewed results on public preferences (e.g. Wu et al., 2017). Hence, there is a paucity of quantitative evidence for evaluation of the relative impacts of influential factors on facility choice behavior.

To bridge these gaps, this study aimed to elicit the Chinese rural public's preferences and trade-offs for first-contact health care facility in a discrete choice experiment (DCE). DCE is a stated preference technique widely used in health service research [21]. Based on random utility theory, it assumes that respondents always prefer the alternative that offers the greatest utility, and its overall utility is decomposed by its attributes in DCE [22]. By virtue of the theoretical basis of DCE, one can elicit the quantified importance of each attribute in the choice process as well as the trade-offs that the respondents are willing to make. Based on the findings in the literature, we incorporated the impact of perceived disease severity in preferences for health care facility, the option of opting out instead of seeking formal care from a facility, and individual factors into analysis. Also, any changes in the probability of choosing a facility brought by modifying its attribute levels can be predicted in DCE [23], which allows us to estimate the impact of real-world decisions and analyze the implications for practice.

2. Methodology

Unlike other stated preference methods that frame abstract questions [24], DCE respondents are asked to make choices in hypothetical choice scenarios consisting of various levels of pre-defined attributes. Therefore, the choice is not made from certain types of goods in interest, but in essence aims to elicit the relative impact of generic attributes. This section describes the two systematic steps taken in conducting DCE: (1) design development and (2) DCE implementation. This is followed by a description of the data analysis method.

2.1 Study design development

2.1.1 Selection of attributes

It is critical to develop attributes and levels to establish the validity of a DCE [25]. Due to task complexity and to ensure precision and reliability, only a few attributes and levels can be included. It thus requires a trade-off between the comprehensiveness of influential factors and cognitive manageability for respondents [26]. We selected the attributes and their corresponding levels through a systematic review [17] and focus group interviews [18]. The focus group interviews identified a set of factors that influence facility choice for first contact. Among these factors, we selected those related to health care facilities and defined them as the attributes in the DCE. We then decided on the attribute levels based on the information we obtained from the focus group interviews and the systematic review. Table 1 shows the eight attributes included in the final design, comprising six provider factors and two composite factors conform the literature [17]. The hypothetical severity was differentiated as perceived minor or severe condition, hereafter referred to as "in a minor scenario" and "in a severe scenario", respectively.

2.1.2 DCE design

We used Ngene (ChoiceMetrics, version 1.1.1) to create the DCE design. Each choice set includes two facility alternatives in the generic form [27] – facility A and facility B – with various attribute levels. Each choice set includes an opt-out option (Figure 1), which resembles the case when patients do not choose any facility but either go for informal care or do nothing. It also avoided overestimating the attributes' influence by forcing respondents to choose a facility [28,29]. Each choice set specifies a hypothetical disease severity, which was consistent across the alternatives in each set. The severity was attributed to each choice set with the two-way interaction function in Ngene.

Figure 1. Example of choice set

Imagine you have a mild symptom, such as a cough, fever, or runny nose...Which health care facility would you prefer to visit for first-contact care?		
☐ **Facility A**	☐ **Facility B**	☐ **Will not visit any facility**
▪ 1 hour to complete the visit	▪ 5 hours to complete the visit	▪ Stay at home or go to a pharmacy to get some medicine
▪ Pay RMB 118 out-of-pocket	▪ Pay RMB 25 out-of-pocket	
▪ Most health professionals are junior doctors	▪ Medical experts are available on call	
▪ You know someone there but are not very familiar with them	▪ You know nobody personally	
▪ General condition of medical equipment is obsolete	▪ General condition of medical equipment is advanced	
▪ 1 hour travel time from home	▪ 2.5 hours travel time from home	
▪ Large-size facility	▪ Small-size facility	

Table 1. DCE attributes and attribute levels.

Scenario variable	Levels	Explanation
Hypothetical perceived disease severity	▪ Minor (reference) ▪ Severe	The examples given to help understand the perceived minor disease were: catching a cold, coughing, sore throat. The perceived severe disease was described as a situation that was very likely to cause the respondent worry and anxiety. No exact examples were given in the severe scenario because aversion to and taboo against severe disease might have harmed the respondents' willingness to continue the survey.
Attributes	Levels	Explanation
1. Time taken for a visit (h)	▪ 5 (reference) ▪ 3 ▪ 1	Time taken for a visit describes the total time to finish one visit from the point the patient steps into the facility. It generally includes physician consulting time and waiting time. This attribute was varied in three possible levels elicited from the focus group discussions (Liu et al., 2018b)
2. Out-of-pocket expense (OOP) for a visit (RMB)	▪ 118 (reference) ▪ 76 ▪ 25	OOP has three levels, which were calculated based on the reimbursement policy and average cost per outpatient visit in Chongqing.* The values were further validated in the pilot study.
3. Medical professionals' skill	▪ Mostly junior doctors (reference) ▪ Many senior doctors; not many experts ▪ Experts are available	Medical professionals' skills were described by the seniority of the individual in the facility.
4. Personal connection in the facility	▪ Know nobody in person (reference) ▪ Know somebody but are not very familiar ▪ Direct personal connection	As there is not much literature on this attribute, we aimed to differentiate personal connection by three levels. It was validated in our pilot study.
5. General condition of medical equipment	▪ Obsolete (reference) ▪ Advanced	The focus group discussions led us to differentiate two levels for the general condition of medical equipment.
6. Drug availability	▪ Deficient (reference) ▪ Sufficient	General condition of the availability of commonly used medicine.
7. Travel time (min)	▪ 2.5 hours (reference) ▪ 1 hour ▪ 0.5 hour	The travel time was described by the time taken to go to the facility from home (one way travel). It was varied by three levels, based on interviews with the representative respondents.
8. Facility size	▪ Small (reference) ▪ Medium ▪ Large	This attribute can be assessed simply by the physical size of a facility, such as its land's area; or by the number of hospital beds.

Notes:
*Average OOP for one outpatient visit was estimated according to the local health insurance policy (Chongqing Municipal Human Resources and Social Security Bureau, 2017) and interviews with local residents.

The number of attributes and levels (6*3 levels+2*2 levels) leads to a very large number of choice tasks for a full-factorial design, which is deemed impractical [30]. Therefore, we used Ngene to create an efficient design that maximized the D-efficiency. It generated a subset of the full design including 36 choice tasks which were divided into three blocks using design theory (blocked design). Each version of the questionnaire included 12 choice questions and they were evenly distributed among the respondents [30].

We conducted a two-stage pilot to achieve the final version of the Chinese questionnaire. In the first stage, we carried out three interviews to check if respondents misunderstood or had difficulty in completing the questionnaire. After that, we refined the format and fine-tuned the expression according to the feedback. Then we applied the refined questionnaires in a formal pilot on 48 respondents. No signs of response fatigue were observed by the interviewers, and the respondents indicated that the task complexity and number of choices were manageable. The pilot data was also used as prior information to optimize the design for a multinomial logit model. To avoid frequently switching scenarios across the choice questions, which would bring cognitive burden, we grouped the questions according to disease severity. Intuitively, a severe condition could have bigger cognitive influence than a minor condition; we therefore presented the ones under minor conditions first, followed by the ones under severe conditions. Another part of the questionnaire collected 11 individual characteristics that were found to correlate with the choice of health care facility in literature [17,18] (Table 2).

2.2 Data collection

The sample were residents older than 18 years from the villages of rural counties in Chongqing. We calculated the sample size in R software by using the code proposed by de Bekker-Grob et al. [31]. We first calculated it based on priori beliefs of the attribute coefficients and the design used in the pilot study. After the pilot study, we further calculated the sample size based on the updated coefficients and the corresponding design used in the main data collection. Both results indicated that a sample size of 500 is sufficient. Stratified sampling method was used to ensure the sample representativeness. Specifically, the strata were pre-defined by gender (female or male) and age (18-45 years or >45 years) of the local population [32]. Table 2 lists the pre-defined sample quota and the respondents' characteristics.

The recruitment was supported by the local health bureau, who assigned study coordinators to approach the respondents in each township. Before and during the pilot, the first author trained the study coordinators to administer the questionnaire. They first screened the residential registration databases to find eligible respondents and then collected the data with paper and pen through door-to-door visits, until the pre-defined sample quota was reached. Before administering the questionnaire, the study coordinators briefly explained the procedure and reminded respondents to answer each question in the indicated hypothetical severity scenario. They also made sure that the respondents understood the survey by giving further clarifications if necessary. Each respondent received a small token of reward (valued 2.5 US dollars) on completing the questionnaire. The rural respondents were recruited from five townships from December 2017 to March 2018.

2.3 Data analysis

2.3.1 Statistical analysis

Over the data collection period, 608 residents were invited to participate in the survey. Among them, 559 respondents answered at least one choice question. We included all the 559 questionnaires in the final analysis so as to include as much available preference information as possible. Our response rate is 91.9%. The questionnaires from 27 out of 559 respondents (4.8%) included missing choice data. The data was analyzed with Stata 15 software (StataCorp. 2017. Stata Statistical

Software: Release 15. College Station, TX: StataCorp LLC). The interaction terms were constructed by interacting the disease severity term with each main attribute. Effects coding was used for all main attributes and dummy coding was used for opt-out and the interaction terms [33]. We estimated mixed logit models for the choice observations, which can capture the panel nature of the choice data in DCE [34,35]. We tried different combinations of ways to specify coefficients as random parameters or fixed parameters [36]. The final model was selected with the consideration of lower Akaike Information Criterion and the aim of arriving at a parsimonious model. To avoid divisions by zero and positive coefficients for cost, all cost-related attributes were modeled as fixed parameters [37]. We used normal distributions for the random parameters. Formal testing showed no evidence of left-right bias between the opt-in alternatives (p=0.119).

Table 2. Respondents' characteristics (n=559).

Characteristics		Sample (%)	Pre-defined quota (%) [a]	Nationwide census (%) [a]
Gender	Female	52.33	51.00	51.02
	Male	47.67	49.00	48.98
Age [b]	18-45 years	39.71	43.00	42.86
	45+ years	59.75	57.00	57.14
Education	Primary school or below	30.77		
	Middle school	36.67		
	High school	19.50		
	College or above	13.06		
Marriage	Married	86.76		
	Not in a marriage	13.24		
Employment status	No job	11.63		
	Employed	16.99		
	Peasant	71.38		
Have children	No	9.84		
	Yes	90.16		
Number of family members [c]	1	7.33		
	2	23.26		
	3 to 4	53.49		
	>5	15.92		
Family annual income [c] (US dollar)	≤ 4,500	51.34		
	> 4,500 and ≤ 7,500	27.37		
	> 7,500 and ≤ 15,000	13.95		
	> 15,000 and ≤ 22,400	5.37		
	> 22,400	1.97		
Insurance type [d]	URRBMI	77.99		
	UEBMI	19.68		
	No insurance	2.33		
Facility visiting experience	Only have visited primary level facilities [e]	55.20		
	Only have visited higher level hospitals [f]	9.32		

	Have visited both above two types of facilities	35.48
Self-rated health condition	Worse than average	16.13
	Average	68.46
	Better than average	15.41

Notes:
[a] Pre-defined quota were calculated by referring the data from the 2010 National Population Census (National Bureau of Statistics of China, 2010).
[b] Not all respondents answered.
[c] These terms represent the number of family members and total annual income pertaining to all family members living together.
[d] UEBMI: Urban Employee Basic Medical Insurance; URRBMI: Urban and Rural Resident Basic Medical Insurance. Compared to URRBMI, UEBMI has higher premium, higher reimbursement rate, and covers more comprehensive service packages (Chongqing Municipal Human Resources and Social Security Bureau, 2018a, 2018b).
[e] Primary level facilities include township health centers and village clinics in rural areas.
[f] Higher level hospitals include secondary and tertiary hospitals.

In the model results, the coefficients of each main attribute represent the effect size in the minor disease scenario compared to its grand mean. The coefficients of the interaction terms represent the changes in preferences when the hypothetical disease severity changes from minor to severe. Therefore, we conducted ex-post calculation of each main attribute’s coefficient in the severe disease scenario, by adding the corresponding coefficient under minor condition and its coefficient of the severity interaction term. The relative importance (RI) of each main attribute represents the relative weight of its impact on the decision making. It is calculated by dividing the difference between the highest and lowest utility of the levels of an attribute by the sum of such difference of all attributes [23].

We built separate models to investigate the impact of demographic attributes on the respondents’ preferences for health care facilities in the hypothetical minor and severe disease scenarios, respectively. For these two models, we created binary variables for the demographic attributes shown in Table 2 (see Table S1 for a list of the binary variables). We used those variables to interact with each main attribute. The main attributes were modeled as random effects except for the cost attributes, and all other interaction terms were treated as fixed effects.

Marginal willingness to pay (WTP) is the monetary amount that an individual is willing to pay for one unit change in the attribute of interest [34,38]. We calculated the WTP for the attributes with significant effects in the two hypothetical severity scenarios by taking the ratio of the coefficient of an attribute to the monetary attribute [26]. The WTP results can be found in online Appendix 1.

2.3.2 Predicted choice probabilities

The overall utility score of an alternative is defined as the sum of all coefficients associated with its attribute levels [23,35]. In DCE, the predicted probability of choosing a facility is calculated based on the stated choice data, by taking the exponent of the alternative's utility divided by the sum of the exponent of all available alternatives in the choice set [23]. In this study, we calculated the predicted probabilities of choosing any facility shown on the choice sets over opting out, and recorded the changes when one attribute was modified each time. In addition, the predicted probabilities of choosing any facility for first-contact care, when it carried highest utility (best case) or lowest utility (worst case), were also calculated. As the variables were effect-coded, the modifications on attribute levels represent the estimates relative to the mean preferences, when each attribute carries its mean value [39,40].

3. Results

3.1 DCE results

(1) Preferences under different hypothetical disease severities

Table 3 shows the coefficients for different hypothetical severity scenarios. The significance of the coefficients indicates that attribute level has a significant impact on the choice of health care facilities. The sign of a coefficient indicates the negative or positive impact of the attribute (level) on the utility of the alternative. In general, all attributes have significant impact in both scenarios, except drug availability in the severe disease scenario (p=0.077).

For both of the hypothetical severity scenarios, the positive signs of "time taken for a visit", "OOP for a visit" and "travel time" indicate that respondents preferred facilities that consumed less time for a visit, less OOP, and shorter travel time, compared to those generating a longer time for a visit, higher OOP and longer travel time. Noteworthy, the middle level of travel time experienced a variation across the two hypothetical severity scenarios. In the minor scenario, only the shortest time generated utility gain, and the other two levels were attached with significant utility loss. However, the middle level showed no significance in the severe scenario, which suggests the respondents were more tolerant of a 1 hour long travel time as compared to the minor scenario. The positive signs of "medical equipment condition" and "drug availability" indicate that respondents preferred facilities that could offer advanced equipment and sufficient drugs. The positive signs of "personal connection in the facility" in both scenarios indicate that respondents preferred having personal connections compared to having no connection at all. For the two levels of personal connection, "know someone but not very familiar with them" was more preferred than "direct personal connection" in the minor scenario, while in the severe scenario, respondents did not significantly prefer either of these personal connection circumstances. The different signs and significance of the levels of “medical professionals’ skill” indicate that respondents’ preferred senior doctors most, followed by junior doctors and experts in the minor scenario; in the severe scenario, senior doctors were most preferred, followed by experts and junior doctors. Similarly, for facility size, under minor scenario respondents preferred small or mid-sized over large facilities, but found no difference between small and mid-sized. In the severe scenario, the mid-sized facilities were most favorable while the small ones were the least preferred. The different signs of opt-out in two severity scenarios indicate a strong preference to opt-out for perceived minor diseases, and to visiting a facility for perceived severe diseases.

The interaction terms in Table 3 indicate significant changes in utility between the two hypothetical severity scenarios. Most obviously, the respondents experienced large utility loss for opting out in the severe scenario in comparison to the minor scenario. They also attached less utility gain for OOP 25RMB and 1 hour visit time in the severe scenario, and perceived increased utility for available experts.

The relative importance shown in Figure 2 indicates that in the minor disease scenario, respondents gave most importance to the time taken for a visit, followed by OOP, personal connection and travel time. In contrast, in the severe scenario, the respondents attached highest importance to the travel time, followed by OOP, visit time and medical skill.

Table 3. Results of the interaction model in hypothetical minor disease and severe disease scenarios

		Mixed logit model estimates (perceived minor disease)				Post-hoc estimates (perceived severe disease) [f]	
Attribute	Attribute level	Coefficient[a,b]	SE	SD [c]	SE [c]	Coefficient[a,b]	SE
Time taken for a visit (h)	5 (reference)	-0.499***	0.077			-0.252***	0.067
	3	0.090	0.057			0.062	0.059
	1	0.409***	0.066	-0.391***	0.059	0.190***	0.066
OOP for a visit (RMB) [d]	118 (reference)	-0.443***	0.061			-0.317***	0.057
	76	0.043	0.058			0.090	0.052
	25	0.400***	0.058			0.226***	0.060
Medical professionals' skill	Junior doctors (reference)	-0.009	0.054			-0.190***	0.058
	Many senior doctors	0.162**	0.065	0.101	0.112	0.157***	0.057
	Experts available	-0.153**	0.070			0.033	0.051
Personal connection in the facility	Know nobody (reference)	-0.238***	0.067			-0.127**	0.063
	Know somebody but not very familiar	0.187***	0.063			0.076	0.056
	Direct personal connection	0.051	0.067			0.052	0.053
Medical equipment condition	Obsolete (reference)	-0.103***	0.040			-0.165***	0.038
	Advanced	0.103***	0.040	0.176***	0.063	0.165***	0.038
Drug availability	Deficient (reference)	-0.189***	0.046			-0.073	0.041
	Sufficient	0.189***	0.046	-0.109	0.084	0.073	0.041
Travel time (min)	150 (reference)	-0.114**	0.553			-0.266***	0.061
	60	-0.146**	0.065	0.154	0.098	-0.037	0.049
	30	0.260***	0.062	0.204***	0.077	0.303***	0.052
Facility size	Small (reference)	0.076	0.066			-0.170**	0.080
	Medium	0.044	0.069			0.138***	0.051
	Large	-0.121**	0.057	-0.396***	0.062	0.032	0.072
Opt-out		1.793***	0.229	4.400***	0.277	-7.076***	0.591
Interaction: attribute × severity [e]	OOP 25 RMB × severity	-0.173**	0.082				
	1 hour visit time × severity	-0.219**	0.091	-0.503***	0.092		
	Expert doctor × severity	0.186**	0.087	0.113	0.090		
	Not visiting a facility × severity	-8.869***	0.595	6.133***	0.408		

Model fit	Akaike Information Criterion	9910.681
	Log likelihood	-4905.340
Observations = 6,642	Respondents = 559	

Notes:

[a] Coefficients of the reference levels are calculated as the negative sum of the coefficients of the other levels of the attribute.

[b] **, *** denote significance at the 0.05 and 0.01 level, respectively.

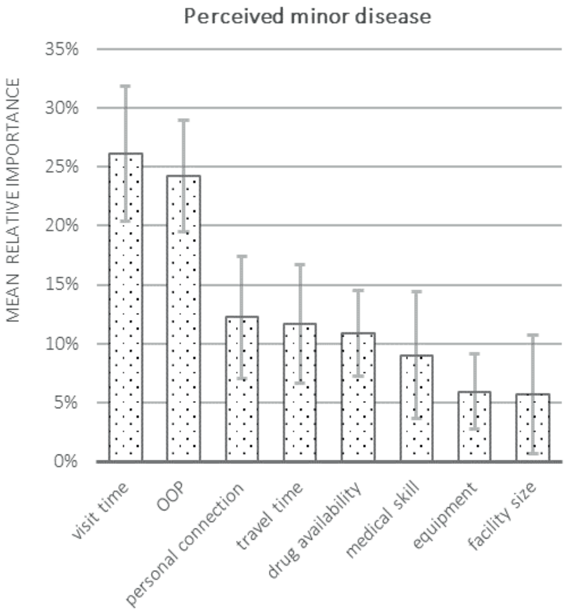
[c] SD: the standard deviations of random coefficients and standard errors.

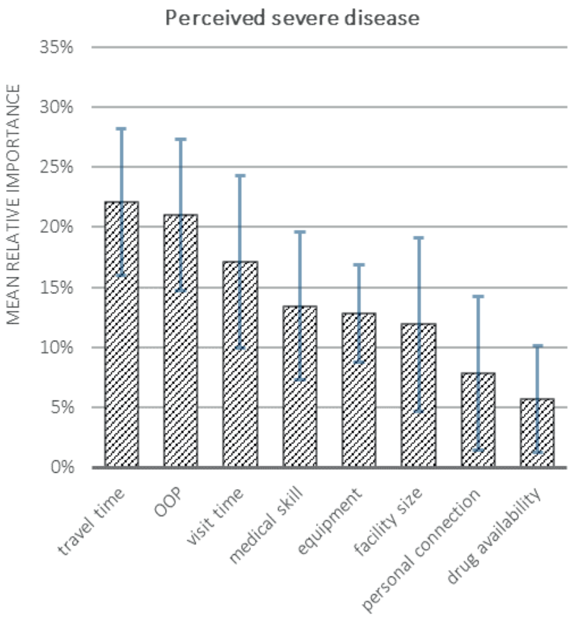
[d] OOP: out-of-pocket cost for a visit.

[e] For conciseness, only the significant interaction terms at 5% level are listed in the table. The reference level of severity is perceived minor disease.

[f] Each main attribute's coefficient in the severe disease scenario was calculated by adding the corresponding coefficient in the minor scenario and its coefficient of the severity interaction term.

Figure 2. Relative importance of the attributes in the hypothetical minor and severe scenarios with 95% CI. (OOP: out-of-pocket cost for a visit)





(2) Preference heterogeneity

Results of the preference heterogeneity analysis in different hypothetical severity scenarios are in Table 4. In the minor disease scenario, five out of ten individual attributes played significant roles in decision making: age, number of family members, family income, insurance type, and facility experience. The negative coefficient of the interaction between opt-out and age indicated that the older the respondents were, the less utility they attached to opting out. Respondents who had more living-together family members, experienced utility loss from direct personal connection and sufficient drug but attached more utility to the one-hour travel time than those who had fewer family members. Respondents with higher family income valued a three-hour visit time and direct personal connection less than those from a lower-income family. Compared to those who contracted with URRBMI, respondents contracted with UEBMI placed less utility on 25 RMB OOP cost and opt-out. Respondents who used to visit higher level facilities in urban areas valued the shortest visit time, direct personal connection and shortest travel time more than those who had only visited village clinics or THC.

Four individual attributes had significant influence on the preferences in the severe disease scenario: employment status, marriage status, number of family members and health status. Employed respondents placed less utility on the lowest OOP cost than those who were unemployed or peasants. Married respondents attached more utility to opting out than their unmarried counterparts. The respondents with more family members valued the level of staff seniority “many senior doctors” more than those with fewer family members. The respondents who evaluated themselves as having average or better health status attached more utility to the middle level of OOP, but less utility to the lowest OOP level.

4

Table 4. Results of the preference heterogeneity analysis.

Attribute	Attribute level	Estimates in the minor disease scenario				Estimates in the severe disease scenario			
		Coefficient [a,b]	SE	SD [c]	SE [c]	Coefficient [a,b]	SE	SD [c]	SE [c]
Time taken for a visit (h)	5 (reference)	-0.493	0.573			-0.323	0.462		
	3	0.410	0.417	0.043	0.243	0.656	0.433	-0.467***	0.096
	1	0.083	0.514	0.480***	0.102	-0.333	0.457	0.669***	0.087
OOP for a visit (RMB) [d]	118 (reference)	-0.994**	0.459			-0.761	0.395		
	76	0.074	0.422			-0.062	0.358		
	25	0.920**	0.428			0.823**	0.406		
Medical professionals' skill	Junior doctors (reference)	0.502	0.382			-0.132	0.407		
	Many senior doctors	-0.119	0.480	-0.024	0.461	-0.385	0.413	0.491***	0.112
	Experts available	-0.383	0.504	0.012	0.155	0.516	0.358	0.008	0.135
Personal connection in the facility	Know nobody (reference)	-0.054	0.496			-0.769	0.439		
	Know somebody but not very familiar	0.270	0.468	0.003	0.118	0.329	0.379	-0.028	0.101
	Direct personal connection	-0.216	0.496	-0.059	0.139	0.440	0.377	0.271*	0.136
Medical equipment condition	Obsolete (reference)	0.077	0.296			-0.261	0.265		
	Advanced	-0.077	0.296	0.214*	0.092	0.261	0.265	0.345***	0.064
Drug availability	Deficient (reference)	-0.602	0.341			-0.206	0.300		
	Sufficient	0.602	0.341	-0.112	0.158	0.206	0.298	-0.281***	0.081
Travel time (min)	150 (reference)	0.204	0.414			-0.154	0.425		
	60	-0.319	0.496	0.251	0.167	-0.362	0.357	0.259	0.139
	30	0.114	0.459	0.264	0.138	0.516	0.353	0.133	0.189
Facility size	Small (reference)	-0.228	0.471			-0.045	0.558		
	Medium	0.051	0.497	0.049	0.268	-0.243	0.361	-0.089	0.346
	Large	0.176	0.420	-0.389***	0.105	0.287	0.505	0.957***	0.103
Opt-out		6.813***	1.849	5.630***	0.432	-3.888***	1.290	3.580***	0.310
Interaction: attribute x demographic attributes [e]	Opt-out × age	-0.072***	0.024						
	OOP25 × employment					-0.472**	0.184		
	Opt-out × marriage status					1.771**	0.722		
	Many senior doctors × family members					0.327**	0.155		
	Direct personal connection × family members	-0.581***	0.200						
	Sufficient drug ×	-0.392***	0.141						

	family members				
	Travel 1 hour × family members	0.535***	0.206		
	Visit 3hrs × family income	-0.331**	0.167		
	Direct personal connection × family income	-0.421**	0.198		
	OOP25 × insurance type	-0.350**	0.168		
	Opt-out × insurance type	-2.886***	0.820		
	Visit 1hr × experience [f]	0.352**	0.163		
	Direct personal connection × experience [f]	0.610***	0.166		
	Travel 30 min × experience [f]	0.322**	0.148		
	OOP76 × health status			0.368**	0.161
	OOP25 × health status			-0.422**	0.177
Model fit	Akaike Information Criterion	4254.254		5445.835	
	Log likelihood	-1949.127		-2544.917	

Notes:

[a] Coefficients of the reference levels are calculated as the negative sum of the coefficients of the other levels of the attribute.

[b] **, *** denote significance at the 0.05 and 0.01 level, respectively.

[c] SD: the standard deviations of random coefficients and standard errors.

[d] OOP: out-of-pocket cost for a visit.

[e] For conciseness, only the significant interaction terms at 5% level are listed in the table.

[f] Experience represents the "facility visiting experience" in Table 2. It varies in three levels – "visited primary level facilities only", "visited higher level hospitals only", and "visited both above two types of facilities". The reference level is "visited primary level facilities only".

3.2 Predicted choice probabilities of choosing to visit a facility vs. opting-out

Figure 3 shows the predicted choice probabilities of any facility (with different combinations of attribute levels) over opting out for first contact. The predicted probabilities of choosing to visit a reference facility are 25.0% and 99.95% in both the minor and severe disease scenarios, respectively. Change in one single level departing from the reference case could vary the probability of choosing to visit a facility from 16.8% to 33.4% in the minor disease scenario; while the range of the probability in the severe disease scenario was much smaller (from 99.94% to 99.97%). In the minor scenario, both the largest decrease and increase in the probability of choosing to visit any facility occurred when modifying the visit time. In the severe disease scenario, modifying the OOP to its highest level generated the largest decrease in the probability of choosing to visit any facility, while the largest increase was brought by shortening the travel time to 30 minutes. Figure 3-c shows the predicted probabilities of choosing to visit a worst-case, average-case, and best-case facility under both of the hypothetical scenarios. When a facility changes from its worst- to best-case, a huge increase (from 4.8% to 66.5%) in the probability of choosing any facility is observed in the minor scenario whereas there is not much change (from 99.80% to 99.99%) in the severe scenario.

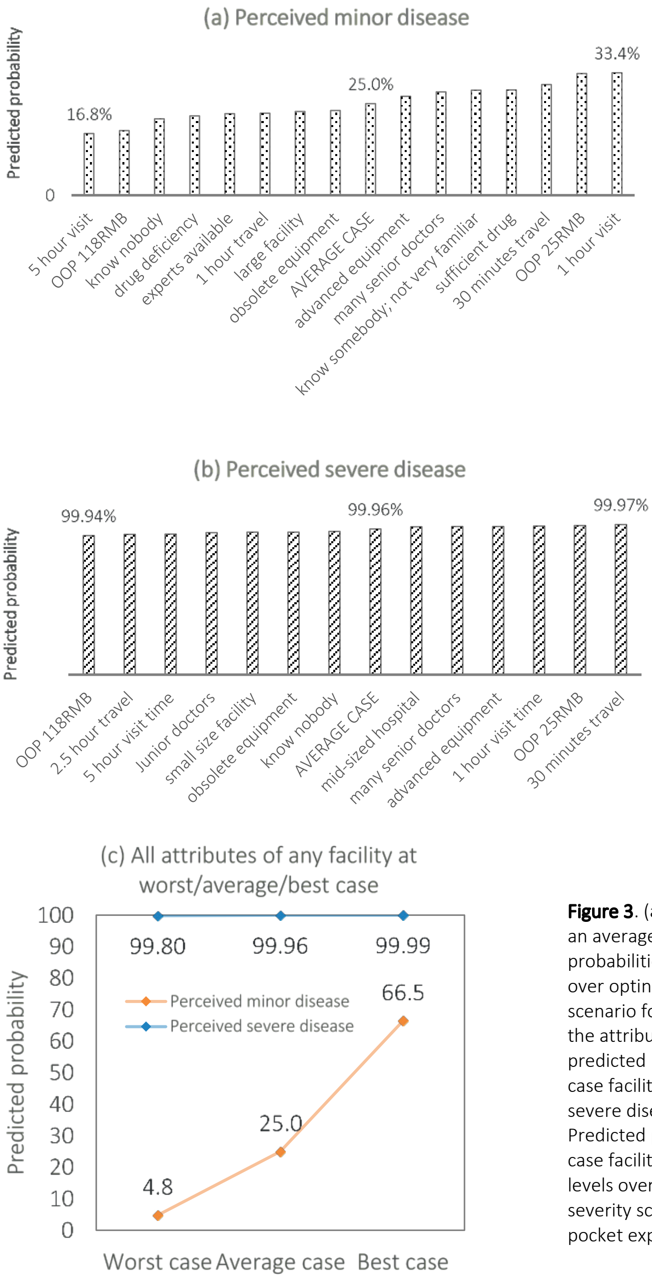


Figure 3. (a) One-way impact of the attributes of an average-case facility on the predicted probabilities of choosing the average-case facility over opting out under perceived minor disease scenario for first-contact; (b) one-way impact of the attributes of an average-case facility on the predicted probabilities of choosing the average-case facility over opting out under perceived severe disease scenario for first-contact; (c) Predicted probabilities of choosing an average-case facility at its worst, average and best attribute levels over opting-out under different disease severity scenarios for first-contact. OOP: out-of-pocket expense per visit.

4. Discussion

4.1 Results interpretation

To the best of our knowledge, this is the first DCE which systematically assessed the impacts of factors influencing the stated choice of health care facilities for first-contact care in rural China. It expands the knowledge regarding the health-seeking behavior of rural residents for different disease severities. In the minor disease scenario, the predicted probability of choosing any facility over opting out rose dramatically from 4.8% to 66.5% if the available facilities were changed from the worst to the best case. This large increase reflects that the potential demand of health care depends on the factors identified in this study and that suppressed demand can be recovered when the available facilities improve [41,42]. In other words, it confirms the relevance of these factors with respect to the opt-out option.

All attributes in the model had a significant impact on the respondents' choices, except drug availability in the severe disease scenario. Interestingly, the residents generally considered the factors concerned with the availability and affordability of health care the most important [42]. In the minor scenario, visit time and OOP stood out with the largest impact on the preferences. In the severe scenario, travel time, followed by OOP, more influence on the preferences than the other attributes. In contrast, the provider factors directly related to the provision of care, such as medical skill and equipment, were never the most influential factors for both severity scenarios, although they gained utilities in the severe scenario compared to the minor. Such findings can be intuitively explained by people wanting quick and relatively cheap treatment as the ailment is usually easy to treat for minor diseases. For severe disease, the concern regarding the affordability can be associated with the worse-off economic status of rural residents, reflected by the high importance attached to cost. Drawing on other researches, factors pertaining to travel and visit time may relate to the high dependence on family caregivers in the Chinese culture [43]. In this situation, those factors represent convenience not only for the patient, but also for family caregivers who accompany the patient on facility visits. It merits further research, probably using qualitative methods, to gain insights to the underlying motives.

Furthermore, choosing to visit a medical expert or a large-size hospital has never been the level the respondents preferred most for first-contact care, even in the severe disease scenario. This may be linked to the lower literacy level of the rural population, which was acknowledged in a previous study [18]. Rural residents usually found it difficult to navigate themselves and became frustrated when seeking help in tertiary hospitals. They also found that the medical experts were usually willing to devote very limited consulting time for each patient [18]. In respect of facility size, all other things being equal, the respondents were less likely to choose a big hospital than the facilities of any other in the minor disease scenario, whereas they were less likely to choose a small hospital than those of any other larger size in the severe scenario. However, although this attribute clearly indicates preferences in terms of facility size, it was ranked least important factor in the minor scenario and the third from last one in the severe scenario, respectively. While it has been observed that in practice, people tend to choose tertiary hospital [10,44], one can expect that the popular term “big hospital” used in health care related narrations in the Chinese health system may not represent physical size only, but other underlying factors commonly associated with size; in other words, the influence of the facility size is carried by other intrinsic attributes. Further qualitative studies are called for to explore the insights. Drug availability is the only attribute that lost significance under severe condition. One possible explanation for this finding is that patients are likely to rely on sophisticated diagnostic methods or interventions rather than medicine to diagnose or cure severe diseases, especially for first-contact care [45,46].

We observed that the ideal facility that meets the respondents' demands for first-contact care in both severity scenarios has the following attributes: in mid-sized, short distance from home, not too time-consuming for a visit, having some senior doctors, good enough equipment and sufficient drugs, with some personal connection, 25–76RMB as OOP per visit. Based on the functions of THCs in rural health system and their current capacity [3,4], THCs have the potential to be the ideal facilities for first-contact care in terms of size, distance and visit time. It can be expected that with investment in staff upskilling and medical equipment, and improvements to drug availability of THCs, rural residents are very likely to choose THCs for first-contact care in both severity conditions.

The benefits of resource allocation favorable to primary level facilities have been well recognized [2]. Moreover, scientific evidence also shows that diverting resources to encourage the competitions among tertiary hospitals may not bring benefits in health care, but enlarge the disparity between rural and urban areas in terms of health care availability [47,48]. Building on the above findings, we conclude that resource allocation in favor of THCs may effectively guide patient flow to primary level in rural areas, and hence improve the system efficiency and population health. The findings in the current study can be cautiously compared with those in the literature. For example, one study that analyzed the data from a household survey [49] revealed that cost and distance were the most influential factors, but distance mattered less when health status was worse-off. In the current study, travel time was considered even more important when the disease was perceived as severe, although the middle level of travel time is more preferred than the other two levels. As in Qian et al. (2009) the stage of health-seeking behavior were not specified, and the disease severity was reflected by the number of bed-days, it is hard to judge if these results are comparable to those in current study.

4.2 Study limitations and future research

As the first study that captures the quantitative impact of factors influential in choosing health care facilities, this study inevitably has its limitations that necessitate further investigation. For example, the DCE in this study focused on the first-contact facility only. Generalizing the results to overall health care seeking behavior or subsequent phases in the seeking process requires further investigation, as different sets of factors have been identified for consideration in different phases [18]. In addition, the results may gain credibility if they were compared with revealed preferences derived from the real-world data, such as visit records from health care facilities. Further, as we used fractional datasets to analyze the impacts of attributes under two disease severities, the results for the impact of demographic attributes should be interpreted cautiously. Mixed logit models can describe the impact of such attributes via interaction terms, but are unable to discover the underlying rationale in depth. Preference heterogeneities may be correlated to or mediated by profound attitudes to risk [50], or to uncertainty [51], and can be better explained through qualitative interviews, for example, why older respondents attach less utility to opting out than younger respondents. Finally, as we grouped the questions by the severity scenario to lessen the cognitive burden for respondents, this may have generated ordering bias to the results under severe condition that were presented after minor disease. Similarly, due to practical reasons, we did not randomize the order of the attributes in the choice sets due to practical reasons, therefore ordering bias may also occur as consequence.

4.3 Conclusion

Factors regarding the availability and affordability of a facility, such as visit time, travel, and OOP cost, are valued highly by rural residents when they choose a health care facility for first-contact care. In addition, rural residents attached different relative importance to these factors in the minor and severe disease condition.

Improvements to drug availability, medical professionals' skill and equipment in rural primary care system can induce potential medical care seeking. Especially, such improvements on THCs may effectively direct patient flow from secondary or tertiary hospitals to the primary level. This study provides evidence for policy making on aligning health resource allocation with rural residents' preferences, a strategy aimed at motivating rational utilization of health care services in China.

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Chapter 5

The impact of facility attributes on patient choice of health care facility for first visit: Evidence from a discrete choice experiment in Shanghai, China

This chapter was published as:

Liu Y, Kong Q, Wang S, Zhong L, Van De Klundert J. 2019. The impact of hospital attributes on patient choice for first visit: Evidence from a discrete choice experiment in Shanghai, China. Health Policy and Planning 35: 267–78.

Abstract

The underutilization of primary care in urban China threatens the efficiency and effectiveness of the Chinese health system. To guide patient flow to primary care, the Chinese government has rolled out a sequence of healthcare reforms which improve the affordability, the infrastructure and workforce of the primary care system. However, these measures have not yielded the desired effect on the utilization of primary care, which is lowest in urban areas. It is unclear how the factors identified to influence facility choice in urban China are actually impacting choice behavior. We conducted a discrete choice experiment to elicit the quantitative impact of facility attributes when choosing a health care facility for first visit and analyzed how the stated choice varies with these attributes. We found that the respondents placed different weights on the identified attributes, depending on whether they perceived their condition to be minor or severe. For conditions perceived as minor, the respondents valued visit time, equipment and medical skill most. For conditions perceived as severe, they placed most importance on equipment, travel time and facility size. We found that for conditions perceived as minor, only 14% preferred visiting a facility over opting out, a percentage which would more than double to 37% if community health centers were maximally improved. For conditions perceived as severe, improvements in community health centers may almost double first visits to primary care, mostly from patients who would otherwise choose higher level facilities. Our findings suggest that for both severity conditions, improvements to medical equipment and medical skill at community health centers in urban China can effectively direct patient flow to primary care and promote the efficiency and effectiveness of the urban health system.

1. Introduction

The Chinese health care system contains three levels. Patients may directly access health care facilities at all these levels [1,2]. In urban China, level-one health care facilities are known as community health centers (CHCs). As the core of the urban primary care system, CHCs provide primary care and public health services, as well as technical support to their branch facilities [3,4]. Urban patients often have easy access to secondary and tertiary hospitals as they are typically located in urban areas [5,6]. They tend to bypass primary care and choose these higher level facilities regardless of disease severity [7–9]. Follow-up visits to primary care facilities after the first visit to higher level facilities are uncommon [10]. Altogether, this leads to underutilization of primary care and congestion in secondary and tertiary hospitals, threatening the efficiency and effectiveness of the Chinese health system [11]. The situation may further worsen, as rapid urbanization and talent flow toward metropolitan cities increase the size of the urban population and corresponding demand for health care [12,13]. Between 2007 and 2017, the population of Shanghai increased from 20.6 to 24.2 million, and the number of consultations in the health care system per year increased from 132.2 to 273.4 million [14,15].

To address these challenges, it is important for policy makers to understand the factors influencing urban patients' facility choice, particularly their relative importance. A systematic literature review reported a considerable body of studies that have identified factors influencing facility choice in China [16]. They can be categorized as individual, facility, context and composite factors. The literature also report that these factors vary with the patient perceived severity of their condition [10,17]. Moreover, urban patients often revert to self-care (such as purchasing self-prescribed medicine from pharmacies, or forms of self-treatment at home) or take no action instead of visiting a facility [10,18]. While a variety of factors has been identified, the literature does not provide rigorous quantitative evidence on the importance attached to these factors by urban residents. To the best of our knowledge, the only study reporting on the quantitative impact of the factors influencing health care facility choice is from rural China [19]. However, the factors considered differ considerably between rural and urban residents (Liu *et al.* 2018c). For example, rural residents considered drug availability as an important factor for first visit, while urban residents did not. To advance understanding of the importance of factors influencing facility choice, this study firstly aims to understand how the urban residents evaluate facility attributes for first visit under different perceived disease severities.

As the initial point of contact with the health care system, primary care should be located close to where people live and work and be able to address main health problems in the community [20]. A strong primary care system can improve population health and health care affordability [21–23]. In China, the recent health reforms in 2009 and 2015 have prioritized strengthening the primary care system, with the objective of diverting patient flow to primary care facilities [24,25]. Specifically, the percentage of patients who choose primary care facilities for the first visit is targeted to reach at least 70% [25]. From 2007 to 2017, subsidies to primary care system have increased from 19 to 181 billion RMB to improve the infrastructure and workforce [9,26]. In addition, funding targeted for educating and training general practitioners in the primary care system has been made available [26]. Notably, substantial efforts have been made to improve demand-side incentives, such as a higher reimbursement rate at the primary level and the establishment of the essential medicine system [9,26].

These measures have shown limited effects [9]. Primary care visits by the urban population have not increased significantly [27] and the outpatients who could have been serviced appropriately in primary care still tend to choose higher level facilities [8,28,29]. Therefore, our second aim in this study is to understand how facility choice is affected by policy interventions to modify facility attributes under different perceived disease severities, taking the options “self-care” or “no action” into account.

To address these research aims, we conducted a discrete choice experiment (DCE) among the general population of a district in Shanghai.

2. Methods

This section described the selection of attributes, data collection and the analysis of the DCE. For an important part, it follows the methods of a related study conducted in rural China [19]. This study received ethical approval from Medical Ethical Review Committee of the authors' institute [No. 2017 KY207].

2.1 Selection of attributes and DCE design

The DCE attributes and levels were selected based on the outcomes of a systematic literature review [16] and subsequent qualitative research conducted for this purpose [10]. Seven facility attributes have been identified to influence health care facility choices of urban residents. In addition, the perceived disease severity played an important role in the choice process [10]. Table 1 shows the seven attributes, the corresponding levels and a description of the perceived severity scenarios included in the DCE.

Using Ngene software (ChoiceMetrics, version 1.1.1), we generated a subset of the full Bayesian D-efficient design that includes 36 choice sets. Each choice set included two unlabeled facility alternatives and an opt-out option [30,31] (see Figure 1 for an example of the choice set). A hypothesized disease severity was attributed to each choice set generated by the two-way interaction function in Ngene, which was consistent across all alternatives in each choice set. These 36 choice sets were divided into three blocks, thus each version of questionnaire included 12 choice sets. These three versions of questionnaires were evenly distributed among the respondents [32], therefore each respondent was asked to answer 12 choice questions. In each questionnaire, we grouped the choice questions by the two hypothesized severity scenarios. In the beginning of each group of questions, there was a short description of the severity scenario. The respondents were asked to answer each choice questions based on its specified severity scenario as shown in Table 1. Respondent data on individual characteristics influencing facility choices were also collected, as shown in Table 2 [10,16]. The questionnaire was piloted (N=48) and revised to reach the final version. No signs of fatigue regarding the choice questions were noticed in the pilot study.

2.2 Data collection

Following the sample size calculation methods presented in de Bekker-Grob *et al*. [33], we targeted a sample of 500 respondents aged 18 years and older. Pre-defined sample quota on gender and age were used to ensure sample representativeness [34] as shown in Table 2. The respondent recruitment was supported by a local residence bureau, which assigned study coordinators from three residential committees. The study coordinators screened the residential databases to find eligible respondents. They contacted the eligible respondents in advance by phone-calls to check their availability to complete the questionnaire. Before data collection, two authors (YL and SW) trained the study coordinators to administer the questionnaires. Door-to-door surveys were conducted to collect data using pencil and paper from January to March 2018. Respondent recruitment continued until the predetermined sample size was met. In total, we approached 535 respondents and the sample characteristics were similar to the pre-defined quota as shown in Table 2. Of these, three respondents did not answer any choice question. Of the remaining 532 respondents who answered at least one choice question, 13 (2.4%) respondents missed at least one question. We included the data from all 532 respondents in the final analysis to ensure we obtained the response data as much as possible. Each respondent was compensated with a small monetary token (15 RMB).

Figure 1. Example of choice set (translated into English from the original Chinese version).

Imagine you have a minor symptom, such as cough, fever, or runny nose… Which option do you choose for a first visit?		
☐ Facility A	☐ Facility B	☐ Will not visit any facility
1 hour visit	5 hour visit	
Pay 105 RMB as out-of-pocket expense	Pay 88 RMB as out-of-pocket expense	
Most health professionals are junior doctors	Medical experts are available on call	
You know somebody there but are not very familiar with them	You know nobody personally	Stay at home or go to pharmacy to get medicine
General condition of medical equipment is obsolete	General condition of medical equipment is advanced	
40 minutes travel from home	1-2 hours travel from home	
Large hospital	Small hospital	

Table 1. DCE attributes and attribute levels

Scenario variable	Level
Perceived disease severity (hypothesized)	Minor (description in the choice sets: imagine you have a mild symptom, such as catching a cold, coughing, sore throat…) Severe [a] (description in the choice sets: imagine you have a situation with a health problem, which makes feel worry and anxious...)
Attribute	**Level**
Time taken for a visit (h) [b]	5 [c] 3 1
Out-of-pocket expense for visit (RMB)	105 [c] 88 59
Medical professionals' skill	Mostly junior doctors [c] Many senior doctors; not much experts Experts are available
Personal connection in the hospital	Know nobody in person [c] Know somebody but is not very familiar Direct personal connection
Medical equipment condition	Obsolete [c] Advanced
Travel time from home to hospital (min)	90 [c] 40 15
Hospital size	Small [c] Medium Large

Notes

[a] No specific symptom or disease was described for a hypothesized severe condition, as the taboo of mentioning disease in Chinese culture may decrease the respondents' motivation to participate in the survey.

[b] Total time to finish one visit calculated from the moment the patient steps into the hospital until the end of all procedures related to the visit.

[c] Reference levels.

Table 2. Respondents' characteristics (n=532).

Characteristics	Percentage
Gender	
Female	48% (Pre-defined quota: 50%)
Male	52% (Pre-defined quota: 50%)
Age	
18-45 years	46% (Pre-defined quota: 55%)
45+ years	54% (Pre-defined quota: 45%)
Education	
Primary level or below	1%
Middle or high school	56%
College or above	43%
Marriage	
Married	85%
Not married	15%
Employment status	
Not employed	40%
Employed	60%
Have children	
No	19%
Yes	81%
Number of family member living together	
1-2	32%
>=3	68%
Family annual income	
<110,000	56%
>=110,000	44%
Insurance type	
UEBMI	65%
URRBMI	34%
No insurance	1%
Hospital visiting experience	
Only primary	20%
Only higher level	12%
Both	68%
Self-rated health	
Worse than average	15%
Average	60%
Better than average	25%

2.3 Data analysis

Statistical analysis

Data analysis was conducted with Stata 15 software (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC). We defined interaction terms between the main attributes and the disease severity. Effect coding was used for each of the attributes and the opt-out and interaction terms were dummy-coded [35]. We used a mixed logit model to estimate the impact of the main attributes and the interaction terms [36–38]. We tested different strategies to model the coefficients as fixed or random parameters Based on the results, the model with the minimum Akaike Information Criterion was selected [19]. It is worth noting that the coefficients of cost were modeled as fixed parameters to avoid a positive coefficient for cost [39]. Normal distributions were used for the attributes modeled as random parameters. The results of this model provide information corresponding to our first research aim on the valuation of facility attributes.

For each effect-coded attribute, the level supposed to carry the lowest utility was specified as the reference level and was omitted in coding. The coefficient of this omitted level can be calculated as the negative sum of the coefficients of the non-omitted levels [37]. Relative importance of each attribute was calculated by the difference between the lowest and highest coefficient of that attribute, divided by the sum of this difference of all attributes [40].

We also tested the interaction between the attributes and the respondent characteristics by building different models for the minor and severe disease scenarios. The respondent characteristics were binary-coded and interacted with the main attributes (online Appendix 1). The interaction terms were treated as fixed effect parameters, while the main attributes were coded as random effects except for the cost.

Predicted probabilities of health care facility choice

In DCEs, changes in predicted choice probability of an alternative reflect the impact of attribute modifications on the alternative [40,41]. Thus, we calculated the predicted choice probabilities to address the second research aim of this study and estimated the following probabilities:

(1) The predicted probabilities of choosing any facility versus opting out, depending on facility attributes at the worst, average, and best-case scenarios.

We calculated this choice probability by taking the exponent of the total utility of facility options, divided by the total utility of the available options including the opt-out. In each severity scenario, we defined an “average facility” as one whose attributes are all at average levels (zero-utility levels); a “worst facility” or a “best facility” when all attributes are at the levels of the lowest or the highest utilities, respectively. These hypothesized facilities at the worst and best-case scenarios are characterized by the attribute levels in Table 3.

Table 3. Attributes of the hypothesized facilities in the worst case and the best case in calculating the predicted probabilities of choosing any facility versus opting out

	Minor disease condition	Severe disease condition
Worst case facility	large-sized 5-hour visit time* out-of-pocket (OOP) expense 105 RMB* mostly junior doctors* direct personal connection obsolete equipment* travel time 90 minutes	small-sized 5-hour visit time out-of-pocket (OOP) expense 105 RMB* many senior doctors* direct personal connection obsolete equipment* travel time 40 minutes*
Best case facility	small-sized 1-hour visit time* out-of-pocket (OOP) expense 59 RMB* many senior doctors* no nobody in person advanced equipment* travel time 15 minutes	large-sized 3-hour visit time out-of-pocket (OOP) expense 59 RMB* expert available* know somebody but not very familiar advanced equipment* travel time 15 minutes*

* indicates the attribute levels that are significant in each scenario

(2) The probabilities of choosing a hypothesized CHC versus a higher-level facility (a hypothetical secondary or tertiary hospital), depending on the CHC at the worst-case, average, and best-case scenarios.

We calculated this choice probability by taking the exponent of the utility of a CHC, divided by the total utility of the available options including the opt-out. For the hypothetical hospitals, we fixed all attributes at their "typical" values [10]. As health care resources are relatively abundant in Shanghai, many patients can reach different levels of facilities within a relatively short distance. Therefore, the travel time to all facilities was fixed at 15 minutes. To quantify the effects of CHC attributes on the CHC choice probability, we firstly varied the attributes one at a time (i.e. one-way impact). In addition, we considered the worst case, resp. best case CHC by simultaneously taking all attributes at the lowest, resp. highest utility level in each severity scenario, while keeping "small-sized" and "travel time 15 minutes" unchanged. The hypothetical "typical" facilities and the hypothesized CHC at the worst case and the best case can be found in Table 4.

Table 4. Attributes of the hypothetical "typical" facilities and the hypothesized CHC at the worst case and the best case for calculating the probabilities of choosing a hypothesized CHC versus a higher-level hospital

Hypothesized facility	Minor disease condition	Severe disease condition
CHC at the worst scenario	small-sized 5-hour visit time* out-of-pocket (OOP) expense 105 RMB* mostly junior doctors* direct personal connection obsolete equipment* travel time 15 minutes	small-sized 5-hour visit time out-of-pocket (OOP) expense 105 RMB* many senior doctors* direct personal connection obsolete equipment* travel time 15 minutes*
CHC at the best scenario	small-sized 1-hour visit time* out-of-pocket (OOP) expense 59 RMB* many senior doctors* no nobody in person advanced equipment* travel time 15 minutes	small-sized 1-hour visit time out-of-pocket (OOP) expense 59 RMB* expert available* know somebody but not very familiar advanced equipment* travel time 15 minutes*
Typical CHC	small-sized, 1-hour visit time, OOP expense 59 RMB, mostly junior doctors, direct personal connection, obsolete equipment, travel time 15 minutes	
Typical secondary hospital	mid-sized, 3-hour visit time, OOP expense 88 RMB, many senior doctors, know nobody in person, medium-level equipment, travel time 15 minutes	
Typical tertiary hospital	large-sized, 5-hour visit time, OOP expense 105 RMB, experts are available, knows nobody personally, advanced equipment, travel time 15 minutes	

OOP: out-of-pocket; CHC: community health center
* indicates the attribute levels that are significant in each scenario

3. Results

3.1 DCE results

Table 5 presents the DCE results. The statistical significance level indicates whether the respondents considered the attribute important or not when making choices. The sign of a coefficient indicates whether the attribute had a positive or negative effect on utility. The interaction terms represent the change in utility resulting from changing perceived severity from minor to severe. The results of the interaction effects between the main attributes and the respondent characteristics can be found in online Appendix 2.

For conditions perceived as minor, three of the seven attributes were not significant: personal connection, travel time and facility size. For conditions perceived as severe, all attributes were significant, except for personal connection.

Table 5. Model estimates.

Attribute	Attribute level	Minor condition coefficient (95% CI)		Severe condition coefficient (95% CI)	
Time taken for a visit (h)	5 (ref)	-0.425***	(-0.585, -0.266)	-0.103	(-0.223, 0.017)
	3	-0.077	(-0.057. 0.201)	0.096**	(0.001, 0.191)
	1	0.502***	(0.344. 0.659)	0.007	(-0.118, 0.131)
OOP for visit (RMB)	105 (ref)	-0.196***	(-0.314, -0.077)	-0.102***	(-0.188, -0.015)
	88	0.072	(-0.057. 0.201)	-0.036	(-0.152, 0.079)
	59	0.124	(-0.011. 0.259)	0.138**	(0.029, 0.247)
Medical professionals' skill	Junior doctors (ref)	-0.277***	(-0.400, -0.154)	-0.050	(-0.155, 0.055)
	Many senior doctors	0.199***	(0.067. 0.332)	-0.089**	(-0.167, -0.011)
	Experts available on call	0.078	(-0.050. 0.205)	0.139***	(0.039, 0.239)
Personal connection within the hospital	Know nobody (ref)	0.038	(-0.092, 0.168)	0.036	(-0.053, 0.126)
	Know somebody, not very familiar with	0.026	(-0.123, 0.175)	0.059	(-0.062, 0.180)
	Direct personal connection	-0.064	(-0.199, 0.072)	-0.095	(-0.201, 0.011)
Medical equipment condition	Obsolete (ref)	-0.275***	(-0.387, -0.162)	-0.430***	(-0.518, -0.341)
	Advanced	0.275***	(0.162, 0.387)	0.430***	(0.341, 0.518)
Travel time (min)	90 (ref)	-0.096	(-0.220, 0.027)	-0.037	(-0.133, 0.059)
	40	0.014	(-0.128, 0.156)	-0.176***	(-0.285, -0.067)
	15	0.083	(-0.063, 0.229)	0.213***	(0.109, 0.318)
Facility size	Small (ref)	0.050	(-0.109, 0.209)	-0.121	(-0.257, 0.015)
	Medium	0.024	(-0.133, 0.181)	-0.095	(-0.179, 0.029)
	Large	-0.074	(-0.218, 0.070)	0.196***	(0.078, 0.314)
Opt-out		2.499***	(2.075, 2.923)	-6.024***	(-6.883, -5.165)
Interaction: attribute levels	3 hours visit x severity	0.173**	(0.012, 0.334)		

x severity	1 hour visit x severity	-0.495***	(-0.690, -0.301)
	Many senior doctors x severity	-0.288***	(-0.442, -0.134)
	Advanced equipment x severity	0.155**	(0.020, 0.289)
	40 minutes travel x severity	-0.190**	(-0.369, -0.010)
	Large size x severity	0.270***	(0.087, 0.453)
	Not visiting a facility x severity	-8.524***	(-9.453, -7.594)
Model fit	Akaike Information Criterion	4539.866	
	Log likelihood	9171.732	
Number of mixed logit iterations used=16; choice observations = 6,357; respondents = 532			

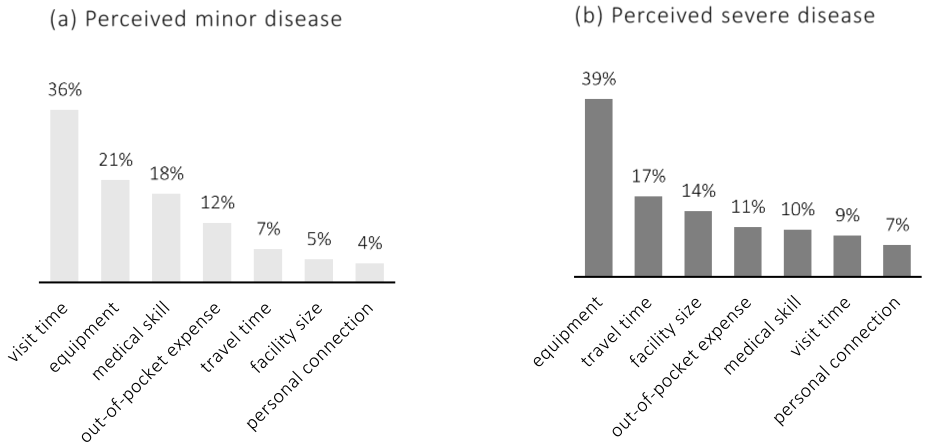
OOP: out-of-pocket expenses
ref: reference levels
SE: Standard Error
, * denote significance at the 0.05 and 0.01 level, respectively.

Notes:
(1) Coefficients for severe condition are post-hoc estimates based on the coefficients for minor condition.
(2) Coefficients of the reference levels are calculated as the negative sum of the coefficients of the other levels of the attribute.
(3) In the minor condition, coefficient and SE represent the estimated results in the case of perceived minor disease; in the severe condition, coefficient and SE represent the estimated results in the case of perceived minor disease.
(4) Only the significant interaction terms are listed in the table.

For a condition perceived as severe, the respondents were more tolerant of a long visit time, showed a strong preference for a 3-hour visit, a larger hospital, and a strong aversion to opting out. Medical experts were most preferred among the three types of doctors, and only medical experts generated a positive effect in utility. However, junior doctors were preferred to senior doctors, although the difference in utility between these two types of doctors is small.

Figure 2 presents the results of the relative importance. The respondents attached different relative importance to the factors depending on perceived disease severity. For conditions perceived as minor, they gave most importance to visit time, followed by equipment, medical skill and OOP expense. For conditions perceived as severe, they attached highest importance to equipment, followed by travel time, facility size, OOP expense, medical professionals' skill and visit time.

Figure 2. Relative importance of attributes under (a) perceived minor disease; (b) perceived severe disease.



3.2 Predicted choice probabilities

(1) Choosing a facility vs. opting out

At 86% for perceived minor conditions and 0.12% for perceived severe conditions, the probabilities of choosing to opt out are notable (Figure 3-a, 3-b). When attribute levels were changed one at a time to the lowest and highest values, these probabilities ranged between 90% and 79% for perceived minor conditions: the predicted probability of choosing a facility was 10% at the lowest and more than doubled to a maximum of 21% for the one-way changes. For conditions perceived as severe, the range of the predicted choice probabilities was much smaller in absolute terms, between 0.19% and 0.08%, for the one-way changes. The relative change in the probabilities, however, was as large as that for the perceived minor conditions.

Now let us consider the best and worst cases attainable when changing all factors simultaneously rather than one at a time (Figure 3-c). For a condition perceived as minor, the predicted probabilities of choosing a facility under the worst scenario was only 4% (96% preferring to opt out), and it increased substantially to 37% under the best scenario. For a condition perceived as severe, the predicted probabilities of choosing opt-out ranged from 0.37% to 0.03%, a 92% difference in the relative probability.

(2) Choosing a community health center vs. a typical secondary hospital

For conditions perceived as minor, the predicted probability of choosing a secondary hospital was higher than that of a CHC. When changing one factor at a time, the secondary hospital still had a higher probability of being chosen, unless the level of medical skills or equipment of the CHC were improved (Figure 4-a). The change in choice probabilities for conditions perceived as severe was as follows: only when the equipment at the CHC was improved to the advanced level was the choice probability of the CHC higher than that of a secondary hospital (Figure 4-b).

Figure 4-c shows the predicted probabilities of choosing a CHC or secondary hospital when the attributes of the CHC changed simultaneously from worst to best scenario. For conditions perceived as minor, the probability of choosing a CHC grew from 2% to 21% (more than tenfold), with a decrease in the choice probability of a secondary hospital from 10% to 8%. It suggests that the large increase in the predicted probability of choosing a best-case CHC mostly came from the patients who previously preferred to opt out when the CHC is at worst case. In severe conditions, the choice probability of a CHC increased from 30% to 68% when it was improved to the best case, accompanied by a corresponding decrease in the choice probability of a secondary hospital from 70% to 32%. In this case, the patients switched to choosing a CHC from choosing secondary hospital when the CHC was improved to its best case.

Figure 3. (a) One-way impact of the attributes on the predicted probabilities of choosing an average hospital over opting-out under out for perceived minor condition; (b) One-way impact of the attributes on the predicted probabilities of choosing an average hospital over opting-out for perceived severe condition; (c) Predicted choice probabilities of choosing to visit an average hospital at its worst, average and best attribute levels over opting-out under different disease severity scenarios for first visit. OOP: out-of-pocket expense per visit.

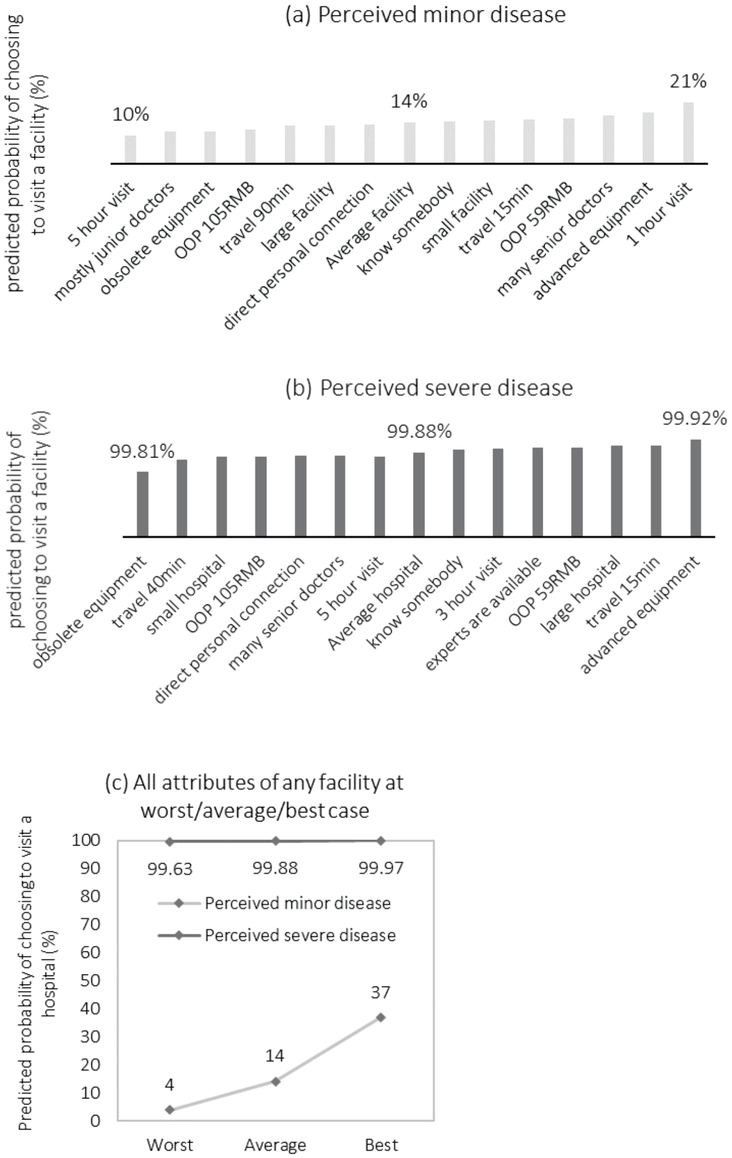
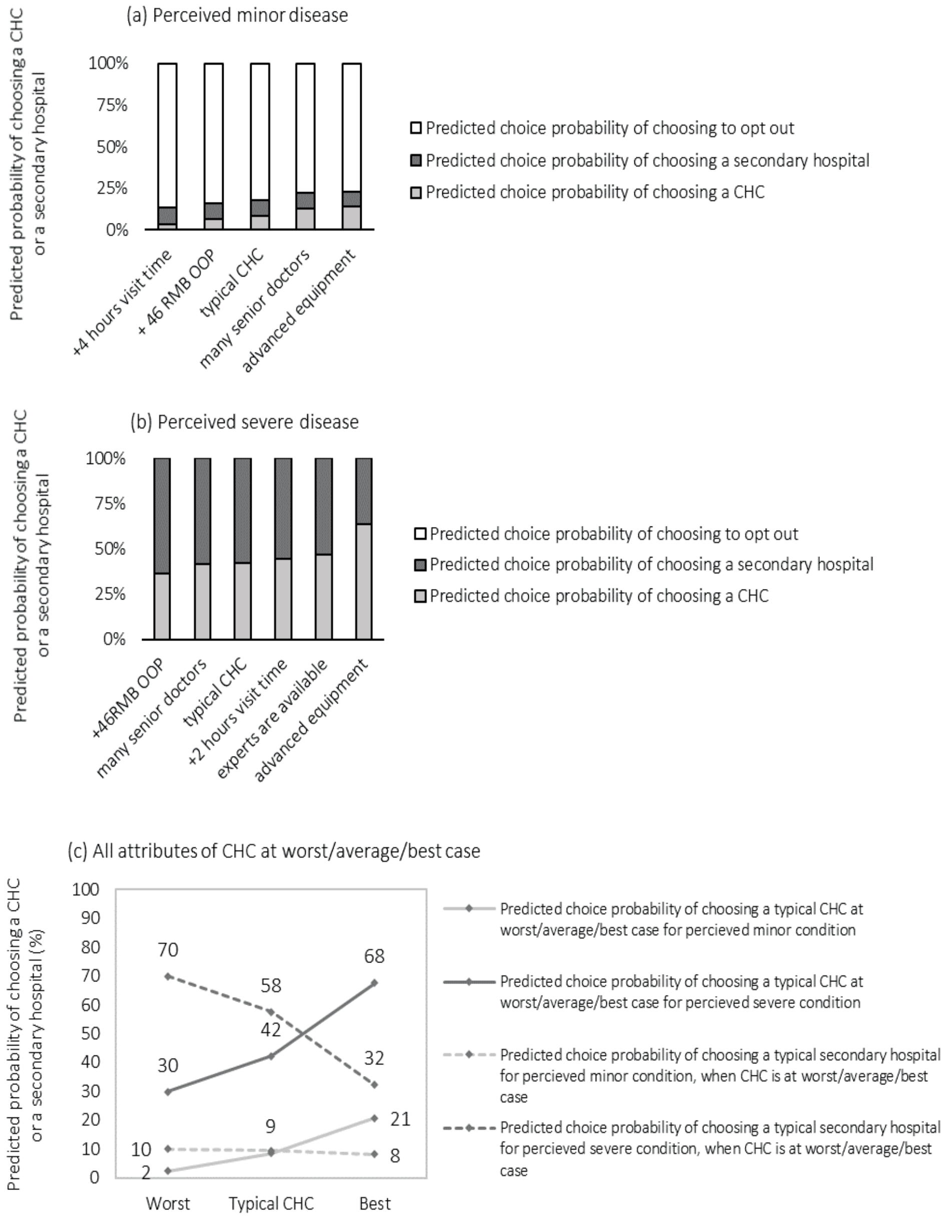


Figure 4. (a) One-way impact of the attributes on the predicted probabilities of choosing a CHC compared to a typical secondary hospital for perceived minor condition; (b) One-way impact of the attributes on the predicted probabilities of choosing a CHC compared to a typical secondary hospital for perceived severe condition; (c) Predicted probabilities of choosing a CHC and a typical secondary hospital under different disease severity scenarios for first visit. CHC: community health center OOP: out-of-pocket expense per visit.

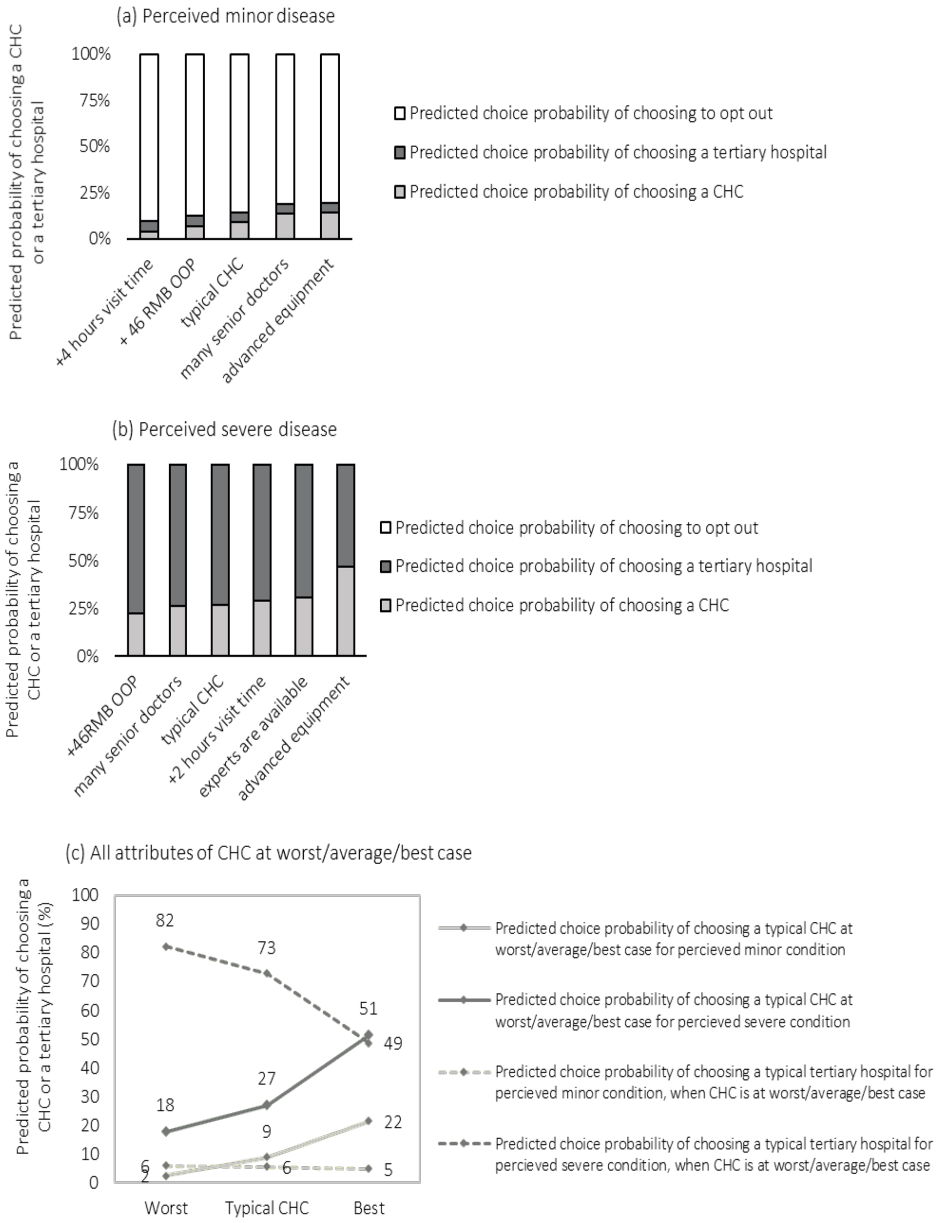


(3) Choosing a community health center vs. a typical tertiary hospital

For conditions perceived as minor, the predicted probability of choosing a CHC was always larger than that of a tertiary hospital, unless the visit time of a CHC increased from 1 hour to 5 hours (Figure 5-a). For conditions perceived as severe, the respondents were more likely to choose a tertiary hospital even if experts or advanced equipment were available at a CHC (Figure 5-b).

Figure 5-c shows the predicted probabilities of choosing a CHC or tertiary hospital when the attributes of the CHC change simultaneously from the worst to the best scenario. In the minor condition, the choice probability of the CHC increased substantially from 2% to 22%. This more than tenfold increase was predominantly due to a reduced probability of opting out. For conditions perceived as severe, the choice probabilities of the CHC and the tertiary hospital were hugely different in the worst-case scenario of the CHC (18% versus 82%), but they converged to be approximately equal (51% versus 49%) in the best-case scenario of the CHC. Thus, the predicted choice probability of a CHC at its best is almost three times higher in comparison to the worst.

Figure 5. (a) One-way impact of the attributes on the predicted probabilities of choosing a CHC compared to a typical tertiary hospital for perceived minor condition; (b) One-way impact of the attributes on the predicted probabilities of choosing a CHC compared to a typical tertiary hospital for perceived severe condition; (c) Predicted probabilities of choosing a CHC and a typical tertiary hospital under different disease severity scenarios for first visit. CHC: community health center OOP: out-of-pocket expense per visit.



4. Discussion

This study addressed valuations of facility attributes by urban Chinese when choosing a health care facility for first visit. We conducted a DCE in Shanghai to elicit the relative importance of facility attributes. To the best of our knowledge, this is the first study on the quantitative effects of facility attributes on facility choice for the urban population of China. The results expand the existing understanding of facility choice and provide suggestions for tailored policies to guide patient flow to primary care in urban China, thus improving the efficiency and effectiveness of the health system.

The results showed that the urban residents weighed facility attributes differently depending on whether they perceived their condition as minor or severe. For conditions perceived as minor, they valued a rapid consultation service highly, followed by availability of advanced equipment and medical skills of doctors. However, visit time became insignificant when the condition is perceived as severe, in which case the relative importance of equipment dominated. These findings echo the literature which reports that people with severe conditions are likely to choose big hospitals for superior care and advanced equipment [17,42]. Notably, the equipment factor was pivotal and, in both cases, had larger importance attached than the medical skills of doctors.

The results of this study can be cautiously compared with a DCE conducted in rural China [19]. Rural residents also valued visit time most in conditions perceived as minor, but they did not attach large importance to equipment for conditions perceived as severe. In addition, OOP expense was considered more important under both severity scenarios for rural residents, which might be explained by their lower average income. For both urban and rural residents, facility size was never the most important factor, which implied that the popular term “big hospital” may not merely refer to the physical size but rather to other attributes commonly associated with size. However, for conditions perceived as severe, urban residents valued a large-sized hospital most of the three sizes, while rural residents preferred a mid-sized facility. This might be due to the difficulty in navigating big hospitals reported by rural residents [10]. These findings suggest that policy measures should be tailored to the different choice behaviors for urban and rural China to enhance their effectiveness.

For conditions perceived as minor, the respondents showed a large preference for opting out, which confirms evidence of a considerable latent health care demand [43]. Our results showed that this latent demand could reduce from 86% to 63% when the facilities (especially CHCs) are improved to the best case. These decreases reflect that improvement of CHC might turn presently latent demand into first visits at CHCs, more than doubling the number of first visits. Similarly, the predicted choice probability of opting out in severe condition decreased relatively by 75% (from 0.12% to 0.03%) when a CHC was improved to the best case.

We found that the health care demand for both severity conditions tended towards higher level hospitals, although people were less likely to visit a tertiary hospital for conditions perceived as minor. Improving CHCs may reverse this situation, causing the corresponding number of first visits to primary care to grow (as we discuss below). Improvements to equipment or medical skill increase the probability of choosing a CHC more than modifying other attributes. Notably, having experts was the most preferred level of medical skill for conditions perceived as severe, while the respondents preferred senior doctors for conditions perceived as minor.

Improving CHCs could not only alter latent demand into actual medical consulting in the minor condition but could also attract a considerable portion of patients who would otherwise choose secondary (11.11%) or tertiary hospitals (16.67%) for conditions perceived as minor. Such changes in the predicted choice probability of CHCs were even more significant for conditions perceived as severe. Most notably, when people choose between CHCs and secondary hospitals – the choice probability of the secondary hospital decreased by 44.83% if the typical CHCs were improved to a best case. For tertiary hospitals, this reduction was 32.88%. These numbers too indicate that improvement of CHCs can lead to very sizable increases in patients attending CHCs for their first visit.

As the middle level of the health care system, secondary hospitals provide health services to the region across different communities and take the responsibility for receiving referrals from CHCs in urban areas [1]. However, the literature has seldom addressed the utilization of secondary hospitals. Our analysis presents the first results addressing secondary care utilization in urban China.

The Chinese government is making efforts to improve the primary care system. For example, as a main component to incentivize choosing primary care, the national health insurance scheme offers a higher reimbursement rate at primary care facilities [44]. However, our results show that OOP expense was not a main factor (ranked only the fourth important factor) in either severity scenarios for our urban respondents. The effect of such costly incentives to shift patient flow to the primary level may therefore be modest in urban areas. To improve the medical skill in the primary care system, several provinces have rolled out a policy to motivate the doctors from higher level hospitals to work periodically in CHCs [45]. The results of our study showed that improving medical skill would work moderately effectively to shift urban patients from higher level facilities to CHCs. Specifically, compared to having medical experts, having more senior doctors would more effectively guide patient flow to primary care. As visit time was so important in a minor disease scenario, our results suggest that accelerating the registration and treatment process may guide the patient flow more efficiently. In addition, this study conveys an important message regarding the high importance of medical equipment. Although policy measures were taken to improve the infrastructure of the primary care system, a considerable number of primary care facilities still cannot do routine procedures such as blood tests or chest x-rays [9]. In general, our results confirm current policies to improve medical skill and equipment as important to advance CHCs towards best case and to redirect patient flow to CHCs. In reality, these policies are constrained by budget and human resource limitations.

The high importance of medical equipment identified in our study and the exclusive availability of advanced medical equipment in higher level hospitals can largely explain why patients tend to choose higher level hospitals [1,42]. This may further exacerbate as competition incentivizes higher level hospitals to invest more in equipment, a situation known as the medical arms race [46,47]. In addition, studies also report that competition among higher level hospitals did not result in significant improvements on service quality or health outcomes [42,47,48]. While it may be difficult to achieve, our results show that it may be beneficial to redirect budget for investment in medical equipment from tertiary hospitals to CHCs. Frugal innovation may serve to do so at an affordable cost [49,50].

It is worth noting that improvements in CHC attributes may result in considerable increases in first visits for conditions perceived as minor and for conditions perceived as severe. Such large increases may eventually cause the presently underutilized capacity of primary care facilities to become insufficient and reduce responsiveness. Therefore, research on the capacity of primary care facilities is called for to ensure these facilities are able to provide timely access to meet demand, as envisioned by the Alma-Ata agreement [20].

Study limitations

One limitation of this study is that all data were collected in three adjacent residency communities in Shanghai. Therefore, the results should be interpreted with caution when generalizing to urban China at large. Moreover, the mid level of travel time (40 minutes) was least preferred for conditions perceived as severe. We fixed the travel time at 15 minutes in a major part of our analysis to limit the effect of this counter-intuitive finding. While in real life, China's urban population can choose between three levels, the choice sets that we used limited the choice between two facilities at a time (and opting out). This was done to control the cognitive burden and promote the credibility of the choice data [51].

5. Conclusion

For perceived minor and severe diseases, urban residents in China weigh facility attributes differently for first-contact facility choice. For conditions perceived as minor, the respondents valued visit time, equipment, and medical skill the most, while for conditions perceived as severe, they placed most importance on equipment, travel time and facility size. The latent demand found is very high at 86% for conditions perceived as minor but can be partly converted into facility visits by improving CHCs. In addition, our results strongly suggest that making appropriate improvements and innovations at CHCs can effectively guide patient flow from higher level hospitals to primary level.

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Chapter 6

Patient choice of health care facilities in Shanghai, China: A modelling study combining utility theory and queueing theory

This chapter was submitted as:

Liu Y, Kong Q, Zhong L, et al. Patient choice of health care facilities in Shanghai, China: A modelling study combining utility theory and queueing theory.

Abstract

Background

Patients' free access to facilities caused overutilization of tertiary care and underutilization of primary care in China. Existing studies have identified the quantitative effects of the factors influencing the facility choice through discrete choice experiments (DCEs). The DCEs investigate visit time as a determinant of facility choice whereas, in reality, visit time and facility choice are mutually dependent. We present a model and policy analysis based on a revised model which capture this relationship.

Methods

We modelled the mutual dependent relationship between visit time and facility choice in a three-facility level system, which combines a utility-based choice model with a queueing model. We explored the impact of the policy interventions to improve the community health center (CHC) on visit time, choice probability and opt-out rate, and compare the results with those obtained using the DCE method.

Findings

When the equipment at CHC stays as basic and the medical skills improve, the visit times of the three facilities do not change much. Only when the medical skills at CHC also improve to the best level, the visit times at tertiary hospital drop significantly as intended by current policy interventions. Moreover, the choice probability increases for CHC and decreases for tertiary hospital, while reducing opt-out. However, all changes are smaller than predicted by a DCE model.

Interpretation

The interaction between visit time and choice probability should not be neglected in policy design. The proposed model enables policy makers to tackle imbalances more effectively in healthcare use in China.

1. Introduction

In China, patients can freely access any health care facility of their choice and tend to prefer tertiary hospitals.[1–3] This has caused overutilization of tertiary hospitals and underutilization of primary care facilities such as community health centers (CHCs). The Chinese government has rolled out a series of policies to promote primary care. However, the effectiveness of these interventions has been limited.[3–6]

Recent literature has identified factors that influence the choice of health care facilities in China.[2,7] These include visit time, medical equipment, medical skill, travel time and out-of-pocket expense.[7,8] The quantitative effects of these factors have been examined through discrete choice experiments (DCEs).[8,9]

Visit time, which is defined as the total time spent per visit at a facility, is an important determinant of facility choice.[8,9] Visit time includes the time spent on consultations and other services as well as the time spent on waiting in queues. DCE models assume a one-directional relationship between visit time and the probability that an individual will choose a particular facility (the choice probability); in other words, visit time influences choice probability. However, this relationship is likely to be bidirectional. For instance, if the choice probability of a CHC increases, more patients will arrive and queue up there, which increases the visit time and in turn decreases the choice probability. Therefore, findings from DCEs have fundamental shortcomings in this situation, hampering their capability to serve as a basis for policy making to improve primary care utilization. This is particularly true for urban China, where visit time is more relevant and utilization problems are more severe than in rural areas.[8,10] In this study, we present a model that considers the bidirectional relationship between visit time and facility choice, combining discrete choice modeling and queueing theory.

Queueing theory enables us to model how waiting times and visit times depend on choice probabilities and arrival rates.[11] Our novel methodological approach, which combines discrete choice modeling with queueing models, captures the mutual dependence between visit time and choice probability, allowing us to improve the findings from previous DCE analyses and assess the impact of policy interventions more accurately. The research questions we aim to answer are:

1. How do patient choice and visit time interact?
2. How do the interventions to improve primary care facilities influence visit time and facility choice?
3. How does incorporating the interaction between facility choice and visit time improve DCE results (that disregard this interaction)?

2. Methods

This section describes how the model was developed (section 2.1), presents the parameters and outcome variables (section 2.1-2.4), and describes the sensitivity analysis (section 2.5).

The main notations used in this paper are given below:

i	Index for disease severity; 1 is for minor disease condition; 2 is for severe disease condition.
j	Index for health facility levels; 1 is for CHC; 2 is for secondary hospital; 3 is for tertiary hospital.
k	Index of summation for health facility levels; 1 is for CHC; 2 is for secondary hospital; 3 for tertiary hospital.
λ_j	Patient arrival rate, which is the average number of patients per doctor per hour at facility j.
μ_j	Service rate, which is the average number of patients a doctor can serve per hour at facility j.
tj	Service time, which is the doctor consulting time per patient visit at facility j.
wj	Waiting time for doctor consultation at facility j.
sj	Sojourn time for doctor consultation at facility j, which is the average total time each patient spends on patient consultation and waiting for doctor consultation at facility j.
oj	Time spent on other activities during a hospital visit at facility j.
Tj	Visit time, which is the total time spent on visiting facility j, including sojourn time and time spent on other activities.
N	The total number of people who feel sick per hour in Shanghai.

α	Proportion of all people who feel sick and perceive their condition as a minor disease.
U_ij	Utility of visiting facility j per disease severity i, obtained from the DCE model.
$U_{ioptout}$	Utility of opting out per disease severity i, obtained from the DCE model.
pj	Choice probability of facility j.
p_{optout}	Choice probability of opting out.
mj	Number of on-duty doctors per day at facility j.
nj	Total number of hospitals at facility level j.
βj	Ratio between total time spent on waiting for other activities and the time waiting for doctor consultation at facility j.
Cj	Sum of the service times of other activities at facility j.

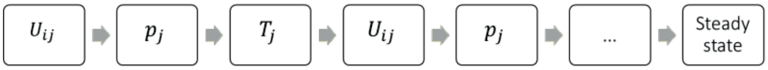
2.1 Model structure

This study models a three level Chinese urban health system which includes a primary care facility (CHC), a secondary hospital, and a tertiary hospital. [7] Each facility hosts a number of doctors among whom patients are assumed to be evenly distributed. Patients choose a facility (level) to access, where they are assigned to a doctor and join the queue to see that doctor.

The proposed model combines a utility-based choice probability component, modeled as previously described by Liu et al[8] (hereafter referred to as 'the DCE model') and a queueing model to capture the waiting times.

To understand the model, we will first introduce the steady state in the three-level health system. The visit times, which include waiting times, are one of the factors determining choice probabilities.[8] Conversely, the choice probabilities determine patient arrival rates and therefore waiting times and visit times. The system is in a steady state if visit times that determine choice probabilities (DCE model) are equal to visit times that result from the same choice probabilities (queuing model). If any intervention is implemented in the system, for instance, changing the skill level of doctors or medical equipment of one of the facilities, it will affect the choice probability of that facility, and hence the visit time, which in turn will affect the choice probability. Eventually, the system may reach a new steady state after the intervention, as shown in Figure 1.

Figure 1. Stylized effect of intervention on choice probabilities and waiting times.



The time components play a key role in linking visit time with choice probability, so we will explain these terms in detail. The sojourn time, s_j, is defined as the total time spent on the doctor consultation (t_j) and the waiting time (w_j) before the consultation:

$$s_j = t_j + w_j$$

The visit time, T_j, is the sum of the sojourn time and the time spent on other activities (o_j). Hence, we may also write:

$$T_j = t_j + w_j + o_j \qquad (1)$$

In the discrete choice model, the utility (U_j) of facility *j* is the sum of the utilities of all factors involved,[12,13] including the visit time. The choice probability of a facility can be calculated as the exponent of its utility, divided by the sum of the exponents of the utilities of all facilities and opting-out.[8]

Disease severity (minor or severe) is a key attribute to determining preferences for health care facilities in China.[2,8] Therefore, it is necessary to determine the fraction of people who feel sick perceive their illness as minor (α), and take this into account when calculating facility choice probabilities. Considering the patients with minor and severe illness together, the choice probability of facility j (p_j) is:

$$p_j = \alpha * \frac{e^{U_{1j}}}{\sum_{k=1}^{3} e^{U_{1k}} + e^{U_{1optout}}} + (1-\alpha) * \frac{e^{U_{2j}}}{\sum_{k=1}^{3} e^{U_{2k}} + e^{U_{2optout}}}$$

For each doctor in each facility, the process of patients attending the doctor can be modeled as a single server queueing model (M/M/1 queueing model) with Poisson arrival process and exponential service rates.[14–16] The expected sojourn time s_j in a stable M/M/1 queueing system can be expressed using Little's Law,[16,17] where λ_j is the patient arrival rate per doctor per hour and μ_j is the service rate:

$$s_j = \frac{1}{\mu_j - \lambda_j}$$

The hourly patient arrival rate per doctor at facility *j* can be calculated by multiplying the total number of people who feel sick per hour (N) by the choice probability of facility *j* (p_j), subsequently divided by the number of on-duty doctors per day (m_j) and the number of hospitals (n_j) of level j. Recalling that the visit time T_j equals the sum of the waiting time, doctor consultation time, and time spent on other activities, we then obtain:

6

$$t_j + w_j = \frac{1}{\mu_j - p_j \times \frac{N}{m_j * n_j}}$$

The choice probability can then be written as:

$$p_j = \frac{\mu_j - \frac{1}{t_j + w_j}}{N} * m_j * n_j$$

In the steady state and for $j = 1,2,3$, the utility-based choice probability of facility j equals the queueing-based probability, which can be expressed as follows:

$$\alpha * \frac{e^{U_{1j}}}{\sum_{k=1}^{3} e^{U_{1k}} + e^{U_{1optout}}} + (1-\alpha) * \frac{e^{U_{2j}}}{\sum_{k=1}^{3} e^{U_{2k}} + e^{U_{2optout}}} = \frac{\mu_j - \frac{1}{t_j + w_j}}{N} * m_j * n_j \quad (2)$$

The utility and waiting times that solve the set of equations (2) (for $j = 1,2,3$) represent the steady state, corresponding choice probabilities and waiting times. It is worth noting that the relationship between the utilities and the waiting times is established through equation (1), which relates waiting time to the factor visit time. In the following we assess the effects of interventions in the health system by reporting the visit time and choice probabilities in the steady state and compare them with those in the base case.

2.2 Model inputs

Service rate

We collected data on service rate μ_j by interviewing doctors from two CHCs, a secondary hospital, and a tertiary hospital in Shanghai in June 2019. Data collection and the values of other parameters are described in online Appendix 1 and Appendix 2. Analysis of service rates revealed that they are roughly the same across the three facility levels at around 12 patients per hour. We further validated this finding by consulting an expert in health services management and by searching the literature.[18] Since the evidence base can still be viewed as weak, we conducted a sensitivity analysis on service rates (see section 2.5 for details).

Number of on-duty doctors, number of facilities, number of people who feel sick

In the same interviews, we also collected data on the average number of on-duty doctors per day and the total number of licensed doctors in each facility. The number of facilities at each level and the total number of people who feel sick per hour were obtained from the national census.[19,20]

Time spent on other activities

Activities other than consultation may involve lab tests, pharmacy prescription fulfillment, registration, cashier services, walking inside of the facility, and parking.[5,21]The time spent on these activities o_j may typically include a fixed value representing the service time of these activities and a variable representing the time waiting for these services. We assume that this waiting time is proportional to the waiting time for the doctor consultation. Therefore, time for other activities can be expressed as:

$$o_j = \beta_j * w_j + C_j$$

In this formula, the product $\beta_j * w_j$ is the total waiting time for other activities. In other words, this waiting time equals β_j times the waiting time for doctor consultation w_j. C_j is the sum of the service times of other activities.

Therefore, by referring to equation (1), visit time T_j can be written as a function of waiting time (w_j), which makes it possible to solve the waiting time in equation (2), if β_j and C_j are known. These are not well described in the literature, so the following assumptions were made about the base-case values of β_j and C_j:

(1) Patients usually choose to visit CHC when experiencing common clinical conditions in which case they may not need many of the aforementioned services. However, in tertiary hospitals, patients usually need more complicated treatment procedures.[5,7,22] Therefore, we assumed $\beta_1 < \beta_2 < \beta_3$, and $C_1 < C_2 < C_3$.

(2) For C_j, we assumed that the service time of other activities is shorter than one hour for any facility. Patients mainly go to CHCs for drug prescriptions, so we adopted the average time spent on drug prescription reported in the literature for C_1.[2,5,23] Patients visiting secondary hospital usually receive drugs and undergo routine lab tests, so C_2 is initially assumed to be two times of C_1.[21] Tertiary hospitals provide most extensive services, therefore C_3 was initially set to be thrice C_1.[21]

(3) As patients visit CHCs mainly for drug prescription,[2,5] we assumed β_1=1 as in the base case. Secondary hospitals are mid-sized hospitals [21] and patients may need to walk through different buildings during a visit. Drug prescription, lab tests and walking within a facility are part of a visit in secondary hospital, so we initially assumed that β_2=3 as in the base case. For tertiary hospitals, patients mainly wait for lab tests, registration, and payment, and usually need to go back and forth to the doctor because they need more than one lab test.[18] We assumed that patient undergo these activities multiple times and set β_3=8 as in the base case.

The values mentioned above can be found in Table 1. Because there is insufficient evidence for these values, we conducted sensitivity analysis to capture the uncertainties of the impact on waiting time. The sensitivity analysis methods are provided in section 2.5.

Proportion of patients who perceive their illness as minor

We calculated the proportion of patients who perceive their illness as minor (α) from solving the set of equations (2) (for $j = 1,2,3$) using the parameter values in the base case and assumed that this value was constant across all analyses.

Utilities from the DCE model

The relationships between visit time and its utility were fitted using data from the DCE model in a continuous manner. The utilities of other attributes were obtained from the DCE model, so the utility of a facility can be expressed by a continuous function of its visit time. The utility values of other attributes and the coefficients for the function of visit time were used to derive the choice probability in the left-hand side of the set of equations (2) (for $j = 1,2,3$). These values can be found in online Appendix 2.

The values of the parameters presented in section 2.2.1 to 2.2.4 are summarized in Table 1.

Table 1. Model inputs

Parameter	CHC (j=1)	Secondary hospital (j=2)	Tertiary hospital (j=2)
β_j (base-case)	1	3	8
C_j (h) (base-case)	0.2	0.4	0.6
μj (base-case)	12	12	12
mj	6.8	40.8	98.9
nj	1009	105	47
α	0.498		

2.2 Intervention analysis

Policies to improve the primary care facilities are being rolled out in China, among which great efforts were made to improve the medical skills and equipment.[24] The DCE model also showed that medical skills and equipment have the strongest influence on patient choice.[5,8] To answer the second research question, we simulated several interventions to improve these two attributes in CHCs and explored how these interventions guided patient flow. The interventions were established by varying the attribute levels of a 'typical CHC' in the DCE model,[8] while the secondary and tertiary hospitals stayed the same across the analyses. We summarized the base case and the interventions as six combinations of medical skill level and equipment level in Table 2. 'Medical skill' has three levels and 'equipment' has two. In the base case, both attributes were at the lowest level. In each intervention, the attribute levels of CHC changed according to the corresponding levels of medical skills and equipment. The coefficients to generate the utility values used in the intervention analysis can be found in online Appendix 2.

Table 2. CHC medical skills and equipment levels in the base case and interventions

	Base case	Intervention 1	Intervention 2	Intervention 3	Intervention 4	Intervention 5
Medical skill level	Junior	Senior	Expert	Junior	Senior	Expert
Equipment level	Basic	Basic	Basic	Advanced	Advanced	Advanced

2.3 Study outcomes

The primary outcomes to compare across the scenarios are visit time, probability of opting out, and choice probability of each facility in the steady state.

In addition, we compared the facility choice probability and opt-out rate between the current model and the DCE model after implementing the five interventions. We did not compare visit times because these were input parameters in the DCE model.

2.4 Sensitivity analysis

To determine how sensitive the outcomes ($T_j, p_j,$ and p_{optout}) are to service rate μ_j and visit time parameters β_j and C_j, we conducted a set of univariate sensitivity analyses for the base case. We also performed a sensitivity analysis for the intervention scenario in which the equipment and medical skills at CHC are at the highest level (intervention 5 in Table 2).
We assume that the service rate cannot be higher in a CHC than in a secondary hospital, and that the service rate in a secondary hospital cannot be higher than in a tertiary hospital. The upper limit of the service rate is 20.[25] The lower limit of service rate has not been defined, so we decreased the value until the model had no solution. For β_j and C_j, the base-case values for the secondary and tertiary hospitals were used as the upper limit for the CHC and secondary hospital, respectively. The base-case values for CHC and secondary hospital were used as the lower limit for the secondary and tertiary hospital, respectively. The lower limits of these two parameters have not been defined for CHC, so we decreased the value until the

model had no solution. The upper limits for the tertiary hospital were set to be at 150% of the base-case values. These values and the full sensitivity analysis results can be found in online Appendix 3.

3. Results

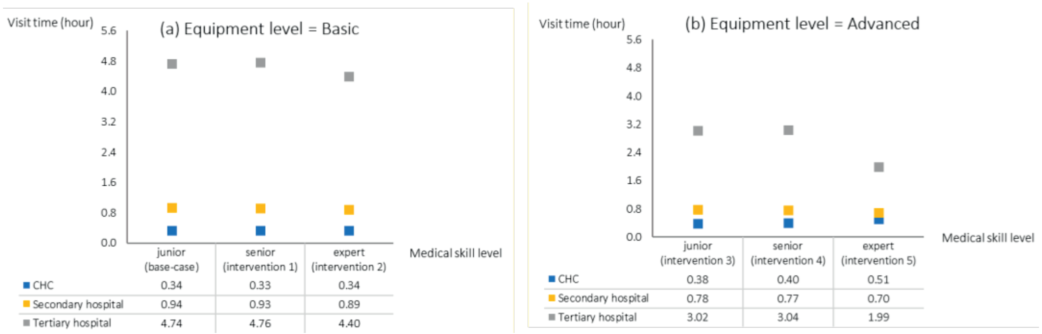
3.1 Intervention analysis

To answer the second research question, we compared visit times, choice probabilities and opt-out rates in the base case with those in the intervention scenarios, which were obtained by solving the set of equations (2) (for $j = 1,2,3$). In general, when medical skills and equipment are improved at CHC, the visit times of secondary and tertiary hospitals decrease, and the visit time of CHC slightly increases. Meanwhile, the choice probability for CHC increases, while the choice probability for secondary and tertiary hospitals, and the opt-out rate, decrease. We now present these results in detail in the following. For ease of illustration, we group the interventions and present the results by the equipment level.

3.2 Visit time

The visit times are shown in Figure 2. With basic equipment and improved medical skills at CHC, the changes in the visit times of the three facilities are within 7% (Figure 2(a)), compared to the base case. Advanced equipment and improved medical skills at CHC increased the visit time at CHC and decreased the visit time at secondary and tertiary hospitals (Figure 2(b)). Compared with the base case, high medical skill and advanced equipment reduced the visit times at secondary hospital by 25% (from 0.94h to 0.70h) and at tertiary hospital by 58% (from 4.74h to 1.99h). Specifically, comparing Figure 2(a) with Figure 2(b), the visit times of tertiary hospital shows a clear drop when the equipment level of CHC becomes advanced.

Figure 2. The stead-state visit times in the base case and the intervention analysis



3.3 Choice probability and opt-out rate

Table 3 presents the choice probability and opt-out rates observed in this study and in the DCE model, grouped by the medical equipment level. The CHC choice probabilities obtained in our model are mostly lower than those predicted by the DCE model, with a gap of up to 5.7%. The choice probability for a tertiary hospital was mostly higher in our study than in the previous DCE model, and this difference was most prominent among the three facility levels. The largest difference (14.7%) was observed at the highest medical skill level and advanced equipment upgrade at the CHC. The predicted choice probability of the secondary hospital was lower in the current model than in the DCE model, but this difference was small.

Table 3. Comparison of choice probabilities and opt-out rates in the two models
p: Choice probability of the corresponding facility (or opt-out) in current model; p_DCE: choice probability in the DCE model; change in percentage: difference in probabilities between the current model and the DCE model; CHC: community health center.

Medical equipment	Basic			Advanced		
Medical skill	Junior (base case)	Senior (intervention 1)	Expert (intervention 2)	Junior (intervention 3)	Senior (intervention 4)	Expert (intervention 5)
CHC						
p	0.1407	0.1614	0.1700	0.2397	0.2685	0.3574
p_DCE	0.1407	0.1614	0.1733	0.2542	0.2841	0.3780
Change in percentage	0.0%	0.0%	-1.9%	-5.7%	-5.5%	-5.4%
Secondary hospital						
p	0.2011	0.1985	0.1907	0.1637	0.1594	0.1370
p_DCE	0.2011	0.1985	0.1939	0.1708	0.1665	0.1412
Change in percentage	0.0%	0.0%	-1.7%	-4.2%	-4.3%	-3.0%
Tertiary hospital						
p	0.3182	0.3185	0.3138	0.2854	0.2859	0.2395
p_DCE	0.3182	0.3185	0.3059	0.2570	0.2583	0.2088
Change in percentage	0.0%	0.0%	2.6%	11.1%	10.7%	14.7%
Opt-out						
p	0.3400	0.3216	0.3255	0.3113	0.2862	0.2660
p_DCE	0.3400	0.3216	0.3269	0.3180	0.2911	0.2720
Change in percentage	0.0%	0.0%	-0.4%	-2.1%	-1.7%	-2.2%

3.4 Sensitivity analysis

We conducted sensitivity analysis for the base case and the intervention with highest improvement in CHC equipment and medical skills. Figure 3 and Figure 4 show the relative changes in outcomes ($T_j, p_j,$ and p_{optout}) in regard to the relative changes in input parameters (μ_j, β_j and C_j). For concision, we only present results for equal service rates $\mu_j \geq 4\ (j = 1, 2, 3)$ and for visit times up to eight hours. The full sensitivity analysis results are presented in online Appendix 3.

Impact of β_j and C_j in the base case

At CHC and secondary hospital, changes in β_1, β_2, and C_1, C_2 resulted in a linear change to respective visit time (T_1, T_2; Figure 3A, 3B, 3D, 3E). Changing β_3 had a non-linear impact on T_3 and these changes also affected other outcomes (Figure 3C). For example, when β_3 increased, p_3 decreased and p_1 slightly increased. Changing C_3 did not affect the outcomes (Figure 3F), in conformance with the small fraction of time the constant visit time represents of the total visit time in tertiary hospitals in the base case.

Impact of μ_j in the base case

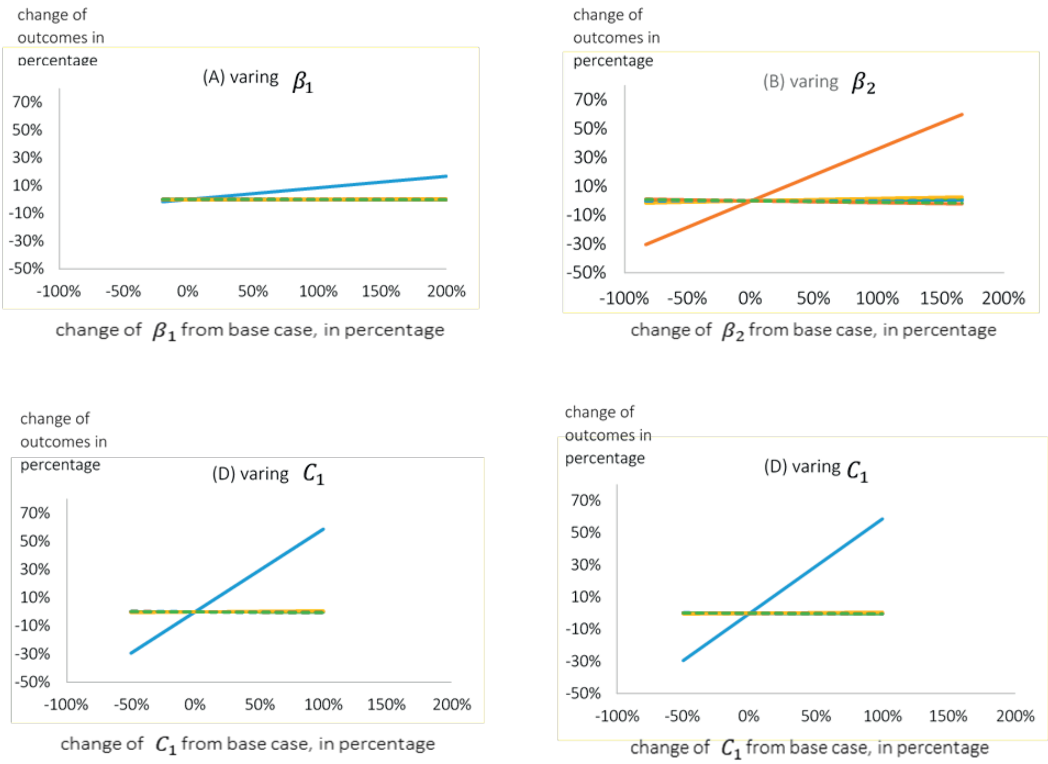
Visit times decreased in all three facilities as the service rates increased (Figure 3G). When service rates were lower than base-case values, visit times in secondary hospital were most sensitive to service rate changes. When service rates were higher than the base-case values, the largest impact was on the visit time of tertiary hospitals T_3 and it reduced by up to 67%.

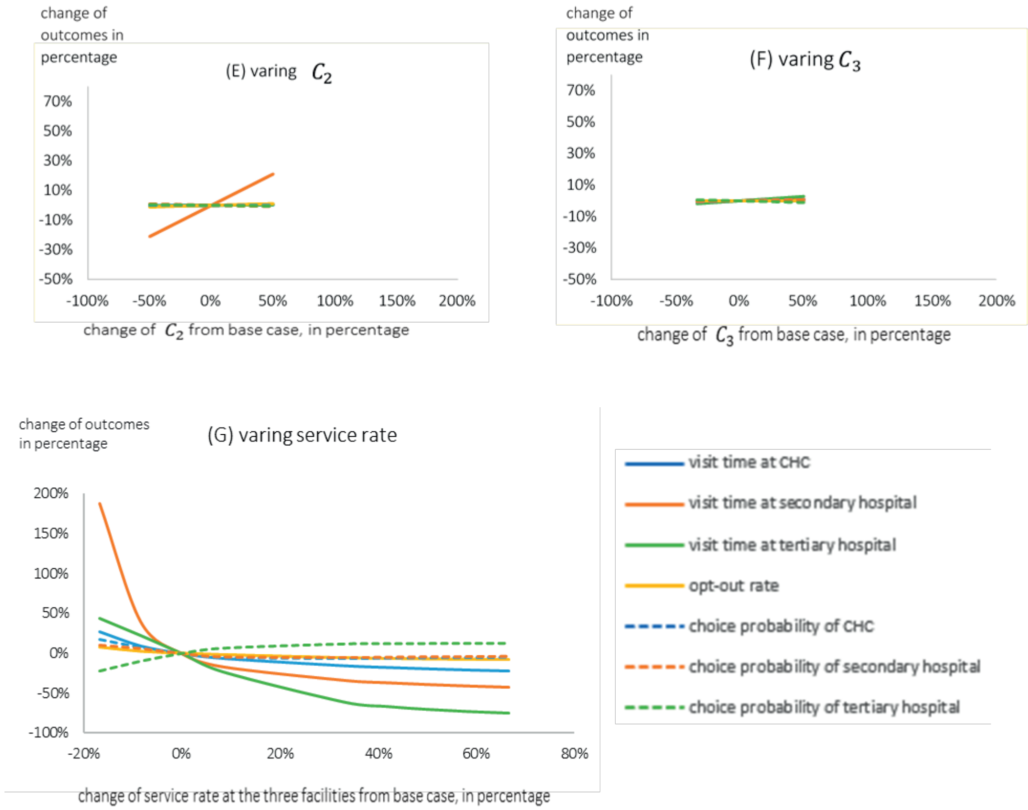
Impact of μ_j, β_j *and* C_j *in the intervention scenario with the best CHC equipment and medical skills*

Most results from the base-case sensitivity analysis (online Appendix 3, Figure S1) are replicated in the intervention with the best CHC equipment and medical skills. The main difference is the change in β_3 and C_3, which shows a linear relationship to T_3, and is similar to varying the values of β_1, β_2, and C_1, C_2.

Figure 3. Base-case sensitivity analysis results.

CHC: community health center.





4. Discussion

In this study, we used a novel model that combines discrete choice modeling and queueing theory to analyze the bidirectional relationship between visit time and facility choice. The proposed model captures that visit time is also affected by choice probability. Compared to DCE models which assume a one-directional relationship that visit time determines facility choice probability, the current model allows to more accurately determine whether interventions can promote primary care utilization and alleviate tertiary care overcrowding. To the best of our knowledge, this is the first study to address the interdependence between visit time and healthcare facility choice and consider it in an analysis of the persistent facility choice challenges faced in urban China.

Our intervention analysis revealed a modest reduction in tertiary hospital visit time when medical skills are improved in CHC and equipment is not. A substantial decrease in tertiary hospital visit time from 4.74 hours to 1.99 hour occurs only if equipment and medical skills are maximally improved . This finding suggests that considerable investments are needed in resources and skills at primary care facilities to relieve congestion in tertiary hospitals.

We also found that improving medical equipment and skills in CHC increases the choice probability of CHC, and thus in more patients visiting the CHC. It also reduces the number of patients arriving at secondary and tertiary hospitals and decreases the opt-out rate. Thus, the increased patient interest in CHC is not only from patients who would otherwise choose higher level hospitals but also from patients who chose to opt out before the improvement. This confirms the results from the DCE model that the opt-out rate will drop if CHCs are improved. Health care access can be categorized as realized access and potential access.[26] Realized access can be measured by health care utilization whereas potential access is usually difficult to observe.[26] It is important to assess the opt-out rate as an indicator of potential health care access, as it is key to population well-being.[26–28]

Another key finding is that the intended effects of the interventions to attract patient flow to primary care are smaller in this study compared to those from the DCE model. The relative choice probabilities are mostly smaller than those from the DCE model by 1.9% to 5.70%. For the scenarios with increased medical equipment level at CHC, the differences are all above 5%. Similarly, the corresponding choice probabilities of the tertiary hospital decreases, however, the predicted choice probabilities in this study were always higher than in the DCE model, and the differences are more than 10% when the medical equipment was upgraded. This finding can be explained by the bidirectional modeling of the relationship between choice probability and visit time in the current model. When the CHC improves, it attracts some of those patients that previously visited the tertiary hospital. This relieves congestion in the tertiary hospital, thereby reducing its visit time, which in turn attracts some patients back to tertiary hospital. Likewise, longer visit times at the CHC decreases the choice probability, preventing some of the intended effects from being realized. The opt-out rate decreased when the CHC improved, but not as much as was observed with the DCE model. This smaller effect in current model can also be explained by the bidirectional relationship between visit time and choice probabilities; when more patients visit health care facilities, the visit time increases, which in turn increases the probability of patients opting-out.

Taken together, our findings indicate that the interaction between visit time and choice probability should be considered when designing policies to improve medical skills and equipment at primary care facilities. Particular attention should be paid to the impact on tertiary hospitals. Qian *et al.* reported on the interaction between equipment upgrading and patient flow among facilities at different levels. They found that upgrading medical equipment in primary care facilities reduced the bed turnover rate in tertiary hospitals.[22]

Sensitivity analyses on the parameters relating to time spent on other activities show that the model outcomes are fairly robust. When visit times of the three facilities are relatively comparable, increases in visit times at one level do not affect choice probabilities or visit times at other levels. However, when for instance the visit time at the tertiary level is much higher as in the base case, there are also indirect effects on choice probabilities and therefore waiting times and visit times at other levels.

Our research has some limitations. The system in each facility was modeled as an M/M/1 queue while arrival and service rates may have followed other distributions in practice, and queues among doctors may not be independent. Further empirical and theoretical research is needed to confirm the queuing mechanisms, which may be M/M/S and M/G/1 models.[29] Another limitation lies within the choice problems presented in the DCE study, which involved choices between two facilities instead of three.[8] Thus, further studies are needed to verify whether the corresponding assumption of independence of irrelevant alternatives holds in practice.[30]

5. Conclusions

We present a model that can estimate patient flow in a three-level health system. Our model incorporates the bidirectional relationship between visit time and facility choice and captures the dynamics of patient flow, thereby allowing policy makers to tackle patient congestion more effectively. We showed that interventions attracting patient flow to primary care facilities had less effect than was shown by DCE models. This indicates that the interaction between visit time and choice probability should be considered when deciding how to improve primary care facilities. The results shed light on the need to consider the interactions among multiple factors to capture real-world settings when designing policies to guide patient flow.

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Chapter 7

Conclusion

We conclude the dissertation by providing concise answers to our four research questions, discussing the contributions made, the implications of our work, and proposing directions for future research.

Summary of findings

1. What are the factors influencing patient's health facility choice in China?

The results identified four factor types classified as either attracting factors or repulsing factors: 1) patient factors, 2) provider factors, 3) context factors, and 4) composite factors which combined patient, provider, and/or context attributes. Patient factors are mentioned the most, but the evidence on patient factors is often inconclusive. Most of the evidence is regarding factors that push patients away from the lower levels and cause them to seek care at higher levels. Evidence suggests that the provider factors 'drug variety' and 'equipment', and composite factor 'perceived quality', push patients from lower levels towards higher levels, because primary care facilities are not trusted to safely address basic patient health needs.

2. What is the process of decision making in which these factors are considered in rural and urban China?

We identified four stages of health service utilization: initial visit, diagnosis, treatment, and treatment continuation. Respondents considered various factors in each stage, and they confirmed most previously reported evidence-based factors. Moreover, the analysis revealed a new factor: facility design. The complexity of tertiary hospitals especially pushed elderly patients towards lower levels. Self-assessment of disease severity served as a prime factor to consider for the phase of initial visit. Transportation convenience and medical skill were considered important in all stages. Availability of drugs and equipment particularly had a large influence on choice at the diagnosis and treatment stages, where they often dominated other factors.

The factors considered per stage differed considerably between the rural and urban respondents. The rural respondents considered transportation convenience, cost, and the inconvenience of having to navigate the large hospitals. They were much more inclined to access nearby township health centers as default and prefer to continue in primary care. Urban respondents are less affected by distance, travel time or cost barriers and valued the patient–doctor relationship over facility-related factors. Therefore, they chose higher levels by default and seldomly moved down to primary care. We conclude that strengthening primary care correspondingly may well be effective to increase primary care utilization by the rural population but insufficient for the urban population.

3. Which facility attributes are considered by patients for first visits under different perceived disease severities and what is the importance of each of these factors, in rural and urban China?

In rural China

For rural residents, the factors regarding the availability and affordability of a facility, such as visit time, travel time, and out-of-pocket cost, were highly valued for first visit, except drug availability in the severe disease scenario. In the minor disease scenarios, visit time and out-of-pocket (OOP) cost stood out for their large impact on the preferences. In the severe disease scenarios, travel time, followed by OOP, influenced preferences more than the other attributes. The provider factors directly related to the provision of care, such as medical skill and equipment, were never the most influential factors for both severity scenarios. Considering the attribute levels that rural patients preferred, township health centers have the potential to be the ideal facilities for first-contact care in terms of size, distance and visit time. Improvements of drug availability, medical professional skill and equipment are likely effective to induce patients to choose primary level facilities.

In urban China

For conditions perceived as minor, the respondents valued visit time, equipment, and medical skill most. For conditions perceived as severe, they placed most importance on equipment, travel time and facility size. Notably, the equipment factor was pivotal and, in both cases, had larger importance attached than the medical skills of doctors. Health care demand for both severity conditions tended towards higher-level hospitals, although people were less likely to visit a tertiary hospital for conditions perceived as minor. Improvements to equipment or medical skill at CHCs appears most effective to promote first visits to primary care. Notably, having access to expert level doctors was preferred most for conditions perceived as severe, while the respondents preferred senior doctors for conditions perceived as minor. In addition, improving CHCs could not only attract a considerable portion of patients who would otherwise choose secondary or tertiary hospitals for both minor and severe conditions, but also alter latent demand into actual medical consulting in the minor condition.

4. How do patient choice and visit time interact? How do the interventions to improve primary care facilities influence visit time and facility choice in view of such interaction?

We developed a novel model that combines discrete choice modeling and queueing theory to analyze the bidirectional relationship between visit time and facility choice which allows to more accurately determine whether interventions can promote primary care utilization and alleviate tertiary care overcrowding. Intervention analysis revealed a modest reduction in tertiary hospital visit time when medical skills are improved in CHC and equipment is not. A substantial decrease in tertiary hospital visit time occurs only if equipment and medical skills are maximally improved. This finding suggests that considerable investments are needed in resources and skills at primary care facilities to relieve congestion in tertiary hospitals.

We found that the intended effects of the interventions to attract patient flow to primary care are smaller in this study compared to those from the DCE model, which indicates that the interaction between visit time and choice probability should be considered when designing policies to improve medical skills and equipment at primary care facilities.

Contributions and implications

Our study provides a comprehensive picture of how patients choose health care facilities for their first visit. It focuses on patients' trade-offs in the decision-making process and how the trade-offs affect patient flow between different facility levels. Compared to existing literature which usually studied choice between fixed facilities in terms of the size or level, we decomposed the preferences into facility attributes and investigated the preferences to the attribute levels. Therefore, our findings can be used to model and evaluate simulated effects of health policy interventions targeting to improve patient flow by changing relevant attributes of health care facilities. These contributions are specifically in the domain of health policies targeting the needed improvement of primary care effectiveness.

Our results showed that improvement of primary care can effectively guide patient flow to primary care. However, tailored policies are called for as the preferences between rural and urban patients differ due to their characteristics and inherent knowledge. In urban areas, priority should be given to medical equipment and skills to triage patients who prefer to visit big hospital over primary care. In addition, as urban patients consider patient-doctor relationship important, efforts should also be made towards developing better patient relationships. As urban patients have nearby options to visit, better communication and instilling trust in the patient-doctor relationship, including trusting to be referred when necessary, are needed to guide patients to visit primary care rather than directly choosing a big hospital. In rural areas, financial arrangements are needed to lower the OOP and improve the convenience of access. Our study highlighted the importance of better primary care to attract latent health care demand, as it is important for the wellbeing of the population and for the health system effectiveness that health problems can be identified and treated as early as possible.

Our study used tailored research methods and contributed methodological advancements to health services research. We adopted various tailored methods to answer each research question on patient preferences and patient flow, rather than using secondary cross-sectional data. We developed and applied innovative models, including the DCEs which used targeted questionnaires based on the results from the systematic literature and qualitative research. This enabled specific and quantitative insights on factors of patient choice beyond from the state of the art ,which mostly relied on other methods and data. We also developed an innovative model and methods to connect utility theory to queueing theory to assess the effects of policy interventions more accurately. All these innovative models have effectively enabled us to answer the corresponding research questions.

Ideas for future research

Despite the significance of our research for improving the utilization of primary care facilities, we realize that our study only partially advances insight into an important and complex research field. There is more research to be done. The directions for future research will be based on the study limitations.

First, we have chosen to focus on the first outpatient visit in most of the chapters. However, as described in answering the second research question, the health service utilization consists of several stages and the factors considered by patients vary per stage. Therefore, future research could make efforts to investigate patient preferences after the first visit, for example, the preferences for subsequent visit and rehabilitation, so as to provide a comprehensive picture of patient behavior in health service utilization. This is especially important because of the growing volume of health care demand by patients with chronic diseases, who need regular follow-up visits.

Second, in analogy with the effectiveness analysis of policy interventions to improve medical skill and medical equipment, further research can address the effects of policies aimed to improve other facility attributes. Specifically, the personal connection with doctors was considered important by urban patients, however, we have not advanced on the non-trivial research questions exploring how policy interventions can improve such connections.

Third, the advancements in research models and methods of health service utilization presented in Chapters 4, 5 and 6 leave room for improvement. For example, we studied a three-level system in the policy simulation in chapter 5 and 6, while the DCE questions only considered a choice of two levels in Chapter 4 and 5. In other words, we relaxed the hypothesis of the independence of irrelevant alternatives (IIA) assumption of choosing facilities. Future work may formally test if the IIA hypothesis holds in this scenario. Furthermore, we assumed M/M/1 queues in Chapter 6 to develop a first basic model combining utility theory and queuing models which captures the interactions between choice probability and waiting time. Future work may explore alternative, more accurate queuing models. Likewise, the evidence based for some of the parameters in the analysis of Chapter 6 is still weak, which calls for future research on for instance service times and hospital capacity.

In addition, the studies in chapter 3, 4 and 5 were conducted in one rural district and one urban district, which restricted the generalizability of the implications. Although these districts were carefully selected for representativeness, caution is called for to generalize the study results to other rural and urban districts. Our research may serve as a basis for future research that aim to explore the research questions in urban and rural China.

Last, as most of our empirical and modelling work is based on stated preferences, it will be interesting to validate the models and see how closely the outcomes match the reality. Therefore, interventional studies evaluating health policy interventions addressing the identified factors are called for to provide stronger evidence.

Summary

Introduction

hapter 1 introduces the hospital system and primary care system in China and describes our research objectives and questions. Primary care is essential health care which is to be made universally accessible to all individuals, and it should work as the central function and the core of building an integrated health system. In China, patients tend to bypass primary care and directly choose hospital care for common primary care services, resulting in compromised health outcomes for the population and unfavorable cost consequences. Hence, this dissertation aims to explore and understand patients' facility choice in China and, more specifically, the choice trade-off's between primary care and higher-level facilities.

We let the following four research questions guide the research:

- What are the factors influencing patient's health facility choice in China?
- What is the process of decision making in which these factors are considered in rural and urban China?
- Which facility attributes patients consider for first visits under different perceived disease severities, and what is the importance of each of these factors in rural and urban China?
- How do patient choice and visit time interact? How do the interventions to improve primary care facilities influence visit time and facility choice given such interaction?

In answering these questions, we studied the quantitative effects of the factors that influence patients' facility choice and the interaction between visit time and facility choice. We adopted multiple methods including systematic literature review, focus group interview, discrete choice experiments, and queueing analysis. We conducted the research following the four research questions.

Research question 1: What are the factors influencing patient's health facility choice in China?

To answer this question, in ***Chapter 2,*** we describe a systematic review synthesizing the scientific literature on the factors affecting patient choice of health system access level in China. Through reviewing 45 publications, we classified the factors into four types: 1) patient factors, 2) provider factors, 3) context factors, and 4) composite factors that combined patient, provider, and/or context attributes. We distinguished these factors into four evidence types: a revealed factor for a revealing choice, a stated factor for a revealing choice, a stated factor for a stated choice, and a revealed factor for a stated choice. Patient factors are mentioned the most, but the evidence on patient factors is often inconclusive. Most of the evidence is regarding factors that push patients away from the lower levels and cause them to seek care at higher levels. Evidence suggests that the provider factors 'drug variety' and 'equipment', and composite factor 'perceived quality', push patients from lower levels towards higher levels, because primary care facilities are not trusted to safely address basic patient health needs.

Research question 2: What is the process of decision making in which these factors are considered in rural and urban China?

We contributed to this understanding by conducting eight semi-structured focus group discussions among the general population and the chronic patients in a rural area of Chongqing and an urban area of Shanghai, as reported in ***Chapter 3***. We identified four stages of health service utilization: initial visit, diagnosis, treatment, and treatment continuation. Respondents considered various factors in each stage, and they confirmed most previously reported evidence-based factors. Moreover, the analysis revealed a new factor: facility design. The complexity of tertiary hospitals especially pushed elderly patients towards lower levels. Self-assessment of disease severity served as a prime factor to consider for the phase of the initial visit. Transportation convenience and medical skills were considered important in all stages. Availability of drugs and equipment particularly had a large influence on choice at the diagnosis and treatment stages, where they often dominated other factors. The factors considered per stage differed considerably between the rural and urban respondents. The rural respondents considered transportation

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convenience, cost, and the inconvenience of navigating the large hospitals. They were much more inclined to access nearby township health centers as default and prefer to continue in primary care facilities. Urban respondents were less affected by distance, travel time, or cost barriers and valued the patient-doctor relationship over facility-related factors. Therefore, they chose higher levels by default and seldomly moved down to primary care. We conclude that strengthening primary care correspondingly might be effective to increase primary care utilization by the rural population but insufficient for the urban population.

Research question 3: Which facility attributes patients consider for first visits under different perceived disease severities, and what is the importance of each of these factors in rural and urban China?

So far, the studies in previous chapters provided a thorough comprehension of what factors influence patients' facility choice. In pursuit of research question 3, ***Chapter 4*** and ***Chapter 5*** report on two discrete choice experiments (DCEs) carried out in rural and urban China, respectively, to elicit the quantified effects of the factors influencing the health care facilities choices by the Chinese population.

For rural residents, the factors regarding the availability and affordability of a facility, such as visit time, travel time, and out-of-pocket cost, were highly valued for the first visit, except drug availability in the severe disease scenario. In the minor disease scenarios, visit time and out-of-pocket (OOP) cost stood out for their large impact on the preferences. In the severe disease scenarios, travel time, followed by OOP, influenced preferences more than the other attributes. The provider factors directly related to the provision of care, such as medical skill and equipment, were never the most influential factors for both severity scenarios. Considering the attribute levels that rural patients preferred, township health centers (THCs) have the potential to be the ideal facilities for first-contact care in terms of size, distance, and visit time. Improvements in drug availability, medical professional skill and equipment are likely effective to induce patients to choose primary level facilities.

For urban residents in conditions perceived as minor, the respondents valued visit time, equipment, and medical skills most. For conditions perceived as severe, they placed most importance on equipment, travel time and facility size. Notably, the equipment factor was pivotal and, in both cases, had larger importance attached than the medical skills of doctors. Health care demand for both severity conditions tended towards higher-level hospitals, although people were less likely to visit a tertiary hospital for conditions perceived as minor. Improvements in equipment or medical skills at community health centers (CHCs) appear most effective in promoting first visits to primary care. Notably, having access to expert level doctors was preferred most for conditions perceived as severe, while the respondents preferred senior doctors for conditions perceived as minor. In addition, improving CHCs could not only attract a considerable portion of patients who would otherwise choose secondary or tertiary hospitals for both minor and severe conditions, but also alter latent demand into actual medical consulting in the minor condition. The results of this chapter (***Chapter 5***) further advance the analysis to address research question 4.

Research question 4: How do patient choice and visit time interact? How do the interventions to improve primary care facilities influence visit time and facility choice given such interaction?

In previous chapters, visit time is found to be one of the attributes that influence choice probability of health care facility. In ***Chapter 6***, we propose and explore a bidirectional relationship between visit time and choice probability, instead of considering visit time as a factor that unidirectionally influences patient choice. For instance, if the choice probability of a CHC increases, more patients arrive and queue up, thus increasing the visit time and in turn diminishing the choice probability. We developed a model that combines the discrete choice model with a queuing model to advance the understanding of this bidirectional relationship and to provide more accurate evidence than the previous DCEs to inform policy. The model was established on the findings from the urban DCE (***Chapter 5***), as tertiary hospitals are concentrated in urban areas and urban residents are particularly likely to prefer tertiary level facilities. We carried out intervention analyses with the combined model to assess the effects of improving primary care on choice probability and visit time. We developed a novel model that combines discrete choice modeling and queueing theory to analyze the bidirectional relationship between visit time and facility choice, which accurately determines whether interventions can promote primary care utilization and alleviate tertiary care overcrowding. Intervention analysis revealed a modest reduction in tertiary hospital visit time when medical skills are improved in CHC and equipment is not. A substantial decrease in tertiary hospital visit time occurs only if equipment and medical skills are maximally improved. This finding suggests that considerable investments are needed in resources and skills at primary care facilities to relieve congestion in tertiary hospitals. We found that the intended effects of the interventions to attract patient flow to primary care are smaller in this study compared to those from the DCE model. The results indicate that the interaction between visit time and choice probability should be considered when designing policies to improve medical skills and equipment at primary care facilities.

Conclusion

In ***Chapter 7***, we conclude on the findings of our research. We argue that our research is relevant for policy makers and academic researchers who are committed to improving primary care in China.

Samenvatting

Inleiding

Hoofdstuk 1 geeft een inleiding op het ziekenhuissysteem en eerstelijns zorgsysteem in China en beschrijft onze onderzoeksdoelen en -vragen. Eerstelijnszorg is essentiële gezondheidszorg die algemeen toegankelijk moet worden gemaakt voor ieder individu en zou moeten werken als de centrale functie en kern van een op te bouwen, geïntegreerd volksgezondheidssysteem. In China slaan patiënten de eerstelijnszorg gewoonlijk over. Ze kiezen meteen voor het ziekenhuis om gangbare eerstelijns zorgverlening te krijgen, wat resulteert in gecompromitteerde uitkomsten voor de volksgezondheid en ongunstige gevolgen heeft voor de kosten. Daarom is het doel van dit proefschrift om de keuze van patiënten in China voor bepaalde faciliteiten te onderzoeken en beter te begrijpen, in het bijzonder de afwegingen die een rol spelen bij hun keuze tussen eerstelijnszorg en faciliteiten op hoger niveau.

De volgende vier onderzoeksvragen dienden voor ons in dit onderzoek als leidraad:

- Welke factoren beïnvloeden in China de keuze van de patiënt van een bepaalde gezondheidszorgfaciliteit?
- In welke besluitvormingsprocessen worden deze factoren afgewogen op het Chinese platteland en in stedelijk China?
- Welke kenmerken van een faciliteit spelen een rol in de afweging met betrekking tot eerste visites van patiënten bij een verschillende zelf ervaren ernst van de ziektes, en wat is het belang van elk van deze factoren op het platteland en in stedelijk China?

Hoe verloopt de wisselwerking tussen de keuze van de patiënt en de lengte van het bezoek? Hoe beïnvloeden de interventies om de eerstelijns zorgfaciliteiten te verbeteren de lengte van het bezoek en de keuze van een faciliteit in het licht van deze wisselwerking?

Om deze vragen te beantwoorden hebben we de kwantitatieve effecten onderzocht van de factoren die de keus door patiënten van een bepaalde faciliteit beïnvloeden en de wisselwerking tussen de lengte van een bezoek en de keuze van een faciliteit. We hebben verscheidene methoden gebruikt, waaronder een systematisch literatuuronderzoek, focusgroepinterviews, discrete keuze experimenten, en wachtrij analyse. We hebben het onderzoek uitgevoerd aan de hand van de vier onderzoeksvragen.

Onderzoeksvraag 1: Welke factoren beïnvloeden in China de keuze van de patiënt van een bepaalde gezondheidszorgfaciliteit?

Om deze vraag te beantwoorden, beschrijven we in ***Hoofdstuk 2*** een systematisch literatuuronderzoek naar wat in de wetenschappelijke literatuur te vinden is over de factoren die effect hebben op de keuze door patiënten van het niveau waarop ze in China toegang krijgen tot gezondheidszorg. Aan de hand van 45 publicaties deelden we de factoren in vier types in: 1) patiëntfactoren, 2) factoren rond de zorgaanbieder, 3) contextfactoren en 4) samengestelde factoren, die een combinatie vormen van kenmerken van de patiënt, de zorgaanbieder en/of de context. We onderscheidden onder deze factoren vier bewijstypen: een gebleken factor voor een gebleken keuze, een beweerde factor voor een gebleken keuze, een beweerde factor voor een beweerde keuze, en een gebleken factor voor een beweerde keuze. Patiëntfactoren worden het meest genoemd, maar de bewijsvoering rond patiëntfactoren blijft vaak onduidelijk. De meeste aanwijzingen betreffen factoren die patiënten wegdrijven van de lagere niveaus en hen ertoe brengen om zorg op hogere niveaus te gaan zoeken. De aanwijzingen suggereren dat de zorgaanbiederfactoren ‘geneesmiddelenaanbod’ en ‘uitrusting’, en de samengestelde factor ‘ervaren kwaliteit’, patiënten van de lagere niveaus naar hogere niveaus drijven, omdat ze er niet op vertrouwen dat eerstelijns zorgfaciliteiten op een veilige manier met basale gezondheidsbehoeften van patiënten omgaan.

Onderzoeksvraag 2: In welke besluitvormingsprocessen worden deze factoren afgewogen op het Chinese platteland en in stedelijk China?

Om deze kwestie beter te kunnen begrijpen, voerden we acht semigestructureerde focusgroepdiscussies onder de algemene bevolking en de chronische patiënten op het platteland van Chongqing en in het stedelijke gebied van Shanghai, zoals beschreven in

Hoofdstuk 3. We identificeerden vier stadia in het gebruik van de dienstverlening in de gezondheidszorg: eerste bezoek, diagnose, behandeling en de voortzetting van de behandeling. Respondenten overdachten verschillende factoren in elk stadium, en ze bevestigden de meeste eerder gemelde evidence-based factoren. Bovendien bracht de analyse een nieuwe factor boven water: het ontwerp van de faciliteit. De complexiteit van tertiaire ziekenhuizen dreef vooral oudere patiënten naar lagere niveaus. De eigen beoordeling van de ernst van iemands ziekte diende als de voornaamste factor die we voor het stadium van het eerste bezoek in ogenschouw namen. Vervoersgemak en geneeskundige vaardigheden achtten we in alle stadia van belang. Met name de beschikbaarheid van geneesmiddelen en apparatuur waren van grote invloed op de keuze in de stadia van diagnose en behandeling, waar ze vaak andere factoren domineerden. De factoren die per stadium werden overwogen, verschilden aanzienlijk tussen respondenten van het platteland of uit de stad. De respondenten van het platteland overdachten het vervoersgemak, de kosten en het ongemak van hun weg te moeten zoeken in de grote ziekenhuizen. Zij waren er standaard veel meer toe geneigd om de nabijgelegen gezondheidscentra in de buurtschap te gebruiken en gaven er de voorkeur aan om in de eerstelijns faciliteiten verder te gaan. Respondenten uit de stad werden minder beïnvloed door afstands-, reistijd- of kostenbarrières en kenden meer waarde toe aan de relatie tussen patiënt en arts dan aan factoren gerelateerd aan de faciliteit. Ze kozen om die reden meteen al voor hogere niveaus en daalden zelden af naar de eerstelijnszorg. Wij concluderen, daarmee in overeenstemming, dat het versterken van de eerstelijnszorg een effectieve manier zou kunnen zijn om het gebruik van de eerstelijnszorg onder de plattelandsbevolking te vergroten, maar dat dit voor de stadsbevolking niet zou volstaan.

Onderzoeksvraag 3: Welke kenmerken van een faciliteit spelen een rol in de afweging met betrekking tot eerste visites van patiënten bij een verschillende zelf ervaren ernst van de ziektes, en wat is het belang van elk van deze factoren op het platteland en in stedelijk China?

Tot dusverre hebben de onderzoeken in de voorgaande hoofdstukken een gedegen inzicht verschaft in de factoren die van invloed zijn op de keuze van patiënten van een bepaalde faciliteit. Op zoek naar het antwoord op onderzoeksvraag 3, geven ***Hoofdstuk 4*** en ***Hoofdstuk 5*** een beschrijving van twee discrete keuze experimenten (DCE's) die we uitvoerden in, respectievelijk, ruraal en stedelijk China, om de gekwantificeerde effecten te achterhalen van de factoren die van invloed zijn op de keuze van gezondheidszorgfaciliteiten door de Chinese bevolking.

Voor de inwoners van het platteland waren de factoren met betrekking tot de beschikbaarheid en betaalbaarheid van een faciliteit, zoals bezoektijd, reistijd en kosten die uit eigen zak betaald moeten worden, van groot belang voor het eerste bezoek. De enige uitzondering vormde de beschikbaarheid van geneesmiddelen in het scenario van een ernstige ziekte. In de scenario's waarin minder ernstige ziekten een rol speelden, sprongen de bezoektijd en uit eigen zak te betalen kosten (OOP) eruit vanwege hun grote impact op de voorkeuren. In de scenario's waarin een ernstige ziekte speelde, beïnvloedde de reistijd de voorkeuren meer dan de andere kenmerken, gevolgd door de OOP. De factoren rond de zorgaanbieder die direct gerelateerd waren aan de levering van zorg, zoals geneeskundige vaardigheden en apparatuur, waren voor geen van beide soorten ziektescenario's ooit het meest van invloed. Met het oog op het niveau van de kenmerken die de patiënten op het platteland prefereerden, hebben gezondheidscentra in de buurtschap het potentieel om de ideale faciliteiten te zijn voor eerstelijnszorg in termen van grootte, afstand en bezoektijd. Verbeteringen in de beschikbaarheid van geneesmiddelen, medische professionele vaardigheid en apparatuur zullen waarschijnlijk effectief zijn om patiënten ertoe te bewegen om eerstelijnsfaciliteiten te kiezen.

Onder de stadsbewoners die naar hun eigen oordeel in een niet al te ernstige toestand verkeerden, kenden de respondenten de meeste waarde toe aan de bezoektijd, apparatuur en medische vaardigheid. In situaties die wel als ernstig werden beoordeeld, vonden ze de apparatuur, de reistijd en de grootte van de faciliteit het belangrijkste. Met name de apparatuurfactor was doorslaggevend en was in beide gevallen van meer belang dan geneeskundige vaardigheden of artsen. De vraag naar gezondheidszorg neigde voor beide niveaus van ernst naar ziekenhuizen van hoger niveau, hoewel het minder waarschijnlijk was dat mensen een tertiair ziekenhuis zouden bezoeken voor een toestand die ze als minder ernstig beoordeelden. Verbeteringen op het gebied van apparatuur en geneeskundige vaardigheden in buurtgezondheidscentra lijken het meest effectief te zijn om eerste bezoeken aan de eerstelijnszorg aan te moedigen. Wanneer patiënten hun toestand zelf als ernstig zagen had met name het toegang hebben tot medische experts grote voorkeur, terwijl de respondenten die hun toestand als minder ernstig zagen het vaakst oudere artsen prefereerden. Verder zou het verbeteren van buurtgezondheidscentra niet alleen een aanzienlijk deel van de patiënten aantrekken die anders secundaire en tertiaire ziekenhuizen zouden kiezen voor zowel minder ernstige als ernstige ziektebeelden, maar het zou ook een latente zorgvraag veranderen in daadwerkelijke medische consultering in geval van minder ernstige klachten. De resultaten van dit hoofdstuk (***Hoofdstuk 5***) dragen verder bij aan de analyse om onderzoeksvraag 4 aan te pakken.

Onderzoeksvraag 4: Hoe verloopt de wisselwerking tussen de keuze van de patiënt en de lengte van het bezoek? Hoe beïnvloeden de interventies om de eerstelijns zorgfaciliteiten te verbeteren de lengte van het bezoek en de keuze van een faciliteit in het licht van deze wisselwerking?

In de vorige hoofdstukken vonden we dat de lengte van het bezoek één van de factoren was die van invloed zijn op een waarschijnlijke keuze van een gezondheidszorgfaciliteit. In ***Hoofdstuk 6*** stellen we een wederkerige relatie voor tussen bezoektijd en keuzewaarschijnlijkheid, in plaats van bezoektijd te beschouwen als een factor die de keuze van patiënten eenzijdig beïnvloedt. Als bijvoorbeeld de keuzewaarschijnlijkheid van een buurtgezondheidscentrum toeneemt, arriveren er meer mensen en vormt zich een wachtrij, wat dus de bezoektijd langer maakt en, andersom, de keuzewaarschijnlijkheid doet afnemen. We ontwikkelden een model dat het discrete keuzemodel combineert met een wachtrijmodel om ons begrip van deze wederkerige relatie te vergroten en nauwkeuriger bewijs te leveren dan de eerdere DCE's ten behoeve van de beleidsontwikkeling. De basis voor dit model waren de bevindingen van de stedelijke DCE (***Hoofdstuk 5***), aangezien tertiaire ziekenhuizen zich vooral in stedelijk gebieden bevinden en het bijzonder waarschijnlijk is dat stadsbewoners de voorkeur geven aan faciliteiten van een tertiair niveau. We voerden interventieanalyses uit met het gecombineerde model om de effecten te evalueren van de verbetering van de eerstelijnszorg op de keuzewaarschijnlijkheid en bezoektijd. We ontwikkelden een nieuw model dat discrete keuzemodellering combineert met de wachtrijtheorie om de wisselwerking te analyseren tussen de bezoektijd en de keuze voor een faciliteit. Dit levert een nauwkeurige bepaling op of interventies het gebruik van eerstelijnszorg aanmoedigen en de overbevolking van de tertiaire zorg verlichten. De analyses onthulden een bescheiden afname van de bezoektijd aan tertiaire ziekenhuizen als medische vaardigheden in buurtgezondheidscentra worden verbeterd, maar niet de apparatuur. Een substantiële afname van de bezoektijd aan tertiaire ziekenhuizen vindt alleen plaats als zowel de uitrusting als de medische vaardigheden maximaal worden verbeterd. Deze bevinding suggereert dat er in de eerstelijns zorgfaciliteiten aanzienlijk investeringen in bronnen en vaardigheden nodig zijn om de overbelasting in tertiaire ziekenhuizen te verminderen. We vonden dat de beoogde effecten van de interventies om de toestroom van patiënten naar de eerstelijnszorg te lokken in deze studie kleiner zijn dan die van het DCE-model. De resultaten vormen een indicatie dat wanneer er beleid wordt ontwikkeld om de medische vaardigheden en apparatuur in eerstelijns zorgfaciliteiten te verbeteren, er naar de wisselwerking tussen bezoektijd en keuzewaarschijnlijkheid gekeken moet worden.

Conclusies

Hoofdstuk 7 bevat de conclusies die we uit de bevindingen van ons onderzoek hebben getrokken. We betogen dat ons onderzoek relevant is voor beleidsmakers en academische onderzoekers die zich wijden aan de verbetering van de eerstelijnszorg in China.

Acknowledgements

I would like to thank my supervisor Joris van de Klundert for his invaluable supervision and support during my research. Thank you for providing me with opportunities to grow as an academic. I always feel lucky to be your PhD student. I will forever be thankful for your immeasurable moral support whenever I felt insecure in my PhD trajectory.

I would like to thank my co-supervisor Qingxia Kong for mentoring me during this research and for helping me build a network with other researchers. You are the smartest person I know, and I am so impressed and motivated by your passion and your optimistic mindset. I have learnt so much from you.

I give sincere thanks to Professor Wan Guohua, Professor Wang Fang and Professor Zhong Liwei in China, for their many forms of support and collaboration in this research. I would also like to thank Professor Esther W. de Bekker-Grob for her expertise and guidance regarding the study design.

Thank you, Tong. I would not have had this fun adventure in Europe without you. Thank you for your inspiration and encouragements.

Thank you, Judy, I feel so lucky to have you as my friend in life. I will always remember the day when we met on campus in Beijing. Thank you for always standing by my side.

Bedankt Christine, Timo en Lars, voor jullie gezelschap als vrienden, buren en speelkameraadjes. Bedankt ook mijn harige vrienden Jo en Alfred voor het knuffelen, vooral op de moeilijke momenten.

感谢伊尔、梁远距离的陪伴。

感谢家人的支持和鼓励。

Curriculum Vitae & PhD Portfolio

CV and portfolio

EDUCATION

2015	Erasmus School of Health Policy & Management, Erasmus University Rotterdam, Rotterdam, The Netherlands MSc, Health Economics, Policy & Law (specialized in Health Technology Assessment)
2009	Capital Medical University, Beijing, China MSc, Pharmacology

PROFESSIONAL EXPERIENCE

2015-2020	Erasmus School of Health Policy & Management, Erasmus University Rotterdam, Rotterdam, The Netherlands Doctoral candidate
2009-2013	Pfizer, Beijing, China Senior Clinical Research Associate / Clinical Research Associate
2006-2009	Capital Medical University, Beijing, China Teaching Assistant in course Laboratory Animal Medicine

PUBLICATIONS Published or in review

- **Liu, Y**, Kong, Q, & van de Klundert, J. Patient choice of health care facilities in Shanghai, China: A modelling study combining utility theory and queueing theory. *Submitted*.
- **Liu, Y**., Kong, Q., & de Bekker-Grob, E. W. (2019). Public preferences for health care facilities in rural China: A discrete choice experiment. Social Science & Medicine, 237(May), 112396. https://doi.org/10.1016/j.socscimed.2019.112396
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PhD PORTFOLIO

PhD period: 2015-2020

Promotor: Prof.dr.Joris van de Klundert

Co-promotor: Dr. Qingxia Kong

Courses	Year	Workload (hours/ECTS)
Academic writing in English for PhD students	2016	2 ECTS
Doing literature review	2016	2 hours
Introduction to Refworks	2016	2 hours
Meta-analysis	2016	2.5 ECTS
Brush up your SPSS skills	2017	1 ECTS
Qualitative data analysis	2017	2.5 ECTS
Patient preferences in the delivery of health care	2017	30 hours
Hands on R in data science	2019	10 hours

Presentations during conferences	Year
INFORMS Healthcare (Rotterdam, the Netherlands)	2017
Public Health and Health Care Management (Dubai, UAE)	2019

Attended seminars and workshops	Year
Hospital management in the Netherlands	2015-2019