Construction and Evaluation of the Bidirectional Referral System in Internet Hospital: A Perspective Based on the Case of Children's Hospitals in Western China

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Abstract

Background: Bidirectional referral is essential in modern healthcare as they facilitate seamless patient transitions between primary and higher-level medical institutions. Conventional referral systems are hindered by offline methods, complex processes, and inadequate information sharing, negatively impacting efficiency and patient experience.

Objective: This research aims to develop a systematic and standardized bidirectional referral framework for Internet hospitals by investigating the construction and implementation effects of the "Internet +" bidirectional referral model at the Children's Hospital of Chongqing Medical University.

Methods: We analyze the bidirectional referral model of Internet hospitals from the perspectives of platform operation and management.

Results: The "Internet +" bidirectional referral model enhances the exchange of patient diagnosis and treatment data, promotes information sharing, simplifies and standardizes the referral process, ultimately saving time, enhancing efficiency, and fostering the integration and optimal allocation of healthcare resources.

Conclusions: The "Internet +" bidirectional referral service model deserves promotion and adaptation across other medical institutions.

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Abstract

Bidirectional referral is essential in modern healthcare as they facilitate seamless patient transitions between primary and higher-level medical institutions. Conventional referral systems are hindered by offline methods, complex processes, and inadequate information sharing, negatively impacting efficiency and patient experience. This research aims to develop a systematic and standardized bidirectional referral framework for Internet hospitals by investigating the construction and implementation effects of the "Internet +" bidirectional referral model at the Children's Hospital of Chongqing Medical University. We analyze the bidirectional referral model of Internet hospitals from the perspectives of platform operation and management. The "Internet +" bidirectional referral model enhances the exchange of patient diagnosis and treatment data, promotes information sharing, simplifies and standardizes the referral process, ultimately saving time, enhancing efficiency, and fostering the integration and optimal allocation of healthcare resources. The "Internet +" bidirectional referral service model deserves promotion and adaptation across other medical institutions.

KEYWORDS

bidirectional referral; Internet hospital; children; healthcare integration; patient transition; telemedicine

Introduction

As China's demographic shifts towards an aging population, with 60 years and older increasing to 28% of the total population by 2040[1]. Over the past three decades, the epidemiological transition has undergone significant changes, gradually shifting from a predominance of infectious diseases to a predominance of non-communicable diseases[2]. The distribution of healthcare resources in China is significantly uneven[3]. Such challenges have led China to propose a tiered medical treatment framework[4].

Central to tiered medical is bidirectional referral, which enables a reciprocal diagnostic and treatment process between primary and higher-level hospitals. This process considers the severity and urgency of the patient's condition, alongside the

complexity of required treatment[5]. Patients whose conditions surpass the capabilities of primary healthcare facilities are directed to higher-level hospitals, while those in recovery are transferred to nearby primary medical centers[6]. This strategy seeks to establish a rational and systematic healthcare network. In conventional referral systems, certain primary hospitals have developed referral protocols with higher-level hospitals. However, these procedures predominantly depend on offline methods. The physicians are obligated to meticulously fill out a referral document, which must be transported by the patient or their relatives to the higher-level hospitals[7,8]. They are tasked with executing a sequence of processes, encompassing registration, consultation, and admission. Furthermore, the challenges associated with obtaining referral records and the insufficient dissemination of patient visit information undoubtedly hinder the efficiency of medical referrals and adversely affect the overall patient experience within the healthcare system.

The reform of the medical and health system encounters a novel task and area of exploration: how to leverage Internet hospitals as a platform to promote the efficient and orderly operation of a bidirectional referral system, thereby enhancing the overall efficiency of the healthcare system and improving patient satisfaction with medical visits [9,10].

Children's Hospital of Chongqing Medical University stands as a comprehensive tertiary facility for pediatric care in Western China. It functions as a national regional medical center, merging healthcare, education, and research. In early 2020, the hospital acquired a practice license for Internet hospitals, marking it as the first public Internet hospital in Chongqing. In January 2022, we initiated a bidirectional referral platform linked to our Internet hospital. Up to September 2024, we have forged remote joint diagnostic partnerships with 131 medical institutions. This collaboration encompasses services such as remote consultation scheduling, audio and video consultations among healthcare professionals across various hospital tiers, sharing of patient medical records, and the bidirectional exchange of patient information.

This research will analyze the online implementation of the bidirectional referral

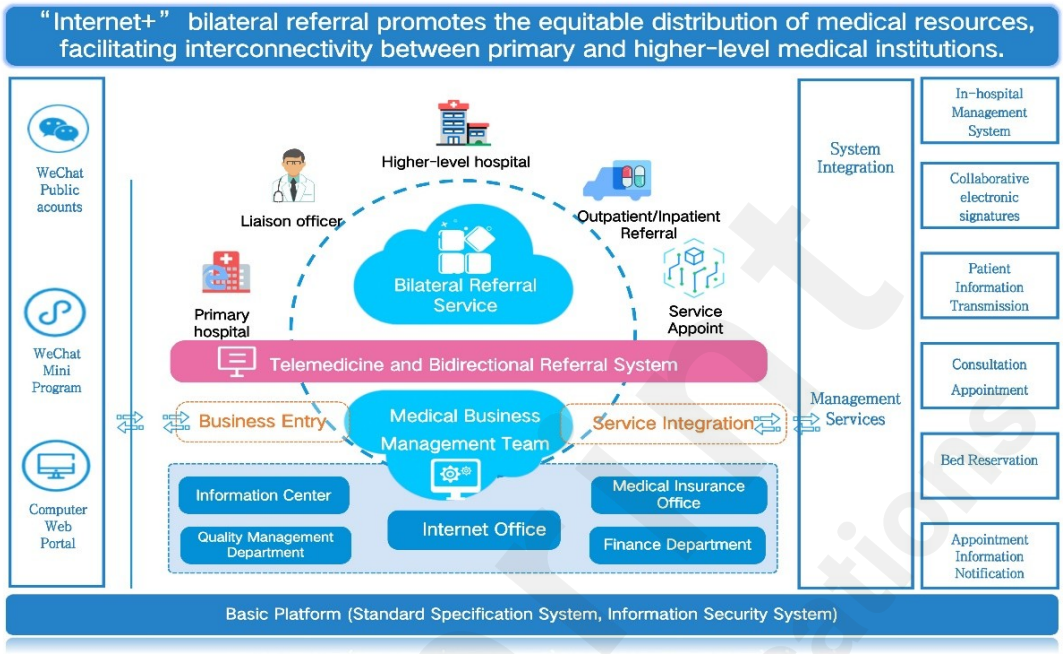
model at the Children's Hospital of Chongqing Medical University. It will investigate how this model enhances inter-hospital collaboration across different regions. The study will focus on the integration of online services, including remote consultations and video medical consultations, to create a seamless link between online and offline healthcare services. The goal is to maintain continuity in medical operations while delivering a comprehensive, efficient, and convenient healthcare experience for patients. Furthermore, the research will evaluate the effectiveness and practicality of this model in improving the quality of medical services and optimizing resource distribution.

The operating environment

The bidirectional referral system functions effectively on the Internet hospital platform. All processes, including upward and downward referrals and remote consultations, are conducted through the "Chongqing Medical Children's Hospital" WeChat public accounts, WeChat mini-program, or the computer web portal. This “Internet+” bidirectional referral platform integrates seamlessly with the hospital information system and collaborative electronic signatures. It allows for real-time patient information transmission, instant appointment scheduling for consultations and beds, push notifications for appointment updates, and electronic signatures from consulting physicians. The Internet Office, part of the Medical Affairs Department, manages the daily operations of the “Internet+” bidirectional referral services. The Information Center, Quality Management Department, Medical Insurance Office, and Finance Department provide collaborative support. The hospital president directly supervises this initiative. To facilitate a smooth referral process, each collaborating lower-level hospital appoints a dedicated remote liaison officer. Their main duty is to communicate and coordinate with the leading unit, as well as the medical staff and patients at their respective hospitals. Through effective collaboration among liaison officers, it can ensure efficient and accurate communication during the referral process and timely appointment arrangements between primary and higher-level hospitals. The operating environment of the “Internet+” bidirectional referral system is shown in

Figure 1.

Figure 1: The operating environment of the “Internet+” bidirectional referral system

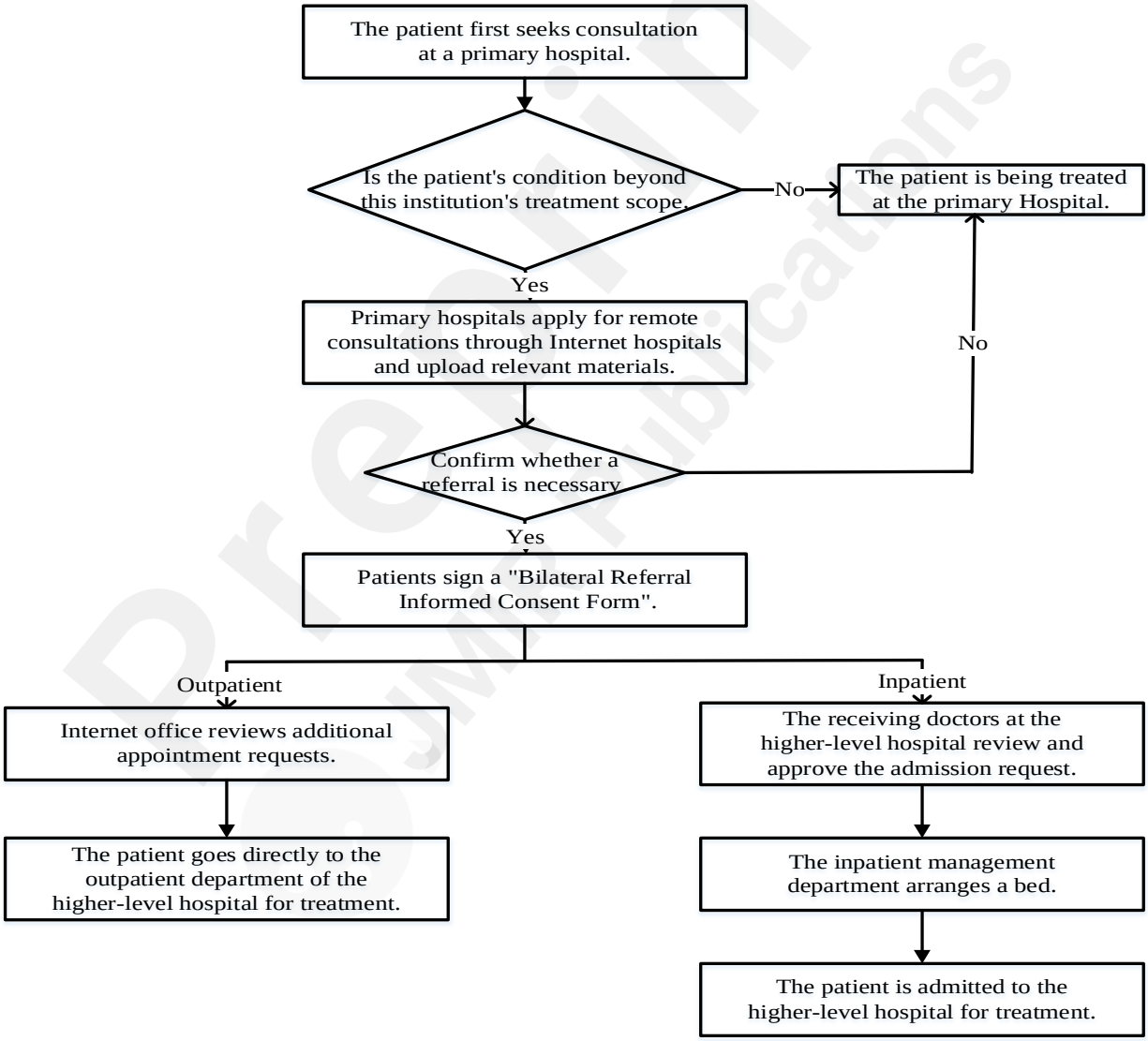


The process of upward referrals

(1)The patient first seeks consultation at a primary care facility, where an initial diagnosis is established. In cases of complexity, the patient's data and examination results are synchronized and uploaded from the Hospital Information System (HIS) to the “Internet+” bidirectional referral platform, following a consultation request directed to the higher-level Internet medical management center. (2) A senior physician at the higher-level hospital evaluates the patient's information and conducts a video consultation at the designated time. (3) Following the consultation, the senior physician at the higher-level hospital generates a consultation report. (4) The primary care facility determines whether to refer the patient based on the recommendations provided during the remote consultation. If a referral is warranted, the patient's family is briefed on the referral process, and they provide their signature on the "Informed Consent for Bidirectional Referral." The referral specifics are then documented on the “Internet+” bidirectional platform, and the consent form is uploaded to facilitate the

referral request. (5) For outpatient referrals, once the Internet office reviews and approves the additional appointment, the patient proceeds directly to the higher-level hospital outpatient department for treatment. (6) For inpatient referrals, the receiving department at the higher-level hospital assesses the case and issues a hospitalization request. (7) Upon the inpatient management office at the higher-level hospital arranging a bed, the patient is admitted for treatment. The specific upward referral process is illustrated in Figure 2.

Figure 2. The process of upward referrals.

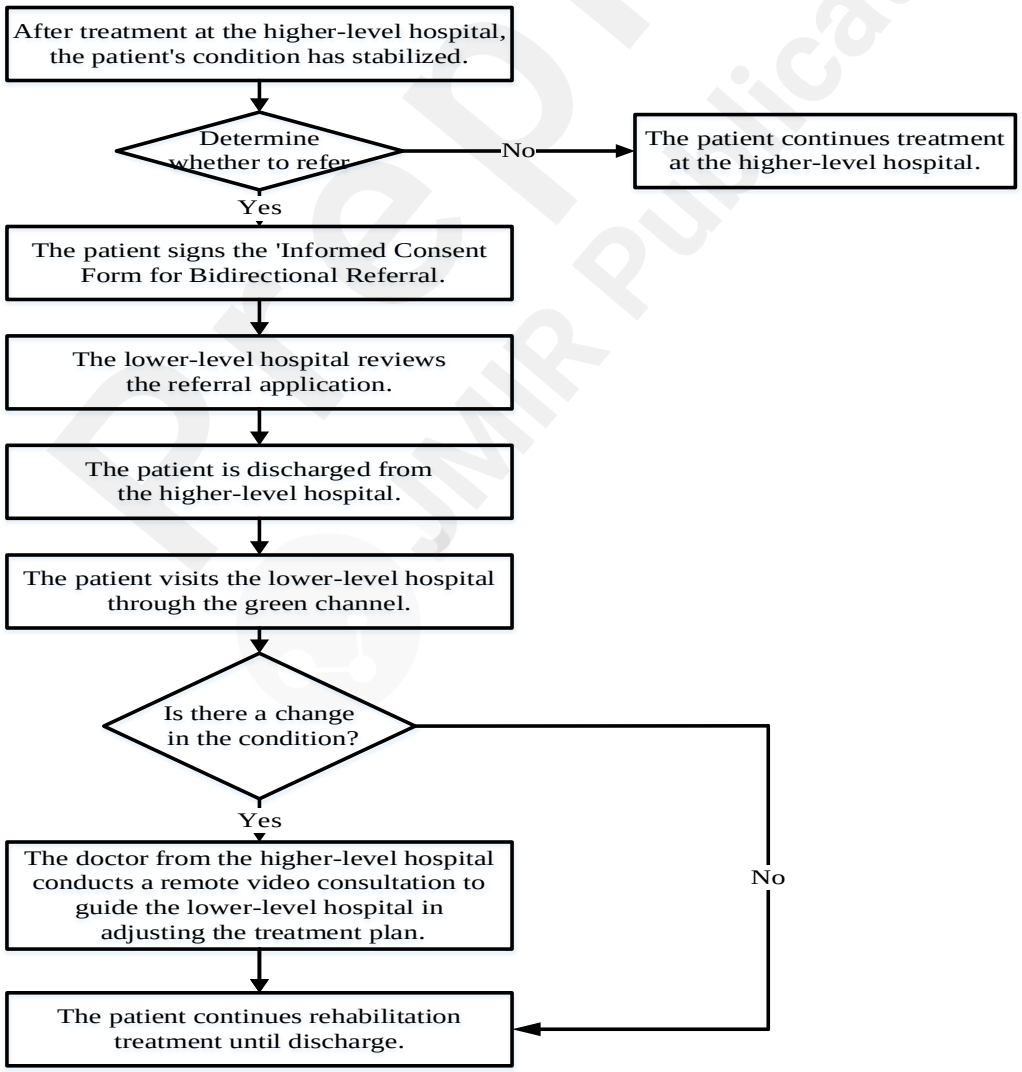


The process of downward referrals

(1) After patients finish the acute treatment phase and enter rehabilitation, they will receive systematic referrals to local primary hospitals for ongoing care. (2) Inpatients will undergo evaluation by the medical team at the higher-level hospital. Once they

fulfill the referral criteria, medical staff will notify the patient's family about the transfer and secure the patient's consent. The attending physician will then generate the informed consent form for referral, access the online referral platform to complete the referral details, upload the consent form, and submit the referral request. (2) The physician at the primary hospitals will assess the referral application. (3) The physician at the higher-level hospital will print the referral order, the patient handover form, and the patient will visit the medical insurance office to finalize the settlement and referral processes. (4) The primary hospital will admit the patient via a green channel. (5) The physician at the higher-level hospital will oversee and assist the primary hospital in modifying the relevant diagnosis and treatment plans through remote consultations. The specific downward referral process is illustrated in Figure 3.

Figure 3. The process of downward referrals.



Doctoral authority management

The criteria for physicians participating in “Internet+” bidirectional referrals are as follows: they must occupy the role of attending physician or a higher designation and have a minimum of three years of clinical experience. The Internet hospital's administration will offer training for physicians seeking referral privileges. Upon successful completion of the evaluation, these physicians will receive consultation and referral privileges. A roster of physicians and their respective privileges will be submitted to the Chongqing Municipal Health Commission for documentation.

Scope of services

Currently, the main patient demographic served by our hospital's bidirectional platform consists of individuals with chronic illnesses and intricate medical conditions. Moving forward, we plan to progressively integrate emergency care patients into the operational framework of this platform.

Information security & assurance

All activities pertaining to “Internet+” bidirectional referral system comply with the stipulations outlined in the Cybersecurity Law of the People's Republic of China[11]. We diligently enforce data security management protocols to protect patient information and maintain privacy. The operations of “Internet+” bidirectional referral system are conducted under the oversight of the Chongqing Municipal Health Commission. Our platform has successfully achieved seamless integration with the regulatory framework of the Chongqing Municipal Health Commission, facilitating real-time synchronization of bidirectional referral data. This integration guarantees the precision and promptness of data oversight.

Promotion and facilitation

In collaboration with contracted hospitals, we are establishing a bidirectional referral platform for Internet hospitals. A ceremony will be held to inaugurate pediatric teleconsultation and officially launch the “Internet+” bidirectional referral system. Utilizing various new media platforms, including the hospitals' WeChat public accounts, we will consistently publish promotional articles that thoroughly detail the

benefits, operational protocols, and practical examples of teleconsultation, effectively illustrating the convenience and efficacy of telemedicine services.

Medical quality assessment and control

We incorporate the number of downward referrals into the performance evaluation metrics of our clinical departments and conduct regular evaluations of the medical services rendered by the referring entities.

Visit reception and engage in experience sharing

We have disseminated our methodologies and operational insights to subordinate healthcare institutions over 500 times. We published expert consensus on remote consultation and two-way referral based on Internet hospitals in southwest China (2023 Edition)[12].

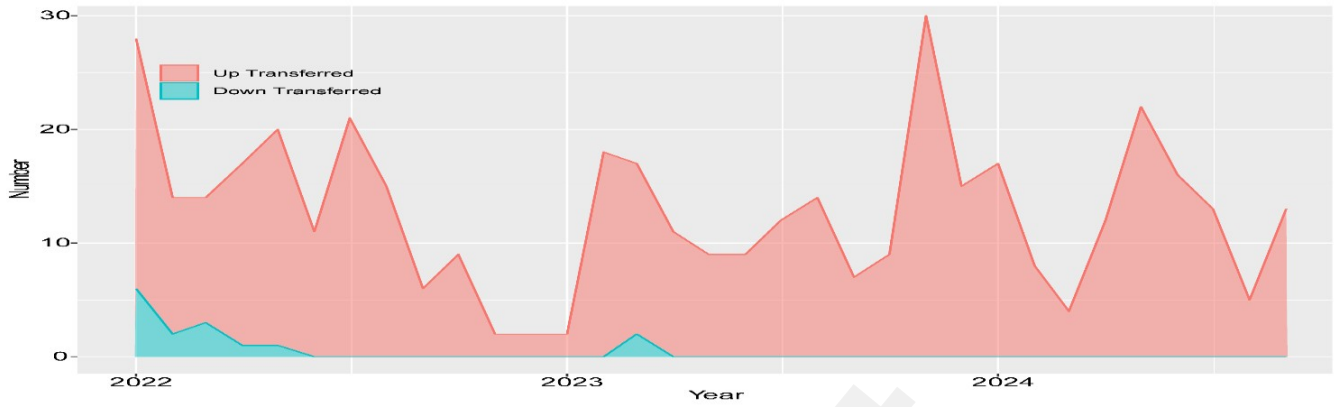
Data Collection

The Hospital Information System (HIS) and the "Internet +" bidirectional referral platform can automatically record patient referral information, including referral time, reasons, basic information, and medical history. All collected data undergoes rigorous data cleaning and organization to ensure the accuracy and validity of the analysis results. This data provides an important foundation for evaluating the efficiency of the referral process and the patient experience in seeking medical care.

Overview of “Internet+” bidirectional referral patient conditions

As demonstrated in Figure 4, by the end of September 2024, the “Internet+” bidirectional platform effectively enabled the upward referral of 407 patients for primary care. Furthermore, a total of 15 patients were referred downward, yielding a downward-to-upward referral ratio of 3.69%.

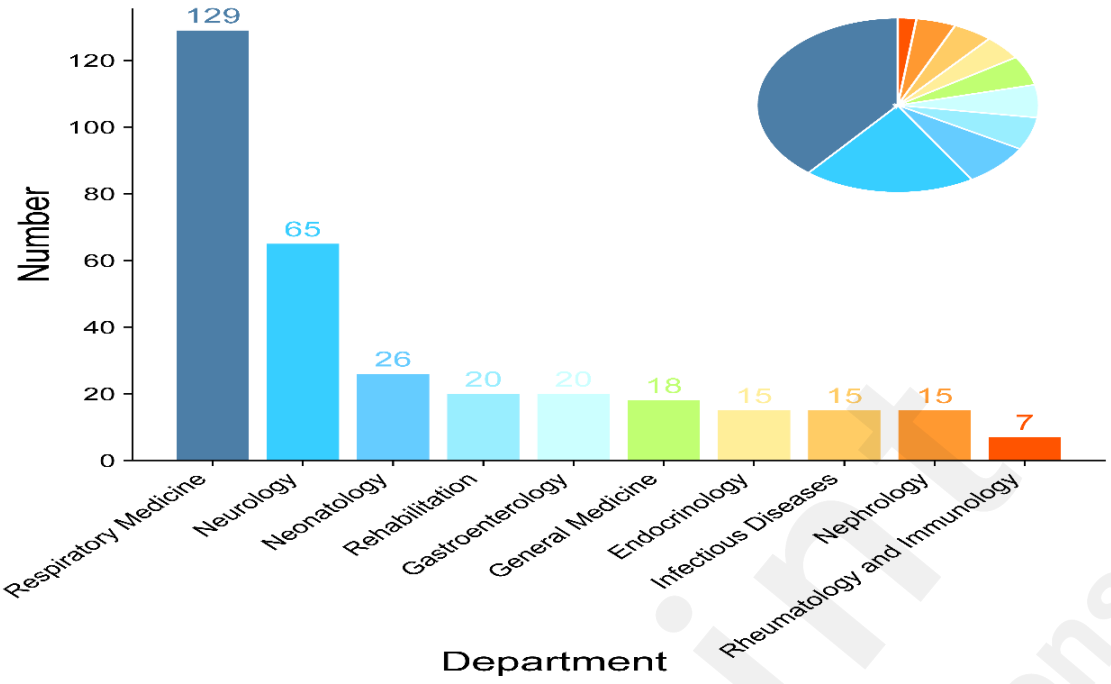
Figure 4: Number of upward/downward transferred patients.



Distribution of inpatient departments for upward transferred patients

Figure 5 clearly shows the top ten departments in terms of upward transfer rankings. The Respiratory Department leads with 32.99% of transfers, markedly surpassing other departments. The Neurology Department follows with 16.62%, while the Neonatology Department accounts for 6.65%. The Rehabilitation and Gastroenterology Departments each represent 5.12%. Family Medicine contributes 4.60%, and Endocrinology, Infectious Diseases, and Nephrology each comprise 3.84%. Lastly, the Rheumatology and Immunology Department makes up 1.79% of the transfers.

Figure 5. The top ten departments in terms of up transferred rankings.



Discussion

This study elucidates the enhancement of convenience, standardization, and optimization in resource allocation during the referral process within the contemporary healthcare system, specifically through the implementation of the "Internet+" bidirectional referral model at the Children's Hospital affiliated of Chongqing Medical University. However, our institution faces a challenge with a higher number of upward referrals compared to downward ones. This trend can be attributed to several factors: notably, the majority of upward referrals pertain to respiratory conditions, such as pediatric pneumonia, which generally require shorter treatment durations[13]. Furthermore, there appears to be a lack of trust among patients towards lower-tier hospitals, resulting in a preference for seeking care at higher-level facilities[14,15]. Consequently, increasing the downward referral rate will be a primary objective for future bidirectional referral initiatives.

The “Internet+” bidirectional referral model has the potential to significantly decrease referral times and improve referral efficiency[16]. Traditional bidirectional referral processes are frequently characterized by their cumbersome nature, protracted timelines, and high costs. In contrast, the “Internet+” bidirectional referral optimizes procedures such as patient transfer and appointment scheduling through innovative

communication strategies, facilitating the seamless integration of consultations, medical record retrieval, examinations, and hospital admissions. This model enhances collaboration among healthcare institutions, addresses deficiencies in the referral process, and markedly reduces patient waiting times and expenses, thereby improving referral efficiency and ensuring continuity of care, which ultimately improves the overall referral experience for patients.

The "Internet+" bidirectional referral system plays a pivotal role in facilitating the rational allocation of healthcare resources [17,18]. By consolidating and redistributing medical resources, this system enables appropriate patient allocation, allowing healthcare facilities at different levels to perform diagnostic and therapeutic responsibilities aligned with their designated roles. Such an approach not only improves the efficiency of healthcare services but also enhances the hierarchical structure of medical resource usage. Notably, similar challenges in resource allocation and utilization have been reported in other regions of China, such as Shenzhen. Evaluations of the multi-tiered medical system in Shenzhen revealed significant disparities in spatial accessibility and equity, emphasizing the urgent need to optimize resource distribution to ensure fair and efficient healthcare delivery [19]. Additionally, the remote consultation capabilities embedded within Internet hospitals provide a robust platform for the real-time exchange of medical knowledge, ensuring the continuity of care and maintaining the quality of medical services throughout the referral process. These capabilities not only offer a seamless quality assurance framework for patients but also facilitate coordination between different healthcare tiers. During global emergencies such as the COVID-19 pandemic, telehealth systems have demonstrated remarkable potential to enhance healthcare delivery by addressing resource limitations and bridging gaps in care provision[20]. This underscores the critical necessity of integrating remote consultation functionalities into healthcare systems to improve preparedness and resilience in times of crisis.

The absence of comprehensive top-level design has led to the underdevelopment of regulations governing “Internet+” bidirectional referrals, which remain in a nascent

exploratory stage[21]. This situation is marked by a lack of well-defined operational processes, evaluation mechanisms, and regulatory frameworks. To enable effective “Internet+” bidirectional referrals facilitated, it is imperative to achieve synchronization and integration of information systems between primary and higher-level medical institutions[22]. Presently, there exist significant disparities in the advancement of information technology across hospitals of varying tiers, which results in inadequate interoperability of medical information and the risk of creating information silos. Consequently, it is critical to establish a unified interface that allows for the integration and sharing of patient information, health records, electronic medical records, and imaging data. Additionally, to improve the quality of information services in clinical practice, it is essential to implement cloud-based integration and analysis of dispersed medical data. This requirement not only elevates the demands on the system's data processing capabilities but may also lead to increased costs related to the development of information infrastructure.

In the future, it is imperative to enhance efforts in promoting “Internet+” bidirectional referrals. Firstly, at the societal level, the government should advocate for the significance of “Internet+” bidirectional referrals and health insurance policies through various media channels, with the goal of shifting public dependence away from large hospitals and rectifying misconceptions regarding medical care access[23]. At the level of healthcare professionals, it is essential to underscore the role of physicians in health education, ensuring they provide clear explanations of the standard operating procedures for “Internet+” bidirectional referrals to patients, thereby increasing their understanding of the referral process and actively guiding them towards a "primary care first, orderly referral" approach[24]. Secondly, the establishment of an online referral coordination mechanism is crucial. Internet hospitals act as a conduit connecting different tiers of medical institutions, playing a pivotal role in expediting information flow and improving efficiency within the “Internet+” bidirectional referral system. It is necessary to enhance the communication frameworks between Internet hospitals and physical hospitals to ensure the continuity and effectiveness of the

referral process, thereby strengthening the integration of Internet hospitals with offline medical services. This includes the development of a comprehensive docking mechanism, standardization of communication methods, and careful planning of the admission process[25].Thirdly, the broad promotion and implementation of the bidirectional referral management model in Internet hospitals necessitate collaboration among various stakeholders, including the government, health authorities, hospitals, and patients. The "Internet+" bidirectional referral system is still in its nascent stages, and relevant laws and regulations require further refinement[19,26].

This paper analyzes the bidirectional referral model of Internet hospitals, offering insights into its operational and management. The "Internet +" bidirectional referral model not only enhances the seamless exchange of patient diagnosis and treatment data, but also promotes information sharing across healthcare platforms. It streamlines the referral process, standardizing procedures and trimming down time, thereby enhancing operational efficiency. This model is pivotal for the integration and optimal distribution of healthcare resources, ensuring that medical services are both accessible and efficient. Given its proven benefits, the bidirectional referral service model of Internet hospitals is not just viable but also recommended for broader implementation across various medical institutions, aligning with the evolving landscape of digital healthcare.

Conflicts of Interest

None declared.

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